Analysis of Economic Freedom of The Nations

Presenter:

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DEFINITION

- The Economic Freedom Index will allow to follow the development of economic freedom, prosperity, and opportunity over the past 20 years and spread these concepts in their homes, schools, and communities.
- The Index examines 12 freedoms across 186 nations, ranging from financial independence to property rights.

INTRODUCTION

- Often times, the prosperity of a country is measured in terms of economic status and progress.

- A developed country's ability to build its economic structure depends on both political and economic freedom.

- The function of government expenditure and taxation is vital for the wellbeing of the nation, just as economic progress is.

- A country's residents can benefit from the fruits of their labor and contribute to the growth of the country as a whole when it enjoys economic freedom.

Introduction

- A nation's Economic Freedom Index tracks changes in economic freedom, wealth, and opportunity over a 20-year period.

- The defining factors of the economic progress of a country depends on numerous factors.

- An index of economic freedom compares different jurisdictions based on factors like trade openness, tax load, judicial efficacy, and more.

REASONS TO PICK THIS DATASET

- Every person has the fundamental right to control their own labor and property, which is known as economic freedom. People are free to work, create, consume, and invest whatever they want in a society where the economy is free.

- Governments in economically free societies permit the free flow of labor, capital, and goods and refrain from restricting individual freedoms in excess of what is required to uphold and safeguard that freedom.

- By studying and modelling this data we like to achieve a sense of understanding over the prevailing economic status quo of countries divided on the basis of regions.

DATA SPECIFICATIONS

- Data was obtained Kaggle.com

- The data factored in many parameters which were presented in a CSV format. The parameters are enlisted below:

CountryID, Country Name, WEBNAME, Region, World Rank, Region Rank, 2019 Score, Property Rights, Judical Effectiveness, Government Integrity, Tax Burden, Gov't Spending, Fiscal Health, Business Freedom, Labor Freedom, Monetary Freedom, Trade Freedom, Investment Freedom, Financial Freedom, Tariff Rate (%), Income Tax Rate (%), Corporate Tax Rate (%), Tax Burden % of GDP, Gov't Expenditure % of GDP , Country, Population (Millions), "GDP (Billions, PPP)", GDP Growth Rate (%), 5 Year GDP Growth Rate (%), GDP per Capita (PPP), Unemployment (%), Inflation (%), FDI Inflow (Millions), Public Debt (% of GDP).

Important Variable Definitions

- *Judicial Effectiveness:* Prevalence Effective and fair justice systems to ensure laws are respected.

- *Government Integrity:* Policies fostering high standards of behaviour to reinforce credibility.

- *Tax Burden:* Amount of Tax paid by the nation over a specified period of time

- *Government Spending:* Money spent by public sector in acquisition of goods and services.

- *Fiscal Health:* Ability of local governments to plan, manage and pay for critical services

- *Business Freedom:* Quantitative measure of ability to start, operate and close a business.

Important Variable Definitions

- *Labor Freedom:* Quantitative measure for various aspects of legal and regulatory framework of the labor market.

- *Monetary Freedom:* Combination of measure of price stability with assessment of price controls.

- *Trade Freedom:* measure of absence of tariff and non-tariff barriers that affect import and export of goods and services.

- *Investment Freedom:* Evaluation of variety of Investment restrictions

- *Financial Freedom:* Financial resources to be able to afford the minimum set of living expenses.
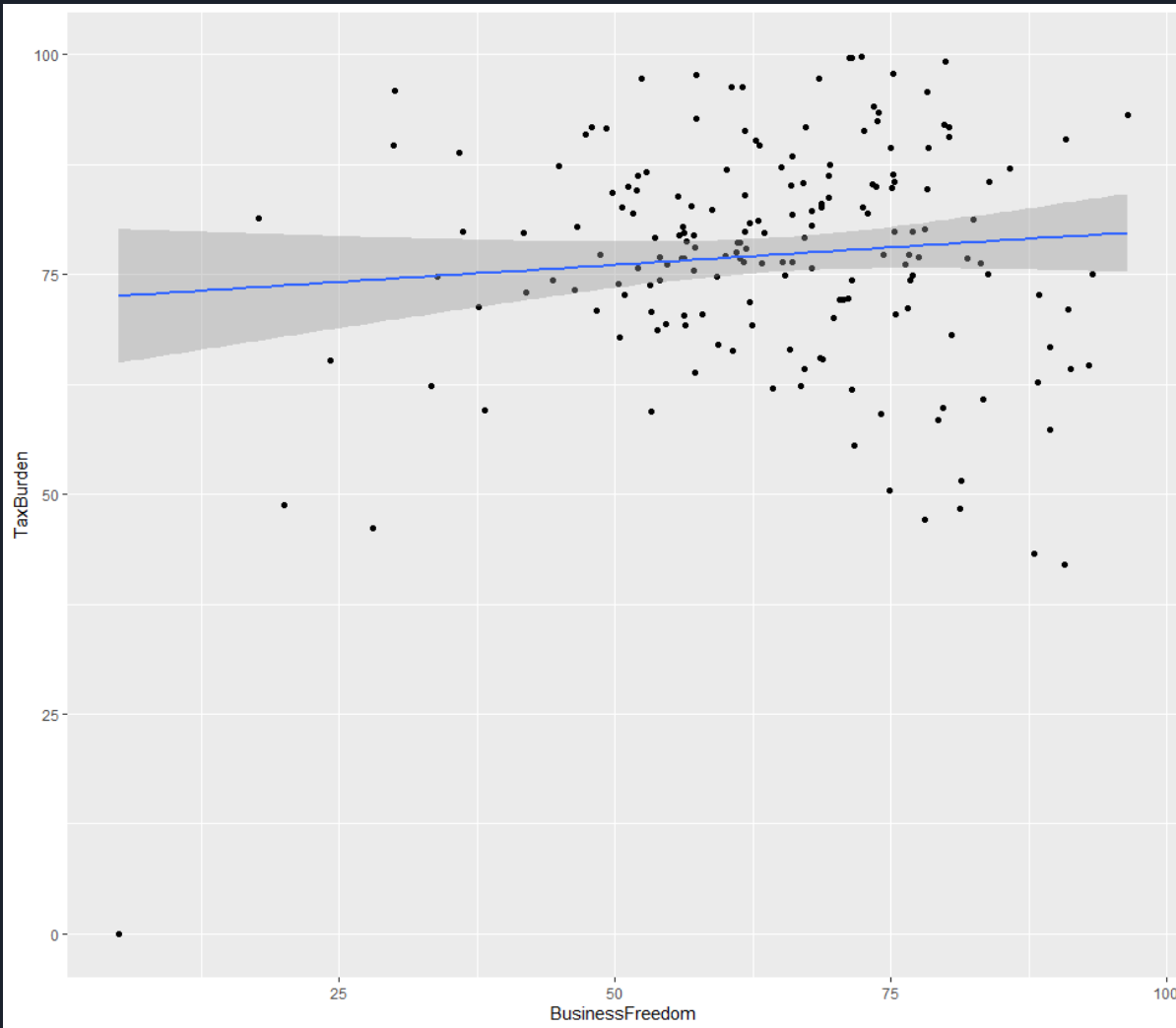
Business Freedom
VS
Tax Burden

Call:
lm(formula = TaxBurden ~ BusinessFreedom)

