Global House Market Analysis

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R Markdown

This is an R Markdown document. Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents. For more details on using R Markdown see http://rmarkdown.rstudio.com.

```
library(grid)
library(tidyverse)
library(sf)
library(rnaturalearth)
library(scales)
library(naniar)
library(ggplot2)
library(tinytex)
library(RColorBrewer)
library(rvest)
library(corrplot)
library(leaflet)
```

```
#tinytex::install_tinytex()
```

Reminder:

Make sure to check your file source since this is run inside my personal computer the file path might change on your end. ’

from github you can use this directory:

Global-Housing-Market-Analysis/Dataset/global_housing_market_extended.csv House_market_analysis/Global-Housing-Market-Analysis/Dataset/world_country_and_usa_states_latitude_and_longitude_values.csv

```
house_market <- read_csv("/Users/julius/Personal/Personal_Project/House_market_analysis/Global-Housing-
Countries_coordinate <- read_csv("/Users/julius/Personal/Personal_Project/House_market_analysis/Global-
```

Reminder:

Filtering the list again would remove the other files in the dataset so make sure to run this chunk of codes only one time so no data will be missing for the analysis below.

```r
Countries_coordinate <- select(Countries_coordinate,1:4)
```

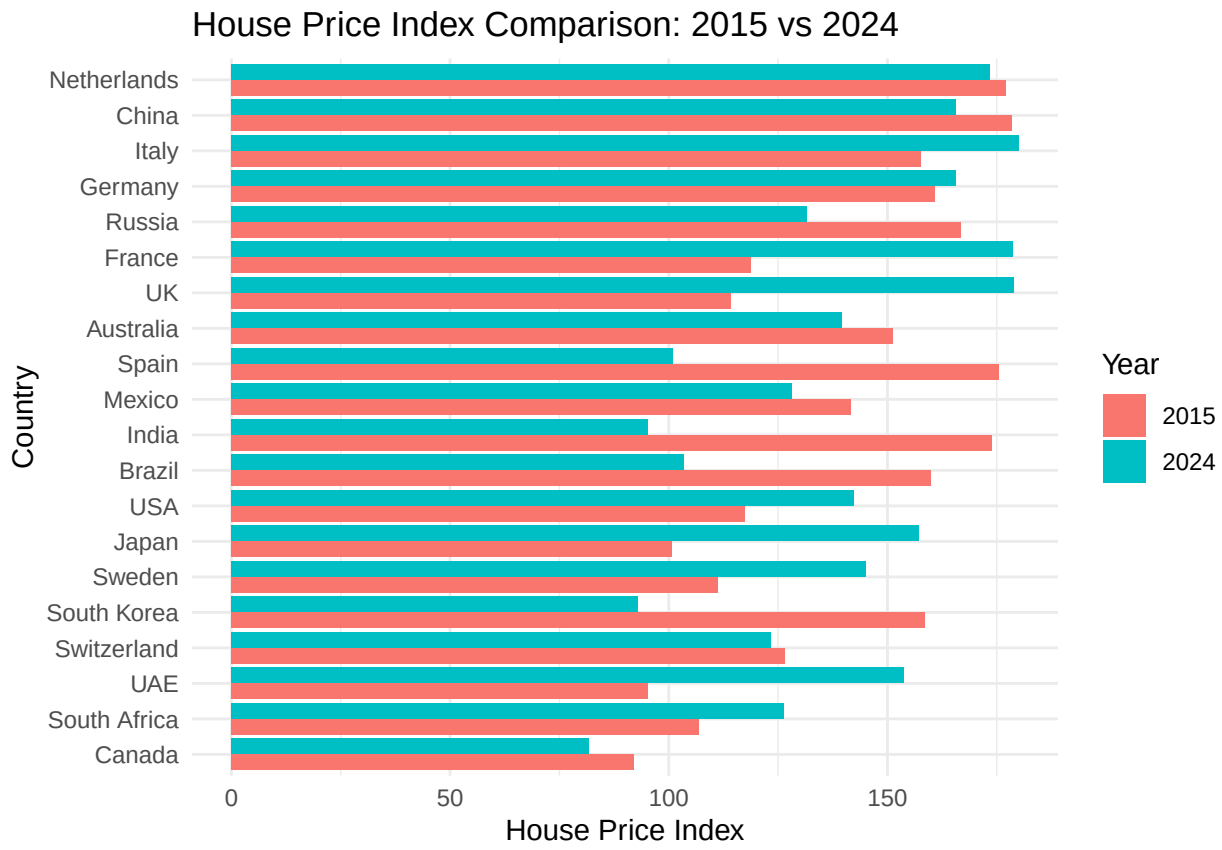
```r
#Run this once only
#Filtering the list of countries that are inside the house market dataset and. joining the two dataset
country_filter <- c("United States","Canada","United Kingdom","Germany","France","Italy","Spain","Austra

Countries_coordinate <- Countries_coordinate %>%
  filter(country %in% country_filter) %>%
  mutate(country = ifelse(country == "United Arab Emirates", "UAE", country)) %>%
  mutate(country = ifelse(country == "United States", "USA", country))%>%
  mutate(country = ifelse(country == "United Kingdom", "UK", country))

colnames(Countries_coordinate)[4] <- "Country"

#joining the two files
House_market_coordinate <- (left_join(house_market, Countries_coordinate, by='Country'))
```

```r
summary(House_market_coordinate)
```

```
##    Country               Year      House Price Index   Rent Index
##  Length:200         Min.   :2015   Min.   : 80.55    Min.   : 50.35
##  Class :character   1st Qu.:2017   1st Qu.:104.14    1st Qu.: 60.47
##  Mode  :character   Median :2020   Median :129.19    Median : 83.72
##                     Mean   :2020   Mean   :130.38    Mean   : 83.05
##                     3rd Qu.:2022   3rd Qu.:157.13    3rd Qu.:100.60
##                     Max.   :2024   Max.   :179.97    Max.   :119.86
##  Affordability Ratio Mortgage Rate (%) Inflation Rate (%) GDP Growth (%)
##  Min.   : 3.042      Min.   :1.538     Min.   :0.5321     Min.   :-1.92183
##  1st Qu.: 5.034      1st Qu.:3.045     1st Qu.:1.9392     1st Qu.:-0.09563
##  Median : 7.376      Median :4.330     Median :3.6646     Median : 2.30755
##  Mean   : 7.238      Mean   :4.151     Mean   :3.6498     Mean   : 2.13372
##  3rd Qu.: 9.276      3rd Qu.:5.218     3rd Qu.:5.2617     3rd Qu.: 4.27278
##  Max.   :11.880      Max.   :6.486     Max.   :6.9123     Max.   : 5.95893
##  Population Growth (%) Urbanization Rate (%) Construction Index
##  Min.   :-0.9614       Min.   :60.17         Min.   : 70.97
##  1st Qu.:-0.1833       1st Qu.:66.92         1st Qu.: 90.18
##  Median : 0.7224       Median :75.10         Median :110.59
##  Mean   : 0.7228       Mean   :74.77         Mean   :111.20
##  3rd Qu.: 1.6213       3rd Qu.:82.68         3rd Qu.:133.78
##  Max.   : 2.4979       Max.   :89.79         Max.   :149.74
##  country_code          latitude        longitude
##  Length:200         Min.   :-30.56   Min.   :-106.347
##  Class :character   1st Qu.: 23.58   1st Qu.:  -3.514
##  Mode  :character   Median : 38.78   Median :  11.509
##                     Mean   : 32.72   Mean   :  22.936
##                     3rd Qu.: 51.41   3rd Qu.:  85.271
##                     Max.   : 61.52   Max.   : 138.253
```

```r
ggplot(House_market_coordinate %>% filter(Year %in% c(2015, 2024)),
       aes(x = reorder(Country, `House Price Index`),
           y = `House Price Index`,
           fill = factor(Year))) +
```

```
  geom_bar(stat = "identity", position = "dodge") +
  coord_flip() +
  labs(title = "House Price Index Comparison: 2015 vs 2024",
       x = "Country",
       y = "House Price Index",
       fill = "Year") +
  theme_minimal()
```

