

[Year]

US Military Spending Analysis

Introduction

Picture a world where terrorism is a constant threat, where people fighting for freedom clash with those seeking power, and where countries with lots of oil are used as tools in a political game. This is the world we live in - where what governments decide and what extremist groups do, affect many countries along with countless individuals. This idea inspired our group to dive deeper into this and we stumbled upon an idea – a question that made all of us raise our eyebrows.

Is there something “fishy” going on with the number of “terrorist” attacks in the world, the amount of money US spends on a subset of its defence contractors, and the “freedom” index of countries in the world? By “fishy”, we mean: Does the US government increase its defense spending when terrorist attacks occur in countries with low freedom indexes and significant oil reserves?

Our hypothesis is that **there is some correlation between the money the US government spends on defence each year (estimated by net sales of 2 of the largest US defence contractors), and the freedom index of a country with a considerable amount of oil.** This hypothesis stems from the controversial & historic invasions of countries by the United States government, into countries they deemed at least “communist” or “dictatorial” (both of which would have a low freedom index), and which also happened to have a lot of oil / natural resources. Examples of this include: Iraq (Oil), Afghanistan (Rare earth elements / minerals), Venezuela (Oil). Military spending is not the only way a powerful country like US can get what it wants. Another unsurprisingly good weapon are sanctions. The US never invaded Venezuela, they put numerous sanctions on them.

Our method here is not ideal, as the US government websites are so insanely broken, and so few links work, that they make sure no one ever gets the data that is supposedly “available” for the public. Nevertheless, the question is interesting enough and we will explore it. There are too many correlations, and too many factors from the political world that we aren’t able to consider in this project. However, we will try our best to honestly analyze the data and present our findings.

Data

Data Collection:

Where we got the data for net sales:

Lockheed Martin

Only works if you modify the URL from 1995-2018 (inclusive)

<https://www.lockheedmartin.com/content/dam/lockheedmartin/eo/documents/annual-reports/2004-annual-report.pdf>

Later, they switched over to a different URL, where they tracked both yearly & quarterly earnings:

<https://investors.lockheedmartin.com/financial-information/quarterly-results>

General Dynamics

https://www.annualreports.com/HostedData/AnnualReportArchive/g/NYSE_GD_2004.pdf (pre 2003 data is not available on this site)

<https://investorrelations.gd.com/financial-reports/annual-reports-archive/default.aspx>

<https://investorrelations.gd.com/financial-reports/sec-filings/default.aspx> Where

we got data about oil:

<https://www.worldometers.info/oil/oil-reserves-by-country/>

Where we got data about terrorist attacks:

<https://www.kaggle.com/datasets/willianoliveiragabin/terrorism-in-world/data>

Where we got data about the freedom index:

<https://www.kaggle.com/datasets/mlippo/freedom-economic-index>

We emailed these good people for data on sanctions, but they never got back to us:

<https://www.globalsanctionsdatabase.com/>

Data Preprocessing

1. US-defence.csv
 - a. Manually built the csv file ourselves over ~4 hours, so there was no preprocessing to be done. The SEC filings were scattered everywhere.
2. oil_reserves_per_country.csv
 - a. Manually built the file ourselves here as well. We needed to remove the extra commas that were present in the amount of barrels a country had (e.g. Jordan had : 1,000,000 so we needed to remove those 2 commas).
 - b. Needed to standardize names of countries in the way that made sense to us. For example, Czech Republic was written like “Czech Republic (Czechia)”, so we removed the “Czechia” part. Ivory Coast was written in french, with the characters that are not easy to get to. Democratic Republic of Congo was written as “DR Congo”.
3. terrorist-attacks.csv
 - a. Renamed “Czechia” to “Czech Republic”, changed the french spelling of Ivory Coast again.
 - b. Deleted Czechoslovakia and Vanuatu, as they don’t appear anywhere else, and they didn’t have many terrorist attacks.
 - c. Deleted all sub groupings of countries, like “World” “Western Africa”, “Asia”.
 - d. Deleted everything that has a date of attack before 1994
4. freedom_index.csv
 - a. Removed features which didn’t feasibly relate to the propensity for external interventions or the “promotion” of democratic values. Kept 'Government Integrity' , 'Judicial Effectiveness' , 'Trade Freedom' and 'Property Rights'. We believe these are enough for judging a country as not free / democratic.
 - b. Similarly, we changed some of the countries’ names that didn’t sit right with us and didn’t match the other countries’ names in different csv files.

