Technical Assessment Report

Summary

This report highlights the firms which are of interest in order to allocate scarce resources. The report will include analysis on firm size, outliers and firms with changing business profiles as these are the main properties in which resources should be allocated. Furthermore, in the annex section, there will be machine learning techniques to further gain insight on the dataset.

Analysis

Firm Size

Firm size is an important factor. Firms with large revenues and large assets should be allocated more resources. Initially, exploratory analysis had been conducted. Looking at GWP and NWP shows the amount of revenue a firm makes as well as the revenue minus reinsurance. This could be a good indication of large firm size. Creating a joint plot of the year 2016 resulted in a graph that can be seen in Figure 1.

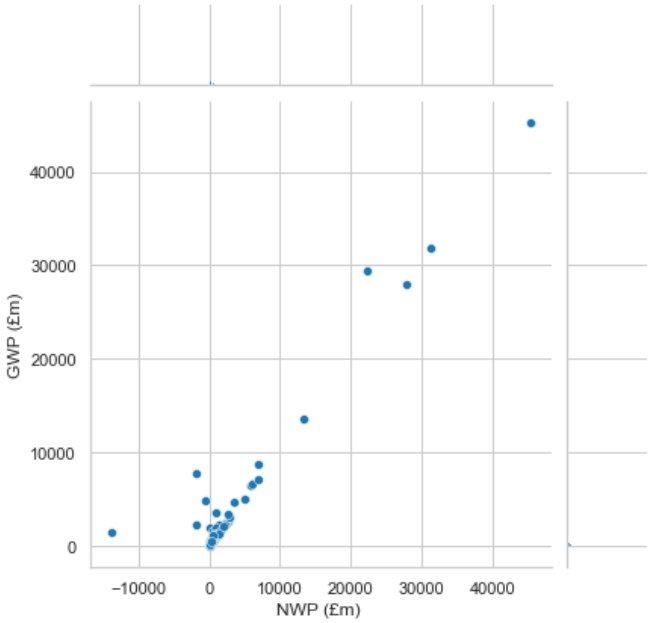

Figure 1 - GWP and NWP for 2016

From Figure 1, it can be seen that there are a couple firms that are greatly higher than the other points. Although this graph does show interesting aspects, GWP and NWP are dependent on each other. Therefore, in order to find the firms with large firm sizes GWP and Total Assets were looked at.

In order to discover the firms with large revenues and total assets a function was created where the Gross Written Premium and Total Assets were multiplied with each other. Once multiplied, each year was then analysed and the top 10 firms with highest value were recorded. The graphs for the year 2016 and 2020 can be seen in Figure 2 and Figure 3 respectively.

