# rmd

draft

Introduction

Background

The world economy and global finance has strengthened over time. Not only the US, whose import and export over the past year had a better growth than in 2017, but also the whole world has benefit from Comparative Advantage. However, the improvements in 2018 in growth remain unevenly distributed across countries and regions. Economic prospects for many commodity exporters remain particularly challenging. Also, we has experienced a trend of Protectionism in global economy over the past years. To explore the grwoth of world economics, reasearching on protectionism is an important part. This requires us to learn about the import and export of each country. Trade between countries is the window to know protectionism and the world economy since it is equivalent to one of engines of economic growth. This is the view of Keynesian economics as well as modern liberal economists. The figure below shows how important trading between countries is. From 1960 to 2017, the percentage of trading between countries is increasing all the time.
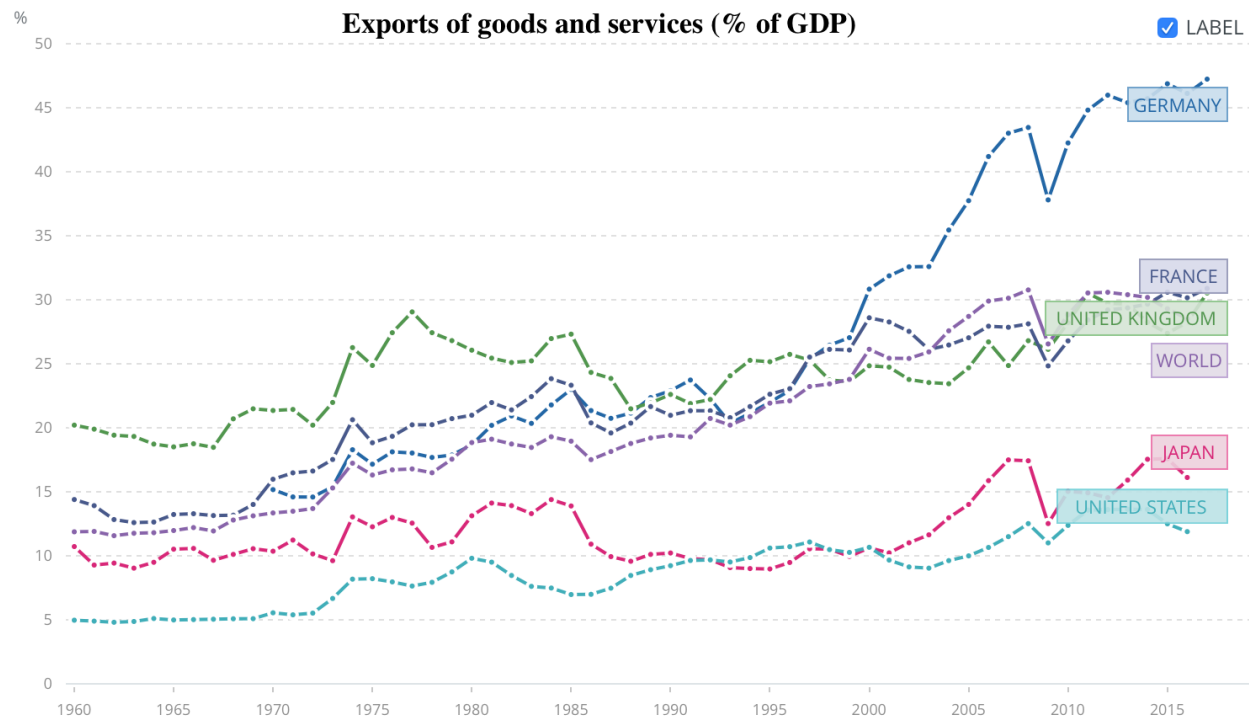
Resource: The World Bank

From the image, we know that different countries are influenced by export and import differently. Also, differnt countries have different fiscal and currency policies. Thus, it's interesting to know how different these countries are influenced by different indicators.

Previous work

Import and export has been explored deep in the field of macroeconomics and global finance. A lot of studies have examined the determinants of exports and imports. Riedel(1984) found that export and import behavior is heavily influenced by market conditions, which is used to measure domestic profitability and domestic demand. Matket conditions can be determinned by many factors. Cory Mitchell(2018) summarized that there are factors shaping trends over the long term and providing insight into how future trends may occur:government, liquidity, supply, demand, speculation and expectation and so on. (https://www.investopedia.com/articles/trading/09/what-factors-create-trends.asp#ixzz5YeMXgWVM) This actually is a rough summary. For example, We can further divide "government" into unemployment ratio, government policy, government credit, government corruption condition. Gaston(2010) found strong evidence that higher terms of trade lower the equilibrium rate of unemployment. Government policy definitly influence a lot on international transaction.It is related with taxation, import and export restraints, and exchange rate. Elizer Ayal(1965) (Eliezer B. Ayal (1965) The impact of export taxes on the domestic economy of underdeveloped countries, The Journal of Development Studies, 1:4, 330-362, DOI: 10.1080/00220386508421162) quantitatively researched on the impact of export taxaztion on economy of developing countries, like Thailand and Burma. Holly(1992) found that supply side factors are comparatively much more important than demand side factors for explaining export and import performance in the sector of German manufacturing. Jongwanish(2007) also did similar research in East and Southeast countries. Also, some indicators influencing a coutry's import and export are explored independently. Zhong, Xiaojun(2009) uses Co-integration analysis and Granger Causality test to empirically analyze the FDI (Foreign Direct Investment) influence over Chinese import and export trade after reform and opening-up. But the influence of FDI on other countries still needs to be figured out. Also, in recent years, people pay more attention to the influence of expectation on import and export. Live Briefs US(2013) **(Export Prices Fall 0.5% Vs Expectations for 0.1% Gain; Import Prices Unchanged Vs Consensus For 0.2% Gain. (2013). Live Briefs US, p. 12.)** quantitatively concluded that 0.1% gain in expectation will contribute to 0.5% fall of export price.

