Multinational Production and Corporate Labor Share

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Motivation

- Labor share (LS) has been decreasing in developed countries
  - This is raising concern about rising income inequality
  - It also challenges a canonical observation on which growth models are based
- One of the literature attributes it to the bias of technological change
  - Its examples include automation and offshoring
  - However, the literature has not provided causal evidence of the role of MNEs
- We study this, drawing on evidence from a natural experiment

This Paper

- Gives stylized facts of Japanese corporate LS and MNE activities:
  - A firm-level decomposition of corporate LS
  - Event study from the 2011 Thailand Floods as a foreign shock to MNEs
- Proposes a hetero-firm GE model to study firm-level and aggregate LS
  - The model provides how factor prices react to shocks, which affects LS
  - The hat-algebra solution approach involves the cost saving by offshoring
- Estimates several elasticities of substitution (EoS) in the model
  - A main target parameter is the EoS between home and foreign factors
  - A reduced form literature estimates the home labor reaction to the foreign labor demand shock
  - We show the relationship of our target parameter to the literature estimand

Main Findings

- Corporate LS decreased from ’95-’07 in Japan, and more so for large firms
  - Firms operating in flooded areas reduce employment and capital in Japan
  - The effect is stronger for capital
- Our “extensive margin hat algebra” workarounds a solution issue
  - The marginal offshorer’s cost saving is hard to observe in the data
  - The hetero-firm model restrictions relate it to observable cost shares
- Home labor is more substitutable with foreign inputs than home capital
  - Hence, MNEs’ foreign factor productivity growth leads to LS decrease
  - During ’95-’07, this force explains 1.4 pp reduction in Japanese LS

Literature

- Causes of the labor share decline
  - Bias of technological change: Elsby, Hobijn, Sahin ('13); Acemoglu, Restrepo ('18); Oberfield, Raval ('21)
  - Factor prices: Karabarbounis, Neiman ('14); Hubmer ('18)
  - Market power: Autor, Dorn, Katz, Patterson, Van Reenen ('17a, b); Barkai ('17); De Loecker, Eeckhout ('17); Gouin-Bonenfant ('18)

- Home labor market effects of MNEs: Desai, Foley, Hines Jr. ('09); Harrison, McMillan ('11); Ebenstein et al. ('14); Boehm, Flaaen, Pandalai-Nayar ('18); Kovak, Oldenski, Sly ('21)

- Solving GE models: Dekle et al ('08); Costinot Rodriguez-Clare ('14); Caliendo, Dvorkin, Parro ('19)

Roadmap

Empirical Evidence

Model

Estimation

Quantitative Exercises

Data

- We combine three datasets
  - Basic Survey of Japanese Business Structure and Activities (BSJBSA)
    - Firm-level survey spanning 1995-2016
    - There are size-based sample thresholds (employment and capital stock)
    - Includes employment, labor compensation, and accounting variables (e.g. fixed assets) in Japan
  - Basic Study on Oversea Business Activities (BSOBA)
    - Universe of Japan's MNEs and their oversea subsidiaries
    - Contains subsidiary's country-level location, employment, labor compensation
      Aggregate Statistics
  - Orbis BvD for obtaining address-level location of each plant
- Matched by firm names, location, and phone number
  - The match rate is 93.0%

- Using BSJBSA, we measure corporate labor share (Rognlie, 2018)
    - Labor compensation wl is divided by value added va
    - va is measured by the sum of wl and operating surplus
- We compute micro and macro labor shares and the value added share

