

Project 4: Report

Global Population Growth and Urbanization Report

By 25090135

Introduction

This project aims to investigate population growth rate and urbanisation metrics for BRICS nations as included in the US World Population Prospectus. The methodology this project will use is the EDA method in order to uncover what insights can be derived for value within the data set.

Exploratory Data Analysis (EDA)

This report's EDA process aimed to answer these questions:

1. Global Population Growth Trend:
 1. What is the trend movement and distribution of global population growth rates?
2. The spread of indicators within BRICS:
 1. What is the statistical spread of BRICS population growth rate and other indicators?

Data Analysis

```
Warning: package 'ggplot2' was built under R version 4.3.2
```

```
Warning: package 'tidyverse' was built under R version 4.3.2
```

```
-- Attaching core tidyverse packages ----- tidyverse 2.0.0 --
v dplyr     1.1.4     v readr     2.1.5
v forcats   1.0.0     v stringr   1.5.1
v ggplot2   3.5.1     v tibble    3.2.1
v lubridate 1.9.3     v tidyr    1.3.1
v purrr     1.0.2

-- Conflicts -----
x dplyr::filter() masks stats::filter()
x dplyr::lag()    masks stats::lag()
i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to become non-conflicting.

Attaching package: 'scales'
```

The following object is masked from 'package:purrr':

discard

The following object is masked from 'package:readr':

col_factor

Warning: package 'ggridges' was built under R version 4.3.2

Warning: package 'tinytex' was built under R version 4.3.3

Cleaning the Data

In the cleaning process we analysed the data and noticed falacies in the variable names and we then changed them, as well as removing NA values and columns with no data for further analysis.

```
Rows: 84360 Columns: 67
-- Column specification -----
Delimiter: ","
chr (6): Notes, ISO3_code, ISO2_code, LocTypeName, Location, Variant
dbl (61): SortOrder, LocID, SDMX_code, LocTypeID, ParentID, VarID, Time, TPo...
i Use `spec()` to retrieve the full column specification for this data.
i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

Transformations and Visualisations

In the data we noticed a large amount of locations and thus we isolated Brics countries for our study as seen below:

```
pop_growth_rate
Min.    :-71.0640
1st Qu.:  0.0210
Median   :  0.8030
Mean     :  0.9881
3rd Qu.:  1.9510
Max.    : 37.8870
```

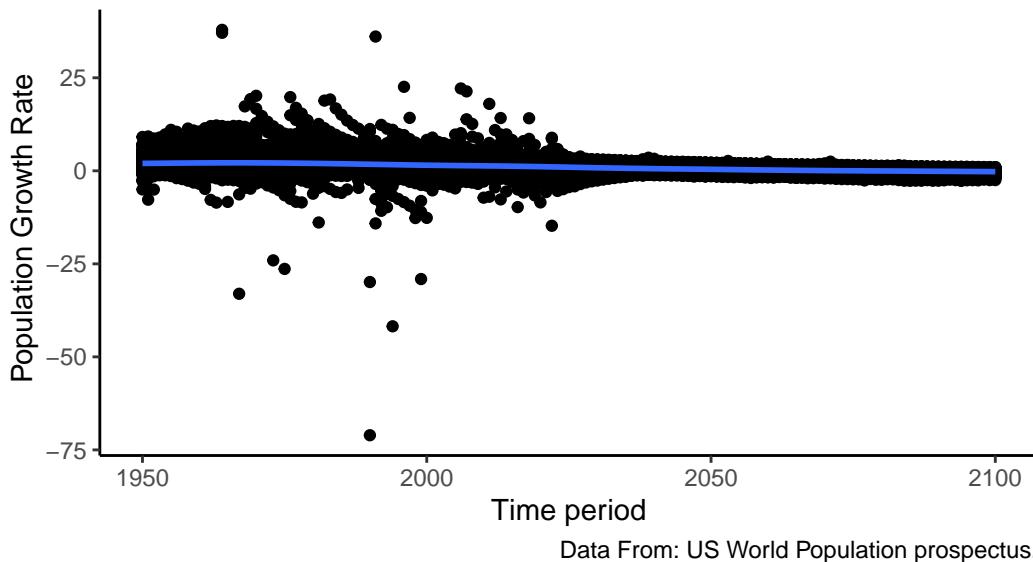
Within the data our first point of observation was the whole set's population growth rate and in it we see the above statistics, which we will use for comparison.

1. Global Population Growth Rate

