# Final report

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CS 2704: Data Analytics Using Python

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**Introduction and Background**

I investigated the relationship between a country's wealth and its national debt in this study. I concentrated on Total External Debt stocks and Gross National Income as variables to narrow my investigation. Total External Debt stocks refers to the external debt countries owe to developed countries and multilateral lending institutions. Gross National Income is the total amount of money earned by a nation's people and businesses. I found this to be an excellent way to measure a country's wealth in order to show the significance of my findings. I believed that studying this data as well as applying some statistical operations would produce interesting results that may prove helpful to a nation. Interestingly enough, while doing my research, I learned that many other people had been studying the same relationship.

This showed me that I was studying an important topic and made me want to add to the ongoing conversation. In my study, I decided to look at the relationship and apply regression techniques to see how current data could help us make informed decisions regarding how we view debt.

**Hypothesis**

I hypothesize that Gross National Income has a positive correlation with Total External Debt Stocks. Therefore, by looking at a county’s Total External Debt, we can make reasonable estimates concerning its gross national income. This is because we can find a significant correlation between the two variables. I tested my hypothesis on the dataset found at the world bank website. I looked at 117 countries for this investigation. The goal was to observe a linear pattern on a GNI vs Total Ext scatter plot. Debt. I decided to view GNI as the dependent variable while considering Total Ext. Debt as an independent variable. Lastly, a correlation test of these two variables would be used to determine if my hypothesis was true. Getting an R-value close to 1 would display a significant correlation, thus proving my hypothesis and allowing regression techniques to be applied.

At early stages, I noticed that the relationship would not be linear as expected but the data observed an exponential relationship. I then revised my hypothesis to say that there is an exponential growth in GNI based on Total Ext Debt. This could be tested by a scatter plot of a log (GNI) vs log (Total Ext. Debt).

**Analysis and implication**

After conducting the necessary tests and operations on the data sets provided, I was able to compare my results to my predictions in the hypothesis. After using python to make a scatter plot of GNI vs Total Ext. Debt, I observe a pattern that suggests exponential growth as my revised hypothesis suggests. This observation, however, was based on my naked eye, so I looked at the scatter plot of log (GNI) vs log (Total Ext. Debt). I observed a clear linear relationship here, implying that the relationship between my two variables is exponential.

From the correlation test, I got an R-value of 0.920. such a high R-value indicates a strong positive correlation between my two variables which means that linear regression would work well in this case. Again, using Python Pandas, I was able to plot a line of best fit on the log (GNI) vs log (Total Ext. Debt) graph. These results and my hypothesis show that debt is not always something to fear but may also be an opportunity to develop a country, as shown by the results. This discovery leads to more similar research avenues that study Total External Debt to make better-informed decisions. An example is Malaysia, as highlighted by Choong et al. (2010) “Over the years, Malaysia has been the successful country implementing and undertaking prudent debt management strategies such as minimizing risk exposure against global shocks, managing exchange rate fluctuations and against shifts in investor sentiments.” (p. 1565).

Predictive analytics based on this data is very reliable as the relationship observed between the two test variables is statistically significant. Therefore, nations can monitor Total External Debt combined with other factors to make substantial boosts in their GNI and overall wealth.

**Conclusion**

After analyzing my results, I can conclude that my hypothesis holds true. I also found many other articles and studies that support my findings. Though some of them focused on different aspects, the core claim was that debt is not necessarily a bad thing. They also went further to address how certain nations use this learned phenomenon to manipulate the odds to their favor. Some articles also highlight limitations to using only two variables. Further research would lead to more variables being looked. It is obvious that more than one variable affects GNI and looking at other closely related variables for example: GDP, GNP, and many others might be able to provide even better educated results as well as predictive analysis.

In this experiment, we proved a correlation but not necessarily causation. This investigation showed a significant area of interest that may show causation, but we would have to consider more data to prove this. Nevertheless, our findings indicate that we are on the right path and that investigating these two variables using predictive analysis could have a potentially great outcome.

# References

**Datasets**

* <https://data.worldbank.org/>
* <https://datatopics.worldbank.org/debt/ids/countryanalytical/chn/counterpartarea/wld>

**Scholarly Articles**

Choong, C. K., Lau, E., Liew, V. K. S., & Puah, C. H. (2010). Does debts foster economic growth? The experience of Malaysia. *African journal of business management*, *4*(8), 1564-1575. <https://academicjournals.org/journal/AJBM/article-abstract/833991426364>

Muhanji, S., & Ojah, K. (2011). Management and sustainability of external debt: a focus on the emerging economies of Africa. *Review of Development Finance*, *1*(3-4), 184–206. <https://doi.org/10.1016/j.rdf.2011.09.00>