ECONOMIC POLICY ISSUES

Trade – The China Syndrome
Sample Teaching Slides II

The China Syndrome: Local Labor Market Effects of Import Competition in the US

By Autor, Dorn and Hanson (2013)

Background

- US manufacturing employment fluctuated around 18 million workers between 1965 and 2000 before plunging 18% from March 2001 to 2007.

- Why?

    1. Skill biased technical change?
    2. Outsourcing?
    3. Trade:
        - Trade with low-income countries was too small initially.
        - By 2000, the low-income country share of US imports reached 15% and climbed to 28% by 2007. China accounted for 89% of this growth.

Background

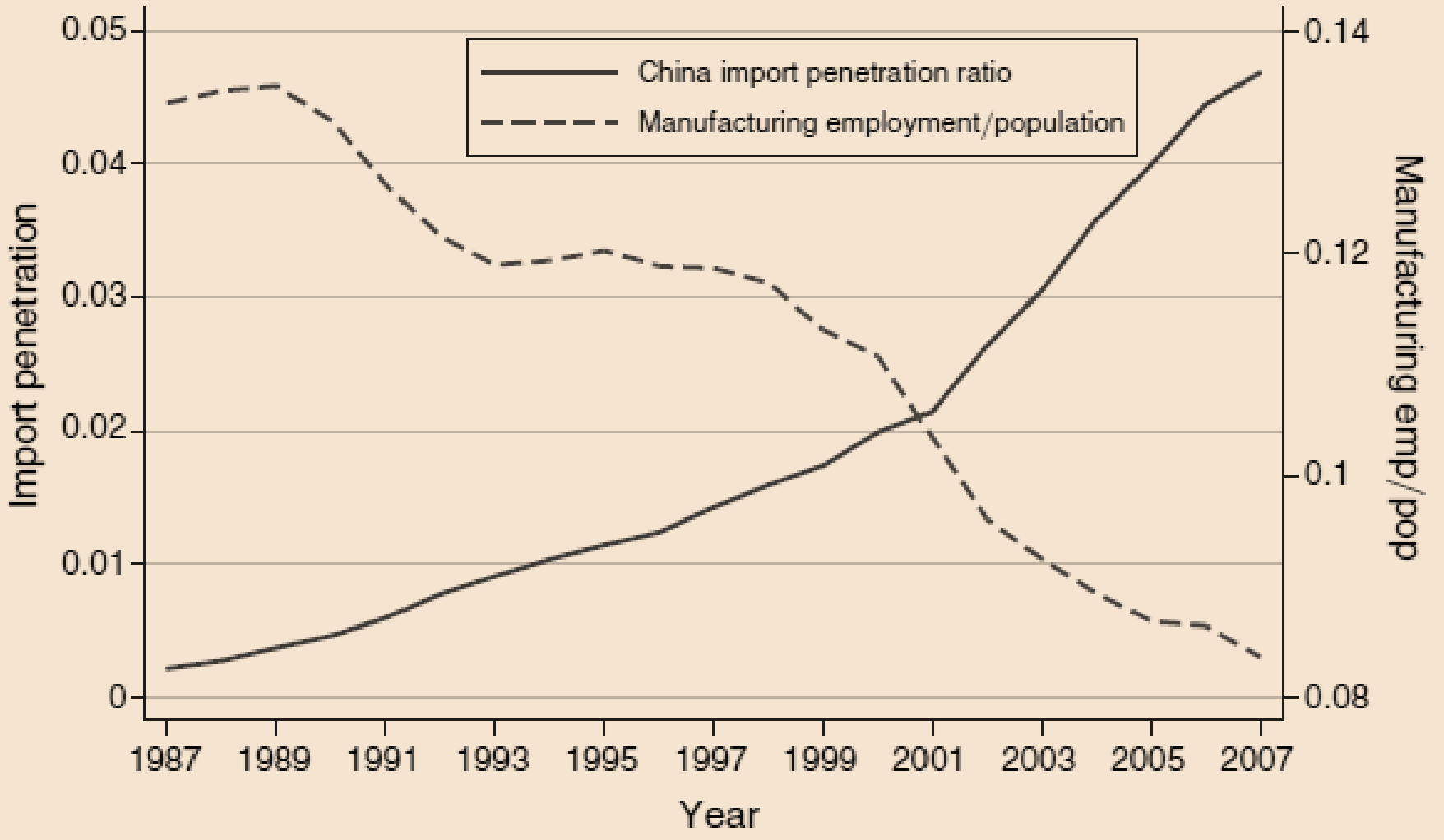


FIGURE 1. IMPORT PENETRATION RATIO FOR US IMPORTS FROM CHINA (*left scale*), AND SHARE OF US WORKING-AGE POPULATION EMPLOYED IN MANUFACTURING (*right scale*)

The Big Question

What are the effects of trade shocks on the US local labour markets?

