Global Development Analysis

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About This Summary Document

- The purpose of this document is to:
  - Highlight the general approach adopted for the investigation
  - Display the key graphs/results from the analysis
- Only the most relevant results and insights were included in this document
  - For full details, see the Analysis Jupyter Notebook.

Motivation

- To provide a detailed analysis of global development trends and to identify any relevant discrepancies between in the economic growth/decline of different nations.

Data Source

- Compilation of World Development Indicator (WDI) data collected by various international organisations associated with the World Bank.
- The data set, stored as a SQLite file type, can be found on Kaggle.
- All monetary values have been adjusted for inflation and are expressed in terms of current US Dollars (US$).

Methodology

- The data was inspected visually such that the relevant tables for the analysis were identified and cleaned (i.e. missing values filled and duplicate rows removed).
- GDP (current US$) and annual GDP percentage change were used to assess economic development because of:
  - Insight into economic output and growth/decline.
  - Generally correlated with employment rate and income growth.
  - However, there are some limitations (e.g. neglects non-market activity and environmental/social factors).
- Evaluating relationships between indicators required Pearson (linear) and Spearman (non-linear) correlation metrics.
  - Whilst these measures provide insight into the correlation between factors, causation required human inference by applying logic and prior economic knowledge.

Initial Exploratory Data Analysis (EDA)

- Focused on observing global economic trends, such as:
  - GDP growth by region
  - The current fastest growing economies
  - The relationship between income (per capita) and economic growth.
- Most intriguing aspect was investigation into the highest GDP countries
  - Only countries that are not classed as ‘High Income’ are Brazil, China, and India; all newly industrialized countries (NICs)

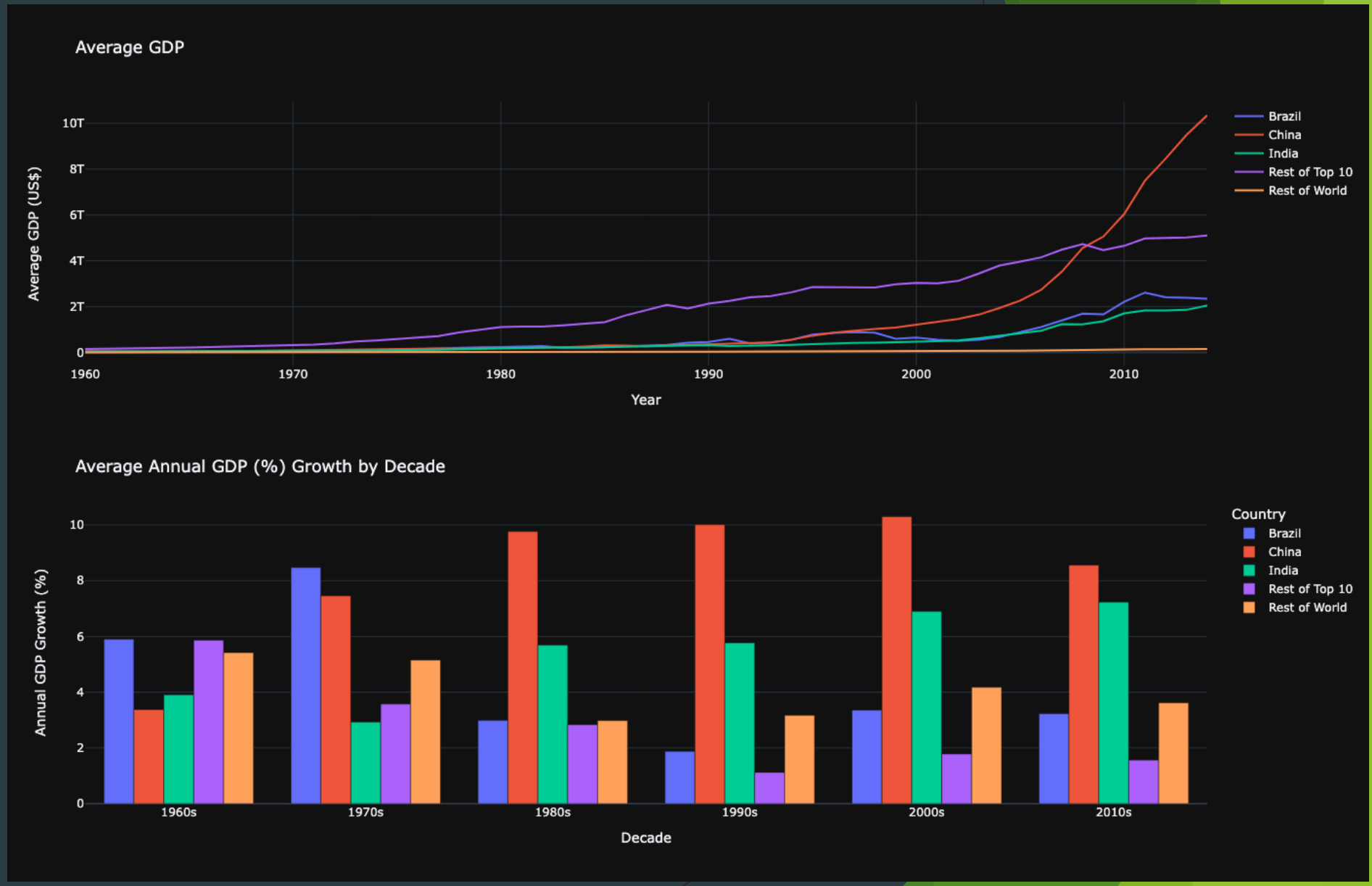
Country	Income_Group	GDP_US$
United States	High income: OECD	1.741900e+13
China	Upper middle income	1.035483e+13
Japan	High income: OECD	4.601461e+12
Germany	High income: OECD	3.868291e+12
United Kingdom	High income: OECD	2.988893e+12
France	High income: OECD	2.829192e+12
Brazil	Upper middle income	2.346076e+12
Italy	High income: OECD	2.141161e+12
India	Lower middle income	2.048517e+12
Russia	High income: nonOECD	1.860598e+12

