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The Visualization Analysis of Economic Crisis in Pakistan (2000 – 2022)

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ABSTRACT

Economic crises play an important role in regulating the stability and trends in the growth of a country. In the world of economy economics crises is a still critical challenge for economists because of their multidimensionality and instead of involving single variable that causes an impact economic crises involves a wide range of variables. The main objective of this research is to investigate the problematic relationship between economic variables such as Money Supply (MS), Interest Rate (IR), Inflation (I), Unemployment (U), and Political Stability (PS). By using econometric analysis methods and data analysis skills this research aims to establish how the above-mentioned variables play their role in affecting economic growth or development and political stability of a country. Moreover, the main focus of this study in on Pakistan and to examine the adverse effects of different economic variables on the growth ability of a country.

KEYWORDS multidimensionality, economic crises, economic variables, econometric methods, data analysis

Introduction

There are various indicators (variables) included in the economic crises of Pakistan that affects its growth. One cannot say that economic crises is a simple term but in case of Pakistan one of the reasons for the economic crises is its political instability and its weak governance. Including a broad range of linked variables that worsen it. For example, Pakistan is in a risky financial situation due to ongoing budget deficits and its large dependence on international borrowing. The basic problems in Pakistan's economy include an even more limited source of revenue and the decline in the significant industries like agriculture and manufacturing.

Furthermore, the economy is strained by issues like increasing poverty, population, and income inequality. These social issues are made worse by the absence of investment in the human capital such as education system and health, and presence of weak welfare systems.

To assist the economists and policy makers, the research study aims to create an efficient model for analyzing the indicators that determines the GDP of Pakistan. The purpose of the study is to deeper understand the GDP patterns (ups and downs) so that better fiscal and monetary policies can be created and so that will support political stability and economic growth of Pakistan.

Variable Explanation

GDP: It is indicated as annual percentage of market prices in constant local currency.

Real Interest Rate: It is the lending interest rate that is adjusted for inflation.

Inflation: It shows the annual percentage change in the consumer's cost of purchasing goods and services (a basket), which either be fixed or vary at different times, mostly annually, and it is measured by the CPI (consumer price index).

Unemployment: Unemployment refers to the share of the labor force and also includes individuals who are not employed but available for and seeking employment. Definitions of labor force and unemployment differ by country.

Broad Money Growth: Broad money is the sum of currency outside banks; demand deposits other than those of the central government.

Political Stability: The index of Political Stability measures perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically motivated violence.

Literature Review

"Economic Growth and Its Determinants in Pakistan" by Shahbaz, Ahmad, and Chaudhary explores the variables influencing Pakistan's economic growth, emphasizing labor force increase, capital accumulation, and technical advancement. They also look at the impact of CPI (inflation), money supply (MS), and unemployment rate on the GDP growth. Understanding the complex relationship between these factors is important to understand the economic growth trends of Pakistan's economy, as their research suggests. Research results from this paper provides in an in-depth information of the variables affecting GDP, and most importantly these results align with my paper's objective of understanding the complexity involved in the economic development in underdeveloped countries such as Pakistan. This research paper will be helpful in the analysis of GDP patterns and in the formation of Pakistan's economic policies.

"Key Factors Affecting GDP in Pakistan Over the period 1975 – 2011" by Muhammad Umar Farooq et al. provides an in-depth econometric analysis of the key economic factors and sectors that impacts the GDP growth of Pakistan. In this research the

authors have examined how economic development between 1975 and 2011 is affected by the industrial output, services sector, agriculture, trade openness, and currency rates. Authors applied the Johansen VAR-based Co-integration technique to identify the long-term correlations between economic variables and real GDP. After seeing the results, we can conclude that every sector and factor investigated has a significant and positive impact on the real GDP, with industrial output having the highest and strongest impact. This work presents a different perspective on factors of economic growth in developing countries therefore this work is significant to my research on GDP patterns in Pakistan.

"Macroeconomic Determinants of Economic Growth in Pakistan" by Zafar Iqbal and Ghulam Mustafa Zahid explores that how variables affects the economic growth of Pakistan from 1959 – 1960 and 1996 – 1997. To examine the impact of important factors like elementary education, budget deficit, health system, and external debt on economic growth, the authors have applied a multiple regression approach. The results shows the magnitude of health and primary education as an important growth driver, which agree with the global economic theories. There are adverse effects of the external debt and budget deficit on economic growth and political stability. On the other hand, economic openness positively impacts the economic growth of Pakistan, and the study suggests that an outward-focused approach will be favorable. This study has made easier to understand economic trajectories of Pakistan economy and moreover this paper is essential and relevant to studies on GDP growth in developing countries.

