**Group 6 ADTA 5130 Project Report**

**LAY-OFFS ANALYSIS**

**TEAM MEMBERS**

**AMITHA REDDY PEDDIREDDY 11605342**

**KEERTHI MALATHKAR 11651973**

**SRI CHARAN BODDUNA 11661666**

**SIVATEJA DIDDEKUNDA 11655074**

|  |  |
| --- | --- |
| TOPIC | PAGE |
| Introduction | 3 |
| Project Plan | 3 |
| Data Plan |  |
| Problem Statement |  |
| Methodologies used | 4 |
| Hypothesis for Problem Statement | 6 |
| Data Dictionary | 7 |
| Data Understanding | 7 |
| Exploratory Data Analysis | 8 |
| Problem Analysis | 9 |
| Problem Analysis 1 | 11 |
| Problem Analysis 2 | 12 |
| Problem Analysis 3 | 13 |
| Conclusions | 14 |
| Limitations | 14 |
| References | 15 |

**Introduction**

A recession is a time of sustained economic deterioration that can endure for several months or even years. Many people lose their jobs during a recession, and businesses have trouble turning a profit. Many people are going through difficult times right now, which might have a big impact on the economy and society as a whole.

A recession is brought on by a number of things, such as a drop in consumer and corporate confidence, excessive debt levels, inflation, supply chain interruptions, and financial crises. These elements may result in less spending and investment, which would hinder economic expansion.

The COVID-19 pandemic was the root cause of the most recent worldwide recession, which occurred in 2020. A significant drop in economic activity was caused by the epidemic, which also caused several firm closures, travel restrictions, and lower consumer purchasing.

Many people lose their jobs during a recession, which can cause them to struggle financially and have trouble paying their payments. Additionally, it might be difficult for enterprises to survive because they might have decreased revenue and have trouble acquiring funding.

Governments and central banks are able to take a number of actions to lessen the consequences of a recession, including establishing fiscal and monetary policies to boost demand, offering financial support to failing companies, and investing in infrastructure projects to generate jobs. These actions can support economic stability and serve to clear the way for a recovery.

It is crucial to remember that a recession is a normal phase of the economic cycle. Economic cycles include both growth and decline, and recessions can force required alterations and changes that, over time, can assist to create a more robust and sustainable economy.

In conclusion, a recession is a time of economic downturn that can significantly affect both individuals and society as a whole. Governments and central banks can take action to lessen the consequences of a recession and clear the way for a recovery, despite the fact that it can be a difficult period.

**Project Plan:**

As we received the data from public domain, we first perform data cleaning to remove empty values, data mismatches and make it ready for doing analysis on it. Data analysis to be done on cleaned up data by using various analytical and statistical tools by using R programming language. We can figure out which country and their city have affected most. We can study which industry got affected badly. We can explore companies which have higher layoff rates. We can get insights about layoffs happened over the years. These parameters can help to estimate country going into recession.

We can visualize laying off companies based on the country and their locations. We can find country with higher layoff rate, location where the layoffs are high. With this, we can predict whether country is going into recession. We are also going to visualize layoffs data based on industries like Infrastructure, Retail, Information Technology, etc. We can find out which companies in the sector have very high layoffs of their employees. We can also view which company fired employees in proportion to total employees. Which helps in predicting industries that hit by recession. We can get insights about the data based on time duration. We can understand layoffs happened during each quarter the past 3 years. We can estimate company’s performance.

**Data Plan:**

The dataset contains data about companies laying off their employees across the globe. Our data consists of various variables at source like locations, countries, industries, number of employees laid off, how much percentage employees laid off, funds raised by laying off employees, laid off date, stage, source and date on which the data added into dataset. The data is available from March 2020 to February 2023. Layoffs data consists of approximately 2300 rows. The dataset is made from multiple sources like Bloomberg, San Francisco Business Times, TechCrunch, The New York Times. This data can provide many different insights to understand effect of recession in the world.

**Problem statement:**

1. **Economic downturn:**

When there is a decline in economic activity overall, production declines, the Gross Domestic Product (GDP) declines, and poverty increases, there is an economic downturn that is a severe concern. As a result, businesses produce less goods and services, which lowers production and the GDP. Increased poverty is a result of the fall in economic activity as well as job losses and business closures. Consumer demand may decline as a result, further slowing down economic activity. Although policymakers may take action to alleviate the economic crisis, it may take some time before these measures have a noticeable impact. In general, the effects of a recession's economic downturn on people, businesses, and the economy are profound.