Most of papers pay attention to import and export of one single country. Thus, it will be meaningful to compare indicators of export and import for different countries.

Method

Data source

The data resource will be not only from the IMF website and Federal Reserve System, but also from third-party sites, like Tradingeconomics, theglobaleconomy.com, where we can download data more easily. Moreover, we need to visit websites of central banks in all other countries we want to explore.

On the other hand, we choose several countries as our representative countries.

Model used

EDA

First, we will do the EDA to see the relationships between our selected indicators and import and export. Consider that import and export and totally opposite, their corelation is -1. So we use export alone as our response.

Data cleaning

Before EDA, we need to sort out our data and clean the data. Also, we need to make sure all countries' export data are calculated to US dollar or another unified currency.

```r
#merge monthdata and yeardata
##transfer yeardata

yeardata_new1 <- yeardata_new%>%filter(Year!=1979)
datasorted <- yeardata_new1[rep(seq_len(nrow(yeardata_new1)), each=1),]
datasorted <- datasorted[rep(seq_len(nrow(datasorted)), each=12),]
datasorted <- datasorted[-seq(2809,2832,1),] #remove data of 1980-1081India

##month data
monthdata_new <- monthdata_new%>%filter(Country!="Mauritius"&Country!="South Africa")

#cbind year data&month data
datafinal <- cbind(monthdata_new,datasorted[,-c(1,2,3)])


#exchange rate adjsutment
datafinal[datafinal$Country=="Japan",]$Exports=(datafinal[datafinal$Country=="Japan",]$Exports)/100   #H
datafinal[datafinal$Country=="India",]$Exports=(datafinal[datafinal$Country=="India",]$Exports)/100 #HM
datafinal[datafinal$Country=="United Kingdom",]$Exports=(datafinal[datafinal$Country=="United Kingdom",]
```

Data Visualization

For this part, the main job is to find whether our indicators have obvious relationship with export. It is not recomended to use various kinds of plots, like pie chart and box plot, to show the trend because our variable characteristics are similar.

Country selection

```
## 12 codes from your data successfully matched countries in the map
## 0 codes from your data failed to match with a country code in the map
## 231 codes from the map weren't represented in your data
```

malaria
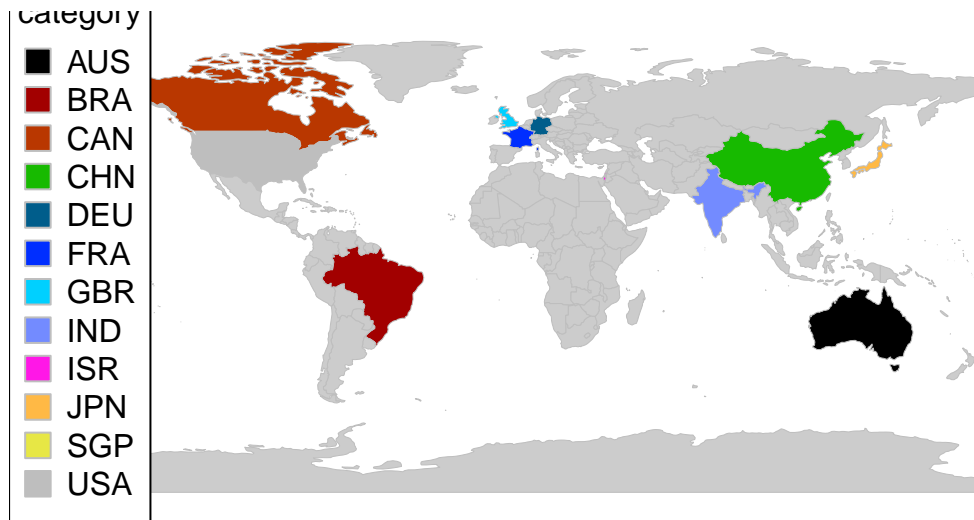
We choose 12 countries as our selected countries. Our primary factor of choosing countries is the availability of their macroeconomic data. If data of a country are difficult to find or missing in the world bank database, we will not choose this country.

Second, we try to make our selected coutries diverse. Thus, we not only choose USA, which is a large country, but also choose Singapore.