Coefficients:
  (Intercept)   BusinessFreedom
    72.17079   0.07872

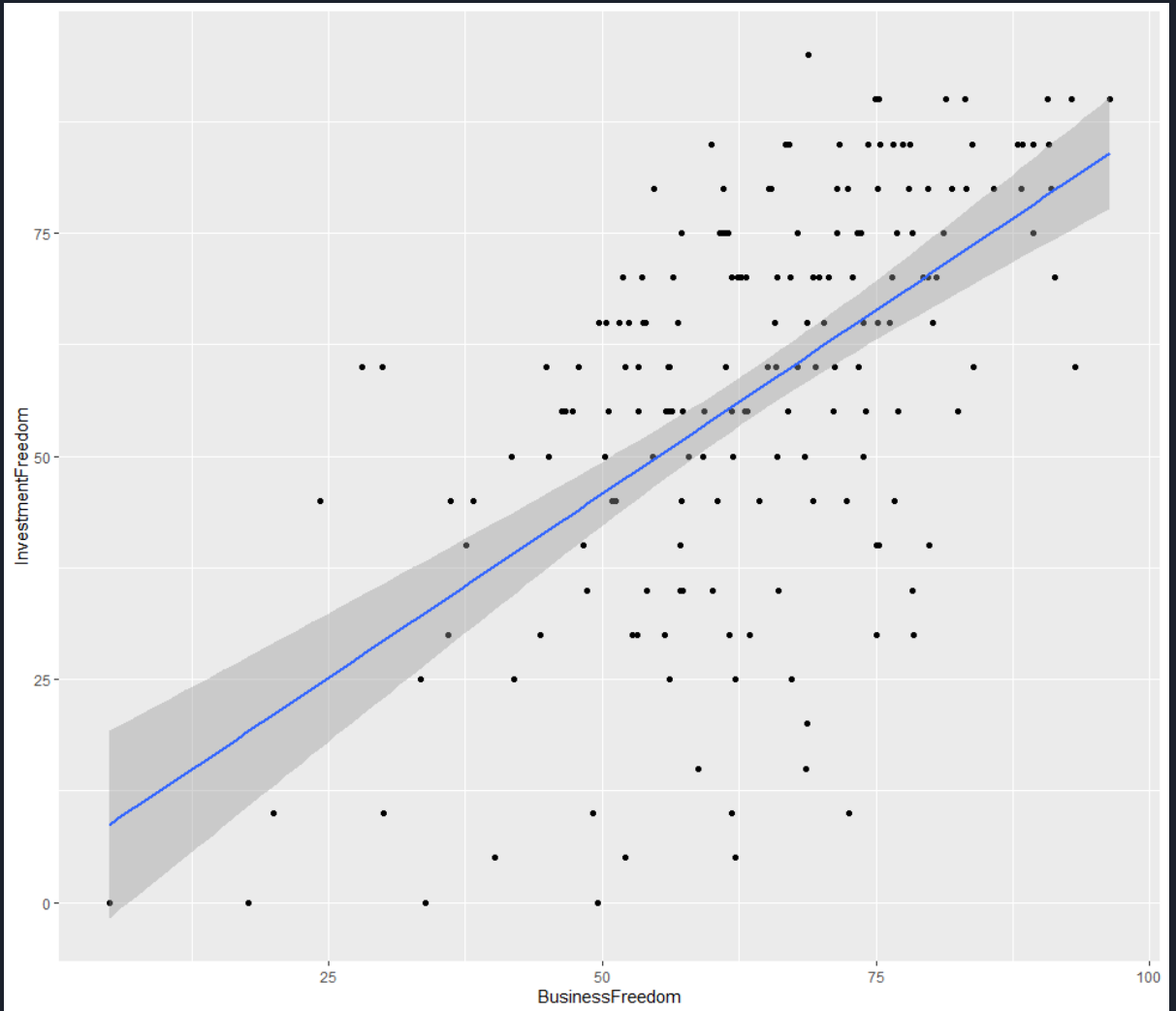TaxBurden = 72.17079 + 0.07872 * Business Freedom

Business Freedom vs Investment Freedom

Call:
lm(formula = InvestmentFreedom ~ BusinessFreedom)

Coefficients:
  (Intercept) BusinessFreedom
    4.6042   0.8237

InvestmentFreedom = 4.6042 + 0.8237 * BusinessFreedom

Insights into the previous slides:

- From the previous graphs, it is clear that Investment Freedom contributed to a higher Business Freedom among nations which in turn was not highly affected by the Tax Burden the nation levies onto it's people.
- Business Freedom was more likely to increase over time due to the innovations happening but a higher Investment Freedom granted always resulted in a free hand to do business.
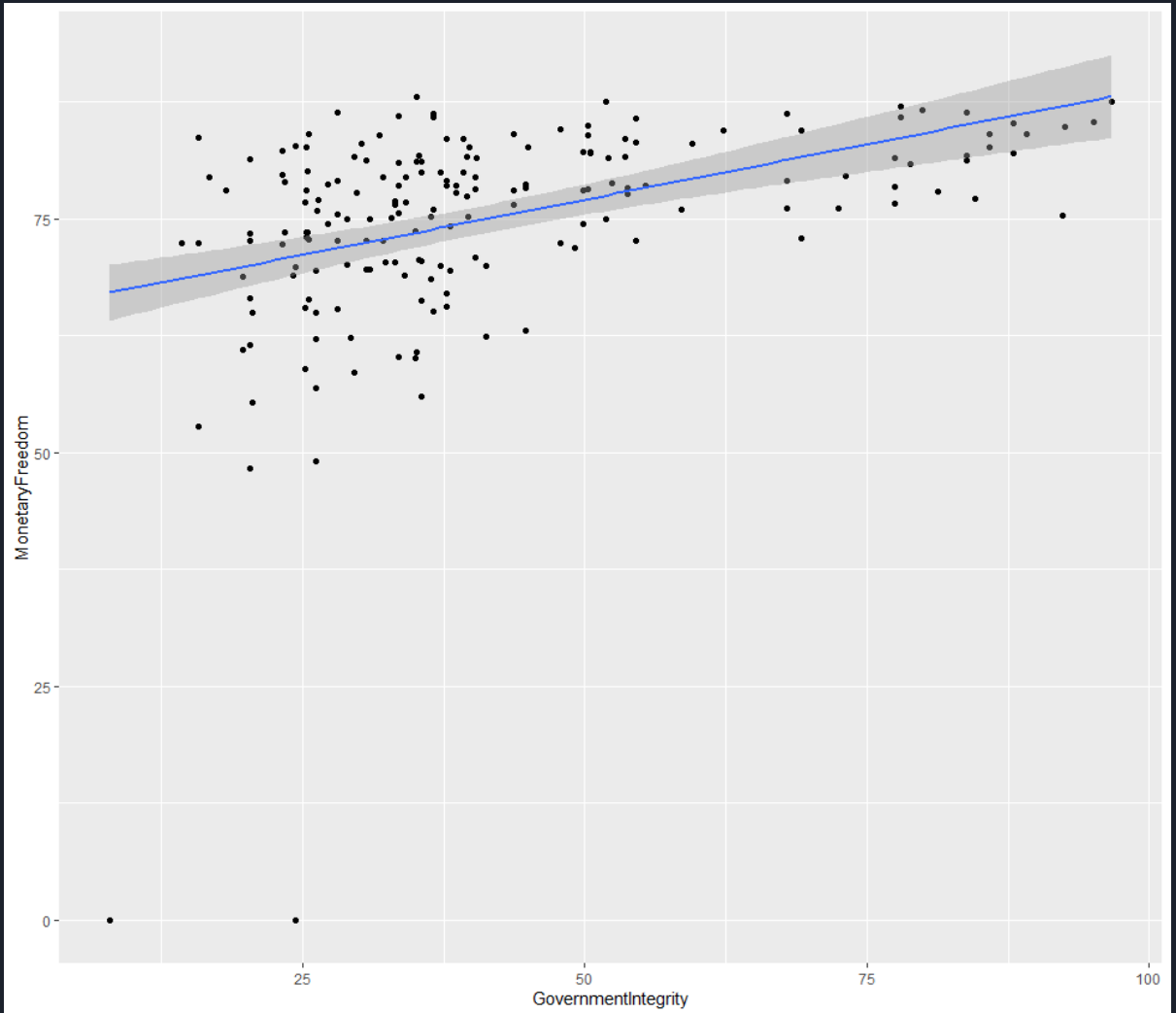
Monetary Freedom vs Government Integrity

Call:
lm(formula = MonetaryFreedom ~ GovernmentIntegrity)

