The Incidence of Foreign Market Accessibility on Farmland Rental Rates

Jisang Yu*, Nelson B. Villoria**, and Nathan P. Hendricks**

*Assistant Professor, Kansas State University, Dept. of Agricultural Economics,
**Associate Professor, Kansas State University, Dept. of Agricultural Economics

NBER Conference on
"Agricultural Markets and Trade Policy"
April 30th, 2020

Motivation

Renewed interest on the effects of international trade on wages:

- Recent empirical work on the effects of rapid growth of low-income countries, particularly China, on regional U.S. labor markets, finds lower wages and higher unemployment in the communities most exposed to Chinese imports (e.g., Autor, Dorn, and Hanson 2013).

What about U.S. agricultural exports and their factor prices?

Exports are crucial to U.S. agriculture

- While some manufacturing sectors have lost from international trade, it is widely acknowledged that U.S. agriculture has been a winning sector.
- The share of agricultural exports in the U.S. farm income has been increasing.

Research focus

This begs the question: how have increased trade liberalization and growth in exports affected the returns to the factors employed in agriculture?

More specifically, we attempt to identify **the effect of "localized" tariffs faced by U.S. agricultural exports on cash rental rates.**

Key challenges

- Cash rents are observed at county-level: How do we measure "localized" export tariffs?
  - Aggregation across different destinations for each crop
  - Aggregation across different crops in each county
- The two aggregation issues are crucial in identifying the effect of localized export tariffs on cash rents.
  - **Contemporaneous destination-specific export volumes (thus, shares) and contemporaneous crop shares can be correlated with unobservables that affect cash rents.**

Motivating literature

- Empirical evidence on better market accessibility and the U.S. agricultural land values (e.g. Donaldson and Hornbeck, 2016)
- Estimates of the incidence of domestic or trade policies (e.g. Hertel, 1991; Kirwan, 2009; Hendricks, Janzen, and Dhuyvetter, 2012)
- Empirical studies on trade liberalization and labor market (e.g. Topalova, 2010; Autor, Dorn, and Hanson, 2013; Kovak, 2013)

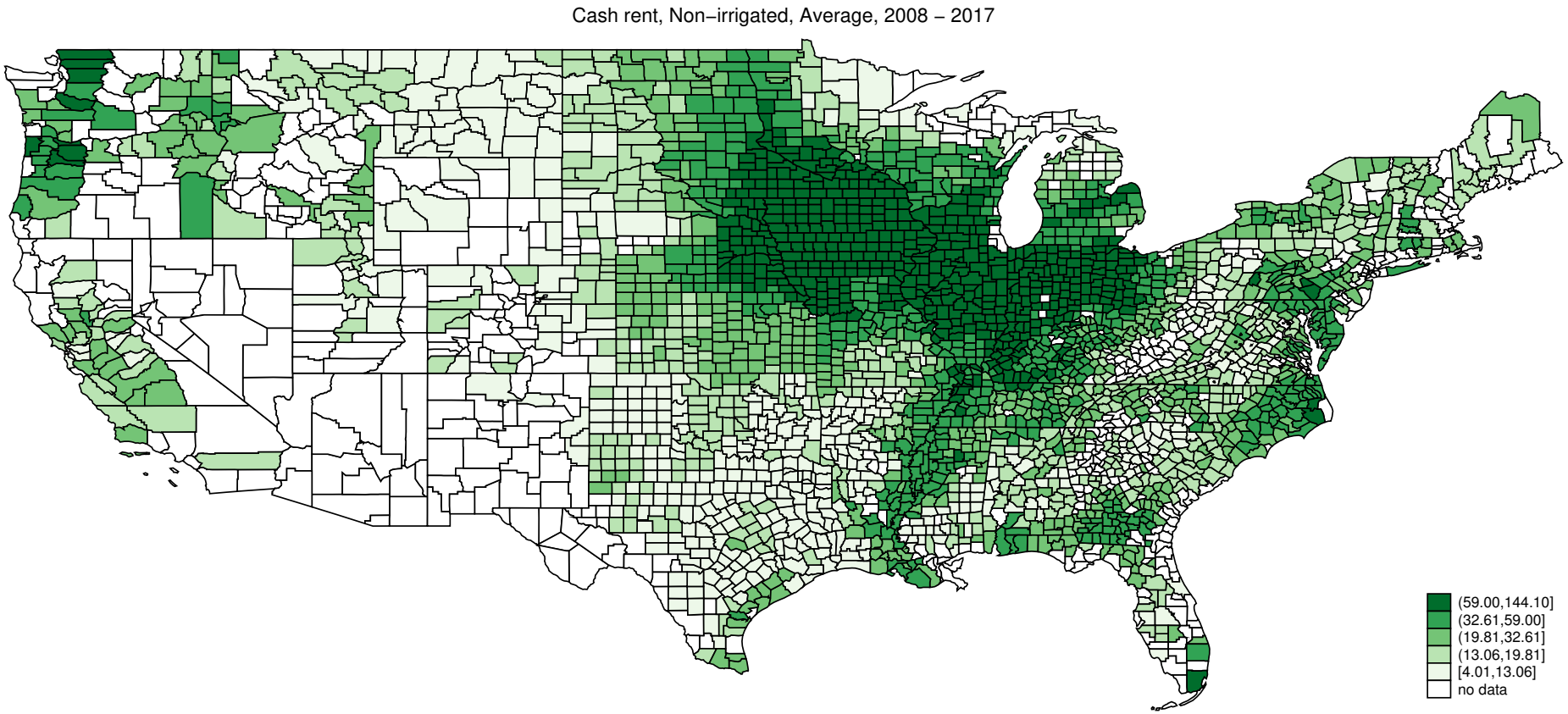
In this paper,...