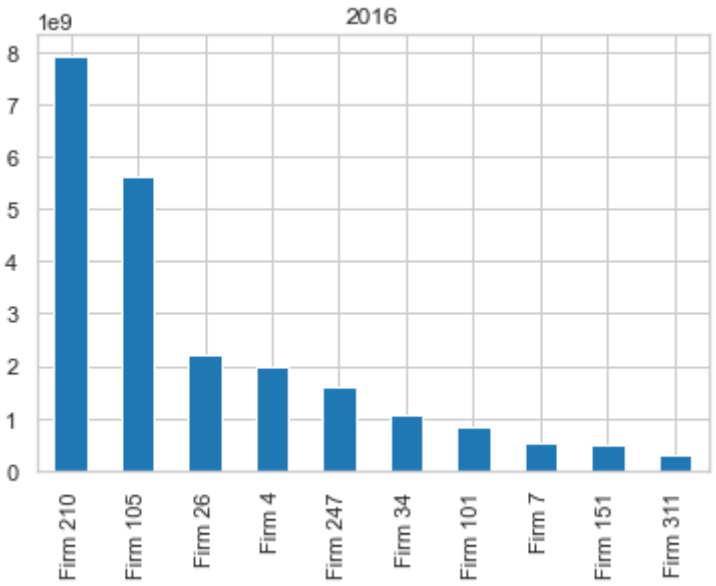

Figure 2 - GWP x Total Assets in 2016

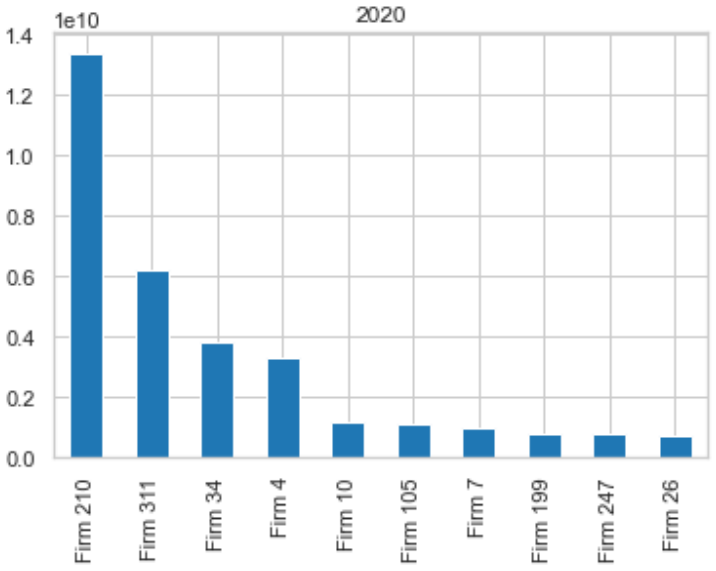

Figure 3 - GWP x Total Assets in 2020

After collecting the top 10 firms for each year, the firms that consistently appeared in all years were considered to be a firm with a large size. These firms were:

1. Firm 210
2. Firm 105
3. Firm 4
4. Firm 247
5. Firm 34
6. Firm 7
7. Firm 311

Outliers and change in business profile

When looking at a single reporting period there are many areas of interest. The area in which the greatest analysis was conducted was the Gross claims incurred (GCI), this is because large changes or outliers within this area would result in the firm needing extra resources. Gross claim incurred is a large cost to the insurer.

In order to find the outliers and firms which have a change in business profile, various techniques were used including creating a class and functions as well as producing tables and graphs. For each year, a histogram plot was created for the values of Gross claims incurred, this would enable the detection of anomalies within the data. In addition, the percentage change of Gross claims incurred from one year to the other would allow to find the firms that had changes in business profiles.

Looking at Figure 4, most firms fall within the £0m to £2000m region, however it can be seen that there are 2 firms that are outliers. These firms were discovered to be Firm 105 and Firm 216

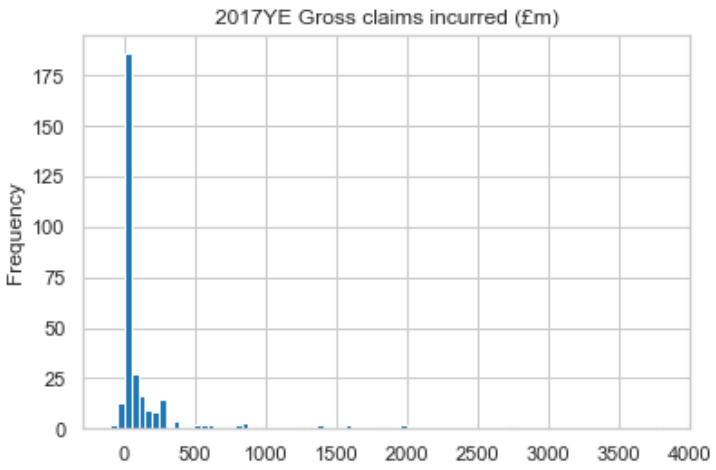

Figure 4 - Histogram of Gross claims incurred

Looking deeper into Firm 105 allowed for further insights. From Figure 4, it showed that in 2017, the Gross Claims incurred for Firm 105 was very high compared with the rest of the data. Looking at Figure 5, it can be seen that this increase in Gross claims incurred may have resulted in Firm 105 getting a large amount of reinsurance in 2018 as the NWP is significantly lower than the GWP. Firm 105 may have predicted the Gross claims incurred would rise further so it protected itself through taking a large amount of reinsurance. Furthermore, it can be seen that although this is a large company, both GWP and NWP are pretty much decreasing year on year and hence has a large change in business profile.

