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Final Project Report

Influence of Political Factors on Foreign Direct Investment in China and India

Introduction

Project Goal

Foreign direct investment (FDI) refers to an investment made by an institution or individual from one country into another. In the long-run FDI has the capacity to form geopolitical juxtaposition such as the difference in economic growth seen between North and South Korea throughout modern history. This project aims to determine the political factors which have impacted foreign direct investment in China and India over the past three decades.

This project aims to determine the factors that impact a country's ability to stimulate foreign direct investment - specifically focusing on political factors, government policies, and economic intervention. During the specified period, China has adequately stimulated FDI and achieved remarkable economic growth while many of its neighbors have lagged. This can largely be attributable to China's socialist economic model characterized by a state ownership of goods with a private control over manufacturing, allocation of resources to educating its youth, providing subsidies to growth driving industries. This has paralleled an unimpressive growth rate in India - attributable to government corruption, lack of spending on sanitation and education, lingering effects of a caste system, overemployment in federal government and under employment in state and local government, lack of incentives for FDI, etc.

A final point that should be made clear is the lack of robust statistical analysis within political academia. Though the ability of political scientists to theorize is accepted in academia, political academia was late to reap the benefits of thorough and advanced statistical analysis. Thus, applications of robust data analysis, statistical methods, software architecture, and advanced machine learning models could prove to be revolutionary in the way we approach politics.

GDP vs GNP

Before viewing the data, it is important to have a fundamental understanding of why FDI is desired. Gross domestic product (GDP) is known as the aggregate production of goods and services within a country during a given period of time Contrarily, gross national product (GNP) is the aggregate production of goods and services by a country - domestically or internationally - during a given period of time. Formally speaking, foreign direct investment is the "net inflow of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor". Ultimately, inflows of FDI spur domestic economic growth and contribute to GDP rather than GNP. This has the effect of boosting job growth, infrastructure development, and can strengthen an economy's currency.

While the academic literature suggests that factors that support government stability are the primary factors attracting FDI, China has seen far more FDI since the Deng Xiaoping era. Therefore, expropriation, centralized economic decision making, and structured strategies towards attracting FDI have a greater impact on foreign direct investment into developing countries.

Structure of This Project

Firstly, this report will contain a brief historical overview of the Chinese and Indian economic superpowers. Then the strategy for collecting data and approaching the project will be discussed. Lastly, the tools and techniques used in the project will be described in greater detail before presenting the findings.

Historical Background

Chinese Political Structure

Following the Chinese civil war from 1927-1949, the emerging political faction - led by Mao Zedong - aimed to abolish warlordism and the age of imperial China. Largely inspired by Vladimir Lenin and the Bolshevik revolution of 1917, the People's Republic of China adopted a socialist form of government. During the process Mao led China through great periods of famine and suffering by sending young citizens to harvest crops for the state, restricting education, exploiting the lower class by forcing them into steel manufacturing, meeting attempts at privatization with swift repression, etc. During periods known as the Great Leap Forward and the Cultural Revolution, Mao caused the deaths of tens of millions. China had faced a demographic crisis and was in need of a revolution.

Chinese Economic System

At the time of Mao's death around 1980, Deng Xiaoping became the General Secretary of the Chinese Communist Party. Deng's actions resulted in hundreds of millions being freed from poverty and famine, a dramatic increase in the education rate, and the adoption of a semi-privatized economy. Though Deng adhered to traditional Chinese socialist practices like registered housing, his reforms are primarily responsible for shaping the economic giant that China is today through the establishment of special economic zones, embrace of small businesses, and restructuring of the educational system. Ultimately, Deng Xiaoping's legacy was tarnished due to the Tiananmen Square of 1989.

