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INSURABILITY OF ACADEMIC PERFORMANCE

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Abstract

When families invest in a college education, they are giving the student a foundation for a prosperous career. Unfortunately, if he ends up dropping out of school without credit, the family loses a significant sum of money. Consumers utilize insurance to protect other investments like homes and cars, so a natural question is whether academic performance can be insured.

The first step to answering that question is checking whether academic performance meets the theoretical definitions of an insurable risk. Scholars have put forth several criteria that must be met for insurability, so college performance will be evaluated against each of them. Additionally, current products exist that protect against similar risks in college education.

If the insurability criterion is met, the next step is to conduct product design and exploratory financial analysis, followed by a market demand analysis. Recommendations will be made for further research in these areas.

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Introduction

As the standard of living and average income in the United States gradually rise, consumers are increasingly able to meet the basic goals of food, clothing, and shelter. As they begin to accumulate disposable income and other investments, a fourth basic goal develops: the desire for financial security (Anderson & Brown, 2005, p. 2). A primary source of this security for modern households is the array of personal insurance products. In exchange for a defined series of payments, policyholders can transfer away many economic risks and uncertainties. Insurance companies can then pool together the payments from many different families and redistribute the funds to the unlucky few who do suffer misfortune.

Through this pooling mechanism society can provide protection for a variety of risks, such as needing expensive health care, losing property in a fire or crash, and outliving retirement savings. One of the largest and most valuable financial commitments, however, remains essentially uninsured. Over $186,000,000,000 is spent on college education every year, yet college students have no financial protection against a common cause of early exit: poor performance (National Center for Education Statistics, 2010, pp. 197, 345). If a student fails to obtain academic credit due to subpar grades, his advantage in the workplace can be lost, while the funds invested in tuition are gone.

A wasted investment of such magnitude can bring financial hardship to both students and tuition payers. Both parties expect their investments in education to pay off in the future through better careers and higher salaries. When those anticipated benefits fall through, students can be stuck with low-paying jobs, while struggling to pay off mountains of debt. Considering the significance of this potential loss, it seems that risk averse and security-driven tuition payers would be interested in some form of financial protection. For a product triggered by student grades to become a reality, student failure must meet the definitions of an insurable risk, or no organization will consider offering coverage against it. Insight into potential product success will also be gleaned from similar products currently on the market.

If insurability can be established, future research must evaluate whether organizations can design products that provide the desired financial security, without exposing themselves in turn to excessive risks and losses. Additionally, marketers must survey whether consumers are willing to pay the required premium for those products, on top of the tuition costs themselves.

Insurability

In order to evaluate the qualities of grade point average as a risk, one must first establish a baseline definition. Fortunately, industry experts and scholars have already devoted considerable efforts over the last two centuries to the pursuit of this definition. Analyses of many sources on the subject reveal several common themes, namely independence, identical distribution, large number of subjects, finite and calculable losses, and control of moral hazard (Schmit, 1986, p. 2). Together, these criteria determine the predictability of the loss distribution pool, which insurers use to determine prices.

For practical insight into insurability, two similar tuition reimbursement products will then be explored. Insurers have had success offering those products to the same target market, suggesting they captured finite and calculable losses, attracted sufficiently large numbers, and controlled moral hazard.

Independence

The first criterion to check is independence, which stipulates that individual losses are not significantly correlated to each other. In other words, the occurrence of one person's loss does not affect the odds of someone else having a loss (Dorfman, 2008, p. 96). When this criterion is not met, losses can suffer from the "snowball effect," and one event can lead to multiple claims. These linked losses in turn cause problems with the pooling mechanism, which can raise the cost of coverage and void consumers' benefits in purchasing it (Schmit, 1986, p. 5).

Consider the risk of losing property to natural disaster, fire, or other causes. Since these destructive events tend to cover large areas, one loss can set off a chain reaction of losses. For example, a fire in dry, windy weather could spread to several houses and cause millions of dollars in property damage. On an even greater scale, a severe tsunami could devastate an entire region and lead to billions of dollars in losses.

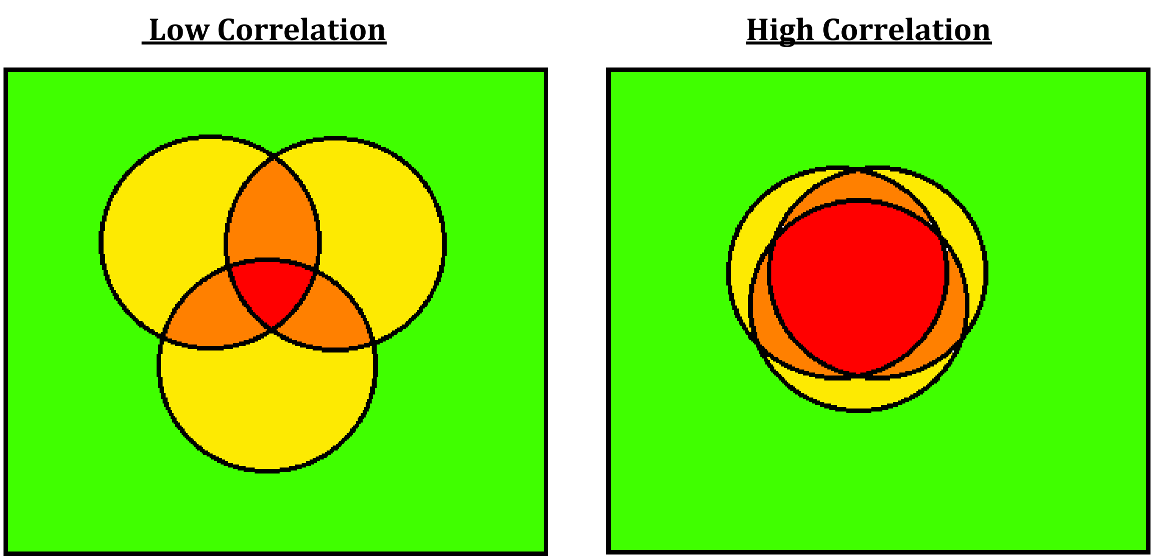

Figure 1

Figure 1 illustrates probability distributions for three sample loss events, such as houses being destroyed. Multiple losses occur in overlapping areas, while zero events happen in the green background. On the left side, the losses are not strongly correlated to each other, in the cases of houses spread apart. On the right, the losses are strongly correlated, as with townhouses. Under both situations, a triple loss is possible, but the odds of hitting that catastrophic red zone are much higher on the right.