- We directly estimate how farmland rental rates are affected by the tariffs that U.S. export crops face:
  - **One percent increase in the localized tariff reduces the cash rents by about 2.6–5.3%**
- Using our estimates, we provide the predicted changes in the cash rents caused by the 2018 Chinese retaliatory tariffs:
  - **Cash rents would decrease by about 2%.**

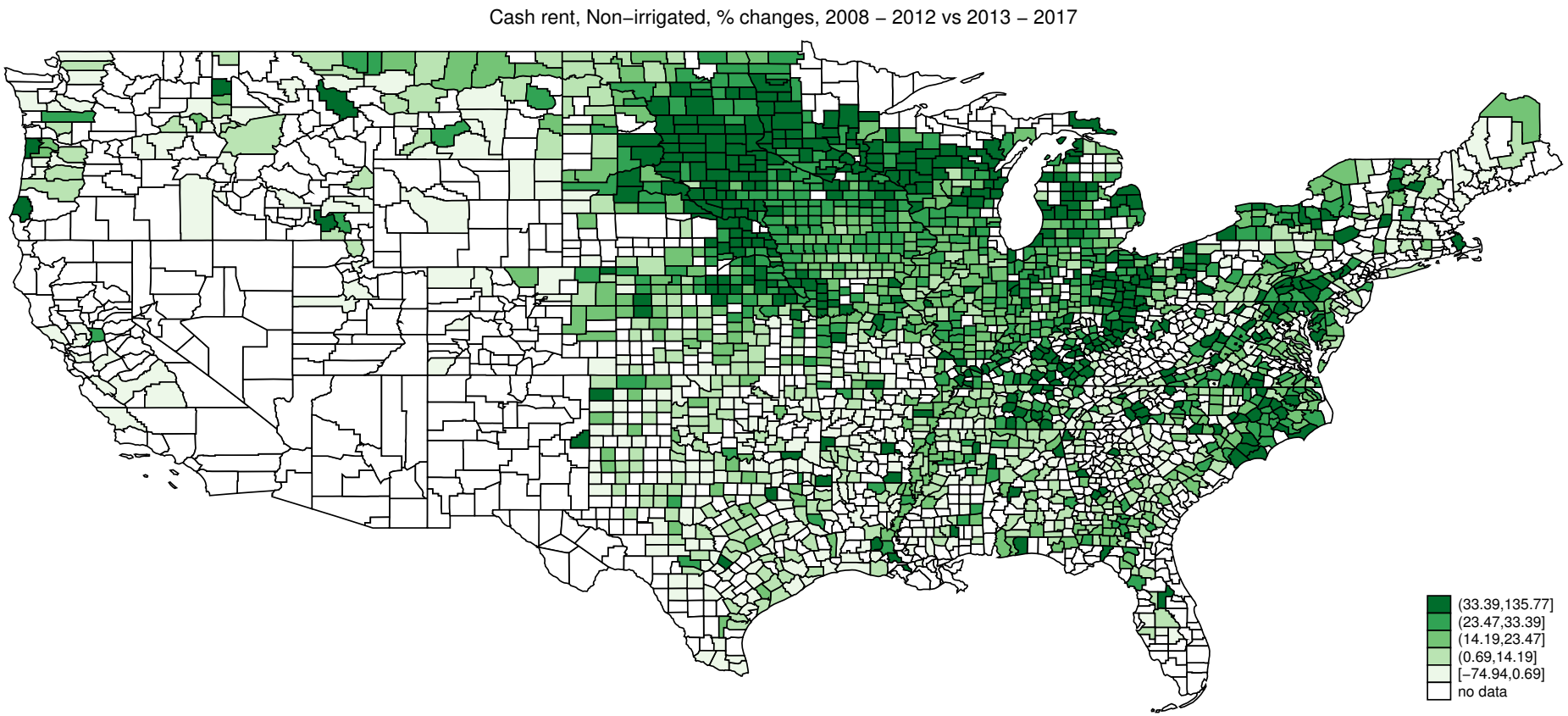
Cash rent data

- We use annual county-level data of cash rents for non-irrigated fields in the U.S. from 2008 to 2014 and from 2016 to 2017 (NASS survey).
- We limit our sample the counties with more than one year of observations from the NASS cash rent survey, which leads to 2,534 counties.
- Per acre cash rents are adjusted by Producer Price Index (1982=100, BLS)

Average cash rent: Non-irrigated



Changes in cash rent: Non-irrigated



Field crops production data

- We focus on the seven field crops: barley, corn, oats, sorghum, soybeans, upland cotton, and wheat (annual county-level planted acreage data from NASS survey).
- To compute the share of each crops, we use county-level data on total cropland, and total harvested irrigated cropland from NASS census (we use the difference between the two as the denominator).

Underlying assumption: Tariffs faced by the U.S. exports of these crops affect the cash rental rates of non-irrigated fields.

Tariff and trade data

- We extract the importer-exporter pair level data for the seven field crops using 4-digit Harmonized Tariff Schedule (HS) codes (1001; 1003; 1004; 1005; 1007; 1201; 5201).
- Tariff data are from TRAINS and trade volume data are from UN Comtrade.
- Extracted from the World Integrated Trade Solution (WITS).

TRAINS tariff data

Two issues with the TRAINS tariff data:

- Missing tariff lines: Most Favored Nation rates are missing for some years in some countries. We use the most recent years for the missing years in those countries.
- TRQ: In general, TRAINS reports out-of-quota rates. Chinese imports of U.S. corn and wheat are less than the quota during the sample period – we replace the reported out-of-quota rates with in-quota rates for these two cases.

Constructing crop-specific tariffs

For destination d for crop j in year t, we denote the ad valorem tariff as τ_{jdt} (we treat the domestic consumption as "export" to the U.S., i.e. $d = US$, with $\tau_{jUSt} = 0$).