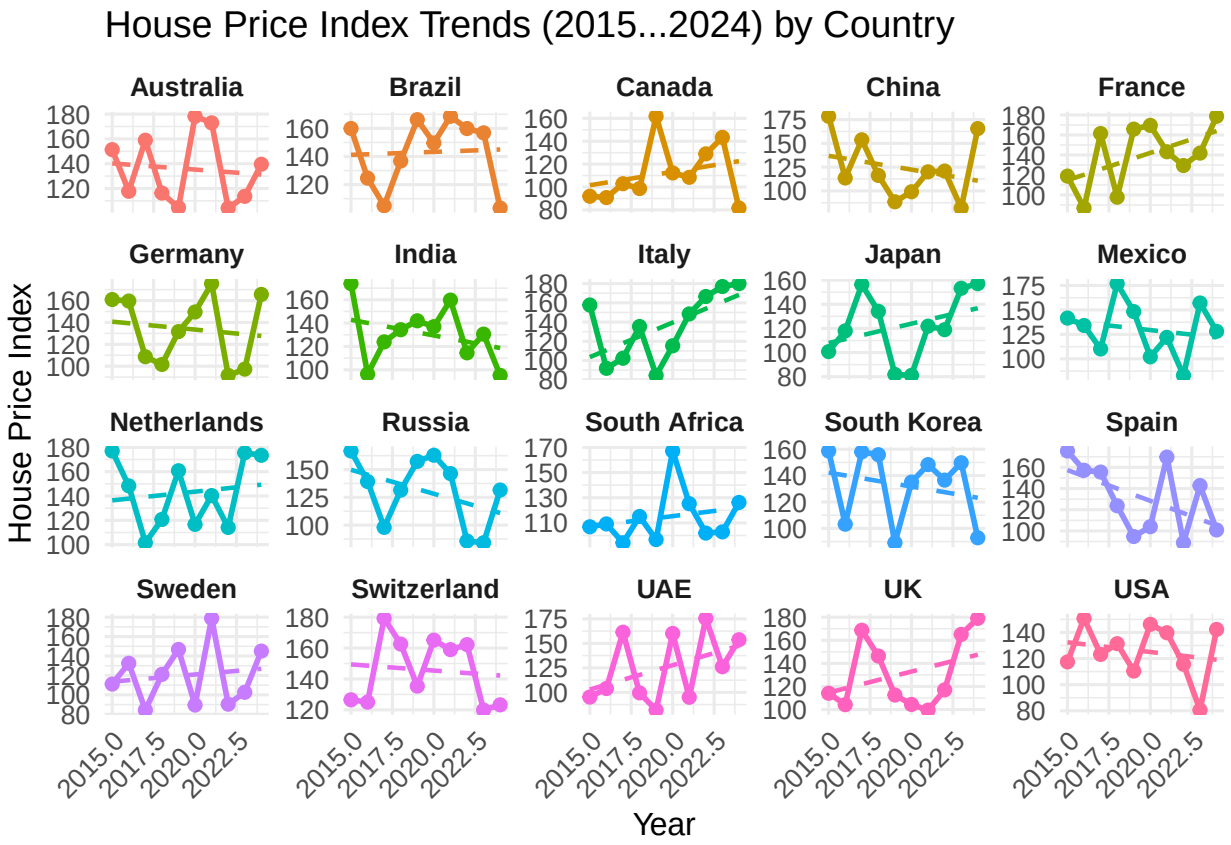


House Price Index Comparison Between Year 2015 And Year 2024

This horizontal bar chart compares the House Price Index (HPI) between 2015 and 2024 for various countries. Notably, countries like China, Italy, the Netherlands, the UK, and France exhibit significantly higher HPI values in both years compared to the benchmark of 100. In 2024, these countries generally show HPI values exceeding 150, representing a 50% or more increase above the assumed 'normal' level of 100. Additionally, a visual comparison of the red (2015) and teal (2024) bars for each country reveals the change in HPI over this 9-year period, highlighting countries with growth, decline, or relatively stable housing markets. One of many reason why some of this countries have a high number of HPI are because they have a strong economic growth and a high number of urbanization and high number of population density.

```
#Time Trends
ggplot(House_market_coordinate, aes(x = Year, y = `House Price Index`, color = Country)) +