Alternatively, the Tables below calculate probabilities for extreme cases, with either zero or perfect correlation. In Table 1, the three loss events are independent, each with a 20% chance of occurring. In Table 2, there is a 20% chance of all three losses and an 80% chance of no losses at all. Since each loss has a 20% chance of happening in either case, and since the loss amounts remain a constant $100 per event, the total expected cost for the insurance company is the same in both cases. However, the lower case clearly has a higher chance of the worst possible outcome.

<u>Probability distribution for three losses, zero correlation</u>

Result	**Calculation**	**Probability**	**Severity of loss**	**Expected loss**
3 losses	.2 x .2 x .2	0.008	300	2.4
2 losses	.2 x .2 x .8 x 3	0.096	200	19.2
1 loss	.2 x .8 x .8 x 3	0.384	100	38.4
0 losses	.8 x .8 x .8	0.512	0	0
Total		1.0		60

Table 1

<u>Probability distribution for three losses, direct correlation</u>

Result	**Calculation**	**Probability**	**Severity of loss**	**Expected loss**
3 losses	.2 x 1 x 1	0.2	300	60
2 losses	0	0	200	0
1 loss	0	0	100	0
0 losses	.8 x 1 x 1	0.8	0	0
Total		1.0		60

Table 2

To avoid going bankrupt in high-loss scenarios, insurance companies must hold reserve funds for future payouts (Thoyts, 2010, p. 21). A company facing the zero correlation case might be willing to hold only $200 in reserves, since it has a less than one percent chance of needing all $300. Under the perfect correlation case however, the company would likely hold all $300 in reserves, since it faces a 20% chance of that catastrophic loss. From a financial perspective, a company may have to charge higher and less marketable rates to customers. in order to build up reserves. At the very least, a company holding extra reserves would miss alternative investment opportunities.

Perfect independence is an abstraction that reality can only approximate. Every insurer will face dependence among risks to some extent, so the challenge is to manage its effects. A company can still operate profitably if it considers possible correlations when pricing products, thereby limiting catastrophic risks in relation to its portfolio.

With the independence issue established, we'll examine how academic performance stacks up. Students applying for GPA insurance would be relatively independent, although a few scenarios could arise involving correlated risks.

First, insured students could be friends with each other or members of the same organization. One student who lost motivation and started failing classes could spread his behavior to other students, increasing the chances of them dropping out as well. The risk of this issue among friends is likely unavoidable, since the insurer could not possibly investigate all friendships among applicants. Among organizations, which could involve larger numbers of students, this issue may be monitored by requesting extracurricular involvement information on applications. If a certain sports team or fraternity, for example, consistently has poorer academic results, those increased costs would be factored as a class variable into product pricing. Members of those groups would then be required to pay higher premiums than the average policyholder, within the bounds of anti-discrimination laws. The insurer could also try to avoid that risk by not marketing to those groups. Either way, the risk of lazy students influencing their peers does not seem to severely threaten insurability.

A second situation could be students in the same majors or classes. If a certain class is unusually difficult, it would raise the chance of enrolled students failing. Since one or two classes alone cannot drop GPA by an extreme margin, there would have to be a trend across a significant cluster of courses. Certain majors could meet this size, so students across the department could have higher risks of academic failure. On the other hand, students who enter those majors may be more naturally intelligent or motivated, thus less likely to fail. As discussed in the previous paragraph, student major would almost certainly be a class variable and used to price products, after studying the tendencies of different options. Since those class effects would be well monitored, the insurer could mitigate the threat of dependence by pricing policies appropriately and covering students from varying areas of study.

Third, a large-scale event could occur that affected all insured students. For example, if a recession hit the economy and thinned out the job market, students may lose incentive to perform well. Maybe the government could enact a new law providing stronger social support programs. With these widespread effects, the insurer would have to factor in premium increases across all policies.

In comparison to the risk of losing property to fire or flood, poor academic performance poses relatively minor dependence risks. As long as insurers continually monitor for correlated groups of students, they should be able to avoid interconnected losses. With a low risk of catastrophic strings of losses, insurers can hold manageable reserve levels and provide coverage at a reasonable price to customers.

Similar Distributions

The second criterion for insurability is similar distributions, which means the frequency and severity of losses are comparable across all insured individuals (Amadi, 2010, p. 3). For example, with auto insurance, this requirement means every covered person has the same chances of suffering an accident and causing the same amount of damage or liability. If individual risks are distributed similarly, insurance companies can group them together and benefit from the pooling mechanism. If risks vary too much, then insurers must consider them separately, reducing the benefits of pooling.

In reality, insured risks are rarely identically distributed, so this criterion presents another grey area. Insurers can break down risks into classes that are closely distributed, even if different classes vary significantly from each other. In many cases, companies will price policies based on multiple dimensions of classes. Under the auto insurance example, customers fall into rating groups based on age, marital status, driving record, and other factors (Gardner & Marlett, 2007, p. 8). Through this practice, insurance companies can offer coverage to each customer for a rate that reasonably reflects his risk of a loss, rather than the average risk across the entire population. While technically the individuals in each group may not be identically distributed, they can be close enough to benefit from averaging.

