

STUDYING THE EFFECT OF IMPORT RESTRICTIONS ON THE FOOD SECTOR AND ITS CONSUMERS

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Abstract

Global trade is a necessary component of most economies nowadays. In recent years, numerous countries have put in place a variety of trade policies to regulate goods coming in and out of the country. Government changes in this area can affect organizations significantly if they rely on imports or exports within their supply chain. Moreover, customers are also affected by trade policy changes when they acquire goods that are either imported or have imported components. The scope of this article was limited to the food industry. Therefore, only the impact of new trade restrictions on this sector was studied. A mathematical model was developed to correlate changes in import tariffs with export reductions within this industry. Similarly, another model was created to better understand the impact of import tariffs on consumers and their households.

Introduction

A topic of increasing interest within the economic and financial world is the effects of taxes or tariffs on imports by any given country. One of the sectors affected is the food industry and its products. The high cost of tariffs can directly affect social welfare since it affects the budgetary availability of each family, given their food needs. Some products must be imported due to demand needs, and any restrictions will have a differential impact on the consumer.

Background

Manufacturing is a segment of any economy that substantially impacts most developed countries. Moreover, this industry is also a major employer within the country. According to the Department of Commerce, the food and beverage industry employed 1.7 million workers, making up over 15% of all U.S. manufacturing employment. Agriculture is at the base of the global food supply chain. Many of these products are imported for U.S.-based food manufacturing companies and American households, and most products contain a combination of domestic and foreign materials or ingredients. Foreign value makes up 20% of the final manufacturing value of several countries and over 50% in others.[1] If food prices are high, a country could increase import subsidies and set export taxes, reducing the cost of imported goods for consumers while incentivizing industries to sell the product domestically. Conversely, when food prices are low, the country could subsidize exports or impose import tariffs to maintain prices.[2] Between March and April 2025, the United States announced a plethora of reciprocal tariffs. However, Mexico and Canada have an agreement under the USMCA (United States-Mexico-Canada Agreement) that excludes several goods from tariffs, and others have predetermined tariffs. Conversely, the ones not included here had proposed tariffs of 25% by the U.S.

Problem

One of the main ideas behind this project is to analyze the tax effect on the exchange of goods within the food manufacturing sector of the U.S. and its consumers. This project aims to develop mathematical models to help consumers and organizations better understand the potential impact of new import restrictions.

Methodology

Most U.S. manufacturers produce goods within and export part of their products to foreign countries, the principal ones being Canada (USD 356.5 billion), Mexico (USD 324.3 billion), and China (USD 150.4 billion).[3] Proposed new tariffs are sparking retaliatory tariffs from these countries, which will impact sales and revenues of U.S. manufacturing companies that rely on consumers within and outside the country. The food industry will likely see a reduction in exports due to the retaliatory tariffs mentioned previously. To estimate the effect of U.S. tariffs on the export of goods, an equation from Figure 1 was created using empirical data from 1988 to 2022. When obtaining the export values, the percentage change for the following year was used to account for the lag when countries impose retaliatory tariffs and reflect on exports. This number is from the Foreign Trade Division of the U.S. Census Bureau.

