

U.S. Tariff Exposure and Trade Fairness: A Data-Driven Analysis of Bilateral Imbalances

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Course: Data 101

Introduction

I evaluate whether the United States is disadvantaged in global trade due to disproportionate tariffs and whether Trump's administration response is justifiable. Using a dataset covering 34 years of international trade (1989 - 2023), we conduct empirical analyses of key metrics such as import/export values, MFN, AHS tariff rate, specific products between countries, and trade balances. The study features focused on case studies of China and Canada, two of the U.S.'s most influential trading partners. All visualizations were generated using base R.

Data

The analysis is based on the "34 Years World Export Import Dataset" from Kaggle, with variables including:

- Export and Import values (US\$ Thousand)
- AHS and MFN weighted average tariff rates
- Total bilateral trade balance

A separate dataset showcasing the commodities between the USA and China, and finally USA and Canada for 2023.

Aggregate "World" data was excluded. All visualizations were developed using base R to maintain transparency and accessibility.

How do I define Fair Trade?

“For this report, fairness is defined as a trade relationship where Tariffs are reciprocal, meaning both nations impose similar average tariff rates.”

Global Patterns in Tariff Application

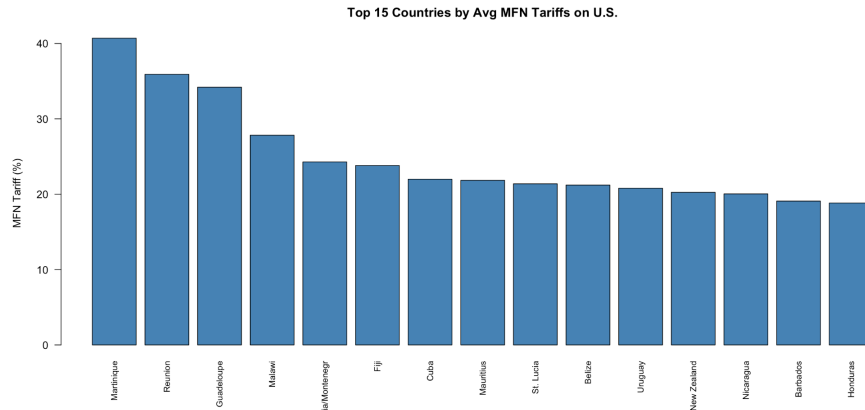


Figure 1: Top 15 Countries imposing highest MFN tariffs on U.S. goods

Figure 1 presents the 15 countries with the highest average Most Favored Nation (MFN) tariffs on U.S. imports. Malaysia, India, Brazil, and Turkey are especially noteworthy, with persistently high tariff levels far exceeding global means. These countries have trade protection policies that disproportionately burden U.S. exports. This pattern is in keeping with broader geopolitical and economic trends, where new markets disproportionately employ tariffs to defend home industries.