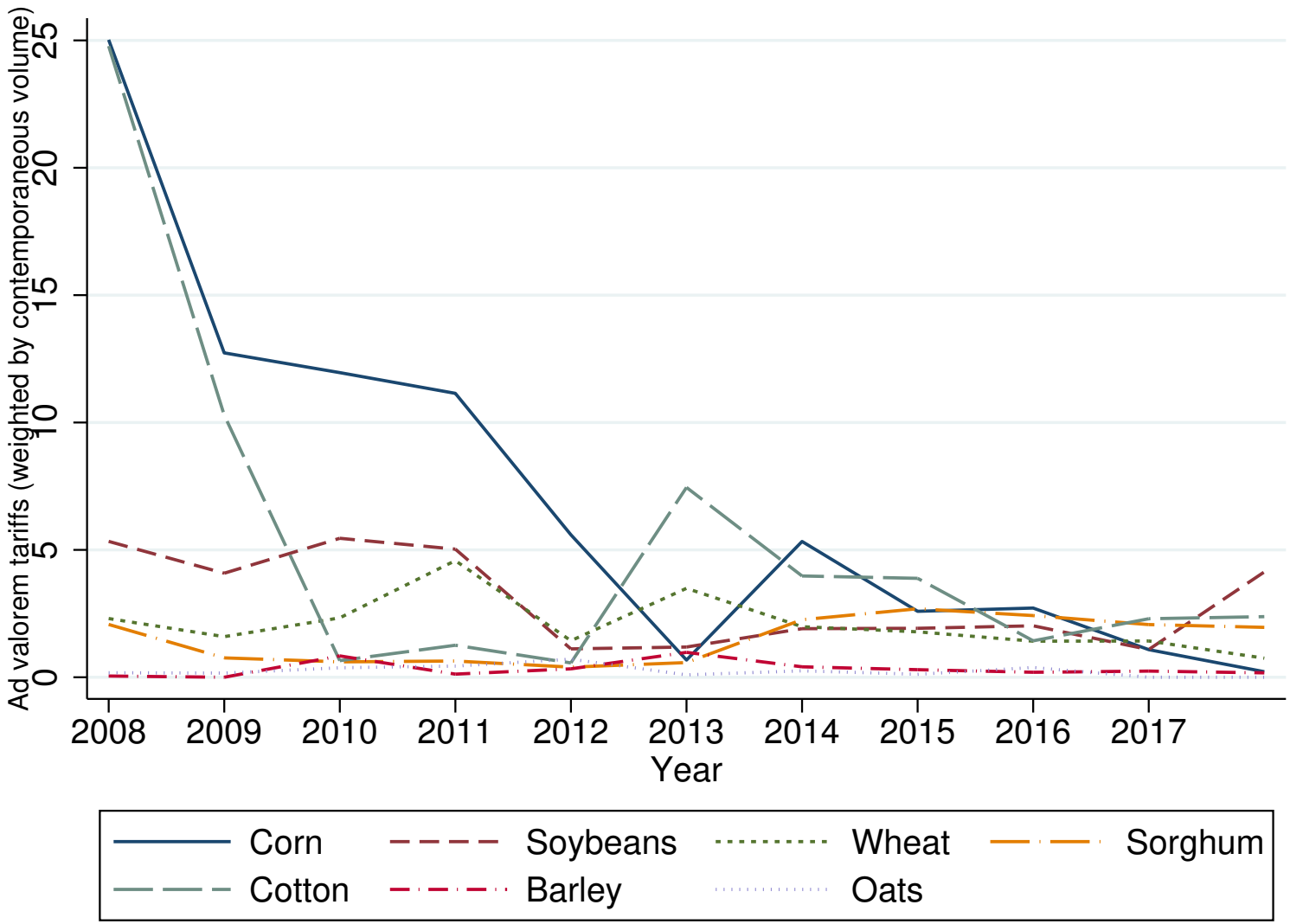
For crop j, in year t, the crop-specific tariff for crop j in year t, τ_{jt}, is

$$\tau_{jt} = \sum_{d} \theta_{jdt} \times \tau_{jdt}$$

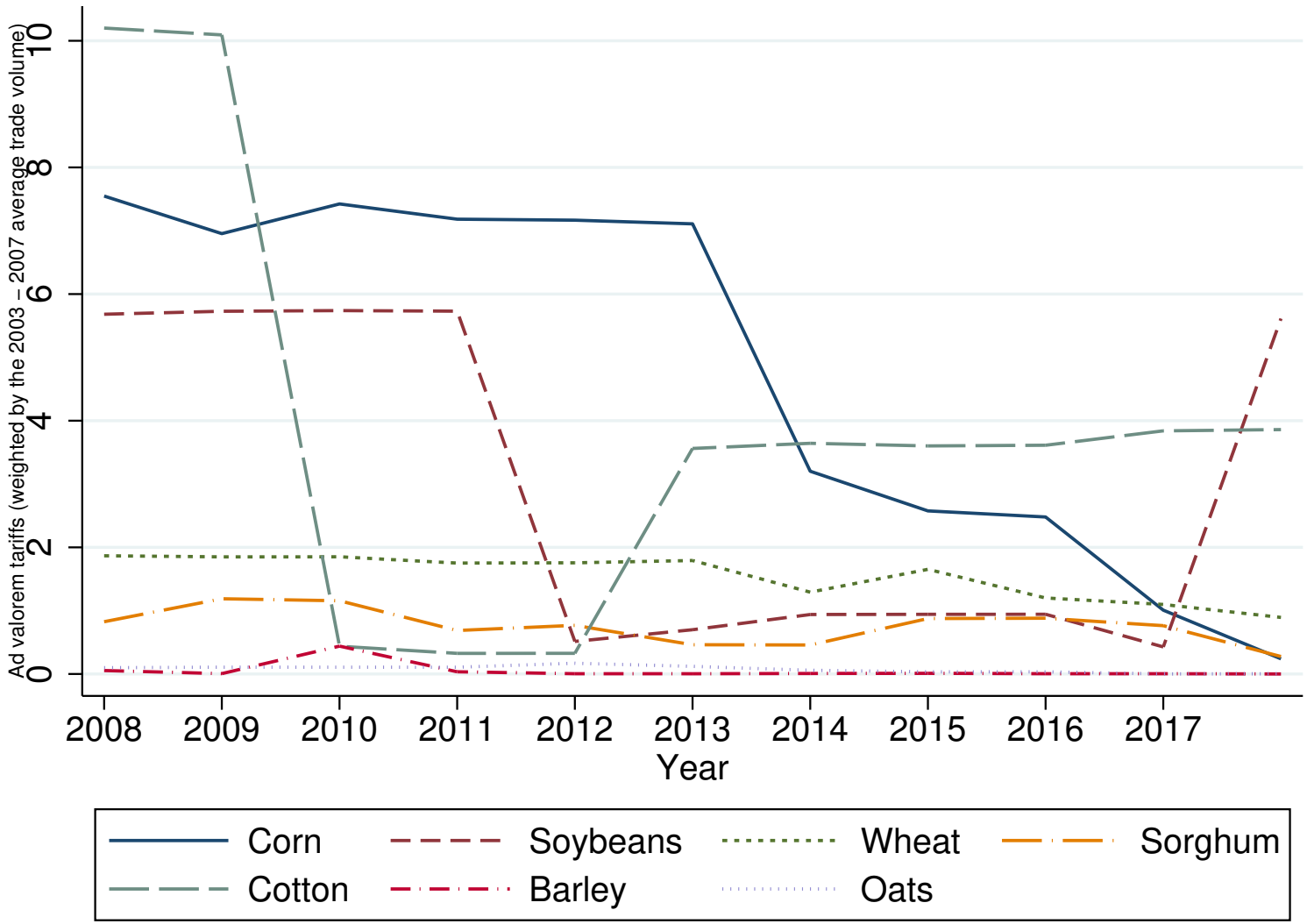
where θ_{jdt} is the weight defined as $\theta_{jdt} = \frac{Imported\ Volume_{jdt}}{\sum_d Imported\ Volume_{jdt}}$.

