Empirical Effects of Trade Policy I

Distributional Effects on Local Labor Markets

ECON 871

Empirical Effects of Trade/Trade Policy

Plan for this week is to talk about some **reduced form** studies of the effects of trade and trade policy on various outcomes.

- **Today:** Effects of trade policy/import competition across regions.
  - **Key Empirical Strategy:** "Shift-share" designs.
- **Wednesday:** Other identification strategies.

Basics of "Shift Share"

Intuition: Model the impact of aggregate shocks ("shifters") on given outcomes in regions that have differential exposure ("shares") to the shock.

Specification typically takes the following form:

$$y_n = \alpha_0 X_n + \alpha_1 \sum_j \omega_{nj} Z_j + e_n$$

- y_n is an outcome of interest.
- X_n is a set of controls.
- e_n is an error term.
- Z_j is a set of shocks, or "shifters," that are heterogeneous across sectors, j.
- ω_{nj} is the employment share of sector j in region n.

Example: Topalova (2010)

Topalova (2010) applies the shift-share method to study the effects of trade liberalization on poverty in rural districts in India.

Two sources of variation:

1. Heterogeneous sectoral composition of economic activity across 450 districts in India.

2. Sectoral variation in trade liberalization.
   - Average tariff fell from 80 to 37 percent from 1990-1996.
   - Standard deviation of tariffs fell by 50 percent.

Example: Topalova (2010)

The baseline specification is:

$$y_{dt} = \alpha_0 + \alpha_1 \underbrace{\text{Tariff}_{d,t}}_{\text{shift share}} + \text{Post}_t + \delta_d + e_{dt}$$

- y_{dt} is the outcome of interest at the district level, d, time t.
- α_0 is a constant.
- Post_t are time fixed effects that controls for aggregate shocks or trends that affect the economy.
- δ_d are district fixed effects.
- Tariff_{dt} captures the **level of protection at the district level**.

Example: Topalova (2010)

Tariff_{dt} captures the level of protection at the district level. This term takes a shift-share form:

$$\text{Tariff}_{dt} = \sum_j \omega_{dj,1991} \left[\tau_{j,t} - 1\right]$$

- $\tau_{j,t}$ are one plus sectoral ad-valorem tariffs.
- $\omega_{dj,1991}$ are employment shares of industry j in district d in the pre-shift period of 1991:

$$\omega_{dj,1991} = \frac{L_{dj,1991}}{\sum_j L_{dj,1991}}$$

- Intuitively, gives us a measure of how exposed each district is to the tariff cuts.

Example: Topalova (2010)

Back to the baseline specification:

$$y_{dt} = \alpha_0 + \alpha_1 \text{Tariff}_{d,t} + \text{Post}_t + \delta_d + e_{dt}$$

- The coefficient of interest is α_1—captures the average effect of trade liberalization on the district-level outcome.
- This estimation strategy cannot capture *aggregate effects*, but can only measure whether some districts are affected more than others.
- **Main Finding:** Rural districts in which sectors are more exposed to tariff changes experience a slower decline in poverty and lower consumption growth than other regions.

Example: Kovak (2013)

Kovak (2013) employs a similar shift-share analysis to study the effects of trade liberalization on wages across Brazilian regions:

$$d \ln w_r = \zeta_0 + \zeta_1 \underbrace{\text{RTC}_r}_{\text{shift share}} + e_r$$

- $d \ln w_r$ is the log wage in region r.
- RTC_r are region-level tariff changes.
- ζ_0 is a constant.
- e_r is the error term.
- ζ_1 is the coefficient of interest, which measures the effects of changes to regional tariffs on earnings across regions.

Example: Kovak (2013)

The RTC_r variable takes a shift-share form:

$$\text{RTC}_r = \sum_j \omega_{rj} d \ln \tau_j$$

- $d \ln \tau_j$—the "shifter"—is the change in tariffs across sectors j.
- ω_{rj} is the weight of each industry in each region:

$$\omega_{rj} = \frac{\frac{L_{rj}}{L_r} \frac{1}{1-\beta_{rj}}}{\sum_{j'} \frac{L_{rj'}}{L_r} \frac{1}{1-\beta_{rj'}}}$$

- where β_{rj} is the share of labor payment in gross output in industry j.
- **Main Finding:** Regions exposed to largest tariff declines experienced smaller wage growth relative to regions that experienced smaller tariff cuts.