Indian Political Structure

As a relatively young government which was dramatically influenced by British colonial rule, the Indian government, political landscape, and economy has faced severe turbulence through its lifetime - even requiring a multi-billion dollar loan from the International Monetary Fund after the collapse of the Soviet Union. Moreover, India faces lingering effects even over 70 years after it underwent partition into Pakistan, West Pakistan (Bangladesh), and India. That said, India has seen rapid economic growth over the past decade - arguably due to Narendra Modi, its conservative prime minister of over 10 years.

Indian Economic System

After the collapse of the Soviet Union in 1991, India underwent a vast economic liberalization. Plagued with poor property right laws for years, India abolished the License Raj - a complex regulatory system. India became open to global markets and gradually distanced itself from the protectionist economic policy it had adopted for decades. Though India and its federal

and state governments are far from free from issue, it has achieved noteworthy economic growth over the past two decades and is predicted to grow as a manufacturing giant and target for foreign direct investment over the years to come.

Analysis Strategy

Which Political Factors Influence FDI?

According to literature on political determinants of foreign direct investment, factors including Rule of Law, government corruption, property laws, regulatory processes, and economic governance strongly dictates a nation's investment inflows. Moreover, these factors tend to correlate strongly with government stability when analyzing investment from developed economies to developing countries (Busse and Hefeker, 2007). Thus, the collected data should include aggregate FDI data, governance indicators (e.g. Rule of Law, government stability, etc.), and indicators of economic freedom (e.g. property rights, trade freedom, business freedom, etc.).

Key Data Sources

- Index of Economic Freedom - Heritage Foundation: a database based on indexes on property rights, government integrity, judicial effectiveness, business freedom, and trade freedom.
- Federal Reserve Economic Data (FRED): a database hosted by the Federal Reserve bank of St. Louis containing vast collections of economic data.
    - China nominal GDP
    - India nominal GDP
- World Bank Governance Indicators Database: a database from the World Bank containing indexes on corruption control, political stability and absence of terrorism, Rule of Law, and regulatory quality
- World Bank Special Economic Zones Database: a database containing information on global special economic zones.
- OECD FDI restrictiveness database: a database containing indexes and categorical indicators that describe whether or not FDI was restrictive or flowing in a given country during a given year.

Data Collection

The primary method of data collection used was loading data from online databases.

Data Cleaning and Transformation

Cleaning and Transformation

1. Since the collected FDI data was in the format of "Percentage of GDP", it needed to be converted to represent an absolute FDI. This could simply be done by converting the nominal GDP datasets to real GDP to adjust for inflation and multiplying the percentages

of GDP by the total GDP to get the aggregate FDI data. However, converting the GDP data would have been inefficient. Thus, a dataset with real GDP was found and converted from an Excel spreadsheet to PANDAS DataFrame.

```
new_path = "C:\\Users\\Harb\\OneDrive\\Documents\\foreign-direct-investment-analysis\\data\\raw\\real_gdp\\real_gdp_china.xls
real_china = pd.read_excel(new_path, sheet_name="Data")
real_china.drop(labels=["Unnamed: 0"], axis=1, inplace=True)
headers=["Year", "Real GDP"]
real_china.columns = headers
real_china.drop(labels=[0, 1, 2, 3], axis=0, inplace=True)
real_china.reset_index(drop=True, inplace=True)

real_china.head()

export_path = "C:\\Users\\Harb\\OneDrive\\Documents\\foreign-direct-investment-analysis\\data\\processed\\real_gdp\\real_gdp_
real_china.to_csv(export_path, index=True)
```

2. At this point, the FDI formatting process can be performed. The collected FDI and GDP databases are merged and an Absolute FDI column is generated.

```
merged_data = pd.merge(gdp_combined, fdi_tidy, on=['Year', 'Country Code'], how='inner')

merged_data['Absolute FDI (Billion USD)'] = (merged_data['GDP (Billion USD)'] *
                                             merged_data['FDI Percentage'] / 100)

output_path = 'C:\\Users\\Harb\\OneDrive\\Documents\\foreign-direct-investment-analysis\\data\\processed\\fdi_data\\fdi_data.
merged_data.to_csv(output_path, index=False)

print(f"Processed data has been saved to {output_path}")
merged_data
```

3. At this stage, the political factors data collected from the other sources must be formatted.
    a. The Economic Freedom Index data is cleaned to only include data from China and India.
    b. The OECD FDI is cleaned to only include relevant columns and to also only include data from China and India.
    c. The World Bank governance indicators dataset is reduced.
    d. The World Bank special economic zones dataset must be converted from JSON format to a PANDAS DataFrame.