Alternatively, one can use the weight $\theta_{jd0} = \frac{Imported\ Volume_{jd0}}{Total\ Production_{j0}}$ based on the five-year average over the years 2003–2007.

Trends in crop-specific tariffs



Trends in "shift-share" style crop-specific tariffs



Estimating the incidence of localized export tariffs

Estimation equation

Our main empirical specification is

$$Rent_{it} = \beta_0 + \beta_1 LT_{it} + \Gamma X_{it} + \lambda_{1s} t + \lambda_{2s} t^2 + u_i + v_t + \varepsilon_{it}$$

where LT_{it} is the localized (ad valorem) tariff exposure, and X_{it} is the vector of other covariates including weather variables, and we include state-specific quadratic time trends.

Measuring localized export tariff

We define the localized (ad valorem) export tariff rate for county i in year t as

$$LT_{it} = \sum_j \tau_{jt} \times S_{ijt}$$

where S_{ijt} is the weight for crop j. And note that $\tau_{jt} = \sum_d \theta_{jdt} \times \tau_{jdt}$.

Again, what are the right measures of S_{ijt} and θ_{jdt}?

Identification issues

We face the possibility of $Cov(LT_{it},\ \varepsilon_{it}) \neq 0$ because of

- $Cov(S_{ijt},\ \varepsilon_{it}) \neq 0$: e.g. the U.S. biofuel policy may affect cash rents and crop shares simultaneously by changing profitability and promoting corn production,
- $Cov(\theta_{jdt},\ \varepsilon_{it}) \neq 0$: e.g. the 2012 drought may affect cash rents and export shares simultaneously by keeping more grain in the U.S. for the domestic consumption.

Empirical strategy and "shift-share" design

Motivated by the recent development in "shift-share" designs (e.g. Bartik, 1991; Autor, Dorn, and Hanson, 2013):

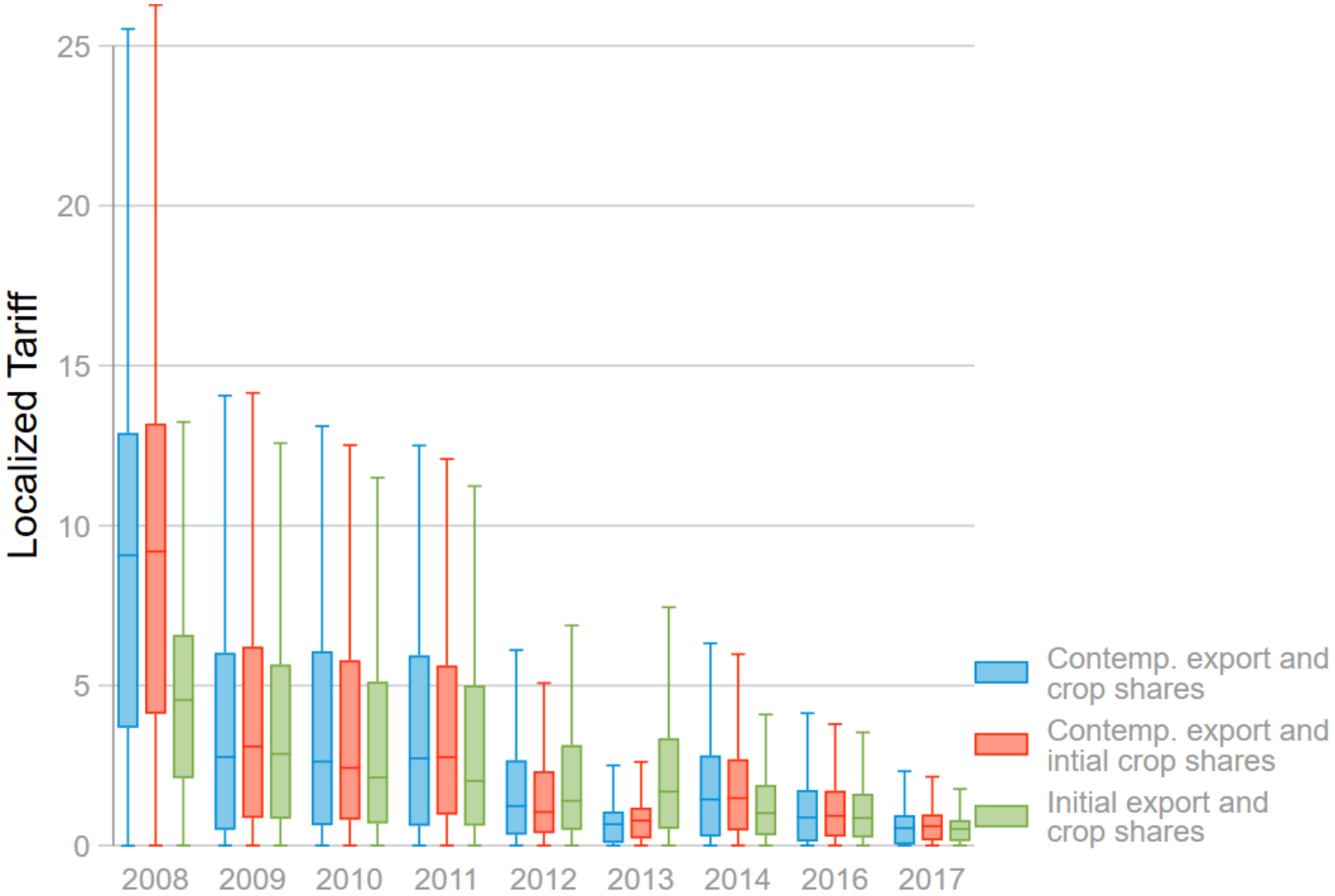
- "Shift-share" design measures within-country spatially disaggregated variation in the country-level shocks (e.g., trade or immigration) by using initial sectoral employment shares.

