Executive Summary

Harbour Enterprise Liability & Property (HELP) has asked our team to provide analysis of their risk portfolio. With their provided data, we have run several analyses comparing multiple variables to get a clear picture of HELP's current risk portfolio and what future actions can be taken to mitigate losses.

Diving into the data, it was found that freshmen had the lowest average loss per claim, moderate total losses, and lowest risk tier compared to other classes. It was also found that Greek students had a much larger average less per claim and a larger total loss compared to non-Greek individuals, making non-Greek individuals less risky. Furthermore, business majors had the lowest amount per claim on average and the lowest total loss compared to the other fields of study. So, we expanded our analysis on this fact and within the additional living insurance we compared business to humanities, which had the highest average loss per claim.

Using Monte Carlo simulations to forecast data, humanities majors had larger total losses by around $100,000. Using this fact, which is also backed up by the current raw data, it may be wise to add additional coverage to business majors. More specifically, since freshmen's have the lowest risk and lowest average loss per claim, and freshmen non-Greek students have a total loss that is about half that of freshmen Greeks, expanding coverage to non-Greek living business freshmen may be a safe and beneficial plan.

After researching Hurricane catastrophe events in Florida, we have found that there have been 110 recorded Hurricanes from 1851 to 2024. Using this information, we modeled how these CAT events affect the distribution of number of claims and claim amounts. This resulted in showing how humanity majors tend to have few then average claims per year but the claims amounts are extremely high, causing them to on average lose the company lots of money from their additional living expense insurance. On the other hand, we found business majors have more claims on average but are distributed much nicer and they don't have too many outliers skewing the average loss implying that insuring business majors would be less risky and lose the company less money on their additional living expense insurance.

After our analysis we have found out that the best group of people to focus additional living expense insurance towards would be non-Greek freshman business majors and to reduce or but less focus on the insurance of any humanity majors for additional living expense.

Key Findings and Insights from the Raw Data

After diving into the data, there were significant findings that are important to be noted.

Average Claim Loss by Class & Study ($)

	Business	Humanities	Science	Other	Total Average
Freshman	162.84	227.23	197.58	173.88	189.71
Sophomore	226.67	194.89	178.25	164.41	191.80
Junior	192.15	229.08	211.45	253.82	220.71
Senior	195.38	182.49	195.74	316.13	223.78
Grad Student	247.30	312.28	359.08	135.65	265.57
Total Average	199.74	219.58	212.76	218.47	

Figure 1: Average claim loss by class & study

Through Excel analysis we found the average loss per claim by class and study seen in Figure 1. Here we can see the average claim losses for each. Although the totals between the field of studies are similar, with Humanities still having the highest total of $219.58, we can see a much more noticeable difference between the grad student total compared to the totals of other classes. Specifically, the most noticeable average claim loss amounts come from science grad students. From looking at the data, all grad students are also given a risk value of 3, on scale of 1-3, which aligns with them also having the highest claim amounts on average. Freshmen's have the lowest risk value of 1 and they have the lowest average claim amount. Out of the different fields of study, business has the lowest average loss per claim of $199.74.

Total Claim Loss by Class & Study ($)

	Business	Humanities	Science	Other	Total
Freshman	364,600.50	481,046.73	446,925.87	407,400.03	1,699,973.13
Sophomore	536,750.11	454,495.08	403,914.65	354,465.87	1,749,625.71
Junior	459,055.78	500,085.88	457,781.98	536,316.37	1,953,240.01
Senior	462,469.88	390,884.12	424,950.34	741,326.98	2,019,631.31
Grad Student	245,819.94	337,265.22	373,804.61	135,380.10	1,092,269.87
Total	2,068,696.20	2,163,777.03	2,107,377.44	2,174,889.35	

Figure 2: Total claim loss by class and study

Here (Figure 2), it also shows that business freshmen have a moderate total loss amount compared to the other classes with $364,600.50. Due to their low risk, low loss amounts per claim, low total losses, more coverage towards those individuals may be beneficial. With this it may also be wise to lower the coverage towards seniors since they have the highest total loss and like grad students, have a high-risk value of 3. But another interesting find is that grad students have the lowest total loss amounts. So, despite the high average loss per claim, they have the fewest claims, specifically with 162 claims (Figure 3), so no price adjustments are necessary for grad students. We also noted that Humanities had the highest average loss per claim and second highest total losses.