Primary Focus of EDA

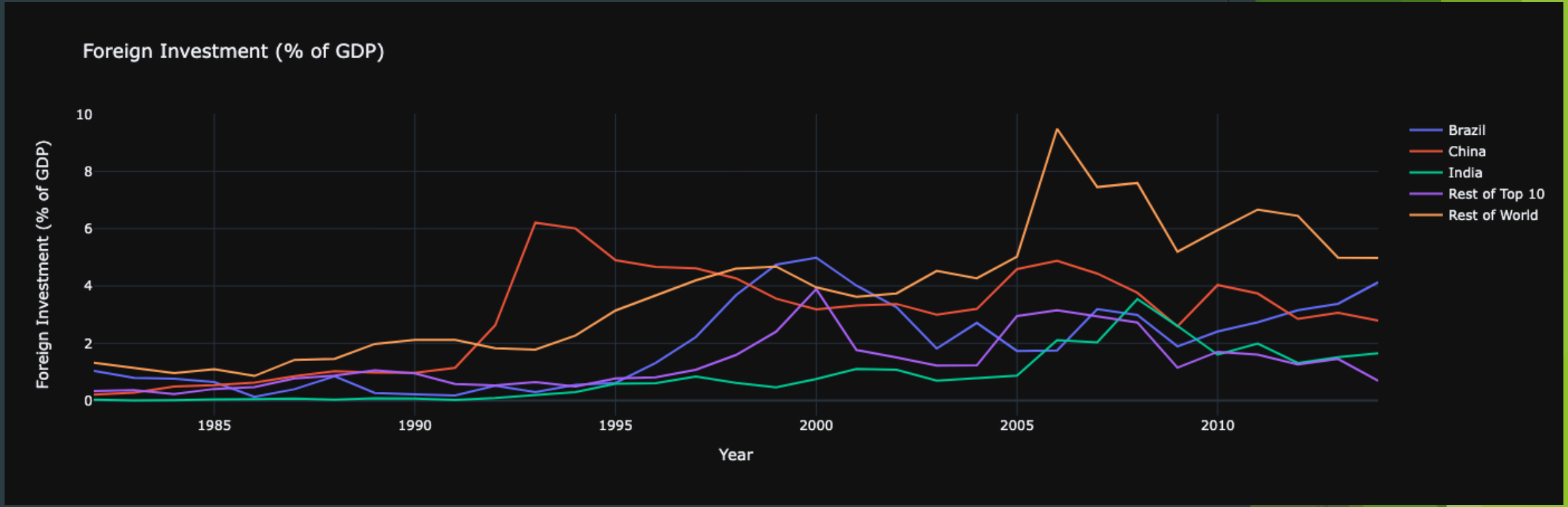
- Examine the differences between the high-GDP NICs with respect to:
  - Each other
  - The Rest of the Top 10 (countries by GDP)
  - The Rest of the World
- Determine factors that have driven the economic development of the NICs