Thus, we consider

- $S_{ij0} = \frac{Planted\ Acreage_{ij0}}{Non-irrigated\ Cropland_{i0}}$,
- $\theta_{jd0} = \frac{Imported\ Volume_{jd0}}{\sum_d Imported\ Volume_{jd0}}$.

Both of them are computed by using the five-year averages over the years 2003 -2007.

Three measures of localized tariffs by year



Instrumental variables approach

Recall that our main empirical specification is

$$Rent_{it} = \beta_0 + \beta_1 LT_{it} + \Gamma X_{it} + \lambda_{1s} t + \lambda_{2s} t^2 + u_i + v_t + \varepsilon_{it}.$$

We use $\bar{LT}(\theta_{jd0},\ S_{ij0})$, which is the localized tariff constructed with initial trade volume shares $\theta_{jd0} = \frac{Imported\ Volume_{jd0}}{Total\ Production_{j0}}$ and crop shares $S_{ij0} = \frac{Planted\ Acreage_{ij0}}{Cropland_{i0}}$, as the instrument for LT_{it}.

Reduced-form regression

An alternative is to estimate a reduced-form regression where we substitute the instrument directly into the second-stage equation:

$$Rent_{it} = \beta_0 + \beta_1 \bar{LT}(\theta_{jd0},\ S_{ij0}) + \Gamma X_{it} + \lambda_{1s} t + \lambda_{2s} t^2 + u_i + v_t + \varepsilon_{it}.$$

We also consider the measure of LT that uses the contemporaneous export shares, but holds crop shares fixed at initial levels (denoted as $\tilde{LT}(\theta_{jdt},\ S_{ij0})$).

Results: real cash rents

VARIABLES	(1) FE Real Cash Rent	(2) FE-IV Real Cash Rent	(3) FE Real Cash Rent	(4) FE Real Cash Rent
Contemp. shares, LT_{it}	-1.226***	-2.116***		
	(0.208)	(0.493)		
Contemp. export and init. crop shares, $\tilde{LT}_{it}$			-1.518***	
			(0.281)	
Init. shares, $\bar{LT}_{it}$				-1.964***
				(0.546)
Observations	18,739	18,739	18,739	18,739
First stage F	NA	61.59	NA	NA
Weather Covariates	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes
State-specific trend	Yes	Yes	Yes	Yes

Note: Standard errors are clustered at the state and year levels.

Results: ln of real cash rents

VARIABLES	(1) FE ln(Real Cash Rent)	(2) FE-IV ln(Real Cash Rent)	(3) FE ln(Real Cash Rent)	(4) FE ln(Real Cash Rent)
Contemp. shares, LT_{it}	-0.0134***	-0.0257***		
	(0.00316)	(0.00470)		
Contemp. export and init. crop shares, $\tilde{LT}_{it}$			-0.0165***	
			(0.00390)	
Init. shares, $\bar{LT}_{it}$				-0.0239***
				(0.00471)
Observations	18,739	18,739	18,739	18,739
First stage F	NA	61.59	NA	NA
Weather Covariates	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes
State-specific trend	Yes	Yes	Yes	Yes

Note: Standard errors are clustered at the state and year levels.

Estimating the effects of the 2018 Chinese tariff

In order to place the estimated effects in the context of the 2018 trade war between the U.S. and China, we provide several estimates on the predicted impact of Chinese retaliatory tariffs on the U.S. exports.

We consider the two cases:

- Assume that there is no trade diversion/adjustment,
- Allow the trade volumes to reallocate in terms of their destinations (use GTAP).

Computing the changes in localized tariffs

- No trade adjustment: use initial export and crop shares, and nominal increases in tariffs

$$\Delta_{China}\bar{LT}_i = \sum_j (\theta_{j\ China\ 0} \times (\tau_{j\ China\ 2018} - \tau_{j\ China\ 2017})) \times S_{ij0}.$$

- Trade volumes reallocation: use GTAP estimates for export shares by destination as responses to the tariff increases

$$\Delta_{China}LT_i = \sum_j \left(\sum_d (\hat{\theta}_{jd2018}\tau_{jd2018} - \theta_{jd2017}\tau_{jd2017}) \times S_{ij2017} \right).$$

Predicting the effects on the cash rents

- No trade adjustment: use $\Delta_{China}\bar{LT}_i$, and the estimated β_1' of column (4) in the main tables (the reduced-form estimates).
- Trade volumes reallocation: use $\Delta_{China}LT_i$, and the estimated β_1 of column (2) in the main tables (the IV estimates).