```
Warning in geom_point(binwidth = 20): Ignoring unknown parameters: `binwidth`  
`geom_smooth()` using method = 'gam' and formula = 'y ~ s(x, bs = "cs")'
```

The Periodic Shift of Growth Rate over time

A graphical view of the spread of growth rate alongside the estimated fut



The above scatter plot depicts the movement of population growth throughout the 1950's and the projected growth for the future. The data indicates a stable population growth throughout the ages with certain periods being data out-liers. The out-liers of drastic negative population could reflect periods in time where there has been conflict or periods such as the Chinese government birth laws where the nations aimed to keep the population at a manageable point. Meanwhile periods of drastic population growth could be an indicator of methods of corrections for negative growth rates resulting in a surplus. However despite the out-liers the trend line indicates a stable population growth leveled yet slightly declining line with a correction point being above the 0 value

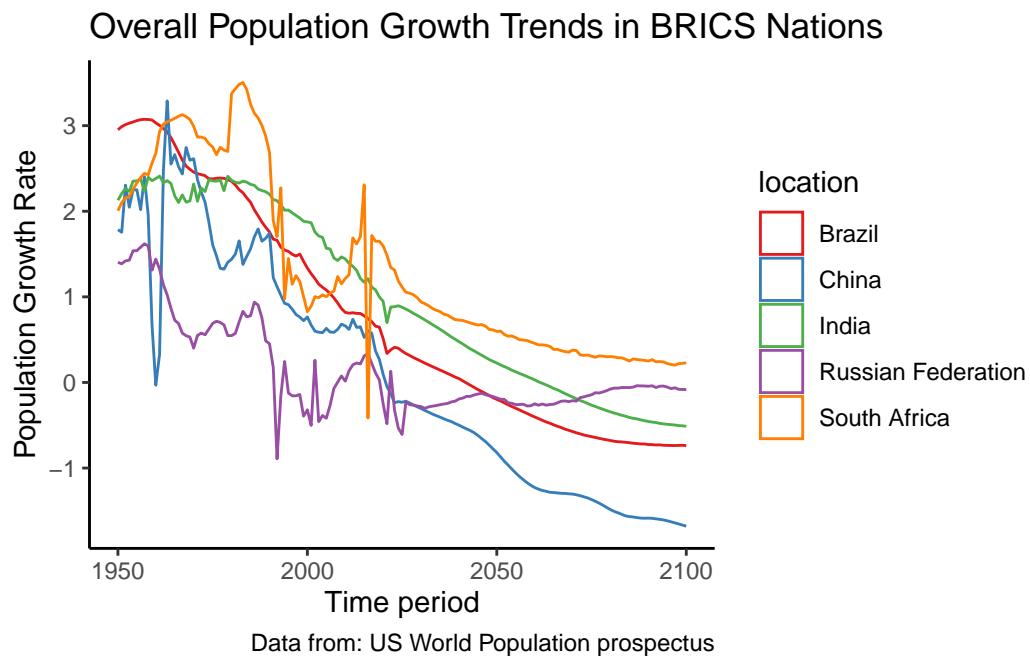
To gain a better understanding of this project report's primary objective we will be analysing the population metrics of countries that are under the BRICS trade coalition, namely (Brazil, Russia, India, China, and South Africa).

2. Summary Statistics of BRICS nation Data

location	pop_growth_rate	Time	life_exp
Length:755	Min. : -1.6790	Min. : 1950	Min. : 33.42
Class :character	1st Qu.: -0.2370	1st Qu.: 1987	1st Qu.: 63.68
Mode :character	Median : 0.4530	Median : 2025	Median : 72.94
	Mean : 0.6565	Mean : 2025	Mean : 70.92
	3rd Qu.: 1.5345	3rd Qu.: 2063	3rd Qu.: 80.31
	Max. : 3.5040	Max. : 2100	Max. : 89.79
median_pop_age	infant_mortality_rate	net_migrations	Deaths
Min. : 16.67	Min. : 0.8205	Min. : -1353.48	Min. : 233.4
