Memo on Visualization Process: Depicting Refugee Movements from Asia

To: Federico Torretti

From: Analytic Avengers (Team 4)

Date: 02-24-2024

Subject: Visualization of Asian Refugee Movements – Process and Design Principles

Introduction

The visualizations we have crafted aims to shine a light on the narrative of refugee movements, mainly in Asia, throughout the years. This memo lays out the story our graphic portrays, the design principles we have used, and how our methods match up with recognized standards for top-notch visual data representation.

Narrative of the Visualization

Our visualization tells the compelling story of refugees as they undertake difficult journeys in search of safety in other countries. Focused on Asia, a continent experiencing a significant number of refugees, our story highlights the role of Myanmar, Iraq, and Bhutan in this trend due to geopolitical reasons. Indeed, we have decided to focus primary on this continent as it is the best one to analyze from our perspective and to gain valuable insights. The data not only shows the large scale of migration but also reflects important events in these countries that have influenced these movements.

Design Principles Applied

To construct a coherent and impactful visual story, we applied several core design principles:

Contrast: The choropleth map uses a color gradient to illustrate the differing numbers of refugees across various countries. Darker shades signify higher numbers, quickly capturing the viewer's attention towards areas of significance, such as Myanmar.

Repetition: Across all visuals, we maintained a consistent color scheme for representing data points. This repetition aids in reinforcing the viewers' understanding and memory of the information.

Alignment: The elements within each visual are strategically positioned to create a natural flow. For instance, in the heatmap, the countries are listed alphabetically, and the years are placed in chronological order, providing a logical narrative structure.

Proximity: Related information is grouped closely, as seen in the line graph depicting the immigration rate in Myanmar over time, where annotations are placed directly next to the corresponding data points.

Adherence to Kieran Healy's Principles

Our visualization also adheres to Kieran Healy's principles, focusing on clarity and simplicity to ensure the message is communicated effectively:

Clear visual point of comparison: The choropleth map provides a clear point of comparison between countries, emphasizing regions with the highest number of refugees.

Data context and background: The line graph for Myanmar includes annotations for significant events, offering context that explains spikes or declines in refugee numbers.

Effective data-ink ratio: We ensured that every ink on the page serves a purpose, avoiding unnecessary decorations that do not enhance understanding.

Simplification of complex data: Through the heatmap, we simplified the complex data of immigration across various countries and years, allowing for an immediate grasp of trends and outliers.

In our exploration of refugee movements from Asia, it's crucial to recognize the dual narrative of challenges and opportunities. Insights from Dany Bahar and Meagan Dooley (*Cf. Refugees as assets not burdens -The role of policy - February 2020*), as well as the American Immigration Council (*cf. New Report Reveals Refugees Profound Economic Contributions and Integration in the United States - June 20,2023)*, illuminate the profound contributions refugees make to their host countries. Bahar and Dooley's perspective on viewing refugees as assets, not burdens, underscores the potential for positive integration outcomes. Similarly, the American Immigration Council's report on refugees' economic contributions in the United States highlights the significant role refugees play in enriching communities and economies. These findings support the notion that with the right policies and support, refugees can thrive and contribute positively, challenging the often-negative portrayal of refugee flows. Our visualization aims to reflect not only the journeys and struggles of refugees but also the potential for their successful integration and contribution to host nations.

Conclusion

In conclusion, the visualization has been crafted with meticulous attention to detail, ensuring that each element serves the narrative and adheres to both fundamental and advanced principles of design and data representation. The result is a set of visuals that not only conveys the data but also tells the human story behind the numbers. Moving forward, it is imperative to focus on countries as Myanmar to implement effective refugee policies that address the pressing humanitarian crisis. By directing attention and resources towards this region, we can work towards alleviating the suffering of displaced populations and fostering stability and prosperity in the affected areas.

Avengers Analytics

- Celine Della Corte
- Ganga Singh
- Sharayu Kasar
- Umar Farooq
- Yu-Chang Teng

3

A2.1 - Refugees

Team 4: Celine Della Corte, Ganga Singh, Sharayu Kasar, Umar Farooq, Yu-Chuan Teng
2024-02-23

Executive Summary

This analysis delves into the global refugee crisis, aiming to identify nations in need of better facilities for refugees. Through our analysis, we seek to understand the reasons behind refugee movements and how best to support them, emphasizing targeted support and policy reform to leverage the potential contributions of refugees to host countries.

