

# “Using gambling to teach insurance principles”

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## Using gambling to teach insurance principles

### Abstract

A basic understanding of insurance principles is useful for making personal finance decisions and for considering public policy issues. Yet, insurance concepts tend to be less intuitive, more difficult for students to grasp, than other concepts. This paper shows how fundamental insurance principles can be taught by relating them to the principles underlying gambling, the game of roulette in particular. This approach has been used successfully with college freshmen taking macroeconomics at the University of Nevada, Reno. After hearing a lecture given using this approach, students tend to come alive with questions, can understand why they might not want to buy an extended warrantee the next time it is offered, can understand why investing in the stock market is usually different than gambling, and can even start to see the subtleties in public policy issues involving insurance.

**Keywords:** insurance, gambling, moral hazard, adverse selection, teaching.

### Introduction

While they are a relatively modern phenomenon, insurance contracts are ubiquitous today. Insurance in various forms had appeared before the Great London Fire of 1666, but that calamitous event is often referenced as the starting point for the modern insurance industry. Nicholas Barbon, a British entrepreneur, is given credit for starting the first fire insurance company in 1680 (Finkelstein, 2000). Marine insurance among traders also developed in the 17<sup>th</sup> century, and the development of life contingency tables allowed for the development of life insurance in the early 18<sup>th</sup> century (Westall, 2002). From these beginnings, the commercial insurance industry has expanded to the point, where insurance can now be purchased to protect against a wide variety of hazards, even against wear and tear on your shoes (The Consumerist, 2009).

Governments also now provide insurance for individuals, in a variety of forms, but especially through entitlement programs. A major revenue category tracked by the U.S. Department of Commerce is “Contributions to Social Insurance”, which includes the payroll tax collections for Social Security and Medicare. Even though the Social Security and Medicare programs do not involve explicit insurance contracts between individuals and government, they have insurance characteristics, as the name for their tax collection category suggests. The Patient Protection and Affordable Care Act and Health Care and Education Reconciliation Act were signed into federal law in 2010 as part of “health care reform”. The debates surrounding this significant legislation often focused on perceived failures of paying for health care expenditures through private insurance contracts, and on the worsening financial condition of government’s Medicare and Medicaid “social insurance” programs.

Despite the fact that insurance is so much a part of everyday life, and so much a part of public policy, few college freshmen have a meaningful understanding of basic insurance principles. The typical student not only cannot apply these principles to public policy issues, for example to considering Medicare reforms, but they also do not possess a sound basis for evaluating opportunities to buy insurance, for example, the opportunity to buy an extended warrantee on a computer.

Believing that a basic understanding of insurance principles is essential for considering macroeconomic policy issues effectively, I now include one lecture in my principles of macroeconomics course that focuses on insurance. Living in a state that has had legalized gambling since the Great Depression may have biased my thinking, but I have found it effective to teach basic insurance principles by showing how they relate to the principles underlying gambling. The simple approach involves a lecture on the basics, followed by the presentation of applications, which includes time for student questions and interaction. This paper presents this approach, with the hope that others may find the approach useful.

The paper proceeds as follows. Section 1 presents the essence of gambling, section 2 shows the essence of insurance, and section 3 compares the two. Section 4 presents extensions to the basic theory that can be covered in a longer class. Section 5 presents shows how I typically apply the basic concepts, focusing on two applications I typically cover: extended warrantees and health care policy. Section 6 presents the questions and issues of interest most commonly raised by students, with illustrations of the learning that can occur during the interaction time and the final section concludes.

### 1. The essence of gambling

Consider a gambler playing the game of roulette, or “little wheel” when the French name is translated to English. In case you have not played the game, or seen it played, the croupier spins the wheel in one

direction and then spins a ball in the opposite direction. The wheel is constructed so, it slopes downward from the external portion of the wheel toward the internal. Initially, the centripetal force of the spinning wheel holds the ball against a lip crafted onto the external portion of the wheel. But, this force wanes as the wheel slows, and after a few seconds the ball eventually falls into one of the equally spaced slots fashioned into the internal portion of the wheel.

There are a variety of bets that can be made in the game, but a \$1 bet on red will be considered here. There are 38 slots into which the ball can fall on the American wheel, and 37 on the European wheel. We will consider the American wheel here. Of the 38 slots, 18 are red, 18 are black, and 2 are green (on the European wheel only one slot is green).