1st Qu.: 22.14	1st Qu.: 3.9423	1st Qu.: -175.83	1st Qu.: 1049.4
Median : 33.94	Median : 12.4085	Median : -29.66	Median : 2099.2
Mean : 34.00	Mean : 33.5381	Mean : -30.76	Mean : 5979.2
3rd Qu.: 43.39	3rd Qu.: 47.8559	3rd Qu.: 179.00	3rd Qu.: 9512.1
Max. : 62.21	Max. : 196.1061	Max. : 1358.94	Max. : 21060.1
Births	life_exp_65_female	life_exp_65_male	
Min. : 534.1	Min. : 8.597	Min. : 6.96	
1st Qu.: 1231.0	1st Qu.: 14.704	1st Qu.: 12.30	
Median : 2810.7	Median : 17.908	Median : 14.77	
Mean : 7947.7	Mean : 18.031	Mean : 15.53	
3rd Qu.: 16079.4	3rd Qu.: 21.174	3rd Qu.: 18.43	
Max. : 33461.1	Max. : 27.350	Max. : 24.81	

The table above shows us the various distribution of recorded indicator levels. We are able to deduce that the average level of population growth for these developing nations is at a level of 0.6565 (US World Population prospectus, 2024) which is lower than that of the overall global population growth rate observed in the entire data set of 0.9881.

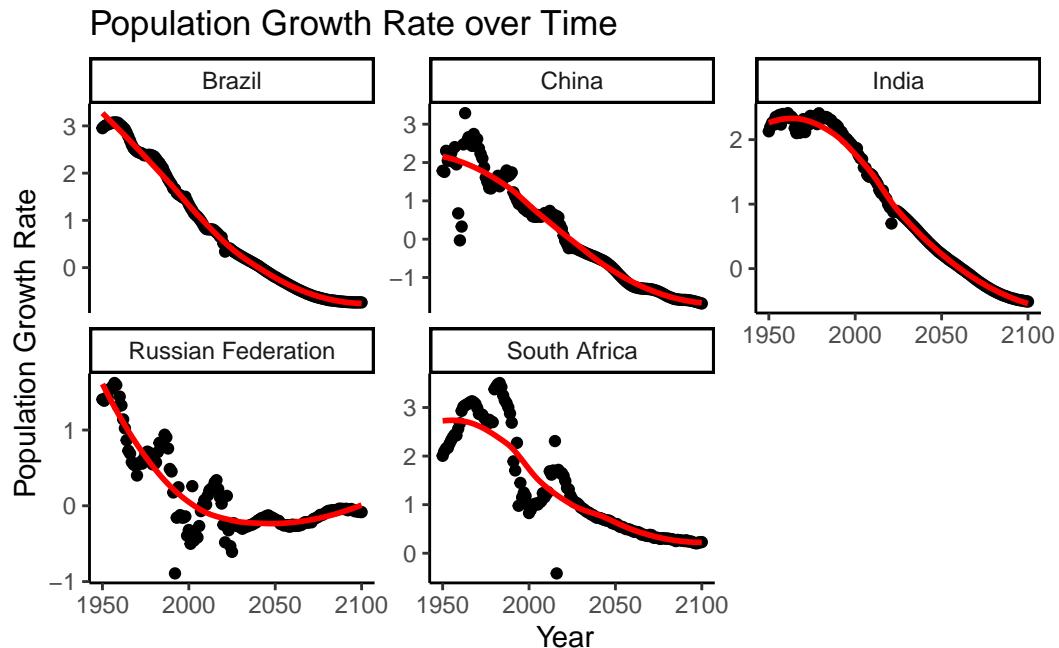
3. BRICS Nations Population Growth Rate



The above plot gives us a view of how the population growth rate moved throughout the period 1950 to a future prediction of movement to 2100. The graph indicates a declining rate which can be attributed to modernization and a general trend of people having less children within the countries.

4. Isolated Trend of BRICS Nations Population Growth Rate

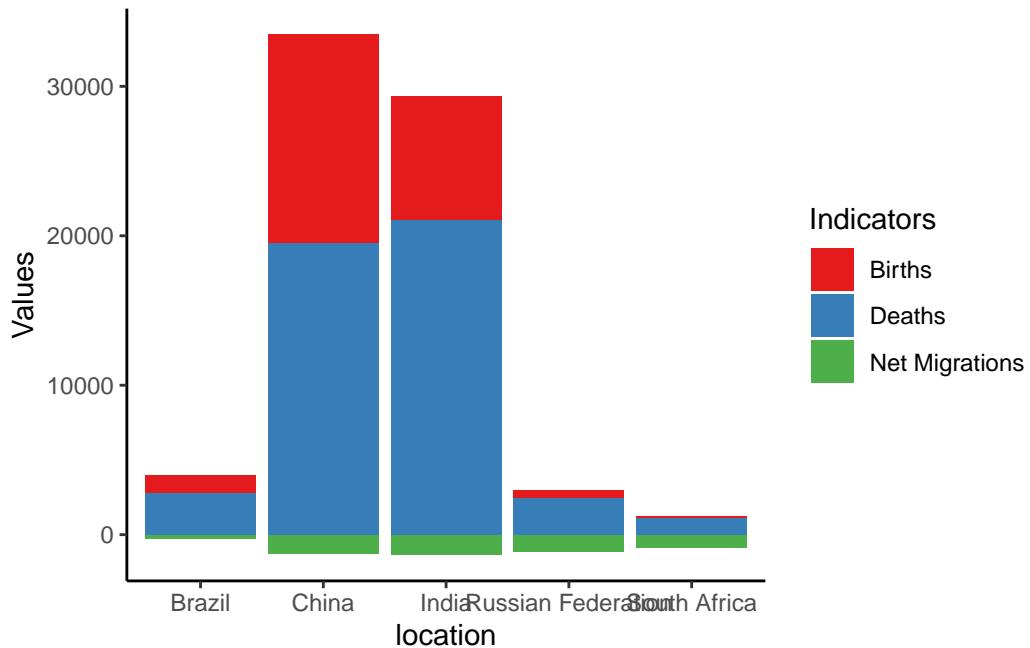
```
`geom_smooth()` using method = 'loess' and formula = 'y ~ x'
```



Whilst we were able to see the trend on line the above visualisation shows us the individual performance in a better view alongside the distribution of growth rates for each country in each period and future projects. The nations continue to follow a a decline, whilst Russia is projected to grow again in the future.