Introduction

The global refugee situation presents a complex challenge that requires nuanced understanding and strategic responses. Refugees, often seen through the lens of burden, hold potential as significant assets to host nations, a perspective highlighted by Dany Bahar and Meagan Dooley in their article called "Refugees as assets not burdens". Indeed, it underscores the importance of integrating and empowering refugees, highlighting their potential contributions and capabilities. Additionally, the American Immigration Council's report reveals that refugees significantly contribute economically and integrate well into the United States, further demonstrating that refugees can bring valuable skills and strengths to their host countries. These insights underscore the imperative for policies that acknowledge and harness the positive economic contributions refugees can make at both national and local levels. Thus, this analysis adheres to a straightforward pyramid structure, progressing from a broad continental overview to the examination of an individual nation. To attain our objective, we pursued several pivotal questions:

1. Which continent harbors the greatest concentration of refugees?
2. What are the top three nations accommodating the largest refugee populations?
3. What are the primary factors contributing to countries hosting a significant number of refugees?

Furthermore, exploring the reasons that compel people to flee their homes is essential for crafting effective policies and support mechanisms to not only aid refugees but also harness their potential to contribute positively to their new communities.

The continent with the highest number of refugees over time:

Geographical Plot for Refugees Count in Asia
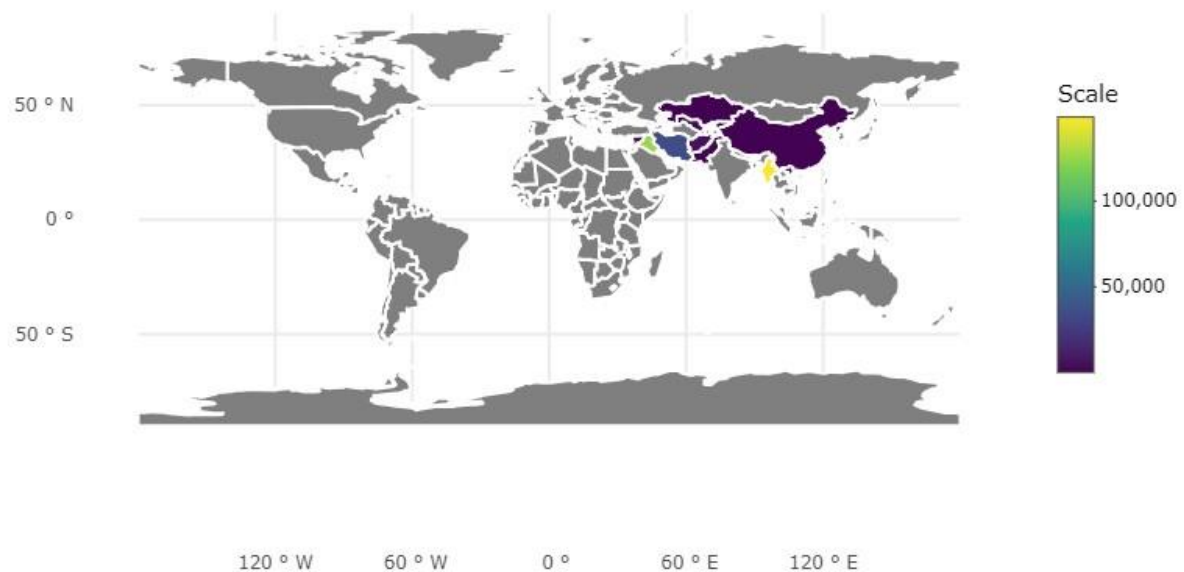
The visualization presents a global choropleth map for a Geographical plot of the refugee count in Asia. The map and an animation gif illustrate refugee populations, with shades of purple indicating the density of refugees in each country. The legend to the right specifies a numerical range from 0 to 100,000, with deeper shades corresponding to larger refugee counts. Upon closer examination and the animation above, it is apparent that Asia is highlighted as the region with the most significant number of refugees, as evidenced by the presence of darker shades. This suggests that Asia has a higher refugee density compared to other regions on the map.