Shift-Share Analysis: Theory

Kovak (2013) makes an important methodological contribution by presenting an economic theory that can justfy shift-share specifications.

- Consider an economy with R regions indexed by n, J sectors indexed by j.
- Assume labor is freely mobile across sectors **within a region**, but **perfectly immobile** across regions.
- Firms produce with a CRS technology that uses local factors of production: labor (L) and a fixed factor (H).
- Assume labor and the fixed factor are aggregated with a Cobb-Douglas technology.

Shift-Share Analysis: Theory

Output in sector j and region n is given by:

$$Y_{nj} = A_{nj} L_{nj}^{\beta_{nj}} H_{nj}^{1-\beta_{nj}}$$

- A_{nj} is TFP in sector j and region n.
- β_{nj} is the share of labor in output.
- $1 - \beta_{nj}$ is the share of the fixed factor in output.

The demand for labor and the fixed factor in sector j and region n are given by L_{nj} and H_{nj}, respectively, and will take the usual form:

$$L_{nj} = \frac{\beta_{nj} P_{nj}}{w_n} Y_{nj}$$

where P_{nj} is the price of output in sector j and region n.

Shift-Share Analysis: Theory

Regional labor market clearing requires:

$$L_n = \sum_j \frac{\beta_{nj} P_{nj}}{w_n} Y_{nj} \text{ for all } n$$

Totally differentiating the labor market clearing condition, using the FOC of the firm's cost minimization problem, and solving for the change in wages, this becomes:

$$d \ln w_n = -\delta_n d \ln L_n + \sum_j \omega_{nj} d \ln P_{nj} + \sum_j \omega_{nj} d \ln A_{nj}$$

where $\delta_n \equiv \left[\sum_j \frac{L_{nj}}{L_n} \frac{1}{1-\beta_{nj}}\right]^{-1}$ and $\omega_{nj} = \delta_n \frac{L_{nj}}{L_n} \frac{1}{1-\beta_{nj}}$.

Shift-Share Analysis: Theory

Turning to the regional supply of labor, we introduce imperfect labor mobility by assuming that moving to location n entails a cost ε_n that is an i.i.d. draw from a Frechet distribution with shape parameter ν.

- Using the properties of the Frechet distribution, labor supply in location n will be given by:

$$L_n = \frac{[w_n]^\nu}{\sum_i [w_i]^\nu} L$$

  where L is the country's total endowment of labor.

- Totally differentiating this expression:

$$d \ln L_n = \nu d \ln w_n - d \ln \phi$$

  where $\phi \equiv \sum_i [w_i]^\nu$.

Shift-Share Analysis: Theory

Subbing this into our totally differentiated expression for $d \ln w_n$:

$$d \ln w_n = \frac{\delta_n}{1 + \delta_n \nu} d \ln \phi + \frac{1}{1 + \delta_n \nu} \sum_j \omega_{nj} d \ln P_{nj} + \sum_j \frac{\omega_{nj}}{1 + \delta_n \nu} d \ln A_{nj}$$

Finally, assume that each region is a small open economy, so that:

$$d \ln P_{nj} = d \ln \tau_j$$

Then, we have:

$$d \ln w_n = \frac{\delta_n}{1 + \delta_n \nu} d \ln \phi + \frac{1}{1 + \delta_n \nu} \sum_j \omega_{nj} d \ln \tau_j + \sum_j \frac{\omega_{nj}}{1 + \delta_n \nu} d \ln A_{nj}$$

Shift-Share Analysis: Theory

This relationship (from the last slide):

$$d \ln w_n = \frac{\delta_n}{1 + \delta_n \nu} d \ln \phi + \frac{1}{1 + \delta_n \nu} \sum_j \omega_{nj} d \ln \tau_j + \sum_j \frac{\omega_{nj}}{1 + \delta_n \nu} d \ln A_{nj}$$

Looks similar to the shift-share regression:

$$d \ln w_n = \zeta_0 + \zeta_1 \sum_j \omega_{nj} d \ln \tau_j + e_n$$

Identifying Assumption: Local exposure to tariffs is uncorrelated to changes in local labor supply (ϕ) and technology (A).

