Analysis of Tariff Impact on US Soybean Agriculture:

Rishi Siddharth, Gabriel Frost, Qasim Siddique, Henish Patel, Vignesh, Hardy

Agenda

1. **Problem Statement**
2. **Hypothesis**
3. **Economics**
4. **Data Science**
5. **Consumer Impacts**

Problem Statement

Problem: How will tariffs affect the agricultural industry?

Scope: Focusing on soybeans prices in the top 5 US states from 2008 (pre-tradewar baseline) - 2020.

Primary Factors: Soybean exports, farmer profits, soybean futures

Compounding Factors: Federal aid, crop harvests

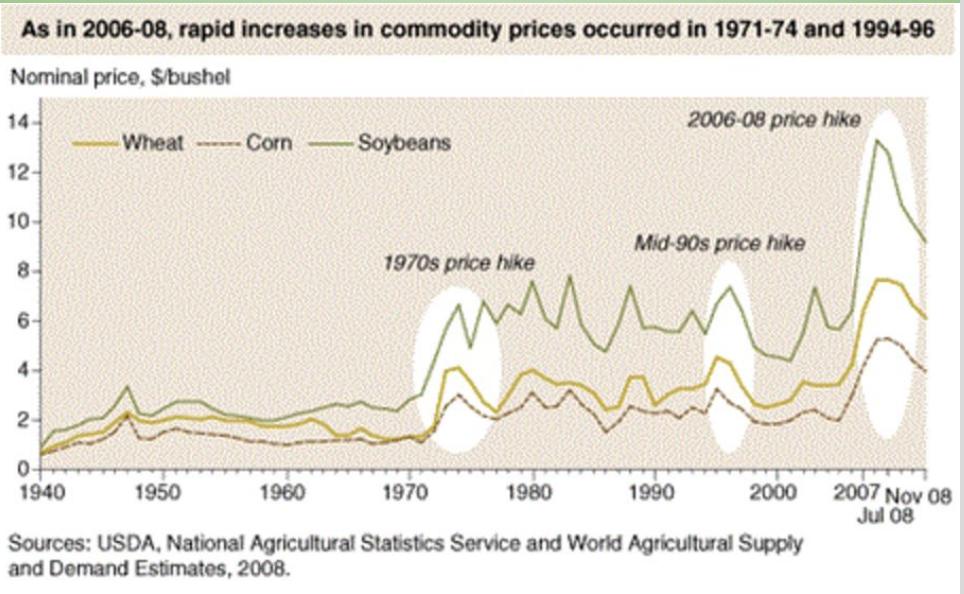
Consumer Impacts: How does this affect the average person?

Hypothesis:

- The US-China trade war (2018–2020) reduced soybean exports, lowering soybean prices in the top 5 soybean-producing states.
- Federal aid programs partially offset the decline in farmer profits.
- Soybean futures prices reflect increased volatility due to trade uncertainty.
- Prices in tariff-affected years (2018–2020) were significantly lower than in the pre-tariff period (2012–2017).

History

History: Pre-2008



How have soybean prices changed historically?

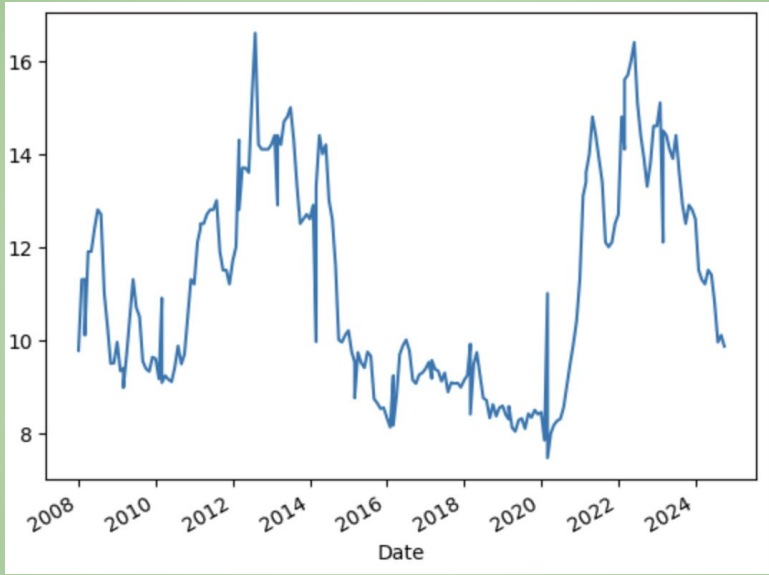
The 1970s Soybean Spike:

1. US dollar moved off gold standard, resulting in 30% depreciation in value
2. Soviet Union started unexpectedly buying huge amounts of grains and soybeans
3. Drought led to low production that year

The 2006 Soybean Spike:

1. Depreciation of US dollar
2. Developing countries increased demand by 63%
3. Drought and poor soybean conditions led to low production

History: 2008-2014



How have soybean prices changed historically?

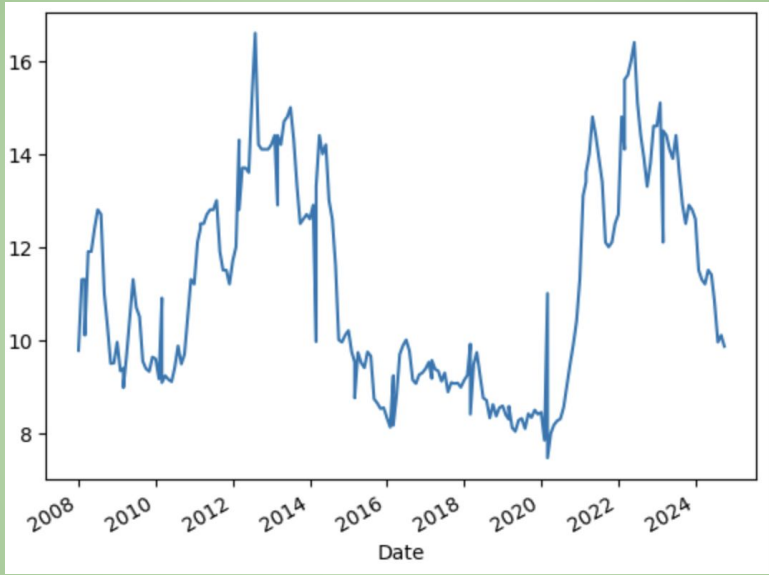
The 2012 Soybean Spike:

1. Both the US and Brazil had droughts, lowering supply of all crops
2. Substitution effects away from corn, since prices rose higher than soybeans
3. Increased market dominance for soybeans

The 2014 Soybean Crash:

1. Brazil had an unbelievable soybean harvest
2. Markets shifted further towards soybeans as primary feed source for animals
3. Prices stayed low (to be explained)

History: 2014-2020

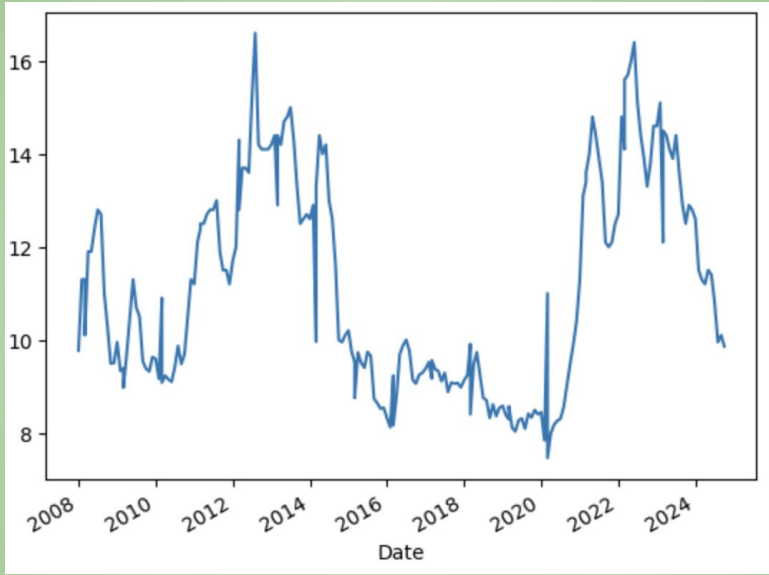


How have soybean prices changed historically?