Top 3 countries:

Total Refugees migrating from Asia
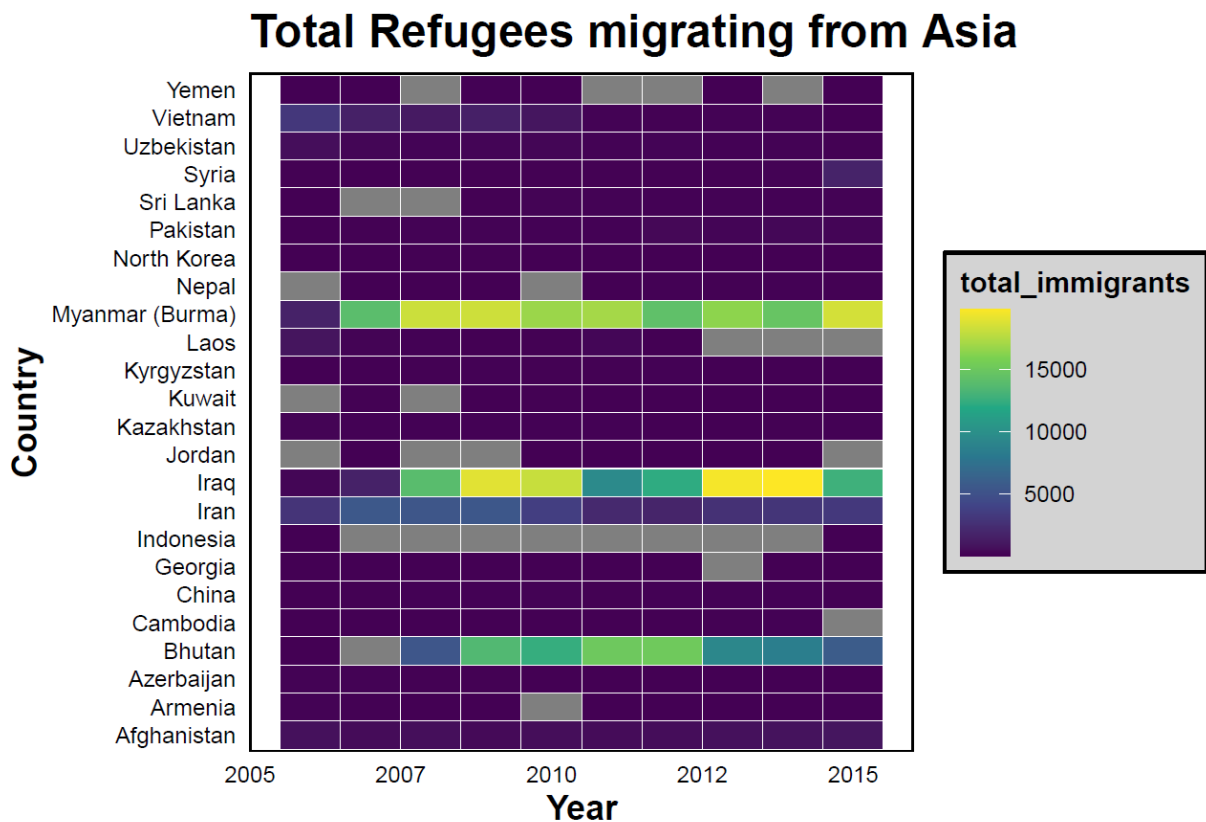
The heatmap of total refugees migrating from Asia is a visual representation that shows how refugees are distributed across different countries in Asia. The use of shades of purple and yellow indicates the number of refugees present in each country. If the colors tend towards yellow, the higher the number of refugees. This map allows us to quickly identify which countries in Asia have the highest refugee populations. For instance, Myanmar, Iraq, and Bhutan are depicted closest to the yellow hues, indicating their status as having the highest number of refugees among Asian nations.

Effects of geopolitical events on migration rate in Myanmar over time:

Migration Rate in Myanmar Over Time
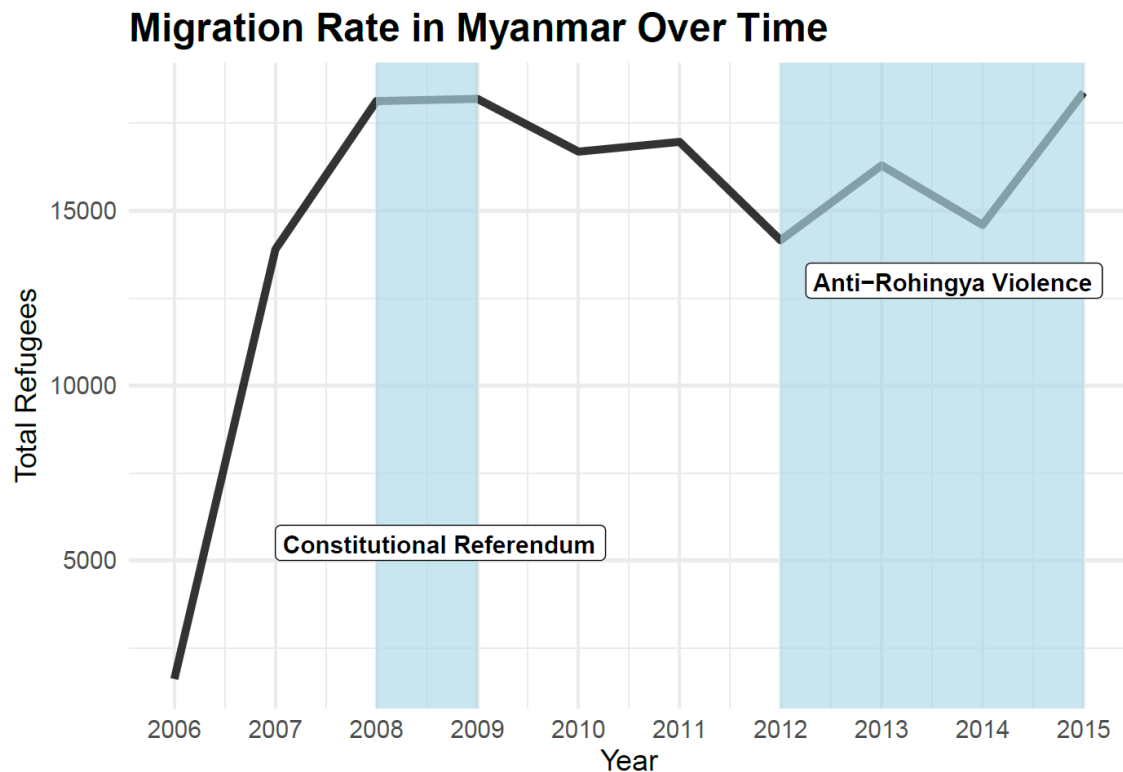
This visualization is a line graph focusing on the country with the highest refugee population: Myanmar. This graph delineates the fluctuation in refugee numbers within Myanmar from 2006 to 2015. It incorporates annotations for noteworthy events, such as the "Constitutional Referendum" and periods marked by "Anti-Rohingya Violence." The graph reveals prominent peaks and troughs in refugee figures, notably an escalation during periods of violence. Such a graph is instrumental in comprehending how specific events impact refugee rates. However, without supplementary information or context, a comprehensive understanding of the underlying factors or data accuracy remains elusive.

Appendix:

R codes to run the file and cleaning

1.
```{r setup, message=FALSE, warning=FALSE}
knitr::opts_chunk$set(echo = TRUE, message = FALSE)
knitr::opts_chunk$set(warning = FALSE, message = FALSE)
```

2.
```{r Importing libraries and data, message=FALSE, warning=FALSE}
library(readr)      # For reading and working with CSV files
library(tidyr)
library(lubridate)  # For working with dates
library(tidyverse)# For data manipulation and visualization
library(dplyr)
library(stringr)
library(countrycode)
library(sf)  # For GIS magic
library(plotly)
library(gganimate)
library(gapminder)
library(ggplot2)
library(magick)
library(gifski)
library(ggplot2)
library(dplyr)
library(leaflet)
library(countrycode)
library(geonames)
library(sf)        # For GIS magic
library(shiny)
library(shinydashboard)
```

3.

```{r cleaning, message=FALSE, warning=FALSE}

world_map <-
read_sf("data/ne_110m_admin_0_countries/ne_110m_admin_0_countries.shp")

refugees_raw <- read_csv("data/A2_refugee_status.csv", na = c("-", "X", "D"))


non_countries <- c("Africa", "Asia", "Europe", "North America", "Oceania",
            "South America", "Unknown", "Other", "Total")
```

```
refugees_clean <- refugees_raw %>%
  # Make this column name easier to work with
  rename(origin_country = `Continent/Country of Nationality`) %>%

  # Get rid of non-countries
  filter(!(origin_country %in% non_countries)) %>%

  # Convert country names to ISO3 codes
  mutate(iso3 = countrycode(origin_country, "country.name", "iso3c",
                 custom_match = c("Korea, North" = "PRK"))) %>%

  # Convert ISO3 codes to country names, regions, and continents
  mutate(origin_country = countrycode(iso3, "iso3c", "country.name"),
      origin_region = countrycode(iso3, "iso3c", "region"),
      origin_continent = countrycode(iso3, "iso3c", "continent")) %>%

  # Make this data tidy
  gather(year, number, -origin_country, -iso3, -origin_region, -origin_continent) %>%

  # Make sure the year column is numeric + make an actual date column for years
  mutate(year = as.numeric(year),
      year_date = ymd(paste0(year, "-01-01")))
```

