Pricing of a proposed Parametric Unemployment Insurance Product

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Abstract

Parametric insurance products have been in existence for some time now but they have predominantly been deployed in the mitigation of catastrophic risks such as floods and hurricanes. However, further scrutiny reveals that products of this sort can be built for much more diverse risk. In this paper, I focus on one such application in the field of college unemployment where I design and price such a product. The product is has a low limit coverage of $5000 based on double trigger of initial unemployment claims exceeding a preset percentile as well as lack of job offerings a week after graduation. I make some considerations of the costs associated with the product as well as how to make the product more useful to college grads. I then price the product using the equivalence principle. Finally, a brief consideration of product expansion is made.

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INTRODUCTION

ABOUT PARAMETRIC PRODUCTS

Parametric insurance is a type of insurance where an ex ante amount is paid to the insured after a set condition is met. Historically, parametric insurance products have been developed only for catastrophic perils such as flood and earthquakes. In the case of flood, the set condition (also called triggering event) may be the amount of inches the water rises, say 1 inch. In case this condition is met, the insurer pays the insured an amount of money which had been previously agreed upon. In recent years, there have been novel applications of parametric insurance in such sectors as life insurance (National Insurance Academy in India).

There are several usefulness of these parametric products. Due to the nature of parametric products, they are very cost effective. This is because the transactions costs such as those incurred in loss appraisal are very much reduced or entirely removed. The extent of loss indemnity is also set in advance and thus there is no need to bear any cost in assessing how much to pay in response to a loss. In a report by Clyde & Co (2018), this is what was noted, 'Parametric products can cover risks that are not otherwise easily insurable, and allow for more scientific pricing of products that respond to specific isolated parameters, rather than the physical losses which might result from any number of a wide range of occurrences. Together with lower claims management costs, this makes lines of business commercially viable that were not

previously.' In the same report, it was noted that the key benefits of parametric insurance is the speed, certainty of payout and the ability to plan ahead.

THE PURPOSE OF THIS PAPER

Although unemployment insurance is primarily done by the government, this paper focuses on providing a theoretical framework to develop and price a parametric unemployment insurance product by a private company. We will examine the factors which go into the pricing and then use the equivalence principle to price it.

The product will be designed primarily for college graduates. This is because data show that graduate unemployment rate in the USA has been increasing in recent years. To quote an article from Forbes, 'According to the Fed, college graduates—defined as ages 22 to 27 years old, holding a bachelor's degree or higher— are more likely to be unemployed and underemployed compared to overall workers. This is the first time it's happened in *almost 30 years*. Statistics show that the unemployment rate for recent college graduates has been steadily moving upward, while the general unemployment rate for all other workers has been rapidly declining over the last 10 years.' (Kelly, 2019)

We will consider any moral hazards to be faced by the firms in providing these products. We also deliberate if there should be any discrimination in deciding premiums to be paid. Example; should there be any premium reduction for students who are doing well in school? Do we consider the probability that a student who starts school finishes in our premium calculation?

Regardless of the considerations, in agreement with Beenstock (1985), 'The basic premise is that individual premia should reflect the marginal cost of the unemployment contingent risks that are being underwritten. Alternatively, the premia should be competitively determined in the sense that the insurance company supplying unemployment insurance contracts should not be able to earn arbitrage profits or monopolistic profits.'