The 2014 - 2020 Soybean Recession:

1. Brazil and Argentina continued to expand their production, encouraged by favourable weather conditions
2. China's economic growth slowed, reducing their demand growth for soybeans
3. Trump's tariffs and Chinese retaliation

History: 2020-2024



How have soybean prices changed historically?

The 2020 Soybean Spike:

1. In 2020, soybean prices began to rise sharply as COVID-19 disrupted supply chains, leading to tighter global inventories.
2. Demand from China to rebuild its pig herds following the African swine fever outbreak
3. Weather-related production challenges in South America and increased biodiesel demand

The 2021 - 2023 Volatile Soybean Market:

1. The Russia-Ukraine war disrupted global agricultural markets, affecting fertilizer availability and crop yields
2. Supply uncertainties for soybeans and other crops.

The 2023-2024 Soybean Cost Reductions:

1. Improved global supply conditions, particularly stronger crop outputs in the United States and Brazil, alleviated some price pressures.
2. Gradual slowdown in China's economic growth softened demand

Testing Period:

- **Background:** In 2018, the Trump administration imposed tariffs on Chinese goods worth billions of dollars, citing unfair trade practices, intellectual property theft, and the goal of reducing the US trade deficit.

- **Impact on Soybeans:** China (biggest buyer of US soybeans) retaliated with tariffs on US agricultural exports, particularly soybeans, targeting a major US export to pressure Trump's political base in rural farming states.

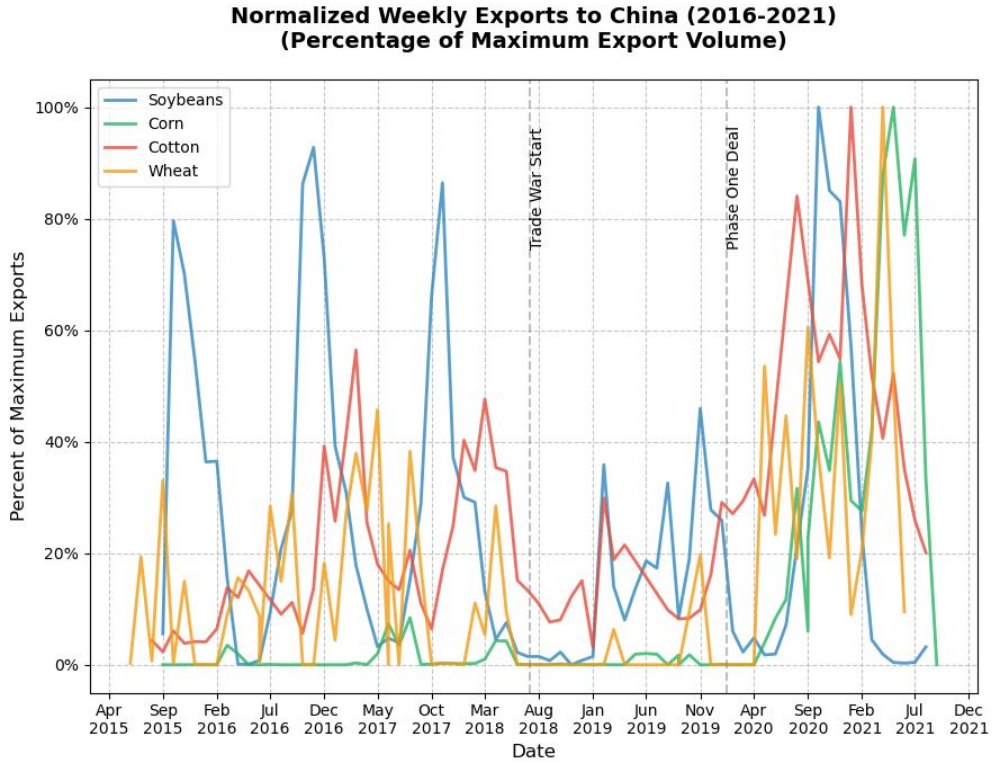
Long-term impacts:

- **Market Volatility:** The uncertainty surrounding tariffs and trade negotiations created price volatility in soybean futures markets, affecting long-term planning for farmers and traders.

