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Statement of integrity: By typing the names of all group members in the text box below, you confirm that the assignment submitted is original work produced by the group (*excluding any non-contributing members identified with an "X" above*).

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1. Introduction

Four significant financial crises have occurred since the early 1980s because of dramatic swings in the pricing of goods, foreign exchange, housing, and stocks. The global financial crisis has had a significant influence on South Africa's economy. In the year 2008 to 2009, the economy entered a recession for the first time in over two decades. In only one year, over a million jobs were lost, and the unemployment rate remained persistently high at 25 percent throughout the country [5].

Economic growth has perked up a little in recent months, but the recovery is still fragile, and a new recession is still a distinct possibility. South African banks cannot thrive in the absence of a robust economy. Similarly, the economy cannot prosper until the quantity of money and credit expands significantly. Both have been deficient when it comes to the relationship between real economic growth and real money and credit supply [3].

This study delves substantially deeper into and grasps the market data behavior of South Africa's crises during the preceding 10 years.

2. Methodology

The group focused on extracting the best suitable economic indicators data and daily returns for South Africa for years ranging from 1990 to 2009, utilizing Python as the programming language. We have performed diverse in-depth analyses to gain a deeper knowledge of the data, which will result in more insightful findings.

The data characteristic was observed by plotting four distinct EDAs, namely density plots, box plots, qq plots, and conditional plots by our chosen frequency on three different EDAs. In order to fully explain the data pattern, we have also applied different calculations for basic statistics such as the standard deviation.

Also, we estimate both the normal and the heavy-tail distributions and compare their results to ensure that the data supports the model being used. Finally, multiple econometric models were fitted to analyze and assess the data distribution before and after the crisis.

3. Results and Interpretation

We begin by determining the most suitable indicators to employ to provide more significant and data-driven outcomes. We've opted to investigate the following economic indicators to start with: the unemployment Rate, Foreign Direct Investment (FDI), the deficit, exchange rates, the real interest rate, Gross Domestic Product (GDP) per capita, and Gross National Income (GNI).

For a long time, South Africa has paid its current account deficit by getting money from other countries. It was only after 1976 that South Africa was forced to run balance payments surpluses because of the return of net foreign capital inflows from oversea [1]. As seen in Figure 1.1, South Africa's deficit decreased significantly between 2002 and 2004, after having been relatively stable during the 1990s.
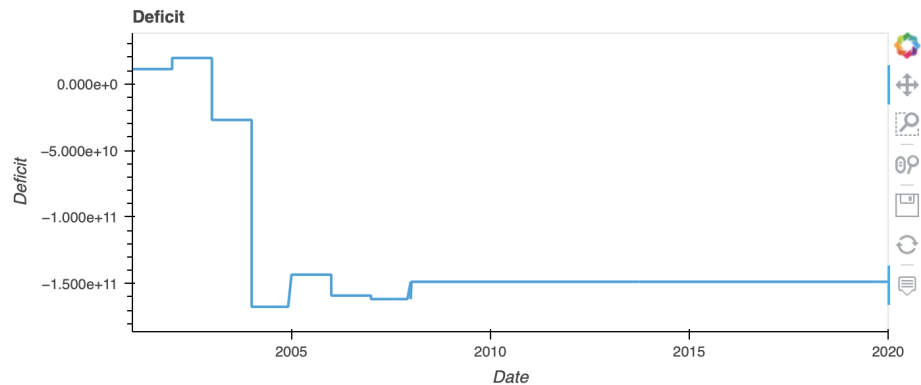
Figure 1.1: Line Plot Graph of the South Africa's Deficit and its stock prices

In comparison to other economic indicators, official exchange rates have been steadily increasing throughout the 2010, as illustrated in Figure 1.2. The exchange rate fluctuates as a result of the low interest rate, as seen in Figure 1.3.
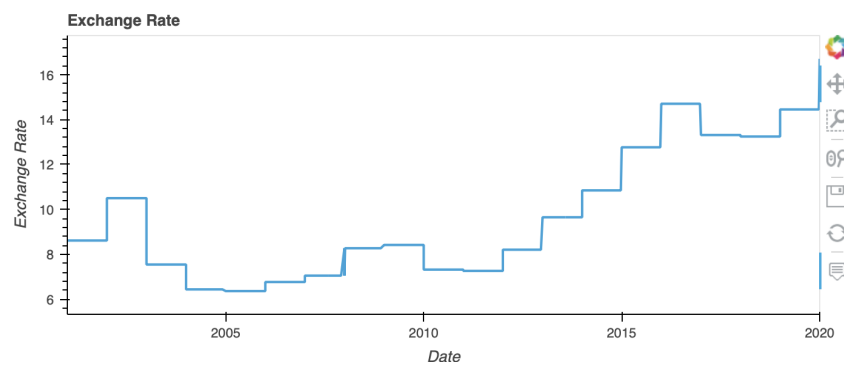