Results

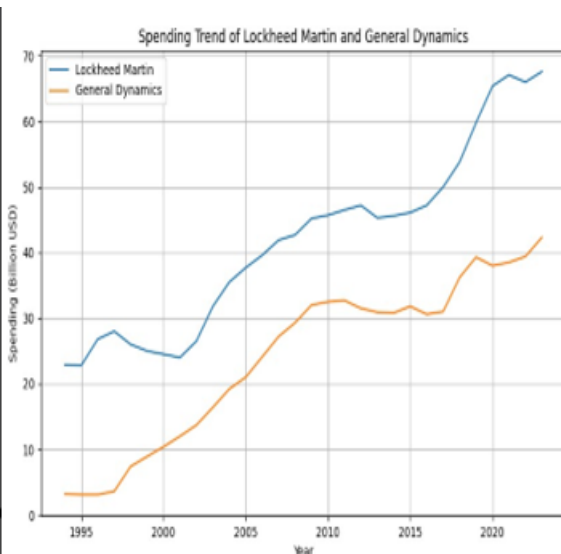


Figure 1: Annual Spending on Lockheed Martin &

Exploratory Analysis:

In our study, we first examined the trends in spending by Lockheed Martin and General Dynamics over the years. The visualizations revealed a consistent positive increase in defense expenditures, suggesting a

continual rise in military spending over time. This trend underscores the significance of defense contracting activities and hints at potential shifts in government priorities towards bolstering national security.

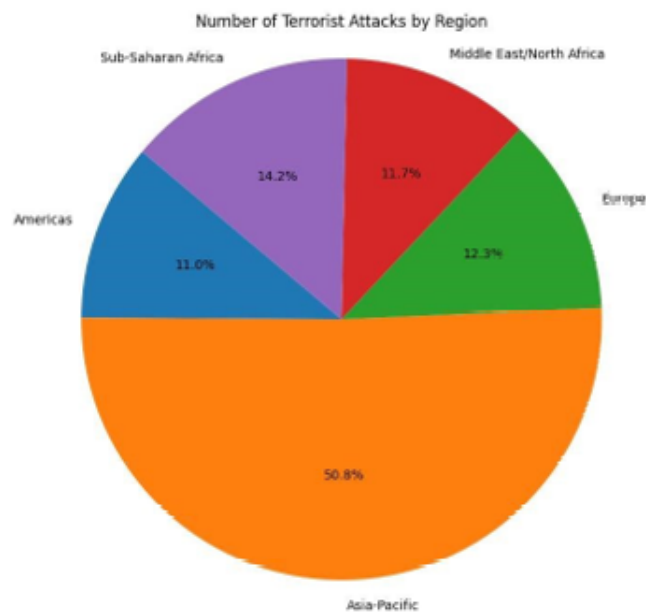
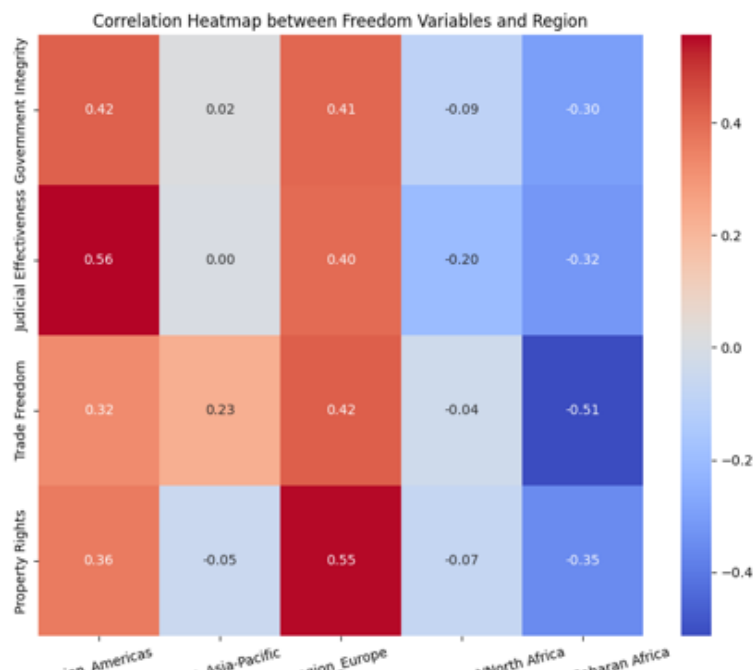


Figure 2: Baseline showing terrorist attacks by region

Next, we delved into the geographical distribution of terrorist attacks using a pie chart depicting the percentage distribution by region. The Asia Pacific region emerged with the highest proportion of attacks at 50.8%, followed by Sub-Saharan Africa, MENA, Europe, and the Americas. This visualization sheds light on the varying degrees of security threats across different regions, highlighting the importance of understanding regional dynamics in counterterrorism efforts and policy formulation.