Sidrat Jilani, Farooq – E – Azam Cheema, and Muhammad Asim paper "Exploring Impact of Macro Economic Variables on GDP of Pakistan" examines the relationship of macroeconomic variables with Pakistan's GDP. How Pakistan's GDP is affected by IR, exchange rates, and inflation between 1980 – 2013 is determined by using a multivariate regression analysis. The results shows a significant impact of these indicators on the GDP growth of Pakistan with inflation and IR negatively impacting the growth rate and it was observed that there is a positive correlation between real exchange rate and GDP growth. The methodologies used in this research paper provides deep understanding into the country's economic mechanism and also align with the objective of my paper to understand how different economic variables drives Pakistan's economic growth. This paper provides an evidence-based analysis of the relationship between GDP and macroeconomic factors that affects it, moreover it adds a critical dimension to the existing literature.

Graphical Analysis and Visualization

Graphical analysis plays an important role in research work. In visualization complicated data sets are made easier and simpler by applying different graphs such as line graphs, histograms, scatter plots, and bar charts so that trends can be understood easily. Because it shows the hidden patterns and trends that are not easy to point out in an unstructured dataset. By applying these charts on the dataset (collected from different official websites) offers a simpler synopsis of the economic patterns and it also identifies that how variables like inflation, interest rate, money supply, and unemployment rate interact with GDP growth with the passage of time. This strategy highlights the most important findings and improves the research's accessibility to a wider audience. Implementing graphic analysis into the research process is essential, as it offers a more transparent perspective for the reader to understand the complex nature of economic growth in Pakistan.

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Results and Discussion

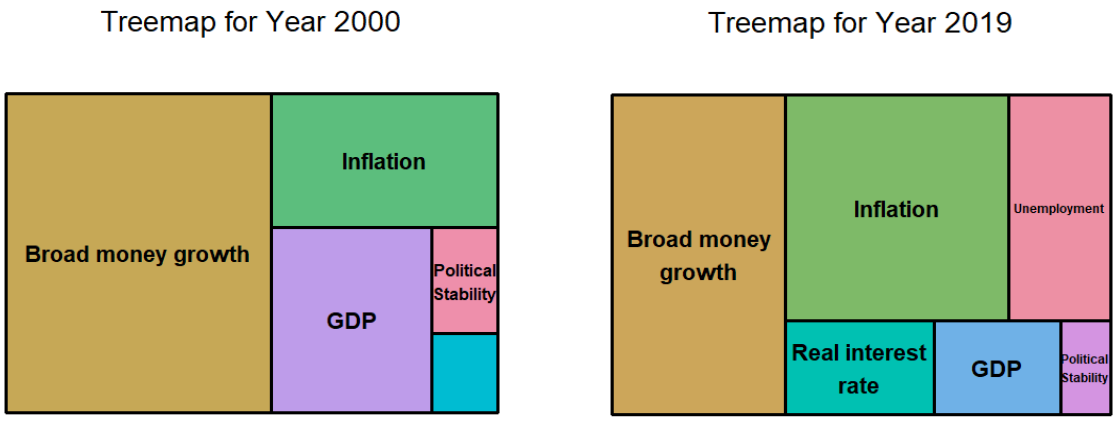

Figure1.1: Treemap

In Treemap I have used grouping extension in which I have selected all the variables in my data. This data visualization uses nested rectangles to represent hierarchical data, with the size of the rectangle indicating the dependencies of the variables.

The largest rectangle in the 2000 data shows broad money growth as the most significant factor impacting GDP. Inflation was also significant but less so than broad money growth. Political stability's impact was smaller compared to these variables.

The largest rectangle in the 2019 data shows Broad money growth, inflation, and unemployment are significant factors affecting GDP, while real interest rate has moderate impacts compared to these three.

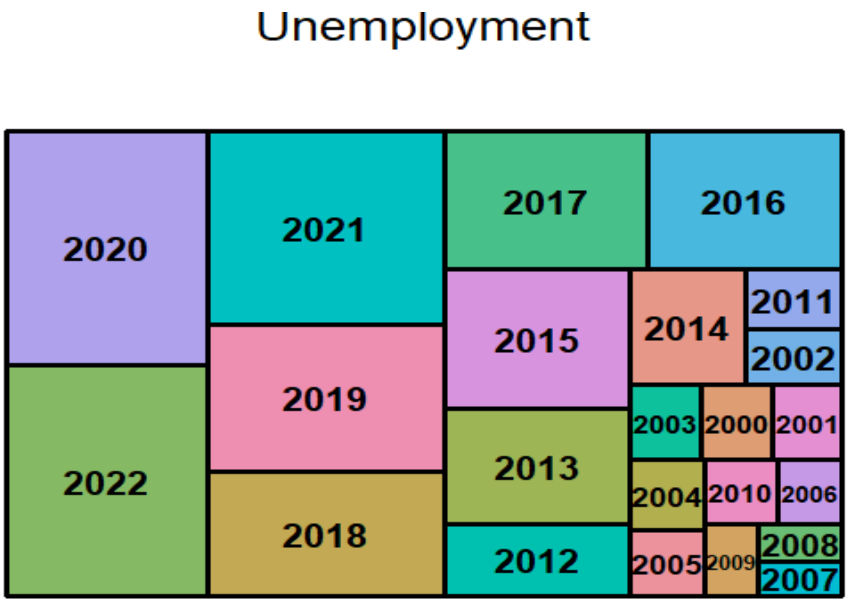

Figure 1.2: Treemap

Treemap displays unemployment data over different years, with each rectangle representing the unemployment rate or related metric, with larger rectangles indicating higher values.

