Impact of the China Trade Shock on U.S. Regional Inequality: A Replication Study

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Overview

Introduction

Research Question

What is the impact of a large international trade shock on inequality across regions in the US?

Methodologic Approach

A composition-adjusting approach is applied to the outcomes using a Two-Stage Least Squares Regression Analysis. Potential changes in the composition of gender, age, education, race, and nativity (US-born) are held constant to assess demographic shifts across industries that may impact inequality.

Key Findings

Larger effects of the China shock on inequality across regions are observed.

Data Description
Sources

The two main data sources used in this study are:

1. Dependent variables from the 1990, 2000 Censuses + 2007 3 year ACS (2006-2008)
   - `https://usa.ipums.org/usa/`
2. **Data II:** Independent variables from "China Shock" paper
   - **Author:** David H. Autor, David Dorn, and Gordon H. Hanson, 2013, "The China Syndrome: Local Labor Market Effects of Import Competition in the United States"
   - **Dorn Data:** `http://www.ddorn.net/data.html`

Data Description
Transformations

- *Step 1:* Ten-year equivalent changes (btw 1990-2000 and btw 2000-2007) are constructed at the commuting zone (CZ) level, composition-adjusted for working-age individuals (also the same for 1990 - 2000) for
  - average wage, e.g., log(average wage$_{2007}$) log(average wage$_{2000}$)
  - unemployment rate, e.g., unemployment rate$_{2007}$/unemployment rate$_{2000}$
  - labor force participation (LFP) rate, e.g., LFP rate$_{2007}$/LFP rate$_{2000}$
- *Step 2:* 2SLS is used to estimate the impact of the "China shock" on the CZ-level outcomes above, with progressive controls added for additional CZ-level variables as described in the paper.

Methodology
Main Model

The paper explores how changes in industry-level import exposure affect labor outcomes at the commuting zone level, specifically analyzing unemployment rates, wages, income levels, and labor force participation.

The primary estimation employs an Instrumental Variables Two-Stage Least Squares model[1]:

$$\Delta L_{it}^{m} = \gamma_t + \beta_1 \Delta IPW_{it}^{u} + \boldsymbol{X}_{it}' \beta_2 + \epsilon_{it} \tag{1}$$

Where:

- ΔL_{it}^{m}: 10-year change in the average share[2] of manufacturing employment in the working-age population in commuting zone i and year t.
- γ_t: Time fixed effect.
- ΔIPW_{it}^{u}: Observed change in U.S. import exposure from China.
- $\boldsymbol{X}_{it}$: Set of control variables for demographic and labor force characteristics.

[1] Clustered by area using FIP code.

[2] Average calculated across groups based on gender, origin, age, education level, and ethnicity.

Methodology
Composition-Adjusted Model

The results of the main model are compared with those from a model in which labor outcomes are adjusted to control for changes in population composition. This alternative model is:

$$\Delta L_{it}^{CA,m} = \gamma_t + \beta_1 \Delta IPW_{it}^{u} + \boldsymbol{X}_{it}' \boldsymbol{\beta}_2 + \epsilon_{it} \tag{2}$$

Where:

- $\Delta L_{it}^{CA,m}$: 10-year change in the composition-adjusted average share of manufacturing employment within the working-age population in commuting zone *i* for year *t*.

Methodology
Composition Adjustment

Original regression coefficients may be influenced by labor mobility between regions; therefore, composition adjustments are applied while aggregating the dependent variable by groups g.

In the case of the share of manufacturing employment within the working-age population L_{igt}, the composition adjusted average is defined as:

$$L_{it}^{CA} = \sum_{g} \bar{\theta}_{ig} L_{igt} \tag{3}$$

Where the time-invariant weights $\bar{\theta}_{ig}$ are defined as:

$$\bar{\theta}_{ig} = \frac{\theta_{ig1990} + \theta_{ig2000} + \theta_{ig2008}}{3} \tag{4}$$

and

$$\theta_{igt} = \frac{hours_{igt}}{\sum_{g} hours_{igt}}. \tag{5}$$

Where $hours_{igt}$ denotes the number of weekly hours worked by group g in commuting zone i at time t.

Results

Impact of Chinese Imports on Manufacturing Employment Proportion (Table 3)

Table: Imports from China and Change of Manufacturing Employment in CZs, 1990–2007: 2SLS Estimates[3]