Comparison of Greek Vs Non-Greek Life

	Average Claim ($)	Total Claims ($)	Number of Students	Average Risk Tier
Greek	559.36	4,416,124.86	7,895	1.849
Non-Greek	127.38	4,098,615.17	32,176	1.884
Total	212.49	8,514,740.03	40,071	1.877

Figure 3 (a): Greek vs non-Greek life comparison

Furthermore, Figure 3 (a) shows data pulled from the raw data on Greek versus non-Greek life. Although both groups have similar risk, Greek life has a much higher average loss per claim of $559.36 compared to non-Greek of $127.38. Additionally, despite a small fraction of the data population being Greek life individuals, they still manage to have a higher total claim amount. With this information, focusing coverage on non-Greek may be wiser.

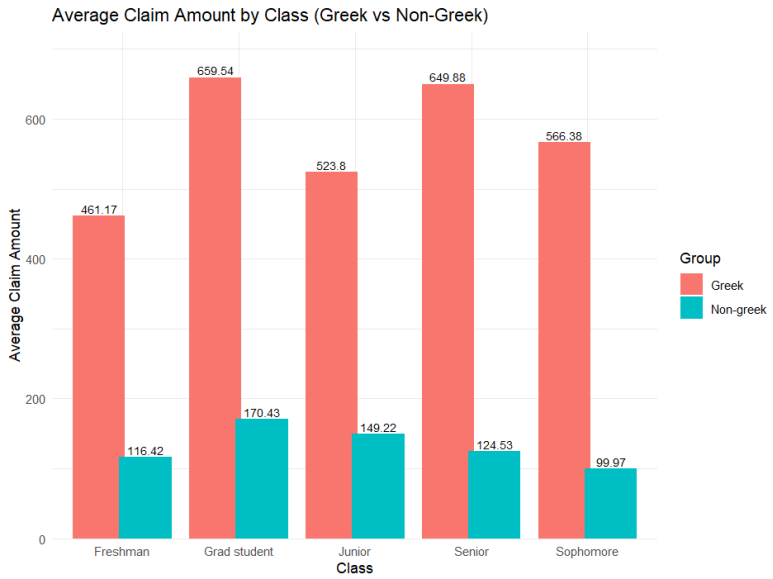

Figure 3 (b): Average claim amount for Greek vs non-Greek by class

Figure 3 (b) displays that for Greek freshmen, the average claim loss amount is about four times that of non-Greek freshmen which may make non-Greek freshmen a safer option in this regard. With this information on Greek and non-Greek populations, focusing coverage on non-Greek may be wiser.

Findings from Further Analysis

Looking to expand coverage with this insurance, further analysis was conducted. To be sure expanding coverage to business majors as a beneficial plan, we wanted to create additional models.

Lognormal Distribution

To assess the claims data, we constructed a lognormal distribution to use as a predictive model for the Addition Living Expenses claims. The lognormal distribution accurately accounts for the right tail of the

data, capturing the potential for very large losses while retaining the overall shape of the distribution. This behaviour is typically of severity modelling and is key for accurate risk assessment.

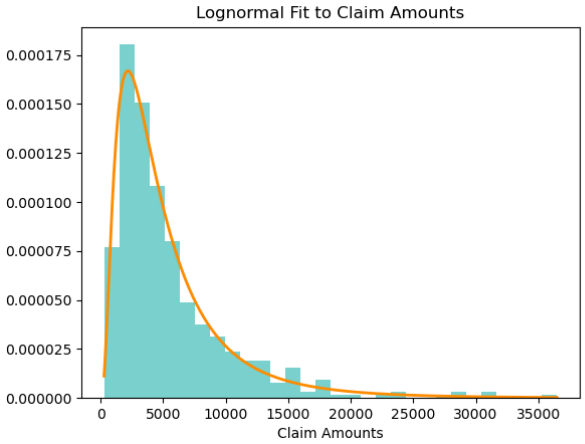

Figure 4: Lognormal fit to claim amounts

Risk metrics from the Additional Living Expenses data provides further evidence for our findings.

Mean of Simulated Claims: $5492

95th Percentile VaR: $14,569

Tail Value at Risk: $21,147

The massive gap between the mean, VaR, and TVaR highlights the right tailed nature of the claims. More specifically, the TVaR shows the average of the worst 5% of outcomes, which is significantly higher than the VaR which shows what the 5th percentile outcome is. This is consistent with the exposure to low frequency and high severity claims found in lognormal insurance models.