  geom_line(size = 1) +
  geom_point(size = 2) +
  geom_smooth(method = "lm", se = FALSE, linetype = "dashed", size = 0.8) +  # Add trend line
  facet_wrap(~ Country, scales = "free_y") +
  labs(title = "House Price Index Trends (2015-2024) by Country",
       x = "Year",
```

```
      y = "House Price Index") +
  theme_minimal(base_size = 12) +
  theme(legend.position = "none",
        strip.text = element_text(face = "bold", size = 10),
        axis.text.x = element_text(angle = 45, hjust = 1))
```



House Price Index between 2015 - 2024 by Country

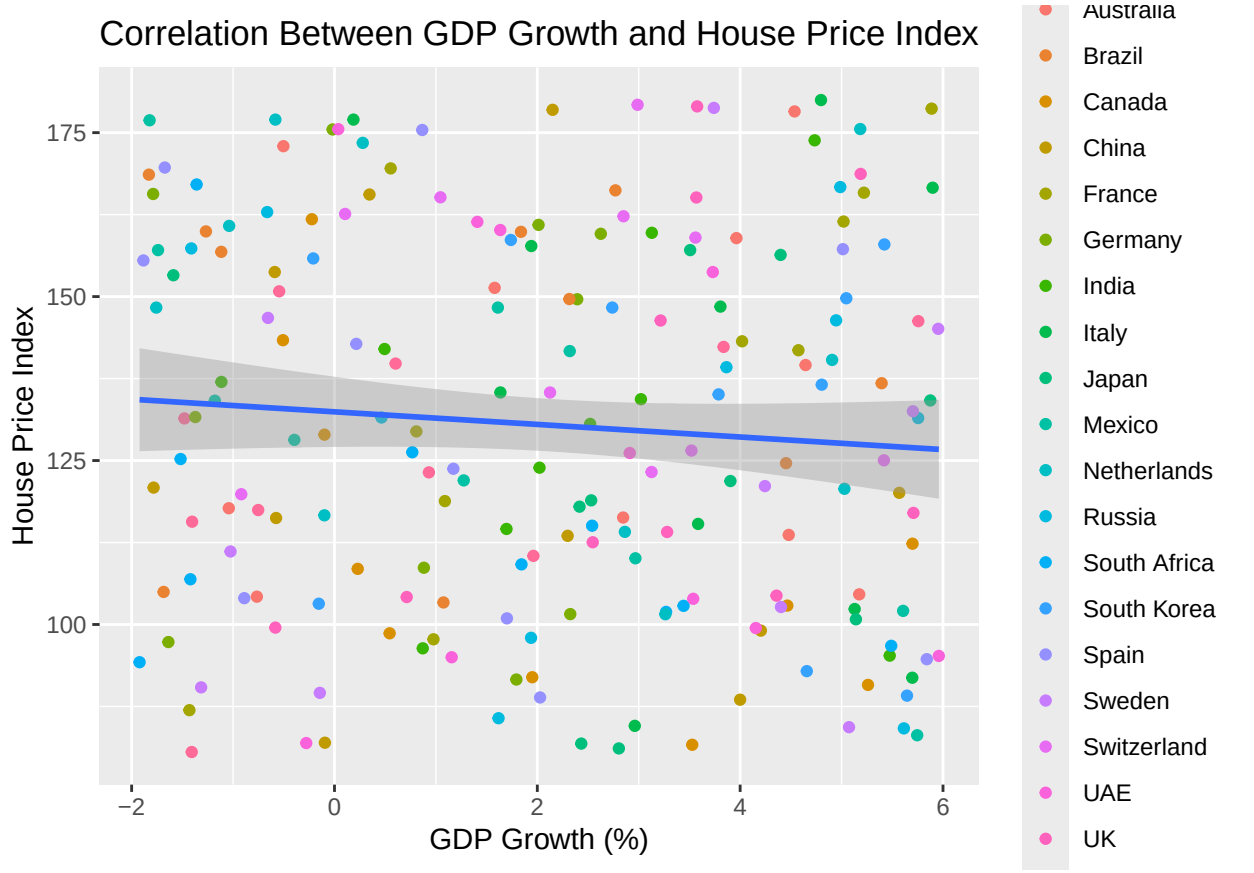
This chart above shows how House Price Index changed in various countries between 2015 to 2024, and it shows that a HPI trends vary significantly across countries, showing different levels of volatility and growth patterns. Additionaly, some countries have consistently rising HPI such as UK while others show fluctuations or decline this trends are also affected by each countries unique economic and market factors.