NATURE OF THE PROPOSED PARAMETRIC UNEMPLOYMENT PRODUCT

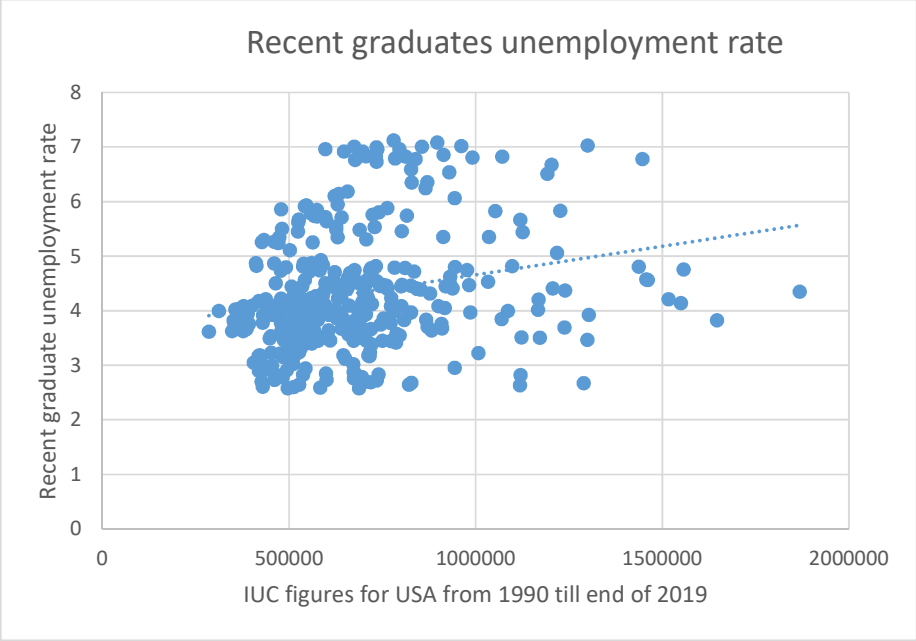
In designing our parametric product, we need a parameter which is correlated to the unemployment rate. One parameter to consider is the Initial Unemployment Claims (IUC). Initial unemployment claims is an index which captures the number of new claimants seeking unemployment benefits.

As one can guess, the IUC is a very useful tool in predicting how the unemployment rate is going to be. A sudden hike in the IUC signals a potential increase in the unemployment rate. This was certainly observed during the era of COVID 19 which displaced a lot of people from work. This measure is not without its weakness and we will look into that under the Assumption and Limitation section of this paper.

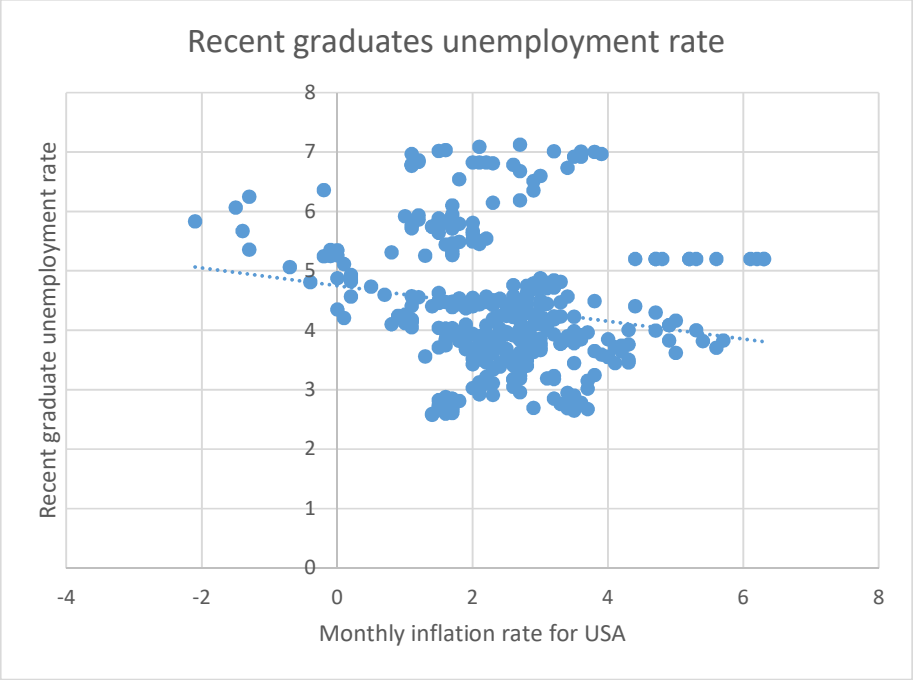
A close inspection through a scatter plot will be beneficial in establishing the relationship between the IUC and the unemployment rate (Due to the focus of our paper, we look at the relationship between IUC and the recent graduate