Coefficients:
    (Intercept)   GovernmentIntegrity
      65.2154   0.2367

MonetaryFreedom = 65.2154 + 0.2367 * GovernmentIntegrity

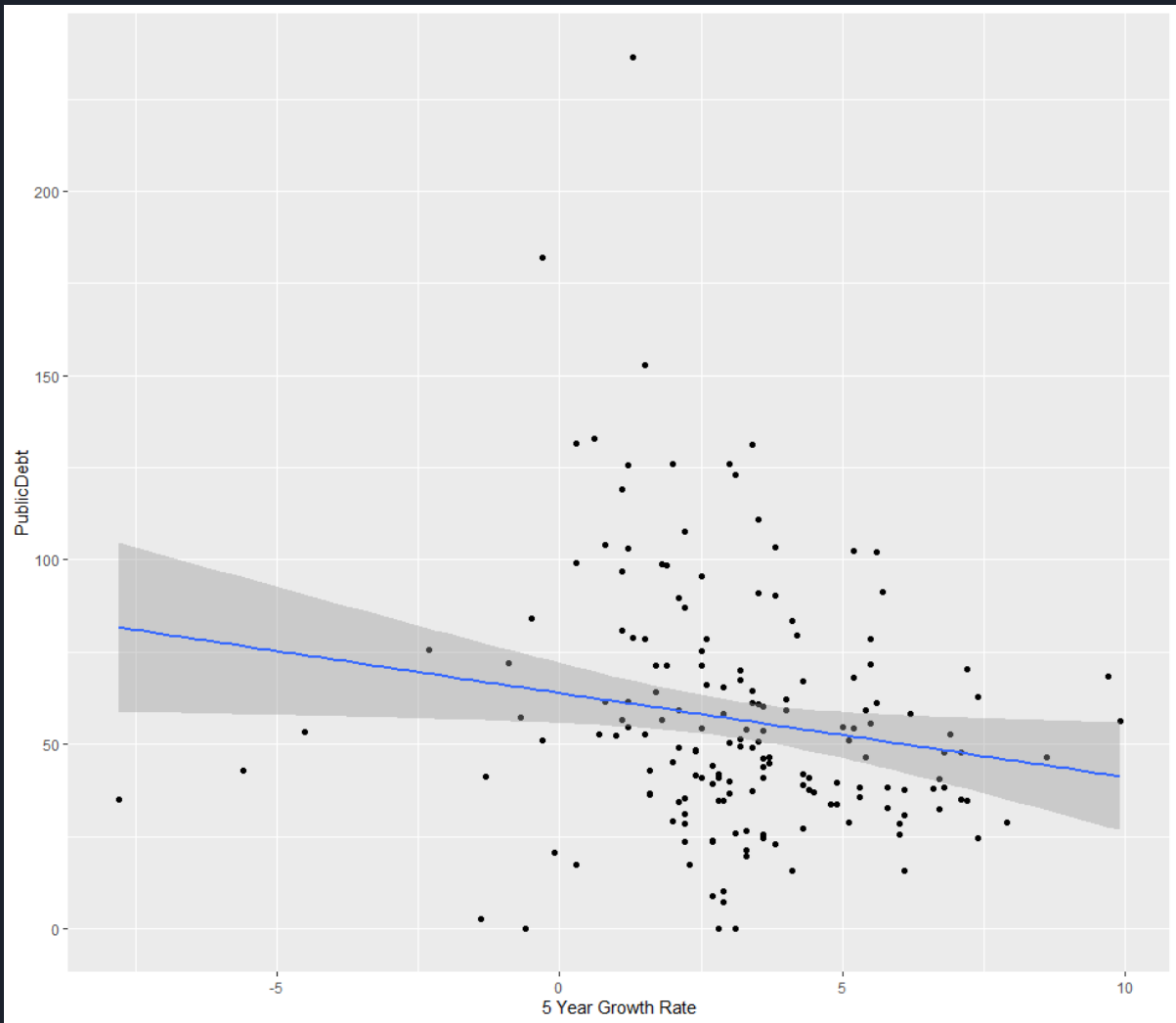# 5 Year Growth vs Public Debt

Call:
lm(formula = PublicDebt ~ X5YearGDPGrowthRate)

Coefficients:
   (Intercept)   X5YearGDPGrowthRate
      63.106   -2.221

PublicDebt = 63.106 - 2.221 * 5 Year Growth Rate

Insights into the previous slides:

- Monetary Freedom contributed to almost negligible increase in Government Integrity until a higher value of it was achieved. Which could be summarized to say that a higher monetary freedom would result in the government acting with integrity but would not always promise it.
- The 5 year Growth Rate vs Public Debt plot indicates that when the growth rate sees an increase over the 5 year period the public debt saw a small but significant decline over that period.
 This could be an important factor to study from the data given that decreasing public debt of a nation would always grant a higher economic freedom to the people.

World Population Distribution
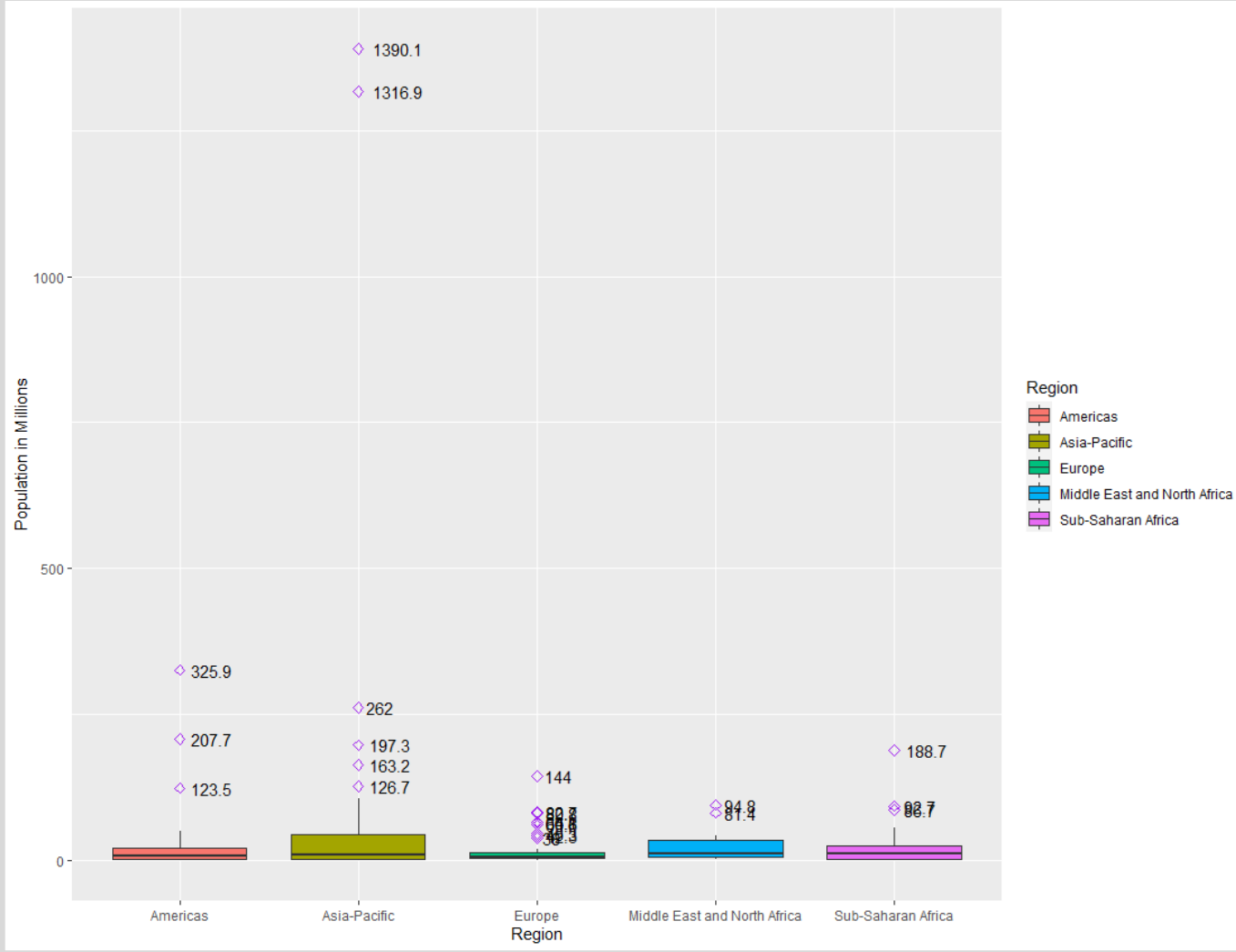
REGION WISE FINANCIAL FREEDOM

Financial freedom usually means having enough savings, financial investments, and cash on hand to afford the kind of life we desire for ourselves and our families


Region Wise Financial Freedom
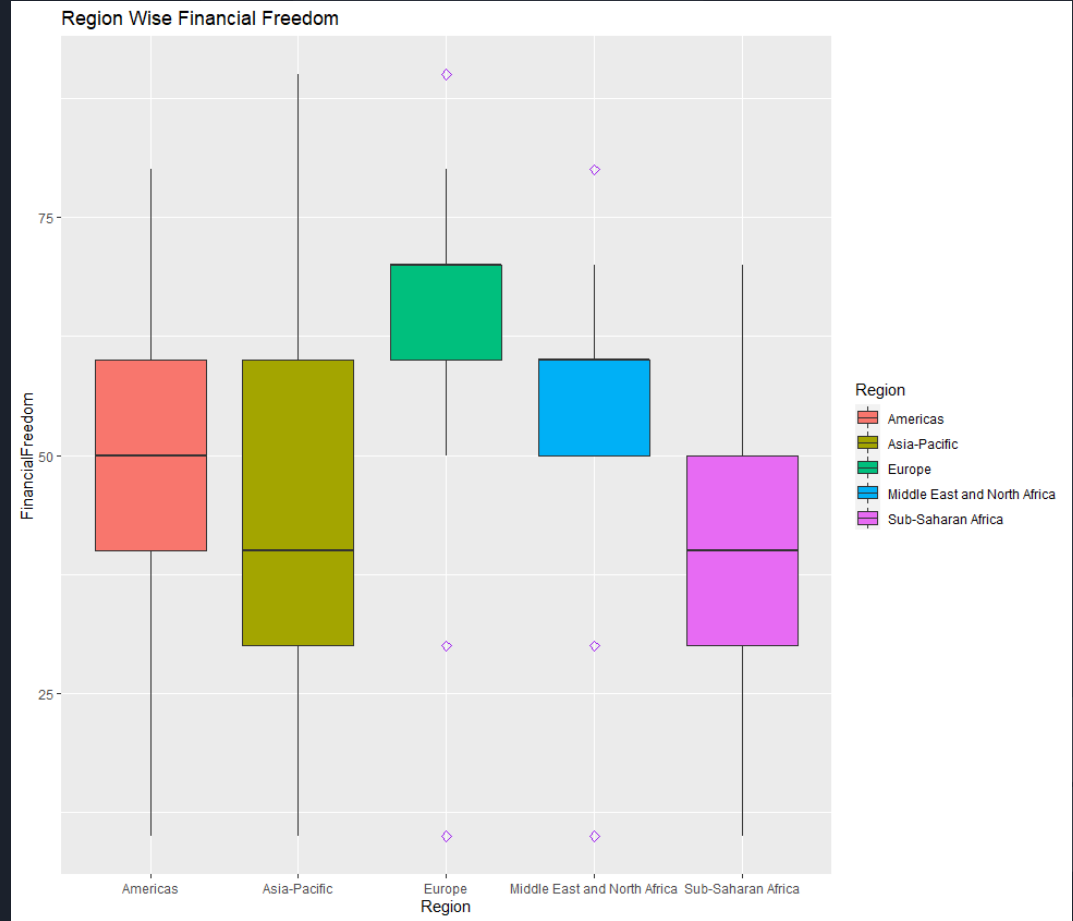
REGION WISE GDP PER CAPITA