R codes to generate animation and choropleth map
4.
```{r animation, message=FALSE, warning=FALSE}
rfg_smry <- refugees_clean %>%
```

```
    group_by(year, origin_continent, origin_country) %>%

    summarize(total_immigrants = sum(number))


my_animation <- ggplot(rfg_smry, aes(x = year, y = total_immigrants, color =
origin_continent, size = total_immigrants, text = origin_country)) +

  geom_point(alpha = 0.7) +

  labs(title = 'Yearly Immigration by Continent', x = 'Year', y = 'Total Immigrants') +

  transition_states(year, transition_length = 2, state_length = 1) +

  ease_aes('linear') +

  theme_minimal() +

  facet_wrap(~ origin_continent)


# Save as gif using magick

anim_save("my_animation.gif", animation = my_animation, renderer = gifski_renderer())


```
```

5.
```{r map, message=FALSE, warning=FALSE}
# Filter data for Asia and calculate total immigrants per country
asia_data <- refugees_clean %>%
  filter(origin_continent == "Asia") %>%
  group_by(iso3, origin_country) %>%
  summarize(total_immigrants = sum(number))

# Calculate the total immigrants for each country (sum over all years)
total_immigrants_all_years <- asia_data %>%
  group_by(iso3) %>%
  summarize(Scale = sum(total_immigrants))  # Capitalizing the first letter of the column
to 'Scale'

# Merge data with world map
map_data <- left_join(world_map, total_immigrants_all_years, by = c("ISO_A3" =
"iso3"))

# Create choropleth map
my_plot <- ggplot() +
```

```
  geom_sf(data = map_data, aes(fill = Scale, text = paste(ADMIN, "<br>Total
Immigrants: ", scales::comma(Scale))), color = "white", size = 0.2) +
  scale_fill_viridis_c(labels = scales::comma) +
  theme_minimal() +
  theme(legend.position = "bottom") +
  labs(title = "Geographical Plot for Refugees Count in Asia")

# Convert ggplot to plotly with custom data
my_plotly <- ggplotly(my_plot, tooltip = "text")

# Add custom data for 'origin_country'
my_plotly$x$data[[1]]$text <- with(map_data, paste(ADMIN, "<br>Total Immigrants: ",
scales::comma(Scale)))

# Show the plotly object
my_plotly

```
```

6.

```{r heatmap, message=FALSE, warning=FALSE}

# Filter data for Asia

asia_data <- refugees_clean %>%

  filter(origin_continent == "Asia") %>%

  group_by(year, origin_country) %>%

  summarize(total_immigrants = sum(number))

heatmap_plot <- ggplot(asia_data, aes(x = year, y = origin_country, fill =
total_immigrants)) +

  geom_tile(color = "white") +

  scale_fill_viridis_c() +

  labs(title = 'Total Refugees migrating from Asia', x = 'Year', y = 'Country') +

  theme_minimal() +

  theme(

    axis.text = element_text(size = 8, color = "black", angle = 0),

    axis.title = element_text(size = 12, color = "black", face = "bold"),

    plot.title = element_text(size = 16, face = "bold"),
```

```
    panel.grid = element_blank(),  # Remove grid lines

    legend.title = element_text(size = 10, face = "bold"),

    legend.text = element_text(size = 8),

    legend.position = "right",  # Adjust legend position

    legend.background = element_rect(fill = "lightgrey", color = "black", size = 0.5),

    plot.background = element_rect(fill = "white"),  # White background

    panel.background = element_rect(fill = "white", color = "black"),  # Add border

    plot.margin = margin(20, 30, 20, 20)  # Add margin

  ) +

  scale_x_continuous(labels = function(x) as.integer(x))  # Remove decimal points from
x-axis labels


heatmap_plot