- **Global Realignment:** China's tariffs prompted it to seek alternative soybean suppliers, such as Brazil and Argentina, reducing US market share in the long run.

Tariffs affect everyone: A Story through different perspectives

The United States and the rest of the International Market of Soybeans:



Clear decrease in exports to China during the 2018-2020 Period, up until the Phase One Deal was signed.

"The Phase One Agreement also includes commitment by China that it will make substantial additional purchases of U.S. goods and services in the coming years."

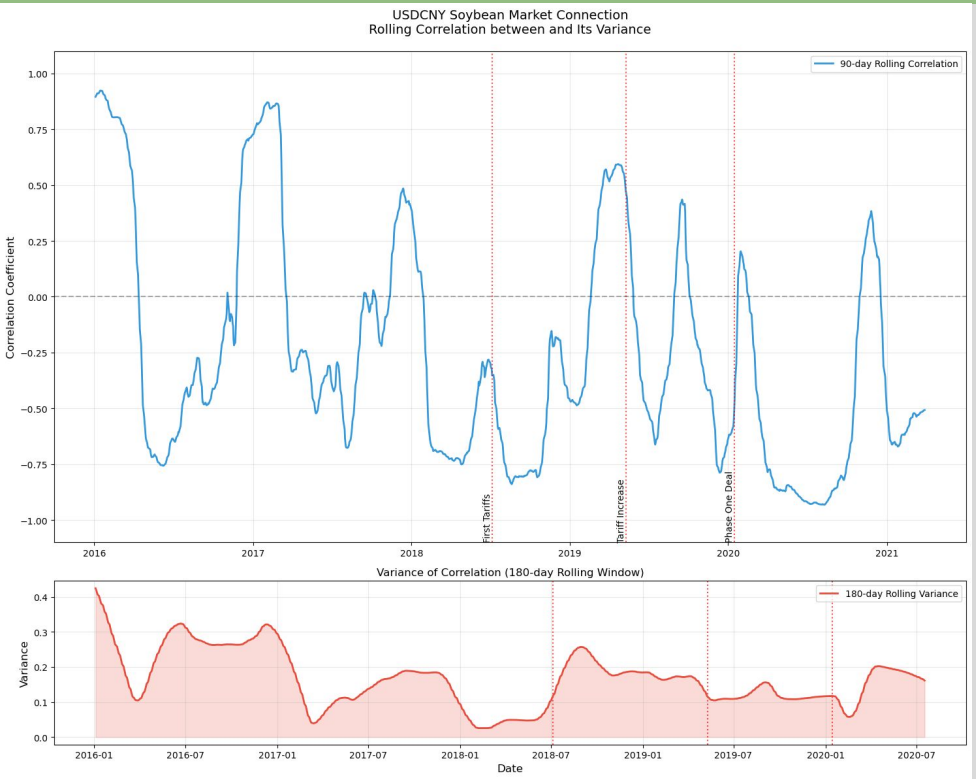
It can be seen in the sharp increase in exports during 2020/21 however the irregularly large exports for crops other than soybeans shows China's ability to rapidly shift it's agricultural sourcing shifting suggesting they can do so in any upcoming trade war the U.S. is planning.

To offset the lost sales the paid out to farmers and amount estimated to be making up more than a third of total farm income in 2019 and 2020 [1][2]

[1] : https://www.wsj.com/articles/trade-war-with-china-took-toll-on-u-s-but-not-big-one-1157883238

[2]: https://www.wpr.org/agriculture/more-40-percent-2020-farm-income-projected-come-federal-payments

The United States and the rest of the International Market of Soybeans:

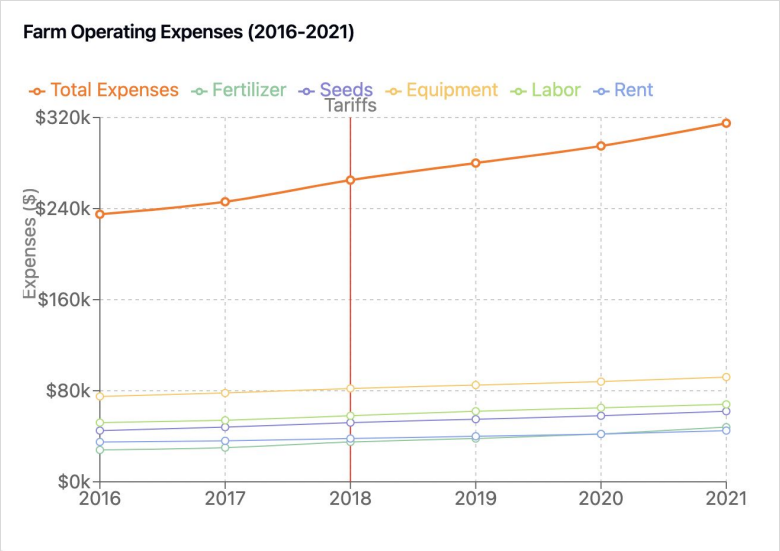


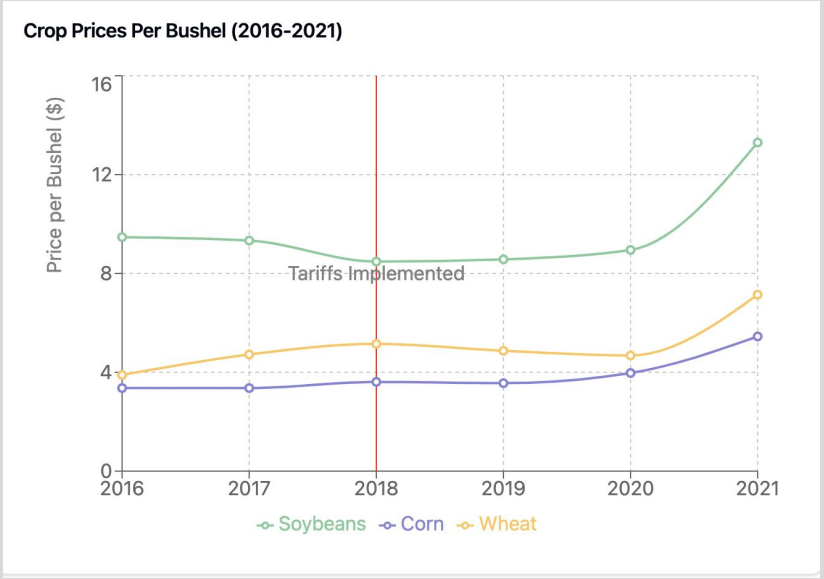
Clear Shifts in the market correlation patterns are evident during 2018-2020 after tariffs were implemented. Showing increasing market uncertainty but not at historically high levels.

Phase One Deal shifts between 0.6 and -0.5. This volatility, combined with relatively stable variance levels shows that while markets were uncertain, they adapted to the new trade environment.

Suggesting that both the US and China had managed to find new sourcing / consumers for their agricultural goods whether it be from other countries or subsidies as mentioned previously.