We can see good box plots for most of the region apart from Sub - Saharan Africa where its generally at the lower end showing poverty and subsequently lack of growth. Also we can see that Asia - Pacific is an upcoming market for the world.
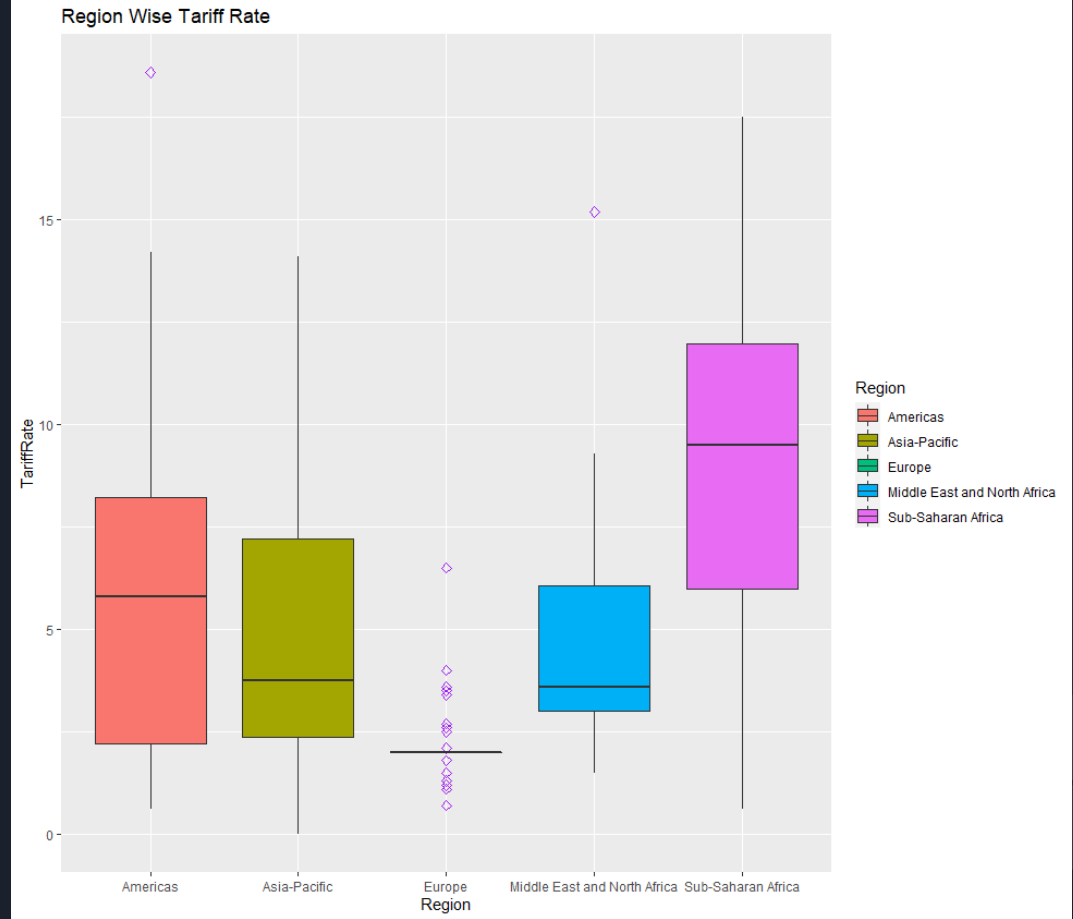

Region Wise GDP Per Capita
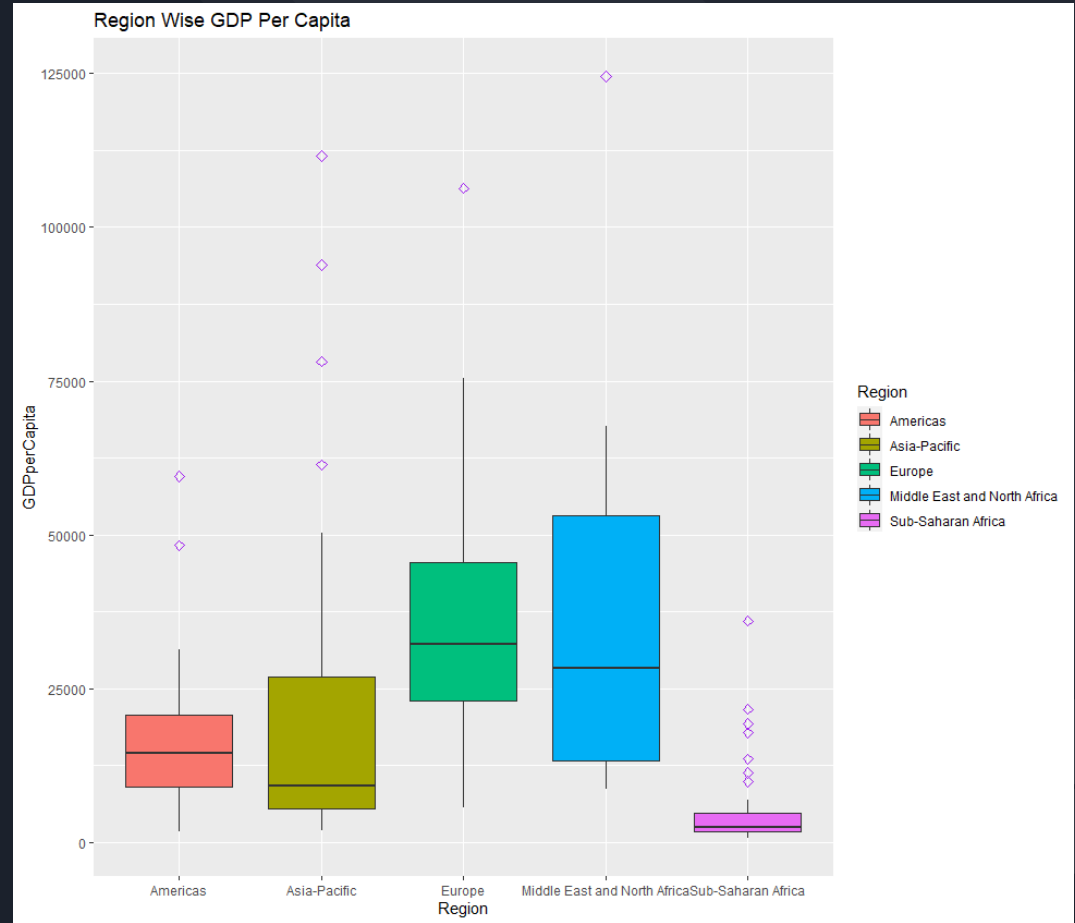
Region Wise Trade Freedom