Large rectangles in different colors identify the years 2020, 2021, and 2022, indicating unemployment was an important issue throughout these years. While 2000, 2001, and 2003 had smaller rectangles, suggesting lower unemployment statistics, 2019 and 2018 also have significant sizes, indicating they were years with considerable unemployment numbers.

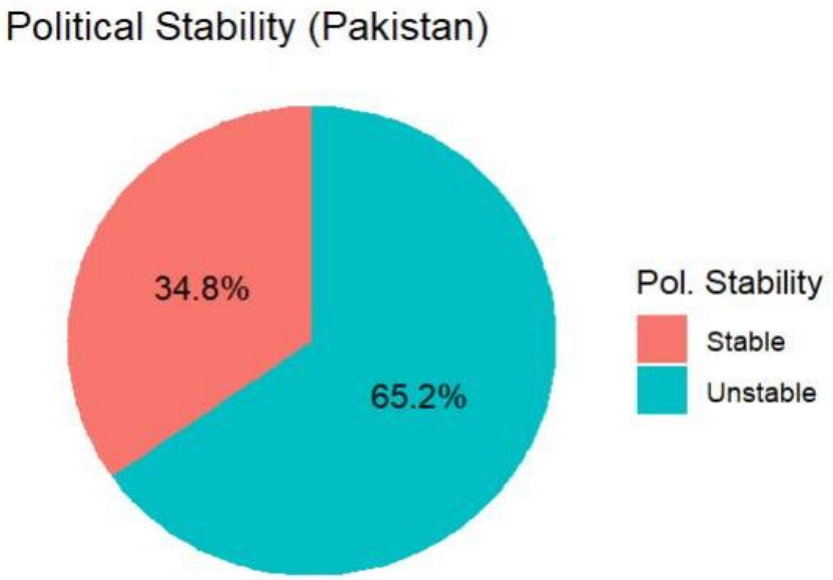

Figure 2: Pie chart

This pie chart categorizes Pakistan's political stability into stable and unstable segments. The 'Stable' category is represented in red, while the 'Unstable' category is represented in blue, indicating a more time of instability and less stability in political terms.

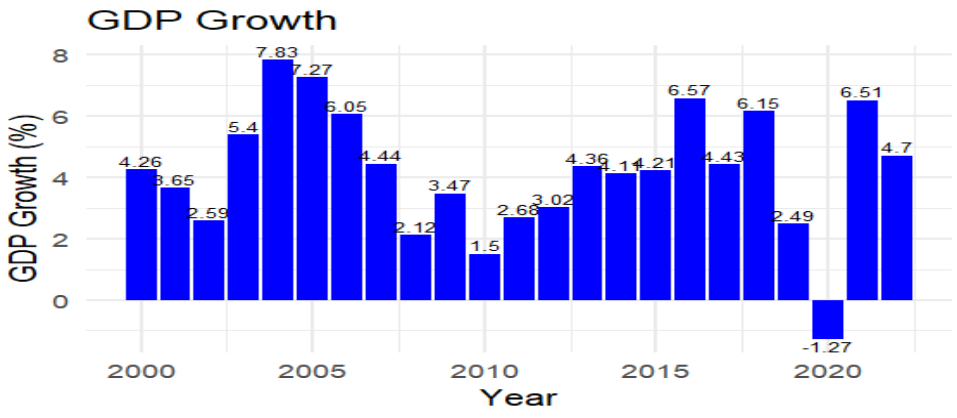

Figure 3.1: Bar Chart

This bar chart displays the annual GDP growth rate for a series of years, with each bar representing the GDP growth rate for a specific year and its percentage growth rate.

- The chart demonstrates fluctuations in GDP growth rates over time, with 2004 showing the highest growth rate at 7.83%.
- However, 2020 saw a negative dip at -1.27%, indicating an economic contraction.
- Furthermore, the reason for contraction in the economy was not due to the factors in the data as I early stated that economic crisis is a complex term that does not only depends on some factors in the economy there are always a third party playing its role. Because 2020 year was the beginning of Covid – 19 which did not only cause economic crisis in Pakistan but COVID-19 but overall, of the World.