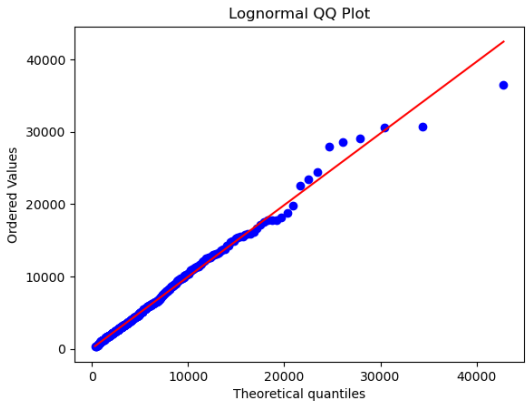

Figure 5: Lognormal fit to additional living expense

The QQ plot (Figure 5) also shows how the lognormal distribution fits the data for additional living expense (ALE) insurance, which fits very well indicating that the lognormal distribution is indeed the best distribution for this data.

Now that We have shown that the Lognormal distribution is the best fit for the data, we used the distribution for specifically business majors and humanities majors as seen below.

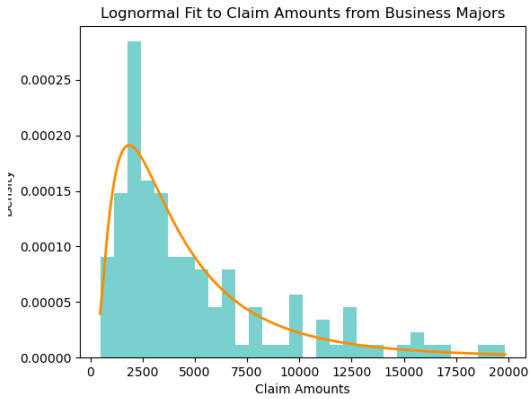

Figure 6 (a): Lognormal fit to ALE claim amounts for

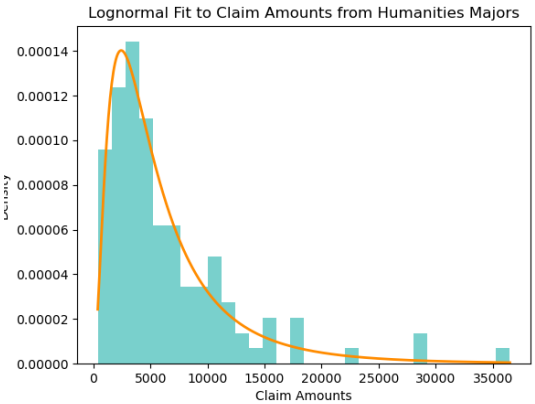

Figure 6 (b): Lognormal fit to ALE claim amounts for

These graphs (Figure 6 (a) and 6 (b)) show the distribution of claim amounts for specifically additional living expense insurance. Using these graphs, we can see that humanity majors tend to have longer and bigger tails going all the way to 35 thousand while the business majors have a distribution that has much less variation compared to the humanities.

Monte Carlo Simulations

Next, we model the number of claims from given majors for additional living expense insurance using the Poisson distribution since these are very rare events. The lambda for business majors is 136 with an expected value of 0.05257 and the lambda for humanity majors is 121 with an expected value of 0.04907. This would indicate that humanity majors tend to have less claims on average and we can see that in the graphs below in Figure 7 (a) and 7 (b).