Data Storage

MySQL Server

The database chosen for storage and querying is MySQL, primarily due to its strong performance for small, simple datasets like the ones used for this project's analysis. A MySQL server was hosted locally and a database was generated and populated using the Python MySQL connector API.

SQL Database Creation and Population

Using PANDAS and the MySQL connector API, the data is used to create SQL databases and populate them using PANDAS DataFrames. A database is first created, then tables are initialized for each dataset. Lastly, the rows of the DataFrames are iterated upon and inserted into the SQL databases. This database provides robust storage and accessibility of the data.

```
def create_database():
    try:

        cursor = connection.cursor()

        cursor.execute(f"CREATE DATABASE IF NOT EXISTS {MYSQL_CONFIG['database']}")
        cursor.execute(f"USE {MYSQL_CONFIG['database']}")

        datasets = {
            "governance_indicators": governance_indicators,
            "economic_freedom_country_scores": economic_freedom_scores,
            "oecd_fdi_flows_restrictiveness": oecd_fdi_data,
            "global_special_economic_zones": global_sez
        }

        for table_name, df in datasets.items():
            create_table_from_dataframe(cursor, table_name, df)

        connection.commit()

        print("Tables done.")
```

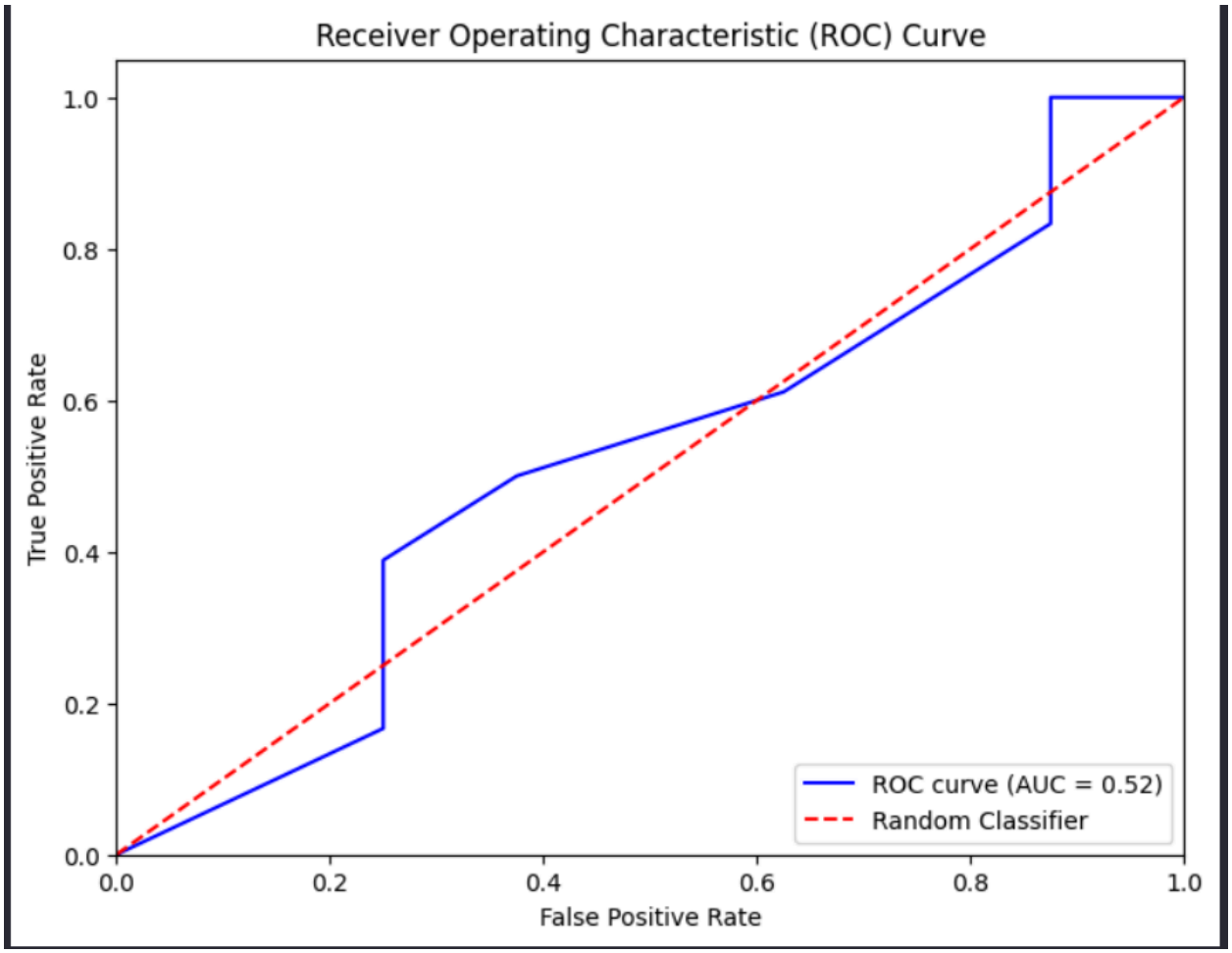
Model Selection, Implementation, and Evaluation