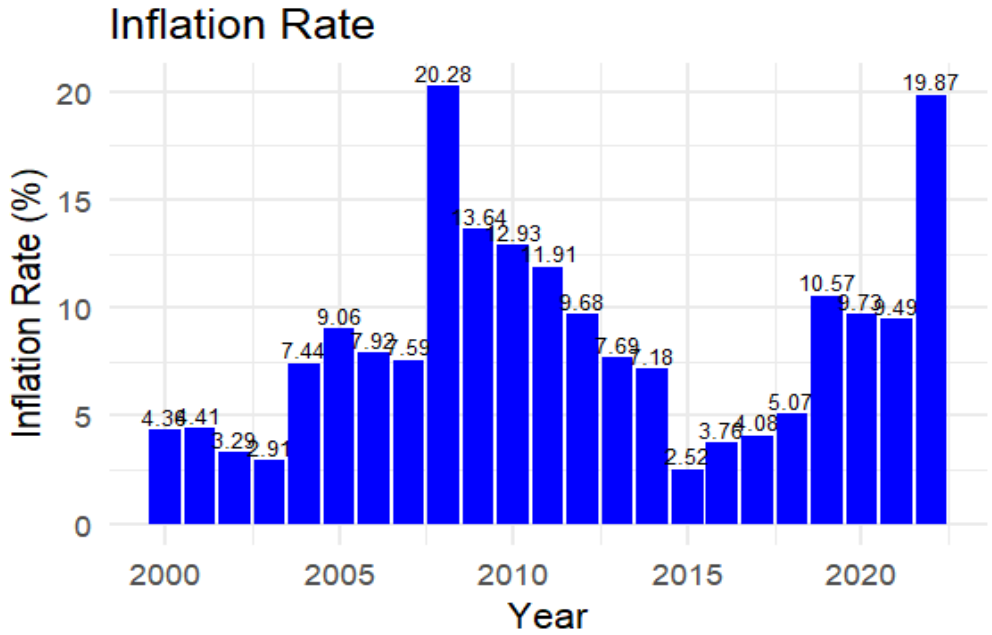

Figure 3.2: Bar Chart

This shows the inflation rate over several years, with each bar representing the rate for a specific year and the percentage displayed above it.

Inflation rates have fluctuated significantly over the years, with two significant peaks in 2008 and 2022, with rates of 20.28% and 19.87% respectively. The lowest rates were in 2003 and 2015, with rates of 2.91% and 2.52%, respectively. The trend of increasing inflation rates is clear in 2022.

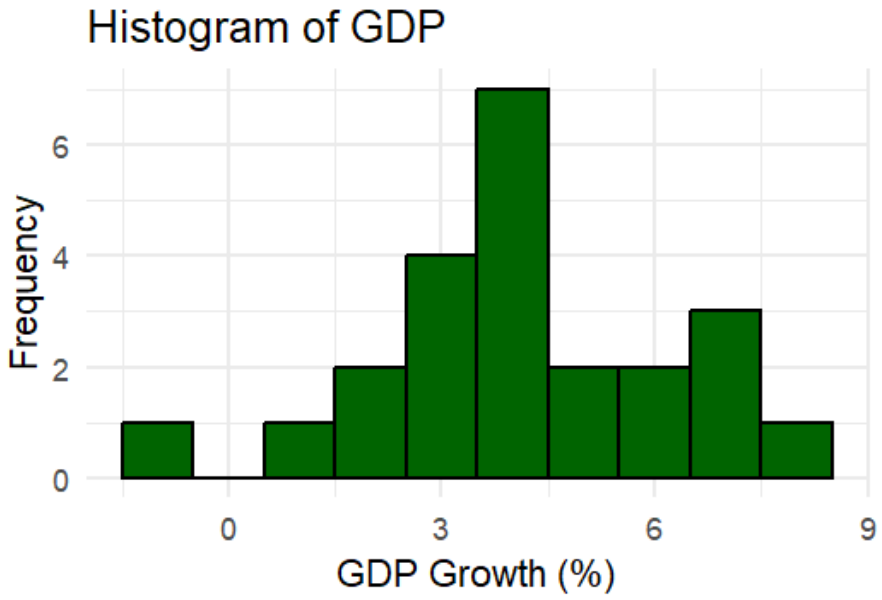

Figure 4: Histogram

It shows the distribution of GDP growth rates, with each bar's height representing the frequency of growth rates falling within the range indicated by the bar's width on the x-axis.

The highest bar shows that the most common range for the GDP growth rate in Pakistan from 2000 to 2022 is between around 2% and 4%, with fewer instances of very low and high rates. The distribution is right skewed, with more cases of lower rates and fewer higher rates. The most unusual GDP growth rates are those closest to 0% and those approaching 9%.

