Correlation between Exchange rates and Growth in GDP in Brazil

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INTRODUCTION

Understanding Exchange Rates
It is known that the United states has a strong economy, but how do this affect other countries? This is answered with a very fundamental theory of economics – gains from trade. The US buys goods and services from other countries to promote our economy, in turn affecting the other countries economies as well. If a country has a high exchange rate they will experience less gains from trade as it will cost the US more to import from them, and vice versa if they are low. This and the high value of the USD (United States Dollar) causes many countries rely on the USD.

Introducing "Plano Real"
July 1st 1994 the Brazilian Real was introduced with hopes that it would stabilize the Brazilian economy and counter the hyperinflation that they were facing. This was also the creation of UNV, Unit of Real Value, which played as the intermediate between the modern Real and the cruzeiro Real. At the time, the Real and UNV were 1:1, and the UNV was worth 2750 Cruzeiro Real, while also setting the new Real equivalent to the USD (1 USD = 1R\$ = 1UNV = 2750CR\$) . The goal of "Plano Real" was to depreciate their currency, encouraging trade and stabilize/decrease inflation all by pegging the USD. Inflation decreased to single digits and the economy stabilized, but over the introduction period the Real appreciated. In 1999, Brazil decided to stop pegging the USD and switch to a floating exchange rate.

GOALS

Tracking GDP and Exchange Rates

To what extent does the exchange rate impact GDP statistically?

The overarching goal was to track average exchange rates and GDP to see if there was any correlation. I wanted to learn more about this because Brazil has the 8th largest GDP in the world yet it is still a developing country

While in Brazil

While in Brazil, my main goal was to understand more about exchange rates. By dealing with exchange rates first hand, I hoped to see if my actions individually match what I have learned in different classes. To observe this I planned to tracked all my purchases and different exchange rates through ATMs, Debit/Credit Cards, and Monetary exchanges.

METHOD

Gaining data

While I was in Brazil, I viewed my purchases as a foreign investor. I kept track of all my purchases as well as the means by which they were bought: Credit/debit or real. This gave me a perspective that if I were in fact a foreign nation, I would be more likely to invest in Brazil because the USD had more purchasing power there; I was able to buy more in Brazil than in the US for the same price.