Export Comparation
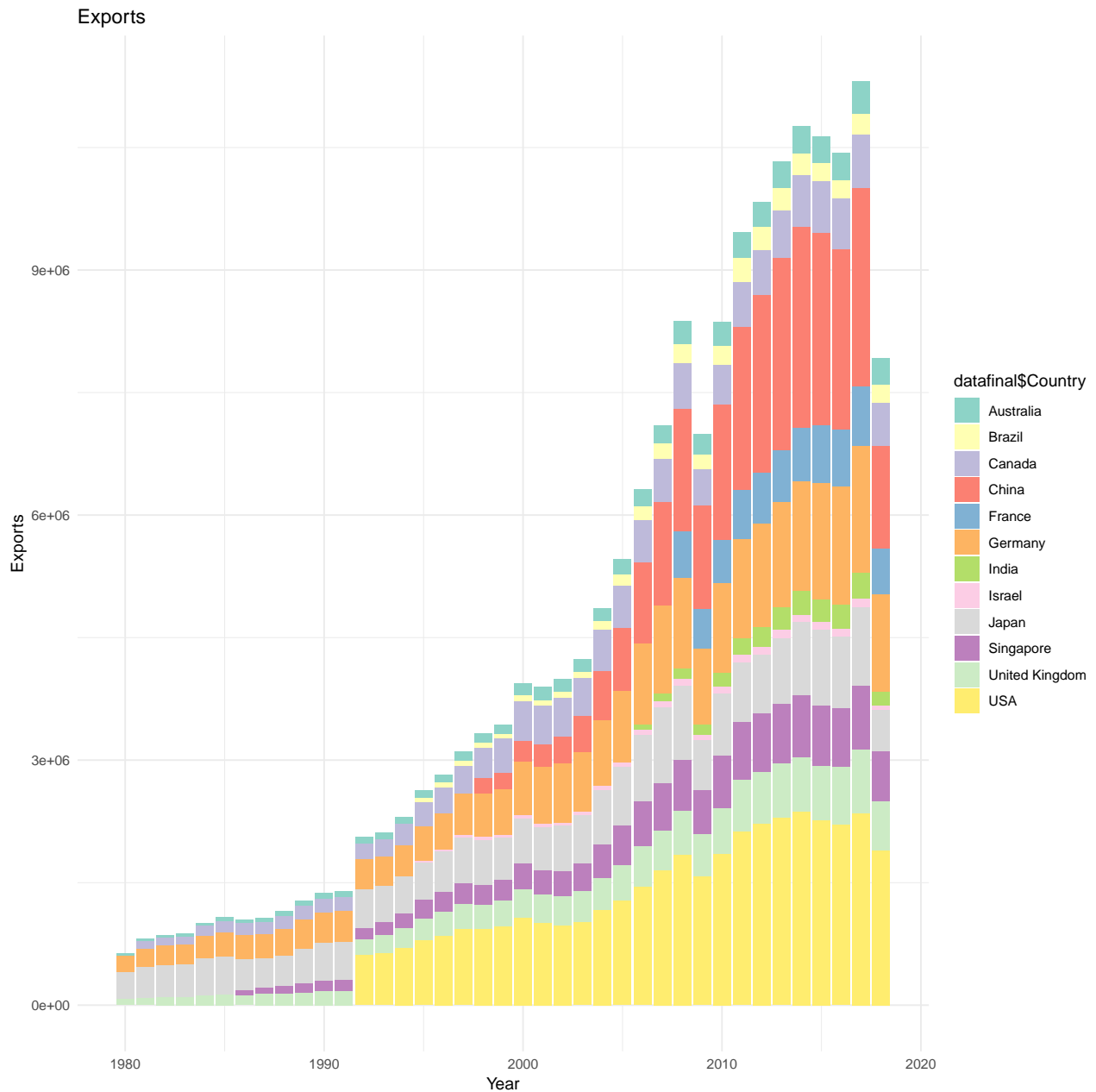
Exports

From the barplot above, we can visually see the export of each country. We found that from 1980-2017, the export of these countries is continuously increasing. We don't have data of November and December in 2018, so the amount of export in 2018 should be higher.

Moreover, we find from the barplot that from 2008 to 2009 the export of these countries drop down suddenly from about 8000000 to 65000000, we've found that it is dut to the financial crisis in 2008. It influenced USA and Japan most in terms of the amount of export. But in 2010, the export returned to the level of 2008, indicating that financial crisis didn't influence much to export of selected countries.

Finding predictors

Now we are going to use visualization to find which variables are related to export, so as to prepare for the modelling.

GDP and Economic Growth

Now we try to find whether Economics Growth is related with exports. According to Kayesian Formula,

$$GDP = C + I + G + NX,$$

where C represents consumption, I represents investment, G represent government budget, NX represents export minus import. Thus, we cannot use GDP growth to represent economic growth.

We use Business confidence survey to represent economic growth. Business confidence survey offers valuable insight into trends of global business growth by surveying people across a broad spectrum of industries.

Government Effectiveness versus exports

From this plot, we find that export of each country is influenced differently by the Business confidence survey. For USA ,China and India, there is no trend to show the relationship of export and confidence survey. And for countries like Brazil, United Kindom, France, the smooth line is flat, which means the relationship is not clear. And for Japan and Germany, there is a obvious positive relation between the two.

Thus, we can put this variable in our model and check whether it's a significant indicator.

