Final Project - Step 3

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Introduction

I currently work for a holding company with many subsidiaries. My functions include finance manager, data warehousing and management as well as risk analysis and claims reserve projections on ultimate loss ratios. Claims are the leading expense on an insuring business's profit statement outside of salaries and related. Much emphasis is placed on predicting how a product will perform. This leads to evaluating the reasonableness of the warranty cost and claims experience to present loss reserves. The subsidiary I will focus on for this project is a warranty group that specializes in servicing extended warranties on appliances (refrigerators, washers, dryers, stoves, small home appliances), TV's and other electronics (audio equipment, home wine coolers, portable air conditioners, mobile phones). These products can have different warranty periods from 12 months to 5 years. The reason I am choosing this subsidiary is due to the fact that their operating income has fallen in the past couple of years. Assumption is that this is due to an increase in claims experience since bringing on a large client. This particular buying group (many dealers under the same contract) product mix consists 99% of refrigerators, washers, TV's and small home appliances.

Data

Data Set 1: Sales

Source: Internal system of record for warranty group

This data set contains all sales information for the last 5 years. Including contract number, product sold, manufacturer, dealer name, warranty terms, sale date, warranty costs and retail costs. **Data Set 2:** Claim

Source: Internal system of record for warranty group

This data set contains all claims information for the last 5 years. Including contract number, loss date, payment date, total claim amount, parts amount, labor amount, servicing company.

Data Set 3: Dealers

Source: Internal system of record for warranty group

This data set contains all dealer information for the largest buying group within the warranty companies book of busies. Including dealer location and demographics.

The problem statement addressed

The below questions will help address the main question of: *How can we make dealers and products more profitable?*

1. Can a predictive model help project claims assumptions using historical data and trends?
2. Has there been in an increase in claims volume, or a decrease?
3. Are there regional concentrations of dealers that are performing under contract terms?
4. Can we pinpoint ill performing dealers with the model?
5. Are the claims increasing or decreasing in a certain product group?
6. Are the claims increasing or decreasing in relation to a certain product and manufacturer?
7. Is there sufficient reserves for future claims?
8. Are the warranty products priced correctly?

Approach

Within the warranty business, the process of claims is approaching real time acceptance and denial. The certificate to replace a product, service a product and pay any associated costs with the claim needs to happen within a set time frame according to contract terms. Usually within 72 hours. An example within this project case with appliances would be to determine if the product is serviceable, start the process to get a tech out to the house. If determined to be a total loss, send certificate for full replacement and any associated costs with that replacement such as food loss. I began with EDA on my data sets, determining if I have sufficient volume with 5 years of sales and claims historical. I then calculated the ultimate loss ratio to determine if the premiums outweigh the loss projections. With this information I can then conduct a correlation exercise to determine what data point has the most impact on the ultimate loss ratio. These steps will lead to the regression analysis on how the products will perform in the future and whether the business model is sustainable.

How your approach addresses (fully or partially) the problem.

The earnings pattern of the warranties sold should more than cover the cost to service the product over the life of the warranty. My approach will address many aspects of what determines to be a good profit margin (15% or greater) and an ultimate loss ratio of 73%. I can not say it will be fully addressed as there may be factors outside of my approach that I can address in future project work. When complete, a recommendation can be given as to the areas that need to be addressed to improve the products performance within the pricing model, claims costs and cost sharing.

Analysis

All tables will show top 15 in group.

The table below represents the total contract warranty sales by product description.

Table 1: Total Sales by Product

ProductDescription	ContractCostAmount
REFRIGERATOR	14287698.6
WASHER	8196732.8
RANGE	4996541.0
DISHWASHER	4823405.5
DRYER	4056086.5
REFRIGERATOR-W/ICE	1897703.2
FREEZER	1163320.2
WALL OVEN	1045730.2

ProductDescription	ContractCostAmount
MICROWAVE	755533.2
COOKTOP	682983.5
GAS RANGE	265244.5
WASHER COMBO	246590.2
ICE MACHINE	238522.7
OTR MICROWAVE	237393.3
HOOD	185709.3

The table below represents the total claims incurred by product description.