Regression Analysis

The first goal of regression analysis in this project was to determine whether or not the Heritage Foundation's Economic Freedom Index correlates expectedly with the FDI restrictiveness index from the Organization for Economic Co-operation and Development (OECD). That is, they are positively correlated. If this is the case, it can be determined that factors that impact economic freedom have a direct relationship with FDI incentives from other countries. Additionally, given a high correlation, only the Economic Freedom dataset would need to be used for regression modeling with FDI data. The datasets were imported from the MySQL server, preprocessed, and merged.

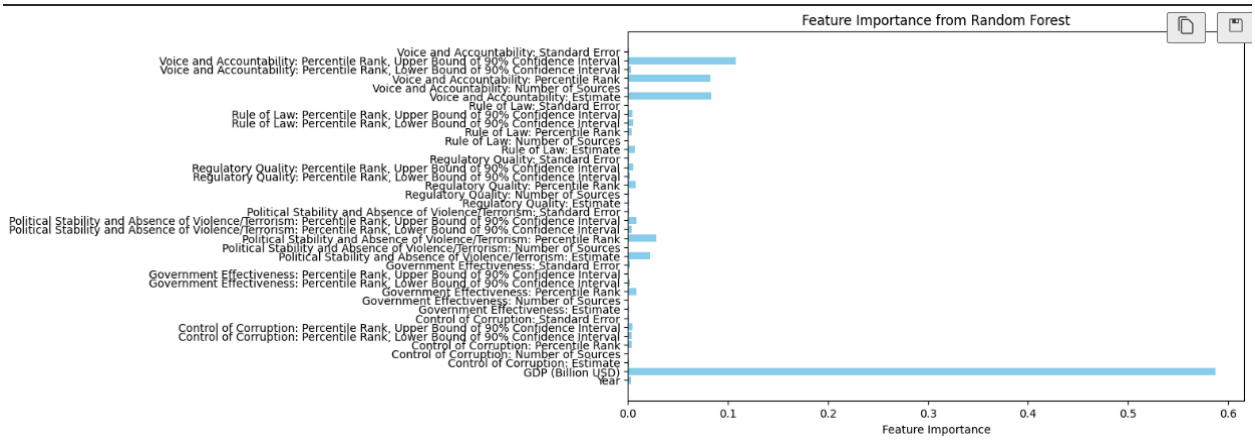
The dataset was prepared for multiple regression analysis since there were many variables in the Economic Freedom Index that could've potentially correlated with FDI restrictiveness. However, based on the variance inflation factor from the independent variables, they were too closely related, causing high multicollinearity. Thus, only the "Overall" column was used as a representative variable to perform regression analysis against the FDI restrictiveness categorical variable. Since the FDI restrictiveness data is categorical, a logistic regression was performed. According to the classification report comparing the test and prediction data, the logistic regression model performed successfully when predicting FDI inflows, but poorly when predicting restrictiveness.