- Normally impose structure on the TFP term—either controls, or modeling it inside the error term.

Discussion and Interpretation

$$d \ln w_n = \zeta_0 + \zeta_1 \text{Shift-Share}_n + e_n$$

Key Takeaway 1: Specifications cannot estimate level effects.

- Coefficient can only be interpretated as the deviation from aggregate effects.
- That is, the effect of a change in tariffs in a region r relative to the average effect of the change in tariffs in the economy.

Key Takeaway 2: Shift-share analysis can shed light on relevant mechanisms or elasticities, which can guide structural models.

- If labor is perfectly mobile across sectors, but not across regions predicts a coefficient of $\zeta_1 = 1$.
- If labor is perfectly mobile across regions, $\zeta_1 = 0$.
- Kovak (2013) finds $0 < \zeta_1 < 1$, suggesting imperfect labor mobility.

Other Issues

Another important set of issues relates to the assumption of the exogenous variation in shifters and shares.

- Highlighted in recent debate about the identification employed in Autor et al. (2013), which uses a shift-share analysis to study the impact of the "China Shock" on local labor markets.

- Many subsequent papers have relied on the same identification strategy, so it is important to understand the issues.

Background on the "China Shock"

Rapid economic growth following a series of market-oriented reforms in the late 1970s caused China to emerge as a major source of import competition for producers of manufactured goods in developed countries.

- The share of U.S. manufacturing imports from low income countries grew from 9 percent in 1991 to 28 percent in 2007, with China accounting for 89 percent of this growth.
- Rise in China's import penetration was particularly rapid following China's admission to the WTO in 2001.
- China's rise in the U.S. also coincides with a decline in U.S. manufacturing employment.

The "China Shock"