Table 2: Total Claims by Product

ProductDescription	ClaimAmount
REFRIGERATOR	2791210.96
WASHER	1123367.82
DISHWASHER	762710.24
RANGE	488056.04
DRYER	467908.16
REFRIGERATOR-W/ICE	330147.30
MICROWAVE	110423.94
WALL OVEN	91786.99
FREEZER	67992.38
OTR MICROWAVE	43140.74
WASHER COMBO	39906.60
COOKTOP	34669.65
GAS RANGE	23455.52
ICE MACHINE	19057.42
OVEN/MICROWAVE COMBO	11998.95

Summarizing the claims and premium totals by year sold below, shows there has been an increase year over year. Per the claim data, most are incurred within years 2 and 3 of the contract term.

Table 3: Total by Year

Year	ClaimAmount	ContractCostAmount
2021	729961.8	13909713
2020	2462515.5	16744537
2019	2855405.4	11750608
2018	418682.3	1339205

Summarize by the Product Description and calculate loss ratio. Created new variable, Loss Ratio, which tells us the likelihood of a loss happening on a product: Refrigerator = LR of 0.1954, loss will happen at least 20% of the time within the first 3 years of the gross written premium. This will only increase with calculating on earned premium, which is the contract cost earned over the contract term. Typically a factor of 5x. You want to see a gross loss ratio around .15 or lower.

ProductDescription	ContractCostAmount	ClaimAmount	LossRatio
REFRIGERATOR	14287698.6	2791210.96	0.1953576
WASHER	8196732.8	1123367.82	0.1370507
RANGE	4996541.0	488056.04	0.0976788
DISHWASHER	4823405.5	762710.24	0.1581269
DRYER	4056086.5	467908.16	0.1153595
REFRIGERATOR-W/ICE	1897703.2	330147.30	0.1739720
FREEZER	1163320.2	67992.38	0.0584468
WALL OVEN	1045730.2	91786.99	0.0877731
MICROWAVE	755533.2	110423.94	0.1461537
COOKTOP	682983.5	34669.65	0.0507621
GAS RANGE	265244.5	23455.52	0.0884298
WASHER COMBO	246590.2	39906.60	0.1618337
ICE MACHINE	238522.7	19057.42	0.0798977
OTR MICROWAVE	237393.3	43140.74	0.1817268
HOOD	185709.3	8133.12	0.0437949

Summarizing the claims and premium totals by the Dealer.

Table 5: Total by Dealer

DealerName	ClaimAmount	ContractCostAmount	LossRatio
AIRPORT HOME APPLIANCE	556831.71	4810964.0	0.1157422
BRAY & SCARFF INC	679601.45	3657991.3	0.1857854
JUDD & BLACK	387391.20	2195444.1	0.1764523
GOOD DEALS APPLIANCES	424826.26	2063253.9	0.2059011
ROSNER'S INC	192809.27	1419959.8	0.1357850
KELLY'S HOME CENTER	180511.72	1223089.8	0.1475866
JESSUPS MAJOR APPLIANCE CENTER	180925.64	1065668.0	0.1697767
GOEDEKERS	74502.38	1061500.5	0.0701859
HOWARDS APPLIANCES INC	73109.39	1038707.3	0.0703850
SCHAEFERS	146779.66	907939.6	0.1616624
STANDARD TV AND APPLIANCE INC	106263.72	870601.2	0.1220579
IVAN SMITH FURNITURE	141065.20	796556.3	0.1770938
BIG GEORGE HOME APPLIANCE MART	115849.35	795999.0	0.1455396
OLUM'S OF BINGHAMPTON	115390.95	769739.3	0.1499091
SPICHERS APPLIANCE	141168.60	759539.7	0.1858607

Summarize by the manufacturer.

ManufacturerDescription	ContractCostAmount	ClaimAmount	LossRatio
GE	12210966.4	1580676.66	0.1294473
WHIRLPOOL	6221980.1	1155607.68	0.1857299
FRIGIDAIRE	4423036.8	769546.08	0.1739859
LG ELECTRONICS	3620556.9	337783.77	0.0932961
MAYTAG	3327104.6	630374.08	0.1894663
KITCHENAID	2969257.4	559064.84	0.1882844
BOSCH	1966091.1	204486.38	0.1040066
SAMSUNG	1952696.2	305978.02	0.1566951
ELECTROLUX	1543437.5	257413.64	0.1667794