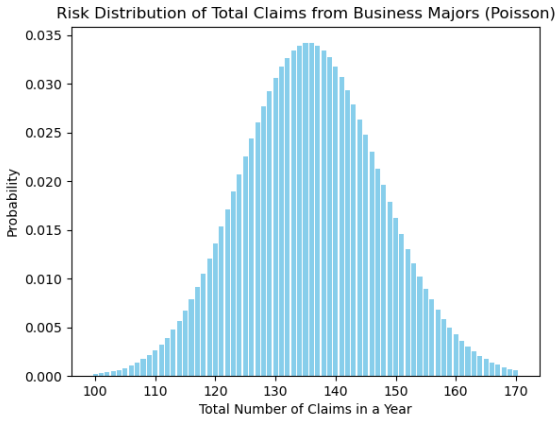

Figure 7 (a): Risk distribution of total claims for business

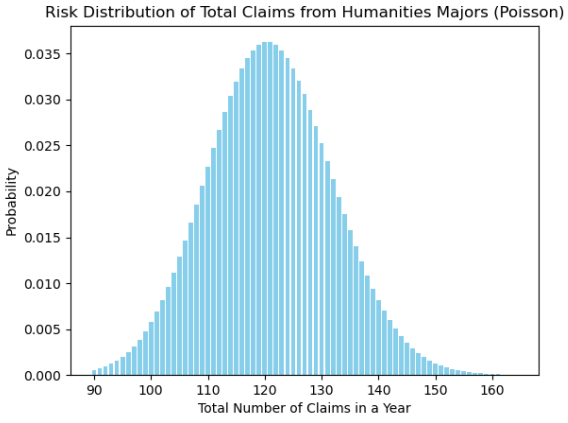

Figure 7 (b): Risk distribution of total claims for humanities

Now we have models to both represent the claim amounts and the number of claims for both humanity majors and business majors. Using these models, we ran monte Carlo simulations with 10,000 runs which is shown below.

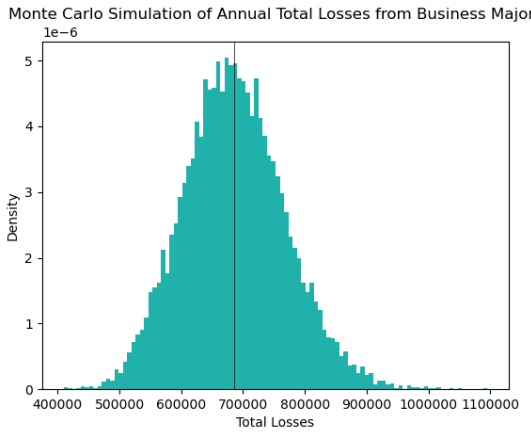

Figure 8 (a): Monte Carlo simulation for annual total losses from humanities majors

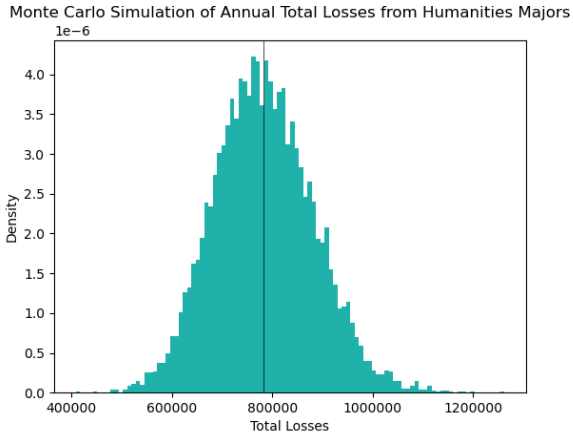

Figure 8 (b): Monte Carlo simulation for annual total losses from business majors

In Figure 8 (a) we can see that there is an average total loss of around 690,000 and standard deviation of around 82,000. In Figure 8 (b) we can see that there is an average total loss of around 780,000 with standard deviation of around 98,000

From the earlier graphs we have shown that business majors tend to have more claims, but the claim amounts tend to be lower, while humanity majors tend to have low claims with higher amounts. Putting this into the monte Carlo simulation has shown that the humanity majors both have higher total losses on average and also have a higher standard deviation of losses meaning they are much riskier to insure

Catastrophe Forecasted/Prediction Analysis

Using the historical data found on catastrophe events in Florida we were able to forecast hurricane catastrophes and how they impact the predicted total number of claims per year from business and humanities majors using Poisson processes which impacted the prior total number of claims in year distribution given by Figure 9 (a) and Figure 9 (b) below.

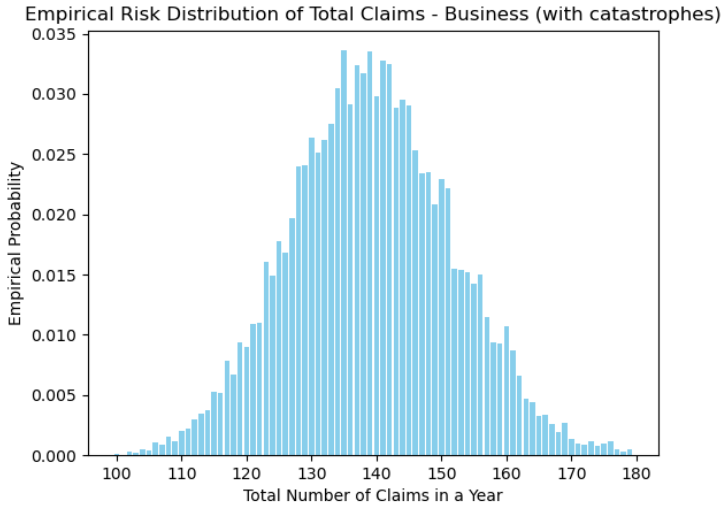

Figure 9 (a) Empirical Risk Distribution of total number of claims for business majors with CAT