Economic Growth Comparison

- During the 1960s and 70s, Brazil's average GDP percentage growth was the highest of the groups.
- From the 1980s onwards, China (followed by India) had by far the percentage growth.
- China's GDP exhibits massive exponential growth since ~ 1990; the reasons for this are a target for discovery.
- All the NICs (particularly China and India) experienced huge economic progression. Effects of three potential factors were investigated:
  - Foreign Investment
  - GDP composition by sector
  - Working age proportion of population

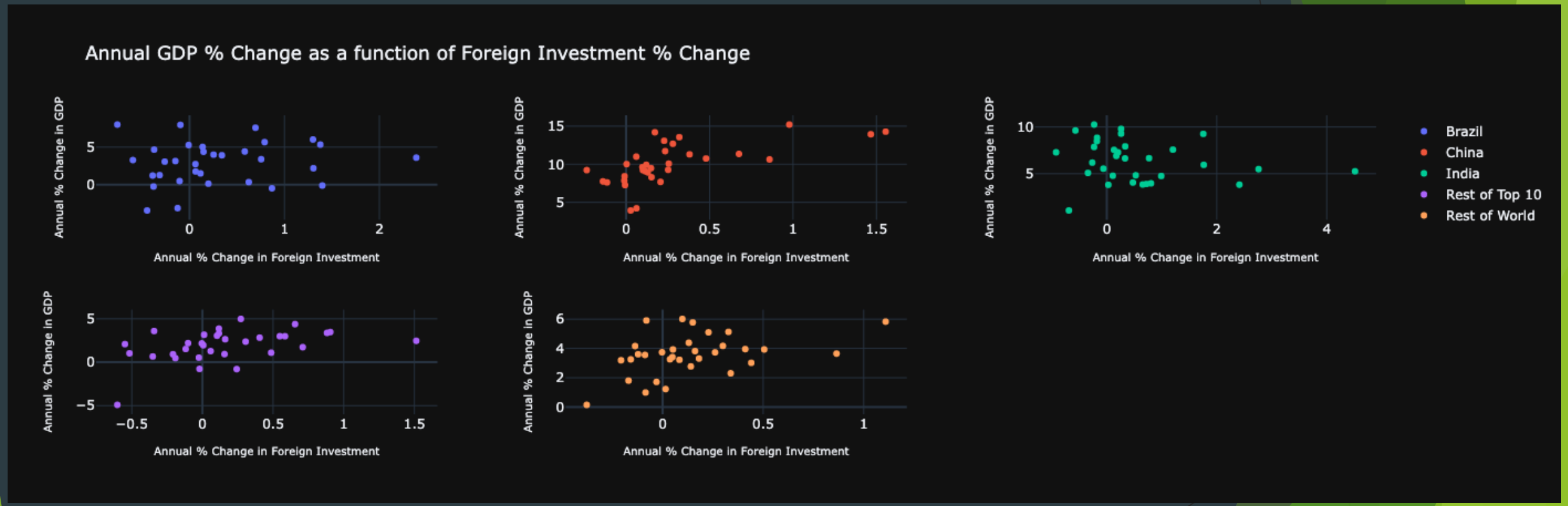


Foreign Investment



- Globally foreign investment has increased due to modern globalism.
- The 1992-94 spike in foreign investment in China coincides with the initiation of China's exponential GDP growth and so indicates that foreign investment is a contributing factor to their rapid economic development.
- A more steady rise in foreign investment in Brazil (from 1995 to 2000) is concurrent with variable GDP growth thus indicating the increasing foreign investment is not a guaranteed method to bolster economic progression.