Trade freedom is a composite measure of the extent of tariff and non-tariff barriers that affect imports and exports of goods and services.
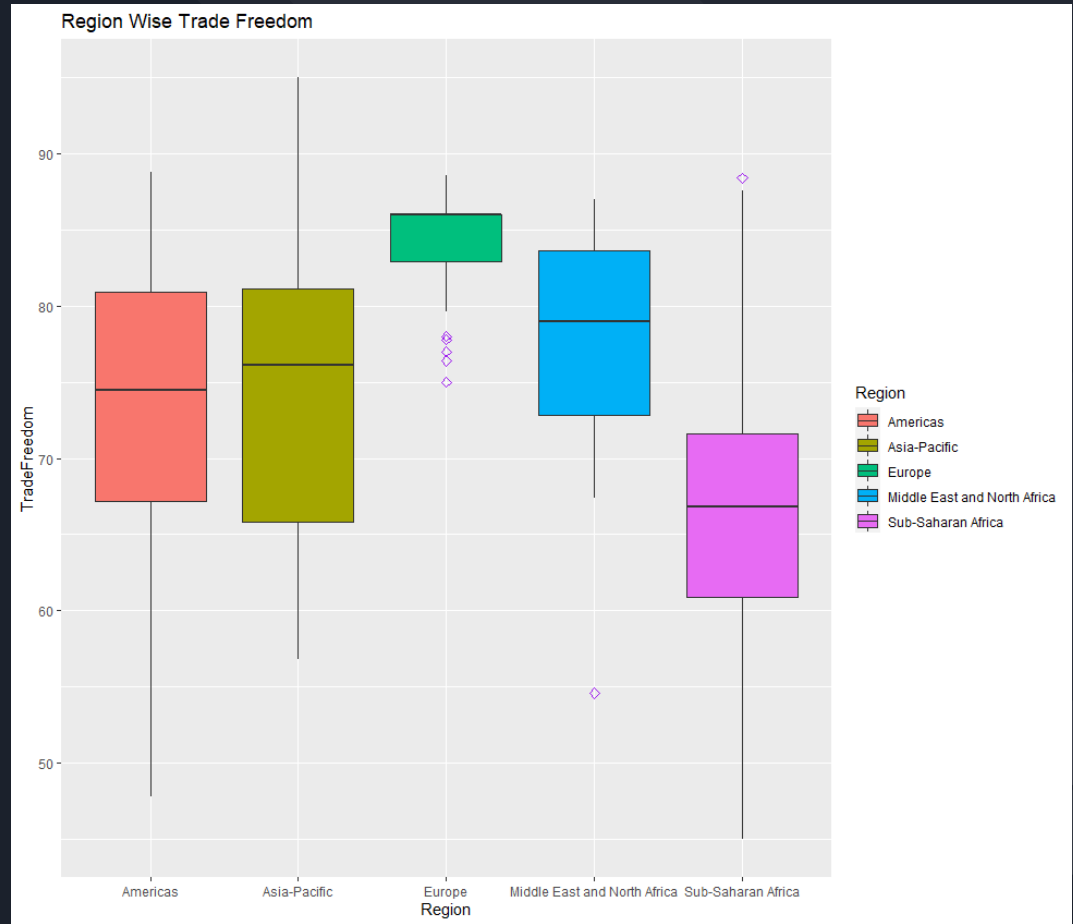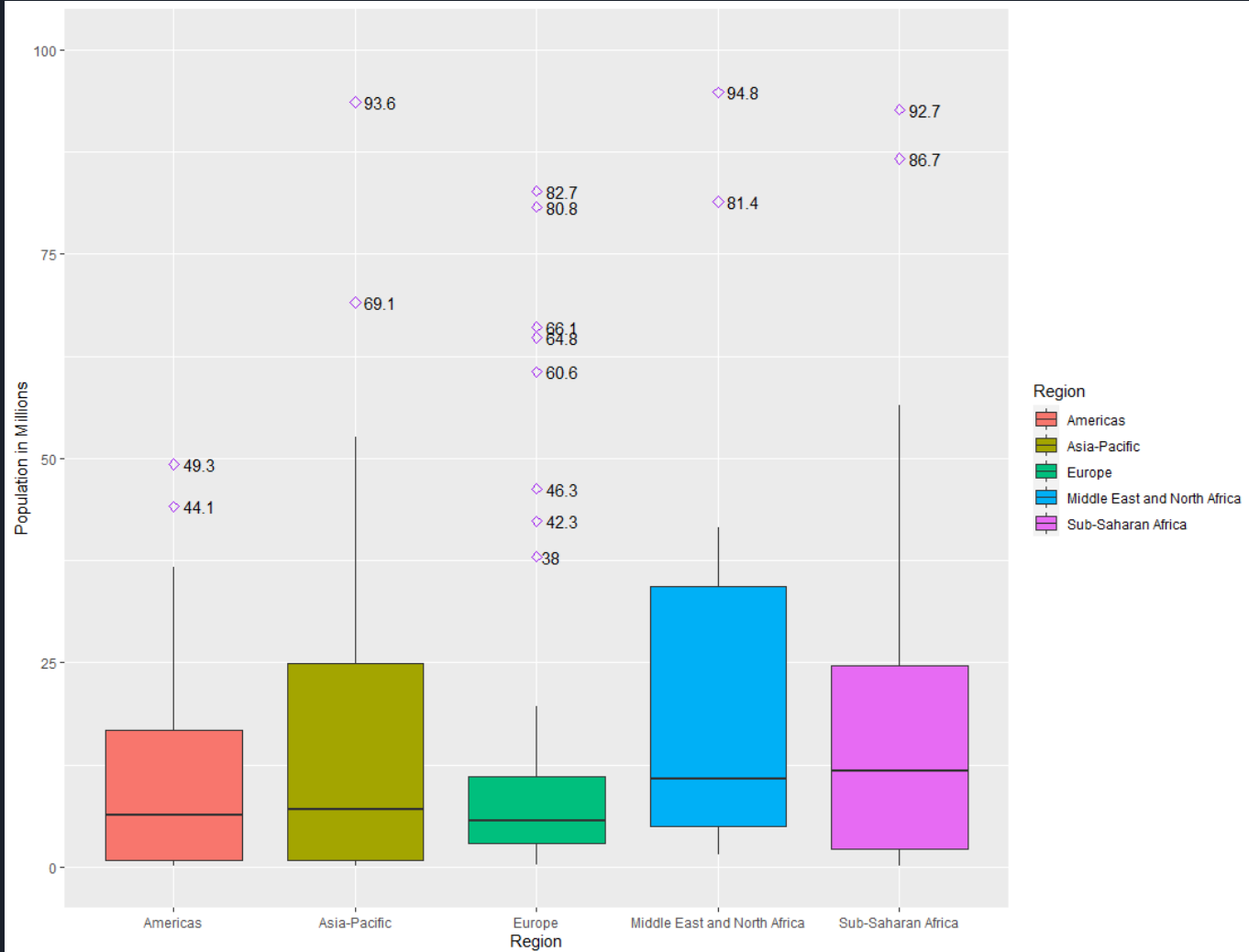
REGION WISE TARIFF RATE

Increase in the prices of goods and services purchased from another country, making them less attractive to domestic consumers.

WORLD RANK BY REGION

This graph displays the global rankings of nations according to their regional economic freedom scores.
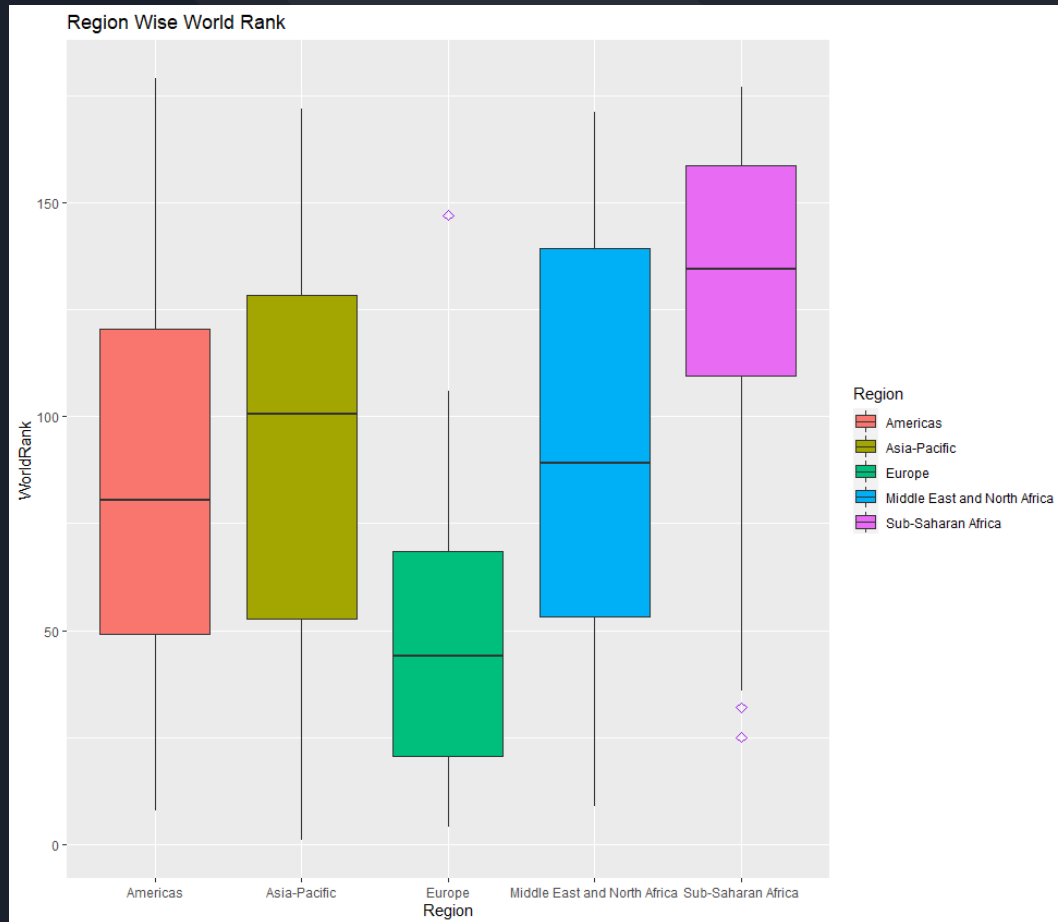
REGIONAL GOVERNMENT SPENDING

Government expenditure refers to funds used by the public sector for the purchase of products and the delivery of services, including those related to defense, social protection, healthcare, and education.