The wheel is designed and balanced so it is equally likely that the ball falls into each slot. Today, gambling establishments keep careful records of the outcomes and will replace a wheel that is not providing a uniform distribution of outcomes among the 38 slots. This is because a gambler can win much if they are able to identify a defective wheel, as illustrated by Joseph Hobson Jagger (1830-1892), who became known as “The Man Who Broke the Bank at Monte Carlo”. As an engineer, Jagger realized mechanical imbalances might bias the wheel toward particular outcomes. In 1873, he hired six accomplices to secretly record the outcomes of wheels at a casino in Monte Carlo. Examining the data, he discovered one of the wheels had a bias, with the numbers 7, 8, 9, 17, 18, 19, 22, 28 and 29 occurring more frequently. Jagger went to the casino, bet more frequently on these numbers, and then won what today would be multiple millions of dollars.

Here, we assume the wheel is balanced, so the probability of a red outcome is  $18/38$ . Analogously, the probability of a black outcome is  $18/38$ , while the probability of a green outcome is  $2/38$ . It then follows, with a bet on red, that the probability of winning is  $18/38$ , while the probability of losing is  $20/38$ . Notice, then, it is the two green spaces that give the house the advantage on the red bet.

The outcome of the game changes the wealth of the gambler. If the ball falls into a red slot, the gambler wins, receives back the \$1 bet, plus an additional dollar. Thus, the change in wealth is +1 dollar. Alternatively, when the ball falls into a black or green slot, the gambler loses. The croupier scraps the gambler’s bet off the betting table, so the change in wealth is -1 dollar.

When we seek to quantify the gambler’s expected change in wealth on a single bet, we are asking the same kind of question that led to the develop-

ment of the theory of expected value back in the 17<sup>th</sup> century. Then, a Frenchman named Chevalier de Mere posed the “problem of points”, the problem of deciding how to fairly divide the stakes in a game, which must be halted early, where the definition of fairness is based upon the chance each has of winning the game at that point. In our modern day roulette example, we could think that the gambler had contractually agreed to place the \$1 bet on red game 38 times, but then got a phone call and could not play. How might this contract be fulfilled given the chances of winning and losing described above?

Blaise Pascal is given credit for first solving this problem of points in a 1654 letter he wrote to a colleague, but the Dutch mathematician Christiaan Huygens (1657 [2010]) is given credit for first publishing the expected value idea. Huygens’ famous words were, “If I expect  $a$  or  $b$ , and have an equal chance of gaining them, my expectation is worth  $\frac{a+b}{2}$ ,” (Huygens, 1657 [1714], p. 2). This idea is generalized, to what we now call “expected value”, by weighting the possible outcomes by their chances.

In our roulette example, of 38 plays the gambler could not play because of the phone call, we would expect 18 wins and 20 losses. This implies, as a solution to the problem of points, the gambler would just pay the casino \$2 on the spot to justly fulfill the contract. Applying Huygen’s valuation of a single chance, we calculate the expected change in the gambler’s wealth as

$$E = \frac{18}{38}[+1] + \frac{20}{38}[-1] = -\frac{2}{38} = -0.0526. \quad (1)$$

In the gaming business, the “edge” of the house, or the casino, is the average percentage of each dollar bet won by the house, while the “payback rate” for the gambler is the average percentage of each dollar bet that returns to the gambler. Condition (1) indicates the gambler expects a -0.0526 dollar change in wealth on the \$1 bet on red, or a 5.26 percent loss. This 5.26 percent is house edge on the red bet in roulette. When this house edge percentage is subtracted from 100 percent, we have the gambler’s payback rate, 94.74 percent.

The house must have an edge in each casino game because it is a business with costs and a desire for profit. Compared to other businesses, keeping just 5.26 percent of a transaction for costs and profit is small. Essentially, casinos follow the Walmart business model, and followed it long before Walmart existed: make money by obtaining a small margin on many transactions. Using the 94.74 percent pay-

back rate, we see that a gambler, who sits at a roulette table long enough to make just 13 equal bets on red, will on average have just less than 50 of the bet amount remaining, since. Is it now clear why many casinos serve “free” drinks as long as the customer continues to gamble?

The fact gamblers must lose on average in order for the casino to be in business begs the question: “Why do people gamble?”. Figure 1 provides insight. As shown, if no gamble is taken, then with 100 percent probability there will be zero change in individual’s wealth (with regard to gambling). So, it is clear that *choosing to gamble is choosing trade certainty for uncertainty*. By placing the \$1 bet on red, the gambler trades away the certainty of no change in wealth for the uncertain situation, where wealth will decrease by a dollar, with 20/38 probability, or increase a dollar, with 18/38 probability. If no bet is made, there is no opportunity to increase wealth. Thus, Figure 1 also informs us that *gambling offers a possibility to increase wealth*.