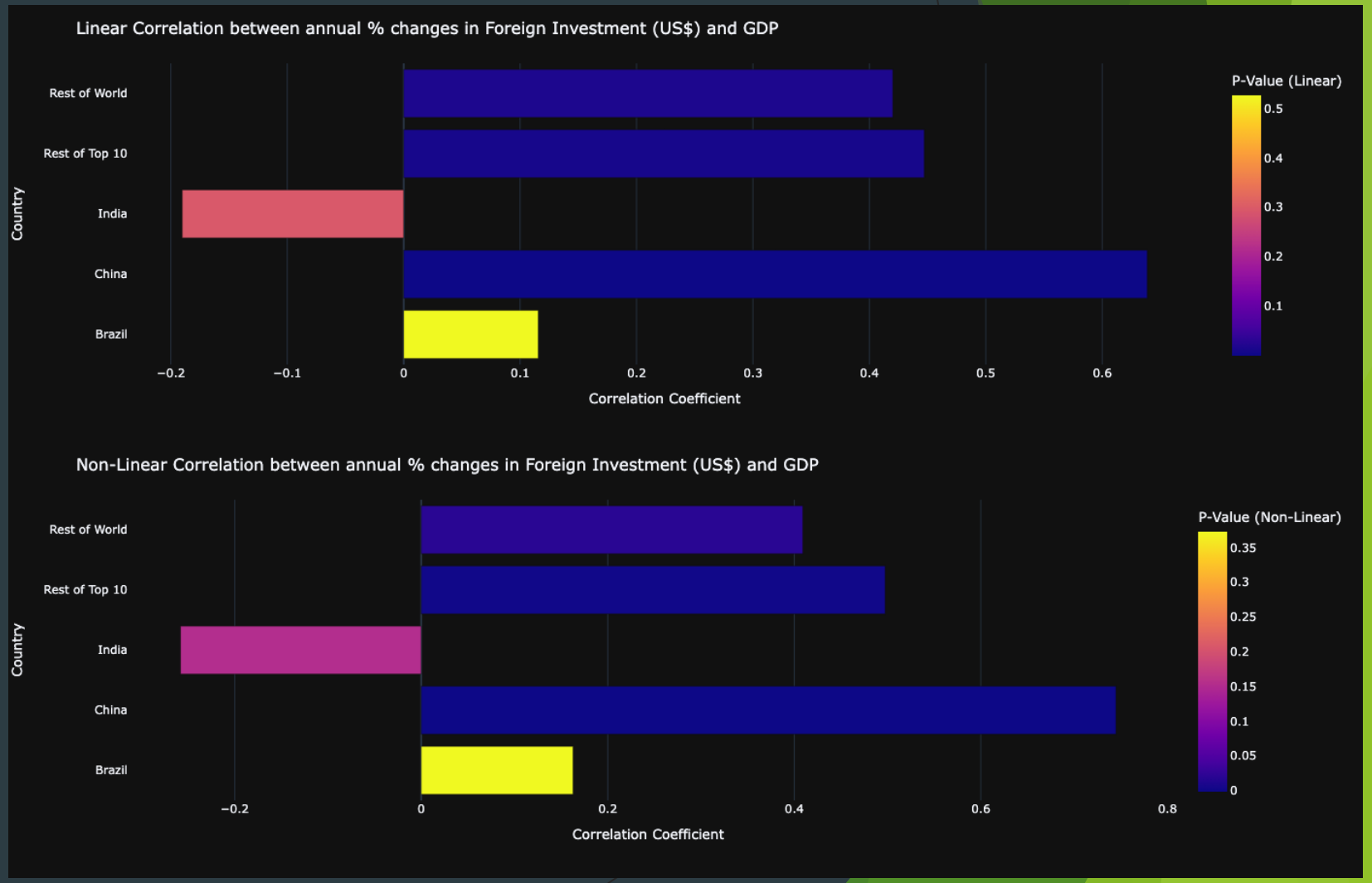
GDP Growth dependence on Foreign Investment