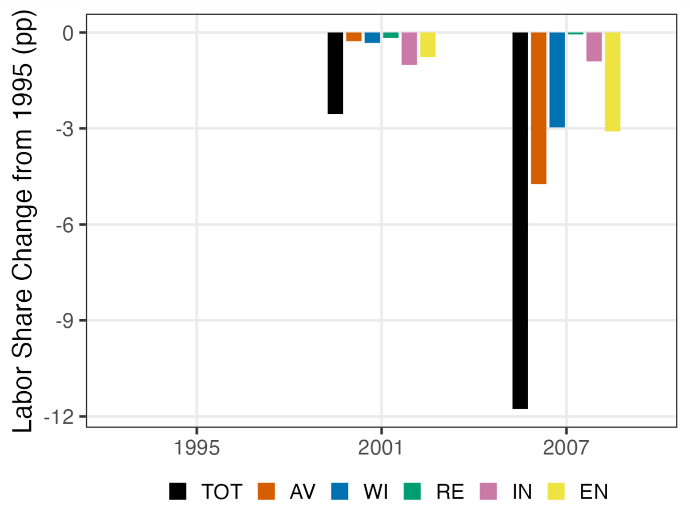
$$s_{it}^{L} = \frac{(wl)_{it}}{(va)_{it}}, \quad S_{t}^{L} = \frac{\sum_i (wl)_{it}}{\sum_i (va)_{it}}, \quad \omega_{it} \equiv \frac{(va)_{it}}{\sum_i (va)_{it}}$$

- We perform a standard decomposition exercise (Kehrig Vincent, '21)

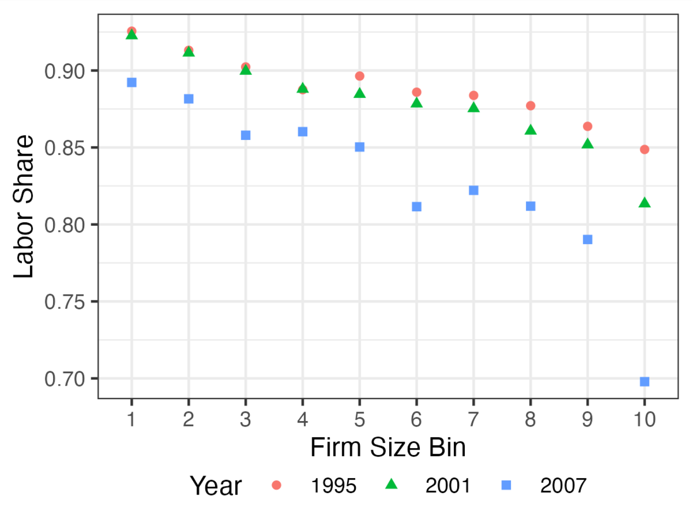
$$\Delta S_t^L = AV_t + \underbrace{\sum_{i \in \Omega_t \cap \Omega_{t_0}} \omega_{it_0} \Delta s_{it}^L}_{\text{Within-firm effect (WI)}} + \underbrace{\sum_{i \in \Omega_t \cap \Omega_{t_0}} s_{it_0}^L \Delta \omega_{it}}_{\text{Reallocation effect (RE)}} + \underbrace{\sum_{i \in \Omega_t \cap \Omega_{t_0}} \Delta \omega_{it} \Delta s_{it}^L}_{\text{Interaction effect (IN)}} + EN_t$$

where AV_t is the average effect and EN_t is the entry-exit effect Detail

Decomposition of the Change in Labor Share



Firm Size and Labor Share



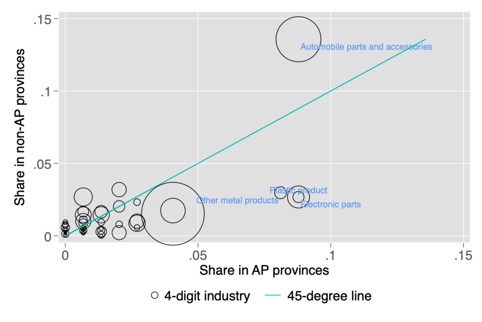
Natural experiment: The Thailand Floods

Source: https://en.wikipedia.org/wiki/2011_Thailand_floods

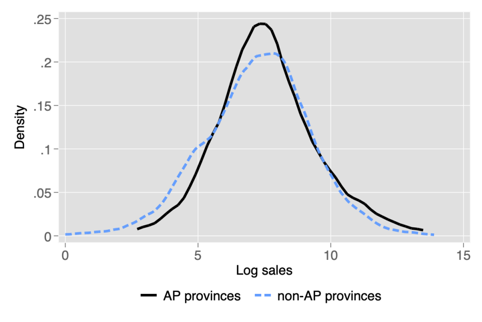
The Floods as a Foreign Productivity Shock

