,

# Global Effects of Local Subsidies

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# Effect of Subsidies on ROW

- Classic Result
  - Export subsidies benefits ROW
  - Subsidies on domestic goods hurts ROW
  - Empirical applications?
- Effect of subsidies in multi-industry model of heterogeneous firms
  - Firm-specific subsidies/taxes
  - Some firms export and others do not

# Our contribution

- *Measurement* of subsidies on domestic vs. exported products
  - Subsidies on exporting vs. non-exporting firms
  - Export share of exporters
- *Dispersion* in subsidies
  - Dispersion within exports: "Exporting misallocation"
  - Dispersion within domestic: "Shooting yourself in the foot"
  - New sufficient statistic: Average relative to dispersion
- *Distributional* effect of subsidies
  - Average/dispersion across *sectors*
- Application to China, 2007-2019

# Model

- Home (no subsidies) and foreign (firm specific subsidies)
- Cobb-Douglas in sectors ($i$); sectors CES in firm output ($j$)
- Firm output linear in TFP and employment
- Gross subsidy rate on sales $s_{ij}$
  - $s_{ij} > 1$ for firms that are subsidized
  - $s_{ij} < 1$ for firms that are taxed
  - Balanced budget: weighted average of $s_{ij} = 1$
- Some firms export
  - Exporting firms also sell in domestic market
  - Do not model export decision

# Home real wage $\frac{w^{/}}{P^{/}}$

- From definition of price index at home:

$$\frac{w^{/}}{P^{/}} \propto \prod_i \left[ \left( A_i^{d/} \right)^{\sigma-1} + \left( A_i^{x} \, \frac{s_i^x}{d_i^x} \, w^{/} \right)^{\sigma-1} \right]^{\frac{\alpha_i}{\sigma-1}}$$

- Direct effect of foreign subsidies:
  - Average export subsidy $s_i^x$
  - Dispersion of export subsidies $d_i^x \approx \exp\left(\frac{\sigma}{2} \operatorname{Var} \log s_{ij}\right) \geq 1$

# Relative wage

- Balanced trade pins down relative wage

$$d\log w' \approx -\sum_i \alpha_i \left[ \lambda'_i \underbrace{d\log\left(s_i^x/d_i^x\right)}_{\text{exported products}} + \lambda_i \underbrace{d\log\left(s_i^d/d_i^d\right)}_{\text{domestic products}} \right]$$

- Subsidies in domestic products affects ROW through relative wage
  - Classic effect: higher $s_i^d$ hurts ROW
  - New effect: higher $d_i^d$ benefits ROW

# Home real wage

$$d\log\frac{w^{\prime}}{P^{\prime}} \approx \sum_i \alpha_i \left[ (1-\lambda_i^{\prime}) \underbrace{d\log\left(s_i^x/d_i^x\right)}_{\text{exported products}} - \lambda_i \underbrace{d\log\left(s_i^d/d_i^d\right)}_{\text{domestic products}} \right]$$

- Updated classical result
  - Higher $s/d$ for exports benefits ROW
  - Higher $s/d$ for domestic products hurts ROW

# What if Foreign Subsidies "Work"?

$$d\log \frac{w^{\prime}}{P^{\prime}} \approx \sum_i \alpha_i (1-\lambda_i^{\prime}) \left( d\log s_i^x + \frac{d\log A_i^x}{ds_i^x} \right)$$

$$- \sum_i \alpha_i \left( \lambda_i \, d\log s_i^d + \frac{d\log A_i^d}{ds_i^d} \right)$$

- If subsidies are effective $\rightarrow$ reinforces effect of subsidies
- If subsidies are a boondoggle $\rightarrow$ offsets effect of subsidies

# Distributional effect of foreign subsidies

- Profits in $i$ $\propto$ trade surplus in $i$

$$d\log\frac{X_i'}{X_i} \propto \underbrace{-\lambda_i' \, d\log\left(s_i^x/d_i^x\right) \; - \; \lambda_i \, d\log\left(s_i^d/d_i^d\right)}_{\text{s/d in sector } i}$$

$$\underbrace{+\sum_k \alpha_k \left[\lambda_k' d\log\left(s_k^x/d_k^x\right) \; + \; \lambda_k \, d\log\left(s_k^d/d_k^d\right)\right]}_{\text{s/d in other sectors}}$$

- Average/dispersion in sector *relative* to other sectors

- "Negative" China shock necessarily associated with "positive" shocks.

# Measuring subsidies

- Firm data on revenues, inputs, and export share
- Impute $\tau_i$ for each *firm*
  - Production Cobb-Douglas in capital and labor
  - Profit maximization: $\frac{P_i Y_i}{K_i^{\alpha} L_i^{1-\alpha}} \propto \frac{w^{\alpha} r^{1-\alpha}}{\tau_i}$
- Impute subsidy of each *product* from firm-level $\tau_i$ and export share
- Use imputed subsidy of each product to calculate:
  - Average subsidy on exports
  - Average subsidy on domestic products
  - Subsidy dispersion within exports
  - Subsidy dispersion within domestic products

# Application: Effect of Chinese subsidies on ROW

- NBS Industrial Survey, 2007-2013
- Survey of Tax Administration Office, 2013-2019
- Estimate sampling weights in tax data to match:
  - Size distribution in NBS industrial survey in 2013
  - National aggregates

# Inferred Moments: Exports vs. Domestic Products

| | 2007 | 2013 | 2019 |
|---|---|---|---|
| **Average subsidy** | | | |
| Exports | 0.92 | 0.91 | 1.34 |
| Domestic | 1.02 | 1.01 | 0.99 |
| **Subsidy dispersion index** | | | |
| Exports | 1.43 | 1.64 | 1.45 |
| Domestic | 1.54 | 2.00 | 1.69 |

# Aggregate Effect of Subsidies on ROW

**% Change in Real Wage**

| | 2007 | 2013 | 2019 |
|---|---|---|---|
| Total | -0.6 | -2.8 | -1.4 |
| From $s^x \neq s^d$ | -0.02 | -0.2 | 0.4 |
| From $d^x \geq 1$ | -1.1 | -3.9 | -3.4 |
| From $d^d \geq 1$ | 0.5 | 1.3 | 1.1 |

# Effect of Subsidies on Sectoral Trade Imbalances

Gap between Exports and Counterfactual Exports