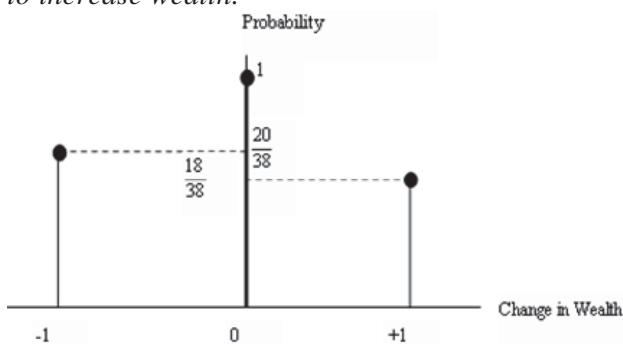


Fig. 1. Probability distributions for the change in wealth—gambling versus not gambling

Therefore, in a general sense, the casino business is that of converting certainty into uncertainty, such that at least one of the uncertain outcomes results in a gain for the gambler. Where else besides a casino can a person legally earn a 100% rate of return in about one minute? This is exactly what happens when winning bet is made on red in roulette. In exchange for providing this service, the casino takes 5.26 percent of the average bet on red, which allows the casino to pay its costs and earn a profit. The 5.26 percent advantage for the house implies *the average gambler must lose*.

Because the average gambler must lose, a rational individual must exhibit “risk-seeking” behavior in order to gamble. Behavior is risk-seeking when facing an uncertain situation with a particular expected value is preferred to receiving the expected value amount with certainty. When placing a \$1 bet on red, the gambler could receive more than the  $-\$0.0526$  expected value, because a zero change in wealth can be obtained for sure by not placing the bet. Thus, the gambler is a risk seeker.

An interesting empirical question is: “Would anyone pay money to face an uncertain situation where all of the possible outcomes resulted in a decrease in wealth?” If so, we would know the risk seeking behavior is only the result of the “thrill” associated with facing the uncertainty. With the \$1 bet on red, and every other gamble available in a casino, there is not only the potential thrill of facing the uncertainty but also the possibility of gain. Thus, when we observe people gambling, we do not know whether the thrill of the uncertainty is primarily motivating them, or the possibility of gain, or both.

In summary, using roulette as an example, and thinking about casino games in general, gambling involves: (a) trading certainty for uncertainty; (b) obtaining a possibility to gain wealth; and (c) losing wealth on average.

## 2. The essence of insurance

Suppose there is a community with 38 homes, and suppose fire will totally destroy one of the homes in an average year. Assume fire is the only hazard a homeowner faces, and assume it is equally likely each home will burn. Then, notice that a spin of the American roulette wheel captures the uncertainty each homeowner faces with respect to the fire hazard. If you owned one of the homes, then there would be a  $1/38 = 2.6\%$  chance that you would lose your home to fire during the year.

Without insurance, each homeowner faces an expected loss. Suppose each home is valued at \$200,000. The probability is 37/38 that no change in wealth will occur for a given homeowner, and the probability is 1/38 a change in wealth of  $-\$200,000$  will be experienced. Therefore, the expected loss of each homeowner is

$$E = \frac{37}{38}[0] + \frac{1}{38}[-200,000] = -5,263,16. \quad (2)$$

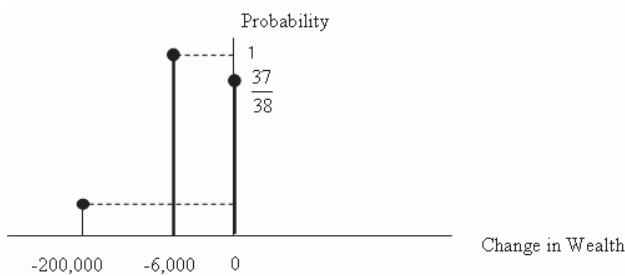
By forming an insurance pool, the homeowners can eliminate the uncertainty they face. If each of the 38 homeowners contributes \$5,263,16 into the pool, there will be \$200,000 available to pay the unlucky homeowner whose home burns. Actuaries call the \$5,263,16 payment the “fair premium” because this premium payment would exactly cover the individual’s expected loss. (Note: because people in the real world pay much less than \$5,263,13 per year to insure a home worth \$200,000, not only for fire but also for a wide variety of other risks, we know the probability that a typical home will burn is a much lower probability than 1/38.)

However, because costs would have to be incurred to form and administer the insurance pool, and because a normal profit must be earned in order for



organizing the insurance company to be worthwhile, the actual insurance premium paid by the homeowner must be higher than the so called 'fair premium'. Thus, just as the average gambler must lose to a casino, so the average person buying insurance must lose to an insurance company, paying out more in insurance premiums than is received to cover losses. The insurance company, like the casino, is a business that must cover costs and earn a profit to continue operation.