The overarching goal was to look at multiple years of data, not just one weeks. This data, GDP and exchange rates of Brazil, was available on the FRED database. The first graph below is a graph of the Real/USD exchange rates over the past 22 years. The orange line is the average annual while the blue is the daily rate. The second graph is of Brazil's GDP over the past 23 years.
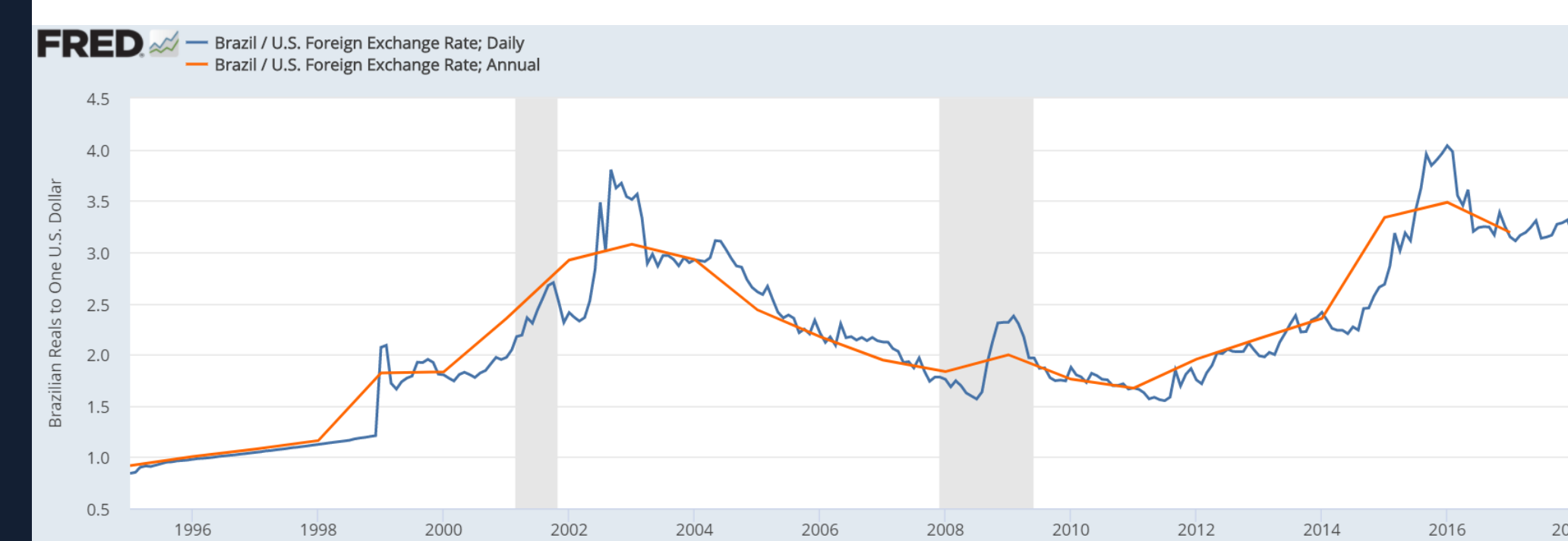
Graph pf Daily and Average Annual Exchange rates from 1994-2017.
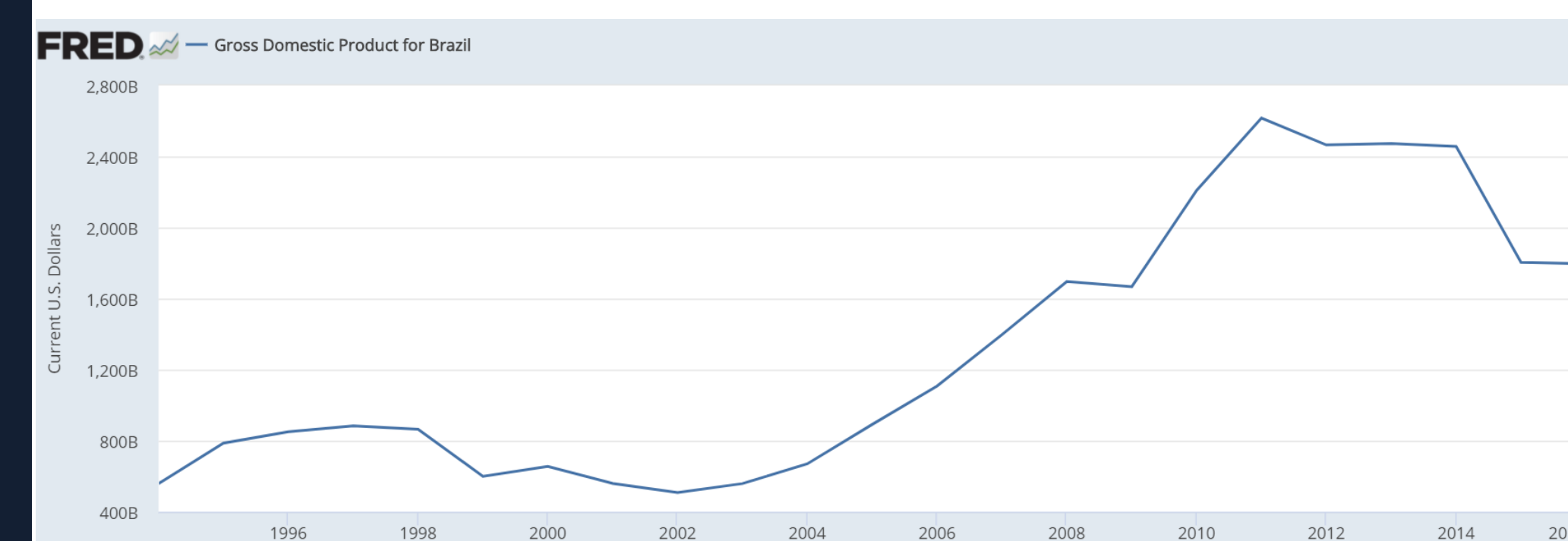
Graph of Brazil's GDP is current USD from 1994-2017