Finally, we explored the relationship between freedom variables and regions using a correlation heatmap. The heatmap revealed positive correlations between freedom factors and regions like the Americas and Europe, suggesting a potential alignment between democratic values and regional stability. Conversely, a negative correlation was observed between freedom factors and Sub-Saharan Africa, indicating a possible association between political repression and security challenges. However, correlations for

Asia-Pacific and Middle East/North Africa were inconclusive, underscoring the nuanced nature of geopolitical dynamics in these regions and the need for further analysis.

Ordinary Least square Analysis

The Ordinary Least Squares (OLS) regression results for Lockheed Martin and General Dynamics highlight the key factors influencing defense spending by these companies.

For Lockheed Martin, Trade Freedom demonstrates the strongest correlation with defense spending, indicating that countries with greater trade freedom tend to spend more on defense contracts with Lockheed Martin. Additionally, Terrorist attacks and Percentage of World Reserves also show significant positive correlations with defense spending.

Similarly, for General Dynamics, Trade Freedom emerges as the strongest predictor of defense spending. However, the influence of Percentage of World Reserves appears to be less pronounced.

Regression Results for Lockheed Martin (Billion USD):						
OLS Regression Results						
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Dep. Variable:	Lockheed Martin (Billion USD)	R-squared (uncentered):	0.890			
Model:	OLS	Adj. R-squared (uncentered):	0.890			
Method:	Least Squares	F-statistic:	3776.			
Date:	Thu, 11 Apr 2024	Prob (F-statistic):	0.00			
Time:	22:27:53	Log-likelihood:	-9486.3			
No. Observations:	2340	AIC:	1.898e+04			
Df Residuals:	2335	BIC:	1.901e+04			
Df Model:	5					
Covariance Type:	nonrobust					
=====						
	coef	std err	t	P> t	[0.025	0.975]

Terrorist attacks	0.0120	0.002	4.924	0.000	0.007	0.017
Oil Reserves (Barrels)	1.927e-11	5.62e-12	3.426	0.001	8.24e-12	3.03e-11
Trade Freedom	0.6020	0.011	53.956	0.000	0.580	0.624
Government Integrity	-0.0572	0.031	-1.822	0.069	-0.119	0.004
Judicial Effectiveness	-0.0356	0.025	-1.405	0.160	-0.085	0.014
=====						
Omnibus:	64.765	Durbin-Watson:	0.406			
Prob(Omnibus):	0.000	Jarque-Bera (JB):	59.886			
Skew:	0.343	Prob(JB):	9.91e-14			
Kurtosis:	2.621	Cond. No.	7.37e+09			
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Regression Results for General Dynamics (Billion USD):						
OLS Regression Results						
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Dep. Variable:	General Dynamics (Billion USD)		R-squared (uncentered):		0.768	
Model:	OLS		Adj. R-squared (uncentered):		0.767	
Method:	Least Squares		F-statistic:		1545.	
Date:	Thu, 11 Apr 2024		Prob (F-statistic):		0.00	
Time:	22:27:53		Log-likelihood:		-9220.3	
No. Observations:	2340		AIC:		1.845e+04	
Df Residuals:	2335		BIC:		1.848e+04	
Df Model:	5					
Covariance Type:	nonrobust					
=====						
	coef	std err	t	P> t	[0.025	0.975]