Currency and inflation
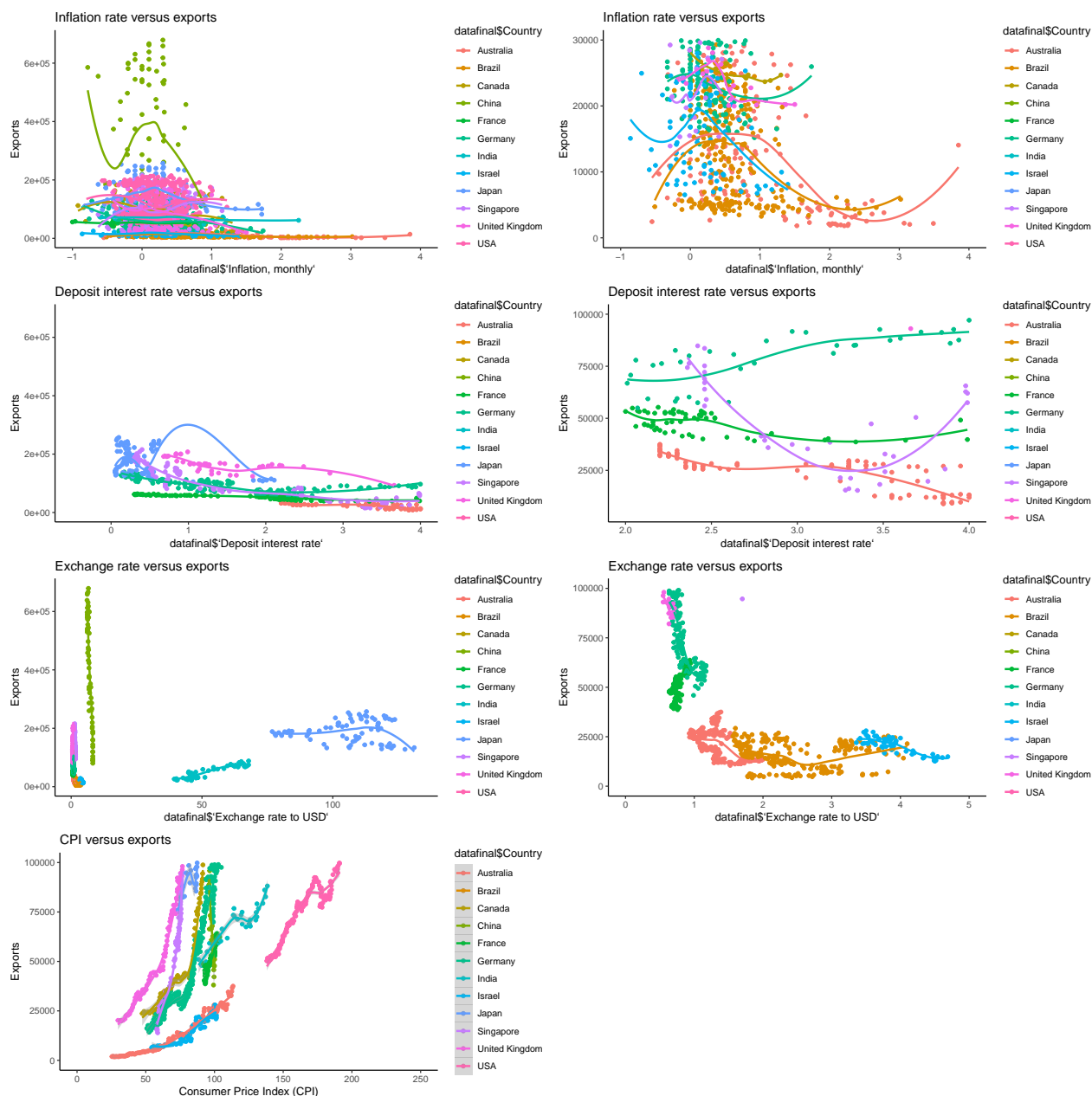
Now it's the section of Currency and inflation.

In this section, we have 4 indicators: Inflation Rate, Interest Rate, Exchange Rate and CPI. Each row represents plots for one indicator.

For the first row, the two plots are showing the relationship between Inflation Rate and export. We can find

that for most countries selected, there are quadratic relationship here.The points are not showing lines but quadratic curves.

For the second row, the two plots are showing the relationship between Interest Rate and export. The lines are flat and not showing a strong negative trend. Generally, the lower the interest rate is, the more goods and service a country will export: when interest rate is low, people inside the country will attempt to invest outside (where the interest rates are higher than domestic interest rates. Let's assume the country as USD. To do this, they will require US dollars. This means that they will sell yen to buy USD. Japanese Yen will be more available to the foreign exchange market (forex) , the amount of USD in the forex market will decrease.As there are more Yen in forex, the value of yen in the forex market depreciates (Yen depreciates) . This allows net exports of japan to increase as japan is able to be more competitive due to the low exchange rate.

For the thrid row,the two plots are showing the relationship between Exchange Rate and export. Generally, there is also a negative relation because lower interest rate will cause lower exchange rate. However, the negative curves also differ in selected countries.

For the fourth row, the plot is showing the relationship between CPI and export. There is a clear positive trend here.

Labor Market
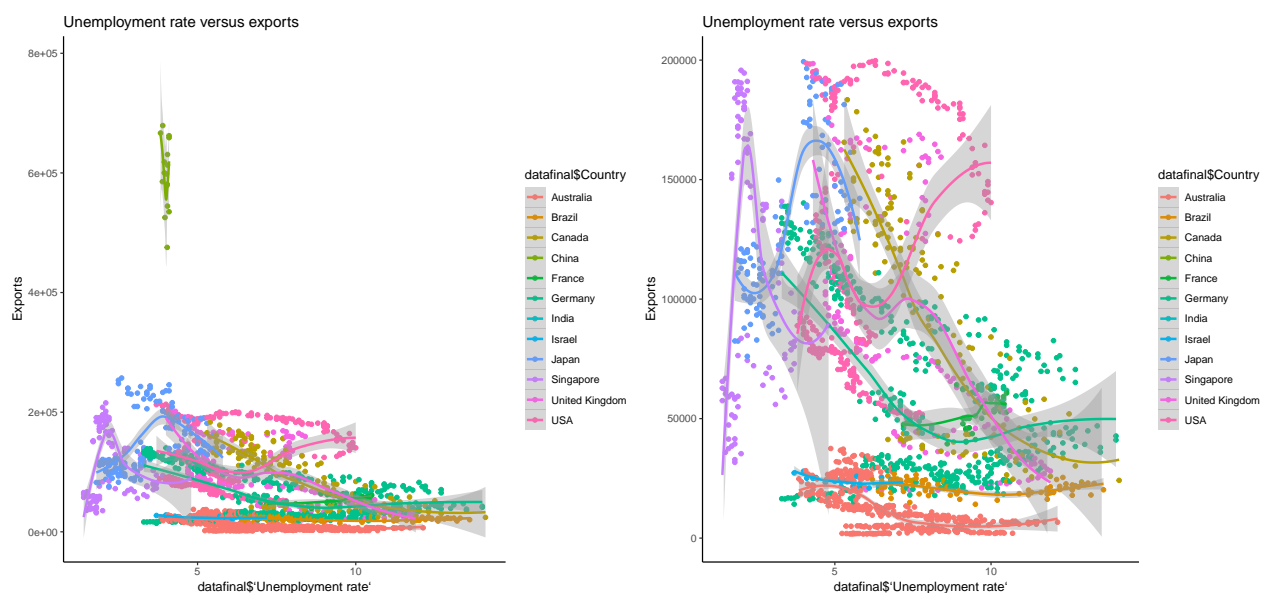
Now it's the section of unemployment. We are here drawing a plot of unemployment versus export.