Some key findings:

An increase in import pressure from China results in economic losses to the local labour markets:

- Decreased manufacturing employment and no increase in non-manufacturing employment,
- Depressed wages in non-manufacturing industries,
- Benefits (e.g., retirement and disability benefits but not unemployment benefits) increased, suggesting workforce participation fell,
- Overall, household income fell.

The Big Question

What are the effects of trade shocks on the US local labour markets?

- The focal point is not the overall gain from trade, but rather the redistributive effect.

- The findings seem to suggest that the labour market does not adjust as quickly and perhaps not as efficiently as expected.

  However, why exactly do we observe such labour market responses is not a part of Autor et al's research agenda.

Estimation strategy

How should we define local labour markets?

→ **Commuting Zone (CZ)**

722 commuting zones covering all the US counties (mainland)

What is a CZ?
A CZ is defined based on commuting patterns within and across counties in 1990. A CZ has strong commuting ties within itself and weak commuting ties with other CZs.

Estimation strategy

The idea is to first measure the change in Chinese import exposure per worker for each local market or CZ using the following proxy:

$$\Delta IPW_{uit} = \sum_{j} \frac{L_{ijt}}{L_{ujt}} \frac{\Delta M_{ucjt}}{L_{it}}$$

Where:

- L_{ijt} is the employment in year t (start of period) in CZ i
- L_{ijt} is the employment in year t in industry j in CZ i
- L_{ujt} is the total US employment in industry j
- ΔM_{ucjt} is the change in US imports from China in industry j between the start and end of the period.

Estimation strategy

The idea is to first measure the change in Chinese import exposure per worker for each local market or CZ using the following proxy:

$$\Delta IPW_{uit} = \sum_j \frac{L_{ijt}}{L_{ujt}} \frac{\Delta M_{ucjt}}{L_{it}}$$

Therefore:

- $\frac{L_{ijt}}{L_{ujt}}$ is the CZ i's share of US employment in industry j
- $\frac{\Delta M_{ucjt}}{L_{it}}$ is the change (or growth) in US import of industry j's products from China per worker in CZ i
- The import exposure per worker in industry j of CZ i is just $\frac{\Delta M_{ucjt}}{L_{it}}$ weighted by its share of employment in industry j.

Estimation strategy: Endogeneity concern

The US imports from China may be affected by **unobserved US product demand shocks** rather than the supply-driven story (e.g., China's growing productivity, falling trade costs, decentralization, WTO membership, etc).

Since positive demand shocks drive more employment and import, not addressing this endogeneity issue could lead to an understatement of the true employ effect of the Chinese import exposure on the US local labour markets.

Address this endogeneity concern using the instrumental variable approach.

$$\Delta IPW_{uit} = \sum_{j} \frac{L_{ijt}}{L_{ujt}} \frac{\Delta M_{ucjt}}{L_{it}}$$

Estimation strategy: Endogeneity concern

How to solve? IV approach.

$$\Delta IPW_{oit} = \sum_{j} \frac{L_{ij,t-1}}{L_{uj,t-1}} \frac{\Delta M_{ocjt}}{L_{i,t-1}}$$

- ΔM_{ocjt} is the growth in Chinese imports in eight other developed countries on the assumption that
  - they didn't experience the same demand shocks as the US did (i.e., there was no economic synchronization between the US and these other countries, and there is enough randomization in these other nations' demand shocks that the shocks don't matter anymore)
  - Similar export bundles from China going to the US and the other countries
- All employment variables denoted by L are now $t-1$ lagged variables (10-year lagged) to eliminate the possibility of contemporaneous employment in each CZ being affected by anticipated China trade.