unemployment rate). Consider such a plot below showing the monthly recent graduate unemployment rate on the vertical axis and the IUC for the USA on the horizontal axis (Figure 1) from 1990 till the end of 2019. In Figure 1 below, we see the trend line is positively sloped suggesting a positive relationship between IUC and the recent graduate unemployment rate. We obtain that the Pearson's correlation coefficient (r) is equal to 0.238709, further strengthening the case that IUC is positively correlated with the recent graduate unemployment rate. This means that we can choose the IUC rate as a parameter in creating a parametric unemployment product.

Another parameter which can be considered is the interest rate. The relationship between unemployment rate and the interest rate is summarized by the Philips curve. This theory postulates an inverse relationship between the unemployment rate and the inflation rate but has called into question following stagflation in the US in the 1970s. In normal situations however, an increase in inflation rate decreases the unemployment rate and vice versa. We show this relationship in Figure 2 with the recent graduate unemployment rate and the inflation rate. It is the Philip's curve for these parameters from 1990 till the end of 2019. We notice that the trend line is negatively sloped which suggests an inverse relationship between the factors involved. In fact Pearson's coefficient, r, equals -0.17461.



(Figure 1, Pearson's correlation coefficient, r = 0.238709)



(Figure 2, r= -0.17461)

We will design the product in this way: an insurance company in Illinois (Company A) offers these unemployment products according to the information provided below:

Company A

This company seeks to price a product which would pay graduating college students the amounts specified under 'Product Types' when these two criteria are met:

1. Initial Unemployment Claims (IUC) for a particular month exceed a specified percentile set by the insurance company.
2. College graduate has not received a job offer within one week of graduation.

There is a reason why we considered the double trigger and more importantly, the second trigger. If we had designed the product with just the first trigger in mind, the resulting product will be a derivative and not an unemployment insurance product. The second trigger thus helps us to obtain an insurance product which is what we seek.

Product Types:

- Basic – One-time payment of $5000
- Intermediate - Recurring payments for each month that IUC exceeds chosen percentile up to aggregate limit of Option A-$10,000, Option B- $20,000, Option C- $30,000
- Special- Chosen percentile is not necessarily triggered but an agreed upon percentile is triggered and a specified amount is paid for specified period.

Example: If the May 2020 IUC of Illinois exceeds 95th percentile of 30 year monthly average IUC of Illinois for May and a recent graduate has not yet received a job offer, then payment of $5000 will be made under the Basic policy.

METHODOLOGY

We will use the equivalence principle to price this product.

To do this, we will create an interactive interface in Microsoft Excel where we can input the pertinent values we want. The program will then return a premium value based on our inputs. The Excel file has 2 sheets – one which takes actual values for costs and one which returns premiums based on percentage estimates of cost.

Among the quantities under our control in the model are

- The number of students in year group
- Percentage of students graduating
- Number of students graduating without a job offer
- Total cost at time 0 and total cost at time t, $t \geq 1$
- Interest rate
- Probability that IUC exceeds chosen level
- Probability that graduate student is unemployed a month and through 5 months after graduation
- Percentage of premium return having graduated with a job offer

- Percentage of premium return for each year that GPA exceeds chosen level (Default = 3.0/4) etc.

The other quantities in our model are based on these quantities above and are not directly in our control. These are

- Number of students graduating
- Number of students not graduating
- Number of students graduating with a job offer
- Average initial cost and average cost at time t, $t \geq 1$, $t \in \aleph$
- Probability that grad student has received a job offer before graduating and probability that grad student has not received a job offer before graduating.
- Premium value

The simplest way to recognize that a parameter is in our control is the color code assigned to its cell. All parameters in our control have a green color in their cell while those not in our control do not. They are plainly colored.