So, as we asked with gambling: "Why do people buy insurance when it is known that the choice is a losing proposition on average?". Figure 2 provides insight. Without the ability to buy insurance, the homeowner faces uncertainty. As shown in the figure, this uncertainty manifests itself in a  $1/38$  probability of losing \$200,000 and a  $37/38$  probability of losing nothing. If the actual insurance premium were \$6,000 for each homeowner, then each homeowner would, with 100 percent probability, lose \$6,000. Each homeowner might prefer losing 6,000 for sure than face the small probability of losing \$200,000.



**Fig. 2. Probability distributions for the change in wealth-not buying insurance versus buying**

So, what characterizes insurance? First, *insurance involves trading uncertainty for certainty*. Once the homeowner buys insurance, the uncertainty is no longer faced. The sure loss of the premium is chosen over the uncertain expected loss. Second, *insurance eliminates a possible decrease in wealth*. In this example, the possible \$200,000 loss is eliminated by buying the insurance. Finally, *insurance is a losing proposition on average*. In our example, the insurance company must charge more than the fair premium of \$5,263,16, something like the \$6,000 shown in Figure 2, so it not only can pay out the \$200,000 to cover the loss when it occurs but also cover the costs and profit of the company.

Because the average person in an insurance pool must lose, a rational individual must exhibit "risk-averse" behavior in order to buy insurance. Behavior is risk-averse when, rather than facing the uncertainty, it is preferred to give up with certainty an amount equal to the expected loss, or more. In our example, the homeowner is risk averse if he or she

is willing to pay more than the \$5,263,16 fair premium to obtain the insurance.

An interesting empirical question is: "Would anyone pay money to avoid an uncertain situation when all of the possible outcomes result in an increase in wealth?". If so, we would know that the risk averse behavior is only the result of the discomfort associated with facing the uncertainty. For our home fire hazard example, and for most every type of insurance offered by insurance companies, they are not only remove any discomfort that is associated with uncertainty but they also remove the possibility of a large loss. Thus, when we observe people buying insurance, we do not know whether it is the discomfort with uncertainty that is primarily motivating them, or the possibility of a relatively large loss, or both.

### 3. Comparing and contrasting gambling and insurance

In comparing and contrasting gambling and insurance, we find they are the converse of each other in two ways, but similar in one way. While gambling involves trading away certainty for uncertainty, insurance involves the converse. While gambling involves obtaining a gain that is not otherwise present, insurance involves eliminating a loss that is otherwise present. However, because the casino and insurance company are each businesses, gambling and buying insurance must monetarily be losing propositions on average.

This latter conclusion does not imply either gambling or buying insurance reduces individual well-being on average. In economics, it is typically assumed people do not purposefully harm themselves. So, as long as the choice is made voluntarily, the choice to gambling or buy insurance must increase satisfaction.

If people gain something from both gambling and insurance, what is compensating for the average monetary loss? The average monetary loss implies the rational a gambler must be risk-seeking, which is roughly equivalent to saying the gambler is willing to pay the casino to increase uncertainty. Conversely, the average monetary loss implies the rational insurance buyer must be risk-averse, which is roughly equivalent to saying the insured is willing to pay the insurance company to decrease uncertainty. So, we have learned that the thrill obtained from uncertainty may be what motivates the gambler to gamble, and the discomfort of uncertainty may be what motivates the buying of insurance. Or, we can say, insurance is purchased to obtain peace of mind, while gambling is pursued to disturb the peaceful mind.

However, the gambler and insurance buyer may also be motivated by a desire to change the specific location of the possible outcomes, not just change their variance. While the gambler may be motivated by the thrill of increasing the variance of the outcomes, increasing the size of the largest possible outcome may independently motivate. Analogously, while the ability to decrease the variance of the outcomes may motivate the insurance buyer, a reduction in the size of the largest possible loss may independently motivate.

#### 4. Extending the basics when there is more class time

The content presented to this point can be effectively presented in about 30 minutes, leaving approximately 20 minutes in a 50 minute class for applications, student questions, and interaction. I have used this approach in both a 50 minute class and a 75 minute class. For the longer class, there is time for extending the content beyond the most basic insurance concepts. While I might refer to moral hazard and adverse selection in applications during the 50 minute class, there is not time to provide much detail. However, in the 75 minute class, there is time to present moral hazard and adverse selection in some detail before focusing on applications. This section provides the content I tend to add to when there is more class time.

People respond to incentives, and making insurance available changes the incentives people face. Because of these potential incentive effects, people may behave differently in a world with insurance than without. An insurance company must consider these incentive effects or the company may well fail. In particular, “moral hazard” and “adverse selection” must be considered.