- Correlation, between changes in GDP and Foreign Investment, apparent for China, the Rest of Top 10, and Rest of World
  - Correlation measures (e.g. Pearson for linear and Spearman for non-linear trends) are required for confirmation

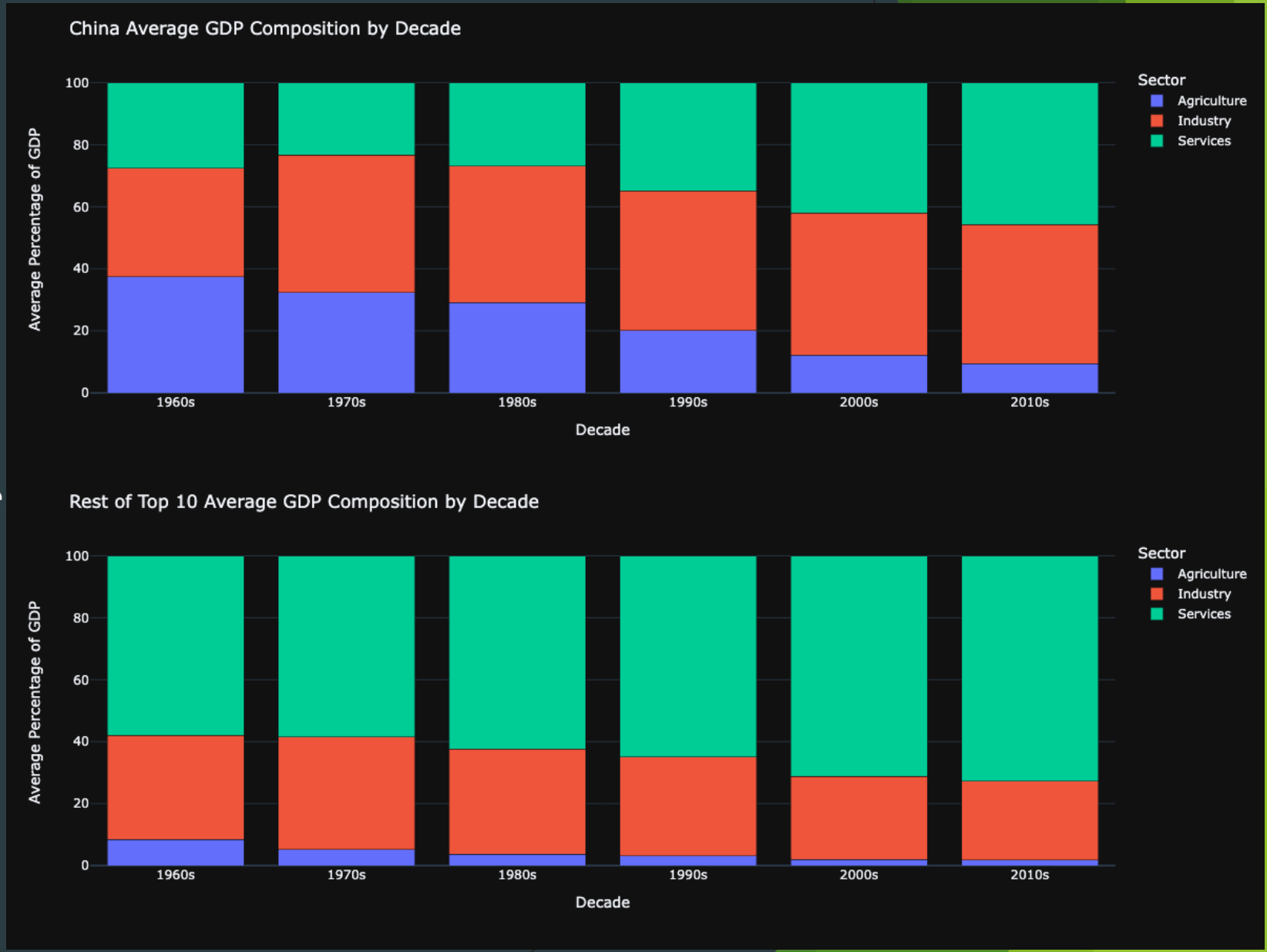
Foreign Investment and GDP Growth Correlation