Growth of import exposure per worker across CZs

Appendix Table 1. Descriptive Statistics for Growth of Imports Exposure per Worker across C'Zones

I. 1990-2000		II. 2000-2007	
A. Percentiles			
90th percentile	2.05	90th percentile	4.30
75th percentile	1.32	75th percentile	3.11
50th percentile	0.89	50th percentile	2.11
25th percentile	0.62	25th percentile	1.60
10th percentile	0.38	10th percentile	1.03

Estimation strategy: The basic ideas

The main goal is to estimate the effect of variation in Chinese import exposure on manufacturing employment by CZ.

Then, extend the analysis to cover other labour market outcomes such as, among other things, changes in:

- Employment by education,
- Labour force participation
- Benefits
- Wages
- Household income.

Estimation strategy: Two-Stage Least Squares (2SLS) Approach

The Main equation:

$$\Delta L_{it}^{m} = \gamma_t + \beta_1 \Delta IPW_{uit} + \boldsymbol{X}'_{it}\beta_2 + e_{it}$$

Where:

- ΔL_{it}^{m} is the 10-year change in the manufacturing employment share of the working-age population in CZ i
- ΔIPW_{uit} is the change in Chinese import exposure per worker for CZ i
- γ_t is a time dummy
- $\boldsymbol{X}_{it}$ is a vector of controls (initial CZ manufacturing employment share and CZ demographics

Estimation strategy: Two-Stage Least Squares (2SLS) Approach

The first stage equation (loosely speaking):

$$\Delta IPW_{uit} = \lambda_t + \alpha_1 \Delta IPW_{oit} + \Gamma'_{it}\alpha_2 + u_{it}$$

Where:

- ΔIPW_{oit} is the instrument that measures change in Chinese import exposure per worker in other countries
- λ_t is a time dummy
- Γ_{it} is a vector of controls for the first stage equation.

Estimation strategy: Two-Stage Least Squares (2SLS) Approach

The Main equation:

$$\Delta L_{it}^{m} = \gamma_t + \boldsymbol{\beta_1} \Delta IPW_{uit} + \boldsymbol{X}'_{it}\beta_2 + e_{it} \qquad (1)$$

The First-Stage equation:

$$\Delta IPW_{uit} = \lambda_t + \boldsymbol{\alpha_1} \Delta IPW_{oit} + \Gamma'_{it}\alpha_2 + u_{it} \quad (2)$$

To get $\boldsymbol{\beta_1}$, we first construct **the reduced form** generated by this system of equations by substituting (2) into (1).

Estimation strategy: Two-Stage Least Squares (2SLS) Approach

Substitute (2) into (1):

The reduced form:

$$\Delta L_{it}^{m} = \gamma_t + \beta_1 \Delta IPW_{uit} + \boldsymbol{X}'_{it}\, \beta_2 + e_{it}$$

Estimation strategy: Two-Stage Least Squares (2SLS) Approach

Substitute (2) into (1):

The reduced form:

$$\Delta L_{it}^{m} = \gamma_t + \beta_1 \Delta IPW_{uit} + \boldsymbol{X}'_{it}\,\beta_2 + e_{it}$$

$$= \gamma_t + \beta_1 (\lambda_t + \boldsymbol{\alpha_1} \Delta IPW_{oit} + \Gamma'_{it}\alpha_2 + u_{it}) + \boldsymbol{X}'_{it}\,\beta_2 + e_{it}$$

Estimation strategy: Two-Stage Least Squares (2SLS) Approach

Substitute (2) into (1):

The reduced form:

$$\Delta L_{it}^{m} = \gamma_t + \beta_1 \Delta IPW_{uit} + \boldsymbol{X}'_{it}\,\beta_2 + e_{it}$$

$$= \gamma_t + \beta_1 (\lambda_t + \boldsymbol{\alpha_1} \Delta IPW_{oit} + \Gamma'_{it}\alpha_2 + u_{it}) + \boldsymbol{X}'_{it}\,\beta_2 + e_{it}$$

$$= \gamma_t + \boldsymbol{X}'_{it}\beta_2 + \beta_1(\lambda_t + \Gamma'_{it}\alpha_2 + u_{it}) + \boldsymbol{\beta_1 \alpha_1 \Delta IPW_{oit}} + (\beta_1 u_{it} + e_{it})$$

Estimation strategy: Two-Stage Least Squares (2SLS) Approach

Substitute (2) into (1):

The reduced form:

$$\Delta L_{it}^{m} = \gamma_t + \boldsymbol{X}'_{it}\beta_2 + \beta_1(\lambda_t + \Gamma'_{it}\alpha_2 + u_{it}) + \beta_1\boldsymbol{\alpha_1}\Delta IPW_{oit} + (\beta_1 u_{it} + e_{it})$$

Let $\boldsymbol{\pi = \beta_1\alpha_1}$ is the "**reduced form effect**".