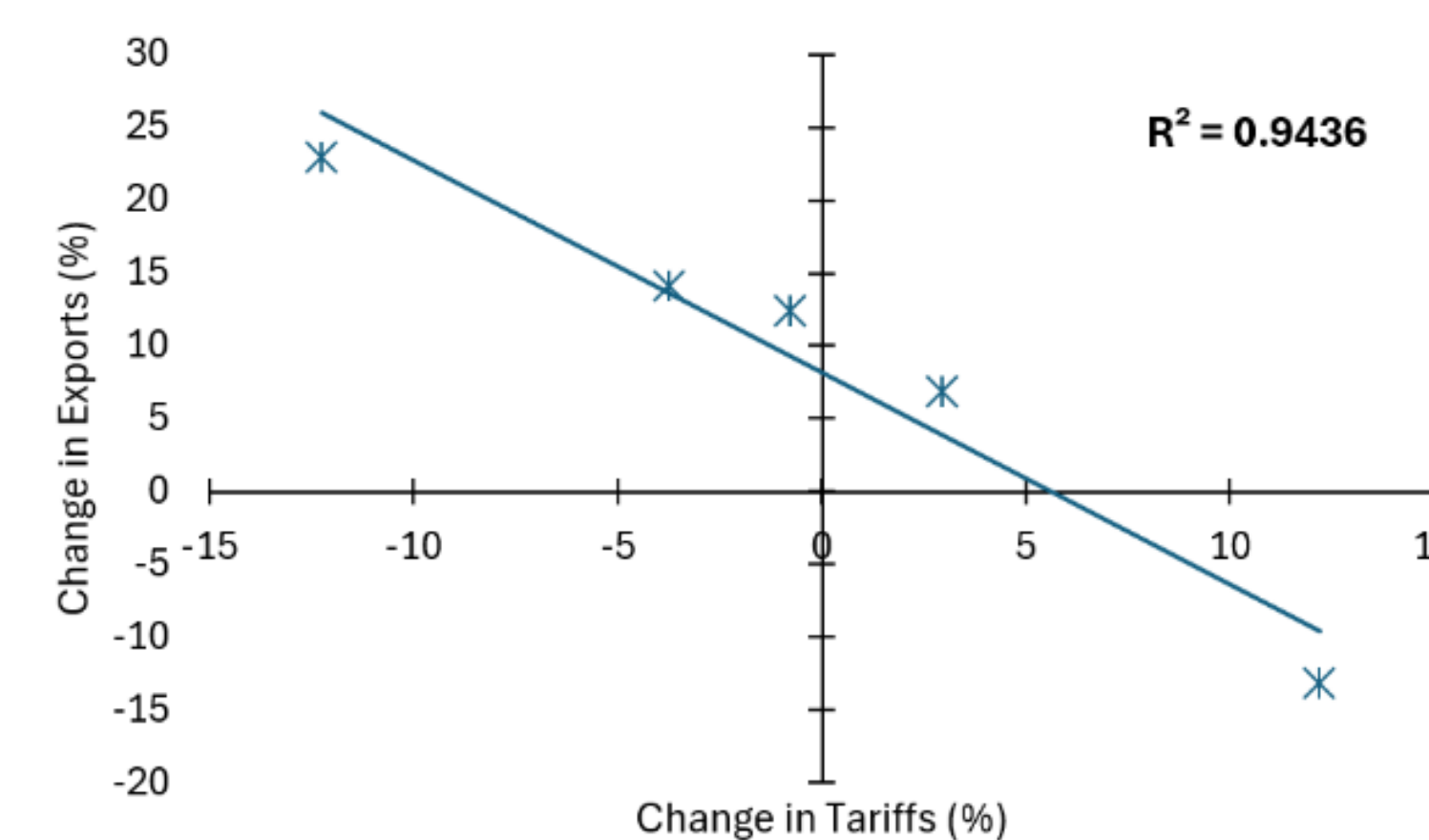


Figure 1: Correlation Between Significant Tariff Changes by the U.S. and the Percentage Change in Exports

From this graph, an equation was created to describe the correlation between the change in U.S. Exports (Ex_{US}) as a function of the change in U.S. tariffs (Tf_{US}).

$$\Delta Ex_{US} = -1.4572 * \Delta Tf_{US} + 8.1447 \quad (1)$$

Similarly, to analyze the potential effects on consumers from new U.S. tariffs, a similar plot was made to compare the overall food sector consumer price index (CPI) with tariffs to understand if there is any correlation between the two. Once more, only significant changes in tariffs (>0.5) were used in Figure 2 to filter out any noise that might cause the CPI of the food sector to fluctuate besides tariffs. For these values, the tariff values from the U.S. by year, according to the World Bank Organization, and the CPI percentage change for food were obtained from the Economic Research Service of the USDA.