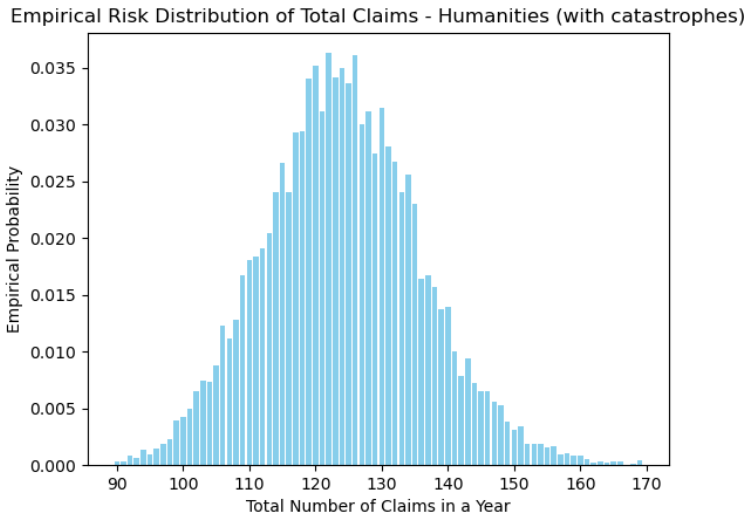

Figure 9 (b) Empirical Risk Distribution of total number of claims for humanity majors with CAT

If we compare these graphs to the earlier distributions of total claims in a year from figures 9 (a) and (b) for business and humanity majors, we can clearly see an increase in total claims which makes sense because we are now factoring in catastrophe events that cause mass damage to people homes causing them to need to claim their additional living expense insurance.

Using this data, we simulated claim amounts using Monte Carlo simulations like what we had done previously, however now we are including how the catastrophe events affect the distribution.

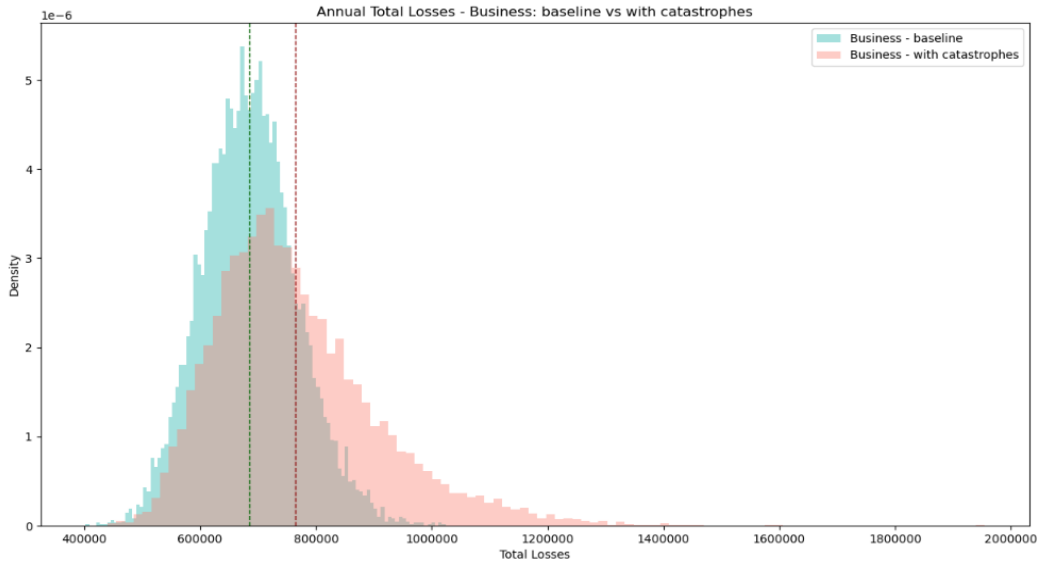

Figure 10 (a) Monte Carlo Simulation of Total losses from business majors with and without CAT

As you can see in the graph above (Figure 10 (a)), once we introduce the chance of catastrophe's occurring modelled by a Poisson process the new Monte Carlo simulation shows a distribution with a much bigger tail and higher mean. This implies that the true risk associated with additional living expense is very heavily affected by catastrophes.