Since individuals within groups become more closely distributed as the group criteria get stricter, it might seem logical to create a high number of small groups, rather than a few larger groups. In the extreme case, the insurer could consider each person as his own group, leading to truly identical distributions within each group. However, this practice would clearly eliminate the benefits of pooling, which the next section will cover in more detail. As shown here, the similarity of distributions within classes must be balanced with the size of those classes.

To satisfy this check regarding the risk of poor academic performance, insurers would have to segregate customers based on at least a few dimensions. All undergraduate students do not have identical risks of failing in any given semester, but subdivisions of those students may come close. Potential class variables include high school GPA, high school quality, SAT score, college major, and extra-curricular activities. More controversial ones such as gender, age, credit rating of parents, zip code, driving record, and socioeconomic status might also be used, unless they are deemed illegal. For example, students from North Penn High School who graduated with a perfect GPA and scored over 2100 on the SAT may have a relatively low risk of college failure. Alternatively, students from a struggling high school with SAT scores under 1500 who study electrical engineering may face an unusually high rate of failure. Although those two groups are drastically different from each other, students within each of those groups should have similar risks in college. Thus insurers may be able to pool together students within each group and offer them comparable rates.

Overall, it seems that the undergraduate population could be divided into groups with reasonably similar loss distributions. The first challenge will be identifying a few main variables that accurately predict college failure risk. The second challenge will be keeping those sub-groups large enough to provide statistical value, while still keeping their distributions alike.

Large Numbers

As mentioned numerous times so far, a primary benefit of the insurance mechanism is pooling. After collecting premiums from a large group, the insurer can pay out benefits or redistribute funds to customers who suffer losses. As the size of those groups increases, the results become more predictable, and the insurer can afford to offer coverage at a lower price (Anderson & Brown, 2005, p. 3). To see how this principle works, reference Table 3.

Table 3

	Expected loss=	$ 100	
	Standard deviation=	$ 100	
Sample size	Total expected loss	Total standard deviation	Coefficient of Variation
Formula	Sample size * expected loss	(StDev^2 * sample size)^.5	
1	$ 100	$ 100	1.000
10	$ 1,000	$ 316	0.316
100	$ 10,000	$ 1,000	0.100
1,000	$ 100,000	$ 3,162	0.032
10,000	$ 1,000,000	$ 10,000	0.010

For this example, each individual exposure unit, or insurance policy, will have an expected loss of 100 and standard deviation of 100. Standard deviation is a measure of variability, so higher numbers mean losses are more variable or less predictable. If the policies covered health care, then the expected losses would represent typical health care costs. Assuming the policies are reasonably independent and similarly distributed, they can be pooled together as follows.

If group size is one, then expected loss and total standard deviation would remain the same by definition. This scenario could occur if an insurer covers a large risk that is too unique or abnormal to pool with any others. To put that standard deviation into perspective, we divided it by the mean to give the *coefficient of variation*, an indicator of relative variability (Anderson & Brown, 2005, p. 5). In this basic case, the coefficient of variation is simply one.

As sample size increases by multiples of ten up to 10,000, total expected loss increases in direct proportion. The expected loss per person remains the same, so this property does not provide value to the insurer or the customer. When measuring variability, the variance also increases in direct proportion with the sample, but the standard deviation is the square root of the variance (Wilcox, 2009, p. 81). Thus, the standard deviation increases more slowly than sample size and expected loss. The combined effect is reflected in the coefficient of variation, which clearly decreases as sample size increases. Following our example, as the number of policies in the group increases, the total health care costs of that group become more predictable and consistent (Anderson & Brown, 2005, p. 5).

If insurers only held exactly enough funds in the bank to pay off the claims they predicted, then this pooling would not offer any benefits. Since expected losses increase directly with the number of customers, the cost per person would remain constant regardless of group size, and the insurer would charge that amount per policy. However, as mentioned earlier regarding independence, companies must hold reserves to make sure they can pay all claims due. Those reserves are the key factor that makes coverage cheaper as group size increases.

Figures 5 and 6 illustrate normal probability distributions, which can be used to model the total loss payments an insurer faces after issuing a group of policies (Anderson & Brown, 2005, p. 15). While these charts center around zero, actual distributions would center on an insurer's total expected losses. The bars represent the probability that the actual total claims number falls on a given value. In Figure 2, the value zero has the greatest chance of occurring, around fifteen percent. In Figure 3, the value zero still has the greatest chance, but the probability decreases to roughly eight percent.

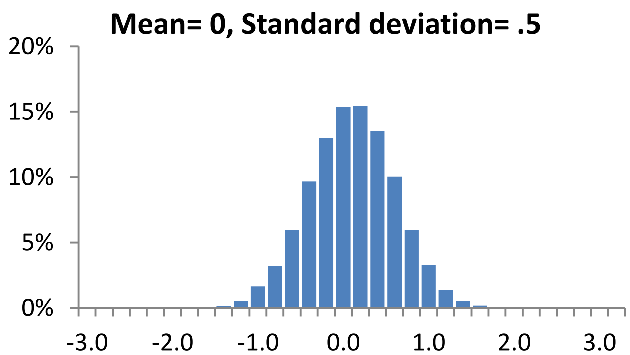

Figure 3

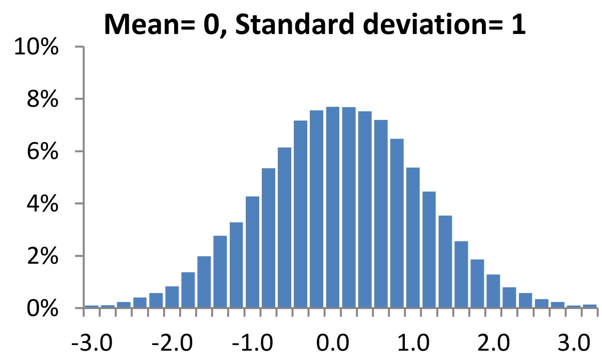

Figure 2

While both distributions have the same mean, the left distribution has a standard deviation twice that of the right case. As shown in the left chart, a larger measure of deviation results in a more spread out curve. In contrast, the chart on the right is steeper and more consolidated around the mean of zero.