Moral hazard is additional hazard created by the introduction of insurance. Once someone is insured against some hazard, like fire burning down a home, the incentive to be careful is not as great as before. It may not be moral for a person to take more risk once they are insured, but this tends to be the case because the incentive has changed. The presence of moral hazard implies more homes will burn after the introduction of homeowner insurance, more car accidents will occur with the introduction of auto insurance, and so on. If the insurance company does not consider moral hazard, it will tend to set its premium too low.

When applied to insurance, adverse selection describes a situation in which those more likely to experience the hazard disproportionately choose to buy insurance, while those less likely to experience the hazard disproportionately choose not to buy. In a given insurance pool, all of those insured may not

have the same likelihood of experiencing the hazard. For example, some are better and more careful drivers than others, so some in an automobile insurance pool are less likely to experience accidents than others. Bad drivers, therefore, have more incentive to buy insurance than good drivers. The natural tendency of the insurance to attract, or select, the more risky customer is the adverse selection.

If the insurance company does not separate people with different risk levels into different insurance pools, then buying insurance need not be a losing proposition on average for people who are more risky than average. As an especially risky person experiences hazard after hazard, they will be paid much more by the insurance company for the losses than they have paid in premiums, which implies purchasing the insurance can provide a positive rate of return. For the insurance company to be financially viable, the least risky in the insurance pool must pay significantly more in premiums than they receive for their losses experienced in order to compensate for the more frequent payouts to the more risky.

However, whenever more risky and less risky people are in the same insurance pool, there is an opportunity for a competing insurance company, who can distinguish the different risks. By identifying the least risky people and offering them a lower premium, a competing insurance company can earn a profit by luring away the less risky people from the insurance company that is charging all the same premium. Thus, competition among insurance companies will naturally produce different insurance pools distinguished by different risk levels, and those who are more risky will pay a higher premium.

The “underwriting” process is the information gathering process an insurance company uses to identify the appropriate risk pool and corresponding premium for the insured. In some cases, the person buying the insurance will have information that the seller cannot effectively obtain during the underwriting process. In this case, we say there is “asymmetric information”. For example, a young male buying auto insurance may know he is an especially good driver, but the insurance company will not take his word for it and may have no effective way of confirming he is different than other young males. Because there is an effective way of distinguishing females from males, and because statistics indicate young females have fewer car accidents than young males, marketplace competition leads insurance companies to adopt the seemingly discriminatory practice of charging young males more for auto insurance than young females. However, within the pool of males, the presence of asymmet-

ric information means that there is typically a wide range of risk levels. Consequently, insurance will tend to be an especially good deal for bad young male drivers, while it will tend to be especially expensive for good young male drivers, who subsidize the bad.

When there is asymmetric information, so the insurance company cannot distinguish the more risky and charge them a higher premium, adverse selection can create the “lemons problem” described by Akerlof (1970). It may well be rational for the least risky not to buy insurance given the high average premium that must be charged in order to also cover the most risky. If those least risky leave the pool, then the average risk increases, and the premium must rise to cover the higher expected losses of the “lemons” left in the pool. But, the higher premium could then motivate another set of less risky people to leave the pool. In the worst case, the market can break down so no insurance is available.

To mitigate moral hazard and adverse selection problems, private sector insurance companies offer varying levels of deductibles. By paying the deductible amount personally before the insurance pays, the insurance customer is “self-insuring” the least expensive risks, or some portion of an expensive risk. Individual well-being will increase by moving from a lower to higher deductible when the money saved on the premium exceeds the peace of mind that is lost from assuming more risk. The premium will be lower on a higher deductible policy not only because the insurance company will not have to pay small claims, but also because a higher deductible motivates the insured to be more careful, reducing the moral hazard. The different deductible levels will also segment the market as those with lower risk levels and less risk aversion choose higher deductibles, self insuring to a larger extent in order to obtain a lower premium. Alternatively, those with higher risk levels and more risk aversion will choose to pay higher premiums and not self insure. By getting people to reveal their risk levels and risk preferences in this way, a deductible can dampen adverse selection overcome the lemons problem, facilitating the formation of a private sector insurance market.

To summarize, moral hazard increases risk, implying the insurance premium must be higher than if the moral hazard were not present. Adverse selection occurs because insurance is a better deal for the more risky in an insurance pool, and adverse selection can prevent an insurance pool from forming when asymmetric information keeps an insurance company from being able to create different pools for different levels of risk. The introduction of a deductible reduces moral hazard and makes it less likely that the insurance market will break down from the lemons problem caused by adverse selection.

