DataFarmers

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Question 1

- We recommend that US importers source milk and eggs to the following developing countries: Mexico, Madagascar, Guatemala, Syria, and South Africa.

Question 2

- Countries that have higher agricultural expenditure typically have higher CO_2 emissions (a more negative environmental impact)
- Invest in countries that have low emission to spending/investment ratios

Question 1

Social Good & Environmental Impact

Poverty

Percent of Population Below Poverty Line

Food Insecurity

Percent Prevalence of Undernourishment

Emissions

Total Greenhouse Gas Emissions, kilotonne of product

Emission Intensity

Greenhouse Gas Emissions, kg of CO_2 per kg of product

Methodology

Choosing Products:

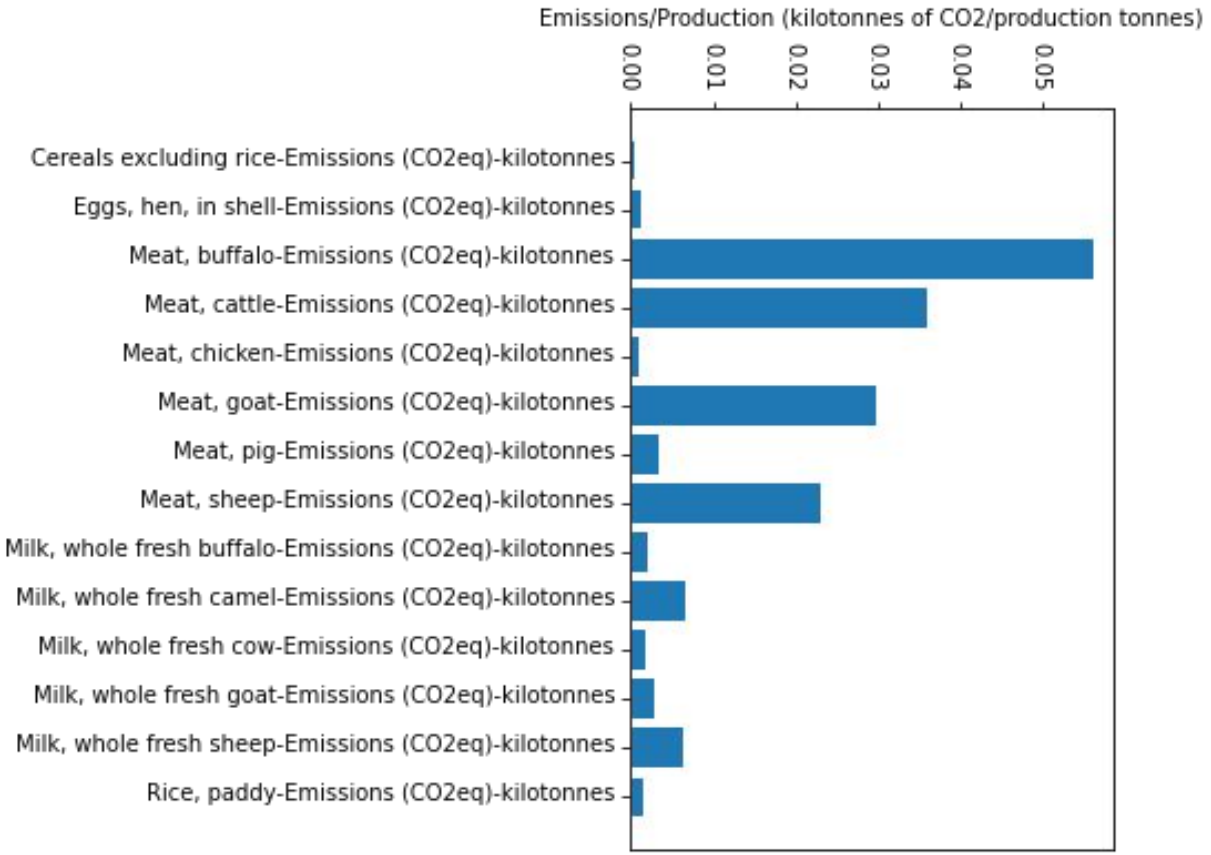
- Split data into X and y values
  - The y values are our 'target' values (our social good values), which are classified based on the X values (our data about each country regarding the crops)
- Use XGBoost regression to determine the importance of each crop
  - Indication of how useful or valuable each crop was in the construction of the boosted decision trees within the model
- Identify the features with the highest relevance/impact on social good and determine which are best
  - Also consider environmental cost (emissions and emission intensity) of the top features

Choosing Countries:

- Based on the products chosen, identify the top countries that produce this crop
  - Determine which countries would be the best choices to maximize social good (ex: those with high poverty and undernourishment rates)
  - We limited our choice of countries to only those with a poverty rate of above 30%, in order to make sure we are focusing on countries with a need for investment
  - We computed the average of rank of milk production, egg production, and poverty rate, and found the countries with the lowest average rank, or most need.