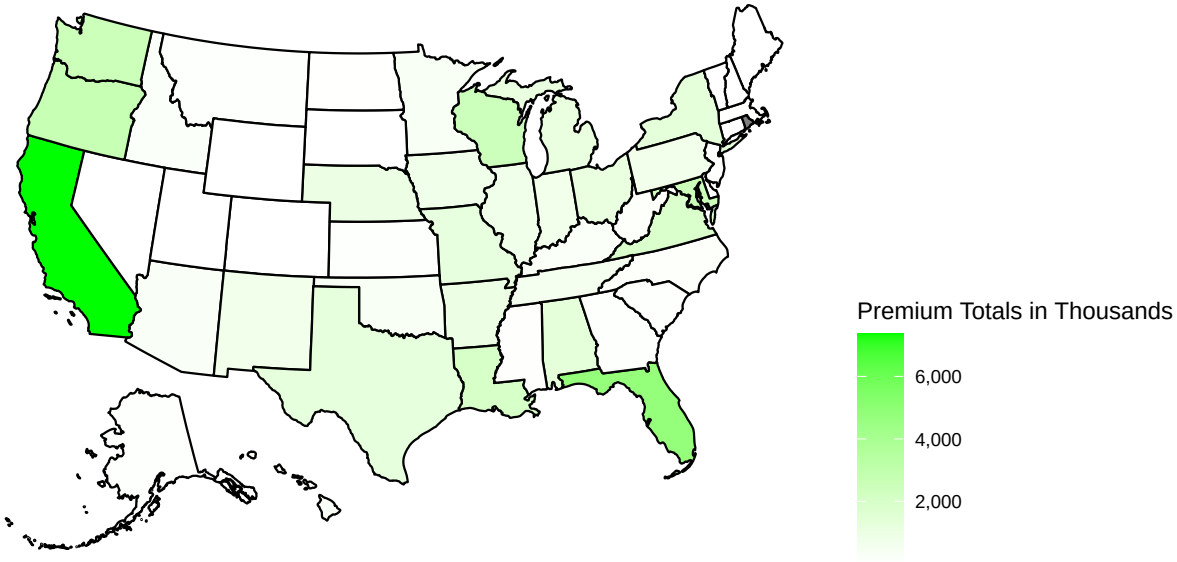
ManufacturerDescription	ContractCostAmount	ClaimAmount	LossRatio
KITCHEN AID	1389700.1	298112.42	0.2145156
JENN-AIR	599647.4	58265.56	0.0971664
THERMADOR	432022.2	24889.75	0.0576122
AMANA	380399.1	59314.18	0.1559262
FISHER & PAYKEL	186333.5	17882.93	0.0959727
SPEED QUEEN	180484.7	12045.80	0.0667414

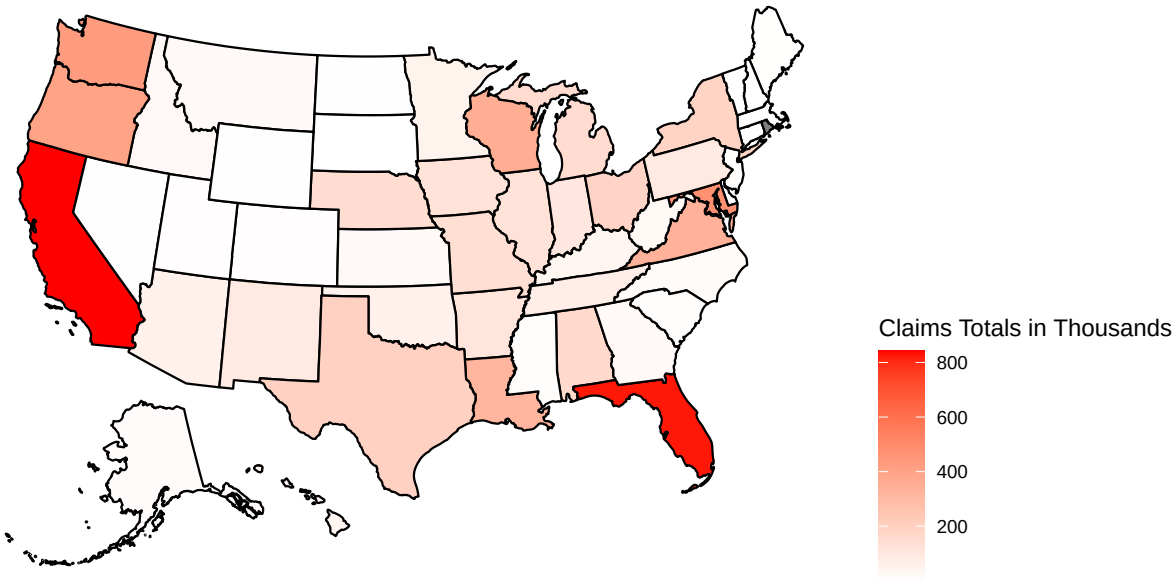
Summarize by the model.