As mentioned in the Independence section, insurers hold enough reserves to be confident they can survive their "worst case scenario." Under the Figure 3 distribution, that worst case scenario may approach +3.0. In the Figure 2 case, the chance of any value over 1.4 is too small to even appear on the chart, so the same worst case scenario would be +1.4. To be precise, the chance of a result more than three standard deviations from the mean is less than .2% (Wilcox, 2009, p. 300). As standard deviation decreases and the distribution narrows, an insurer's "worst case scenario" improves, so it is legally and financially able to hold lower reserves.

In Table 3, standard deviation itself increases as sample size increases, so this may initially seem to hurt the insurer. However, the increased reserve requirement is spread across a proportionally greater increase in customers. The coefficient of variation captures this relationship, since it shows variability relative to total volume.

If an insurer wants to be 99.8% confident that it will not suffer losses greater than its reserves, it would set reserves equal to total losses plus three standard deviations, under this distribution. If only one policy existed, that calculation would yield four hundred dollars ($100 + 3 x $100). Since that entire reserve would only cover one policy, that single customer would end up paying his $100 expected loss plus the entire $300 reserve through premiums. To a customer whose average loss is only one hundred dollars, a four hundred dollar premium would likely seem extremely expensive.

If the insurer instead sells one hundred of the same policies, and still wants to have reserves equal to three standard deviations above the new total expected loss, he would hold $13,000 in reserves ($10,000 + 3x$1,000). While the aggregate amount is clearly greater in this case, the amount per customer is only $130. Each customer would still pay his own expected losses of one hundred dollars, but the three thousand dollars of reserves would be drawn from all one hundred people, equating to only thirty dollars on each policy. The insurer can now offer a much more reasonable premium for the same coverage, without increasing his risk of going bankrupt.

Hopefully this simplified example illustrates the benefits of pooling together policies. If the number of policies in aggregate is too small, then these statistical benefits decrease, and insurers may have to charge rates that will limit sales. However, as discussed in earlier sections, policies pooled together must also be independent and similarly distributed. As the insurer refines the criteria for a given group, variability due to interdependence and differing distributions may decrease, but variability due to sample size would increase.

This tradeoff between the homogeneity of each rating group and the quantity in each group is fundamental throughout the insurance industry. The technical term for the statistical value of these groups is credibility, as in estimates become more credible as groups have more subjects within them (Kaas, Goovaerts, Dhaene, & Denuit, 2008, p. 203). The topic of credibility alone is the subject of many higher level actuarial texts, but the basic principles were shown in this section.

Although many modern insurance policies have become standardized, countless unique exposures have also been insured throughout history, such as space shuttles and celebrity weddings (Schmit, 1986, p. 2). Those cases bring up the method of judgment rating, where an actuary quantifies the risk using his judgment rather than historical results. While this technique may sound weak, judgment rating is used to some extent in all but the most standard insurance lines (Schmit, 1986, p. 3).

For one example, consider an insurer offering coverage on a new type of bridge. Although the company may insure other bridges, the new structure could have a different design or be exposed to different conditions. Underwriters (researchers who analyze risks and calculate premiums to charge clients), would have to use their judgment to adjust premiums for similar structures to match the new one.

For a second example, consider a company insuring a celebrity singer's ability to produce music. Although very few people in the world may have such coverage, the underwriters could do extensive research on the singer's medical background and on medical risks. By multiplying the estimated probabilities of different potential injuries by the policy's coverage value, the underwriters can develop a somewhat objective base from which to assign a premium.

As shown in these examples, usually some cases exist that are similar enough to use for broad reference, until enough data comes in from the newer policies. Furthermore, advanced techniques such as Bayesian statistics, where distributions do not require fixed parameters, can still yield formulated results (Schmit, 1986, p. 4).

When assessing academic performance against the large numbers requirement, the tradeoff between group homogeneity and size will appear again. With 17.5 million undergraduates in the country, there is certainly a large enough body of potential customers (National Center for Education Statistics, 2010, p. 202). However, those students vary tremendously in terms of educational background, college aptitude, and other factors.

Once the company decides on a target customer base, the underwriters can begin assessing how to break those potential customers into similar rating classes. The goal is once again to make the groups as homogenous as possible, while maintaining statistically large group sizes. After completing the grouping and pricing process, the company would have better estimates for the credibility of those groups.

Taking into account the number of undergraduate students and adaptability of insurance markets, it seems that the insurability of poor academic performance will not be jeopardized by insufficient numbers. Insurance companies should then be able to benefit from the pooling properties shown above, leading to reduced reserve levels and affordable prices for consumers.

Finite and Calculable Losses

The next requirement for insurability is that losses are finite and calculable. The expected payouts must be relatively definite as to time, place, amount, and cause, or else the loss distribution pool is entirely unpredictable (Schmit, 1986, p. 5). Insurance providers cannot determine appropriate premiums to charge or appropriate reserves to hold, if they cannot accurately project the timing, size, and probability of potential claims. If losses are not finite, then insurers face the risk of severe losses and bankruptcy (Dorfman, 2008, p. 96).

For example, auto insurance policies specify coverage limits for bodily injury per person, total bodily injury, and property damage, each per accident. The benefits are payable within a defined period after the accident, and policies cover a specific time period. Certain causes may be excluded from coverage, such as stunt driving or using a vehicle for commercial purposes without purchasing commercial insurance. By specifying such details in standardized insurance contracts, insurers can ensure finite and calculable losses.