Region Wise Government spending

Judicial Effectiveness by Region

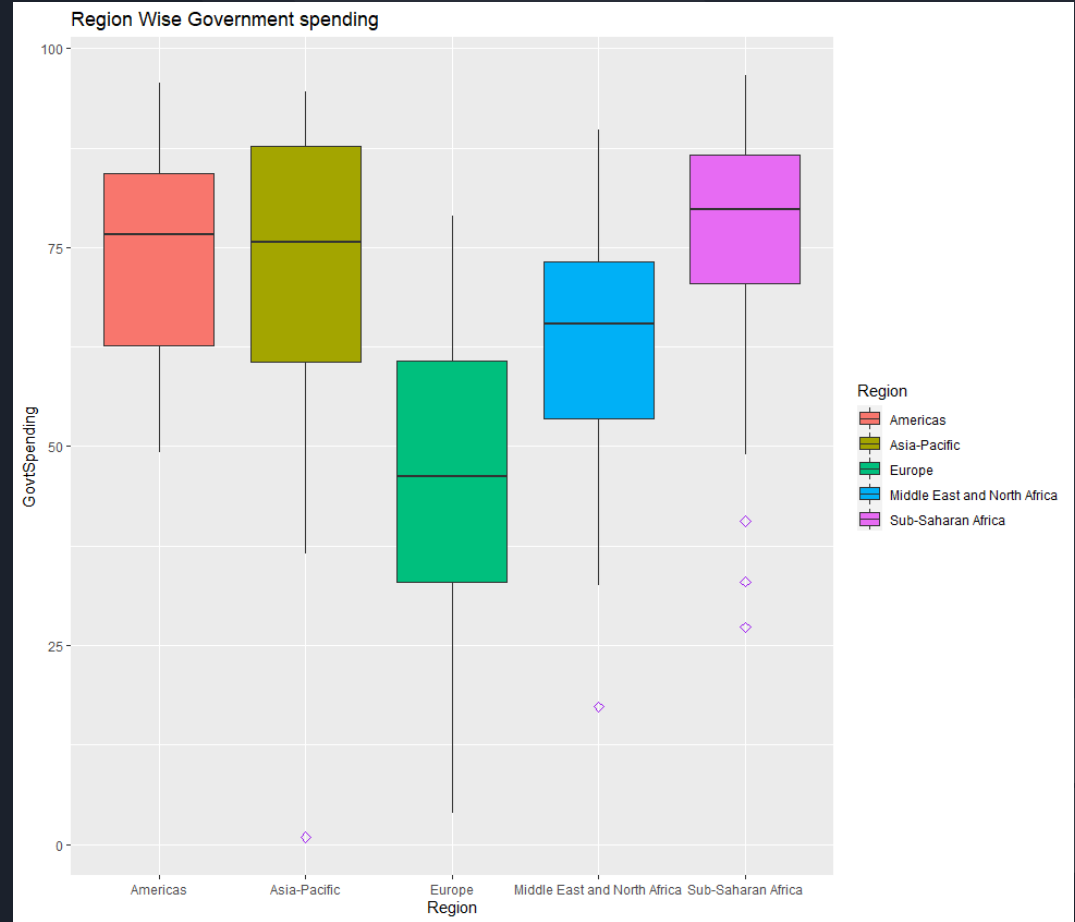To ensure that laws are completely upheld and the proper legal measures are taken against violators, effective and fair judicial systems are necessary for successful administration of justice.