Estimation strategy: Two-Stage Least Squares (2SLS) Approach

Now, we estimate the first stage and the reduced form to get $\hat{\tau}$ and $\hat{\pi}$:

The first-stage equation:

$$\Delta IPW_{uit} = \lambda_t + \boldsymbol{\alpha_1}\Delta IPW_{oit} + \Gamma'_{it}\alpha_2 + u_{it}$$

The reduced form (3):

$$\Delta L^m_{it} = \gamma_t + \boldsymbol{X}'_{it}\beta_2 \; + \boldsymbol{\beta_1}(\lambda_t + \Gamma'_{it}\alpha_2 + u_{it}) + \boldsymbol{\pi}\Delta IPW_{oit} + (\boldsymbol{\beta_1}u_{it} + e_{it})$$

Since $\boldsymbol{\pi = \beta_1 \alpha_1}$, the estimate of the average treatment effect $\boldsymbol{\beta_1}$ is just the ratio of the reduced form to first stage coefficients: $\widehat{\boldsymbol{\beta_1}} = \frac{\hat{\boldsymbol{\pi}}}{\widehat{\boldsymbol{\alpha_1}}}$

Estimation strategy: Two-Stage Least Squares (2SLS) Approach

QUESTION:

Why NOT substituting directly into the main equation the estimates of the first stage? For example:

$$\Delta L_{it}^{m} = \gamma_t + \boldsymbol{\beta_1} \Delta \widehat{IPW_{uit}} + \boldsymbol{X}'_{it}\beta_2 + e_{it}$$

$$\Delta \widehat{IPW_{uit}} = \widehat{\lambda_1} + \widehat{\boldsymbol{\alpha_1}} \Delta IPW_{oit} + \widehat{\Gamma'_{it}}\alpha_2$$

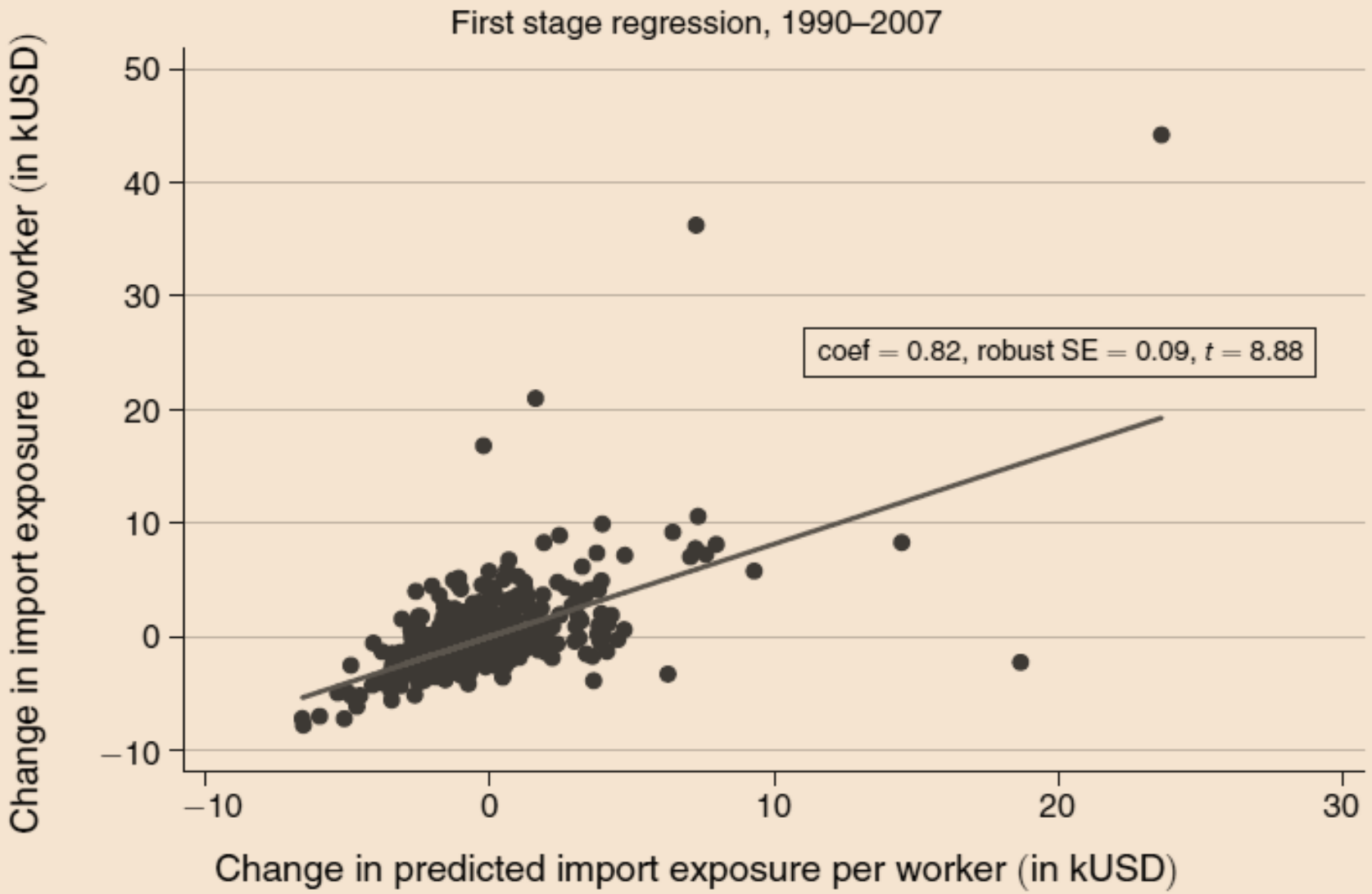
The problem is that, unlike in (3), there is NO extra error term $\boldsymbol{\beta_1} u_{it}$.