More analysis are below.

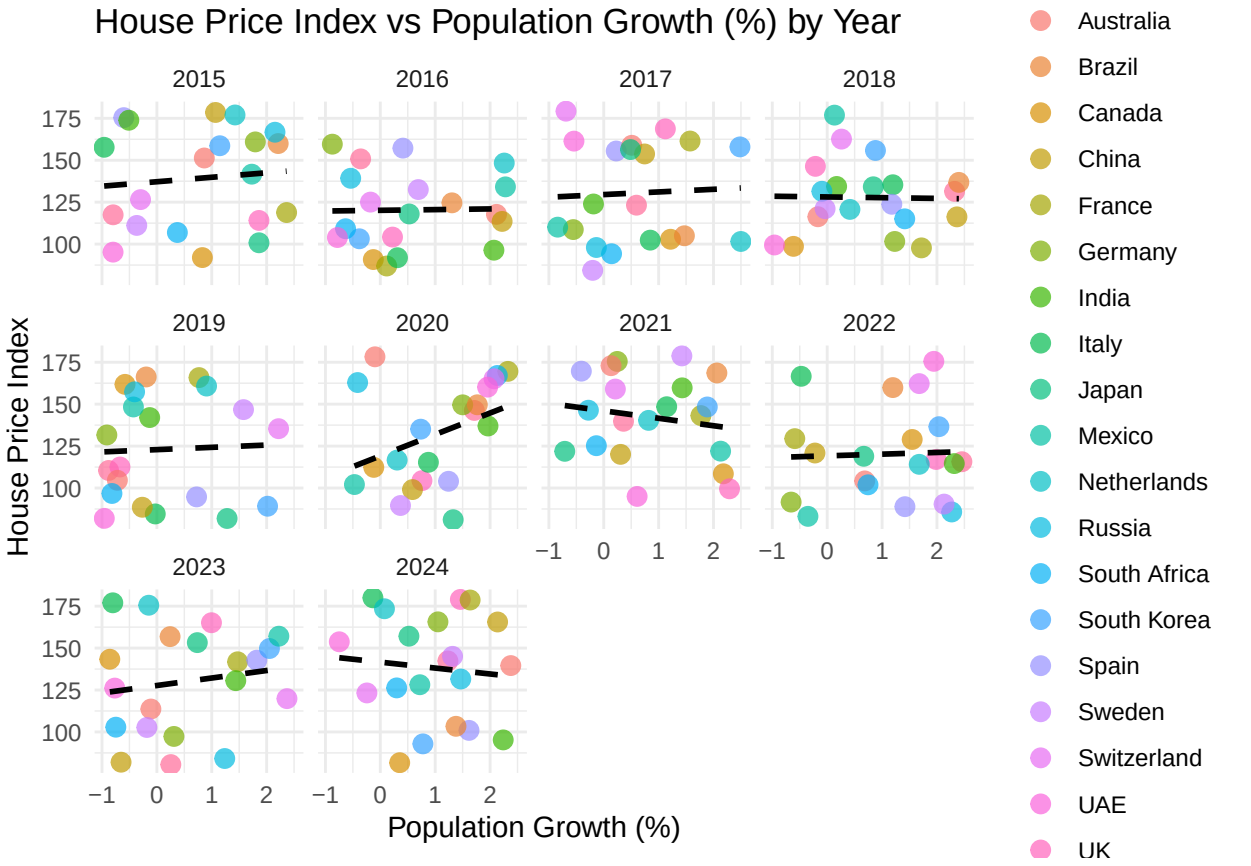
```
summary(House_market_coordinate[, c("House Price Index", "Rent Index", "Affordability Ratio", "Mortgage
```

```
##  House Price Index   Rent Index     Affordability Ratio Mortgage Rate (%)
##  Min.   : 80.55    Min.   : 50.35   Min.   : 3.042      Min.   :1.538
##  1st Qu.:104.14    1st Qu.: 60.47   1st Qu.: 5.034      1st Qu.:3.045
##  Median :129.19    Median : 83.72   Median : 7.376      Median :4.330
##  Mean   :130.38    Mean   : 83.05   Mean   : 7.238      Mean   :4.151
##  3rd Qu.:157.13    3rd Qu.:100.60   3rd Qu.: 9.276      3rd Qu.:5.218
##  Max.   :179.97    Max.   :119.86   Max.   :11.880      Max.   :6.486
```