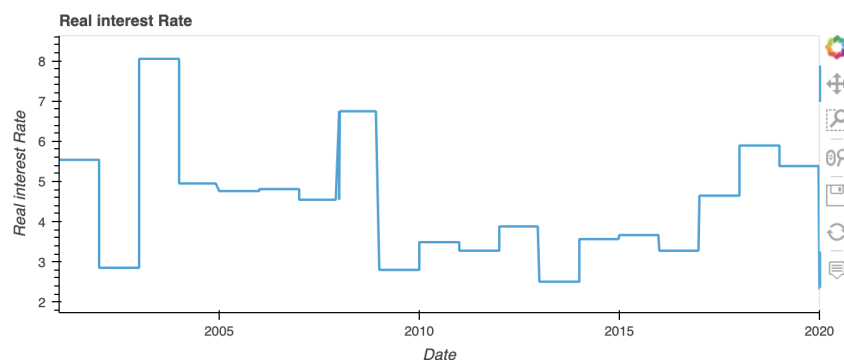**Figure 1.2:** Ling Plot Graph of South Africa's Official Exchange Rate

Figure 1.3: Line Plot Graph of South Africa's Real Interest Rate

GDP per capita is the sum of all resident producers' gross value-added plus any product taxes and minus any non-product subsidies. It ignores the depreciation of produced assets and resource depletion and degradation [4]. In the instance of South Africa, the country's GDP per capita grew steadily from 2002 to

its 2012 peak. However, after ten years of growth, it begins to fall sharply in the following years until 2020, as seen in Figure 1.4.
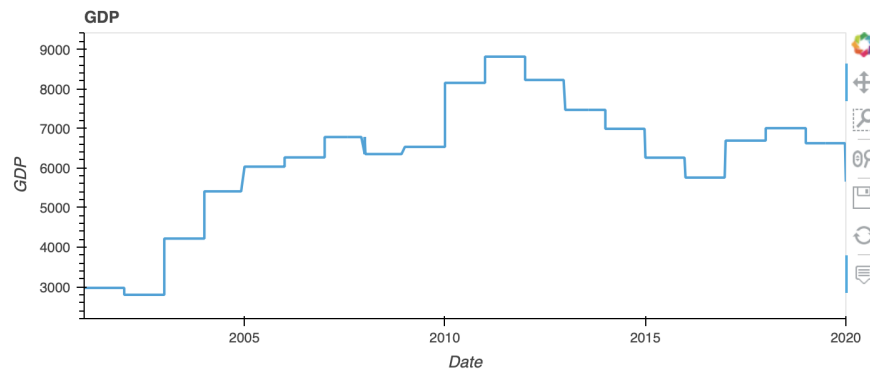

Figure 1.4: Line Plot Graph of South Africa's GDP per Capita

Concerning the biggest issue, the unemployment rate is quite high and has been steadily increasing up to this point. As seen in Figure 1.5, this unemployment rate increased further in 2019, hitting 29.1 percent in the third quarter, its highest level in over 16 years. South Africa's unemployment rate hit a record high of 28% in 2003 [6].
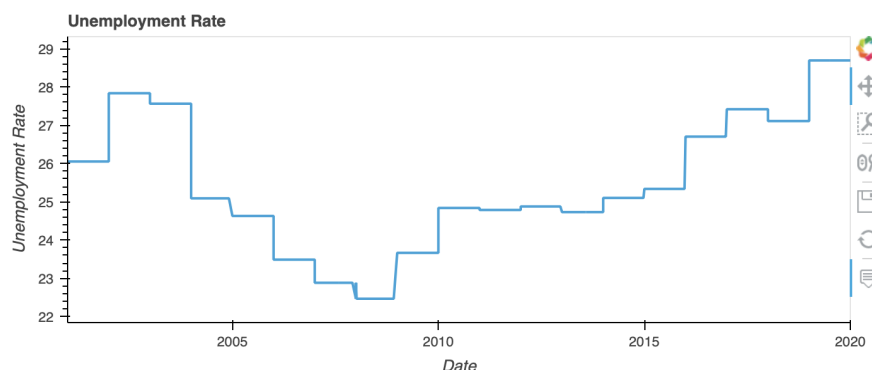