Direct substitution of $\Delta \widehat{IPW_{uit}}$ into the main equation would generate a reduced form equation that **ignores** the first-stage estimation errors.

This leads to **incorrect standard errors for statistical inference**.

Results

Panel A. 2SLS first stage regression, full sample



Results

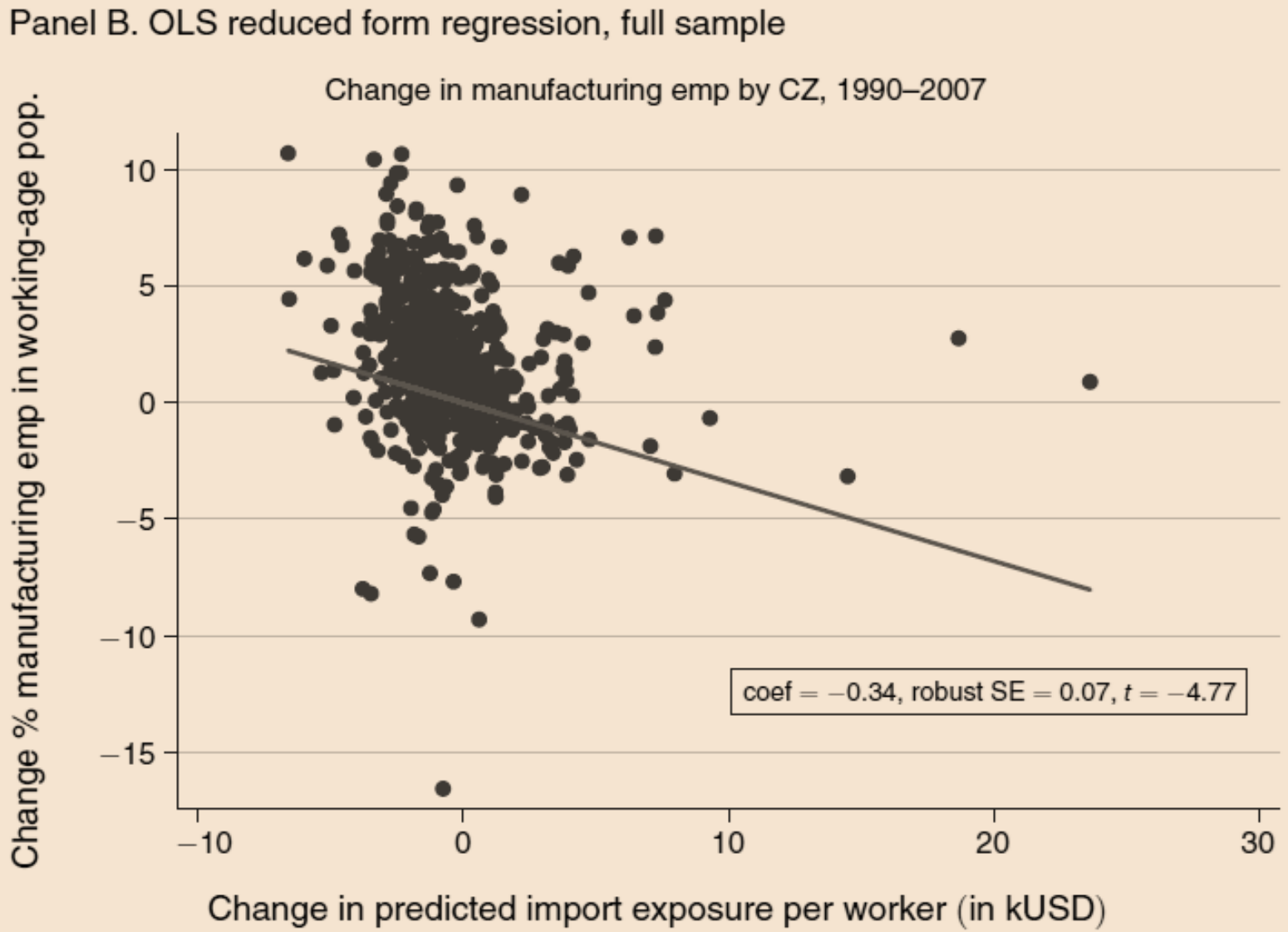


FIGURE 2. CHANGE IN IMPORT EXPOSURE PER WORKER AND DECLINE OF MANUFACTURING EMPLOYMENT: ADDED VARIABLE PLOTS OF FIRST STAGE AND REDUCED FORM ESTIMATES

Results: Imports from China and manufacturing employment

TABLE 3—IMPORTS FROM CHINA AND CHANGE OF MANUFACTURING EMPLOYMENT IN CZS, 1990–2007: 2SLS ESTIMATES

Dependent variable: 10 × annual change in manufacturing emp/working-age pop (in % pts)

	I. 1990–2007 stacked first differences					
	(1)	(2)	(3)	(4)	(5)	(6)
(Δ imports from China to US)/ worker	−0.746*** (0.068)	−0.610*** (0.094)	−0.538*** (0.091)	−0.508*** (0.081)	−0.562*** (0.096)	−0.596*** (0.099)
Percentage of employment in manufacturing$_{-1}$		−0.035 (0.022)	−0.052*** (0.020)	−0.061*** (0.017)	−0.056*** (0.016)	−0.040*** (0.013)
Percentage of college-educated population$_{-1}$				−0.008 (0.016)		0.013 (0.012)