## 5. Applications

Having inculcated a basic understanding of insurance principles through a lecture using the approach above, and having presented some detail on moral hazard and adverse selection if there is additional lecture time, the principles of insurance can be reinforced by applying them. Wanting to engage students, rather than simply proceeding to pre-planned applications, I typically ask students how the principles might be applied. The applications I choose to pursue may depend upon the responses from students to this question. However, because most students, if not all, have had to choose whether or not to buy an extended warranty, applying the principles to this decision is usually fruitful. Also, because I seek to expose students to how the principles can be applied to social policy, health insurance and its relation to health care policy is also an application that engages students. Some detail on how these two applications is now presented.

**5.1. Extended warranties.** Extended warranties are insurance, and today they are offered on a wide variety of products. A product warranty is a promise that a payment will be received if the product fails in some way specified in the warranty contract. Because the product failure is a hazard and because the consumer only receives a payment when the product fails, the price of the extended warranty is essentially an insurance premium.

Because extended warranties are insurance, the principles of insurance apply, in particular the principle that the average person in the insurance pool loses. Here, the principle implies the average person buying a warranty must pay more for the it than they expect to receive back. Otherwise, the business would not be able to cover the costs of administering the warranty process and earn a profit. A good question for the students here is: “Would a business offer an extended warranty if it did not increase its profits?”

There is evidence businesses earn significant profits by offering extended warranties. Chen and Ross (1994, p. 253), referring to an article in *Consumer Reports*, note: “Some of the largest electronic and appliance retailers would be losing money if it weren’t for the profits they make from selling [extended] warranties”. Desai and Padmanabhan (2004, p.1), referring to an article in the *Economist*, note: “Warranties are being purchased by a large number of consumers. The popularity of these extended warranties have led observers to comment that the service support business is the next important battleground because of its capability to potentially increase firm’s profitability”.

In reviewing previous research, Desai and Padmanabhan (2004) note a number of reasons why sellers



have incentives to offer warrantees, but insurance is the only explanation offered for why buyers purchase its. A seller may want to offer a long warranty at a low price to signal high product quality or low riskiness in buying the product, so the seller is then able to sell the product at a higher price. Or, a good warranty might be offered as an incentive to buy the product, which may be a more cost effective way of increasing sales than by advertising. All of these seller motivations suggest that the seller would be willing to offer the warranty at a loss. Yet, Chen and Ross (1994, p. 253) note that warrantees are usually exceptionally expensive in that the “carry a high price relative to the expected costs of the insurer’s obligations under the warranty contract”. This suggests strong buyer demand for insurance protection is what is driving the high price of the warranty contract.

While economic analysis typically frowns on a lack of knowledge as an explanation for behavior, it could be that people spend more on warrantees than they should because a basic understanding of the principles of insurance is lacking. Does the typical person understand that, if they are the average persons in the insurance pool, they will pay more for the extended warranty than they will get back? If so, and if everyone in the insurance pool is equally likely to experience a product failure, then the very expensive nature of warrantees implies people are very risk averse. But, why should people with reasonable incomes be so risk averse when they can readily afford to replace everyday electronic and appliance products? Paying for the peace of mind provided by insurance makes sense on high value items that would be exceptionally painful to replace, but there must be point where the item being insured is of such low value that it is not worth accepting a negative expected outcome. Thus, it could be that people are buying more extended warrantees that is good for them because of a lack of knowledge (My perception is that, while students and the average adult in society tend to understand that the average person in the casino must lose money, they do not so universally understand that the average person buying an extended warranty must lose money).

Chen and Ross (1994) assume consumers are rational and that markets are competitive, as is typically assumed in economic analysis, and explain the expensive nature of warrantees using adverse selection. They recognize some product buyers may be “intensive users” who will more likely then experience product failure. The company offering the warranty cannot distinguish a more intensive user from the less intensive, so all pay the same price for the warranty. To cover the cost of the very intensive users, the average buyer of a warranty must pay significantly more than his or her own expected loss.

Regardless of the explanation of why warrantees are especially expensive insurance on average, an understanding of the principles of insurance should help the student to be a better consumer. Leaving the lecture, the student should understand that, if she is a more intensive user of a product, not the average person in the insurance pool, then buying the insurance may be rational even if she is not risk averse. Leaving the lecture, the student should understand that, if he is risk averse, then the peace of mind of the warranty may be worth the cost. Finally, because the student should leave the lecture understanding the average person in an insurance pool must lose, they may, thereafter, increase their own well-being by not buying extended warrantees that do not sufficiently offer peace of mind.

**5.2. Health care policy.** To provide a more subtle application of the insurance principles, I like to ask students: “Does it make sense to pay for health care costs using insurance?”. Coming into the class, most students know it is very common to pay for health care costs using insurance, and this familiarity tends to bias the students toward a “yes” answer. However, after the lecture outlined above, there are at least a few students who see there should be some contemplation before answering.