Choosing Products

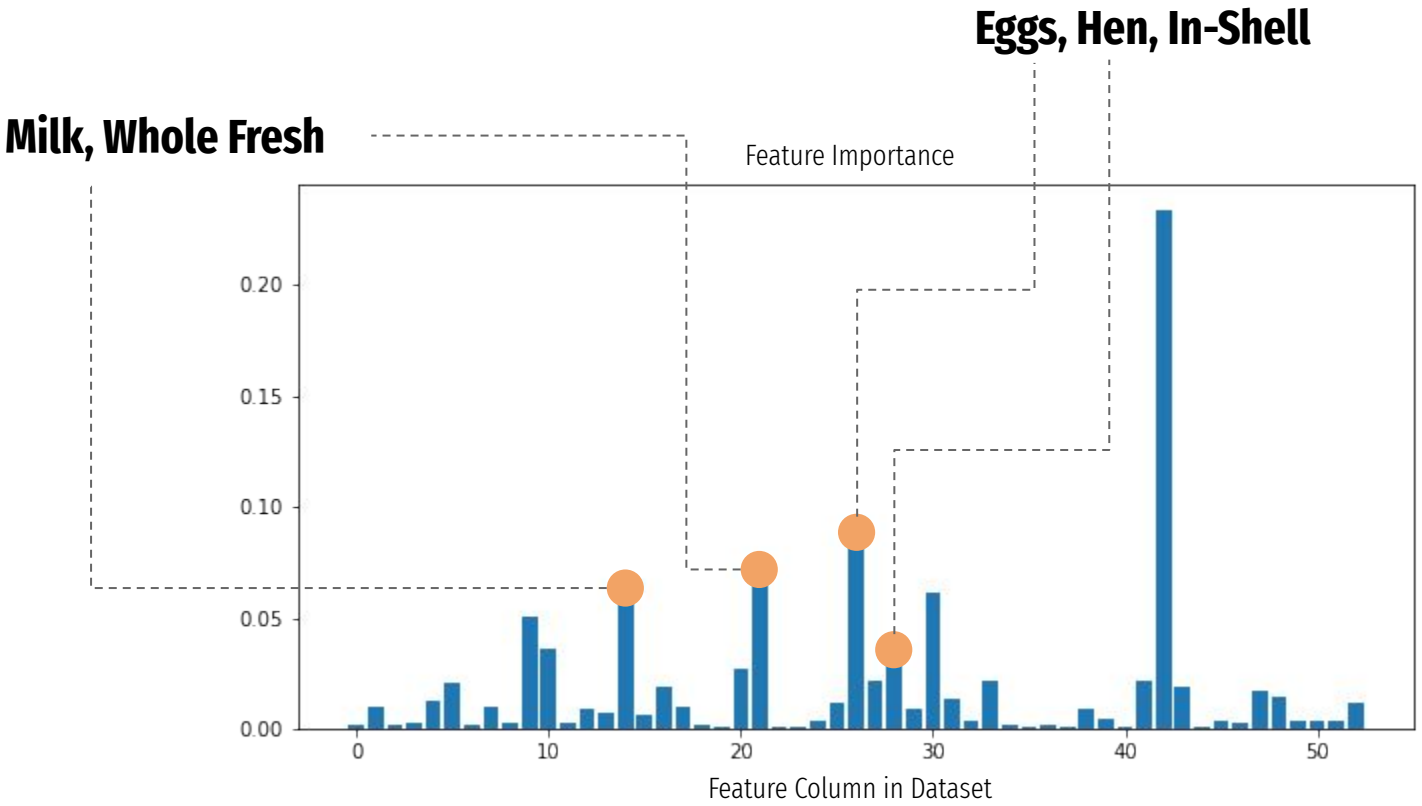
Emission Levels



Best Crops, Environmentally

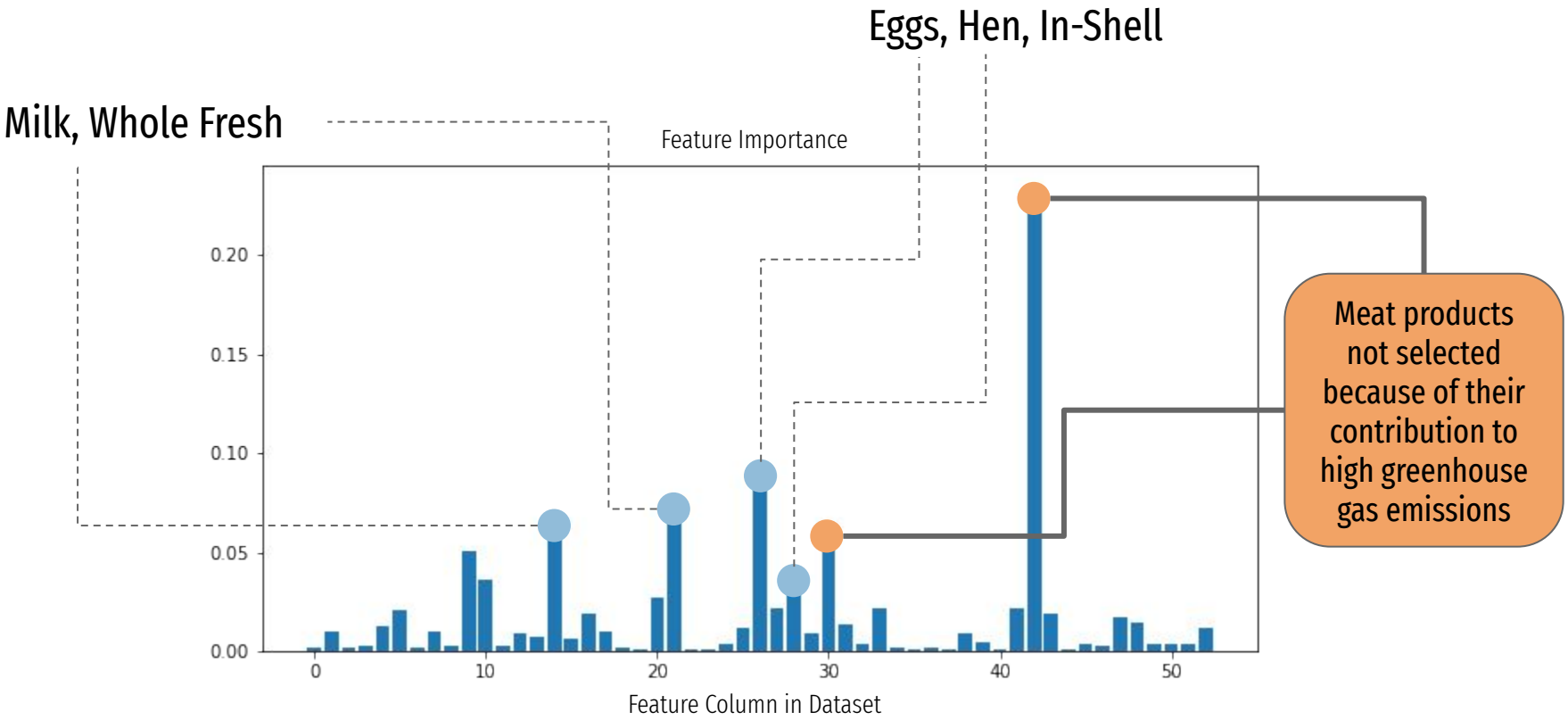
- Cereal/cereal adjacent products
  - Cereals
  - Oats
  - Rye
- Determined by relating specific products with product types using NLP