- Facts of the floods
  - Period: Between July 2011 and 2012
  - Place: Mainly Ayutthaya and Pathum Thani provinces Map
    - North neighbors of Bangkok
    - Seven Industrial clusters in the area
    - In the clusters, many firms were Japanese-parented (cf. Feng Li, '22)
  - The estimated economic damage: USD 46.5 billion (World Bank, '11)
- Key characteristics of the shock
  - Severe effects on the production side of the economy
    - After the floods, Thailand experienced decrease in exports but not in imports (Benguria Taylor, '19) Thailand trade trend
    - The effects lasted for more than 5 years Detail
  - Strong spillover concerns to the Japanese production economy

Balancing Checks



Industry Share



Sales Distribution

- AP = Ayutthaya and Pathum Thani provinces
- The sales distribution passes the Kolmogorov-Smirnov test ($p = 0.172$)

Event Study: Subsidiary Analysis

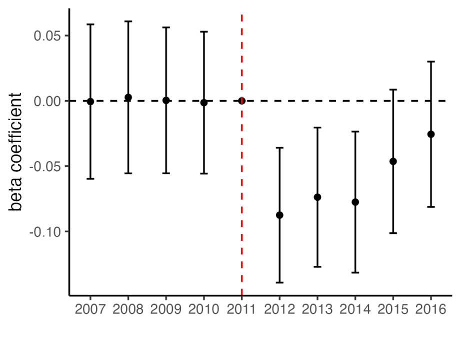
- We focus on a sample of MNEs that have subsidiaries in Thailand
- We first comparison subsidiaries between treatment and control groups
  - Treated subsidiaries are those in Ayutthaya and Pathum Thani provinces
- Event-study specification

$$y_{st} = \alpha_s^S + \alpha_{jt}^S + \sum_{\tau \neq 2011} \beta_\tau^S T_s \mathbf{1}\left\{t = \tau\right\} + \varepsilon_{st}^s,$$

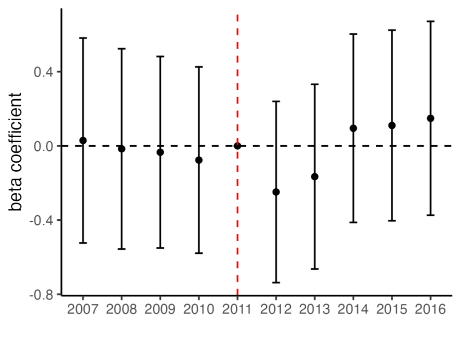
  - T_s is the treatment dummy for subsidiary s
  - β_τ^S captures the dynamic relative effect of the negative floods shock

Subsidiary-Level Results

More Results | Subsample Analysis



Operating Indicator



Log Sales

Headquarter Analysis

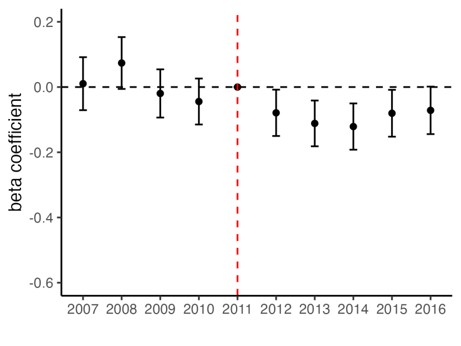
- Next, we consider the following headquarter-level specification

$$y_{it} = \alpha_i^H + \alpha_{jt}^H + \sum_{\tau \neq 2011} \beta_\tau^H Z_i \mathbf{1}\{t = \tau\} + \varepsilon_{it}^H,$$

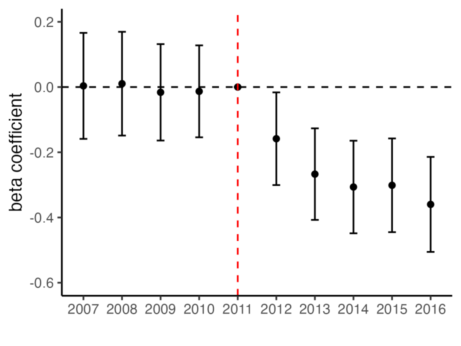
  - $Z_i \equiv \frac{sales_{i,2011}^{flooded}}{sales_{i,2011}^{world}}$ measures the intensity of the shock to the firm i
  - β_τ^H captures the dynamic relative effect of the negative floods shock