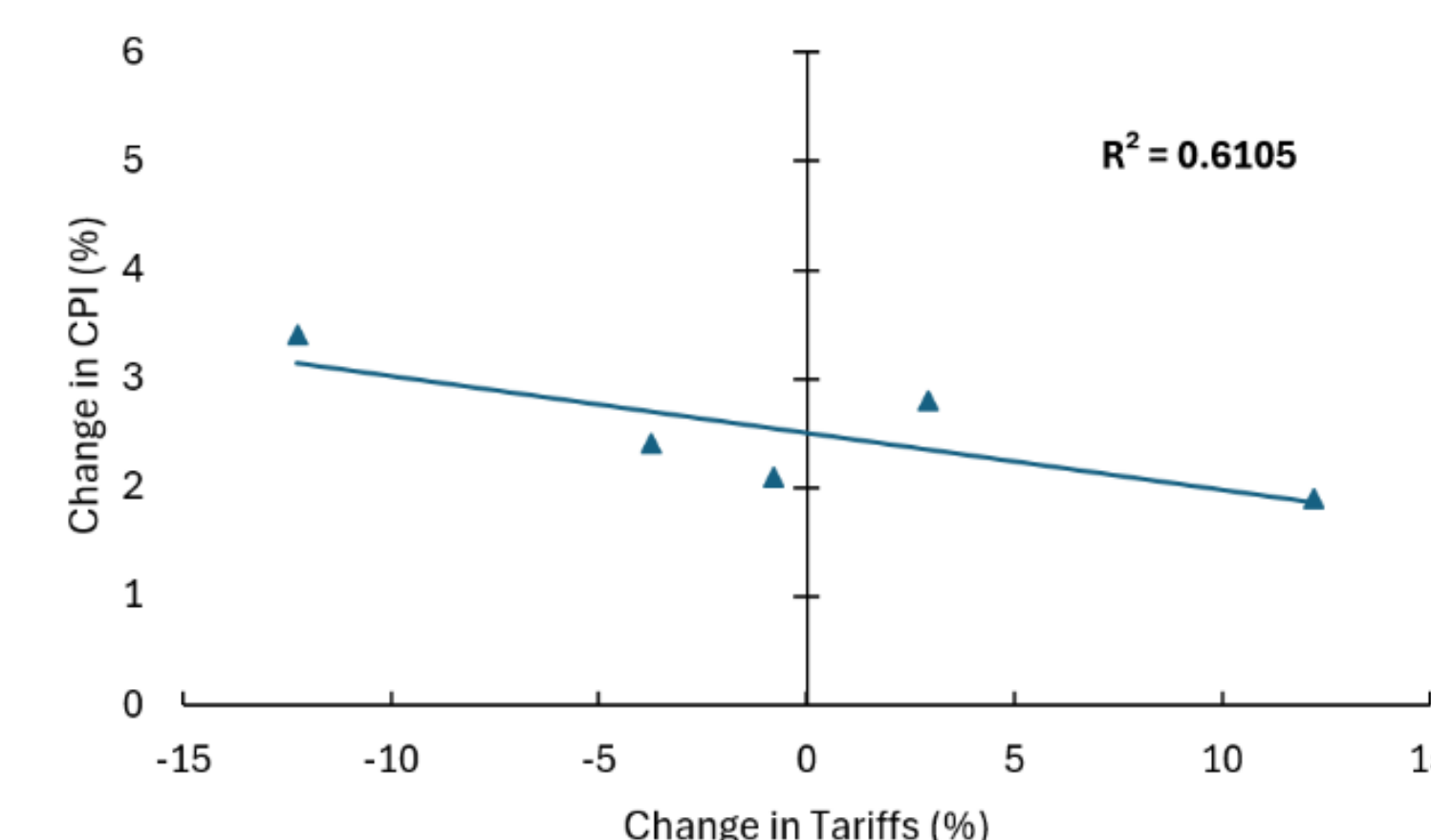


Figure 2: Correlation Between Significant Tariff Changes by the U.S. and Percentage Change in the Food Sector CPI

With these data points mathematical model for the relationship between the change in CPI for the food sector in the U.S. ($CPI_{F,US}$) and the change in U.S. tariffs (Tf_{US}) can be obtained:

$$\Delta CPI_{F,US} = -0.0521 * \Delta Tf_{US} + 2.5027 \quad (2)$$

Results and Discussion

Domestic Food Sector Impact

To estimate the effect of tariffs on exports, an equation was developed (1). This correlation showed that the change in exports strongly correlated with changes in tariffs greater than 0.5%. The accuracy of this mathematical equation in modeling the behavior of the change in exports was validated with the R^2 . This statistical measurement proved with a 0.9436 value that significant changes in tariffs have a great correlation to changes in exports. Later, this equation was used to obtain a theoretical decrease in exports of 8.6%.