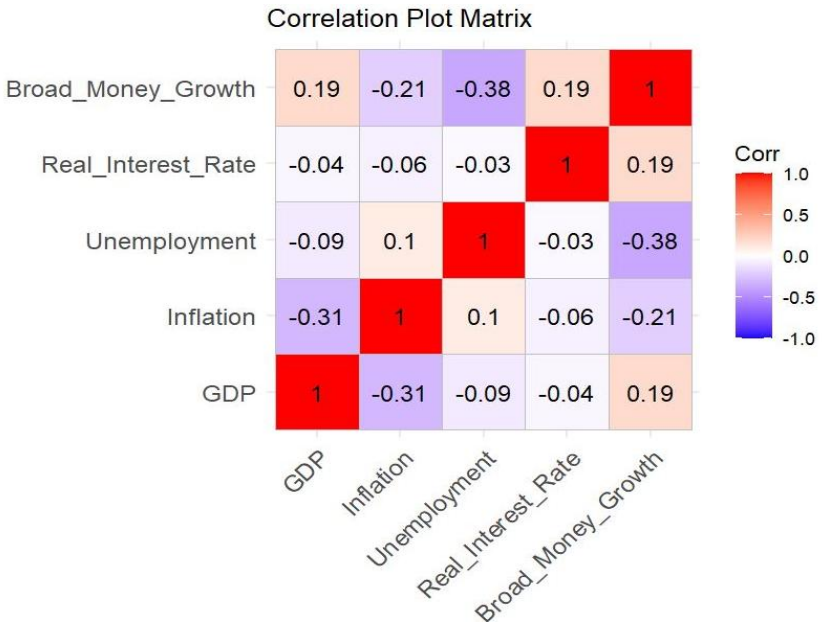

Figure 5: Correlation Matrix Heatmap

It displays the correlation coefficients between economic indicators, with positive correlations represented by red and negative correlations by blue. Neutral correlations are represented by white or light shades of color.

- A strong positive correlation (0.89) exists between unemployment and year, indicating an increase in unemployment over time.
- A significant negative correlation (-0.31) exists between inflation and GDP, suggesting lower GDP growth rates are linked to higher inflation rates.
- A positive correlation (0.19) exists between Broad money growth and Real interest rate, suggesting a slight increase in these variables together.

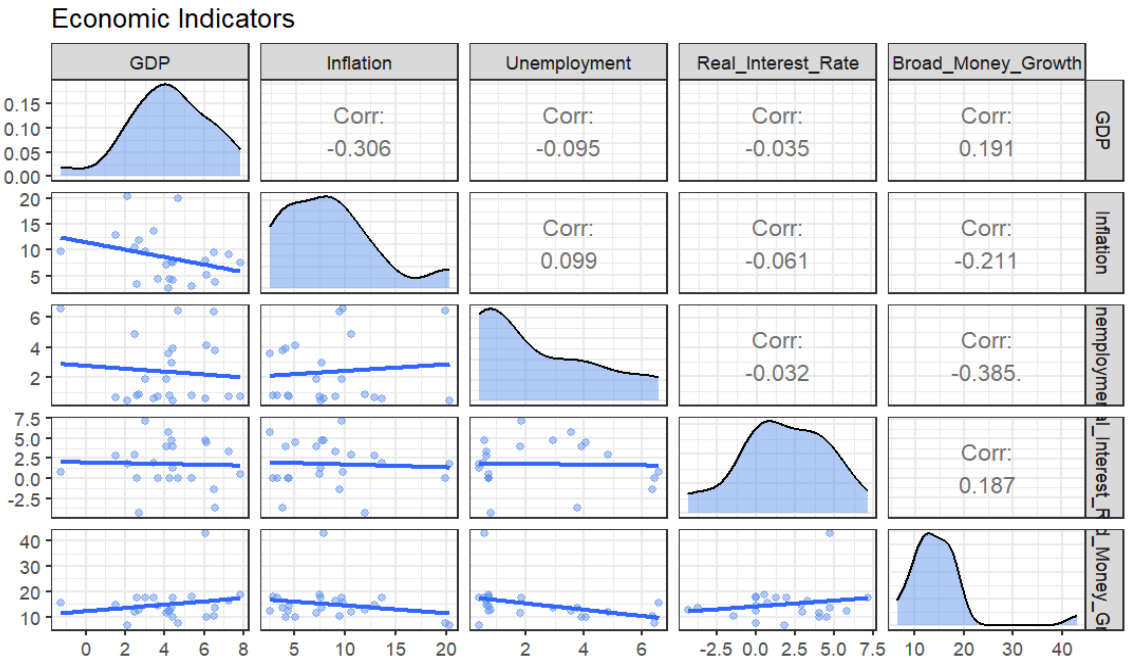

Figure 5: Scatterplot Matrix

In Figure 5, Scatterplot matrix shows us the multiple pairs of variables in the dataset. It is important because it shows skewness in the data, it shows varying trends, and the relation between two variables.

- It shows that the correlation between GDP and inflation is negative. Which means that if inflation increases GDP decreases. Therefore, its graph is negatively sloped.
- As we can see, the distribution for GDP and real interest rate is approximately normal.
- The correlation between GDP and interest rate is negatively related but flatter.