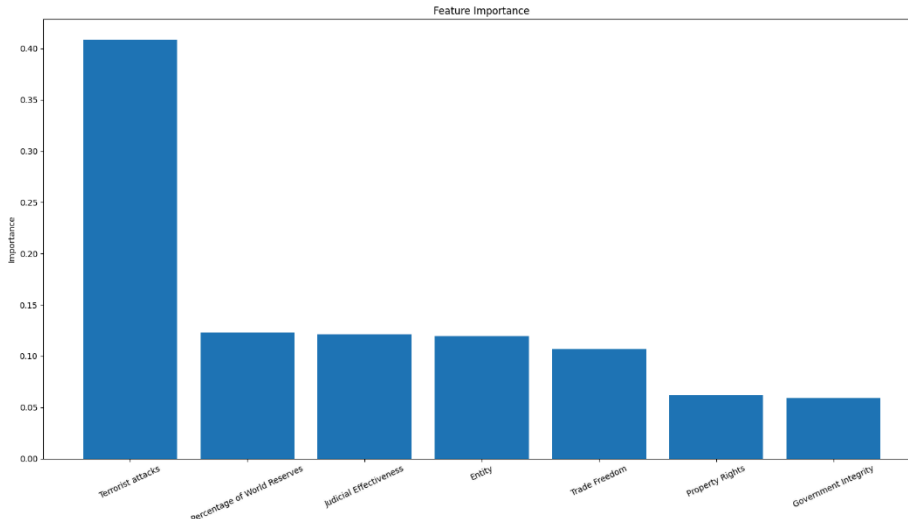
Terrorist attacks	0.0101	0.002	4.652	0.000	0.006	0.014
Oil Reserves (Barrels)	1.093e-11	5.02e-12	2.177	0.030	1.08e-12	2.08e-11
Trade Freedom	0.3414	0.010	34.286	0.000	0.322	0.361
Government Integrity	-0.0316	0.028	-1.130	0.259	-0.087	0.023
Judicial Effectiveness	-0.0202	0.023	-0.892	0.373	-0.064	0.024
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Omnibus:	811.444	Durbin-Watson:	0.319			
Prob(Omnibus):	0.000	Jarque-Bera (JB):	156.825			
Skew:	-0.340	Prob(JB):	8.83e-35			
Kurtosis:	1.930	Cond. No.	7.37e+09			
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Ranking Variables

- Trade Freedom: This variable has the highest coefficient magnitude (0.5858) and a very low p-value (< 0.001), indicating strong significance.

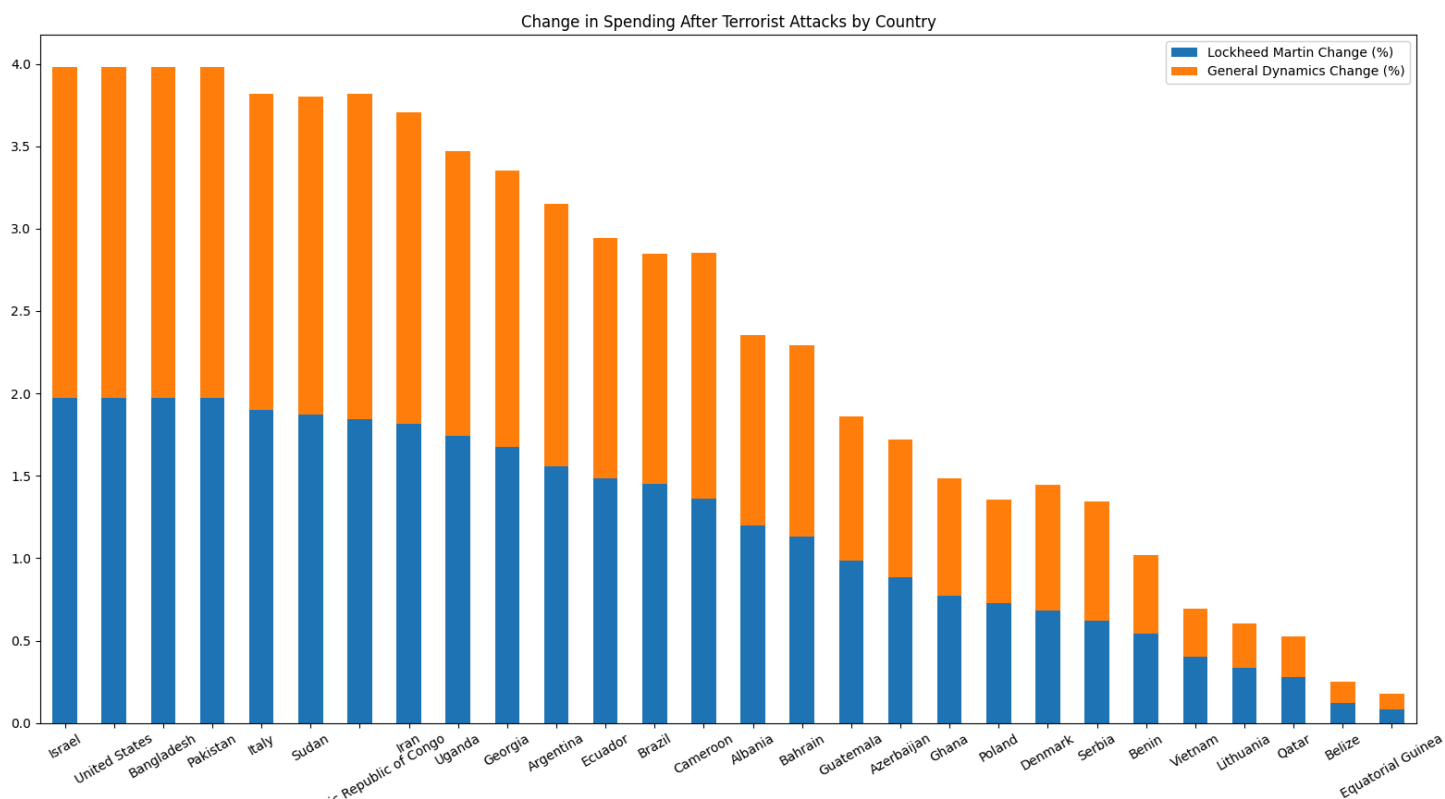
- Percentage of World Reserves: Although it has a lower coefficient magnitude compared to Trade Freedom (0.2740), it still shows statistical significance with a low p-value (0.004).
- Terrorist attacks: While it has a lower coefficient magnitude (0.0117), it remains statistically significant with a very low p-value (< 0.001).
- Government Integrity: This variable has a moderate coefficient magnitude (-0.0637) and a p-value of 0.043, making it statistically significant but less so compared to the above variables.
- Entity: It has a moderate coefficient magnitude (0.0264) and a p-value of 0.032, indicating statistical significance, although slightly less than the other variables.
- Judicial Effectiveness: This variable has the lowest coefficient magnitude (-0.0270) and a relatively high p-value (0.293), making it the least significant predictor among the variables considered.