One extension of this requirement is that losses cannot be catastrophic, or large enough to absorb all of the insurance company's reserve funds (Dorfman, 2008, p. 96). Regulations prohibit insurers from overextending themselves by selling policies for which they cannot hold sufficient reserves (Wong, 2002, p. 5). Otherwise, one catastrophe could bankrupt the company and leave all its customers stranded with unpaid claims. One simple way to guard against this risk is specifying coverage limits for policies, as with the auto insurance example. Essentially all insurance products offered today feature benefit limits in some fashion, as companies recognize the inherent risks of unlimited coverage.

To avoid this risk and still offer high limit policies, some companies seek reinsurance, under which a different insurance company provides coverage to the primary insurer against excessive losses. Reinsurance contracts vary widely in design, with triggers such as losses crossing a given threshold or loss ratio drifting above a cutoff (Thoyts, 2010, p. 169). In that case, the losses and required reserves can be spread among several organizations, each with uniquely diversified portfolios. Still, enormous losses would theoretically bankrupt the whole industry, so insurance companies enlist government backup when providing policy features such as terrorism coverage (Dorfman, 2008, p. 94).

Another aspect to consider is that the policyholder should not be able to change the value of losses after the fact (Anderson & Brown, 2005, p. 6). For example, if a car suffers minor damage in a crash, the policyholder cannot file a claim for the total vehicle value and make a profit. The insurance company would have a hard time projecting future payouts if loss amounts were subjective. For cases where this is not possible, such as insurance against lawsuits or lost business, policies have very specific benefit limits and requirements for payouts to be triggered.

The reverse side of the catastrophe threat is losses that are small relative to premiums. In that case, payments are so frequent that the transaction costs add up quickly (Schmit, 1986, p. 7). Policyholders end up essentially paying for all of their own losses plus the insurer's expenses, since the losses are too small to benefit from pooling. When losses are relatively small, individuals or companies may be better off absorbing them, rather than purchasing insurance (called self-insuring).

The applications to GPA insurance are pretty clear along this dimension. Depending on the exact product, losses could be a specific portion of tuition or the value of a scholarship or loan. In each of those scenarios, the loss amounts would be known ahead of time, would not be catastrophic, and would not be too frequent to bring excessive transaction fees. The potential times would be twice a year at the end of semesters, and the causes would be strictly predetermined, like failing out with no academic credit.

For example, consider a student with a $3,500 per year scholarship contingent on his maintaining a 3.5 GPA. If the loss of his scholarship would render him unable to pay tuition, he may be willing to pay an insurance premium to essentially guarantee those funds. If he maintains a 3.8 GPA throughout the contract term, then he would pay the contract premium and receive no benefit. If his GPA fell below 3.5 however, he would pay the premium but later receive a $3,500 payout from the insurer. He would still have paid the premium, but he would end up only losing that small amount rather than the entire $3,500.

From the insurer's perspective, they are guaranteed premium revenue at the start of the school year, unless an alternate payment schedule is in place. They will then either pay a fixed benefit when grades are calculated after the semester or pay no benefit. The loss amount is locked into the contract, would clearly be finite, and would only be evaluated and paid once to minimize transaction costs.

One potential caveat would be selling too many policies without having enough experience to accurately price them, which could accumulate to a catastrophic loss. This could be exacerbated by the lack of reinsurance, since reinsurers may avoid covering such a new type of product for any reasonable charge. However, this is more an issue of mispricing products, than of losses being catastrophic. Mispricing is a traditional challenge with launching new products, yet insurers nonetheless bring new products to market continually. By rolling out coverage gradually, carefully underwriting clients, and meticulously monitoring results, companies should be able to keep losses finite and calculable.

Control of Moral Hazard

With those criteria satisfied, the largest yet least quantifiable test remains: the management of moral hazard. When insured people act differently or more carelessly with insurance than they would without, then there are intangible loss-producing propensities, or moral hazard (Schmit, 1986, p. 6). Consider a few examples: policyholders failing to question doctors' bills because they are completely covered by insurance, inflating auto repair claims to cover preexisting damage, or driving more recklessly after acquiring physical damage auto coverage. If certain parties can see a gain from losses occurring, without facing any risk of physical or monetary loss, then insurance is generally out of the question.

Traditional theories and popular belief argue that losses must be fortuitous, or that the policyholder can have absolutely no control over the loss (Dorfman, 2008, p. 95). Ideally that condition would be true, but in reality moral hazard exists to some extent in many profitable insurance lines. For example, consider collision auto insurance. Car accidents are generally a result of driver error, and people with insurance may drive more recklessly than those without it. Nonetheless, personal auto insurance is one of the largest lines of business in the country. The threat of bodily harm discourages reckless driving and helps control the moral hazard risk to the insurer.

For a second example, look at fire damage coverage for commercial property. If someone disliked the current office or manufacturing building, they could discreetly burn it to the ground, then take the insurance payment and rebuild a new one. Since the insurance premium would be less than the cost of a new building, the actors would reap a financial profit. The insurer would mitigate this risk of arson by excluding intentional damage from the contract, then ensuring a thorough investigation after any fire damages. The policyholders could still commit arson, but they would risk getting caught and ending up with no building and no insurance payout. Thanks to these policy features, commercial property coverage is a major insurance market despite this risk.

In a third case, consider the more recent development of directors' and officers' liability insurance. In the case that company executives are subject to lawsuits for certain reasons, the policy would cover liabilities resulting from those cases (Chen & Li, 2010, p. 2). This may seem to give directors a safety net to act recklessly, smudging financial records or profiting from insider trading, yet it is still a widely available product.