2018 Chinese retaliatory tariffs

(Source: Regmi (2019))

Product	MFN	September 2018	Note
Barley	3%	3%	
Corn	1%	26%	In-quota rates
Cotton	1%	26%	In-quota rates
Oats	20%	30%	
Sorghum	2%	27%	
Soybeans	3%	28%	
Wheat	1%	26%	In-quota rates

Estimated changes in crop-specific tariffs

Product	No trade volume reallocation (Weighted by the initial export shares)	Trade volume reallocation (Weighted by the GTAP estimates)
Barley	0%	0%
Corn	0.0018%	0.17%
Cotton	7.63%	3.88%
Oats	0.000035%	0.17%
Sorghum	0%	0.17%
Soybeans	3.92%	4.03%
Wheat	0.54%	0.27%

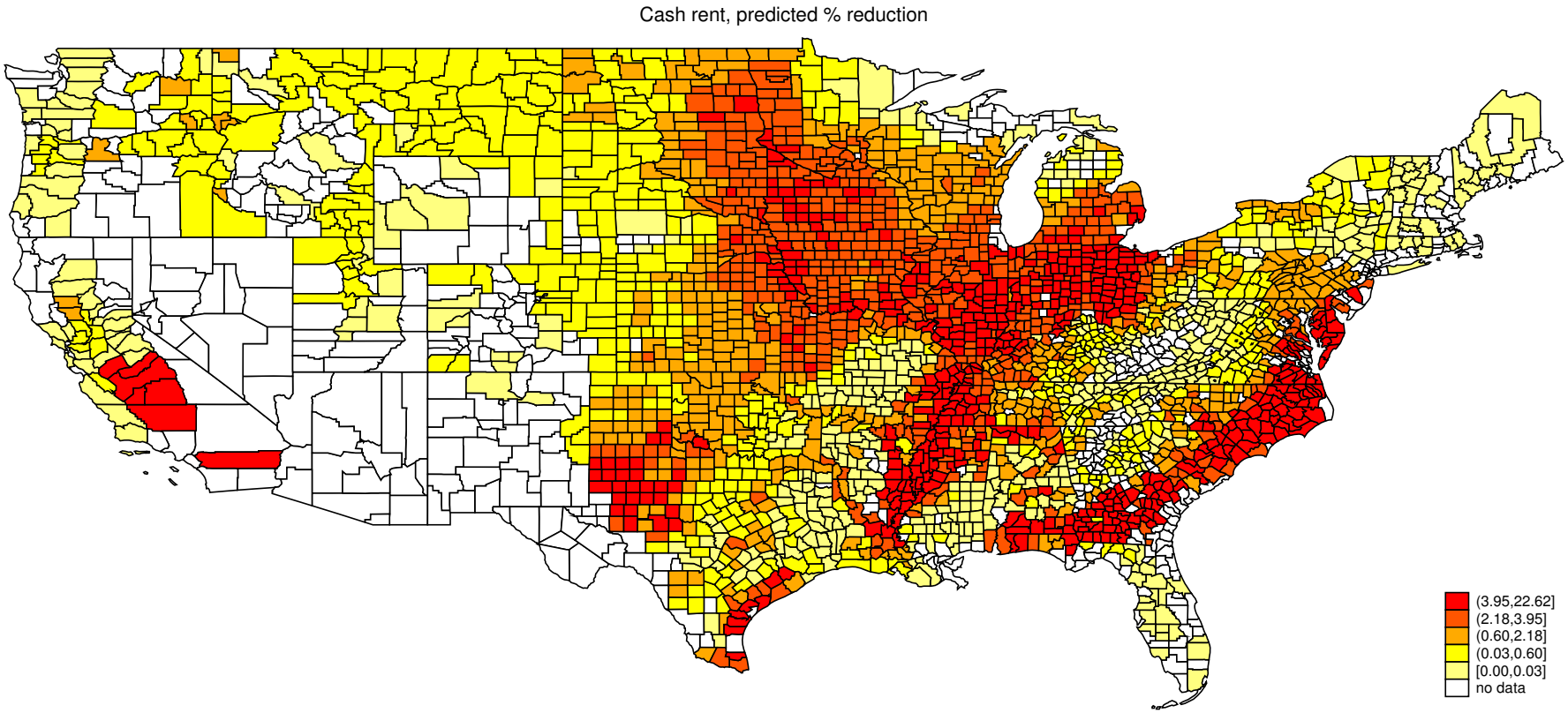
Predicted effect of the 2018 Chinese tariff

Summary of counterfactual predictions

VARIABLES	(1) Mean	(2) SD	(3) Min	(4) Max
Nominal reduction (no trade adjustment)	3.714	4.383	0	36.05
Percentage reduction (no trade adjustment)	2.331	2.751	0	22.62
Nominal reduction (GTAP)	3.906	4.077	0	32.94
Percentage reduction (GTAP)	2.451	2.559	0	20.68
Number of counties	2,240			

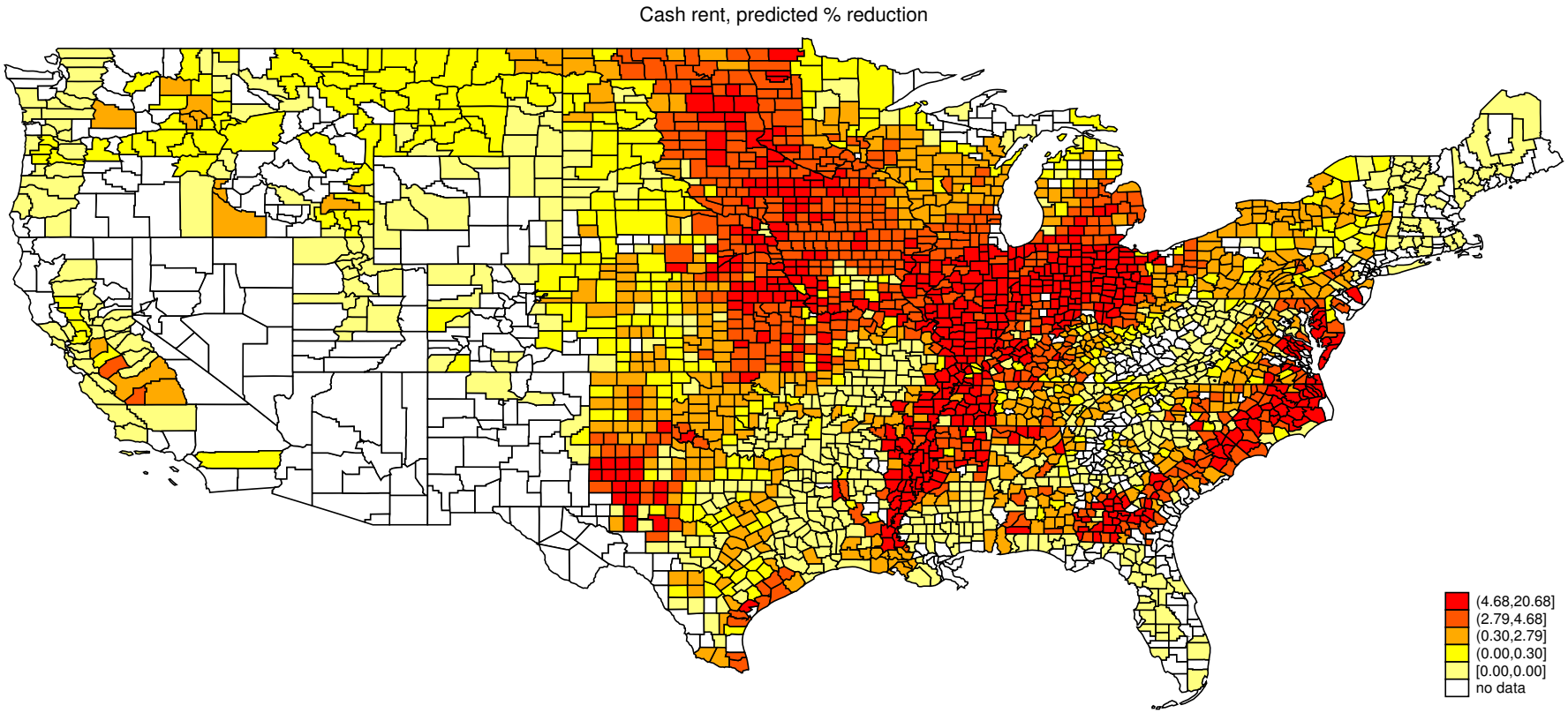
Predicted effect of the 2018 Chinese tariff