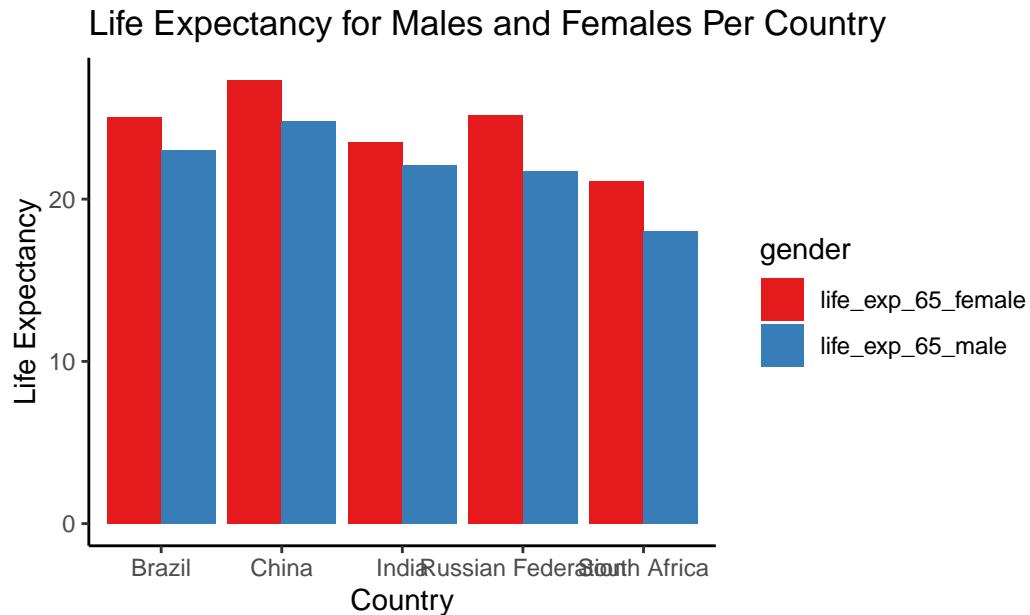
Furthermore we are able to view additional indicators of population growth and urbanization when we analyse the countries' individual factors such as their Net Migration, Deaths and Births.

5. BRICS Nations Indicators



We are thus able to analyse and compare the distribution of these metrics to draw inference for the above table on the factor affecting these nations. We are thus able to see that China has the highest birth rate throughout the years and tied with India the highest net migrations. Indacting that individuals from these countries to to leave and explore other countries that may be more deveoped and urbanized.

6. Life Expectancy Indicators



Furthermore we see that at age 65 the life expectancy for males and females in these countries is at a similar level. Such can be attributed to these nations falling under developing countries and thus the conditions for life are expected to be at similar levels.

Conclusion

Based on the EDA of the US World Population Prospectus data, BRICS nations exhibit significant population growth decline and growing urbanization trends. These trends have important implications for economic development and social structures. The analysis identified migrations and population growth rate movement, which are critical in providing valuable insights for policymakers and planners for future development and planning.

References

- <https://www.youtube.com/watch?v=CUbPdVn5lr4&t=219s>
- <https://www.youtube.com/watch?v=sV5lwAJ7vnQ&t=360s>
- WICKHAM, Hadley, ÇETINKAYA-RUNDEL, Mine and GROLEMUND, Garrett, 2023. R for Data Science: Import, Tidy, Transform, Visualize, and Model Data. Second edition. Beijing ; Sebastopol, CA: O'Reilly \[Online\] Available : <https://r4ds.hadley.nz>