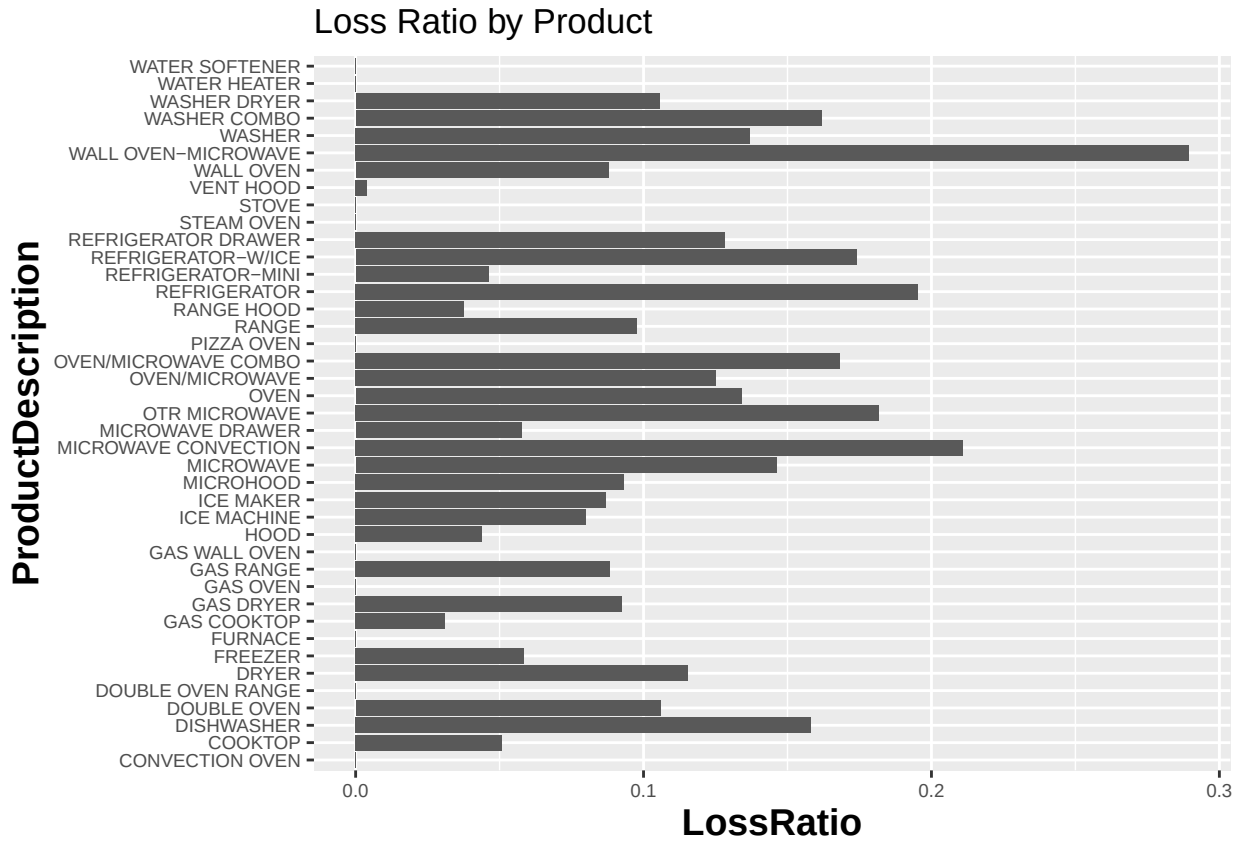
ModelNumber	ManufacturerDescription	ProductDescription	ContractCostAmount	ClaimAmount	LossRatio
FG4H2272UF	FRIGIDAIRE	REFRIGERATOR	219779.53	90042.21	0.4096933
KRFF507HPS	KITCHENAID	REFRIGERATOR	166154.75	61115.81	0.3678246
PVD28BYNFS	GE	REFRIGERATOR	315040.89	57651.01	0.1829953
EFLS627UIW	ELECTROLUX	WASHER	362761.67	53637.08	0.1478576
MHW8630HW	MAYTAG	WASHER	170866.44	48286.93	0.2826004
EFLS627UTT	ELECTROLUX	WASHER	288082.01	39209.97	0.1361070
MHW8630HC	MAYTAG	WASHER	122363.99	38983.80	0.3185888
FGHB2868TF	FRIGIDAIRE	REFRIGERATOR	184898.81	36275.58	0.1961915
KRFF507HPS	KITCHEN AID	REFRIGERATOR	104567.59	36174.77	0.3459463
WRF535SWHZ	WHIRLPOOL	REFRIGERATOR	197588.55	33682.76	0.1704692
MVWC565FW	MAYTAG	WASHER	279774.91	31627.31	0.1130456
WRX986SIHZ	WHIRLPOOL	REFRIGERATOR	80077.21	29900.93	0.3734012
WRF757SDHZ	WHIRLPOOL	REFRIGERATOR	102315.67	29228.70	0.2856718
KRMF706ESS	KITCHENAID	REFRIGERATOR	117507.65	29151.42	0.2480810
WRX735SDHZ	WHIRLPOOL	REFRIGERATOR	140314.20	28906.81	0.2060149