ASSUMPTIONS AND LIMITATIONS

ASSUMPTIONS

1. One of the most important assumptions we are going to make is that a student has exactly an integral number of years from the start of their program till they graduate. Of course, this is not necessarily true as students may graduate earlier or later than an integral number of years.

2. We also assume that costs are paid as annuity-certains for the time in which the product is in effect. For example, a person who buys a 4 year product will pay some costs every year till graduation. These costs will be determined by the company and may be zero if the company so chooses.
3. We assume that the firm designing this product has met all the requirements in its state of operation to be considered an insurance firm. Information on these requirements can be found here. We also assume that it has met the regulators' mandate that every insurance company must issue a policy with a market capitalization of 10% of its value unless it is reinsured.

LIMITATIONS

Inherent in our design of the unemployment product is the assumption that changes in the IUC represents a change in the unemployment rate. However, as Palash (1983) noted in his paper, initial claims is not a good predictor of the direction of unemployment. It is a better predictor of the direction of payroll unemployment. He notes however that in instances of recession, the fall in IUC claims clearly predict the fall in unemployment.

FULL SCOPE OF CONSIDERATIONS TO BE MADE TO DETERMINE PREMIUM

THE PRODUCT CYCLE AND PRICING STRATEGIES

The price of a product at any stage depends on where it is in the product cycle. Basically, there are two stages in this cycle. The 'new product' pricing phase where the firm may enjoy patent protection and protected distinctiveness. Dean J. (1976). This is also called the pioneer pricing phase. In the early stages, it is difficult to estimate demand and thus pricing is harder. At this time, it may be difficult to market but the product is distinct and hence the firm has great control in setting price. If the product survives on the market resulting in an increase in demand, we move to the second part of the pricing cycle. In this stage, competition increases as several other firms create very similar products and thus the initial special distinctiveness of the product is lost. Thus the pricing policy has to change at this time to change to reflect this competition.

Given that this we are trying to price a new product, we will consider the product to be in the pioneer pricing phase. The nature of the insurance industry dictates that products will not have the chance to enjoy their distinctiveness for extended periods before they face strong competition in product design. This is because insurance products do not involve huge capital outlays in their design much unlike products in the manufacturing industry. Thus costs involved here are mostly restricted to the human resource engaged in the product design, maintenance and marketing.

Two main pricing techniques are available during this stage,

a) Skimming pricing: This involves setting a huge initial price to reap benefits of product distinctiveness as soon as possible. This is done when the company

recognizes that demand for the product will be inelastic in the early-going and therefore price increase will increase demand. In the insurance industry, a firm will not be able to enjoy from this strategy for long before another firm creates the same product and sells it for less. This leads to

b) Penetration pricing: Here, the company recognizes that product distinctiveness is ephemeral and thus prices the product very low in order to discourage competition and enjoy from the huge patronage due to the low product price. In doing this, the insurance company hopes to make profit in the long term as opposed to short-term.

   Evidence suggests that penetration pricing will work best in the insurance industry.

When the product gets to the latter stages of its cycle where it has become more commonplace and much more of a commodity than a specialty, there is the need to keep the price in competitive range unless the firm manages to establish superior product quality.

In conclusion Dean (1976) put it best when he said 'in pricing products of perishable distinctiveness, a company must study the cycle of competitive degeneration in order to determine its major causes, its probable speed, and the chances of slowing it down. Pricing in the pioneering stage of the cycle involves difficult problems of projecting potential demand and of guessing the relation of price to sales.'

ON THE COLLEGE GRADUATE

One of the important discussions is whether to make this product voluntary or mandatory for college students. If this product is made voluntary, we can imagine a scenario where only one student purchases the product. In this case, the costs borne by the firm in providing this product will be quite huge. Nonetheless, it is a real possibility which firms must face should they decide to make these products voluntary to students.