Percentage of foreign-born population$_{-1}$				−0.007 (0.008)		0.030*** (0.011)
Percentage of employment among women$_{-1}$				−0.054** (0.025)		−0.006 (0.024)
Percentage of employment in routine occupations$_{-1}$					−0.230*** (0.063)	−0.245*** (0.064)
Average offshorability index of occupations$_{-1}$					0.244 (0.252)	−0.059 (0.237)
Census division dummies	No	No	Yes	Yes	Yes	Yes

Results: Imports from China and wage changes

TABLE 7—COMPARING EMPLOYMENT AND WAGE CHANGES IN MANUFACTURING AND OUTSIDE MANUFACTURING, 1990–2007: 2SLS ESTIMATES

Dependent variables: Ten-year equivalent changes in log workers and average log weekly wages

	I. Manufacturing sector			II. Nonmanufacturing		
	All workers (1)	College (2)	Noncollege (3)	All workers (4)	College (5)	Noncollege (6)
Panel A. Log change in number of workers						
(Δ imports from China to US)/worker	−4.231***	−3.992***	−4.493***	−0.274	0.291	−1.037
	(1.047)	(1.181)	(1.243)	(0.651)	(0.590)	(0.764)
R^2	0.31	0.30	0.34	0.35	0.29	0.53
Panel B. Change in average log wage						
(Δ imports from China to US)/worker	0.150	0.458	−0.101	−0.761***	−0.743**	−0.822***
	(0.482)	(0.340)	(0.369)	(0.260)	(0.297)	(0.246)
R^2	0.22	0.21	0.33	0.60	0.54	0.51