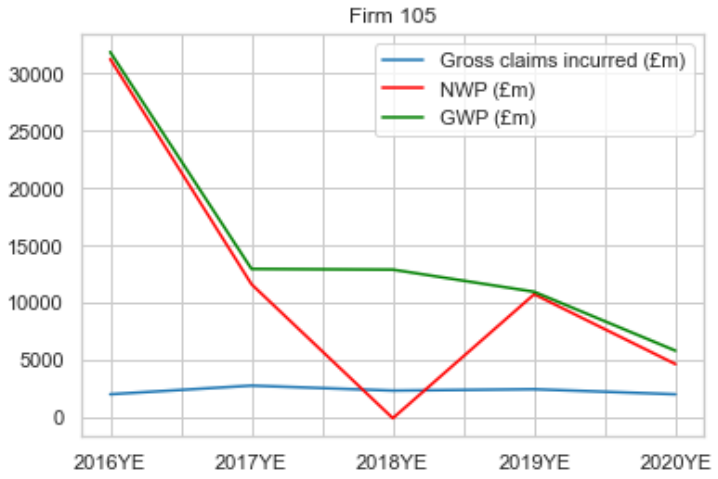

Figure 5 - GWP, NWP and Gross claims of Firm 105

Firm 17 was discovered to be an outlier in 2016 and 2019. When considering each year, it can be seen that in 2018 the firm has minimised its risk by reinsuring their claims. Hence, in Figure 6, it can be seen that the NWP is lower than the Gross claims incurred. Firm 17 has been reporting a loss for 4 of the 5 years. They had very high gross claims incurred with no reinsurance taken out. In 2016, the NWP - GCI was around 1,800 (£m) whereas the eligibility of funds was around 179 (£m). This indicates that they did not have enough funds and would need to raise these from another source.

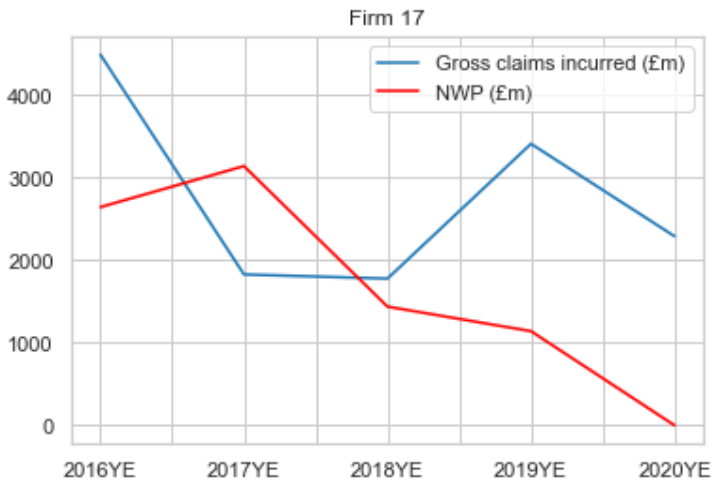

Figure 6 - NWP and Gross claims of Firm 17

Looking at Firm 188, the financial health of the company does not present any obvious anomalies. The reason it was flagged is because this firm went from a £0 worth of claims incurred to around £10m in the space of one year. However, the gross claims incurred remained relatively low and the large decrease in NWP due to reinsurance is a change in a business profile which can be seen in Figure 7.

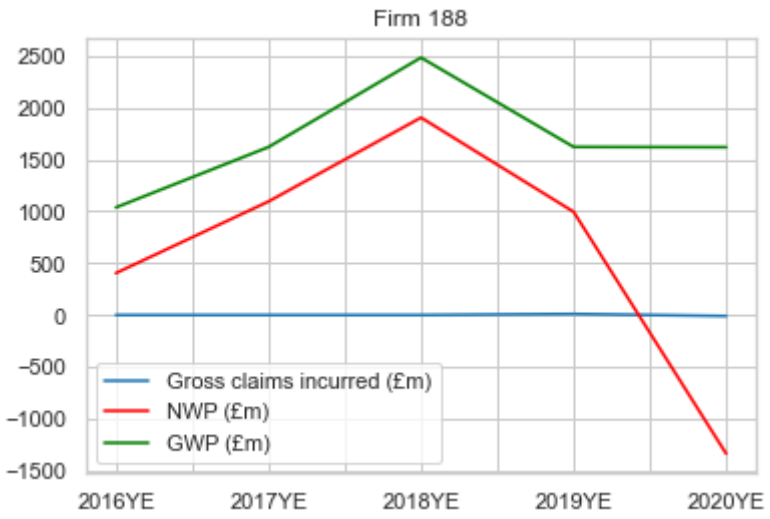

Figure 7 - NWP and Gross claims of Firm 188

Firm 188 stopped taking on risk as the ratio NWP/GWP is very low. In 2020, this became negative indicating that the firm was paying out more to reinsurers than it was making from collected premiums which can be seen in Table 1.

