Tariffs, Global Competitiveness, and U.S. Farm Income

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The reliance of U.S. agriculture on exports makes it highly vulnerable to shifts in trade policy. This paper revisits the impact of tariff changes on U.S. agriculture, a pressing issue stemming from the rising policy uncertainty (Gopinath, 2021). We focus on how import tariffs imposed by trading partners influenced U.S. agricultural exports and farm income. Using a structural model and a shift-share empirical framework, we estimate county-level exposure to relative tariff changes, uncovering regional disparities in trade effects and their implications for farm income. These regional differences are further shaped by evolving structural factors such as farm size and consolidation (MacDonald, 2020). Larger farms may be more resilient to tariff-induced shocks, while smaller farms often face heightened financial vulnerability (Slijper et al., 2021). We investigate whether these structural characteristics contribute to the observed regional variations in the impacts of trade policy, shedding light on the complex interplay between farm structure and trade resilience. This paper contributes to the agricultural trade policy literature by providing insights into the resilience of U.S. agriculture to trade disruptions. It also offers a foundation for evaluating government payment programs and developing more effective bailout strategies.

1 Model

We develop a model of a global agricultural market in which multiple exporting countries supply a fixed world demand. Consumers (importers) have CES preferences over the origin of the product, treating goods from different exporters as imperfect substitutes. This Armington-style approach lets us derive analytical expressions for market share as a function of prices and tariffs. On the supply side, we assume that each country has an upward-sloping supply curve, and prices adjust to clear the global market—a common feature in trade models (**?**). By incorporating tariffs that importing countries impose on each exporter, we can solve for equilibrium prices, quantities, and exporter revenues. The goal is to trace how a change in the relative tariff, the ratio of tariff on U.S. exports to that on competitor exports, affects the U.S. exporter's outcomes.

Demand. Consider a representative import market with a CES utility over varieties indexed by country i. Let q_i be the quantity of the good sourced from country i, and $\sigma > 1$ the elasticity of substitution between country-origin varieties. The aggregate consumption Q is given by:

$$Q = (\sum_i q_i^{(\sigma-1)/\sigma})^{\sigma/(\sigma-1)} .$$

The importers minimize cost for a given Q. The delivered price of country i's product to the import market is $P_i^d = P_i^s(1+\tau_i)$, where P_i^s is the FOB supply price (product price) of country i and τ_i is the ad valorem import tariff imposed on country i. Cost minimization yields the CES demand for each exporter i:

$$q_i = Q \cdot \frac{(P_i^s(1+\tau_i))^{-\sigma}}{\sigma_j(P_j^s(1+\tau_j))^{-\sigma}} .$$

This equation illustrates that demand is apportioned according to each exporter's price, inclusive of tariffs, raised to the power $-\sigma$. Then, the global market share of U.S. exporters in terms of quantity is:

$$S_{US} = \frac{q_{US}}{Q} = \frac{(P_{US}^s(1+\tau_{US}))^{-\sigma}}{\sigma_j(P_j^s(1+\tau_j))^{-\sigma}} .$$

Taking logs, the change in U.S. market share in response to a tariff shock can be expressed as $\Delta \ln(S_{US}) = -\sigma[\Delta \ln(1+\tau_{US}) - \Delta \ln(1+\tau_C)]$, where C represents a competing exporter. This relationship highlights that the U.S. share falls in proportion to the increase in its tariff relative to that of its competitor. In the limit, if τ_{US} rises while τ_C remains constant, the log relative tariff $\ln \frac{1+\tau_{\text{US}}}{1+\tau_C}$ increases, and U.S. quantity share declines elastically by σ times that increase. It aligns with the qualitative findings of **?** on import sourcing and underscores why a relative tariff shock is the appropriate variable for our analysis.

2 Empirical Approach

To examine how U.S. farm income responds to changes in relative tariffs, we employ a shift-share research design that exploits cross-county variation in crop composition to generate localized exposure to global tariff dynamics. The explanatory variable is a county-level measure of exposure to changes in the relative tariff burden faced by U.S. agricultural exporters. For each crop k and year t, we define the relative tariff change as the log-difference between the ad valorem tariff rate applied to U.S. exports and that applied to a major competitor country[1]:

$$\Delta \text{RelTariff}_{k,t} = \left[\ln(1+\tau_{k,t}^{US}) - \ln(1+\tau_{k,t}^{C})\right] - \left[\ln(1+\tau_{k,t-1}^{US}) - \ln(1+\tau_{k,t-1}^{C})\right] ,$$

where $\tau_{k,t}^{U.S.}$ denotes the tariff imposed on U.S. exports of crop k in year t, and $\tau_{k,t}^{C}$ is the tariff applied to exports of the same crop from a reference competitor country C. In our baseline specification, we set C = Brazil, given Brazil's structural importance as the U.S.' leading competitor in several key agricultural exports (e.g., soybeans), particularly in the Chinese market. As a robustness exercise, we alternatively define $\tau_{k,t}^{C}$ as the trade-weighted average tariff faced by a group of major agricultural exporters, including Argentina, Canada, Ukraine, Russia, Australia, India, China, France, and Germany. This alternative specification accounts for broader substitution effects and general trade diversion beyond a single competitor.