Headquarter-Level Results

Third-country Effects | More Results



Employment



Tangible Asset

Summary of Reduced Form Findings

- The Japanese labor share (LS) has been declining between 1995-2007
  - It can be explained by within-firm LS decline and reallocation to low-LS firms
  - Large firms have low LS and the pattern is stronger recently
- The Thailand floods affected MNEs relatively such that
  - Subsidiaries in the flooded region reduced operation
  - Headquarters reduced home employment and capital stock, with larger decline in the latter

Roadmap

Empirical Evidence

Model

Estimation

Quantitative Exercises

Overview

- We consider a heterogeneous firm model of offshore subsidiaries
  - The purpose is to study the domestic labor share effect of offshoring
  - So, we consider a GE and study domestic and foreign factor prices
- The model features:
  - productivity heterogeneity $\Rightarrow$ between-firm effect on labor share (cf. Draszelski Jaumandreu '19)
  - a nested CES production function $\Rightarrow$ within-firm labor share changes
- We also allow quantitative trade model features such as sectoral input-output linkages (e.g., Caliendo Parro '15)

Environment

- There are S sectors indexed by j
- There are three countries $i \in \mathcal{I} \equiv \{J, T, R\}$
  - J stands for Japan, T for Thailand, and R for the Rest of the World
  - Free trade and no factor mobility between countries
- J and T are small-open
  - Thus, we take sectoral price index P_j and factor price in R as given
  - This excludes feedback that activities in J and T affect world prices
- In J, capital $\bar{K}_J$ and labor $\bar{L}_J$ are supplied inelastically
  - By contrast, there is inelastic factor supply $\bar{M}_i$ in $i = T, R$

Production I: Sectoral Producers and Intermediate Producing Firms in Country J

- Sectoral good producers and intermediate-producing firms operate in J
- Sectoral good producers aggregate intermediate varieties by

$$Q_j \equiv \left[\int_\omega \left(q_j \left(\omega \right) \right)^{\frac{\varepsilon_j - 1}{\varepsilon_j}} \, d\omega \right]^{\frac{\varepsilon_j}{\varepsilon_j - 1}}, \ \varepsilon_j \geq 0.$$

- Firms produce unique variety ω under monopolistic competition
    - TFP ψ follows Pareto distribution with shape parameter θ_j
- Firms choose offshoring subsidiary location in $i = T, R$ and produces with

$$q_j = f_j \left(k, m_j^P; \psi \right) = \psi \left[\alpha_j k^{\frac{\sigma_j - 1}{\sigma_j}} + \left(1 - \alpha_j \right) \left(m_j^P \right)^{\frac{\sigma_j - 1}{\sigma_j}} \right]^{\frac{\sigma_j}{\sigma_j - 1}}, \ \sigma_j \geq 0$$

    - k: headquarter capital input
    - $m_j^P \equiv m_j^P \left(l, m_T, m_R, m \right)$: "production input" (up next)

Production II: The Production Input

- The production input is determined by

$$m_j^P\left(l, m_T, m_R, m\right) \equiv \left[l^{\frac{\lambda-1}{\lambda}} + \left(a_T m_T\right)^{\frac{\lambda-1}{\lambda}} + \left(a_R m_R\right)^{\frac{\lambda-1}{\lambda}} + m_j^{\frac{\lambda-1}{\lambda}}\right]^{\frac{\lambda}{\lambda-1}}, \ \lambda > 1$$

  - l: domestic labor input
  - m_i: offshore inputs from subsidiaries in i
  - $m_j \equiv \prod_k m_{kj}^{\delta_{kj}}$: other outsourced inputs in sector j
- a_i represents the exogenous productivity of country $i = T, R$
  - We will study the comparative statics of these changes (floods or globalization)
- Firms in J pay a fixed cost of entry f^E, production f^P, and setting up a subsidiary in location i, f_i^M

Factor Demand in Other Countries and Equilibrium

- In country T, a representative producer uses input M_T with demand function $M_T = (p_T^m / A_T)^{-\gamma}$
- In country R, factor price is given at p_R^m
- In equilibrium, factor prices (w_J, r_J, p_T^m) are determined so that factor markets clear