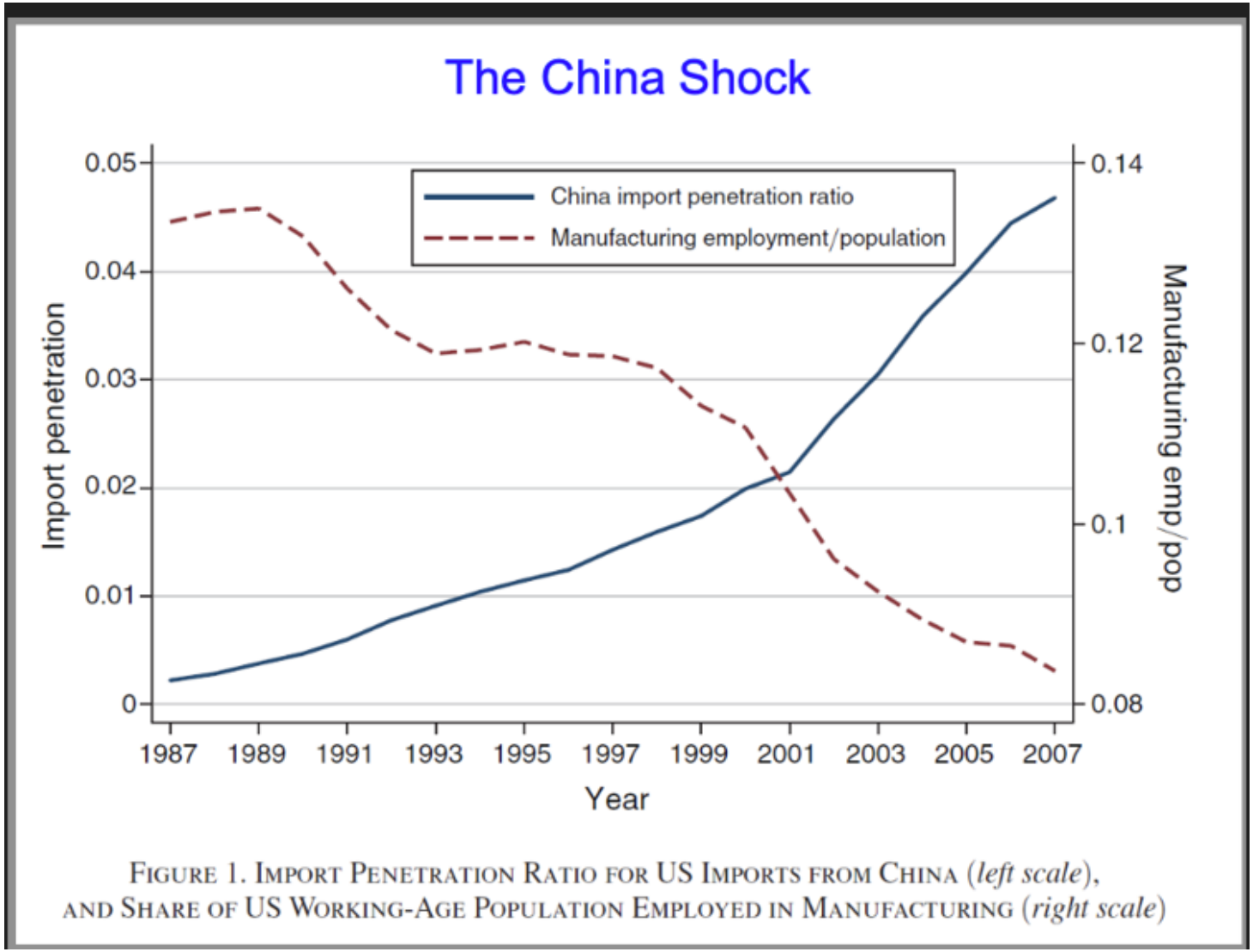
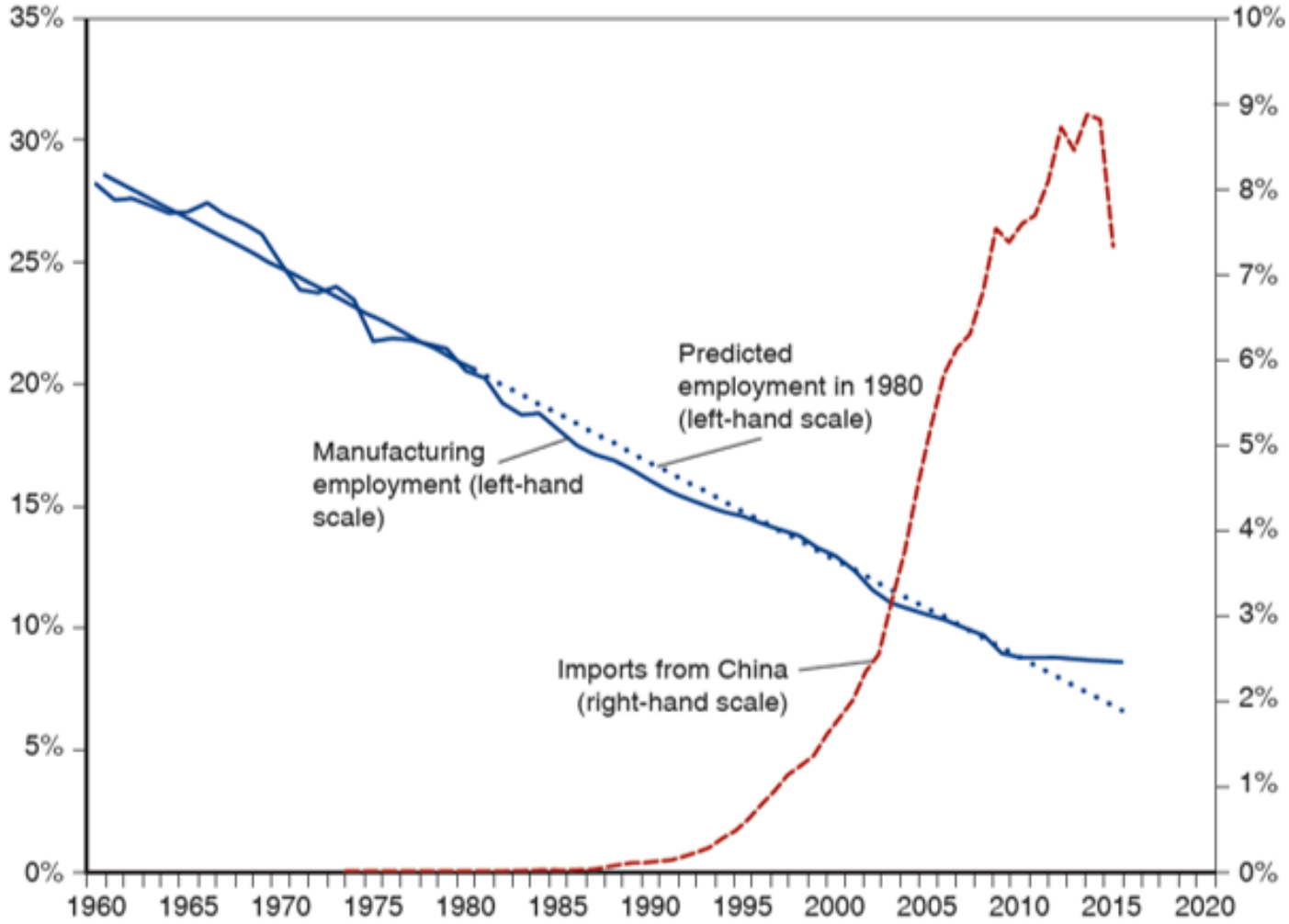