- For Brazil and India, p-values > 0.05; too high for clear correlation.
- For China, Rest of the Top 10, and Rest of the World there is clear evidence for moderate positive correlation
- China's correlation coefficient is more than 50% greater than the others
  - Stronger link between foreign investment and GDP growth supporting notion of China's exponential economic growth being driven by foreign investment

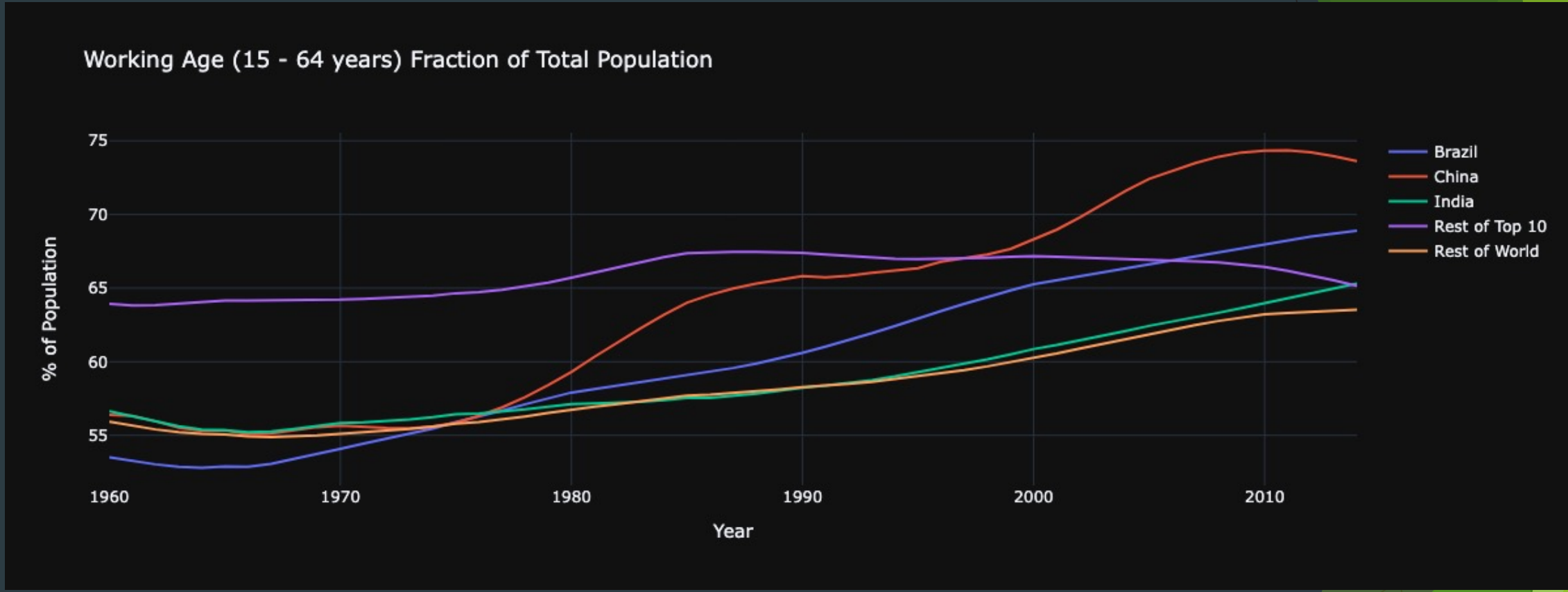


GDP Breakdown (by sector)