	precision	recall	f1-score	support
0	0.25	0.12	0.17	8
1	0.68	0.83	0.75	18
accuracy			0.62	26
macro avg	0.47	0.48	0.46	26
weighted avg	0.55	0.62	0.57	26

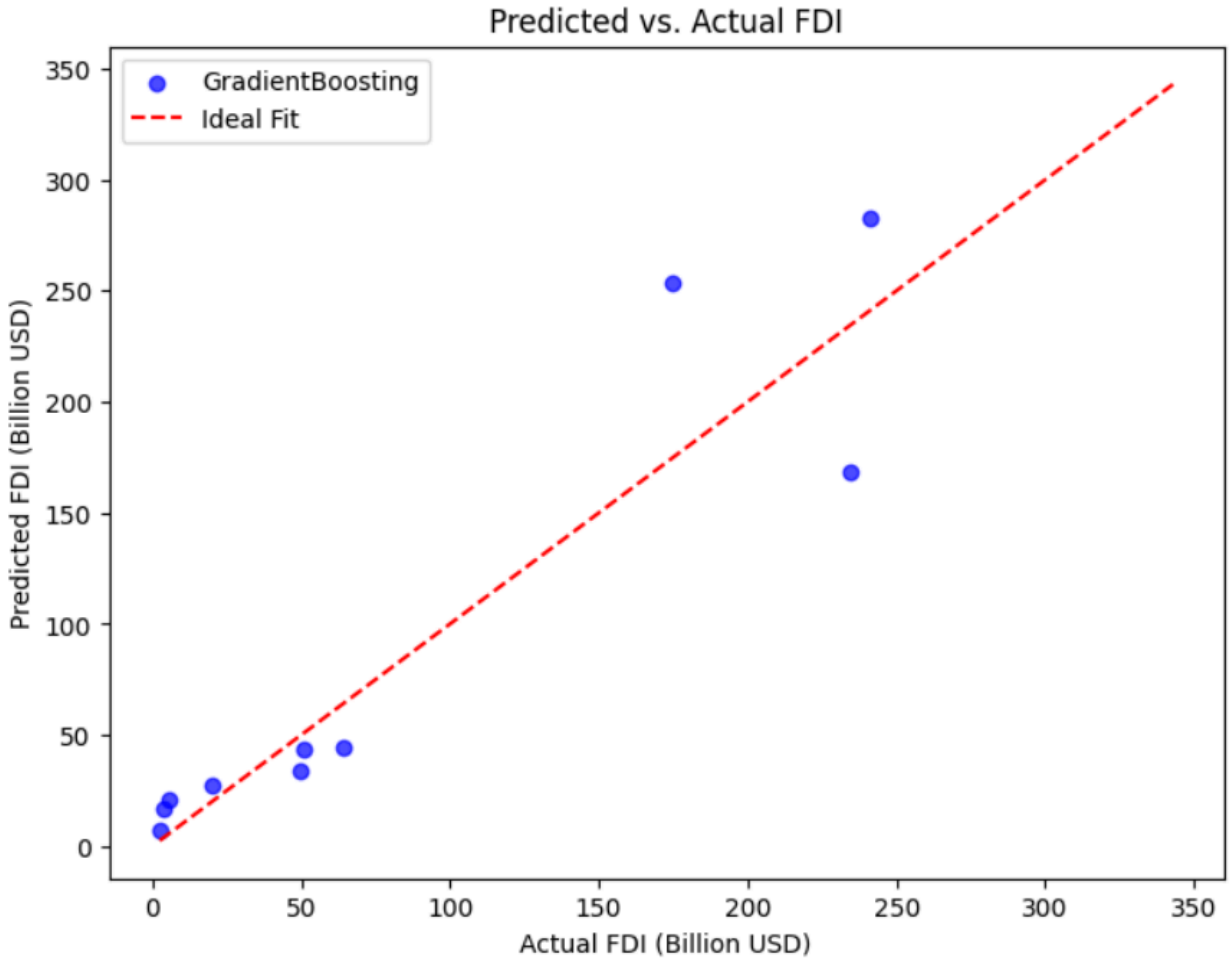


Next, linear regression analysis was performed between governance indicators and the FDI data. Again, data was imported from the SQL server and processed for testing. In this case, the linear regression model performed poorly since the relationship between the variables was not linear. Therefore, it was concluded that a random forest regression model would be better suited for determining a relationship between individual variables and FDI. The random forest model performed successfully and indicated that voice and accountability, political stability,

absence of violence/terrorism, and government effectiveness displayed high feature importance in predicting FDI.



Since the linear regression model performed poorly, a model that is more effective at predicting non-linear data with mixed relationships should be considered: gradient boosting regression. After training the model, an R-squared metric of 0.84 was achieved, indicating a successful result.



Linear regression and time series modeling was performed on the economic freedom and FDI datasets. Data was imported and cleaned by reducing the variables of the economic freedom data to the relevant columns. An ordinary-least square regression was performed on the data, revealing that the “Overall” and ”Property Rights” variables were useful in predicting FDI, whereas “Government Integrity”, “Business Freedom”, “Trade Freedom”, and “Investment Freedom” were more difficult to interpret.

```
                            OLS Regression Results
==============================================================================
Dep. Variable:     Absolute FDI (Billion USD)   R-squared:                       0.917
Model:                                    OLS   Adj. R-squared:                  0.834