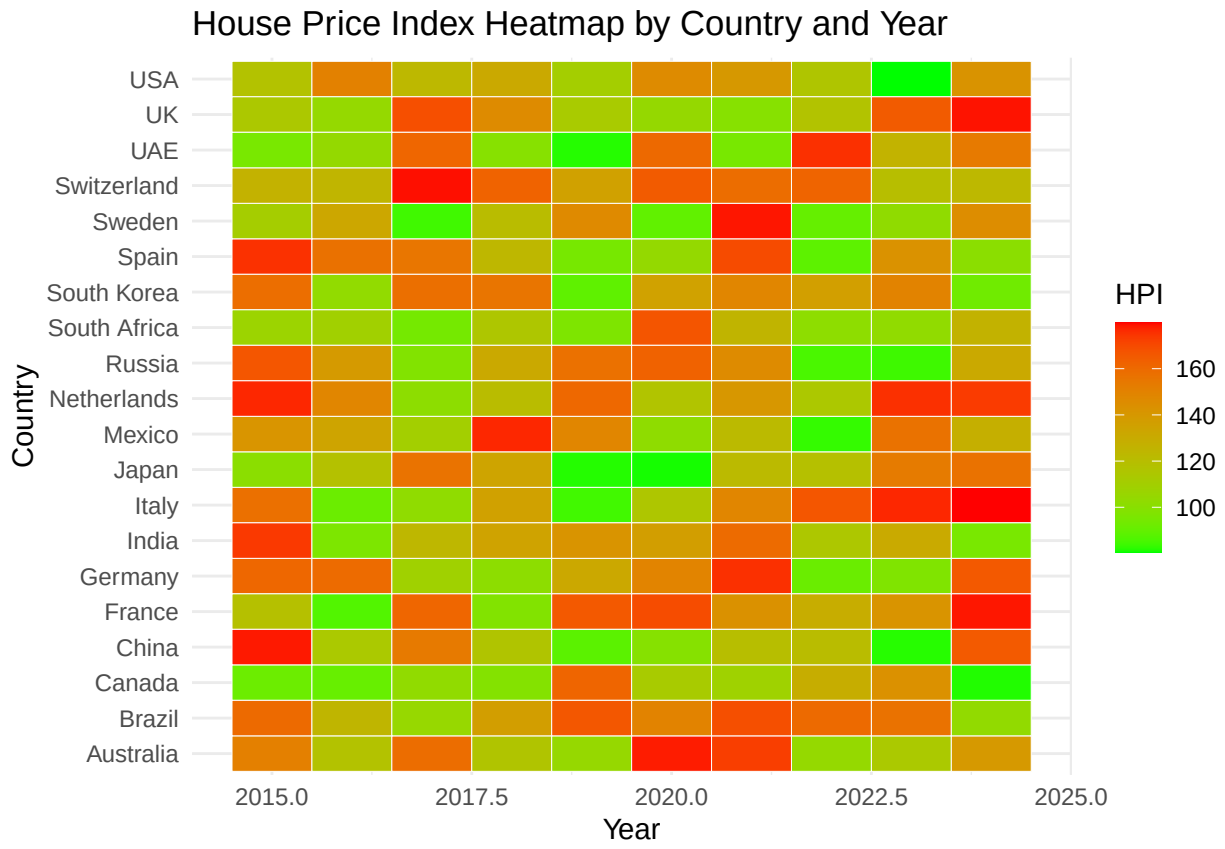
```r
ggplot(House_market_coordinate, aes(x = `GDP Growth (%)`, y = `House Price Index`)) +
  geom_point(aes(color = Country)) +
  geom_smooth(method = "lm") +
  labs(title = "Correlation Between GDP Growth and House Price Index")
```




```r
ggplot(House_market_coordinate, aes(x = `Population Growth (%)`, y = `House Price Index`, color = Countr
  geom_point(size = 3, alpha = 0.7) +
  geom_smooth(method = "lm", se = FALSE, linetype = "dashed", color = "black") +
  labs(title = "House Price Index vs Population Growth (%) by Year",
       x = "Population Growth (%)",
       y = "House Price Index") +
  facet_wrap(~Year) +  # This creates a separate plot for each year
  theme_minimal()
```