On the other hand, if the companies are able to enter into agreements with colleges to make these products mandatory, the benefits are quite huge. For one the costs borne by the firm will be extensively spread so that the overall premium will be reduced for each student. This will also help the firms to properly structure the costs associated with these products: knowing that you have about 10000 students to provide this service is much preferred to not knowing anything about the number of buyers of one's product.

In light of these considerations, the first thing the company needs to do is a market survey to check whether or not these products will be appreciated by their target buyers; college students.

Listed below are a few considerations to make the product as attractive to the average student as possible. We propose the following modifications;

1. Reduction in premium cost for students who have GPA of at least 3.0 out of a possible 4. This will encourage students to do better in their academics as there

are obvious benefits to doing that. For a student with n-years to graduation who pays premiums annually, this offer will be very much welcome as a way to reduce the overall premium cost.

Obviously there are some students who will make 1-time payment and for such students, they can have part of their premiums refunded for every year they meet this condition.

2. Return of percentage of premium to students who get job offers within a week of graduation. This is done to make the product very much appealing to grad students who believe they have a high chance of securing employment after college. The guaranteed amount the product pays as well as this stipulation makes it all the more appealing to procure.
3. The case for drop-out students and students who stay longer in school than the average student.

   These scenarios will be considered on a case by case scenario however the default position is that they will be paid nothing.

ON THE INSURANCE COMPANY

Every insurance company aims to pull enough resources from its product premiums to be able to cover its operational costs as well as provide the benefits specified by the contract. One important discussion we are going to have is about the nature and cost structure of the firm providing this product. There is the need to stress that this pricing

is based on the fact that the firm is in the pioneer product pricing phase and thus has great control on what the price may be.

We will develop cost assumptions on which the firm will base to price this unemployment product.

1. Every company has fixed costs and this company will be no exception. In providing this product, the company may need new offices/cubicles for the staff who will be working on these.
2. The company will also incur variable costs in the form of data collection, claim processing, salary to be paid to staff involved in this project.

According to Young (1990), most large insurance companies have the following cost percentages to their non-life business (which this product falls under):

Claims (typically 65% to 80% of premiums)

Commissions (typically 14% to 19% of premiums)

Management Expenses (typically 12% to 18% of premiums)

Management Expenses as stated here refers to the expenses borne by the firm in the form of salaries to the staff in the insurance company.

In this paper, we will not add claim expenses but we will add overhead cost percentage. This will encompass every cost involved in creating and maintaining this product. This will include the claim-collection costs. Thus we can calculate our premiums based on

percentage estimates for our overhead costs and management expenses. This calculation is captured in the second sheet of our Excel file.

Also, as a more direct approach, we will assume that in providing this product the company bears the following costs:

- Utility costs of running the place
- Salary for staff involved in this project
- Cost involved in data collection
- Miscellaneous

We need to note that these costs are not sacrosanct. They depend on the firm size. A large firm may not need to hire more staff to help or bear any more costs as a matter of fact. As a result, we allow for flexibility in our Excel file so costs can be changed to suit the company size.

Thus the total cost incurred by the insurance company in providing this product for a year is

Initial cost = TC_0

Cost for year t = TC_t , t ≥ 1, t $\in /N$

Total cost = TC = $TC_0 + TC_t$

Average Cost = C= $\frac{TC}{n}$, n = number of products.

What we can deduce is the greater the number of students involved, the less the overall cost borne by each because the number of products produced is tied directly to whether or not the products are in high demand. Also, we need to take note of the

fact that the costs need to be spread across the full years the product lasts per buyer. This premium calculation approach is captured the first page of our Excel file.

With these in mind, we look into the considerations to be made in order to determine the premium under the equivalence principle for the various policies of this unemployment insurance product. We will make the assessments for a single premium payment at the beginning of the program. In our Excel model we will calculate the per semester premium. In the semester-based premium calculation, we will assume that the premiums will be paid as annuity-certains at the beginning of every semester, thus 3 times per-year.

These are the interpretations to the symbols found in our premium calculations

$\mathbf{P_O}$ = One-time premium payment at the beginning of the study period.