From first glance it seems to be an opposite relationship between exchange rates and GDP, so the following simple linear regression equation can be postulated:

$$GDP = \beta o + \text{-}ERx_1 + \varepsilon$$

The data was run through R studio to statistically analyze and verify that the data met all the assumptions. This meant testing for autocorrelation, homoscedasticity, multicollinearity, No serious outliers, and normality. Right away a time series was needed to fix auto-correlation, but other than that the data passed.

RESULTS

R model summary on given model

```
Call:
lm(formula = GDP.in.Current.USD ~ Exchange.Rate + Time)

Residuals:
    Min      1Q  Median      3Q     Max
-539.25 -134.61   24.27  155.49  338.67

Coefficients:
               Estimate Std. Error t value Pr(>|t|)
(Intercept)     8780.91     149.10  58.892  < 2e-16 ***
Exchange.Rate   -657.89      81.98  -8.025 1.60e-07 ***
Time             221.66       9.18  24.147 1.01e-15 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 223.9 on 19 degrees of freedom
Multiple R-squared:  0.9709,    Adjusted R-squared:  0.9678
F-statistic: 316.6 on 2 and 19 DF,  p-value: 2.578e-15
```

Test results from running a regression analysis in R

Final Model:

$$GDP = \beta o + \text{-}ERx_1 + TIMEx_1 + \varepsilon$$

Adding the time series was all that was needed to fix this data. Going from a coefficient of correlation of .-28 to -.99, it is evident here that in a time series, foreign exchange rates and GDP are negatively related. This high correlation value also tells us that foreign exchange rates are strong indicators of Brazil's GDP. Based on the analysis, for every point the \$USD/\$R raises, Brazil's GDP will drop on average \$657.89B. On a more feasible level, for every .1 point the \$USD/\$R increases, Brazil's GDP lowers by \$65.789B. Countering this though, every year that passes by, Brazil's GDP will increase by \$221.66B