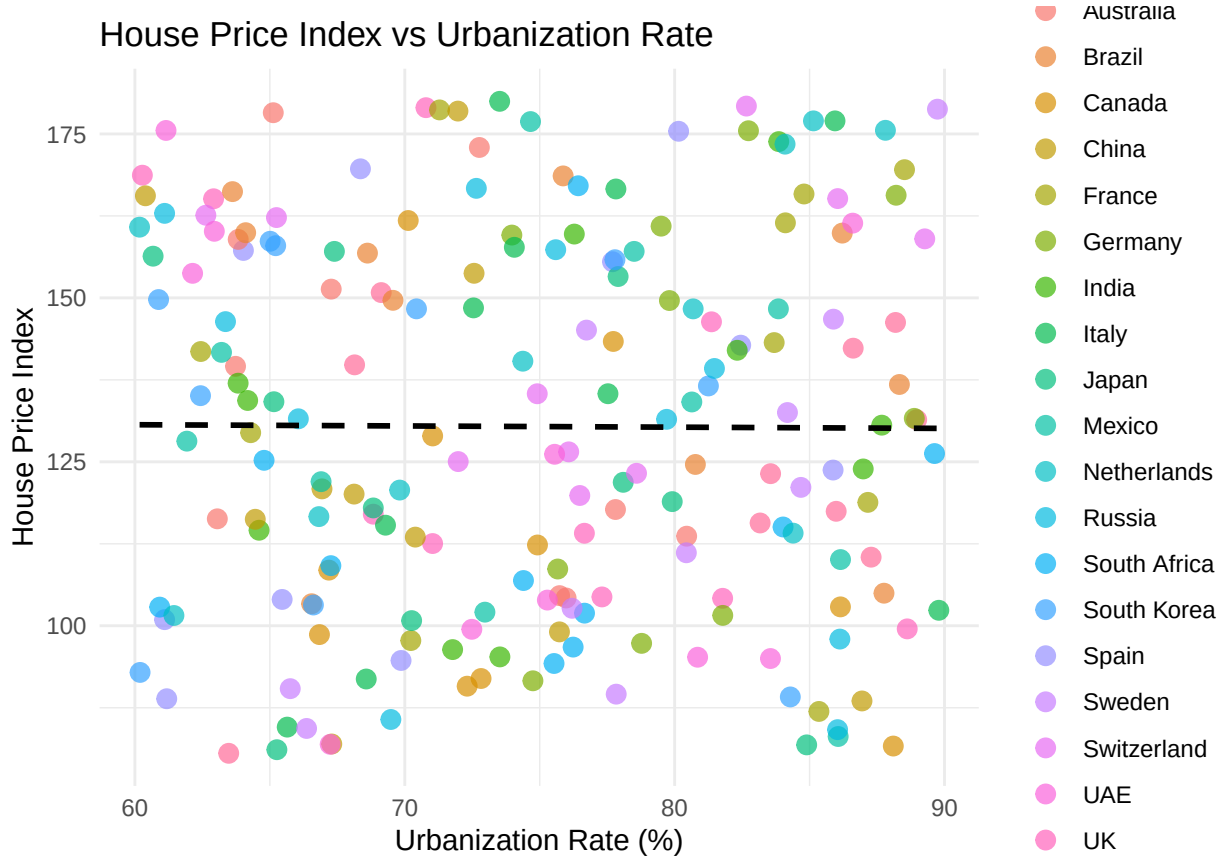



```
ggplot(House_market_coordinate, aes(x = Year, y = Country, fill = `House Price Index`)) +
  geom_tile(color = "white") +
  scale_fill_gradient(low = "green", high = "red") +
  labs(title = "House Price Index Heatmap by Country and Year",
       x = "Year", y = "Country", fill = "HPI") +
  theme_minimal()
```

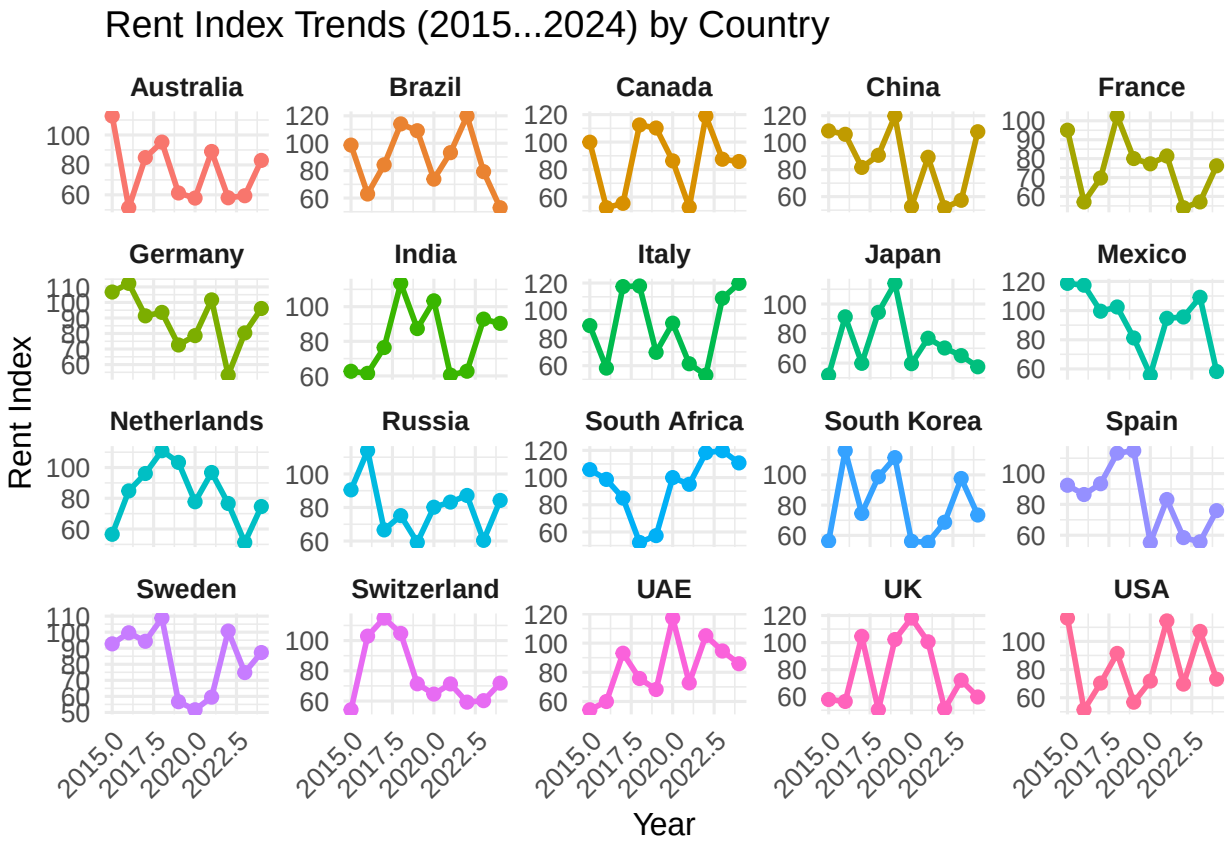



```
ggplot(House_market_coordinate, aes(x = `Population Growth (%)`, y = `House Price Index`, color = Counti
  geom_point(size = 3, alpha = 0.7) +
  geom_smooth(method = "lm", se = FALSE, linetype = "dashed", color = "black") +
  labs(title = "House Price Index vs Population Growth",
       x = "Population Growth (%)", y = "House Price Index") +
  theme_minimal()
```