Figure 1.5: Line Plot Graph of South Africa's Unemployment

We used EDA to explore the dataset and try to uncover patterns and abnormalities (outliers), as well as to create hypotheses about what was happening. This procedure assisted us in becoming increasingly familiar with the dataset. We have graphed all of the metrics and securities in order to better see and interpret the data. Figure 2.1 shows the density, box and qq plot of South Africa's Unemployment rate.
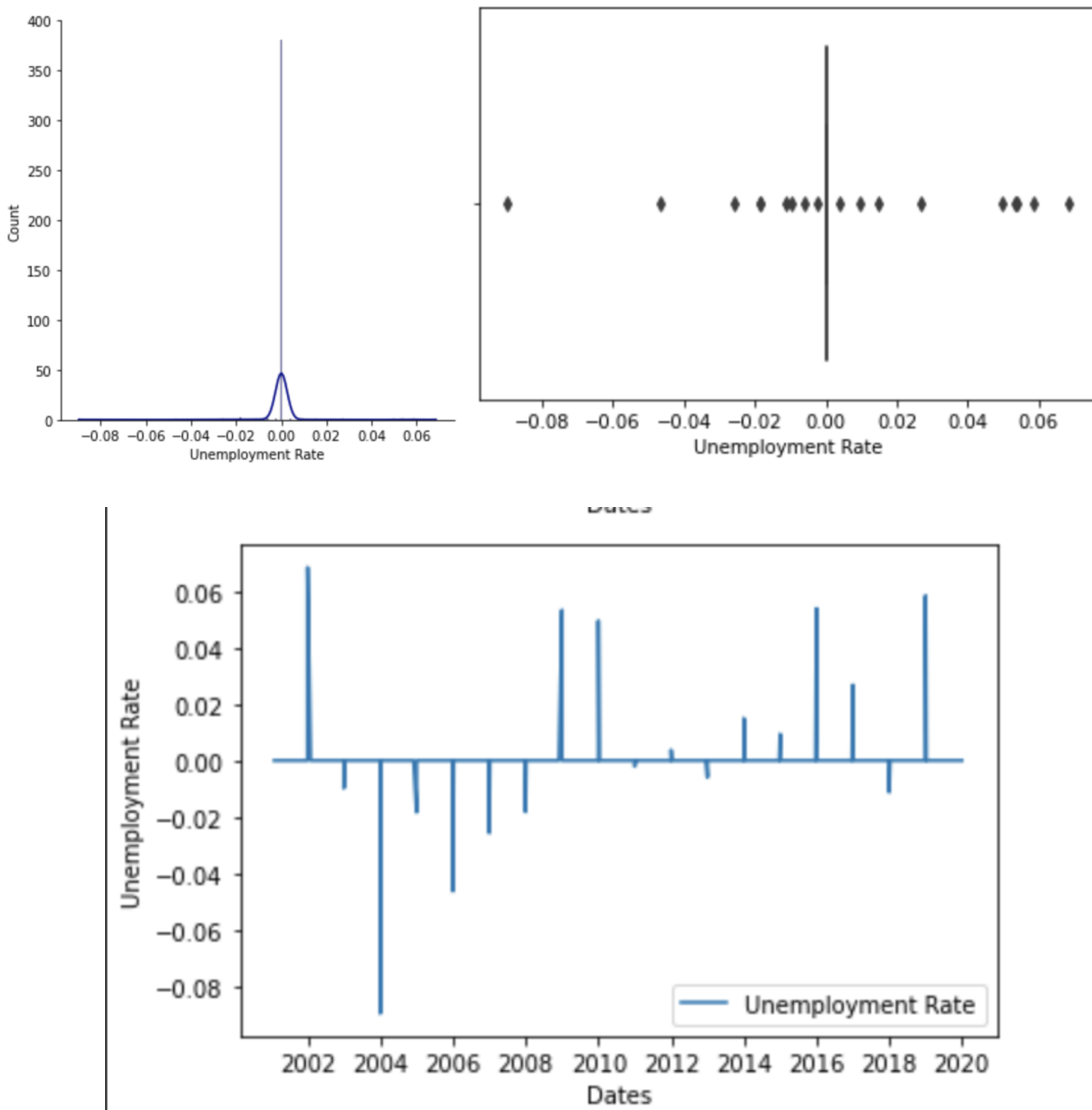
Figure 2.1: Density, Box & QQ plot of South Africa's Unemployment Rate from 2000 to 2020