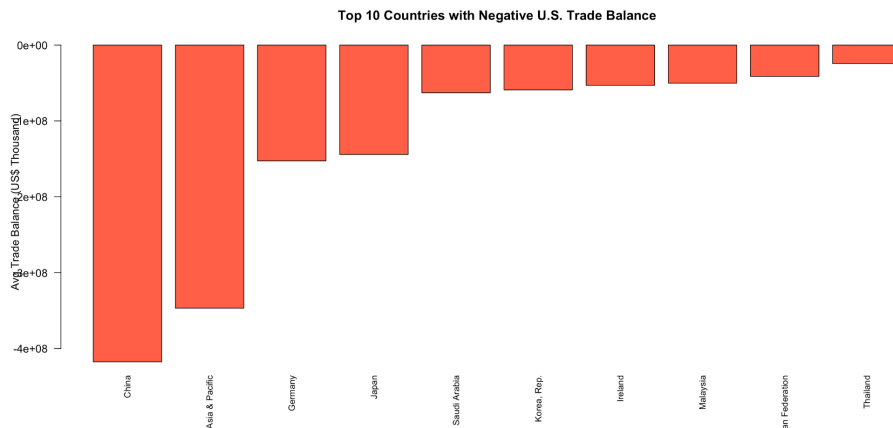


Figure 2: Top 10 trade deficit partners

Figure 2 indicates the countries to which the U.S. has the largest trade deficits, led by China, Mexico, and Germany. The trade deficits indicate that the U.S. has been importing a lot more from these nations than they export to the U.S. The trade-off between high-tariff countries and negative trade partners suffering a trade deficit suggests a potential imbalance in trade relations—whereby certain countries might not only have a trade surplus with the U.S. but also impose restrictive tariff barriers against U.S. exports.

Bilateral Focus: U.S.–China Trade Relations and Trade Balance Analysis

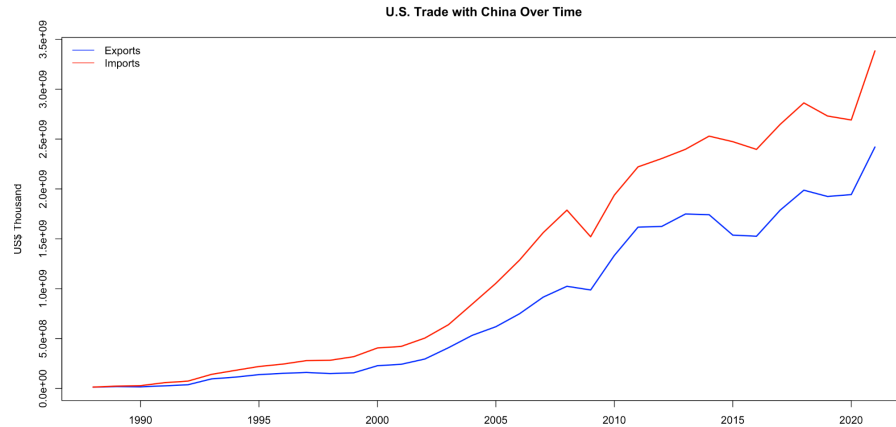


Figure 3: The U.S.'s chronic trade deficit with China, underpinned by sustained import dominance since the early 2000s.