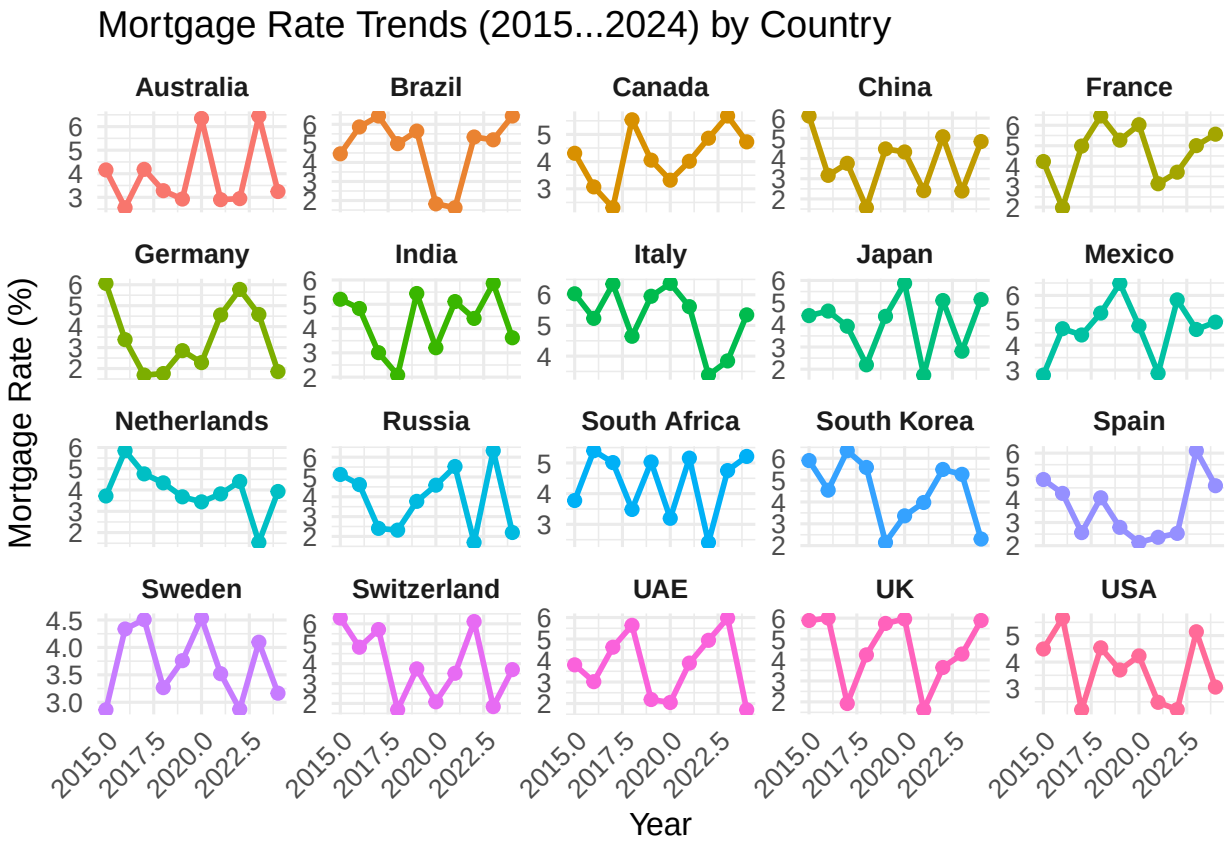

```
ggplot(House_market_coordinate, aes(x = `Urbanization Rate (%)`, y = `House Price Index`, color = Count
  geom_point(size = 3, alpha = 0.7) +
  geom_smooth(method = "lm", se = FALSE, linetype = "dashed", color = "black") +
  labs(title = "House Price Index vs Urbanization Rate",
       x = "Urbanization Rate (%)", y = "House Price Index") +
  theme_minimal()
```




```r
#Rent index over the year
ggplot(House_market_coordinate, aes(x = Year, y = `Rent Index`, color = Country)) +
  geom_line(size = 1) +
  geom_point(size = 2) +
  facet_wrap(~ Country, scales = "free_y") +
  labs(title = "Rent Index Trends (2015-2024) by Country",
       x = "Year",
       y = "Rent Index") +
  theme_minimal(base_size = 12) +
  theme(legend.position = "none",
        strip.text = element_text(face = "bold"),
        axis.text.x = element_text(angle = 45, hjust = 1))
```