Feature Analysis



Digging deeper into the factors driving defense spending, we tackled the sub question of what influences the highest expenditures on defense. While delving into the data, we encountered a peculiar challenge: certain columns, like 'Year,' correlated excessively with our target variable, leading to an inexplicable Mean Squared Error. However, after refining our analysis and removing

these outlier columns, we generated a more interpretable feature importance graph. This visualization revealed key determinants such as Terrorist attacks, percentage of world reserves (oil), and judicial effectiveness, further explaining the dynamics shaping defense budgets.



In examining which countries experiencing terrorist attacks drive the greatest increases in defense spending, our analysis delved into the spending patterns across affected nations. A bar graph was utilized to visualize defense expenditures for each country, with every third country displayed to ensure clarity and readability. This approach allowed us to discern notable trends and identify the countries with the most significant spikes in spending following terrorist incidents, thereby providing valuable insights into the geopolitical and security dynamics shaping defense budget allocations.

Conclusion

In conclusion, our goal aimed to investigate the correlation between US defense spending, terrorist attacks, and the freedom index of oil-rich countries. Our analysis revealed several interesting insights, for example, we found a positive trend in US defense expenditures over time, suggesting a continual rise in military spending. However, our findings - displayed above, yet valuable, we feel are not conclusive enough to conclude that there is a definitive correlation which can be made. Our

challenges in data availability and the complexity of the subject matter made it difficult to conclude and prove our hypothesis with certainty.

Limitations

- Limited Scope: Our analysis was based on a specific set of variables. Other important variables, such as military alliances or geopolitical considerations, were not included
- Intangibles: There may be other reasons or factors may be the reason as to why there is a correlation of defence funding that we may be unable to notice or capture.
- Contextual Factors: Our analysis does not account for specific historical events that may have influenced defense spending over the period we viewed.
- Limits on data collection: Most websites visited with more in depth datasets were locked behind government websites, where you would need an official .gov email to request access. Our Data was pieced together ourselves and caused issues later down the line

More time

If given more time, we could perhaps include or factor in military alliances and political relationships. Another factor could be comparing defense spending patterns across different countries to identify common trends and factors that may influence spending decisions on increased military funding.

Accomplishment Statement

Abdurisag Heban - Excelled in analyzing and visualizing data, bringing clarity and depth to our project. Completed insightful analysis and compelling visualizations which enriched our understanding of the data, providing valuable insights for the research.

Uros Kovacevic - Played a crucial role in the project by precisely collecting and cleaning the data. Provided great attention to detail by ensuring that the datasets worked with were accurate and reliable - laying a strong foundation for our analysis.

Navid Ahmed - Took the lead in synthesizing our efforts and producing a comprehensive report. Displayed ability to distill complex information into a clear and concise format in order to effectively communicate the project findings.