Agricultural Products Chosen



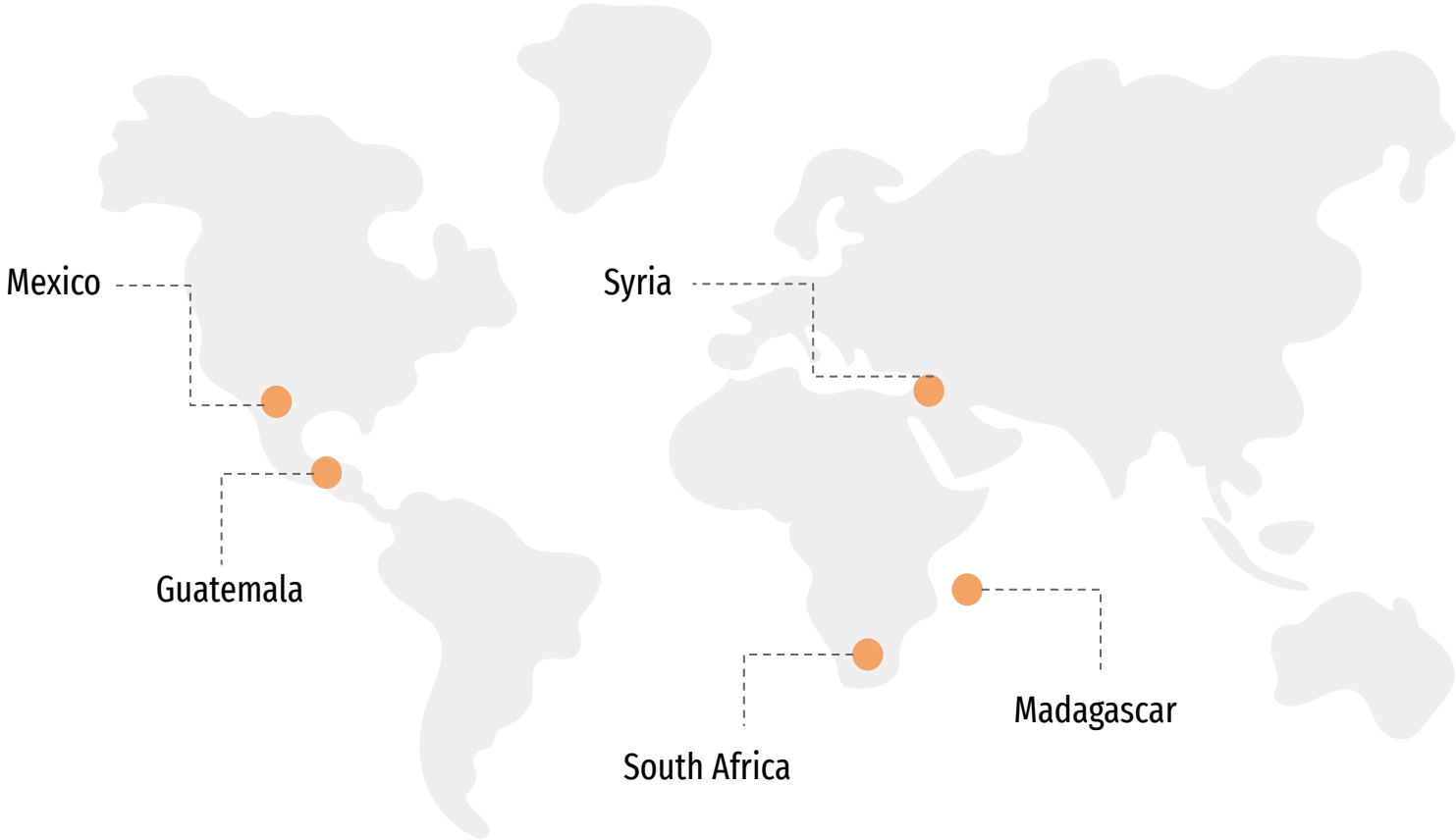
Milk and eggs are features that were found to heavily impact chosen social good metrics

Agricultural Products Chosen



Choosing Countries

Countries to Source From



Next Steps: Quantifying Social Good

Will sourcing certain products from reduce the poverty rates and prevalence of undernourishment in chosen countries?

- Use a predictive model to determine the change in these levels based on changes in production of chosen goods and foreign investments
- A positive change in social good will be indicated by a decrease in these values

How can we compare the impact for each country?