	I. 1990–2007 stacked first differences											
	(1)		(2)		(3)		(4)		(5)		(6)	
	Original	CA	Original	CA	Original	CA	Original	CA	Original	CA	Original	CA
(Δ imports from China to US)/worker	-0.746***	-0.787***	-0.610***	-0.658***	-0.538***	-0.590***	-0.508***	-0.550***	-0.562***	-0.605***	-0.596***	-0.640***
	(0.068)	(0.085)	(0.094)	(0.118)	(0.091)	(0.091)	(0.081)	(0.100)	(0.096)	(0.117)	(0.099)	(0.120)
Percentage of employment in manufacturing$_{-1}$			-0.035	-0.034	-0.052***	-0.050***	-0.061***	-0.071***	-0.056***	-0.057***	-0.040***	-0.048***
			(0.022)	(0.021)	(0.020)	(0.019)	(0.017)	(0.016)	(0.016)	(0.015)	(0.013)	(0.013)
Percentage of college-educated population$_{-1}$							-0.008	-0.033*			0.013	-0.008
							(0.016)	(0.018)			(0.012)	(0.013)
Percentage of foreign-born population$_{-1}$							-0.007	-0.006			0.030***	0.036***
							(0.008)	(0.008)			(0.011)	(0.013)
Percentage of employment among women$_{-1}$							-0.054**	-0.027			-0.006	0.028
							(0.025)	(0.029)			(0.024)	(0.030)
Percentage of employment in routine occupations$_{-1}$									-0.230***	0.113	-0.245***	-0.214
									(0.063)	(0.309)	(0.064)	(0.247)
Average offshorability index of occupations$_{-1}$									0.244	-0.225***	-0.059	-0.247***
									(0.252)	(0.072)	(0.237)	(0.072)
Census division dummies	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
II. 2SLS first stage estimates												
(Δ imports from China to OTH)/worker	0.792***	0.792***	0.664***	0.664***	0.652***	0.652***	0.635***	0.635***	0.638***	0.638***	0.631***	0.631***
	(0.079)	(0.079)	(0.086)	(0.088)	(0.090)	(0.092)	(0.090)	(0.092)	(0.087)	(0.089)	(0.087)	(0.090)
R^2	0.54	0.54	0.57	0.57	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58

Notes: $N = 1,444$ (722 commuting zones $\times$ 2 time periods). All regressions include a constant and a dummy for the 2000–2007 period. First stage estimates in panel II also include the control variables that are indicated in the corresponding columns of panel I. Routine occupations are defined such that they account for 1/3 of US employment in 1980. The offshorability index variable is standardized to mean of 0 and standard deviation of 10 in 1980. Robust standard errors in parentheses are clustered on state. Models are weighted by start of period CZ share of national population.
***Significant at the 1 percent level.
**Significant at the 5 percent level.
*Significant at the 10 percent level.

[3] Equivalent to *Table 3* in the original paper, with additional columns for composition-adjusted models.

Results

Impact of Chinese Imports on Manufacturing Employment Proportion (Interpretation)

- Composition Adjusting leaves impact of share of workers largely unchanged.
- In the model with all variables (6), the $\beta = -0.640$ means that an exogenous increase of \$1,000.00 in exposure per worker leads to a predicted decrease of 0.64 percentage points in manufacturing employment per working-age population.
- The coefficients of the models subjected to Composition Adjustment reveal a beta with a higher magnitude, indicating a larger effectthanthe original estimate.

Imports from China and Employment Status of Working-Age Population

Table: Imports from China and Employment Status of Working-Age Population within CZs, 1990–2007: 2SLS Estimates[4]

Dependent variables: Ten-year equivalent changes in log population counts and population shares by employment status								
	Mfg emp (1)		Non-mfg emp (2)		Unemp (3)		NILF (4)	
	Original	CA	Original	CA	Original	CA	Original	CA
Panel A. 100 × log change in population counts								
(Δ imports from China to US)/worker	-4.231***	-4.831***	-0.274	-0.013	4.921***	5.884***	2.058*	3.296*
	(1.047)	(1.215)	(0.651)	(0.667)	(1.128)	(1.138)	(1.080)	(1.103)

Notes: $N = 1,444$ (722 CZs × two time periods). All statistics are based on working age individuals (age 16 to 64). The effect of import exposure on the overall employment/population ratio can be computed as the sum of the coefficients for manufacturing and nonmanufacturing employment. All regressions include the full vector of control variables from column 6 of Table 1. Robust standard errors in parentheses are clustered on state. Models are weighted by start of period CZ share of national population.
***Significant at the 1 percent level.
**Significant at the 5 percent level.
*Significant at the 10 percent level.

[4] Equivalent to *Table 5* in the original paper, with additional columns for composition-adjusted models. The full table is available in the appendix as Table 4.

Population and Employment Effects in Local Labor Markets

Interpretation

The coefficients tell us the changes in employment in 100 log points for every $1,000 increase in import exposure per worker.

- Composition adjustment exacerbate the impact over: Manufacturing Employment, Unemployment, Labor-force non-participation.
- Non-Manufacturing Employment coefficient is statistically insignificant with and without composition adjustment.

In conclusion, composition adjusting seems to raise the impact of China shock on local labor market. Import shocks from China are associated with job losses in manufacturing but do not necessarily lead to significant job gains in other sectors or labor force participation.