$\mathbf{P_S}$ = Semester-based premium payment at the beginning of every semester

v = discount factor (based on yearly interest rate, i)

q = probability that college graduate has not received a job offer within a week of graduation.

$\mathbf{C_0}$ = initial average cost of providing this product.

$\mathbf{C_t}$ = cost of providing this service for years $t \geq 1$, $t \in$ ℵ

p = probability that college graduate has received a job offer within a week of graduation

b = probability that IUC exceeds chosen percentile

k = percentage to be handed out as return of premium upon being employed

Before we go on, let us note that the semester-based premium for each of the years can be calculated as follows:

4 year policy,

$$\mathbf{P_O = P_S + P_S*v^{1/3} + P_S*v^{2/3} + P_S*v + P_S*v^{4/3} + P_S*v^{5/3} + P_S*v^2 + P_S*v^{7/3} + P_Sv^{8/3} + P_S*v^3 + P_S*v^{10/3} + P_S*v^{11/3}}$$

3 year policy,

$$\mathbf{P_O = P_S + P_S*v^{1/3} + P_S*v^{2/3} + P_S*v + P_S*v^{4/3} + P_S*v^{5/3} + P_S*v^2 + P_S*v^{7/3} + P_Sv^{8/3}}$$

2 year policy,

$$\mathbf{P_O = P_S + P_S*v^{1/3} + P_S*v^{2/3} + P_S*v + P_S*v^{4/3} + P_S*v^{5/3}}$$

1 year policy,

$$\mathbf{P_O = P_S + P_S*v^{1/3} + P_S*v^{2/3}}$$

BASIC POLICY

1. 4 year program

   Under the benefit premium approach, we have that

$$P_O = 5000v^4 qb + C_t a_{\overline{3}|} + C_0 + kP_O * v^4 pb$$

2. 3 year program

   For a single premium paid at the beginning of the period, we have that

   $$P_O = 5000v^3 qb + C_0 + C_t(v+v^2) + kP_O * v^3 pb$$

3. 2 year program

   The single premium paid at the beginning of the period has the following formula:

   $$P_O = 5000v^2 qb + C_0 + C_t v + kP_O * v^2 pb$$

4. 1 year program

   $$P_O = 5000vqb + C_0 + kP_O * vpb$$

INTERMEDIATE POLICY

For the intermediate policy, we take note of the following notation which we use in the premium calculation:

q_1 = probability that graduate student is unemployed a month after graduation

q_2 = probability that graduate student is unemployed 2 months after graduation

q_3 = probability that graduate student is unemployed 3 months after graduation

q_4 = probability that graduate student is unemployed 4 months after graduation

q_5 = probability that graduate student is unemployed 5 months after graduation

Policy A: This product pays $5000 if graduate has not received a job offer a week after graduation while IUC exceeds the specified percentile and another $5000 for the next month if student is still unemployed and IUC exceeds the specified percentile.

The premium is calculated as follows,

1. 4 year program

   $$P_O = 5000v^4 qb + C_t a_{\overline{3}|} + C_0 + kP_O * v^4 pb + 5000v^{4+1/12} bq_1,$$

2. 3 year program

   $$P_O = 5000v^3 qb + C_0 + C_t(v+v^2) + kP_O * v^3 pb + 5000v^{3+1/12} bq_1$$

3. 2 year program

   $$P_O = 5000v^2 qb + C_0 + C_t v + kP_O * v^2 pb + 5000v^{2+1/12} bq_1$$

4. 1 year program

   $$P_O = 5000vqb + C_0 + kP_O * vpb + 5000v^{1+1/12} bq_1$$

Policy B: This product policy pays $5000 for the first month as Policy A but extends to 2 additional months if the conditions above are still met. That is, if student is still unemployed and IUC exceeds the specified percentile.