Results: Imports from China and wage changes

TABLE 6—IMPORTS FROM CHINA AND WAGE CHANGES WITHIN CZS, 1990–2007: 2SLS ESTIMATES

Dependent variable: Ten-year equivalent change in average log weekly wage (in log pts)

	All workers (1)	Males (2)	Females (3)
Panel A. All education levels			
(Δ imports from China to US)/worker	−0.759***	−0.892***	−0.614***
	(0.253)	(0.294)	(0.237)
R^2	0.56	0.44	0.69
Panel B. College education			
(Δ imports from China to US)/worker	−0.757**	−0.991***	−0.525*
	(0.308)	(0.374)	(0.279)
R^2	0.52	0.39	0.63
Panel C. No college education			
(Δ imports from China to US)/worker	−0.814***	−0.703***	−1.116***
	(0.236)	(0.250)	(0.278)
R^2	0.52	0.45	0.59

Results: Imports from China and wage changes

TABLE 7—COMPARING EMPLOYMENT AND WAGE CHANGES IN MANUFACTURING AND OUTSIDE MANUFACTURING, 1990–2007: 2SLS ESTIMATES

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Results: Imports from China and wage changes

→ *Why do we observe no negative wage effects on import competing manufacturing industries*?

Some possible explanations:

- Manufacturing wages are downward rigid
- Most productive workers retained their jobs
- Manufacturing plants reacted by increasing technological and organizational innovations that increase productivity

→ *Why do we observe negative effects on nonmanufacturing wages regardless of education level*?

Perhaps negative shock to local manufacturing jobs reduced the demand for local non-traded services while increasing the supply of workers

Results: Imports from China and wage changes

What are the economic lessons?

- Market adjustments are partial and incomplete.
- Workers leaving manufacturing seek jobs locally outside of the sector, reducing wages in other sectors within the same local labour markets. The general equilibrium effects operate within but not across local labour markets.
- Labour and product markets are not sufficiently integrated to diffuse the adverse import shock across the broader regional and national market.

Results: Imports from China and Government Transfers

TABLE 8—IMPORTS FROM CHINA AND CHANGE OF GOVERNMENT TRANSFER RECEIPTS IN CZs, 1990–2007: 2SLS ESTIMATES

Dep vars: Ten-year equivalent log and dollar change of annual transfer receipts per capita (in log pts and US$)

	Total individual transfers (1)	TAA benefits (2)	Unemployment benefits (3)	SSA retirement benefits (4)	SSA disability benefits (5)	Medical benefits (6)	Federal income assist (7)	Educ/ training assist (8)
Panel A. Log change of transfer receipts per capita								
(Δ imports from China to US)/worker	1.01***	14.41*	3.46*	0.72*	1.96***	0.54	3.04***	2.78**
	(0.33)	(7.59)	(1.87)	(0.38)	(0.69)	(0.49)	(0.96)	(1.32)
R^2	0.57	0.28	0.48	0.36	0.32	0.27	0.54	0.33
Panel B. Dollar change of transfer receipts per capita								
(Δ imports from China to US)/worker	57.73***	0.23	3.42	10.00*	8.40***	18.27	7.20***	3.71***
	(18.41)	(0.17)	(2.26)	(5.45)	(2.21)	(11.84)	(2.35)	(1.44)
R^2	0.75	0.28	0.41	0.47	0.63	0.66	0.53	0.37

Results: Imports from China and Household Income

TABLE 9—IMPORTS FROM CHINA AND CHANGE IN HOUSEHOLD INCOME, 1990–2007: 2SLS ESTIMATES
Dependent variable: Ten-year equivalent percentage and real dollar change in average and median annual household income per working-age adult (in %pts and US$)

	Average HH income/adult by source				Median HH income/adult	
	Total (1)	Wage-salary (2)	Business invest (3)	SocSec + AFDC (4)	Total (5)	Wage-salary (6)
Panel A. Percent change						
(Δ imports from China to US)/worker	−1.48***	−2.14***	−0.51	2.12***	−1.73***	−2.32***
	(0.36)	(0.59)	(0.74)	(0.58)	(0.38)	(0.51)
R^2	0.69	0.43	0.76	0.52	0.53	0.52
Panel B. Dollar change						
(Δ imports from China to US)/worker	−492.6***	−549.3***	40.1	17.3***	−439.9***	−476.5***
	(160.4)	(169.4)	(116.7)	(4.3)	(112.7)	(122.2)
R^2	0.63	0.40	0.72	0.51	0.49	0.48