Method:                         Least Squares   F-statistic:                     11.06
Date:                        Wed, 11 Dec 2024   Prob (F-statistic):            0.00501
Time:                                20:39:06   Log-Likelihood:                -62.169
No. Observations:                          13   AIC:                             138.3
Df Residuals:                               6   BIC:                             142.3
Df Model:                                   6
Covariance Type:                    nonrobust
==============================================================================
                         coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
const                -423.4296    677.681     -0.625      0.555   -2081.654    1234.795
Overall                 0.7235      6.818      0.106      0.919     -15.960      17.407
Property Rights         0.8156      3.999      0.204      0.845      -8.969      10.600
Government Integrity    6.6017      6.998      0.943      0.382     -10.522      23.726
Business Freedom        1.9260      2.310      0.834      0.436      -3.726       7.578
Trade Freedom           4.9291      6.724      0.733      0.491     -11.524      21.382
Investment Freedom     -9.8006      2.262     -4.333      0.005     -15.336      -4.266
==============================================================================
Omnibus:                        1.436   Durbin-Watson:                   2.876
Prob(Omnibus):                  0.488   Jarque-Bera (JB):                1.124
Skew:                           0.617   Prob(JB):                        0.570
```

Time Series Model

Lastly, a Holt-Winters model was used to perform time series analysis due to its robustness in capturing trends and ability to perform analysis on data without a clear seasonality by using exponential smoothing. Using the HW model, a 5-year forecast was able to be obtained on inflows of FDI in China and India.

Citations

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