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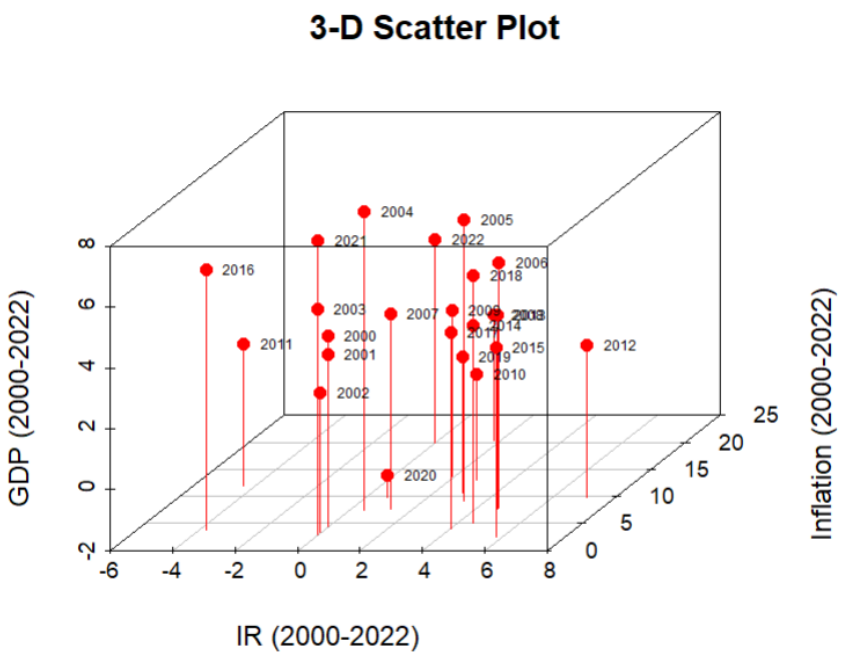

Figure 6: 3-D Scatter Plot

This plot illustrates the relationship between GDP growth, inflation rate, and Interest rate from 2000 to 2022.

The data indicates that inflation doesn't always correlate with interest rates or GDP growth, with 2020 showing negative GDP growth, potentially indicating a recession or economic downturn, often linked to significant events like the COVID-19 pandemic.

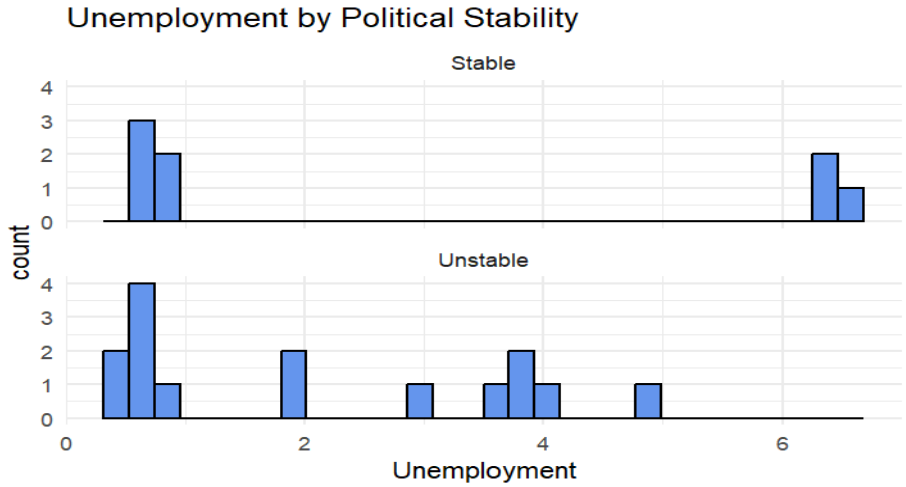

Figure 7: Grouping and Faceting

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In this histogram of grouping and faceting I have selected unemployment, categorized by political stability into 'Stable' and 'Unstable'. The Stable category has lower unemployment rates, with a higher concentration at lower rates and a smaller count at higher rates. On the other hand, the distribution of counts under the 'Unstable' category is more fluctuating, representing different unemployment rates. This suggests that during times of political instability, the unemployment rate is more variable and can reach higher levels compared to periods of stability.

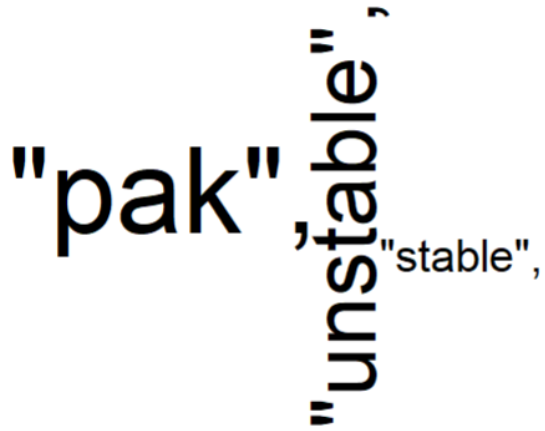

Figure 8: Word Cloud

The word cloud shows that the word ‘Pak’ and ‘unstable’ have the highest frequency relatively.