We found that there is no clear unified trend. In most countries, like United Kindom, Australia, Canada, Germany, there are negative relation. However, the trend in Singapore, USA are not clear. Thus, we need to further explore this indicator.
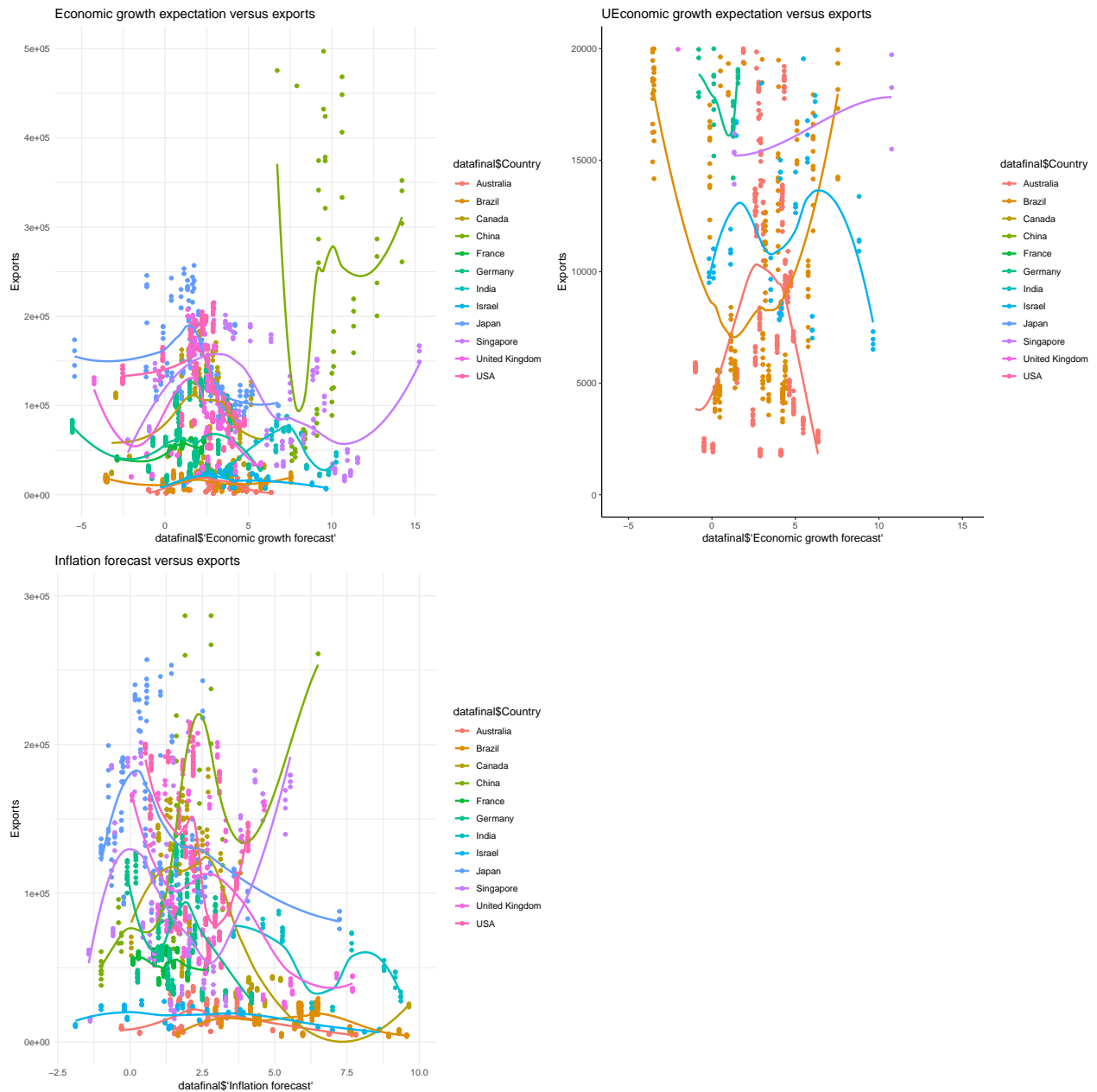
Internation trade and investment
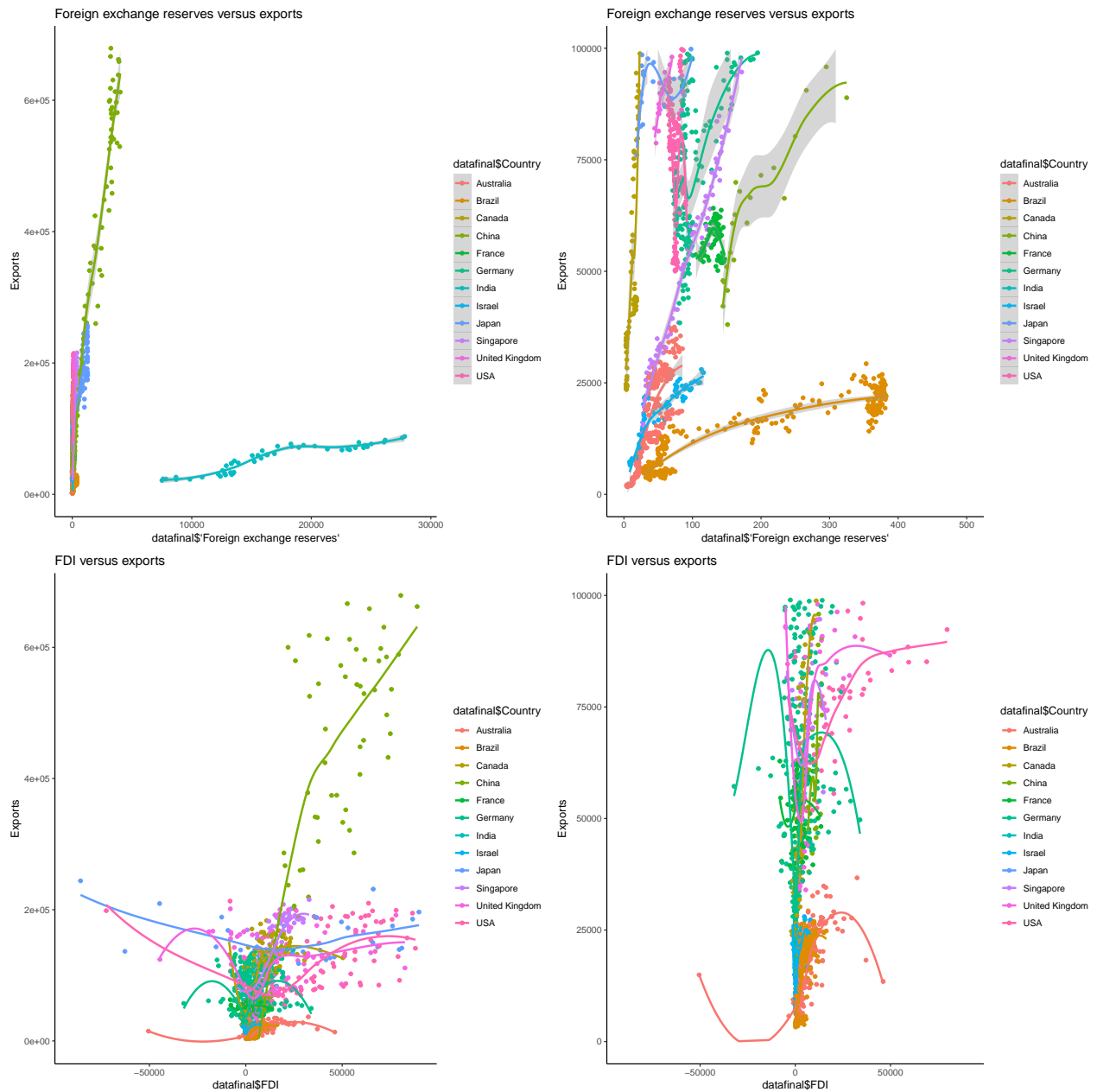
Now it's the section of Internation trade and investment .