1. **Financial market instability:**

Volatility brought on by recessions, which can lower investor confidence and reduce liquidity, can exacerbate the economic situation. This lack of confidence may encourage investors to panic sell and pull their money out of the market, which will lower the value of stocks, bonds, and other financial instruments. Instability in the financial markets can also make it difficult for people and businesses to get credit, which can lead to layoffs and business closures. This starts a cycle that results in an extended recession and additional declines in economic activity. As a result, volatility in the financial markets is a significant issue during a recession, and policymakers may need to take action to calm the market and boost investor confidence.

**3.** **Laid off count:**

In order to cut costs and remain afloat during a recession, businesses may fire staff. Depending on the depth of the economic slump and the particulars of the company, the number of layoffs may vary. To survive a recession, businesses may occasionally be obliged to let go of a sizeable section of their personnel. For example, during the global financial crisis of 2008, countless businesses fired millions of employees. Similar to this, as businesses tried to survive, the COVID-19 epidemic resulted in a rapid rise in layoffs. Employees who are laid off may experience serious repercussions, and assistance may be offered to help them move to other career prospects.

**4.** **Percentage:**

Depending on the depth of the economic slump and the unique conditions of the organization, the percentage of employees laid off during a recession can change. In some circumstances, businesses may be required to let go of a sizeable section of its personnel in order to cut expenses and remain afloat. The size of the business and the sector in which it competes can also affect the proportion of employees let go out of the overall workforce. For instance, some industries, like hospitality and tourism, saw higher layoff rates than others during the recession brought on by the COVID-19 epidemic. However, it is challenging to give a precise proportion because it varies widely based on a number of circumstances.

**Methodologies Used:**

**ANOVA ANALYSIS**: To compare the means of two or more sets of data, statisticians utilize the ANOVA (Analysis of Variance) approach. Finding out if there is a significant difference between the means of two or more populations is done using a hypothesis testing approach.

The analysis of variance (ANOVA) compares the variation between the means of the study groups to the variation within each group. This makes it possible for researchers to ascertain if any observed differences between the groups are statistically significant or are simply the result of chance.

The null hypothesis, which presupposes that there is no significant difference between the means of the groups being compared, is initially developed to conduct an ANOVA study. The ratio of the variation within the groups to the variance between the groups is used to generate the ANOVA test statistic. The null hypothesis is rejected if the test statistic's p-value is less than the preset significance level, showing that there is a significant difference between the means of the groups being compared.

**Linear Regression:** A statistical technique called linear regression is used to examine the relationship between one dependent variable and one or more independent variables. To represent the relationship between the variables, it entails fitting a linear equation to the data.

The equation for simple linear regression is Y = 0 + 1X +, where Y is the dependent variable, X is the independent variable, 0 is the intercept, 1 is the slope coefficient, and is the error term. Simple linear regression only uses one independent variable and one dependent variable.

In linear regression, finding the values of the coefficients (0 and 1) that minimize the discrepancy between the anticipated and actual values of the dependent variable is the main objective. To achieve this, the sum of squared errors, also known as the sum of squared disparities between the predicted values and the actual values, is minimized (SSE).

Several independent variables are taken into account in multiple linear regression, which has the equation Y = 0 + 1X1 + 2X2,... + nXn + where Xi are the independent variables and 0 1, 2,..., n are the coefficients. Estimating the values of the coefficients that reduce the SSE in this situation is the objective.

In many disciplines, including economics, finance, engineering, and the social sciences, linear regression is frequently used to examine the correlations between variables, generate predictions based on those associations, and pinpoint important variables that have an impact on the dependent variable.

**Hypothesis for the Problem Statements**

1. Anova Analysis between AbvGr and Sales Price.
2. Anova Analysis between Total above ground rooms, Fireplaces and Sales Price.
3. Linear Regression between Laid\_off\_count and Funds Raised.
4. Linear Regression between Laid off count and Funds raised, Percentage.
5. Linear Regression between laid off count and Funds raised.

**Data Dictionary**

We have 12 variables in our dataset for our analysis.