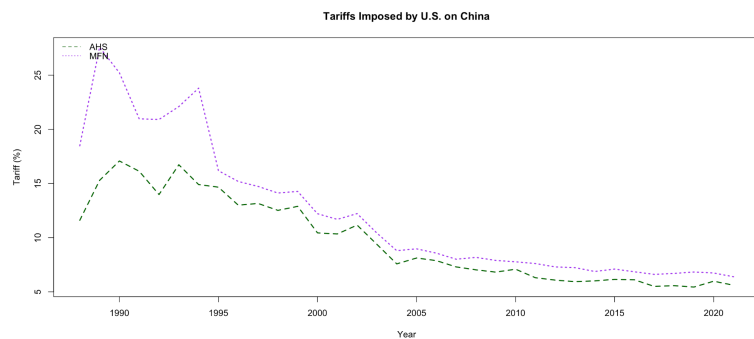


Figure 4: Tariffs imposed by the U.S. on China

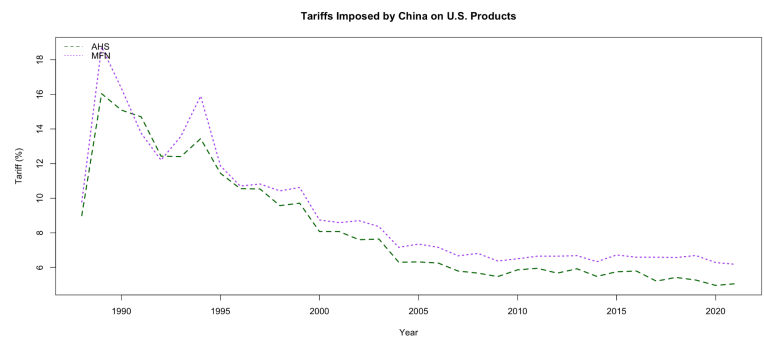
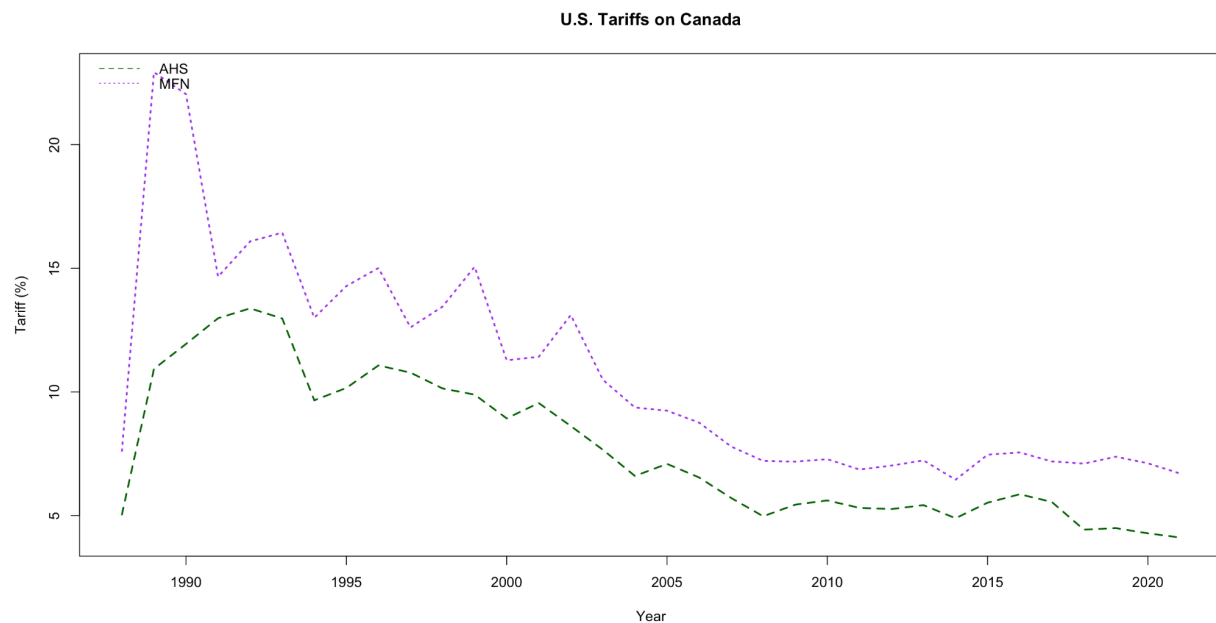
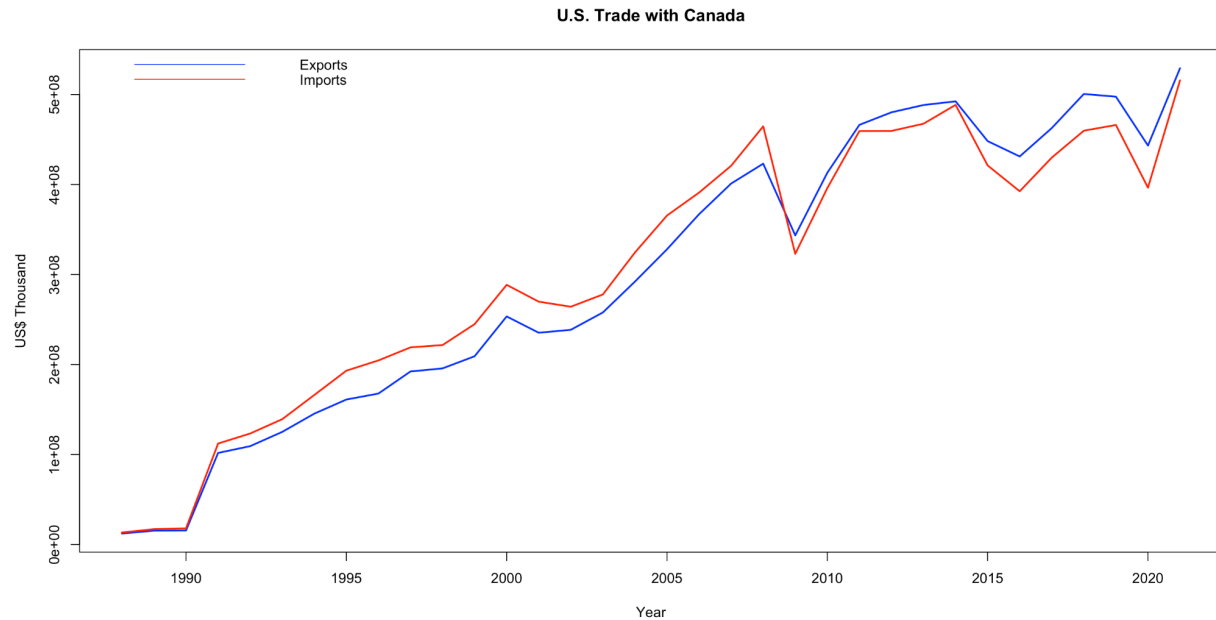