In this section, we have 2 indicators: Foreign exchange reserve and FDI(foreign directory investment).

For the first row, the two plots are showing the relationship between Foreign exchange and export. We can find that for most countries selected, there are positive linear relationship here. So we can add it to our model and test it.

For the second row, the two plots are showing the relationship between FDI and export. It seems that there is no relation here. All the lines seems like in a messy.

Forecast and expectation

Economic growth expectation versus exports

UEconomic growth expectation versus exports


Inflation forecast versus exports

Now it's the section of Forecast and expectation.

In this section, we have 2 indicators: Economic growth expectation and Inflation forecast.

For the first row, the two plots are showing the relationship between Economic growth expectatio and export. Most of the lines here seems also like in a messy. All lines show no unified trend here. We will consider this as a noisy indicator.

For the second row, the one plot is showing the relationship between Inflation forecast and export. It can be found that there is a mild but not clear negative trend here. It means for each country, the effect of decreasing might be different. For example, the effectness of Inflaction Forecast is more obvious in Japan than in Isareal or Canada.

Governance, institution and corruption
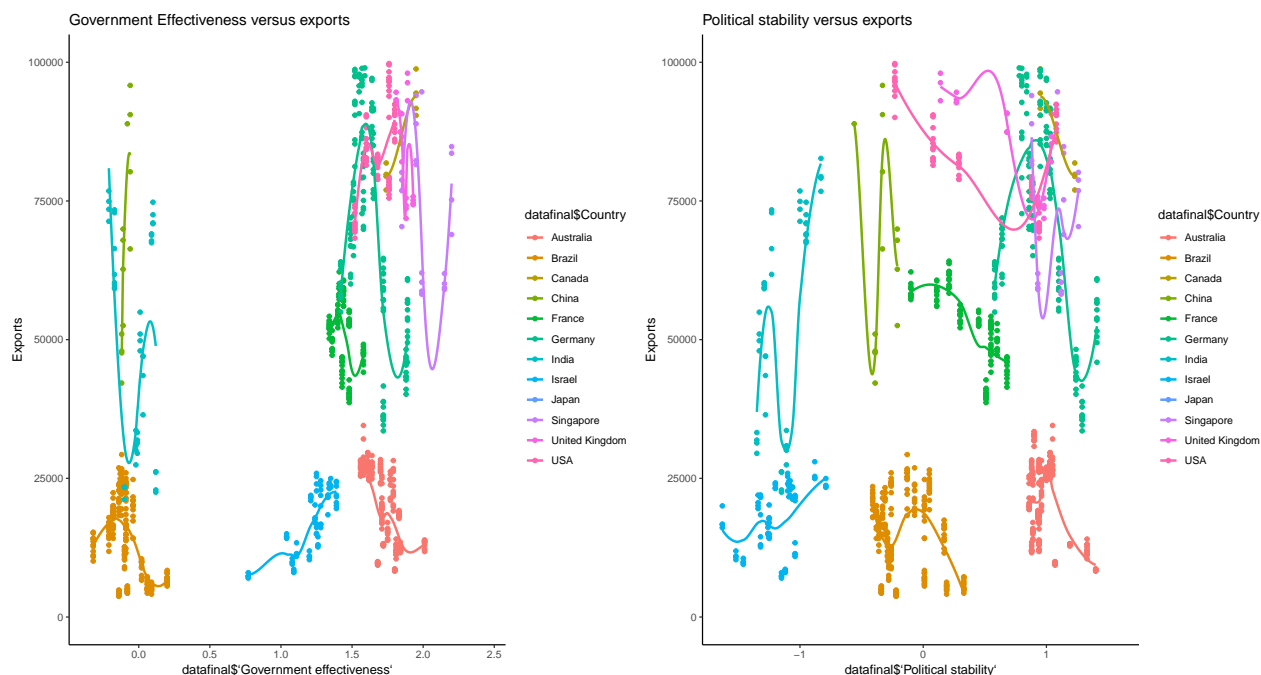
The last section is Governance, institution and corruption.