Characterization I: Marginal Cost and Pricing

- Write D_i as the indicator if a firm enters country $i = T, R$
- A firm's marginal cost depends on the entry decision and offshored inputs

$$c_j = c_j\left(\psi; D_R, D_T\right) = \frac{1}{\psi}\left[\alpha_j\left(r_J\right)^{1-\sigma_j} + \left(1-\alpha_j\right)\left(p_j^{m,P}\right)^{1-\sigma_j}\right]^{\frac{1}{1-\sigma_j}} \equiv \frac{1}{\psi}\tilde{c}_j\left(D_R, D_T\right)$$

where $p_j^{m,P} \equiv p_j^{m,P}\left(D_R, D_T\right)$ is the cost of production input

$$p_j^{m,P}\left(D_R, D_T\right) = \left(w_J^{1-\lambda} + D_T\left(\frac{p_T^m}{a_T}\right)^{1-\lambda} + D_R\left(\frac{p_R^m}{a_R}\right)^{1-\lambda} + \left(p_j^m\right)^{1-\lambda}\right)^{\frac{1}{1-\lambda}}$$

- Given the monopolistic competition, firm prices by $p_j = \frac{\varepsilon_j}{\varepsilon_j - 1} c_j$

Characterization II: Entry Decisions

- Firm ψ enters country i iff $\psi > \psi_{i,j}$
  - We impose parameter restrictions such that $\psi_{T,j} > \psi_{R,j}$ Sales distribution
  - Given this restriction, firms' entry choice is among $d = 00$ (domestic), $d = 01$ (non-Thai international), and $d = 11$ (Thai-investing)
- For instance, threshold $\psi_{d=11,j}$ is given by

$$\pi_j (\psi_{11,j}; d = 11) - \pi_j (\psi_{11,j}; d = 01) = f_T$$

$$\iff \psi_{11,,j} = \left(\frac{f_T}{\tilde{\varepsilon}_j P_j^{\varepsilon_j - 1} Q_j CS_{11,j}} \right)^{\frac{1}{\varepsilon_j - 1}}$$

  - $CS_{11,j} \equiv c_j (\psi_{11,j}; d = 11)^{1-\varepsilon_j} - c_j (\psi_{11,j}; d = 01)^{1-\varepsilon_j}$ is the cost-saving term due to entry to T

Characterization III: Equilibrium Conditions

- Conditional on optimal entry decision d, firm-level factor demand functions can be derived from the CES formulation
    - Write them as $k_j(\psi; d)$, $l_j(\psi; d)$, and $m_{T,j}(\psi; d)$ Detail
- These firm-level factor demand functions can be integrated over ψ
    - Write them as K^D, L^D, and M_T^D.
- Finally, (w_J, r_J, p_T^m) is the solution to the factor market clearing conditions:

$$K^D = \bar{K}_J,\ L^D = \bar{L}_J,\ M_T^D + \left(\frac{p_T^m}{A_T}\right)^{-\gamma} = \bar{M}_T$$

Solving the Equilibrium

- We follow the "hat algebra" (HA) approach (Dekle et al '08)
  - Express all variables x in change, with the hat notation $\hat{x} = x'/x$
- We can show that Detail

$$\hat{K}^D = \sum_j S_j^K \left(\hat{r}_J\right)^{-\sigma_j} \hat{\hat{C}}_j^K$$

$$\hat{\hat{C}}_j^K = \sum_{d \in \{00,01,11\}} S_{d,j}^K \left(\hat{\hat{c}}_{d,j}\right)^{\sigma_j - \varepsilon_j} \hat{s}_{d,j}$$

S_j^K and $S_{d,j}^K$ are cost shares, $\hat{s}_{d,j}$ is offshoring type d's share change

- Deriving the productivity-controlled cost change $\hat{\hat{c}}_{d,j}$ is standard
- Similar derivations for $\hat{L}^D$ and $\hat{M}_T^D$