Region Wise Judicial Effectiveness
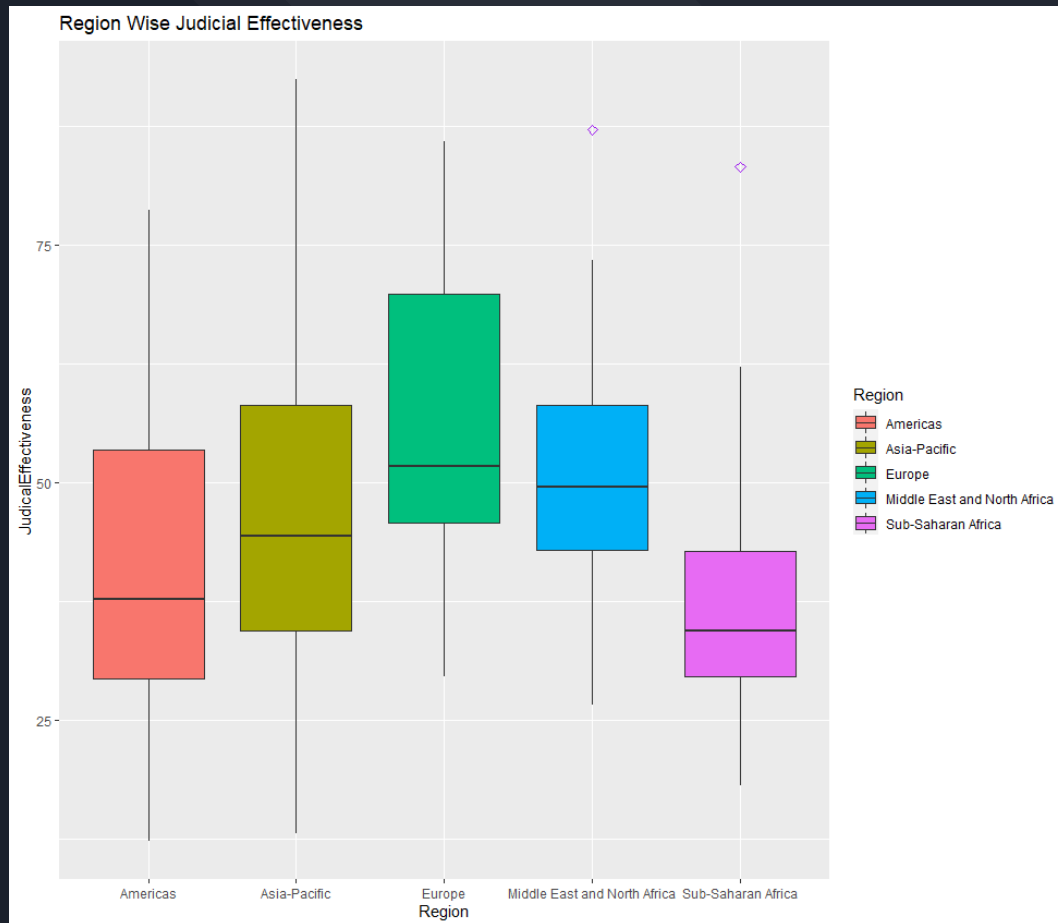
GDP Percentage Contribution By Different Regions of The World
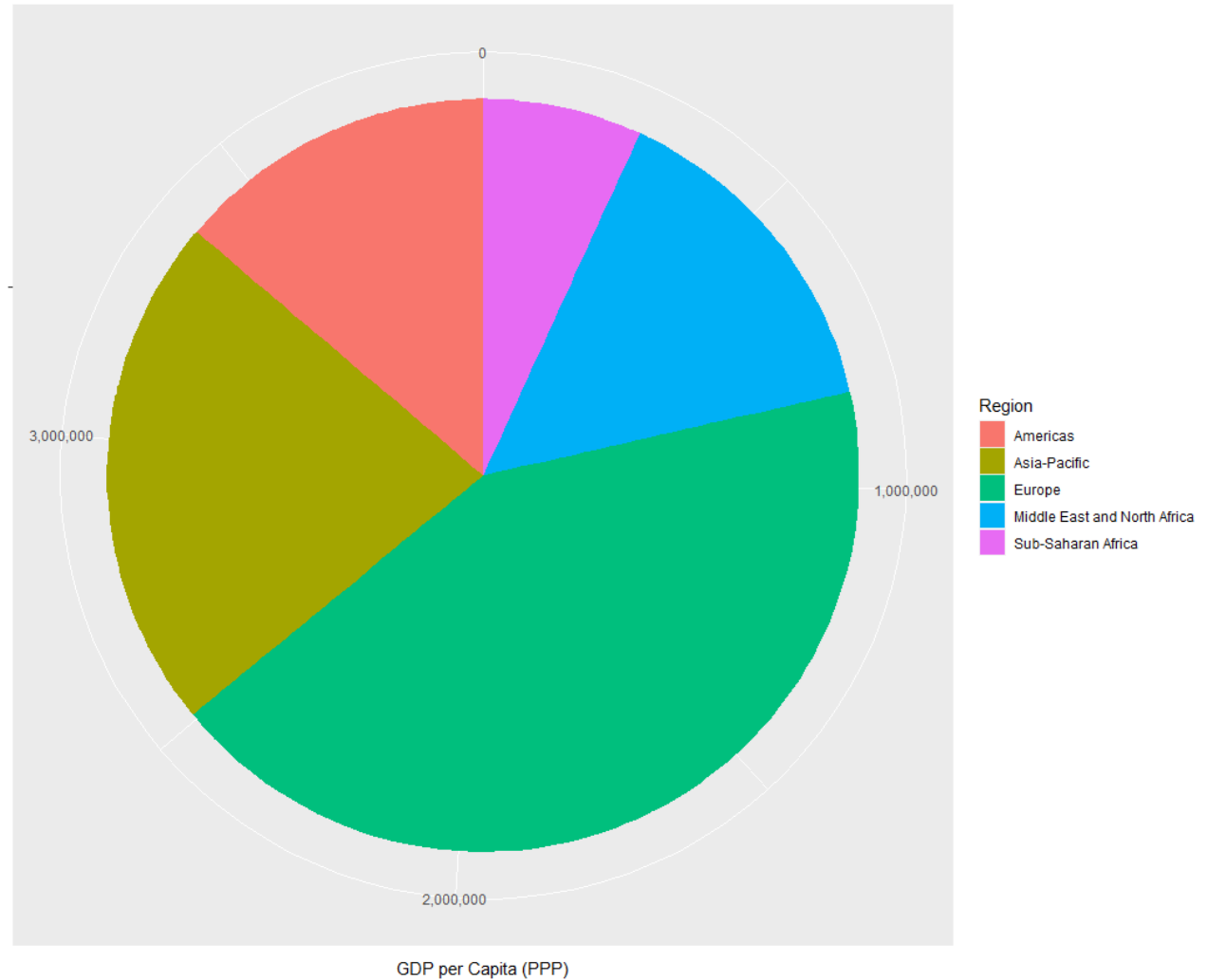
GDP Growth Rate Of Different Regions of The World
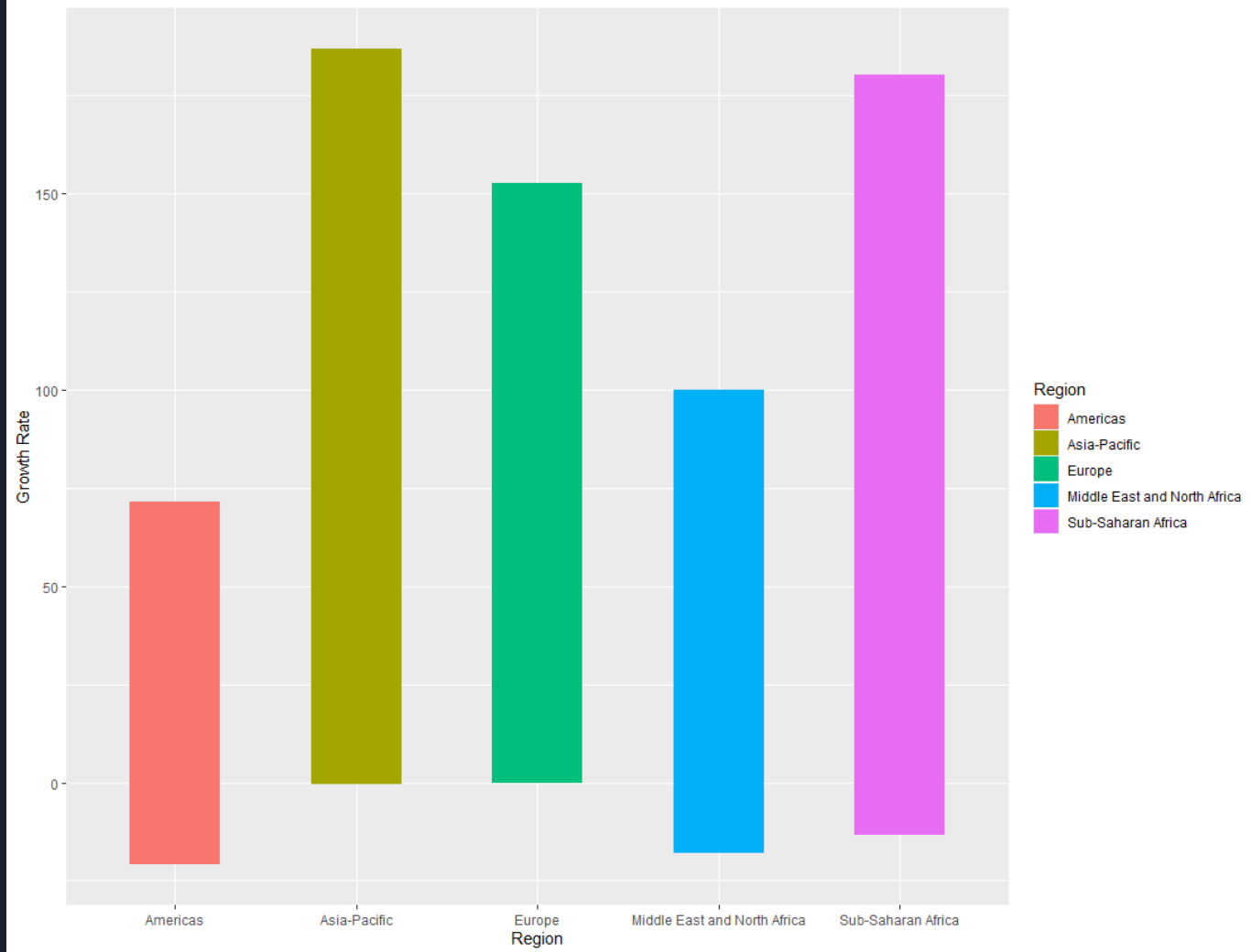
GDP Dependencies

```
> cor(newData[ , colnames(newData) != "GDPBillionsPPP"], newData$GDPBillionsPPP) * 10(
                          [,1]
CountryID            1.5568110
WorldRank          -11.4131313
RegionRank          -8.5824793
X2019Score          11.2114030
PropertyRights      15.9539152
JudicalEffectiveness 28.9566306
GovernmentIntegrity 19.1905024
TaxBurden          -10.2659506
GovtSpending        -4.4006828
FiscalHealth        -1.8728099
BusinessFreedom     11.5259748
LaborFreedom         8.9015258
MonetaryFreedom     -0.9766676
TradeFreedom        10.0575217
InvestmentFreedom   -1.3668744
FinancialFreedom     4.9001271
TariffRate         -12.6386294
IncomeTaxRate       16.1974873
CorporateTaxRate     0.6807099
TaxBurdenofGDP       1.3531845
GovtExpenditureofGDP 5.7382837
PopulationInMillions 80.6187288
GDPGrowthRate        5.2351522
X5YearGDPGrowthRate  5.6481264
GDPperCapita        13.4905740
Unemployment        -8.6499844
Inflation           -1.5475256
FDIInflow           81.2610511
PublicDebt          13.2143212
```

```
> summary(model)

Call:
lm(formula = GDPBillionsPPP ~ FDIInflow + PopulationInMillions +
    JudicalEffectiveness + WorldRank + TariffRate)

Residuals:
    Min      1Q  Median      3Q     Max
-4968.4   -62.9    41.3   108.0  3817.2

Coefficients:
                       Estimate Std. Error t value Pr(>|t|)
(Intercept)           88.223147 437.739704   0.202    0.841
FDIInflow              0.051912   0.002952  17.585   <2e-16 ***
PopulationInMillions   9.051477   0.507271  17.843   <2e-16 ***
JudicalEffectiveness  -1.957818   6.163309  -0.318    0.751
WorldRank             -0.560974   2.293857  -0.245    0.807
TariffRate            -5.569371  18.264108  -0.305    0.761
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 843 on 167 degrees of freedom
Multiple R-squared:  0.8884,    Adjusted R-squared:  0.885
F-statistic: 265.8 on 5 and 167 DF,  p-value: < 2.2e-16
```