- Normalize/scale the change for each country based on initial values to determine relative change
- Compare the amount of change to the given population for each country

Next Steps: Preliminary Attempts

Country	Before	After
South Africa	5.4%	4.900%
Guatemala	16.4%	16.513%
Mexico	5.8%	5.370%
Madagascar	28.3%	28.269%

XGB Regressor

- Compared data from each country against the levels of undernourishment
- Tested accuracy by splitting data into training and testing data sets (MSE ≈ 3.85)

Predictive Model

- Alter milk and egg production for chosen countries to see how undernourishment changes
  - 5% increase in production
- Consider the most recent data for each country
- Limitations: unsure how all data changes, our changes may not accurately reflect

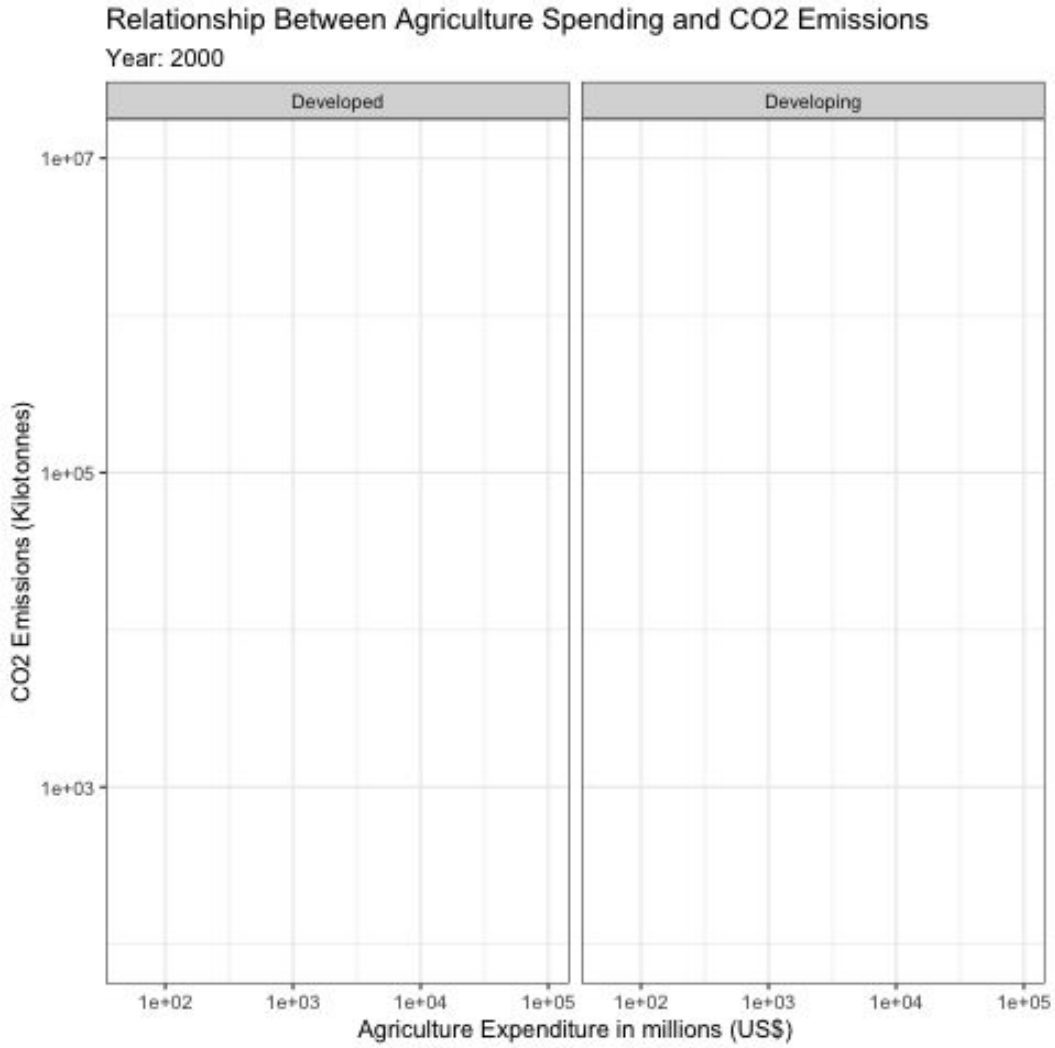
Question 2

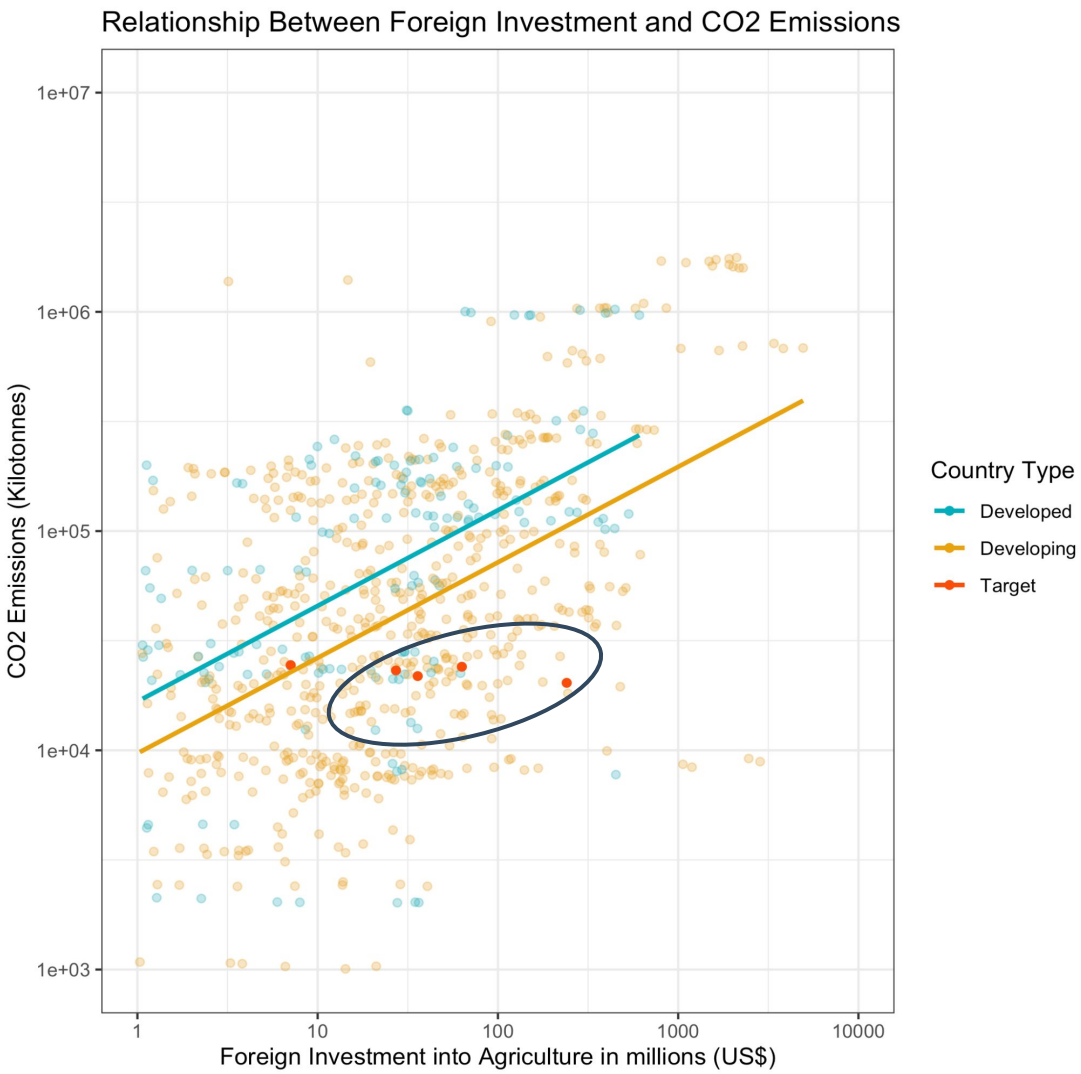
Correlation: Spending and Environmental Impact

1. There is move erratic movement with not developed/developing countries

2. Less developed countries have a high CO_2 emission level compared to total agriculture expenditure

3. Generally there is a positive trend between the two that stays constant over time





Correlation: Foreign Investment and Environmental Impact

1. As foreign investment into a country increases, so does CO2 emissions

2. The countries that we identified earlier tend to have high foreign investment but relatively low CO2 emissions.

Conclusions and Future Work

Conclusions:

- Milk and eggs seem to be the best products to source in order to minimize environmental costs, while impacting certain social factors
  - Determined from creating a model and identifying the most important products for the intended social factors

- Suggested countries to source milk and eggs include: Syria, Mexico, Madagascar, Guatemala, and Mexico
  - Based on the levels of production, as well as the current poverty levels

Next Steps:

- Create adversarial model to balance focusing on picking countries with products that have high social impact potential while also having low environmental impact
- Gathering recent data (from 2021/22) in order to see the impact of post-pandemic supply chain issues on finding the best places to do agricultural investments
- Factor environmental good information into social good calculation for a happy median

Limitations:

- Missing data across countries and years