The Issue with HA under a Heterogeneous Firm Model

- The share change $\hat{s}_{d,j}$ is unique to HA under a hetero-firm model
- Pareto assumption implies $\hat{s}_{d,j}$ depends on the cost-savings change $\hat{CS}_{d,j}$. E.g.,

$$\hat{s}_{11,j} = \left(\hat{\psi}_{11,j}\right)^{-(\theta_j-(\varepsilon_j-\sigma_j))} = \left(\hat{CS}_{11,j}\right)^{-\frac{\theta_j-\left(\varepsilon_j-\sigma_j\right)}{\varepsilon_j-1}}$$

- However, $\hat{CS}_{d,j}$ involves unobservable *counterfactual* marginal costs
  - Cf. classical “counterfactual unobservability” in the treatment effect literature
  - To overcome this difficulty, we propose an “extensive margin HA”

Extensive Margin Hat Algebra (EMHA)

- The (cross-sectional) cost ratio ($CR_{11,j} \equiv (c_{11,j}/c_{01,j})^{1-\varepsilon_j} - 1$) is:

$$CS_{11,j} = c_{11,j}^{1-\varepsilon_j} - c_{01,j}^{1-\varepsilon_j} = c_{01,j}^{1-\varepsilon_j}\left[(c_{11,j}/c_{01,j})^{1-\varepsilon_j} - 1\right]$$

$$= c_{01,j}^{1-\varepsilon_j}\left\{\left[s_{01,j}^{K} + (1 - s_{01,j}^{K})\left(1 - s_{11,j}^{m_T|m^P}\right)^{-\frac{1-\sigma_j}{1-\lambda}}\right]^{\frac{1-\varepsilon_j}{1-\sigma_j}} - 1\right\}$$

where $s_{01,j}^{K}$ and $s_{11,j}^{m_T|m^P}$ are the factor cost shares Detail

  - These shares can be observed *before and after* the change

- Hence, the change in the cost saving is

$$\hat{CS}_{11,j} = \underbrace{(\hat{c}_{01,j})^{1-\varepsilon_j}}_{\text{standard hat algebra}} \underbrace{\left(CR'_{11,j}/CR_{11,j}\right)}_{\text{data}}$$

Roadmap

Empirical Evidence

Model

Estimation

Quantitative Exercises

Calibration

- To solve the EMHA conditions, we need a set of parameters $(\theta_j, \varepsilon_j, \sigma_j, \lambda)$
  - We calibrate $(\theta_j, \varepsilon_j, \sigma_j)$ by applying methods in the literature
  - We then follow the reduced form literature on the role of MNE in employment to estimate the remaining parameter

- Calibration of sectoral parameters
  - θ_j (Pareto shape parameter): fitted to the sectoral tail sales distribution
  - ε_j (Demand elasticity): fitted to the sectoral average markups
  - σ_j (Capital-production input elasticity): fitted to the relative capital demand with respect to local wage (Oberfield, Raval '21) detail

Calibration Results

Code	Label	θ_j	ε_j	σ_j
9	Food	6.57	3.76	0.23
11	Textile	13.58	4.99	0.57
15	Wood	6.17	4.15	0.19
16	Chemical	5.93	2.73	0.22
18	Plastic	10.29	4.62	0.23
19	Rubber	19.78	3.85	0.03
21	Ceramics	4.68	3.07	0.32
22	Metal	7.57	4.38	0.28
23	Non-ferrous Metal	53.2	5.48	0.01
24	Metal Product	8.56	4.1	0.21
25	General Machine	7.45	4.71	0.07
28	Electronics	8.03	4.7	0.22
29	Electric Machine	8.86	4.85	0.36
30	ICT Machine	8.03	4.7	0.22
31	Transportation Machine	8.2	5.35	0.19
32	Other Manufacturing	5.79	4.77	0.4

- Calibrated parameters satisfy restrictions on Pareto dispersion θ_j

Estimating Production Input Substitutability λ

- Focus on a sample of MNEs that have subsidiaries in Thailand
- We follow a D-in-D 2SLS specification: (Kovak, Oldenski, Sly ’21)

$$\ln\left(l_{it}\right) = a_i + a_{jt} + b\ln\left(m_{it}^{T}\right) + e_{it},$$

  - The floods shock IV for the D-in-D regression is $Z_{it} \equiv Z_i \times \mathbf{1}\left\{t \geq 2012\right\}$
  - The estimator of b using Z_{it} converges to $E\left[\frac{d\ln l_{it}/dZ_{it}}{d\ln m_{it}^{T}/dZ_{it}}\right]$