Even if insured students did not act differently because of the insurance, they may still change their career plans. For example, a student in his second or third year of college may decide to drop out and join the Army, or he may accept a job offer before graduation. Possibly he could decide another institution holds better opportunities and then transfer. In all of these cases, the student could intentionally fail his classes and activate the insurance policy. The insurer would have to be aware that those types of policies would essentially cover voluntary withdrawals. Unless these situations could be excluded from coverage, the insurer would have to add these risks into the premiums, raising costs of coverage.

The insurance world has developed many policy design features to overcome these factors, namely deductibles and coinsurance (Anderson & Brown, 2005, p. 7). To an extent, moral hazard can also be accounted for by setting prices higher from the start. However, if the costs of moral hazard end up being greater than anticipated once policies are issued, insurers can be stuck in a losing cycle. In the worst case, a "death spiral" could result, where increased premiums cause less risky customers to drop their coverage, leaving policies with higher probabilities of payouts (Pauly, Mitchell, & Zeng, 2007, p. 413). In the case of academic insurance, an insurer who tries to quickly raise premiums could find itself with a pool of high-risk, low-achieving customers.

Deductibles and coinsurance are built into insurance contracts as clauses, or additional stipulations of the financial agreement between insurer and insured. Deductibles are minimum losses that the insurer will pay out. Whenever a loss occurs, the specified amount is *deducted* from the total loss, and the remaining amount is paid out (Anderson & Brown, 2005, p. 7). If the claim is below the deductible, then simply no payout occurs. For example, take an auto insurance policy with a $1,000 deductible. If the driver suffers an accident resulting in $800 of damage or liability, he would be forced to pay the entire amount out-of-pocket, since it is below his deductible. If the accident causes $3,000 of losses, then the driver would pay the full deductible of $1,000, then the insurer would pay the remaining $2,000.

On the surface, deductibles eliminate small claims and associated transaction expenses, and they also reduce larger claim payouts by a certain amount. Both of these effects reduce expected losses to the insurer. More importantly however, deductibles give the policyholder a stake in his behavior, an economic incentive to prevent potential losses (Anderson & Brown, 2005, p. 7). A person may drive more carefully if he has to pay $1,000 per accident, as opposed to paying nothing out-of-pocket with full coverage. On the other hand, deductibles can lead to customer dissatisfaction, bad public relations, marketing difficulties, and overstated losses to recover the deductible (Anderson & Brown, 2005, p. 7). A downside to insurers is that once the deductible is met, the policyholder has no incentive to keep remaining losses down.

The second main feature addresses that shortcoming. Coinsurance is a provision under which the policyholder pays a certain percentage of the loss (Anderson & Brown, 2005, p. 7). Under 80:20 coinsurance for example, the insurer would pay 80% of a claim, leaving the customer liable for 20%. The principle benefits and risks are similar to deductibles, except that the customer would still receive payouts for small claims. Policyholders are once again discouraged from causing losses, since they have more money at stake than just their premium. Often, coinsurance and deductible features are paired together in some fashion, such as 80/20 coinsurance with a $500 deductible.

In addition to these two features, other less rigid methods exist to discourage moral hazard. First, insurers can do reference checks of some form on potential clients. By contacting an applicant's past insurers, a company may find out that the individual drives recklessly for example. If an individual actually directly causes losses, perhaps by burning his building down, the insurer may proactively warn other insurers. Alternatively, the company could evaluate financial responsibility by checking credit ratings. Either way, the customer with a history of dishonesty may have a difficult time finding affordable coverage.

Given the potential impact of moral hazard and variety of methods to control it, the natural challenge for an actuary is to quantify it. Placing a price tag on an untested and new risk is far from an exact science, but some scholars have proposed methods. One theory relates the moral hazard effect to price-elasticity of demand, suggesting that the more elastic demand is in response to price, the stronger an effect moral hazard will have (Schmit, 1986, p. 6). With that relationship, one can then find the ideal, income-maximizing balance and build that into policies using coinsurance.

This dimension of insurability is surely the most vulnerable in the evaluation of poor academic performance as a risk. On one side, there is a chance that insured students would not study as much, go to fewer classes, or even intentionally drop out if they had a financial safety net. Possibly the student is only attending college for the recreational experience, rather than for the degree. Maybe a student could take the insurance payout and get a degree from a different college, delaying the need to seek full time employment. The risk may be even higher on certain products, such as those linked to scholarships with high GPA cut-offs. A student could slide by and graduate with a 2.8 average, still receiving the benefits of his degree without paying the full cost of losing his scholarship.

On the other side, university degrees are a crucial part of modern careers, and much pressure exists for students to succeed. Even if students received partial tuition reimbursement after dropping out, someone still spent thousands of dollars on room and board for them. If they ended up falling back on high school diploma level employment, they would be a few years behind their peers who did not attend college first. In the scholarship case, a 2.8 GPA may be less appealing to potential employers than a 3.6, leading to lower salary and a long-term cumulative loss far greater than the initial insurance. One survey found college degrees worth $387,000 on average in the 30 years after graduation (Lavelle, 2011, p. 1), so the money saved from filing a claim for tuition reimbursement due to dropping out may be relatively small in the long run.

Another aspect impacting moral hazard would be the degree to which students pay for their tuition. If a student does not pay tuition and thus does not receive the benefits from a claim, the moral hazard may be reduced. If pupils can receive the claim payment directly, then they have some incentive to not care about their grade point average. Of course, the student could theoretically make an arrangement with another party to purchase coverage on their behalf, securing a lower rate without reducing the risk.