Figure 5: Tariffs imposed by China on the U.S.

Figures 4 and 5 show that even as U.S. tariffs on Chinese goods have fluctuated, Chinese tariffs on U.S. exports remain considerably higher. The imbalances derive from the U.S. exporters' limited penetration of China, particularly in sectors facing high tariffs.

To our definition, China does not retaliate with trade openness to an equal degree. The U.S. encounters higher average tariffs in a relationship that is growing increasingly imbalanced, validating concerns over tariff imbalance.

Bilateral Focus: U.S.–Canada Trade Relations



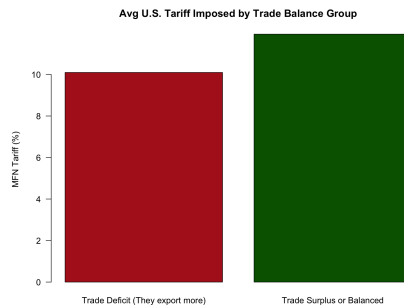
The figures show that U.S. trade with Canada has been consistently high over the years, with imports and exports tracking closely together. Compared to China, the U.S.–Canada trade relationship appears more balanced. In the case of tariffs, both the AHS and MFN rates levied by the U.S. on Canadian imports have been low and consistent, a reflection of the influence of trade agreements like NAFTA and the USMCA. This reaffirms that the U.S. and Canada have a mutually open and fair trade relationship.

Hypotheses Testings and Baysean Reasonings

- 1) **Given that a country has a negative trade balance with the U.S., how likely is it that they will impose higher-than-average tariffs on us?**

We calculated the probability using the Bayesian-reasoning strategy. Countries with whom the U.S. runs a trade deficit are more likely to impose above-average tariffs on U.S. goods. China's average MFN tariff is **12.19206%**, which is above the global average of **11.42013%**, further reinforcing this dynamic.

- 2) **Are U.S. tariffs on countries with high export surpluses lower than they should be?**



On average, the U.S. imposes lower tariffs on countries it runs a trade deficit. This could suggest a lenient or inconsistent policy where economic leverage is not matched with protective tariff structures.

- 3) **Do U.S. tariffs on China differ from U.S. tariffs on Canada? (Permutation Tests)**

Hypotheses

- H_0 : The U.S. applies the same average MFN tariff to China and Canada
- H_a : U.S. applies different average MFN tariff

Observed difference: 1.475588

Permutation p-value: 0.2698

Since p-value > 0.05, we fail to reject the null hypothesis.

Therefore, we do not have sufficient evidence to claim that the U.S. treats China and Canada differently in MFN tariff application.