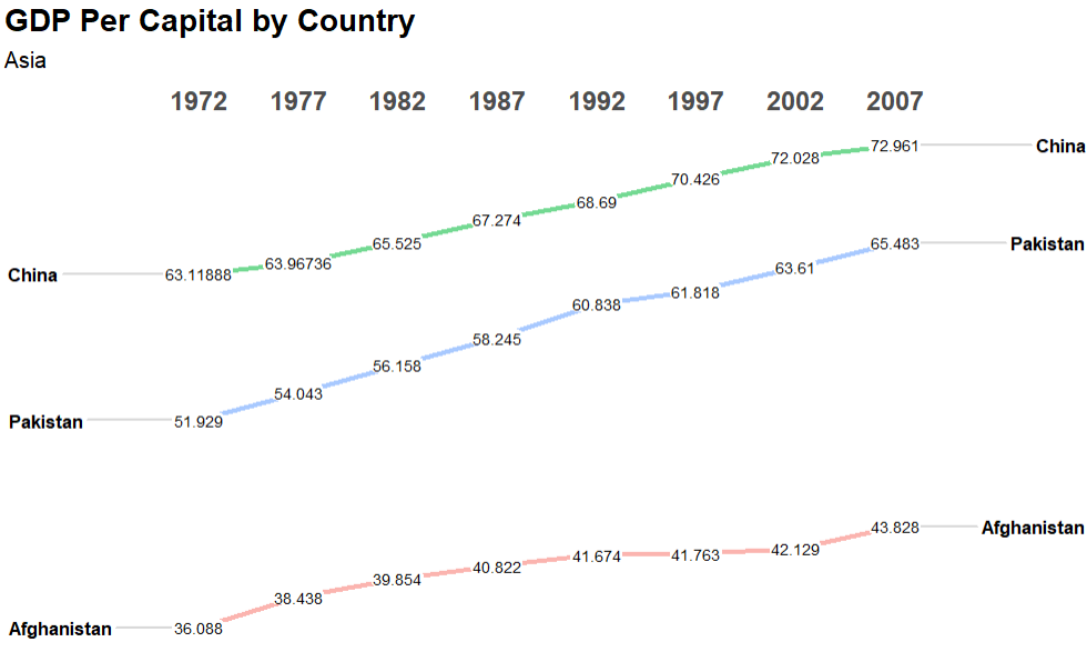

Figure 9: Slope Graph

For this slope graph I have selected the data for Pakistan, China, and Afghanistan from 1972 to 2007 with a year gap of 5 years. The source for this data is

"gap minder" that was already saved in the R program packages. In Pakistan the GDP per capital was rising continuously with passage of time as well as in China. On the other hand, for Afghanistan, it was increasing from 1972 to 1992 but after that it was almost increasing but with a decreasing rate till 2002, and then again it started to incline.

Regression Model and Analysis

Let's name the dependent variable GDP (economic growth) as Y and the independent variables as X_1 for Inflation, X_2 for Unemployment, and X_3 for Real_Interest_Rate, & X_4 Broad_Money_Growth (indicating money supply by the State Bank of Pakistan).

GDP = β0 - β1 (Inflation)- β2 (Unemployment) - β3 (Real IR) – β4 (Broad_Money_Growth)

$$Y = \beta 0 - \beta 1X\_1 - \beta 2X\_2 - \beta 3X\_3 + \beta 4X\_4$$

β1, β2, β3, and β4 are the coefficients for the independent variables and these coefficients represent the expected change in Y (GDP) for a one-unit change in the respective Xi variable, holding all other variables constant. While β0 is a constant term.

To calculate all the coefficients of the data I have used the Mini tab program.

Regression Analysis: GDP versus Inflation, Unemployment, ...

```
The regression equation is
GDP = 4.73 - 0.119 Inflation - 0.015 Unemployment - 0.057 Real_Interest_Rate
      + 0.0415 Broad_Money_Growth
```

Predictor	Coef	SE Coef	T	P	VIF
Constant	4.727	1.752	2.70	0.015	
Inflation	-0.11906	0.09643	-1.23	0.233	1.047
Unemployment	-0.0149	0.2319	-0.06	0.950	1.177
Real_Interest_Rate	-0.0570	0.1624	-0.35	0.730	1.039
Broad_Money_Growth	0.04153	0.07332	0.57	0.578	1.259

$$Y = 4.73 - 0.119X\_1 - 0.015X\_2 - 0.057X\_3 + 0.0415X\_4$$

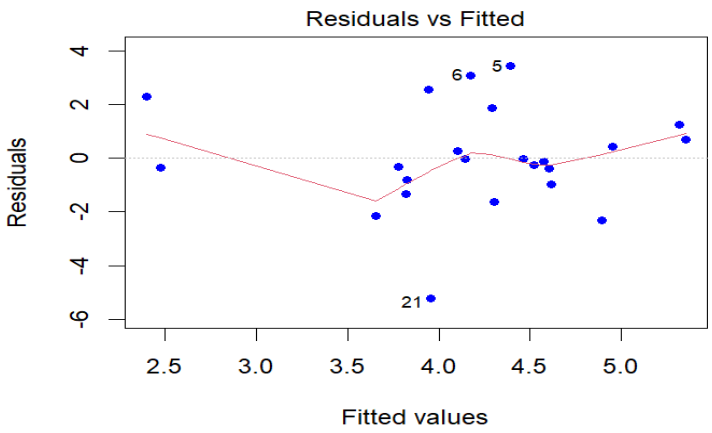

Figure 1: Residuals are the errors while fitted are the variables so there should be no relation between them. The red line shows the fitted and represents the model of linearity and it must be at the origin. While in our data it does not show the even distribution above and below zero and there is a pattern of increase and decrease this means that our residuals do not follow the assumption of linearity, furthermore, since plot doesn't show consistent spread therefore, we conclude that it also does not follow the assumption of homoscedasticity. The pointed values are the outliers.