Year	**NWP/GWP**
2016YE	0.389405
2017YE	0.675891
2018YE	0.766960
2019YE	0.613939
2020YE	-0.826278

Table 1 - NWP/GWP of Firm 188

From the analysis, that was taken place the firms which were considered as outliers and had changes in business profiles were:

1. Firm 17
2. Firm 30
3. Firm 52
4. Firm 64
5. Firm 105
6. Firm 188
7. Firm 216
8. Firm 228

The analysis of all firms can be found in the attached workbook, firms which have been found to have interesting patterns have been included in the report.

SCR Coverage Ratio and Net Combined Ratio

The SCR Coverage Ratio shows the firm's ability to meet capital requirements with their own eligibility of funds. While the Net Combined Ratio shows the ratio of all claim related losses with expenses to the net premiums earned. In order for a firm to be in a good financial position, the SCR Coverage Ratio should be above 1 while the Net Combined Ratio should be less than 1. Therefore, firms that don't fall within these categories are at risk of not being able to pay off claims.

Looking through each year, there are quite a lot of firms that fall into the category of possibly not being able to pay claimants. Looking at Figure 8, it can be seen that Firm 183 has -2 for the SCR coverage ratio and and close to 1.3 for Net combined ratio, which shows that they have a negative eligibility of funds to use.

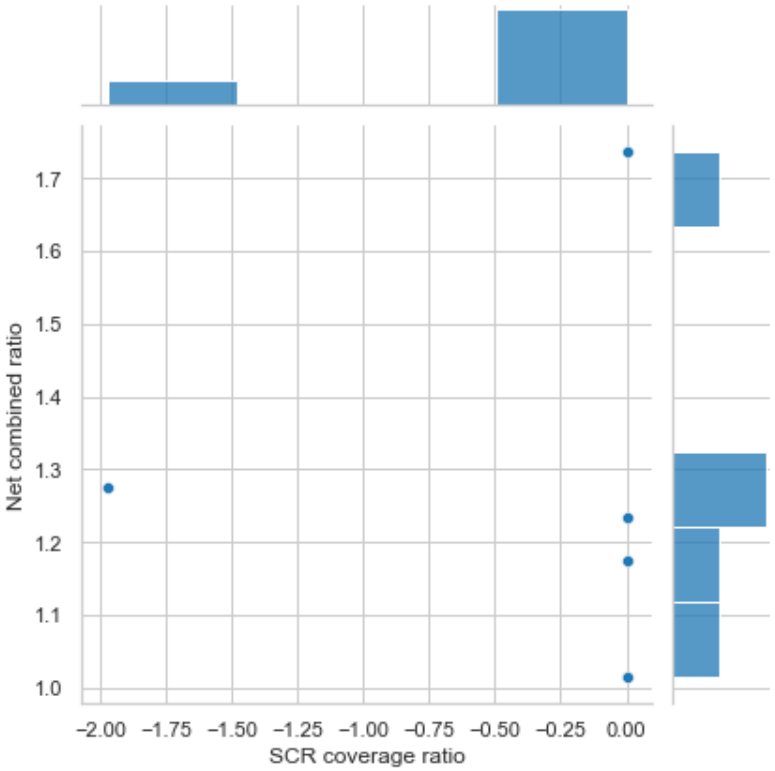

Figure 8 - Net combined ratio and SCR coverage ratio in 2017

Although these firms are interesting to look at, I do not believe including them in the report was necessary but these can be found in the attached workbook.