Summarize by the state.

StateCode	ClaimAmount	ContractCostAmount	LossRatio
CA	841583.1	7353911.9	0.1144402
FL	824295.1	4755110.6	0.1733493
OR	400858.1	2769644.1	0.1447327
WA	430020.0	2553085.6	0.1684315
MD	476132.6	2551460.2	0.1866118
WI	359834.9	2473208.6	0.1454931
LA	321766.1	2028594.0	0.1586153
VA	339489.7	1886904.3	0.1799189
NY	191359.4	1382859.2	0.1383795
AL	163881.4	1314425.7	0.1246791
TX	201323.2	1298528.5	0.1550395
MO	140648.4	1198344.3	0.1173689
MI	154655.6	1137780.3	0.1359275
OH	187718.7	1135061.0	0.1653820
NE	151483.2	973285.6	0.1556411

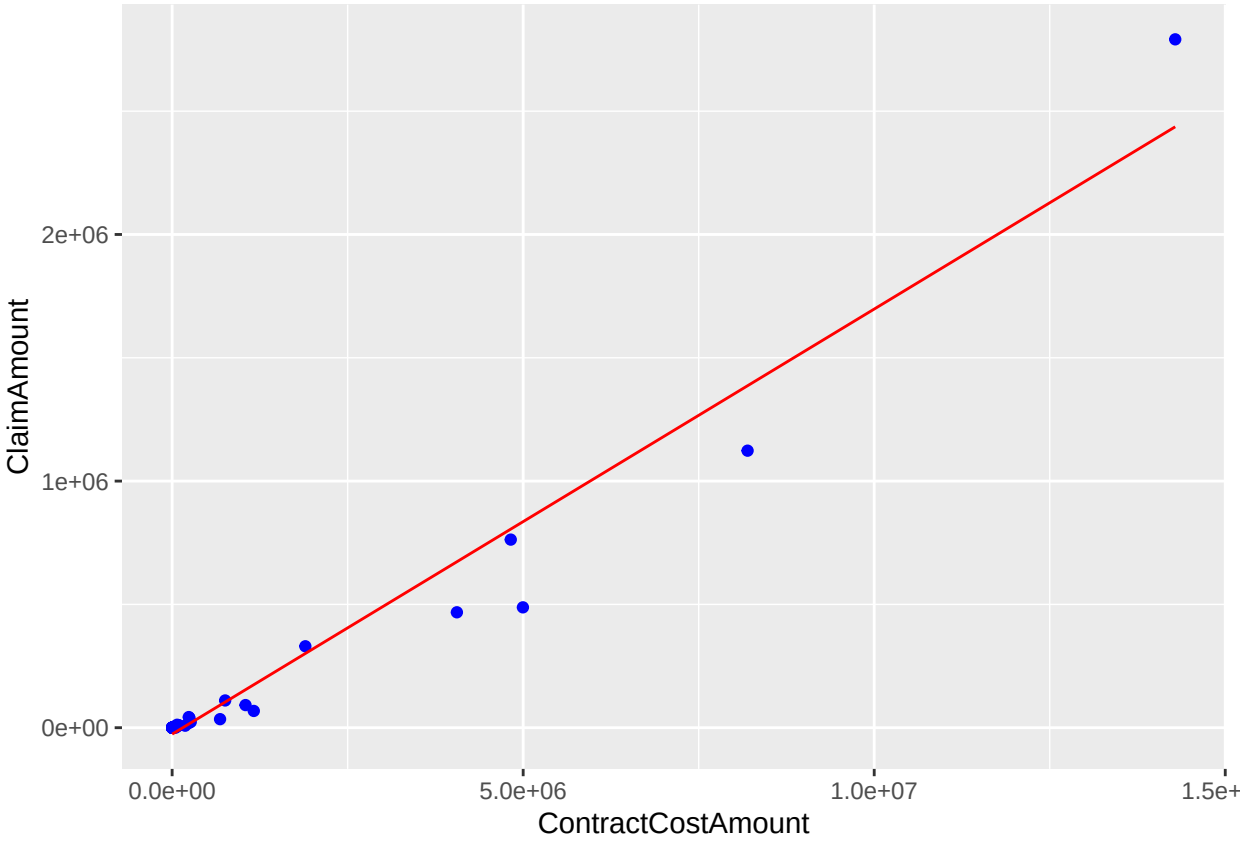

Premium Totals in Thousands
6,000
4,000
2,000


Claims Totals in Thousands
800
600
400
200



Below is the linear regression model for loss ratio.

```
##
## Call:
## lm(formula = ClaimAmount ~ ContractCostAmount, data = df_summary_product_description)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -347008    6378   24498   26144  354640
##
## Coefficients:
##                       Estimate Std. Error t value Pr(>|t|)
## (Intercept)        -2.618e+04  1.692e+04  -1.547     0.13
## ContractCostAmount  1.724e-01  5.846e-03  29.483   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 100700 on 39 degrees of freedom
## Multiple R-squared:  0.9571, Adjusted R-squared:  0.956
## F-statistic: 869.2 on 1 and 39 DF,  p-value: < 2.2e-16
```



Implications

Product	Net Adjusted Premium	Paid Losses	Future Claim Liability	Ultimate Losses	Ultimate Loss Ratio
Refrigerators	$13,027,882	$1,025,254	$11,777,503	$12,802,756	98.3%
Washers	$6,552,717	$463,709	$4,942,869	$5,406,578	82.5%
Other Appliances	$14,911,779	$836,660	$9,090,615	$9,927,275	66.7%
Television	$495,786	$70,009	$335,904	$405,912	81.9%
Total	$34,988,163	$2,395,632	$26,146,890	$28,542,521	81.6%

We can see here from the summary table above that the Ultimate Loss Ratio is above the target 73% for the book of business. The formula = Ultimate Losses/Net Adjusted Premium = Ultimate Loss Ratio.