This premium is calculated as follows,

1. 4 year program

$$P_O = 5000v^4\,qb + C_t a_{\overline{3}|} + C_0 + kP_O{*}v^4 pb + 5000v^{4+1/12}bq_1 + 5000v^{4+2/12}bq_2 + 5000v^{4+3/12}bq_3$$

2. 3 year program

$$P_O = 5000v^3 qb + C_0 + C_t(v+v^2) + kP_O{*}v^3 pb + 5000v^{3+1/12}bq_1 + 5000v^{3+2/12}bq_2 + 5000v^{3+3/12}bq_3$$

3. 2 year program

$$P_O = 5000v^2 qb + C_0 + C_t v + kP_O{*}v^2 pb + 5000v^{2+1/12}bq_1 + 5000v^{2+2/12}bq_2 + 5000v^{2+3/12}bq_3$$

4. 1 year program

$$P_O = 5000vqb + C_0 + kP_O{*}vpb + 5000v^{1+1/12}bq_1 + 5000v^{1+2/12}bq_2 + 5000v^{1+3/12}bq_3$$

Policy C: This product also pays $5000 months if student is unemployed a week after graduation (when first payment is made) and 5 more months if student is still unemployed and IUC exceeds specified percentile. The premium is calculated as follows;

For the 6-payment policy

1. 4 year program

$$P_O = 5000v^4 qb + C_t a_{\overline{3}|} + C_0 + kP_O * v^4 pb + 5000v^{4+1/12} bq_1 + 5000v^{4+2/12} bq_2 + 5000v^{4+3/12} bq_3 + 5000v^{4+4/12} bq_4 + 5000v^{4+5/12} bq_5$$

2. 3 year program

$$P_O = 5000v^3 qb + C_0 + C_t(v+v^2) + kP_O * v^3 pb + 5000v^{3+1/12} bq_1 + 5000v^{3+2/12} bq_2 + 5000v^{3+3/12} bq_3 + 5000v^{3+4/12} bq_4 + 5000v^{3+5/12} bq_5$$

3. 2 year program

$$P_O = 5000v^2 qb + C_0 + C_t v + kP_O * v^2 pb + 5000v^{2+1/12} bq_1 + 5000v^{2+2/12} bq_2 + 5000v^{2+3/12} bq_3 + 5000v^{2+4/12} bq_4 + 5000v^{2+5/12} bq_5$$

4. 1 year program

$$P_O = 5000vqb + C_0 + kP_O * vpb + 5000v^{1+1/12} bq_1 + 5000v^{1+2/12} bq_2 + 5000v^{1+3/12} bq_3 + 5000v^{1+4/12} bq_4 + 5000v^{1+5/12} bq_5$$

ON LEGAL ISSUES

Due to the fact that parametric insurance products have primarily been made for catastrophic perils, there are unclear regulations with regard to its much more novel applications such as this product. In fact, according to the report by Clyde & Co. (2018), the following are some of the more problematic parts of regulation with regard to parametric insurance:

Parametric insurance products may cause legal or regulatory uncertainty in jurisdictions where:

1. The insured must have an 'insurable interest' at the time the policy is underwritten and/or at the time the loss occurs.
2. The size of the insurance pay-out must correspond to the actual loss suffered by the insured. This 'indemnity principle' can mean that in certain jurisdictions, an insurer may only restore insureds to their pre-loss financial position, such that losses must be valued or assessed before claims can be paid

MORAL HAZARD

On one hand, many students will appreciate the security the product provides. For instance, a student with the Intermediate product which pays for 6 months may be reasonably motivated to only take a job once they are sure they will not be underemployed in this venture. This will have tremendous impact on the welfare of the individual as countless studies show that underemployment evokes feelings of depression, insecurity and raises self-doubt as Doodley, Prause and Ham-Rowbottom (2000) noted. On the other hand, there is a problem of moral hazard to be considered. Some students may pass up on reasonable employment opportunities because they want to recoup the maximum benefits of their contracts. This is a problem associated with most insurance products and to which a panacea may never be found. The nature of our product may significantly decrease this chance because of the parametric

component- payment is only due whenever the IUC exceeds a certain specified limit. Also, given that the most durable of them lasts only 6 months, the student is encouraged to get a job because the product is not designed to last till they get a job but to a specified period of time.