These are the following attributes.

|  |  |
| --- | --- |
| **Variable** | **Meaning** |
| Laid\_Off\_Count | Number of employees laid off by the company |
| Percentage | Percentage of employees laid off out of total employees |
| Date | Date on which the layoffs happened in the company |
| Company | Name of the company |
| Industry | Name of the industry that company belongs to |
| Location | Location or city where the company’s head quarter located |
| Country | Name of the country |
| Funds Raised | Amount raised with layoffs |
| Stage | Status of the company |
| Source | Source of the layoff’s information |
| Date Added | Date added into the dataset |
| List\_of\_Employees\_Laid\_Off | Names of the employees (we do not use in the project) |

Control your budget, spending, and saving to prepare for what is coming next. Do your best at your current job to prevent being laid off. Also, remember to showcase your work/performance. However, practice coding interviews to prepare for a job search in case the uncontrollable happens. Review what you want (job with high salary, job that you like, or take some gap year for mental break, etc) Pick the jobs/industries/companies that are recession-proof. One way, in my opinion, is to see

**Data Understanding**

* Our data consists of companies and their layoffs from the start of COVID pandemic.
* The dataset contains data about companies laying off their employees across the globe.
* Our data consists of various variables at source like locations, countries, industries, number of employees laid off, how much percentage employees laid off, funds raised by laying off employees, laid off date, stage, source and date on which the data added into dataset.
* The data is available from March 2020 to February 2023. Layoffs data consists of approximately 2300 rows. The dataset is made from multiple sources like Bloomberg, San Francisco Business Times, TechCrunch, The New York Times. This data can provide many different insights to understand effect of recession in the world.

**Exploratory Data Analysis**

**Population Statistics**

|  |  |
| --- | --- |
| **Parameters** | **Values** |
| Mean (u) | **234.755498** |
| Standard Deviation (s) | **757.579259** |
| Minimum Value | **3** |
| 1st Quartile | **35** |
| 2nd Quartile | **76** |
| 3rd Quartile | **161** |
| Maximum Value | **12000** |
| IQR | **126** |

Sample Statistics

|  |  |
| --- | --- |
| **Parameter** | **Value** |
| Mean (x) | **98.5263158** |
| Standard Deviation | **72.1937875** |
| Minimum Value | **18** |
| Maximum Value | **99.825** |

1. In the population statistics, we got mean as 234.755 and standard deviation as 757.57.
2. In the sample statistics, we got mean as 98.52, standard deviation 72.19, maximum 18, and maximum value is 99.825.

**Problem** **Analysis**

**Box Plot Analysis:**

A screen shot of a graph

Description automatically generated with medium confidence

Box plot is a method for graphically demonstrating the locality, spread and skewness groups of numerical data through their quartiles. In addition to the box on a box plot, there can be lines called whiskers extending from the box indicating variability outside the upper and lower quartiles, thus, the plot is also termed as the box-and-whisker plot and the box-and-whisker diagram.

**Anova Analysis:**

A picture containing text, number, screenshot, font

Description automatically generated

Total Bedroom AbvGr and Kitchen AbvGr were used as an independent variable and sales price was used as a dependent variable in this ANOVA analysis.

The variable is not statistically significant in this case since the p-value is equal to 0.452195,

which is more than 0.05.

Also, based on the F value and P-value, we draw the conclusion that the factors are not substantially correlated.

**Anova Analysis:**

A screenshot of a spreadsheet

Description automatically generated with medium confidence

Total above-ground rooms and Fireplaces were used as an independent variable and sales price was used as a dependent variable in this ANOVA analysis.

The variable is not statistically significant in this case since the p-value is equal to 0.498073, which is more than 0.05.

Also, based on the F value and P-value, we draw the conclusion that the factors are not substantially correlated.

**Linear Regression**

A picture containing text, screenshot, number, font

Description automatically generated

We used different plots to describe the values in the graphs one is line flot plot and Residual plot and Normal probability plot.

The dependent variable in a linear regression is the one you're trying to predict or explain, whereas the independent variables are the predictors or things you think have an impact on the dependent variable. Finding the best-fitting line that minimizes the discrepancies between the observed data points and the line's anticipated values is the aim of linear regression.

One independent variable in a simple linear regression model results in the following equation:

y = β₀ + β₁x + ε

where:

The dependent variable is y.

The independent variable is x.

The y-intercept, or the value of y when x is 0, is equal to 0.

The slope or coefficient, which measures the change in y for a unit change in x, is 1,

The error term (which represents the y-variation that cannot be explained) is

**Linear Regression (Line fit Plot)**

To fit a line to the scatter plot data, use a linear regression technique. By minimizing the discrepancies between the observed data points and the line's anticipated values, the best-fit line will be estimated. The common form of the regression line equation is y = 0 + 1x, where 0 is the y-intercept and 1 is the slope.

We used the Funds raised as an independent variable in this regression study because its value is unaffected by any outside forces, and the Laid of count as a dependent variable.

We obtained the following regression line equation from the analysis and

R Square = 0.67427981

Adjusted R Square= 0.66570823

We draw the conclusion that the laid of count has swiftly increased and is expressing positively.

**Linear Regression (Residual Plot)**

A regression model's goodness of fit is evaluated using a residual plot, a graphical representation. It shows the residuals, which are the discrepancies between the values of the dependent variable that were observed and those that the regression model projected to be present.