FIGURE 1. IMPORT PENETRATION RATIO FOR US IMPORTS FROM CHINA (*left scale*), AND SHARE OF US WORKING-AGE POPULATION EMPLOYED IN MANUFACTURING (*right scale*)

SOURCE: Autor et al. (2013)

The “China Shock”



SOURCE: Krugman, Obstfeld, Melitz (KOM) Ch. 4

ADH 2013

Autor et al. (2013) construct a measure of the exposure of local labor markets in the United States to the China shock.

The measure is based on two parts:

1. **Changes in aggregate industry imports** into the United States. following China's admission to the WTO.

2. **Concentration of industries in local labor markets** across the United States.

ADH 2013

Local Labor Markets: Commuting Zones (CZs)—developed by Tolbert and Sizer (1996).

- Use county-level commuting data from the 1990 Census.
- Construct 741 clusters of counties that are characterized by strong commuting ties *within* CZs and weak commuting ties *across* CZs.
- ADH includes the 722 CZs that cover the entire mainland United States.
- Idea is that labor is mobile within CZs, but not across.

ADH 2013

Specifically, the change in imports per worker, ΔIPW_{it}, in each commuting zone (CZ) i at time t in the United States, u, is constructed as:

$$\Delta IPW_{it} = \sum_j \frac{L_{ijt}}{L_{jt}} \frac{\Delta M_{jt}}{L_{it}} = \sum_j \underbrace{\frac{L_{ijt}}{L_{it}}}_{\text{share}} \underbrace{\frac{\Delta M_{jt}}{L_{jt}}}_{\text{shock}}$$

- L_{it} is total employment in local labor market i at time t.
- ΔM_{jt} is the change in U.S. imports from China in industry j.
- L_{ijt}/L_{jt} is the local labor market i's share of U.S. employment in industry j at time t.
- Intuitively, this is a way of converting *national* shocks into *local* shocks using regional weights.

ADH 2013

Potential Endogeneity Concern: Increased imports from China may be demand-driven, and Autor et al. (2013) goal is to capture the effects of the Chinese import supply shock.

Solution:

- Instrument for Chinese import growth into the U.S. with Chinese import growth into 8 other developed countries (o):
- Also use lagged labor shares in case labor markets anticipated rising trade (L_{ijt-10}/L_{it-10}).

Instrument:

$$\Delta IPW_{oit} = \sum_j \frac{L_{ijt-10}}{L_{it-10}} \frac{\Delta M_{ocjt}}{L_{ujt-10}}$$

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The baseline specification is:

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

- γ_t is a time fixed effect.
- ΔIPW_{uit} is U.S. import exposure, instrumented with import exposure of other developed countries.
- $\mathbf{X'}_{it}$ is a matrix of controls.
- e_{it} is the error term.

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The regression is a **long-differences** specification:

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

- Coefficient of interest, β_1 has a "diff-in-diff" interpretation—first difference is over time, and second difference is across local labor markets.
- Baseline specification considers two long differences: 1990-2000 and 2000-2007.