Tariff effects: Farmers and Consumers

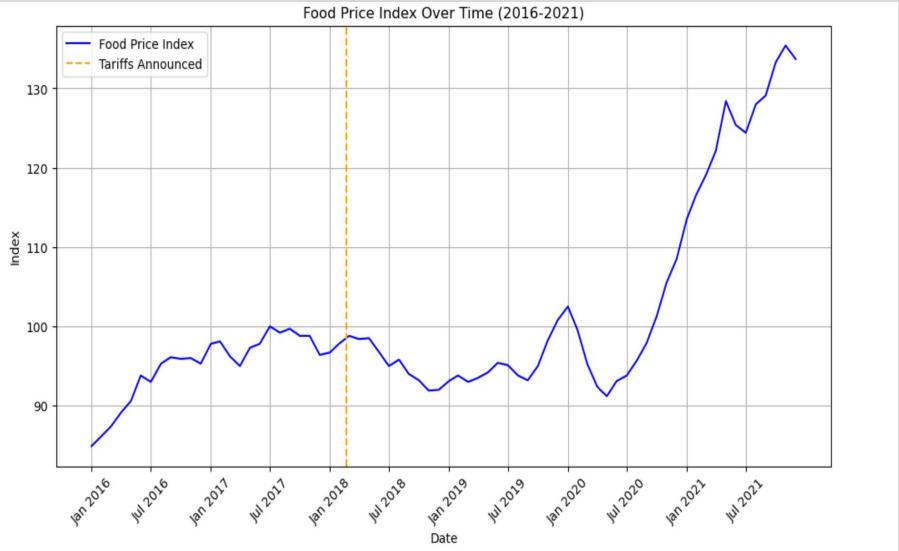




The operating expenses increase consistently over time

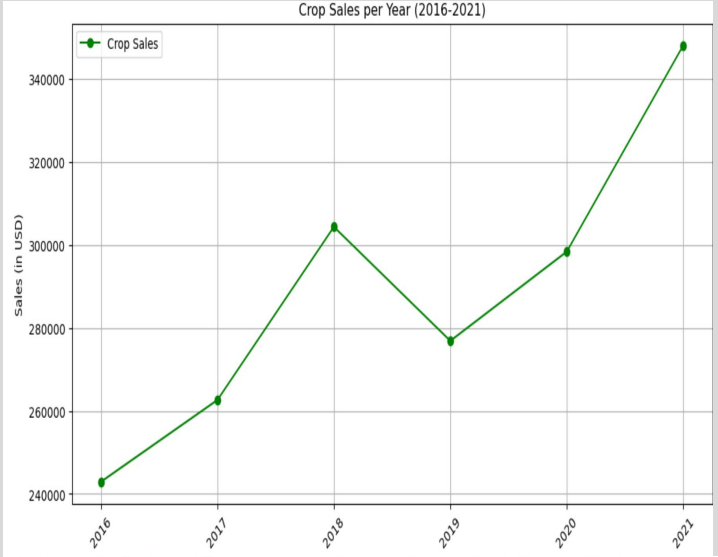
As seen, the crop prices decreased in 2019 right after the Tariffs were introduced. Why?

Tariff effects: FPI and Crop Sales



Food Price Index:

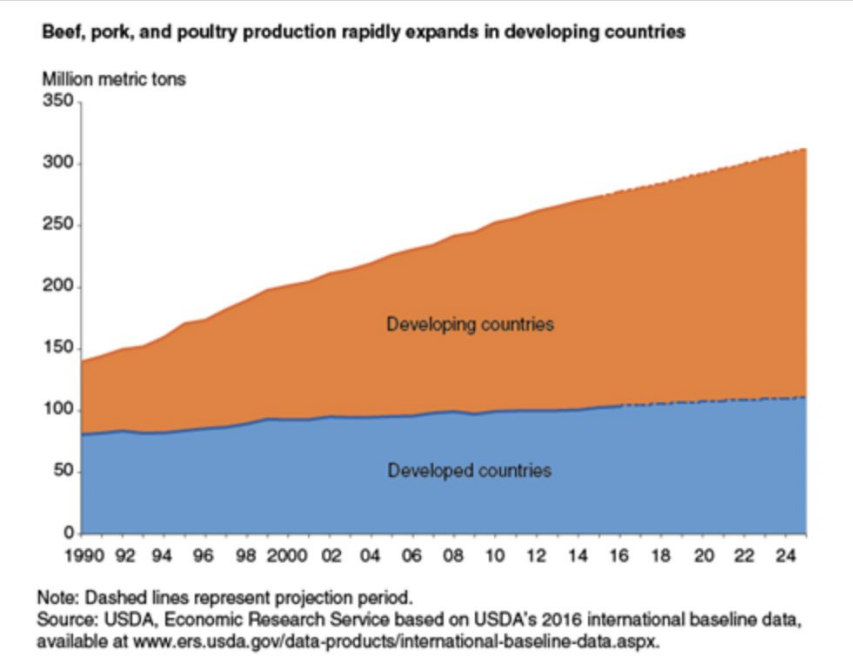
The **FAO Food Price Index (FFPI)** measures the monthly change in international prices of a basket of food commodities. It consists of the average of five commodity group price indices weighted by the average export shares of each of the groups. The five groups are the cereal index, meat index, dairy index, sugar index, and vegetable oil index.