In order to examine the other side of the coin, we have chosen the two most important securities, the Gold Fields Stock (GFI) and the Platinum (IMP), which were both negatively affected by the South African crisis. The return on platinum reached its apex in 2002 and then declines slightly before being unstable for the next several years, as seen in Figure 2.2.
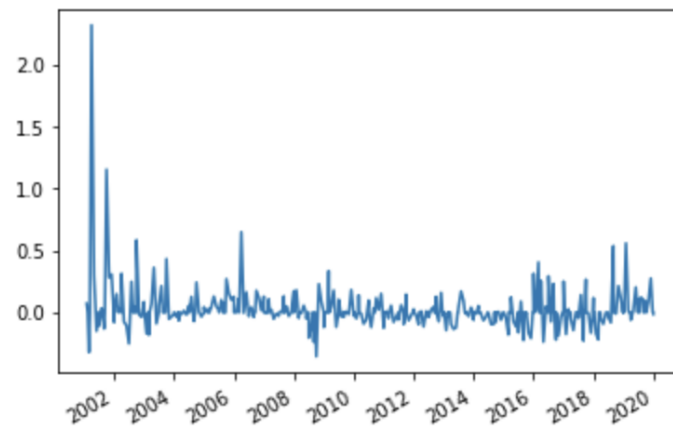
Figure 2.2: Graph of Platinum's return from 2000 to 2020

We have calculated the returns of the Platinum indicator and it gives us the result of 7563.74355 with its 5% trimmed mean of 7300.2651. When we plotted the daily return using a box plot as shown in Figure 2.3, we noticed that the distribution of the daily return was not the same as a normal distribution.
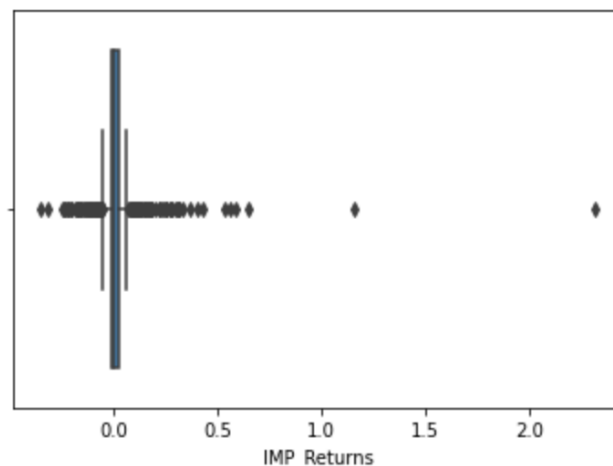

Figure 2.3: Box Plot of Platinum Return

We then proceed with getting all the lower and higher bound outliers for Platinum's Stock and return where we get a good array of positive numbers. We defined our outliers are anything below \ Q1-1.5(IQR) and greater than Q3+1.5(IQR).

The interquartile range measures the data's middle fifty percent. Whereas a range measures the beginning and finish of a set, an interquartile range measures the majority of the values [2]. In the case of South Africa, we calculated the interquartile range for platinum's return, which gave us a figure of 0.3098. Similarly, we weighted the standard deviation of platinum's return and it gave us a figure of 0.1724. Both standard deviation and interquartile range are ways to represent the spread or variation of a given data set.

When we calculated the skewness, median and mean of the platinum series, we obtained the values 7.0627 and 0.0000 and 0.0231, respectively. The mean is close to the median in all cases. Skewness is a measure of asymmetry in the data. Our calculation shown that Platinum's return has high skewness.

Volatility seems to be clustered together, which suggests that there is some volatility that lasts over the short and long term because of changes in the market. The standard deviation of each sample is almost close to the population standard deviation. Kurtosis tells about the distribution of tails relative to the center, while standard deviation tells about the spread of the entire data. These metrics help us infer about hte distribution of the data, the spread, shape and tails of the data.

Observations made after fitting all four datasets (two stocks and two returns) revealed that the data does not follow a normal distribution and is unevenly distributed. We next used the Shapiro-Wilk test to check the results of the normality test, which yielded the same results for all four datasets that did not have a normal distribution as the first. Both the data and the returns do not follow normal distributions. This is because data is uneven and stock data do not generally have a normal distribution and follow random walk.