Because any health insurance plan, private or public, will have administration costs, a basic insurance principle still applies: the average person in any health care insurance pool must lose in the sense of paying more for their health care through insurance than they would pay without insurance. Because the average participant in the plan must lose, it would be irrational for the average participant to voluntarily participate in this plan if they are not risk averse. While it is reasonable to think most people are risk averse when considering very high, catastrophic health care costs, it is not reasonable to think all people would be risk averse when considering lower, non-catastrophic costs. Just as it will often be rational not to buy an extended warranty on a product, so will it often be rational not to buy insurance on smaller health care costs? This tends to be revelation to students.

Introducing health insurance to cover health care costs creates moral hazard, especially if the plan has low deductibles and co-payments<sup>1</sup>. With no deducti-

<sup>1</sup> For an example of such a plan, Physicians for a National Health Program (PNHP) advocates a single payer health care system, run by the federal government, and funded by a national income tax. PNHP claims every American is entitled to following coverage: “A single public plan would cover every American for all medically-necessary services including: acute, rehabilitative, long term and home care, mental health, dental services, occupational health care, prescription drugs and supplies, and preventive and public health measures. Patient co-payments and deductibles would also be eliminated” (PNHP, 2010).



bles or copayments, buying insurance is comparable to paying a fixed price to eat at a buffet. This analogy helps students understand the moral hazard concept, even if there is not much time to discuss the concept in detail. Just as people eat more at buffets than when they pay for each item, so people would desire more health care when they have already paid for it through insurance than when they must pay a fee for each service. Just as it is rational for the buffet eater to eat until another bite produces pain rather than pleasure, so it is rational for the health care consumer without a deductible or co-pay to demand services until an extra health service does more harm than good. Understanding this, students are equipped to understand why a health care system that provides health care without a deductible or co-pay will be very expensive, ration care, be of lower quality, or some combination of these.

When private insurance companies are free to form and compete, the market for health insurance will naturally segment in response to the adverse selection problem. There is an opportunity here to ask students whether they can apply the “arbitrage principle”, along with the principles of insurance, to explain why a free health insurance market will naturally segment so some will pay more for health insurance than others. To motivate their thinking, I have asked students: “If you in this room were in a health insurance pool with a similar number of people from an old folks home, all paying the same insurance premium, what opportunity would there be for a new insurance competing company?”. Many students readily see that the new company could profitably lure away the young people by offering a lower premium.

To move students toward discussing policy, one can then ask them to apply the “law of demand” to explain why many people do not have health insurance. In any market, the law of demand implies a higher price will cause less willingness buy. Consequently, for any good or service, there are always people priced out of the market, and an increase in the price will price more out. Applying the law of demand to health insurance, we would expect people with a higher risk of incurring health care expenses and those with lower incomes to be disproportionately priced out. Because health care is often perceived as a “need”, or even a right, there is considerable social discontent with the fact that high and increasing health insurance premiums have priced people out of the market.

One then can ask students to present the pros and cons of a national health care plan covered by a single insurance premium. Students readily see such a plan solves the problem of people being priced out of the market, as long as the premium is subsidized or

entirely paid by government. However, in solving one problem, another is created, and a few students usually see this: by forcing all into the same pool, those who are less risky are being forced to subsidize those who are more risky, which many will view as unjust. Thus, one can conclude the discussion by pointing out that policy-making often involves making value judgments. Here, the values tradeoff is between the injustice one may perceive in forcing one to subsidize another versus the injustice one may perceive in some having better health care coverage than others. Differing values explain, in part, why people disagree on policy proposals like this one.

## 6. Common student questions

Once students have a basic understanding of the principles of insurance provided using the approach suggested here, they tend to come alive with questions. Most typically, the questions are related to their own world and to the applications covered in class. However, some relatively sophisticated policy questions can also arise.

Because college freshmen have only been driving a few years, and because some know they are paying much more for their car insurance than their friends, questions on car insurance are common. Often students mistakenly think the professor has detailed knowledge, asking questions like: “If I maintain a high grade point average in college, how much will my insurance premium decrease?”. While the professor can virtually never answer such questions, there are many young people buying car insurance in senior-class, and often some students will have the very detailed knowledge to answer questions the professor cannot. On occasion, it is clear that one student benefits in a practical way as another student shares how they were able to find a lower car insurance premium.

With regard to auto insurance, the lecture sometimes motivates questions about coverages that are not required. Students typically understand that liability coverage is required by law and that a bank will also require collision and comprehensive coverage as long as there is a loan on the car. However, the lecture can motivate students to ask about the usefulness of collision and comprehensive coverages on an older car that is wholly owned. In the ensuing discussion, another student might, for example, note that they now see why comprehensive coverage might be more worthwhile for a more expensive used car or a car that will be parked in a worse neighborhood.