$$GDP = 88.22315 + 0.05191 * FDI\_Inflow +$$
$$9.05148 * Polulation\_in\_Millions$$
$$- 1.95782 * Judicial\_Effectiveness$$
$$- 0.56097 * World\_Rank - 5.56937 * Tariff\_Rate$$

```
> step <- stepAIC(model, direction="both")
Start:  AIC=2336.9
GDPBillionsPPP ~ FDIInflow + PopulationInMillions + JudicalEffectiveness +
    WorldRank + TariffRate

                       Df Sum of Sq       RSS    AIC
- WorldRank             1     42507 118734086 2335.0
- TariffRate            1     66087 118757667 2335.0
- JudicalEffectiveness  1     71717 118763296 2335.0
<none>                            118691579 2336.9
- FDIInflow             1 219790905 338482484 2516.2
- PopulationInMillions  1 226287974 344979553 2519.5

Step:  AIC=2334.97
GDPBillionsPPP ~ FDIInflow + PopulationInMillions + JudicalEffectiveness +
    TariffRate

                       Df Sum of Sq       RSS    AIC
- JudicalEffectiveness  1     29624 118763710 2333.0
- TariffRate            1    152066 118886152 2333.2
<none>                            118734086 2335.0
+ WorldRank             1     42507 118691579 2336.9
- FDIInflow             1 220175127 338909213 2514.4
- PopulationInMillions  1 240940867 359674953 2524.7

Step:  AIC=2333.01
GDPBillionsPPP ~ FDIInflow + PopulationInMillions + TariffRate

                       Df Sum of Sq       RSS    AIC
- TariffRate            1    122705 118886415 2331.2
<none>                            118763710 2333.0
+ JudicalEffectiveness  1     29624 118734086 2335.0
+ WorldRank             1       414 118763296 2335.0
- FDIInflow             1 238330329 357094039 2521.5
- PopulationInMillions  1 240916150 359679860 2522.7

Step:  AIC=2331.19
GDPBillionsPPP ~ FDIInflow + PopulationInMillions

                       Df Sum of Sq       RSS    AIC
<none>                            118886415 2331.2
+ TariffRate            1    122705 118763710 2333.0
+ WorldRank             1     46977 118839437 2333.1
+ JudicalEffectiveness  1       263 118886152 2333.2
- PopulationInMillions  1 242251655 361138069 2521.4
- FDIInflow             1 253306920 372193335 2526.6
```

VARIANCE OF GDP

Anova Test for calculation of variance of GDP of a country

```
Analysis of Variance Table

Response: GDPBillionsPPP
                     Df    Sum Sq   Mean Sq  F value Pr(>F)
FDIInflow             1 702082943 702082943 987.8363 <2e-16 ***
PopulationInMillions  1 242251655 242251655 340.8500 <2e-16
***
JudicalEffectiveness  1      263      263   0.0004 0.9847
WorldRank             1    128485    128485  0.1808 0.6713
TariffRate            1     66087     66087  0.0930 0.7608
Residuals           167 118691579    710728
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

GDP Per Capita Dependency

We can see from this model that the tariff rate and inflation are not important factors in influencing the countries' GDP per capita. We can therefore draw the conclusion that trade freedom and financial freedom are related to GDP per capita. Therefore, nations with greater trade and financial independence are wealthier.

```
Call:
lm(formula = GDPperCapita ~ TariffRate + FinancialFreedom + TradeFreedom +
    Inflation)

Residuals:
   Min    1Q Median    3Q   Max
-29360 -11075  -2712   5715  91772

Coefficients:
                 Estimate Std. Error t value Pr(>|t|)
(Intercept)     -104553.82  41417.04  -2.524   0.0125 *
TariffRate          1448.98   1110.48   1.305   0.1937
FinancialFreedom     421.31    105.15   4.007 9.23e-05 ***
TradeFreedom        1287.25    511.14   2.518   0.0127 *
Inflation             17.53     16.52   1.061   0.2903
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 17570 on 168 degrees of freedom
Multiple R-squared:  0.4166,        Adjusted R-squared:  0.4027
F-statistic: 29.99 on 4 and 168 DF,  p-value: < 2.2e-16
```

TARIFF RATE DEPENDENCY

We can observe from this model that the variables that significantly affect a country's tariff rate are not its GDP per capita or inflation. As a result, we can draw the conclusion that the tariff rate depends on financial and trade freedom. Therefore, nations with greater financial and trade independence are wealthier.

```
Call:
lm(formula = TariffRate ~ GDPperCapita + FinancialFreedom + TradeFreedom +
    Inflation)

Residuals:
   Min     1Q Median     3Q    Max
-3.1031 -0.8728  0.0305  0.7506  3.5466

Coefficients:
                 Estimate Std. Error t value Pr(>|t|)
(Intercept)     3.657e+01  7.409e-01  49.351  < 2e-16 ***
GDPperCapita    6.924e-06  5.306e-06   1.305   0.194
FinancialFreedom 4.087e-02  6.924e-03   5.902 1.93e-08 ***
TradeFreedom    -4.414e-01  1.166e-02 -37.851  < 2e-16 ***
Inflation       -5.029e-04  1.145e-03  -0.439   0.661
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 1.215 on 168 degrees of freedom
Multiple R-squared:  0.9258,        Adjusted R-squared:  0.924
F-statistic: 524.2 on 4 and 168 DF,  p-value: < 2.2e-16
```

INFLATION DEPENDENCY

The test's unique finding is that a nation's inflation rate is independent of its tariff rates, GDP per capita, economic freedom, and trade freedom.

From STEP AIC Model

$inflation = 75.681 - 1.001 * Business.Freedom$

Call:
lm(formula = Inflation ~ TariffRate + GDPperCapita + FinancialFreedom + TradeFreedom)

Residuals:
```
   Min     1Q  Median     3Q     Max
 -45.60  -16.67   -5.32    6.64 1036.30
```

Coefficients:

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	1.605e+02	1.960e+02	0.819	0.414
TariffRate	-2.279e+00	5.191e+00	-0.439	0.661
GDPperCapita	3.796e-04	3.578e-04	1.061	0.290
FinancialFreedom	-8.336e-01	5.081e-01	-1.641	0.103
TradeFreedom	-1.380e+00	2.421e+00	-0.570	0.569

Residual standard error: 81.79 on 168 degrees of freedom
Multiple R-squared: 0.04137,   Adjusted R-squared: 0.01855
F-statistic: 1.813 on 4 and 168 DF, p-value: 0.1287

INFLATION DEPENDENCY

We can observe from this model that the Public Debt of GDP is not really a significant variable in determining Country Inflation. As a result, we can draw the conclusion that Business Independence affects inflation. Therefore, nations with greater business freedom are wealthier.

```
Call:
lm(formula = Inflation ~ BusinessFreedom + PublicDebt)

Residuals:
   Min     1Q  Median     3Q     Max
 -48.43  -14.70  -4.96    5.71 1044.05

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)   80.31714  29.39834   2.732  0.00696 **
BusinessFreedom -0.99040   0.42194  -2.347  0.02007 *
PublicDebt    -0.09434   0.18410  -0.512  0.60900
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 81.63 on 170 degrees of freedom
Multiple R-squared:  0.03359,      Adjusted R-squared:  0.02222
F-statistic: 2.955 on 2 and 170 DF,  p-value: 0.05478
```

BEST MODEL FOR GDP PER CAPITA

This test demonstrates unequivocally that just financial and trade freedom are necessary to calculate GDP per capita.

```
> model = lm(GDPperCapita ~ FinancialFreedom + TradeFreedom)
> stepAIC(model)
Start:  AIC=3385.62
GDPperCapita ~ FinancialFreedom + TradeFreedom

                  Df  Sum of Sq       RSS    AIC
<none>                         5.2741e+10 3385.6
- TradeFreedom      1 5062924043 5.7804e+10 3399.5
- FinancialFreedom  1 8126250117 6.0868e+10 3408.4

Call:
lm(formula = GDPperCapita ~ FinancialFreedom + TradeFreedom)

Coefficients:
    (Intercept)  FinancialFreedom      TradeFreedom
      -51097.2            472.6             651.9
```

WORLD RANK DEPENDENCIES

> rank = lm(WorldRank ~ RegionRank + JudicalEffectiveness + GovtSpending + Region + PropertyRights + GovernmentIntegrity + TaxBurden + FiscalHealth + BusinessFreedom + LaborFreedom + MonetaryFreedom + TradeFreedom + InvestmentFreedom + FinancialFreedom + TariffRate + IncomeTaxRate + CorporateTaxRate + TaxBurdenofGDP + GovtExpenditureofGDP + PopulationInMillions)

Multiple R-squared: 0.9963
Adjusted R-squared: 0.9625

CONCLUSION

- Economic freedom takes in consideration different jurisdictions based on factors like tax load, judicial efficiency, and trade freedom, among others.
- These elements could be combined into a single score that facilitates ranking by weighting them in accordance with their impact on economic freedom.

From the studies conducted and the graphs illustrated, few clear observations can be drawn:
- Nations with highest population numbers suffered in the freedom index study and were on the lesser side of the economic index scale.
- Countries showed a greater freedom index when compared to others when their Trade and Financial freedom were higher. This resulted in a higher GDP over the years contributing to the ultimate increase in the index.
- These countries with a better Trade and Financial freedom would later on perform better in the 5 Year Growth Rate of GDP too contributing to a much better economic freedom index than many other countries.

Conclusion

- The Judicial Effectiveness and Spending of the respective nations might work hand in hand but when pitched against the GDP contributions by individual nations they were acting in a inverse relationship.
- The GDP which proved to play a important role in the freedom index acted in a stark opposite manner to the Spending and Judicial effectiveness of a nation.
- Modelling different variables and observing the relations the tests proposed we can conclusively say that economic index being a dependent on multiple parameters need to be studied in a correlative manner to properly understand the behaviour of it in correspondence to various nations.