- Globally, relative contribution of services sector has grown and agriculture sector declined
- Unlike the other groups, China and India's services sector contributions have not surpassed 50% of GDP, retaining relatively high contributions from industry (particularly China) and agriculture (especially India)
  - The more varied, less services-dependent economies were a contributing factor to the robustness of China and India's GDP growth during the 2008 financial crisis



Working Population



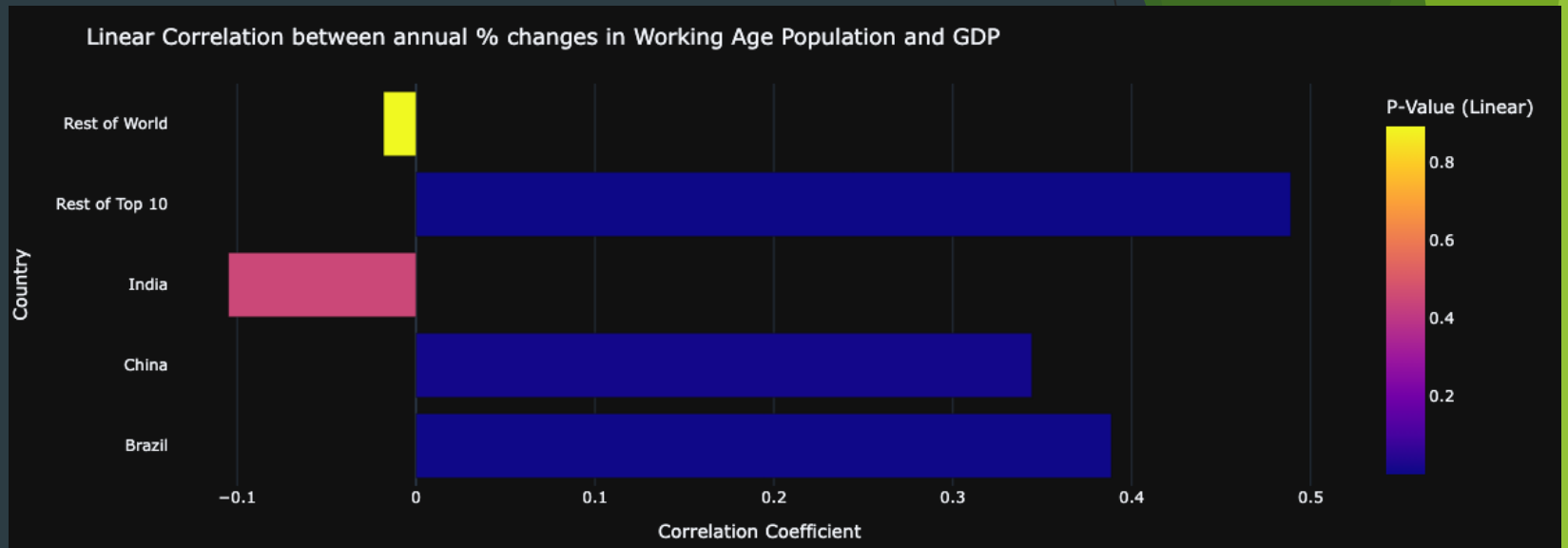
- Other than the Rest of the Top 10, global increase in working age population proportion
  - Increase due to high birth rates and shift towards less dangerous occupations
- Since 1988, decrease in working age proportion in Rest of the Top 10 due to declining birth rates and superior healthcare such that elderly population proportion increases