To successfully manage moral hazard, insurers would have to craft policy contracts to include several of the clauses mentioned above. To start, the GPA insurance would avoid covering one hundred percent of college costs, so every customer would still have some money at stake. Once policy limits were determined, deductibles and/or coinsurance would likely be added on to further reduce expected losses, while proactively discouraging risky behavior. Through policy designs, insurers could factor in and partially control moral hazard risk. For example, underwriters could estimate that purchasing academic performance coverage increases a certain student group's failure rate by 10%. After calculating a reasonably profitable premium rate for that group based on historical performance Figures, they could inflate the price by 10% to account for the moral hazard. As one researcher noted, "it is incalculable moral hazard that makes a risk uninsurable" (Schmit, 1986, p. 7).

Extensive market and academic performance research would be required before bringing these products to market. The costs for coverage would most likely increase due to the loss-producing propensities of covered individuals, so the ultimate fate will depend on market demand at reasonably profitable rates. Considering other examples throughout insurance markets, academic performance does not present severe enough moral hazard to rule out insurability at this stage.

Comparable Products

Insurers have offered various tuition insurance products for over 80 years, covering medically necessary withdrawals and deaths of student or tuition payer (Hill, 2008, p. 1). Some policies even include protection against involuntary job loss or relocation, mental health withdrawals, voluntary withdrawals, and academic or disciplinary dismissal (Kantrowitz, 2012). These products offer coverage on similar risks to the same customers as academic performance insurance would.

GradGuard

Next Generation Insurance Group (NGI) offers a range of college financial protection tools, including a tuition insurance plan titled GradGuard (Next Generation Insurance Group, LLC, 2012). Students can enroll in this plan at any time of the year for 100% protection against medical disability and death of student or tuition payer. Emotional and mental health related withdrawals are also covered up to 75%. GradGuard covers cost of tuition, academic fees, room, board, and other expenses up to $50,000 annually (Next Generation Insurance Group, LLC, 2012).

As with many similar products, GradGuard has several exclusions including voluntary withdrawal, catastrophic campus-closing events, and dishonest acts by the student. There is a 14-day waiting period for illness-driven withdrawals, and the cause must be certified by a campus physician as preventing school attendance. This product also includes numerous other services, such as identity theft protection, medical evacuation, and PC protection, and membership in College Parents of America. Interestingly, the online application for coverage asks only for name, birth date, school, graduation date, and contact information.

Financially, GradGuard premiums sit around 1-2% of face value. $10,000 annual policies cost $239, while $50,000 policies run $599 (Next Generation Insurance Group, LLC, 2012). These premiums seem inexpensive compared to other industry offerings, especially considering the other services included. The lack of detailed underwriting questions on the application suggests that applicants are grouped on a relatively high level. As discussed earlier, that strategy allows strong pooling due to the large numbers, but may suffer from charging the same rates to students with significantly different risk levels. This product also seems especially geared toward parents, with its membership in College Parents of America.

Tuition Refund Plan

An alternative tuition insurance solution, offered since 1930 and currently the largest player in the market at 200 plus colleges, is the Tuition Refund Plan by A.W.G. Dewar (Dewar, 2012). While NGI sells GradGuard directly to students' parents online and over the phone, Dewar partners with colleges to sell through institutional channels. For example, parents paying for their first tuition bill online may be prompted to purchase a policy at the same time. While this system makes marketing more simple, it also means that the policies only cover charges paid directly to the school. Also, applications and payment must be received by the start of the covered semester.

Benefits under this plan cover 100% of tuition and fees, less any refund the college provides. Mental health related withdrawals are only covered 60%. The contracts stipulate that the student must completely withdraw and receive no academic credit, in order for a term to be reimbursed. Similar exclusions to GradGuard apply, including use of alcohol or non-prescription drugs, participation in riots or demonstrations, and suicide or self-inflicted injury.

Exact terms and premiums vary by each college, since they match specific college cost structures and complement college refund policies. For example, policies at Harvard University ensure 90% coverage of tuition, fees, room, and board for $316 a semester (Dewar, 2012). In contrast, plans at Susquehanna University only cover 75% but cost $409 a semester. Based on the costs of attending these universities and coverage amounts, the cost per face value of coverage is almost twice as great at Susquehanna (CollegeBoard, 2012). This discrepancy suggests Susquehanna students have a higher risk of filing claims, which is likely a result of several factors.

Applicability

Despite their differences, several aspects of both the GradGuard and Tuition Refund Plan policies can be extended to potential academic performance products. First, take the benefits these products provide. Each plan reimburses tuition, academic fees, and room/board paid to the school. GradGuard, the generally more flexible choice, even adds on other college expenses and off campus room and board. To protect against catastrophic losses, both companies list several exclusions in their policies, such as universities closing due to war, terrorism, natural disasters, or nuclear incidents. Since these products have been viable, these losses must be finite and calculable.

Second, these products have proven to be able to obtain enough customers to pool together. NGI does not vary GradGuard premiums by high school academic performance, suggesting it is pooling together policies on a higher level. Dewar customizes policies and rates by school, so it must have enough customers at each school to form sub-groups. In both cases, the insurers have managed to utilize pooling enough to keep their required reserves at a reasonable level and run profitable operations.

Finally, these companies use similar features to control moral hazard. NGI excludes academic dishonesty, while Dewar excludes use of drugs. Both policies cover 60-70% for mental health withdrawal, a difficult and subjective risk to cover. The success of these policies suggests that similar coinsurance provisions may sufficiently control the moral hazard of insurance on academic performance.

Further Research

Since academic performance preliminarily meets the requirements of insurability, the product development process may continue. To turn an insurable risk into a profitable operation, the insurance company must design products that appeal to customers at profitable prices.

Exploratory product design could start with product benefits or insured amounts. Different products could appeal to students with GPA-linked scholarships or loans, for example. They could cover partial or full reimbursement or tuition, academic fees, room, board, and other expenses, ranging from hundreds to tens of thousands of dollars. As mentioned above, coinsurance or partial coverage would likely be used to reduce moral hazard. Loss payments would have to deduct any refund provided by the school, to avoid students receiving double payments. In addition to loss payouts, policies could also include supplementary benefits like tutoring to appeal to parents and help improve student grades.