There are several further investigations to determine next steps but we can conclude:

1. Refrigerators are number one in all categories: total premium sold, total claims and loss ratio. Followed by washers, number 2 in sales and number 3 in loss ratio. These 2 products make up more than 50% of the top 15 product groups in terms of number sold, premium collected and losses incurred.

2. Whirlpool and Frigidaire are the lowest performing manufacturers in these product groups.

3. Bray & Scarff followed by Good Deals are lowest performing dealers in the top 15.

4. Sales and claims concentration fall in 2 states, CA followed by FL.

5. The product retail price correlates to the loss amount incurred, meaning the higher the price of the item, the higher the loss claim amount is.

Limitations

There were a few limitations on how the overall operating income performance is scored. The largest being, I did not have access to the overhead expenses on servicing these dealers and products. Assumption is, as long as the Ultimate Loss Ratio remains at or below 73%, the company will be profitable. This is a big assumption as salaries and related is the second largest expense for this business model outside of losses.

Concluding Remarks

After reviewing all the data and performing the analysis above, the buying group in question is performing below the contractual expectation. The next steps will be to take a deeper dive into the lowest performing dealers and their product mix to either drop coverage on certain manufacturers products or instill loss sharing within the contract per dealer. Where if their ultimate loss ratio goes above a certain threshold, such as 73%, they will share the cost of those claims. As well as review the pricing models to ensure the warranty premium is adjusting with current inflation models.