Herein, it was assumed that this relationship could be extrapolated to the food industry, particularly with high accuracy. Another assumption for this section is that the data set from 1989 to 2022 is representative whenever changes in tariffs of more than 0.5% occur. If those are true, the food manufacturing sector will likely see a reduction in exports totaling around USD 12.3 billion.

Consumer Impact

The impact of tariffs on U.S. consumers within the food sector was also theorized by performing a similar analysis to the one previously discussed. The consumer price index (CPI) for food was used to indicate how the sector changes affect consumers and their households. The mathematical model obtained (2) shows the proposed relationship between changes in tariffs and changes in the CPI. For this linear model, the R^2 value calculated was 0.6105. This value indicates that there is a correlation between the two factors. However, this only accounts for about 60% of the variation, meaning that the change in tariffs does not explain a significant part of the change in CPI.

A more holistic view of the CPI behavior was taken in Figure 3 to understand this implication further. This image shows the fluctuation in the CPI over the last two decades, in years when there wasn't a significant change in tariffs. Here, it is seen that there have been considerable fluctuations during these years, which can only be explained by external factors not related to tariffs. This further validates the suggestion from the coefficient of determination, also alluding to some relationship, but showing that the factors that play into CPI changes are more complex than the model theorized.

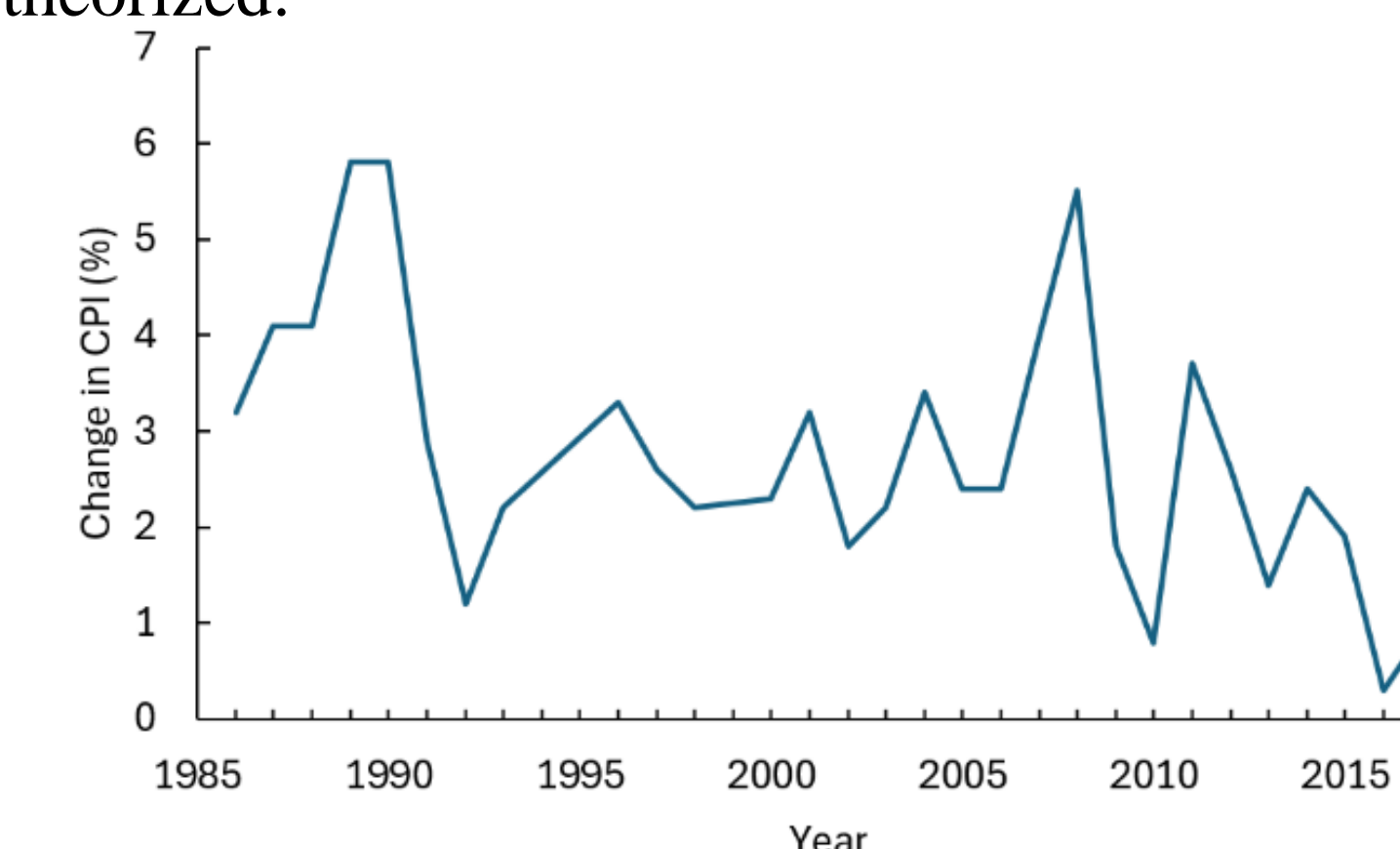


Figure 3: Percentage Change in CPI of the Food Sector for Years without a Significant Change in U.S. Tariffs

With the change in the value of CPI in the food industry caused by changes in tariffs from the model, an increase of 1.9% can be expected. This number is within the range of CPI changes from previous years. From the total of USD 186.1 billion, USD 72.9 billion are imports from Canada and Mexico, which account for 39.2% of all imports and could be included in the USMCA.[4] Coincidentally, these would indicate that tariffs would impact about 60% of imports within the food sector. However, validating or disproving this theory will require additional considerations and is beyond the scope of this study. Further analysis and research should be done to determine if the USMCA agreement truly has a direct correlation to the CPI and, if so, to what extent.