No trade adjustment



Predicted effect of the 2018 Chinese tariff

Trade volumes reallocation (GTAP)



Alternative specifications

- Our estimates may not represent the average effect across years if there are long-run adjustments: Panel long-difference approach (Burke and Emerick, 2016)
- The level of tariffs in a particular year can be coincidentally correlated with the cash rents and the results are driven by that particular year: Shift-share approach by year

Long-difference approach

We estimate the following equation:

$$Rent_{i\ post2012} - Rent_{i\ pre2012} = \beta_0 + \beta_1(LT_{i\ post2012} - LT_{i\ pre2012}) + \Gamma(Z_{i\ post2012} - Z_{i\ pre2012}) + \varepsilon_{it}$$

where $Rent_{i\ post2012}$ and $Rent_{i\ pre2012}$ are the averages of the county-average cash rents for the periods 2008–2012 and 2013–2017, and $LT_{i\ post2012}$ and $LT_{i\ pre2012}$ are the averages of the localized tariff exposure measures.

Results

VARIABLES	(1) FE Real cash rent	(2) FE-IV Real cash rent	(3) FE Real cash rent	(4) FE Real cash rent
Contemp. shares, LT_{it}	-1.961***	-2.140***		
	(0.266)	(0.296)		
Contemp. export and init. crop shares, $\tilde{LT}_{it}$			-2.046***	
			(0.341)	
Init. shares, $\bar{LT}_{it}$				-3.235***
				(0.451)
Observations	2,455	2,455	2,455	2,455
First stage F	NA	356.03	NA	NA
Weather Covariates	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes

Note: Standard errors are clustered at the state level.

Shift-share analysis by year

We estimate the following regression equation for each year t:

$$\Delta Rent_{it} = \beta_0' + \beta_1' \Delta \bar{LT}_{it} + \Gamma \Delta Z_{it} + u_s + \varepsilon_{it}$$

where $\Delta Rent_{it} = Rent_{it} - \overline{Rent}_{i\ 2009-2011}$, i.e. the change in cash rent in county i in year t from the average cash rent from 2009 to 2011. The tariff shocks are measure by

$$\Delta \bar{LT}_{it} = \sum_j \left(\sum_d (\tau_{jdt} - \tau_{jd\ 2009-2011}) \times \theta_{jd\ 2009-2011} \right) \times S_{ij\ 2009-2011}.$$

Results

VARIABLES	(1) Year 2012 Rent Change	(2) Year 2013 Rent Change	(3) Year 2014 Rent Change	(4) Year 2016 Rent Change	(5) Year 2017 Rent Change
Tariff Shock	-1.219***	-4.395***	-2.513***	-3.108***	-1.987***
	(0.356)	(0.844)	(0.382)	(0.389)	(0.271)
Observations	2,115	2,132	2,164	2,147	2,161
Weather Covariates	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes

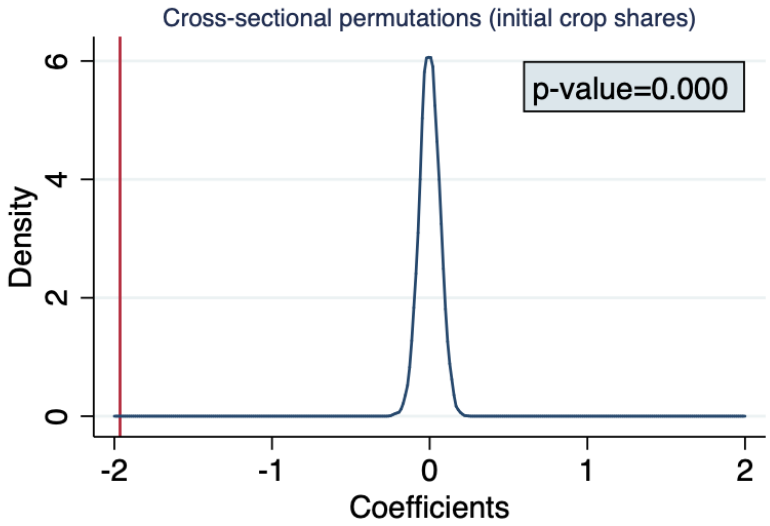
Note: The base period is 2009 – 2011. Standard errors are clustered at the state level.