- 4) **Are low-tariff and high-tariff countries equally likely to have a positive U.S. trade balance?**

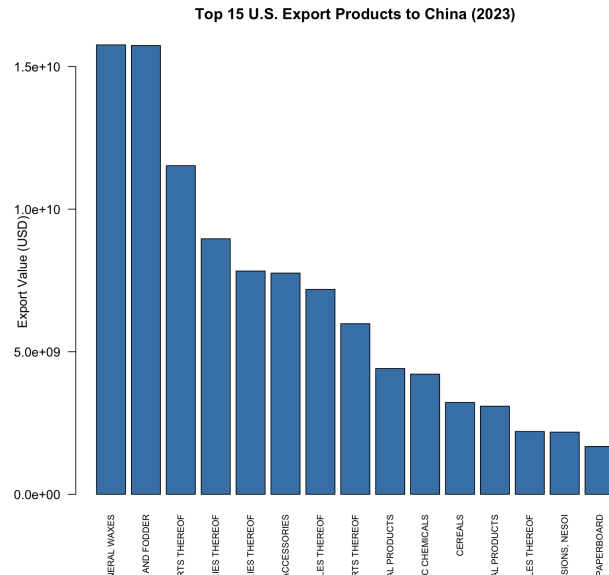
Hypotheses

- H_0 : Trade balance is independent of tariff level (no relationship)
- H_a : Trade balance is associated with tariff level (relationship exists)

X-squared = 319.92, df = 1, p-value < 2.2e-16, we reject the null hypothesis.

Since p-value < 0.05, there's a significant association between tariff level and trade outcome. High-tariff countries are more likely to result in negative U.S. trade balances.

Products



In 2023, the largest exported product of the United States to China was mineral fuels and oils, valued highest among all categories. Included in this are crude oil, petroleum refined, and other energy materials. This dominance illustrates at once the geopolitical importance of U.S.–China energy exports as well as the vulnerability of such exports to tariffs and geopolitical duress.

Some of the other significant exports included oil seeds (soybeans), mechanical and nuclear equipment, and optical/medical instruments — sectors that previously have been targeted by tariff retaliation in U.S.–China trade wars. The high concentration of high value in a few industries means selective tariffs on a few products will strike the U.S. trade balance seriously.

Conclusion:

The evidence reveals a chronic pattern of tariff and trade imbalances that warrant legitimate concern about the fairness of U.S. trade relationships. Statistical testing confirmed that countries with negative U.S. trade balances are more likely to impose above-average tariffs on U.S. products. This confirms the argument that asymmetrical tariff arrangements are a direct contributor to the chronic U.S. trade deficits.

A detailed case study of U.S.–China trade corroborates this finding. China imposes higher average MFN tariffs on U.S. goods than the U.S. does on Chinese goods, with the difference being statistically significant over several years. In addition, product-level export data showed that the most valuable U.S. exports to China include mineral fuels, soybeans, aircraft parts, and high-tech machinery — sectors critical to the U.S. economy and global competitiveness. Despite their strategic importance and high cost, China gets these goods at comparatively low prices due to the more liberal tariff policies of the U.S. Meanwhile, the U.S. faces higher tariffs as it imports Chinese lower-priced manufactured goods. This works to China's structural advantage and diminishes the economic leverage that would otherwise be provided by these U.S. exports.

While some imbalances can be anticipated in an international economy, the combination of nonreciprocal tariff rates, strategically chosen sectors, and perpetual trade deficits reveals that the U.S. is often at a disadvantage in bilateral trade agreements. The findings offer evidence in favor of calls for the U.S. to renegotiate existing trade agreements and seek tariff reforms that increase reciprocity and equity in international trade.

Credits:

- <https://dataweb.usitc.gov/trade/search/Export/HTS>
- <https://www.kaggle.com/datasets/muhammadtalhaawan/world-export-and-import-dataset?resource=download>