Results

From the analysis that has been conducted and looking at a variety of factors the firms which should be given supervisory resources are:

- Firm 210
- Firm 105
- Firm 4

- Firm 247
- Firm 34
- Firm 7
- Firm 311
- Firm 17
- Firm 30
- Firm 52
- Firm 64
- Firm 188
- Firm 216
- Firm 228

Conclusion

In conclusion, there are 14 firms based on the analysis that require supervisory resources. These are due to either the firms being of large size or being outliers and changes within their business profiles. Further improvements can be made by looking at other outliers in terms of the different ratios present as well as change in percentages in other data such as eligibility of funds or SCR. Machine learning techniques can be applied further to gain insights as well as predict the firms that could need extra resources in the future.

Annex

Machine learning models were also used in the analysis to further explore trends within the data. An unsupervised machine learning, KMeans, was used to draw further insights. Using this model and picking a formation of 2 clusters, the results were that 9 firms constituted one cluster while the rest were another cluster. The 9 firms were:

- Firm 4
- Firm 7
- Firm 10
- Firm 26
- Firm 34
- Firm 101
- Firm 105
- Firm 210
- Firm 311

Most of these firms were considered to be the largest in size in analysis conducted earlier. Hence, it can be predicted that the firms being clustered are the ones that should require supervisory resources. Looking at Figure 9, the relationship can clearly be seen between GWP and total assets. The firms which have higher total assets and a higher GWP seems to have been clustered into one group. This further supports the analysis conducted as this was done by an unsupervised model. Looking at Figure 10, most point seem to be proportional however the clustered points seem to be outside of the general trend.