This trend can be seen once again by apply this new equation. When comparing the graphs of the predicated GDP and actual GDP (graph pictured below) they are closely aligned. It is not perfect, as the predicted values can be seen weaving through the actual values, but is close enough to reasonably infer a close relationship.
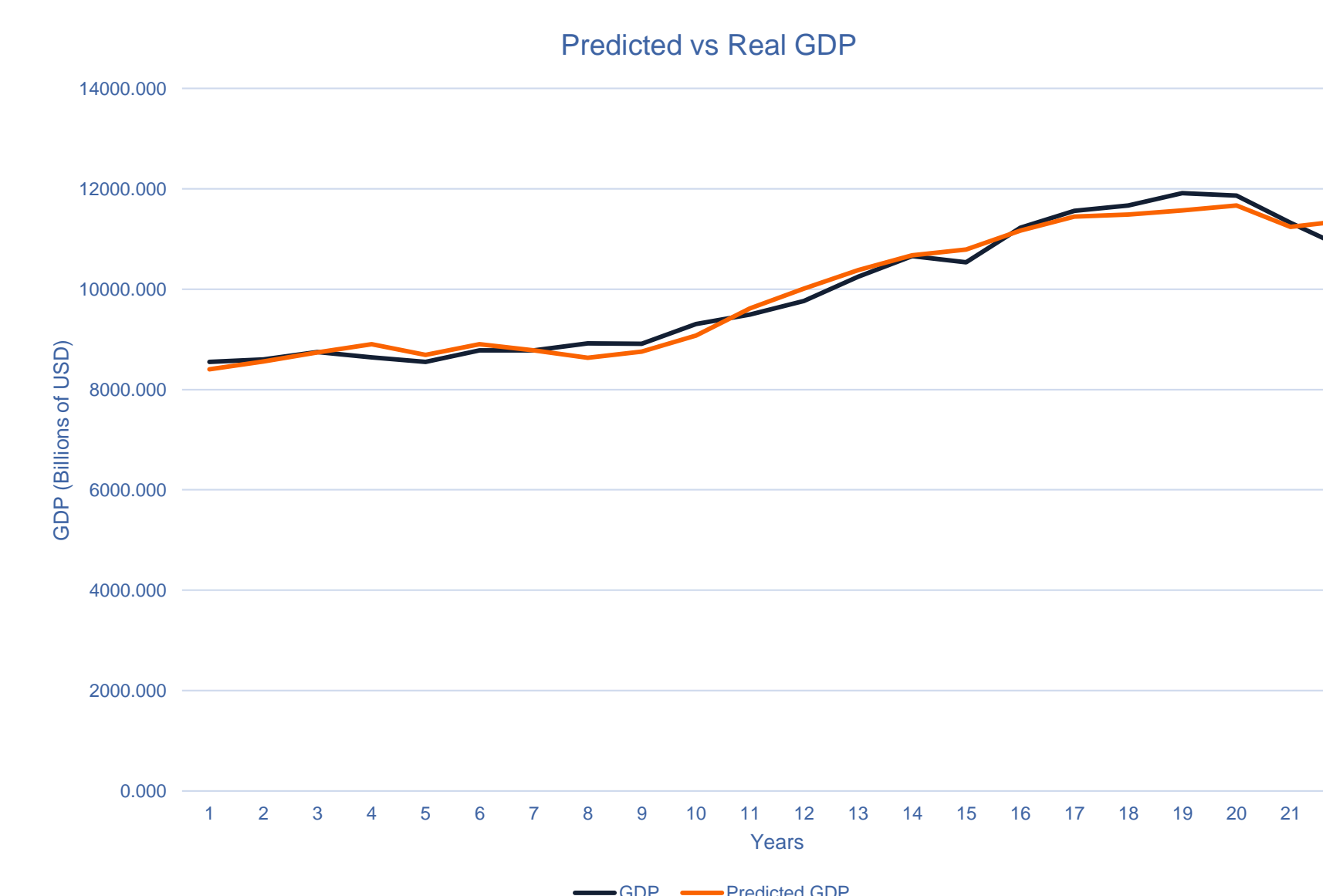
Graph of Predicted GDP vs Time and GDP vs Time. The orange line is the predicted values while the blue line is the real value.

SOURCES

Board of Governors of the Federal Reserve System. "Brazil/US Foreign Exchange Rate." Federal Reserve Bank of St. Louis.

Board of Governors of the Federal Reserve System. "Gross Domestic Product for Brazil." Federal Reserve Bank of St. Louis.

Pinto de Mello , Cristina Helena. "Brazil: Better Macroeconomic Environment for Fintechs?" 18 Mar. 2018, Sao Paulo.

CONCLUSIONS

A countries GDP is influenced by many features – consumption, exports, imports, government spending, etc. These factors are influenced not only by those inside the country but those outside as well. Since there is not one universal currency, foreign exchange rates are important tools in calculating business ventures.

When looking at a countries foreign exchange rate and GDP in a single period of time, it can be hard to spot an influence, but over a long period of time it becomes evident. Exchange rates will have a negative correlation with GDP, meaning that as exchange rates decrease GPD will increase. This study looked at the Foreign exchange rates between Brazil and the United States over a 22 year period, and compared them to Brazil's GPD over the same time period. The analysis concluded that on average, for every point the USD/\$R rate drops, Brazil's GDP will increase by \$657.89 Billion, and every year that passes the GDP will increase on average by \$221.66 Billion.

TAKEAWAYS

- Experiencing and learning about another countries economic situation has given me a more wholistic view on governments and businesses.
- Study abroad allowed me to interact with students and my professor in a more relaxed yet focused way than ever before.
- Pushing yourself outside your comfort zone is the best way to synthesis growth.

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