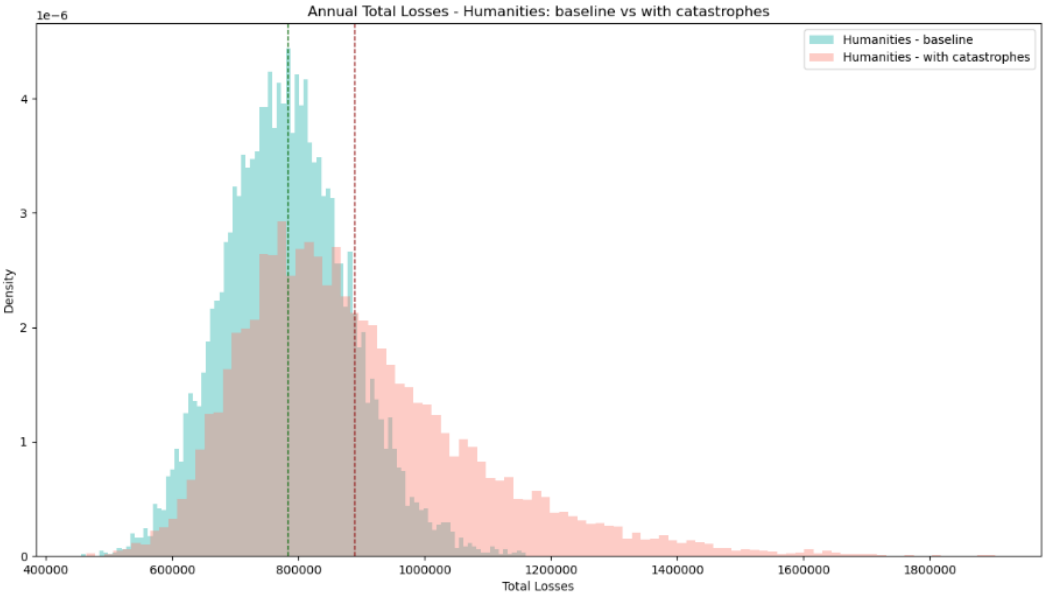

Figure 10 (b) Monte Carlo simulation of total losses from Humanities majors with and without CAT

In the graph above (Figure 10 (b)) for the same new Monte Carlo simulation for Humanity majors shows a very similar outcome. We can see a much larger tail end and a much higher mean of the total losses,

specifically the new mean for humanity majors seems to be just under 900,000 while business majors seem to be just under 800,000 implying that on average humanity majors even with the catastrophe events still are expected to lose the company more money than business majors for additional living expense insurance.

Another key detail is the tail end for humanity majors seems to be much larger than business majors, and if we take a look at the empirical risk distribution of both majors you can see that humanity majors tend to have less total number of claims per year compared to the business majors. This would imply that humanity majors have fewer claims per year but the claims that do occur seem to be extremely large compared to the normal amount.

Our Recommendation to Help

From basic excel analysis of the raw data, it was found that expanding coverage to non-Greek freshmen business majors would be beneficial. Business majors having the lowest average loss per claim and total loss compared to other fields of study and the freshmen population had moderate total loss, but the lowest overall loss amounts and risk compared to the other classes. The non-Greek population had a much lower average claim amount and lower total loss despite having a much larger population than Greek. Together, this makes insurance expansion most ideal for non-Greek freshmen business majors. To expand on this, we did Monte Carol simulations comparing the total annual loss from additional living expense insurance from business majors and humanities majors. We found that business majors tended to have higher number of claims compared to humanity majors. However, the humanity majors had a much higher standard deviation of total loss which caused them to become much riskier to ensure. Then through catastrophe analysis, we found that catastrophes significantly increased the amount of extremely high insurance claims from humanity majors. While business majors did also have an increase, it was not as significant.

Overall, for these reasons, we recommend that HELP considers expanding their additional living expenses insurance coverage more towards the population of non-Greek freshmen business majors.