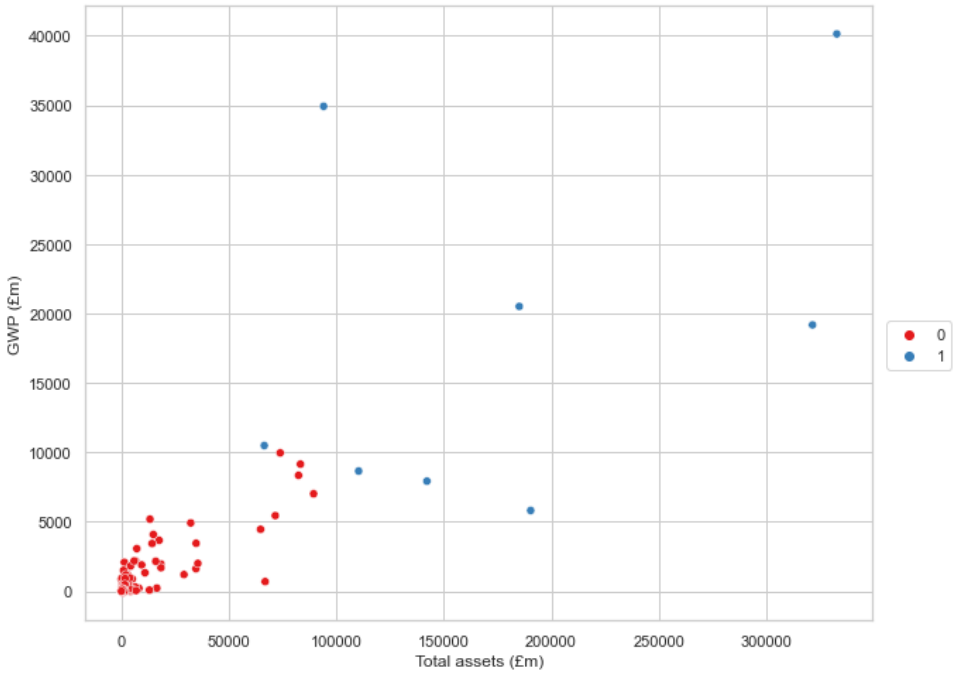

Figure 9 - KMeans clustering model with GWP and Total Assets

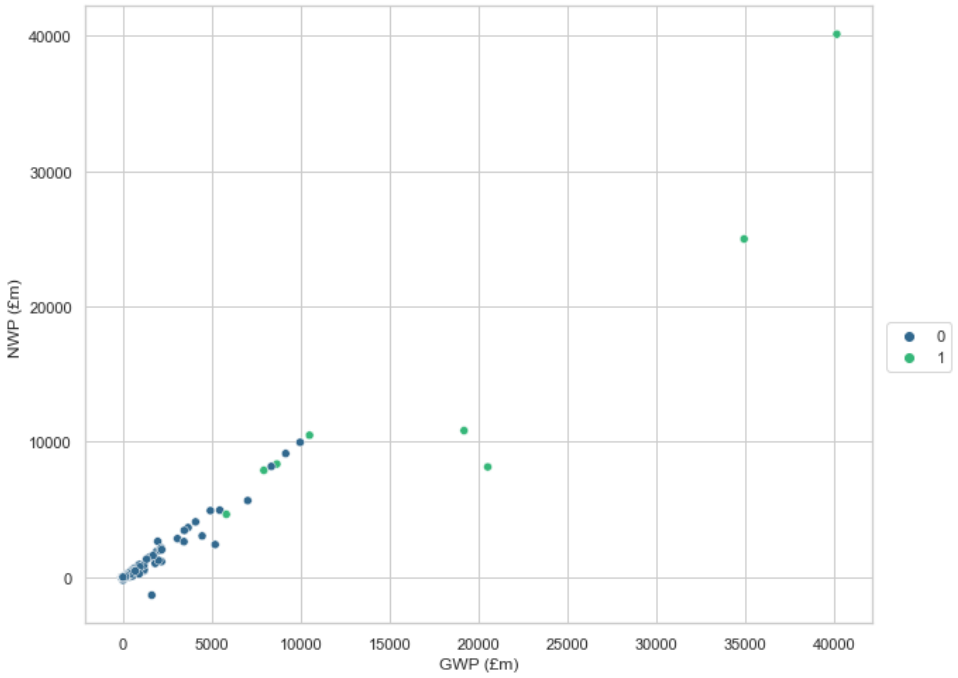

Figure 10 - KMeans clustering model with NWP and GWP

Using Isolation Forest to find the anomalies in the dataset with a contamination of 1% which would mean around 4 firms would be selected. The firms predicted by the model were:

- Firm 4
- Firm 105
- Firm 210
- Firm 311

Once again these are the firms that were considered the largest in size. Looking at Figure 11, it shows that these firms are the ones that differ greatly from the rest of the dataset.

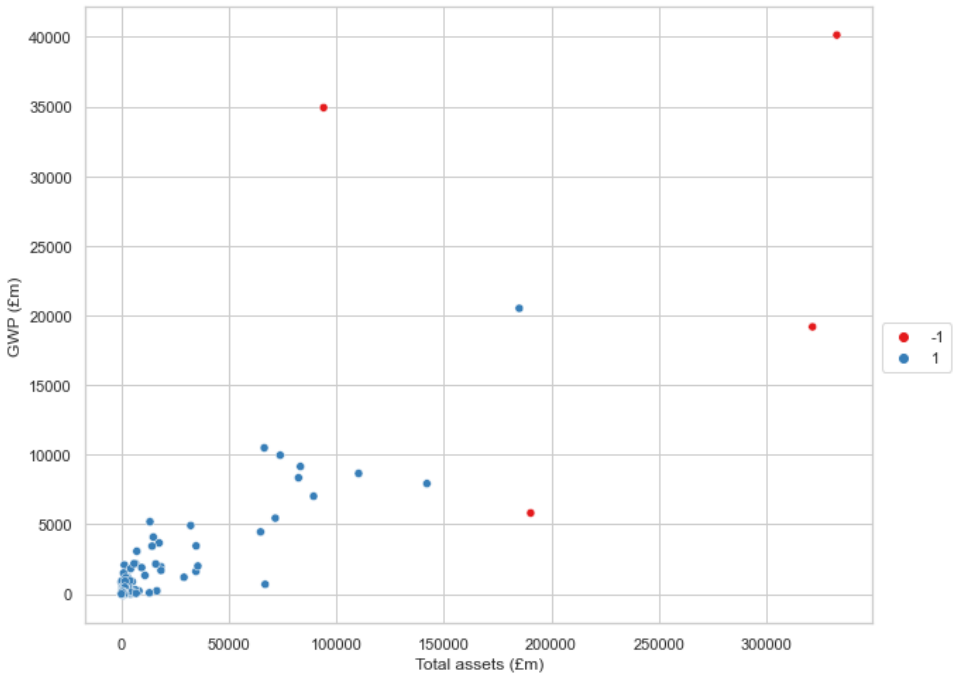

Figure 11 - Isolation Forest model with GWP and Total assets