Using these crop-level shocks, we construct a county-specific exposure measure via a shift-share approach:

$$\text{Shock}_{i,t} = \sum_k w_{i,k}^{2000} \cdot \Delta \text{RelTariff}_{k,t} ,$$

where $w_{i,k}^{2000}$ denotes the share of crop k in county i's total agricultural output in the base year 2000, which serves as the pre-determined period for constructing exogenous exposure to tariff shocks. This Bartik-style measure reflects the degree to which each county is exposed to global changes in relative tariff pressure, based on its initial production structure and composition.

We then propose the baseline equation that relates the log of county-level farm income to the localized shock as follows:

$$\text{Y}_{i,t} = \beta \cdot \text{Shock}_{i,t} + \gamma_i + \delta_t + \varepsilon_{i,t}, \tag{1}$$

where $\text{Y}_{i,t}$ represents the change of the log of farm income for county i from $t-1$ to t, $\text{Shock}_{i,t}$ is a county-specific relative tariff shock at year t, γ_i are county fixed effects, and δ_t are year fixed effects. The coefficient β captures the elasticity of farm income with respect to changes in relative tariff

[1] Our construction of crop-specific relative tariff changes builds on the logic introduced by **?**, who define relative tariffs as the log difference between the tariff rate imposed on one exporter (e.g., China) and that on a reference group of competing exporters. While their framework focuses on sourcing decisions in U.S. import markets, we extend this concept to the export side by modeling how cross-country tariff differentials affect the competitiveness of U.S. agricultural exports abroad.

exposure. An increase in tariffs on U.S. exports relative to those on competing suppliers may erode the competitiveness of U.S. agricultural products abroad. Counties with a higher concentration of affected crops could then face income declines due to reduced export volumes or lower prices. A negative estimate of β would represent such trade-induced pressures.

3 Data

Our empirical analysis is based on a county-level panel dataset covering the period from 2001 to 2022. To measure trade exposure, we construct a shift-share index that combines county-level crop production data with crop-specific retaliatory tariffs imposed on U.S. agricultural exports during recent trade disputes, particularly the U.S.–China trade war. Crop production data are sourced from the USDA's Census of Agriculture and NASS QuickStats, which provide consistent and detailed information on acreage and yields by commodity and geography. County-level farm income data are sourced from the Bureau of Economic Analysis (BEA), which reports both proprietors' income and rental income from agricultural activities. This decomposition allows us to examine distinct income channels through which trade shocks affect farmers and landowners. To capture variation in structural vulnerability, we merge in county-level data on average farm size, cropland area, and cropping concentration. We further incorporate time-varying controls such as Farm Bill program payments and monthly drought indicators to account for non-trade-related income shocks. This rich, spatially disaggregated dataset enables us to estimate the heterogeneous effects of international trade policy on U.S. farm income, taking into account both differential exposure to tariff shocks and the underlying structural features of local agricultural economies.

4 Contributions

This study makes several contributions to the literature on trade policy and farm income distribution in the United States. First, we develop a refined county-level exposure measure to retaliatory tariffs using a shift-share design that accounts for each county's crop production portfolio and the specific foreign tariffs applied to U.S. exports. This allows us to capture granular variation in trade shocks that has been overlooked in studies relying on national or sectoral aggregates. Second, by leveraging BEA's decomposition of farm-related income, we go beyond price or production responses and examine how trade shocks affect farm proprietors' income and rental income separately. This provides a more comprehensive view of the mechanisms through which trade disruptions impact farm households and landowners. Third, we demonstrate that the structural characteristics of local agriculture significantly mediate the income effects of trade shocks. Counties with larger average farm sizes, higher crop concentration, or more specialized production systems tend to experience more pronounced income volatility. This highlights the importance of internal structure—not just external exposure—in shaping regional vulnerability. Ultimately, our findings directly address the limitations of recent subsidy responses, such as the Market Facilitation Program. The observed disparities in income losses suggest that current policies are insufficiently accounting for the geographic and structural heterogeneity of trade-induced risks. Our results advocate for a more targeted, income-based support mechanism that better aligns with the actual distribution of trade exposure across U.S. agricultural regions.

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