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Estimation requires that the instrument, ΔIPW_{oit}, is both **relevant** and **valid**.

- **Relevant:** Chinese imports into other advanced economies is a good predictor of Chinese imports into the U.S.
  - First-stage F-statistics well above 10.
- **Validity:** Import exposure in other developed is uncorrelated with shocks to the manufacturing employment shares in the United States.
  - Harder to satisfy.

ADH 2013

Results: Local labor markets that were **more exposed** to the China shock experienced a **relatively larger decline in the manufacturing employment share** of the working-age population.

Estimates from their preferred specification:

- A $1000 increase in import exposure per worker is predicted to reduce manufacturing employment as a share of population by -0.596 p.p.
- The share of manufacturing employees of a local labor market at the 75th percentile declined by -0.6466 p.p. more than in a local labor market at the 25th percentile.

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ADH also find that increased exposure to the China shock:

- Reduces the overall employment-to-population rate.
- Reduces mean log weekly earnings.
- Increases per-capita unemployment, disability, and income assistance transfer benefits.
- Has little effect on population movement.

Subsequent papers have studied the impact of the China shock:

- In other countries.
- On mortality.
- On marriage outcomes.
- On political polarization.
- On innovation.

ADH 2013

ADH has had a huge impact on the literature, bringing attention to geography as a neglected dimension along which the distributional effects of trade occur.

- Conventional trade theory, like Heckscher-Ohlin, concentrates on national labor markets.
- If there are frictions to migration across space, worker outcomes will depend on local labor markets.
- Since industries are geographically concentrated, shocks to local labor demand for different types of workers can be large and more concentrated than the aggregate effects.

ADH 2013

A few key issues/debates:

- **Interpretation:** relative versus aggregate effects.
- **Econometric Specification:** identification with Bartik-style instruments.
- **Other mechanisms:** consumer price effects.

Interpretation

ADH use a “difference-in-difference” specification that identifies *relative* effects between local labor markets.

- They CANNOT identify aggregate effects.
- Yet, they report that rising exposure to Chinese import competition is found to explain 44 percent of the manufacturing decline between 1990 and 2007.
- To make this claim, they must assume that there is one local labor market in which the China shock has zero effect on manufacturing employment shares.
- This is misleading.

Econometric Specification

Recent discussion in the literature about Bartik or shift-share approaches. The classic Bartik IV:

$$B_{it} \equiv \sum_j \frac{L_{ij}}{L_i} d \log L_j$$

- $d \log L_j$ is the aggregate change in labor in industry j.
- $\frac{L_{ij}}{L_i}$ is industry j's share of labor in local labor market i.
- Intuitively, converts an aggregate shock into a local shock. Or, local "exposure" to the aggregate shock.
- Important part of the debate is whether identifying variation comes from the disaggregate shares or from the aggregate shifters.

Econometric Specification

Goldsmith-Pinkham et al. (2020) take the view that the identifying variation is from the disaggregate shares.

- **Intuition:** Variation in outcomes is by location, and the only component of the instrument that varies across locations is the industry shares.
- This does not hold in ADH—sectors are regionally concentrated
  - e.g., Electronic computers and computer equipment manufacturing are concentrated in more educated areas with less routine employment.
- Need to control for these observables.

Econometric Specification

Borusyak et al. (2022) say that it's ok if the shares are not exogenous as long as the aggregate shifters are exogenous.

- **Intuition:** You can rewrite the location level specification as an industry-level specification.
- Whether the instrument used in ADH (imports into other developed economies) satisfies this is questionable.
  - Could be correlated demand shocks in the U.S. and other developed economies.
  - China could also concentrate in certain industries in response to demand in U.S. and other developed countries.
- **Main Point:** Need to think carefully about your specification if you use a Bartik-style shock.

Other Mechanisms

Lastly, when estimate the effects of trade shocks on the economy, we need to consider all possible mechanisms.

- Autor et al. (2013) provide compelling evidence of worse labor market outcomes in local labor markets more exposed to the China shock.
- Other research suggests that trade affects welfare through the price of tradeable consumption goods.
- Some negative effects of the China shock in more exposed local labor markets may be offset by adjustments in the prices of local goods and services.
- Also import competition on intermediate inputs can boost employment and wages in downstream industries.

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