```
```

7.
```
```{r line, message=FALSE, warning=FALSE}

# Filter data for Myanmar
myanmar_data <- refugees_clean %>%
  filter(origin_continent == "Asia" & origin_country == "Myanmar (Burma)") %>%
  group_by(year) %>%
  summarize(total_immigrants = sum(number))
# Convert year to integer
myanmar_data$year <- as.integer(myanmar_data$year)

# Center annotations
ref_annotations <- data.frame(
  x = c(2007, 2012.25),
  y = c(5000, 12500),
  label = c("Constitutional Referendum", "Anti-Rohingya Violence")
)

myanmar_line_plot <- ggplot(myanmar_data, aes(x = year, y = total_immigrants)) +
```

```r
  geom_line(size = 1.5, alpha = 0.8) +
  geom_rect(data = NULL, aes(xmin = 2008, xmax = 2009, ymin = -Inf, ymax = Inf), fill =
"lightblue", alpha = 0.1) +
  geom_rect(data = NULL, aes(xmin = 2012, xmax = 2013, ymin = -Inf, ymax = Inf), fill =
"lightblue", alpha = 0.1) +
  geom_rect(data = NULL, aes(xmin = 2013, xmax = 2015, ymin = -Inf, ymax = Inf), fill =
"lightblue", alpha = 0.1) +
  geom_label(data = ref_annotations, aes(x = x, y = y, label = label), vjust = 0, hjust = 0, color =
"black", size = 3.5, fontface = "bold") +
  labs(title = 'Migration Rate in Myanmar Over Time', x = 'Year', y = 'Total Immigrants') +
  theme_minimal() +
  theme(
    axis.text = element_text(size = 10),
    axis.title = element_text(size = 12),
    plot.title = element_text(size = 16, face = "bold")
  ) +
  scale_x_continuous(breaks = seq(min(myanmar_data$year), max(myanmar_data$year), by =
1))

myanmar_line_plot

```
```

R codes to generate dashboard
8.
```{r dashboard, message=FALSE, warning=FALSE}


executive_summary <- "Executive Summary:\n\nThis analysis delves into the global
refugee crisis,

aiming to identify nations in need of better facilities for refugees.

Through our analysis, we seek to understand the reasons behind

refugee movements and how best to support them,

emphasizing targeted support and policy reform to leverage

the potential contributions of refugees to host countries.

To attain our objective, we pursued several pivotal questions:


1.Which continent harbors the greatest concentration of refugees?

2.What are the top three nations accommodating the largest refugee populations?

3.What are the primary factors contributing to countries
hosting a significant number of refugees?

This dashboard provides visualizations of refugees data.
It includes a map showing the total number of refugees from Asia,
a heatmap illustrating the migration patterns from Asia, and
a line plot depicting the migration rate of refugees from Myanmar over time."

```r
plotly_map <- ggplotly(my_plot)
# UI definition
ui <- dashboardPage(
  dashboardHeader(title = "Immigration Dashboard"),
  dashboardSidebar(),
  dashboardBody(
    fluidRow(
      box(title = "Executive Summary", status = "info", solidHeader = TRUE,
verbatimTextOutput("summary_text")),
      # Box for total refugees in Asia (using Plotly)
      box(title = "Total Refugees from Asia", status = "primary", solidHeader = TRUE,
plotOutput("map_plot")),
      # Box for refugees heatmap in Asia (using ggplot2)
      box(title = "Refugees migrating from Asia", status = "warning", solidHeader = TRUE,
plotOutput("heatmap_plot")),
      # Box for refugees rate in Myanmar over time (using ggplot2)
      box(title = "Migration rate of refugees from Myanmar Over Time", status = "danger",
solidHeader = TRUE, plotOutput("myanmar_line_plot"))
    )
  )
)

# Server definition
```

```r
server <- function(input, output) {

  output$summary_text <- renderText({
    executive_summary
  })

  # Map plot
  output$map_plot <- renderPlot({
    my_plot
  })

  # Heatmap plot
  output$heatmap_plot <- renderPlot({
    # Your heatmap plot code
    heatmap_plot
  })

  # Myanmar line plot
  output$myanmar_line_plot <- renderPlot({
    # Assuming 'myanmar_line_plot' is your line plot for Myanmar
    myanmar_line_plot
  })
}

# Run the Shiny app
shinyApp(ui, server)

```
```

References

- American Immigration Council. (June 20,2023). *New Report Reveals Refugees Profound Economic Contributions and Integration in the United States*

  https://www.americanimmigrationcouncil.org/news/new-report-reveals-refugees-profound-economic-contributions-and-integration-united-states

- Bahar, D., & Dooley, M. (February 2020). *Refugees as assets not burdens -The role of policy.*

- Healy, K. (2019). *Data Visualization: A Practical Introduction.*