After product benefits were established, exact payout terms would need to be specified, and corresponding base probabilities would need to be calculated. Some products could kick in when GPA dropped below a certain point, while others could require complete withdrawal with no academic credit. These products could also be bundled with existing products to cover medical disability, death of tuition payer, death of student, and other causes. Exclusions and other miscellaneous clauses would also be factored in to prevent unmanageable losses.

Third, the insurer could explore options to classify customers into homogeneous groups. Previous research suggests that high school GPA, SAT score, predicted GPA from the college, and number of credits are reasonably effective predictors of collegiate graduation (DeAngelo, Franke, Hurtado, Pryor, & Tran, 2011, p. 28). More variables could be added as students develop college experience, so freshmen that perform well could obtain less expensive coverage their second year. Once pricing adjustment factors are developed for these different groups, the insurer could develop pricing tables based on the benefit amounts and base probabilities.

Finally, the company would have to run marketing surveys to evaluate whether market demand exists at those prices. Academic performance can definitely be insured for a price. If those premium rates end up being 75% or 100% of insured costs though, very few families would be interested. The survey campaign would strive to obtain responses from a sample of subjects accurately representing the target customer base. The survey instruments would encourage subjects to provide honest answers. With accurate answers from a representative sample, the survey results should reflect actual responses to a real marketing and selling campaign.

Conclusion

Poor academic performance is definitely not a perfect, ideal risk. Issues could arise with groups of students not being independent, with rating groups not having enough members or not being homogeneous, and most notably with moral hazard. Insurance markets have become adaptable though, offering numerous types of coverage for similar risks.

With premiums somewhere in the range from the full coverage amount to zero, an insurer can always offer policies at a profitable level. That price level will drop as the criteria of independence, similarity of distributions, large numbers, finite and calculable losses, and control of moral hazard are more fully satisfied. If all of these factors are perfectly met, the coverage should pose little risk to the insurer, meaning it can charge attractive premiums to customers. If none of the factors are met, the insurance mechanisms would be useless, meaning every customer would pay the full coverage amount in premiums. Academic performance has stacked up reasonably well against these criteria, suggesting it is insurable at a reasonable price in that range.

Given the positive results of this theory-driven analysis, an insurer is free to proceed with design and pricing of GPA-linked products, then run a survey market demand and projected profitability at those prices. After testing the feelings of potential customers toward those products and prices, the insurer could ultimately make a decision whether to launch or abandon academic performance insurance.

Appendix A: List of Figures

Appendix B: List of Tables

Appendix C: Works Cited

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The Pennsylvania State University- Schreyer Honors College
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Bachelor of Science in Actuarial Science Anticipated May 2012
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Relevant Coursework
- Insurance- Risk and Insurance, Life Insurance, Compound Interest and Annuities, Life Contingencies, Property and Casualty Ratemaking
- Statistics- Applied Regression Analysis, Applied Nonparametric Statistics, Stochastic Modeling, Applied Time Series Analysis, Problem Solving and Communication in Applied Statistics
- Professional Development- Financial and Managerial Accounting for Decision Making, Social and Ethical Environment of Business, Business Writing, Effective Speech, Honors Core Marketing, Honors Core Management, Honors Integration and Research

Presentations
- Case studies in honors management course
- Marketing study of grocery store brands
- Data mining research application
- Personal speeches on auto insurance
- Actuarial exam review sessions
- Business plan proposition for a local entrepreneur

Technical Skills
- Microsoft Office Suite, including Word, Excel, Powerpoint, and Access
- SAS
- Minitab
- R
- Oracle Hyperion

EXPERIENCE

Swiss Re Life & Health America Inc. Armonk, NY
Actuarial Development Program (ADP) May 2011 - August 2011
- Reengineered a $100 million reserve valuation process
- Illustrated financial impacts with dynamic exhibits
- Supported team members with quarterly reporting and analysis
- Designed production tools in Excel and Access

Centre County Mutual Fire Ins. Co. Bellefonte, PA
Actuarial Consultant April 2011
- Projected reserve requirements using loss development factors and loss ratios
- Published supporting exhibits for actuarial opinion summary
- Coordinated with second consultant on project tasks

The Pennsylvania State University University Park, PA
Teaching Assistant- Insurance and Real Estate Department August 2010 - December 2010
- Collaborated with professor to optimize learning environment
- Provided supplementary individual instruction in financial mathematics

CIGNA Philadelphia, PA
Actuarial Executive Development Program (AEDP) June 2010 - August 2010
International Health, Life, & Accident Department
- Analyzed over 600,000 claims along several dimensions
- Integrated claims and premiums to project and evaluate monthly results
- Developed high level template to guide similar analyses in other countries
- Presented and discussed summer project with actuarial community
- Utilized Excel, Access, and Oracle Hyperion for dimensional analysis

ACTIVITIES

Penn State Crew Team, *President* 2008-Present
- Elected Varsity Captain 1 yr, Equipment Manager 1 yr, President 1 yr
- Manage over $100,000 between coaches' salaries, equipment, and competition
- Plan and lead weekly meetings among officers, captains, chairs, and coaches
- Train over 12 hours per week and compete on a national level

Actuarial Science Club 2009-Present
- Led FM exam review sessions
- Implemented actuarial student mentoring program

Beta Gamma Sigma Honor Society 2011-Present

COMMUNITY

Pull for a Cure, American Cancer Society 2010-2011
- Represented the cause at Head of the Charles Regatta
- Assisted fundraising efforts

IFC/Panhellenic Dance Marathon 2008-Present
- Supported fundraising efforts and team dancers

Bald Eagle State Park 2011-Present
- Coordinated service project enhancing visitor access to park
- Advocated $2,000 team donation to improve park facilities