- Tariffs on agricultural inputs (e.g., fertilizers, machinery, and packaging materials) **increased production costs** for U.S. farmers.
- Some producers scaled back output or faced financial strain, which could limit supply and counterbalance the price drop caused by oversupply.
- Impact on FPI: These dynamics created **volatility** in food prices, contributing to fluctuations in the index.

Consumers

Issues:

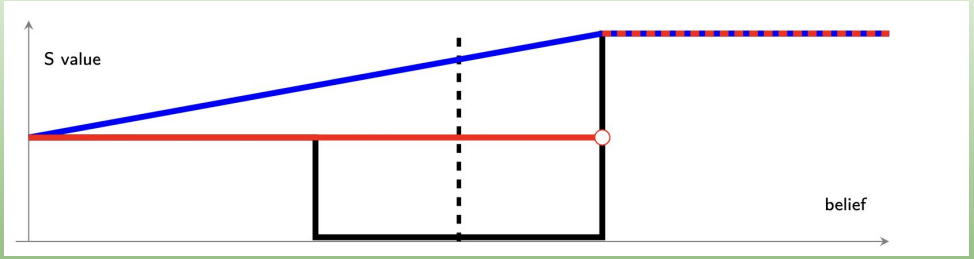


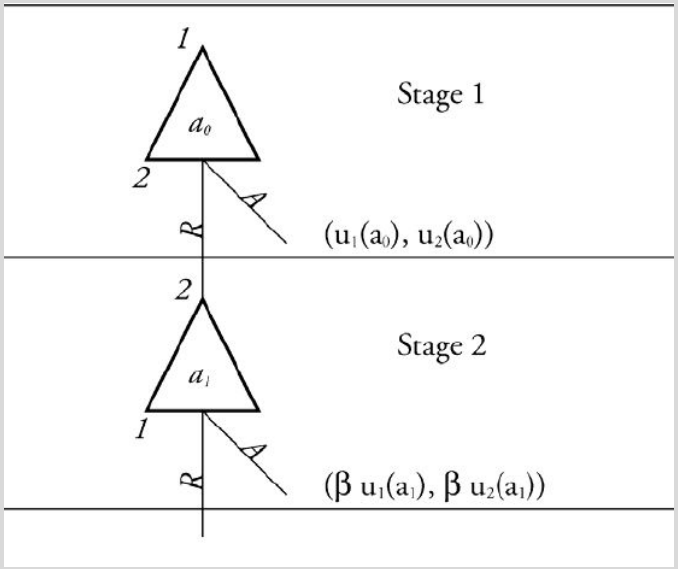
Soybeans are a crucial pricing factor for beef, pork, poultry, and dairy products. Also produce renewable fuels and bioplastics.

Tariffs give majority control over market to Brazil, which has significantly fewer sustainability efforts than the US

It is estimated the economic value of US soybean exports is 25 billion USD annually, affecting a huge number of jobs and they're a major commodity in trading

Theory Approach:





Rubinstein-Stahl bargaining model

- Variations of a strategic communication game
  - Cheap talk
  - Repeated game w/ possibility of lying
- Sender = United States
- Receiver = China
- Best case for US: quasiconcave envelope of utility, evaluated at the prior (Lipnowski-Ravid 2019)
- Requires commitment to losing strategy to win game

Final Remarks

- The reasoning behind ‘the Tariff man’
- Retaliatory Tariffs and rival countries
- Looking ahead: 2024 and beyond

Data Sources:

- https://www.ers.usda.gov/amber-waves/2009/march/agricultural-commodity-price-spikes-in-the-1970s-and-1990s-valuable-lessons-for-today/#:~:text=As%20a%20result%2C%20soybean%20prices,government%20costs%20and%20support%20prices
- [FPI data] https://www.fao.org/worldfoodsituation/foodpricesindex/en/
- https://www.fas.usda.gov/data/commodities/soybeans
- [ARMS data] https://www.ers.usda.gov/data-products/arms-farm-financial-and-crop-production-practices

Questions?