Wage Effects in Local Labor Markets by Gender and Edcation

Table: Imports from China and Wage Changes within CZs, 1990–2007: 2SLS Estimates[5]

Dependent variable: Ten-year equivalent change in average log weekly wage (in log pts)						
	All workers (1)		Males (2)		Females (3)	
	Original	CA	Original	CA	Original	CA
Panel A. All education levels						
(Δ imports from China to US)/worker	-0.759***	-1.222***	-0.892***	-1.203***	-0.614***	-1.258***
	(0.253)	(0.290)	(0.294)	(0.329)	(0.237)	(0.285)
R^2	0.56	0.56	0.44	0.43	0.69	0.68
Panel B. College education						
(Δ imports from China to US)/worker	-0.757**	-0.903***	-0.991***	-1.129***	-0.525*	-0.598*
	(0.308)	(0.334)	(0.374)	(0.372)	(0.279)	(0.349)
R^2	0.52	0.31	0.39	0.18	0.63	0.40
Panel C. No college education						
(Δ imports from China to US)/worker	-0.814***	-1.182***	-0.703***	-1.104***	-1.116***	-1.304***
	(0.236)	(0.266)	(0.250)	(0.312)	(0.278)	(0.271)
R^2	0.52	0.60	0.45	0.48	0.59	0.70

Notes: $N = 1,444$ (722 CZs $\times$ two time periods). All regressions include the full vector of control variables from column 6 of Table 1. Robust standard errors in parentheses are clustered on state. Models are weighted by start of period CZ share of national population.
***Significant at the 1 percent level.
**Significant at the 5 percent level.
*Significant at the 10 percent level.

[5] Equivalent to *Table 6* in the original paper, with additional columns for composition-adjusted models.

Wage Effects in Local Labor Markets by Gender and Education

Interpretation

After Composition Adjustments, A $1,000 increase in import exposure results in:

- All Education Levels: Reduced mean weekly earnings by a larger amount, approximately -1.222 log points for all workers (similar across genders). This suggests that after accounting for compositional changes, the negative effect on earnings is more pronounced.
- College Education: The impact remains negative, with a coefficient of -0.903 log points. Workers still experience a reduction in weekly earnings after composition adjustment, though the effect is slightly smaller.
- Non College Education: The effect is even more pronounced, with a coefficient of -1.1817 log points for all workers. This implies that the impact on earnings is substantial, particularly among those with lower education levels.

Through composition adjustment, it is found that the impact of the China shock on wages is greater than in the original findings.

Conclusion

- As in the original paper, we estimate 2SLS regressions, but with composition adjustment.
- This leads to a more pronounced impact on regional inequality than in the original paper.
  - This is particularly evident when examining wages as an example.
  - The China shock reduces employment, leading to the displacement of low-wage workers into unemployment and non-participation.
  - At first glance, this displacement may appear to increase wages, especially if we do not apply composition adjustments.

Appendix

Table: Imports from China and Employment Status of Working-Age Population within CZs, 1990–2007: 2SLS Estimates

Dependent variables: Ten-year equivalent changes in log population counts and population shares by employment status								
	Mfg emp (1)		Non-mfg emp (2)		Unemp (3)		NILF (4)	
	Original	CA	Original	CA	Original	CA	Original	CA
Panel A. 100 × log change in population counts								
(Δ imports from China to US)/worker	-4.231***	-4.831***	-0.274	-0.013	4.921***	5.884***	2.058*	3.296*
	(1.047)	(1.215)	(0.651)	(0.667)	(1.128)	(1.138)	(1.080)	(1.103)
Panel B. Change in population shares								
All education levels								
(Δ imports from China to US)/worker	-0.596***	-0.640***	-0.178	-0.118	0.221***	0.218***	0.553***	0.539***
	(0.099)	(0.120)	(0.137)	(0.117)	(0.058)	(0.053)	(0.150)	(0.121)
College education								
(Δ imports from China to US)/worker	-0.592***	-0.510***	0.168	0.165	0.119***	0.052**	0.304***	0.293***
	(0.125)	(0.159)	(0.122)	(0.156)	(0.039)	(0.025)	(0.113)	(0.084)
No college education								
(Δ imports from China to US)/worker	-0.581***	-0.640***	-0.531***	-0.265*	0.282***	0.268***	0.831***	0.638***
	(0.095)	(0.107)	(0.203)	(0.146)	(0.085)	(0.070)	(0.211)	(0.160)

Notes: $N = 1,444$ (722 CZs × two time periods). All statistics are based on working-age individuals (ages 16 to 64). The effect of import exposure on the overall employment/population ratio can be computed as the sum of the coefficients for manufacturing and non-manufacturing employment. This effect is highly statistically significant ($p \leq 0.01$) in the full sample and in all reported subsamples, for both composition-adjusted and non-adjusted models. All regressions include the full vector of control variables from column 6 of Table 1. Robust standard errors in parentheses are clustered on state. Models are weighted by start of period CZ share of national population.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.


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