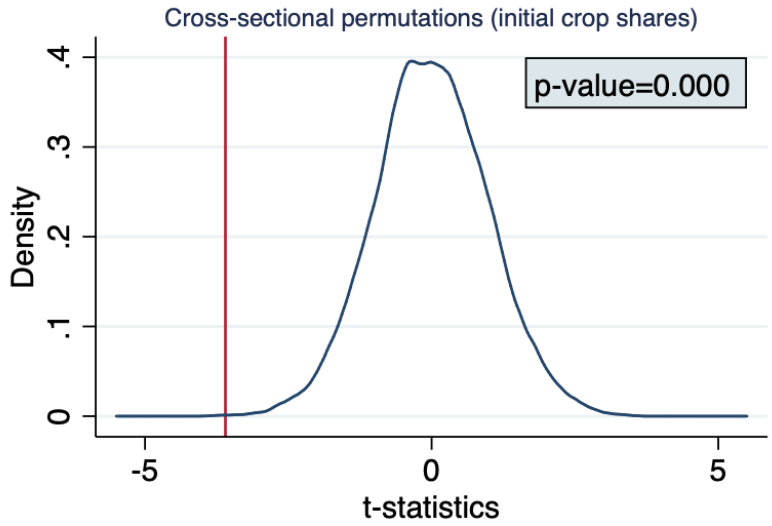
Concluding remarks

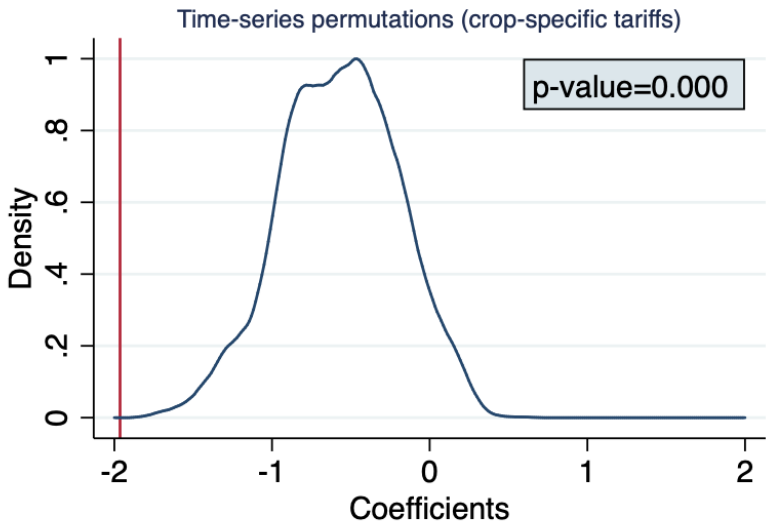
- We find that the nominal tariffs in destination markets have substantial effects on land rents.
- Results are robust to different specifications that mitigate confounding effects due to the adjustment of both, the crop and export destinations as tariffs change.

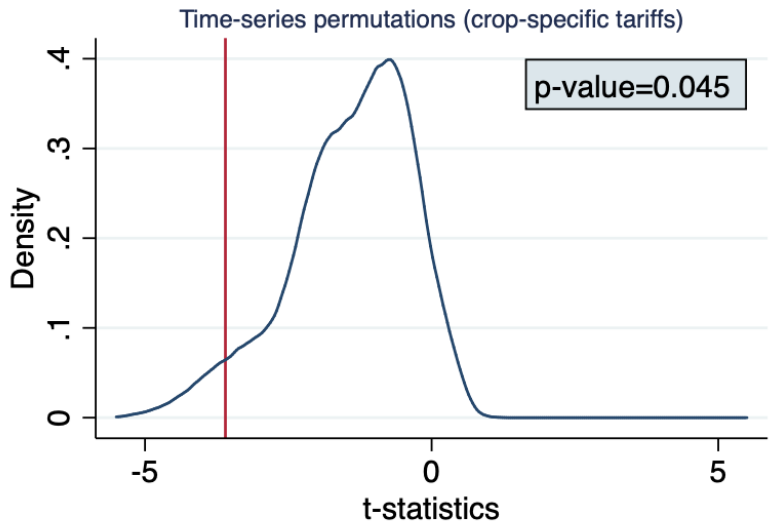
- The estimates provide useful information on the effects of unilateral losses of market access.
  - The retaliatory tariffs imposed by China would cause large declines in land rents, particularly, in the counties where cotton and soybeans are the dominant crops.

Appendix: Randomization Inference









References I

Adão, R., M. Kolesár, and E. Morales. 2019. "Shift-Share Designs: Theory and Inference." *The Quarterly Journal of Economics* 134:1949–2010.

Autor, D.H., D. Dorn, and G.H. Hanson. 2013. "The China Syndrome: Local Labor Market Effects of Import Competition in the United States." *The American Economic Review*, pp. 2121–2168.

Bartik, T.J. 1991. "Who benefits from state and local economic development policies?", pp. .

Burke, M., and K. Emerick. 2016. "Adaptation to climate change: Evidence from US agriculture." *American Economic Journal: Economic Policy* 8:106–40.

References II

Donaldson, D., and R. Hornbeck. 2016. "Railroads and American Economic Growth: A "Market Access" Approach." *The Quarterly Journal of Economics* 131:799–858.

Hendricks, N.P., J.P. Janzen, and K.C. Dhuyvetter. 2012. "Subsidy Incidence and Inertia in Farmland Rental Markets: Estimates from a Dynamic Panel." *Journal of Agricultural and Resource Economics* 37:361–378.

Hertel, T.W. 1991. "Factor Market Incidence of Agricultural Trade Liberalization: Some Additional Results." *Australian Journal of Agricultural Economics* 35:91–107.

Kirwan, B.E. 2009. "The Incidence of U.S. Agricultural Subsidies on Farmland Rental Rates." *Journal of Political Economy* 117:138–164.

References III

Kovak, B.K. 2013. "Regional Effects of Trade Reform: What is the Correct Measure of Liberalization?" *American Economic Review* 103:1960–1976.

Regmi, A. 2019. "Retaliatory tariffs and U.S. agriculture." CRS Report No. R45903, Congressional Research Service, Washington D.C., September.

Topalova, P. 2010. "Factor Immobility and Regional Impacts of Trade Liberalization: Evidence on Poverty from India." *American Economic Journal: Applied Economics* 2:1–41.