Nearly every American student can tell you a story about an extended warranty that they either recently purchased or declined, and questions about such warranties tend to arise. It is interesting to ask

students whether, prior to the lecture, they had a method for deciding whether or not to purchase a warrantee. In answering, at least one student will usually admit that they really did not have a method, but had tended to buy warrantees using a rationale something like “they are not usually too expensive”. After receiving the knowledge from the lecture, most students indicate they will think differently and more carefully when facing an opportunity to buy an extended warrantee in the future. An occasional student will comment that he or she is not the average person in an insurance pool and can take advantage of insurance. Student questions on extended warrantees are also of the type that other students can answer using the knowledge provided in the lecture, which reinforces the concepts.

Because the context is more complex, students questions about health insurance and health care policy are not so readily forthcoming, but they do arise and can be coaxed. An insightful student question might be something like: “Won’t deductibles discourage people from going to the doctor and cost the system more later?”. This question indicates the student implicitly, if not explicitly, understands the moral hazard concept. It also indicates the student is thinking about possible unintended consequences, which is good. In answering, one can review moral hazard, the incentive concept, and the elasticity concept. Specific questions about Medicare and Medicaid programs sometimes arise, ranging from coverages to their long term viability. Values questions can also arise like: “Why should I have to pay for someone else’s health care?”. In answering values questions like this, I like to respond by recognizing the value the student is presenting, recognize an alternative if possible, and make the general point that conflicting values or differing priorities will often explain why two people differ on social policy.

While no student has ever asked me the following question, a question I like to ask students is: “Why do financial planners typically suggest that you consider buying insurance as part of a financial plan, but never suggest gambling?”. Before being equipped with the understanding that the average person must lose, both when buying insurance and when gambling, the question would have seemed silly, but after the lecture students tend to recognize that the question is interesting. A few students will usually understand that risk aversion provides an answer. With some discussion, students can leave the class with an understanding that insurance is commonly viewed as prudent, while gambling is commonly viewed as imprudent, because most people are risk averse in most circumstances, rather than risk seeking.

Lastly, because the approach is to teach the insurance principles by contrasting them to the principles underlying gambling, a common student question only tangentially related to insurance might be something like: “Is it gambling to play the stock market?”. This question not only provides opportunity to distinguish the insurance principles from gambling, but it also provides opportunity to discuss how diversification, in the form of stock mutual fund investing or not, can provide insurance.

When purchasing stock, or more generally any ownership share of a firm, there is typically uncertainty as to what return will be received. If we assume some return on money can be earned with certainty, say by putting the money into a government insured bank account, and we assume the stock purchase offers a higher potential return but also a lower potential return, then the act of taking money from the bank account and buying into stock has at least two of the three characteristics of gambling identified above. Certainty is traded away for uncertainty, and the possibility of a greater gain is obtained. However, in purchasing shares of business firms, the average person need not, and typically does not, experience a decrease in wealth. So, in this latter sense, one can explain to students that playing the stock market differs from gambling<sup>1</sup>.

By explaining a mutual fund conceptually, one can help students see that some financial derivatives have insurance characteristics. A derivative is a security backed by a set of underlying assets, and stock mutual fund is a derivative backed by a variety of stocks. It is not difficult for students to understand that, if an investor buys just one stock, she is in effect putting all her eggs in one basket. As long as all stocks are not positively correlated, and perfectly so, the variability in the return earned by purchasing a set of stocks will be less than the variability of the typical stock purchased. While this is less intuitive, a diagram like Figures 1 and 2 can be used to show how buying a mutual fund might reduce the variability of the possible changes in wealth per dollar invested. As long as the mutual fund increases the lowest change in wealth that might be perceived, while also decreasing the highest change, moving from individual stock investing to mutual fund investing at the characteristic of buying insurance, while moving in the opposite direction has a characteristic of gambling.

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<sup>1</sup> From October 1928 to July 2010, the Dow Jones Industrial average increased at an average annual rate of 4.1%, and with a 30 year investing time horizon, there has been no month from October 1928 to August 1980 in which you could have had such bad luck that you would have lost money on your 30 year investment, so long term investing does not have the negative expected return characteristic of gambling.

## Conclusion

Because the principles underlying gambling and insurance are related, simultaneously teaching the principles of gambling can help a teacher introduce students to the principles of insurance. This paper has demonstrated how the gambling context provides a complementary canvas upon which the

principles of insurance can be painted. An understanding of gambling facilitates is the understanding of insurance. By using this method, a group of college freshmen, with little previous understanding of insurance principles, can in 60 to 90 minutes be provided with an understanding of insurance that allows them to make more informed personal decisions and better contemplate public policy issues.

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