In this section, we have 2 indicators: government effectiveness and political stability.

We have two plots here. It's obvious that the effectness of these two indicators are similar, the trend of each color are pretty much the same. So if we want to add governance factor to our model, we cannot add these two together.

On the other hand, most of the curves in the left-hand plot have similar quadratic trend. Thus, we need to try one of these two indicators in our model and see whether it can improve the model.

Correlation checking

Now we already have several potential predictors: Business Confidence Survey, Inflation Rate, Interest Rate, Exchange Rate, CPI, Unemployment, Foreign exchange reserve, Inflation forecast, Tax, and Political Stability.

First, we will use these variables to draw a correlation plot. It's important because in financial market, there are a lot of indicators which are interrelated.
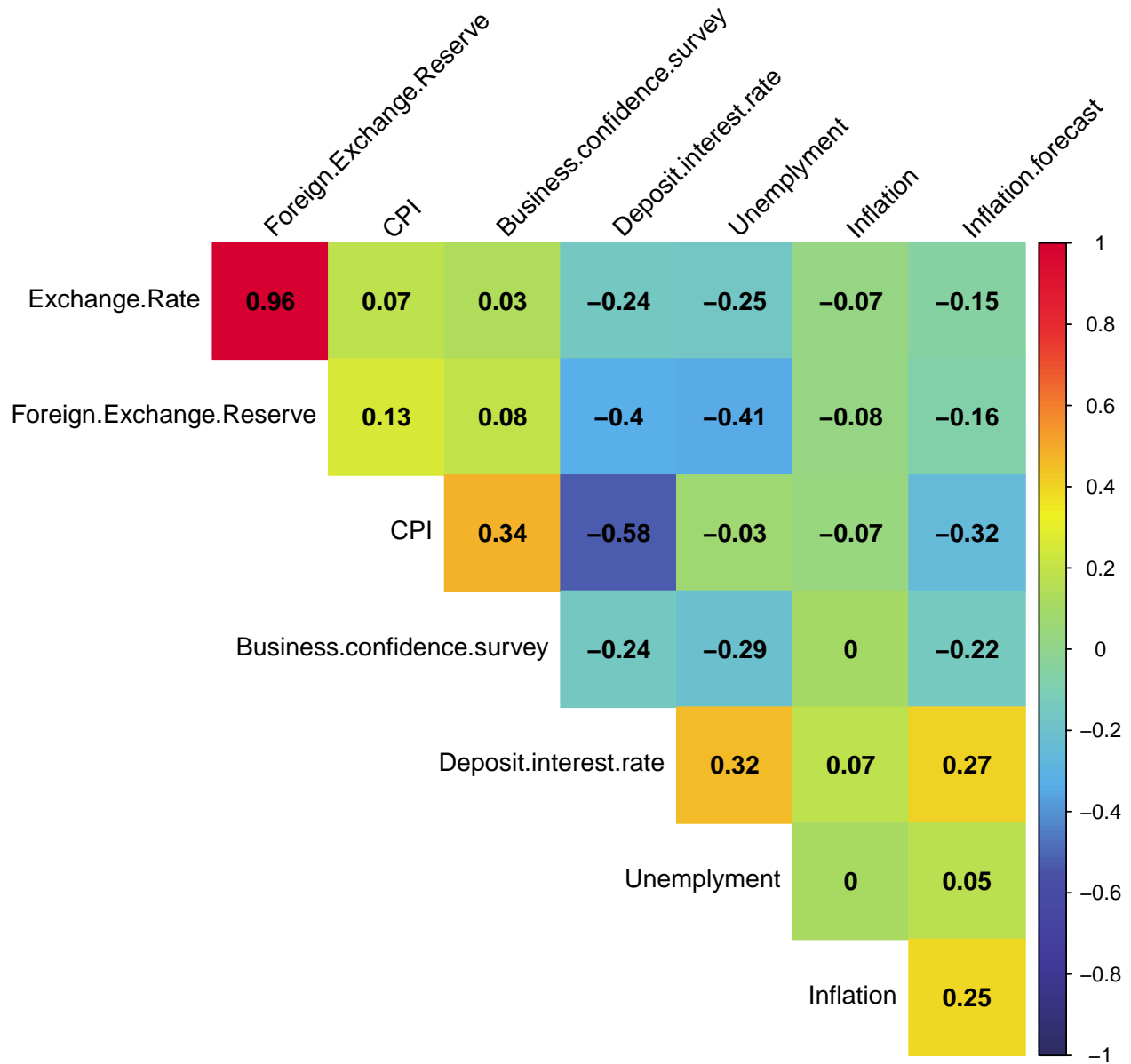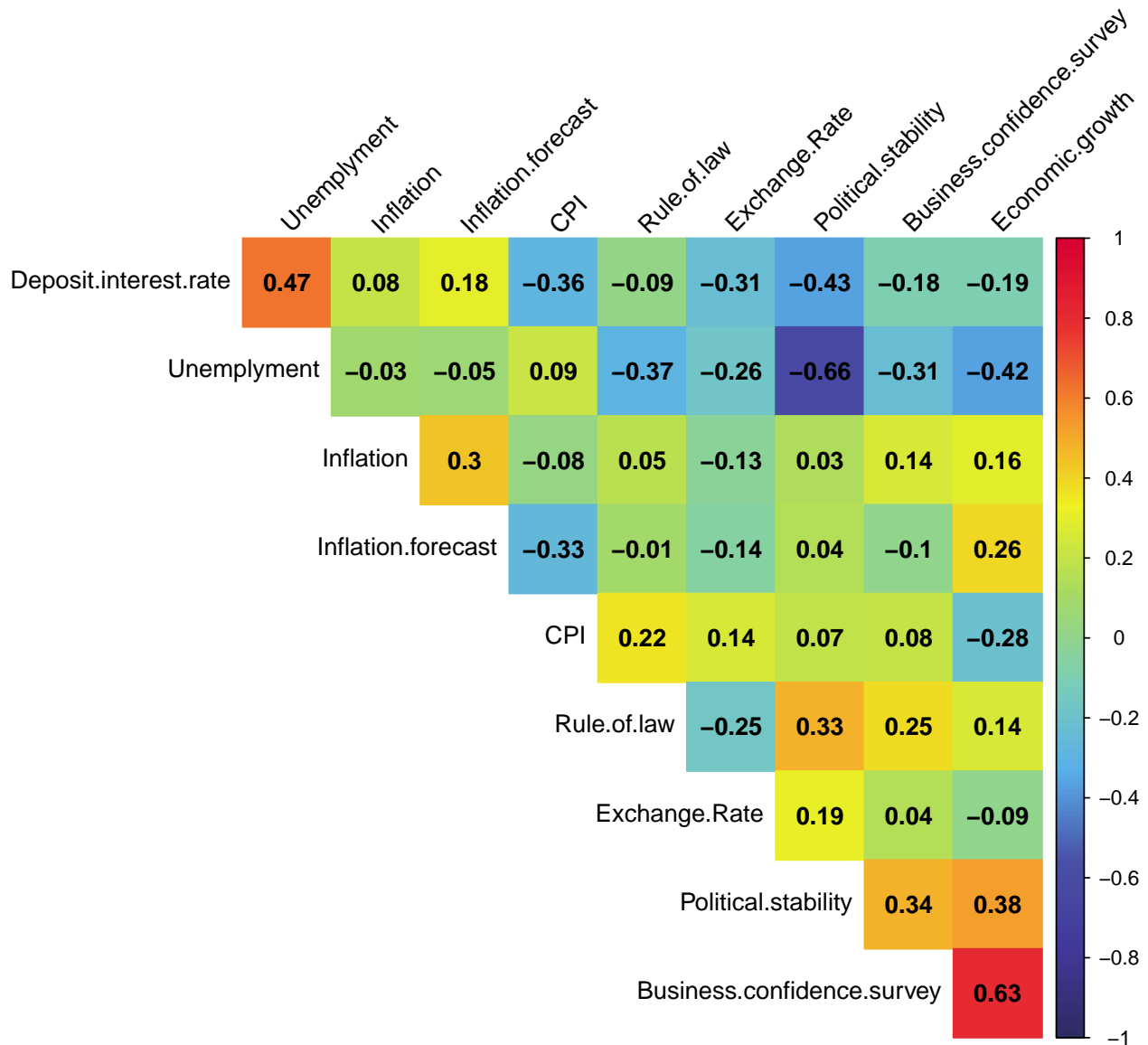
Variables	VIF
Deposit.interest.rate	2.574346
CPI	1.794586
Unemplyment	1.989810
Inflation	1.072776
Exchange.Rate	27.916129
Business.confidence.survey	1.287215
Inflation.forecast	1.239099
Foreign.Exchange.Reserve	33.684718