We used the Funds raised as an independent variable in this regression study because its value is unaffected by any outside forces, and the Laid of count as a dependent variable.

We obtained the following regression line equation from the analysis and

R Square = 0.67427981 and

Adjusted R Square= 0.66570823

Additionally, we used 40 observations in this experiment. And the percentage laid of count in

Residual is 79.23111716 and Residual is -72.231117

We used the 40 observations in the regression process each observation is divided with separate.

probabilities output.

We conclude that laid of count increases, its funds is likely to fall.

**Linear Regression (Normal Probability plot)**

A normal plot, sometimes referred to as a quantile-quantile plot (Q-Q plot), is a graphical tool used to determine if a dataset conforms to a particular probability distribution, usually the normal distribution. The plot's points should nearly lie along a straight line to indicate that the data matches the assumed distribution when the quantiles of the dataset are compared to the quantiles of the theoretical distribution.

You may visually contrast the distribution of your dataset with the theoretical distribution using the normal plot. Divergences from the assumed distribution may be indicated by deviations from a straight line. The data may have heavier or lighter tails than the normal distribution, for instance, if the points dramatically depart from the straight line at the ends of the plot.

We used the Funds raised as an independent variable in this regression study because its value is unaffected by any outside forces, and the Laid of count as a dependent variable.

We obtained the following regression line equation from the analysis and

R Square = 0.67427981 and

Adjusted R Square= 0.66570823

**Visualizations:**

The visualization of the total number of laid-off workers by country is shown in the pie chart below.

The pie chart below breaks down the number of employees who lost their jobs throughout the recession process by nation and the number of people affected. *A picture containing text, screenshot, diagram, design

Description automatically generated*

Looking at this pie chart, we can observe that Australia saw the highest rate of layoffs in comparison to the other nations.

Belgium and Austria are in second and third place, respectively.

Overall, the GDP loss is held in Australia on the basis of financial resources.

**A picture containing text, screenshot, font, number

Description automatically generated**

**Conclusion:**

According to the results, the two most important categorical variables are the neighborhood and possessing the ideal lot size together with a specific garage parking space.

We may draw the conclusion that the year built is the key aspect that the broker should consider when providing information to the seller or buyer based on the regression analysis of various types.

**Limitations:**

In difficult economic times, organizations frequently must make painful decisions like layoffs. Here are some suggestions to aid in the process if you're thinking about or involved in layoffs.

Clearly expressed: Inform the impacted employees honestly and openly about the reasons for the layoffs, the selection procedures, and the support services available to them. Give details on severance payments, outplacement services, and other sources you may have access to for becoming retrained or finding new work.

Establish fair and consistent selection standards before choosing which personnel to let go of. To ensure fairness and prevent appearances of favoritism or discrimination, these criteria should be founded on valid business needs and applied consistently. Support services: Make resources and assistance available to assist impacted employees in finding new employment. This could be resume writing seminars, career counseling, job search support, or networking events. By providing these services, you can assist people in rebuilding their careers and boosting their confidence through trying times.

Key talent retention: Think about the long-term effects of the layoff decisions. Determine whether employees have the essential knowledge, expertise, or institutional skills needed for the organization's future success. Maintaining essential personnel can make the transfer go more smoothly and have less of an impact on continuing operations.

**References:**

1.Asabere, P. (1993). *Price concessions, time on the market, and the actual sale price of homes*. <https://www.semanticscholar.org/paper/Price-concessions%2C-time-on-the-market%2C-and-the-sale-Asabere-Huffman/9d4b832d8478822ff028862cbcd36144190eb6d4>

2.Barkham, R., & Geltner, D. (1995, March 1). *Price Discovery in American and British Property Markets*. Real Estate Economics; Wiley-Blackwell. <https://doi.org/10.1111/1540-6229.00656>

3.Bokhari, S. (2011, June 1). *Loss aversion and anchoring in commercial real estate pricing: Empirical evidence and price index implications*. <https://dspace.mit.edu/handle/1721.1/77150>

4.Eichholtz, P., Kok, N., & Quigley, J. M. (2010, January 1). *Doing Well by Doing Good? Green Office Buildings*. The American Economic Review; American Economic Association. <https://doi.org/10.1257/aer.100.5.2492>

5.Geltner, D., Macgregor, B. D., & Schwann, G. M. (2003, May 1). *Appraisal Smoothing and Price Discovery in Real Estate Markets*. Urban Studies; SAGE Publishing. <https://doi.org/10.1080/0042098032000074317>