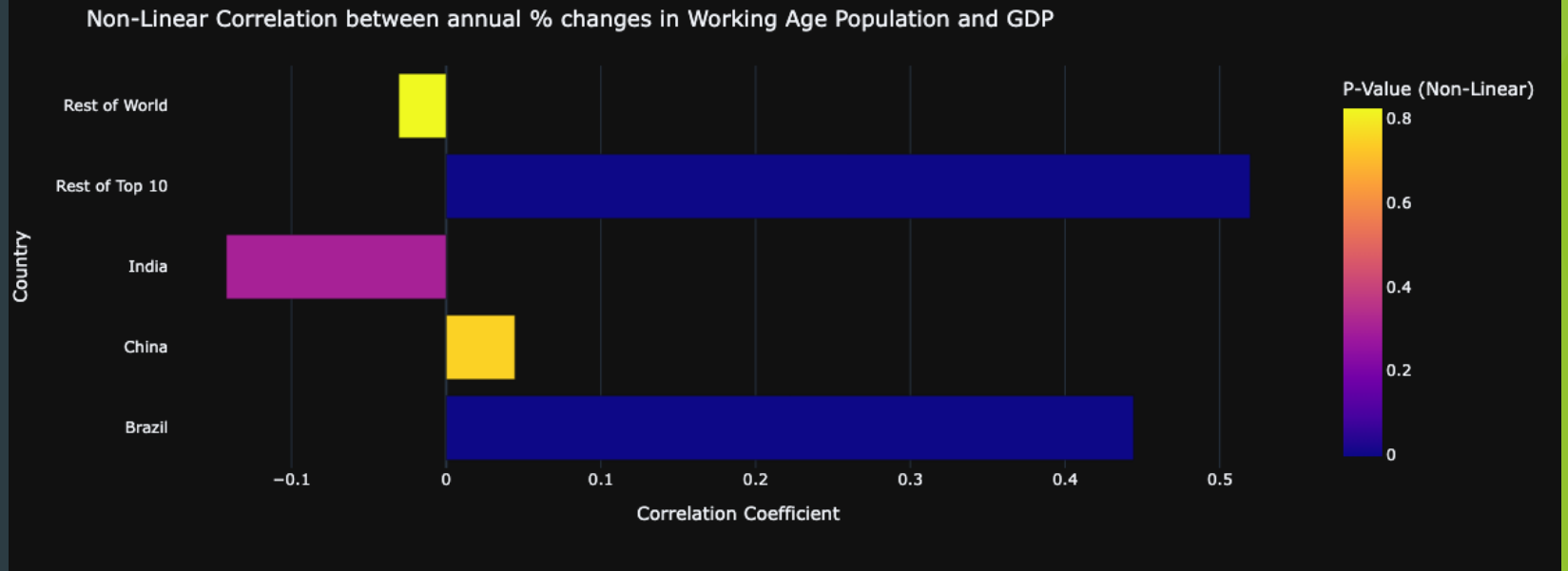
GDP Growth Dependence on Working Population

- Apparent correlations, between changes in GDP and Working Population, in China and the Rest of the Top 10
  - Correlation measures required for verification

Working Age Proportion and GDP Growth Correlation

- Significant evidence of linear correlation, between annual fluctuations in working age population and GDP, for Brazil, China, and the Rest of the Top 10.
- Linear correlation coefficient of the Rest of the Top 10 is more than 20 % higher than others
  - Indicates greater dependency on working population for economic growth
- Statistically insignificant(p-value > 0.05) evidence of correlation for India and the Rest of the World





Caveat: Correlation or Causation

- Correlations between annual changes in GDP and Foreign Investment/Working Population have been observed across several countries/groups
  - Whether GDP changes instigate changes in Foreign Investment/Working Population (or vice versa) is undetermined
  - Alternatively, the correlations between the variables may be caused by third-party features instigating concurrent changes in both GDP and Foreign Investment/Working Population
- Despite these doubts, there is considerable evidence supporting the notion that Foreign Investment and Working Age Population directly impact economic growth (see Borenszstein *et al* (1998) for Foreign Investment and ILOSTAT Report for Working Age Population)
  - Academic literature supports conclusions that these factors are contributing factors to GDP change

Conclusions

- Foreign investment was a significant factor in China's economic growth from the early 1990s
- The varied and relatively low dependency on the services sector of China and India's economy was a plausible reason for their continued GDP growth during the 2008 financial crisis
- The economic growth of 'High Income' Top 10 Countries (by GDP) is considerably more dependent on the working age population, than in Brazil or China
  - Suggests that the economic value per worker in the 'High Income' Top 10 countries is higher than the other groups
- Only handful of indicators were investigated
  - More rigorous investigation would require significantly more time and expertise, although the interesting insights revealed during this investigation are valid contributions to the study of NICs