ASYMMETRY OF INFORMATION AND ADVERSE SELECTION

In the context of this product, asymmetric information is said to have occurred when either party (insurance company or graduate) has more information about the product than the other, typically leading to situations in which they can exploit the other's ignorance. The tendency to exploit asymmetric information is what is termed adverse selection. Adverse selection is common in insurance contexts. For example, individuals aware of imminent death from a terminal disease may purchase life insurance products while hiding that information from their insurers. They do this to avoid paying the much higher premiums associated with such conditions.

In the case of our product, it is reasonably conceivable that the students will have much more information that the insurance companies offering the product. Given that academic performance correlates strongly to student employability, students who do not intend to put in their best efforts academically may purchase this product in order to benefit from it.

Having predicted the IUC amounts for the upcoming periods with ample degree of confidence, the insurance company can also benefit from this information by agreeing

to a predetermined IUC level which they can reasonably expect would not be triggered. Unsuspecting students may purchase this product much to the profit of the company since it may be the only party benefitting from the information it acquired with respect to the predicted IUC level.

PREMIUM REDUCTION FOR STUDENTS DOING WELL IN SCHOOL

As part of our deliberations, we consider the implications of including a premium discrimination based on student performance. Such a stipulation is based on 2 principal reasons:

1. It may encourage students to study harder in order to benefit from the premium reduction.
2. It serves as a marketing strategy. The allure of a possible premium reduction will prove to draw many students who will otherwise not give this product a second thought.

Suppose the insurance company decides to do that, then there is the need to think of how to correlate performance to the premium to be paid. One thing that comes to mind straightway is the Grade Point Average (GPA). Students involved in sports can also be assessed based on their performances. Lecturer evaluations can also be considered in adjudging performance. However, GPA seems to be the most widely

accepted and used form of performance assessment in college. Therefore we will use that measure as the metric to decide on a possible premium reduction.

A reasonable GPA level to use as the cut-off point is 3.0 out of a possible 4.0 or a 4.0 out of a possible 5. We will use this cut-off in our Excel sheet to calculate the reduced premiums. For now, we will consider a 5% premium reduction every time a graduating student meets this criteria. That is, we will refund 5% of the premium whenever a college graduate has a cumulative GPA (CGPA) of more than 3.0 out of 4 or its equivalent in other metric systems. In the Excel sheet however, we allow for other percentage reductions based on the insurance company's preference.

This can easily be incorporated into the our calculation by taking note of this,

Premium = m*Premium*v^t*r + K, where

m = percentage of premium to be paid as compensation for graduating with CGPA 3.0+/4 or its equivalent

r = probability student graduates with CGPA $\geq$ 3.0 out of 4

K represents all other benefits associated with product

THE UNEMPLOYMENT RATE

The Excel file admits of several rates to be able to see how premiums change in response to different unemployment rates.

THE INTEREST RATE

Given market volatility, the optimum approach is to consider how several interest rates may affect the premium. As expected, our Excel file admits of all possible interest rates and thus different interest rates can be entered to calculate the premium.

POSSIBLE ENLARGEMENT OF SCOPE OF PRODUCT

Though the main scope of our project looked at how we could design this product for students (specifically graduates), it certainly takes little imagination to think of how this product can be made for a much broader audience (the entire public). One glaring criteria change is the contingency of whether or not a student receives gets a job a week after graduation. These are some suggestions of what to replace this criteria with:

- An individual becomes unemployed due to recession.
- An individual becomes unemployed during a specified period. For example, there may been an agreement that the contract is activated when the individual becomes unemployed within 5 years after purchasing the product.

SENSITIVITY ANALYSIS OF VARIABLES

Given the numerous variables being used here, we resort to performing a sensitivity analysis of any variables in the Excel file by tweaking the variable and checking how the premium changes in our Excel file.

REFERENCE LIST

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