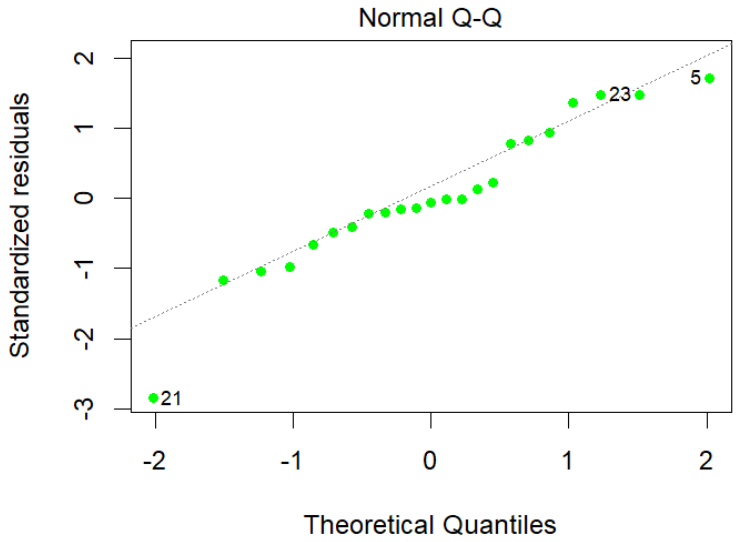

Figure 2: in normal Q-Q (Quantile-Quantile) distribution the dotted line represents the normality whether the dataset follows it or not, and it can also be called rule of thumb (we are strict to the basic laws).

Most of the data points follow the dotted line, which represents the expected pattern if the residuals were normally distributed. This suggests that the residuals are approximately normally distributed.

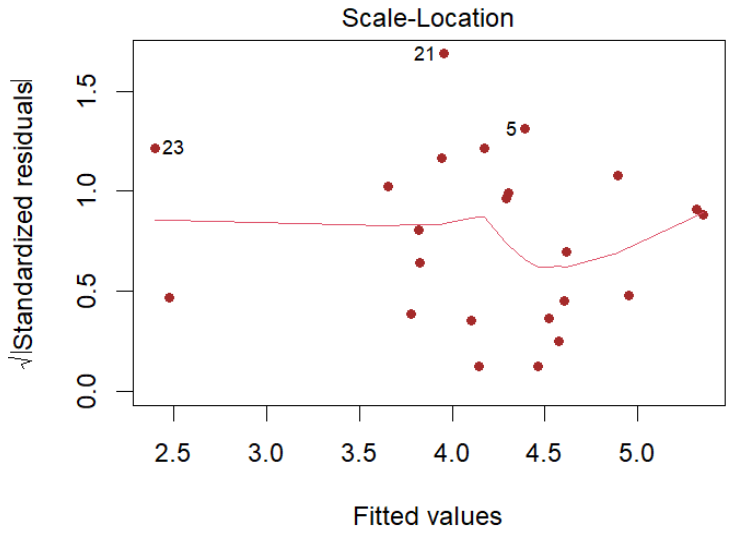

Figure 3: Scale location is used to discuss the equal variability. It is used to verify the assumption of homoscedasticity of residuals in regression model. It will start from zero and will be at the center and will tend towards center.

A positive indication of homoscedasticity in this plot is that the residuals do not spread out or shrink as we move throughout the range of fitted values. The red line shows a minor wave pattern, indicating that there is some variability in the residuals' spread, which could point to minor heteroscedasticity.

Conclusion

The economic review highlights Pakistan's complicated employment, inflation, and growth factors. The GDP growth rate has fluctuated over time, indicating the volatile character of the economy. Peaks in inflation indicate irregular financial difficulties. Variations in unemployment rates may have an impact on economic output and indicate shifts in the labor market. All things considered, this analysis effectively conveys the complexities and difficulties of Pakistan's economic environment and highlights the significance of conscious economic policies in encouraging stability and prosperity in the region.

Recommendations

To tackle Pakistan's economic difficulties, it is recommended to execute an entire strategy:

- The price of goods can be stabilized by monetary policy targeted at inflation.
- Secondly, lowering unemployment rates can be achieved by encouraging industries to increase employment.
- Education and training expenditures can also raise the competitiveness of the labor force.
- Maintaining political stability is essential for developing investor trust and ensuring economic stability.

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