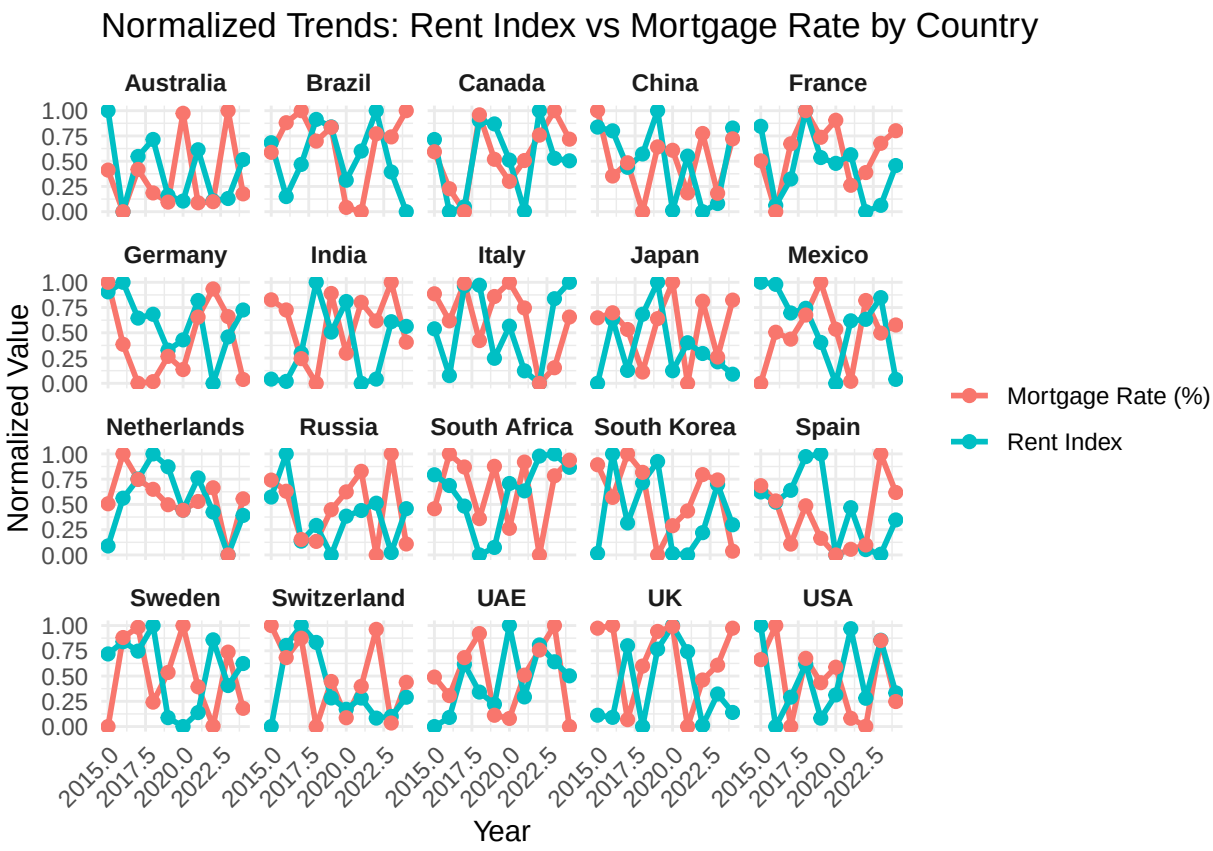



```r
#Mortgage Rate by the year
ggplot(House_market_coordinate, aes(x = Year, y = `Mortgage Rate (%)`, color = Country)) +
  geom_line(size = 1) +
  geom_point(size = 2) +
  facet_wrap(~ Country, scales = "free_y") +
  labs(title = "Mortgage Rate Trends (2015-2024) by Country",
       x = "Year",
       y = "Mortgage Rate (%)") +
  theme_minimal(base_size = 12) +
  theme(legend.position = "none",
        strip.text = element_text(face = "bold"),
        axis.text.x = element_text(angle = 45, hjust = 1))
```




```
#combining rate and mortgage rate
rent_mortgage <- House_market_coordinate %>%
  pivot_longer(cols = c(`Rent Index`, `Mortgage Rate (%)`),
               names_to = "Variable",
               values_to = "Value")

house_long_normalized <- rent_mortgage %>%
  group_by(Country, Variable) %>%
  mutate(Normalized = (Value - min(Value)) / (max(Value) - min(Value))) %>%
  ungroup()
```

```
ggplot(house_long_normalized, aes(x = Year, y = Normalized, color = Variable)) +
  geom_line(size = 1) +
  geom_point(size = 2) +
  facet_wrap(~ Country) +
  labs(title = "Normalized Trends: Rent Index vs Mortgage Rate by Country",
       x = "Year",
       y = "Normalized Value") +
  theme_minimal() +
  theme(legend.title = element_blank(),
        strip.text = element_text(face = "bold"),
        axis.text.x = element_text(angle = 45, hjust = 1))
```


Normalized Trends: Rent Index vs Mortgage Rate by Country
Australia
Brazil
Canada
China
France
Germany
India
Italy
Japan
Mexico
Netherlands
Russia
South Africa
South Korea
Spain
Sweden
Switzerland
UAE
UK
USA
Normalized Value
1.00
0.75
0.50
0.25
0.00
2015.0
2017.5
2020.0
2022.5
Year
Mortgage Rate (%)
Rent Index