Conclusions

Here, the potential impact of trade restrictions in the form of import tariffs was analyzed. First, the tariffs proposed by the U.S. Government in early April of 2025 were presented. These restrictions range from 10% to almost 50%, depending on the country. A weighted average from these tariffs was then used to hypothesize the impact these tariffs can have on manufacturers and consumers. An average increase of 11.51% in tariffs by the U.S. can cause a reduction of 8.6% in exports from food manufacturers based in the country. This is likely caused by retaliatory tariffs that other countries will impose as a response to tariffs by the U.S. Based on the current exports of the food manufacturing industry, this represents a USD 12.3 billion decrease. However, this could be upset by an increase in domestic gains caused by higher prices of imports within this sector.

Moreover, the impact of said tariffs on consumers was also studied. Here, the CPI was used as a measurement of how the consumer would be affected, as it is the price index of goods. Equation (2) shows a change in this index of 1.9%, which is on par with previous years without significant tariff changes. The leading explanation for the relatively low impact on food products is that when it comes to imported food products consumers buy, almost 40% come from Canada and Mexico, and several products from these countries are included in the USMCA.

Overall, the most significant changes will be felt in organizations that rely more on exports within the food industry. For consumers, the impact appears negligible since the increase caused by tariffs is similar to years without significant changes in tariffs.

Future Work

The equations and conclusions derived might not apply to other sectors of the economy, given that others might have higher elasticity than food products, which will affect the accuracy of the models. Other factors are likely to affect exports and CPI, given the complex nature of analyzing economic changes in the international landscape. Further research should be conducted on other factors related to tariffs, exports, and the CPI. With higher complexity models, the accuracy of the models developed here can be tested to assess whether the assumptions hold true. Other sectors should also be studied and modeled to better understand the implications of trade restrictions within the broader economic sector.

Acknowledgements

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