Proceeding with the heavy tail distribution using the return of the two securities, these are obtained by converted each of the data to log normal. The returns data have been made heavy-tailed distributions as shown in the Figure 3.1 below. Both the series we modeled do not fit the Gaussian distribution. The returns data has been made to fit the heavy-tailed distribution. The returns data can be made normal with any transformation.
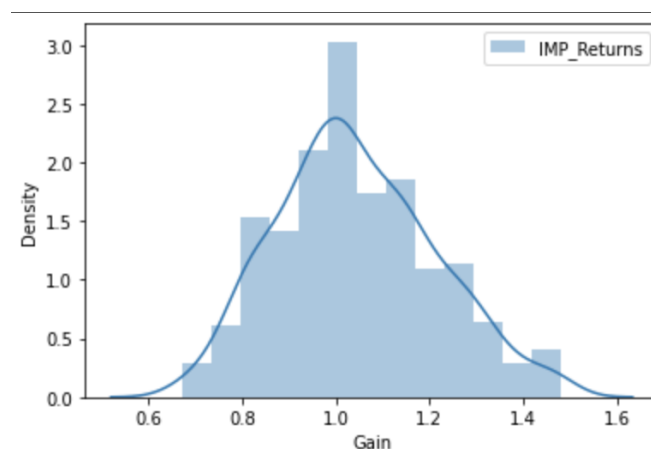

Figure 3.1: Graph of Platinum's return in heavy-tailed distribution

For our last test of the data, we will use GARCH modelling to better understand the behaviour of the data both before and after the financial crisis. It appears from all of the datasets that the time-series was not stationary before and became stationary after the crisis.

Finally, we investigate and seek for any correlations that are mean reverting. Mathematically, the ADF is based on the idea of testing for the presence of a unit root in an autoregressive time series sample. From the ADF test, it is seen that most of the returns do not change over time before and after the crisis.

There is mean reversion for the following macros factors/stocks Deficit (GB.BAL.OVXG.CN), Gold Fields Limited (GFI), Impala Platinum Holdings Limited (IMP.JO) and the rest of the factors have mean reversion.

4. Non-Technical Summary of Leverage

In the financial world, leverage is the use of borrowed money to invest and return on investment. Leverage is an investment strategy that uses borrowed money, especially various financial instruments or borrowed funds, to increase potential investment returns. Leverage is a common strategy in which an individual or company uses borrowed funds to invest and possibly increase the investment in the hope of making a profit. Leverage is when you borrow money, such as a loan, stock, equity or other asset, to invest it to potentially increase the return on that investment. [7,11,13]

With leverage, professionals can significantly increase their purchasing power (and corresponding returns) and potentially invest in multiple companies at the same time using smaller amounts of cash and larger amounts of debt. Investors and professional traders use higher levels of leverage to make better use of the money they need to invest. Investors use leverage to greatly increase the returns that can be made on investments. Leverage can provide investors with a powerful tool to increase their returns, although the use of leverage in investing also entails some significant risks. [8,11,17]

Understanding the risks involved will help you decide whether using leverage is right for you and your financial situation and type of investment. Leverage in investing is known as margin buying and is an investment method that should be used with caution, especially for inexperienced investors, as it has a high potential for loss. The key point Leverage involves borrowing money to trade stocks, and while this can greatly increase your returns, it also means that you may lose more money than you invested. [7,10,17]

Key Points Leverage refers to the use of debt (borrowed funds) to increase the return on an investment or project. Leverage arises from the use of debt capital as a source of funding when investing to expand a company's business base and generate venture capital returns. By using the underlying portfolio, the manager has more capital to work with and can invest in more securities that generate income for the fund. An investment portfolio raises additional capital by issuing debt, issuing preferred shares, or using complex financial products to increase the value of the underlying portfolio. In other words, leveraged funds exhibit greater volatility than unleveraged funds that invest in the same stocks. Since fund managers don't lose money when their holdings of the fund's investments lead to losses -- managers get 2% of their assets anyway -- the extra leverage only makes investors' returns more volatile, exposing them to significant risk. [11,14,15]

As mentioned above, the most popular leverage ratio investors use to study a company's debt exposure is the D/E ratio, which directly compares debt to equity. Leverage is defined as the number of dollars borrowed for every dollar invested. Leverage is a measure of how well a company's operations are funded by debt (borrowed capital). Leverage ratios that are considered "good" or below average vary by industry, as some types of companies are inherently more dependent on debt than others to fund their operations. [9,14]

On the other hand, comparing the leverage ratios of two companies in the same industry can provide valuable insight into which investments might be safer. If two companies are comparable (in terms of industry, size, and age), but one has a significantly lower leverage ratio than the other, the less leveraged company may be considered a safer investment. However, within an industry, if two companies are similar in size and age, and one of them has a significantly higher leverage ratio, this may indicate that it is a riskier investment, especially during periods of low returns. [9]

Companies are leveraging heavily to finance their growth, households are leveraging in the form of mortgages to buy homes, and financial professionals are leveraging to strengthen their investment strategies. To really understand the essence of what leverage can achieve, it is critical to understand the many different types of leverage in business and in life. [12,17]

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