In the heat plot, green color represents that the two indicators are not dependent. Blue and red color shows the dependence.

Also, we use VIF to show the collinearity. VIF can be used to detect collinearity (Strong correlation between two or more predictor variables). Collinearity causes instability in parameter estimation in regression-type

models. The VIF is based on the square of the multiple correlation coefficient resulting from regressing a predictor variable against all other predictor variables. If a variable has a strong linear relationship with at least one other variables, the correlation coefficient would be close to 1, and VIF for that variable would be large. **A VIF greater than 10 is a signal that the model has a collinearity problem.** We can see from the table that our predictors need to be adjusted. The Foreign Exchange Reserve and Echange Rate are too large.

Variables	VIF
Deposit.interest.rate	1.884957
CPI	1.871728
Unemplyment	2.760411
Inflation	1.148769
Exchange.Rate	1.496174
Business.confidence.survey	2.216699
Inflation.forecast	1.421976
Political.stability	1.970059
Economic.growth	2.760477

Variables	VIF
Rule.of.law	1.717307

Here we make some adjustment to our predictors. We remove "Foreign Exchange Reserve", and try to add some another variables to our VIF checking. Finally ,we found another 3 predictors which don't have a large VIF value: Economics Growth, Government Stability and Rule of Law. This 3 variables also don't heve large collinearity with other existing variables.

From the heat plot, we know that although the VIF value are small enough, there is still high correlation existing between indicators selected. To deal with it, we choose to keep them in our model, since VIF has indicated that the problem of collinearity will not influce our model.

Modelling

Now, we begin to construct a model.

Discussion

Implication

Limitation

Future direction

Reference

Appendix