Main Regression Results

VARIABLES	(1) $\ln l_{it}^{JPN}$	(2) $\ln l_{it}^{JPN}$	(3) $\ln l_{it}^{JPN}$	(4) $\ln m_{it}^{T}$	(5) $\ln l_{it}^{JPN}$
$\ln m_{it}^{T}$	0.446***	0.0604***	0.192***		
	(0.00686)	(0.0106)	(0.0502)		
Z_{it}				-0.728***	-0.140***
				(0.108)	(0.0367)
Observations	5,563	5,563	5,563	5,563	5,563
Model	OLS	FE	2SLS	2SLS-1st	2SLS-reduced
Firm FE	-	YES	YES	YES	YES
Year FE	-	YES	YES	YES	YES

Notes: Cluster-robust standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

- The positive 2SLS result is consistent with the literature
- Robustness: other foreign factor measures | extensive-margin IV | different control groups
- Extension: regression by industry

Implied Substitutability λ

- Using our nested-CES specification, we can show that

$$E\left[\frac{d\ln l_{it}/dZ_{it}}{d\ln m_{it}^{T}/dZ_{it}}\right]=\frac{\sum_j S_j^L s_{T,j}^{m_T|m^P}\left[(\lambda-\sigma_j)+(\sigma_j-\varepsilon_j)\,s_{T,j}^{m^P}\right]}{-\lambda+\sum_j S_j^{M_T} s_{T,j}^{m_T|m^P}\left[(\lambda-\sigma_j)+(\sigma_j-\varepsilon_j)\,s_{T,j}^{m^P}\right]}.$$

  - $d\ln l_{it}/dZ_{it}$ comes solely from the inflated cost index
  - $d\ln m_{it}^{T}/dZ_{it}$ comes from the inflated cost index and direct substitution
- The method of moments implies $\lambda = 1.40$ with s.e. 0.133 standard error
- In all industries, we have $\lambda > \sigma_j$
  - Hence, labor is relative substitute of foreign inputs
  - An increase in the factor-augmenting productivity shock in the foreign country implies lower labor share in Japan

Roadmap

Empirical Evidence

Model

Estimation

Quantitative Exercises

Model Fit

- We simulate firms and examine if the model can predict data patterns
- Procedure
  1. Hit productivity shock $\hat{a}_T = 0.1$ to firms operating in Ayutthaya-Pathum Thani (AP) provinces
  2. Solve the model with the EMHA to get $\left(\hat{r}_J, \hat{w}_J, \hat{p}_T^M\right)$
  3. Obtain the model-predicted change in employment $\hat{l}(\omega)$ and capital $\hat{k}(\omega)$
  4. Regress $\hat{l}(\omega)$ and capital $\hat{k}(\omega)$ on AP dummy

	Employment		Capital	
	Model	Data	Model	Data
	(1)	(2)	(3)	(4)
Shocked (AP)	-0.032^{***}	-0.038^{*}	-0.056^{***}	-0.048^{***}
	(0.002)	(0.021)	(0.003)	(0.012)
N of firms	595	595	595	595

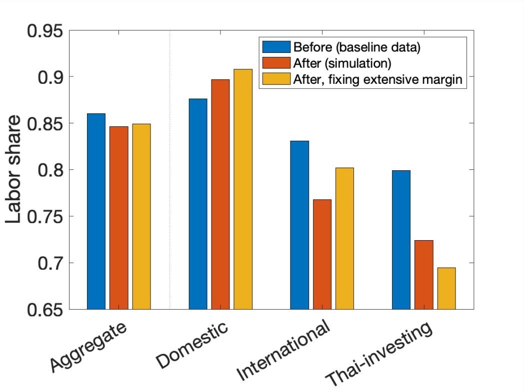
Quantifying the Role of Foreign Productivity Growth

- To study how labor share implications differ across firms' globalization strategy, compute the labor share of firm groups S_d^L
  - E.g., the labor share of Thai-investors is

$$S_{11}^L = \frac{\sum_j \int_{\psi_{T,j}}^{\infty} w_J l_j(\psi)\, dG_j(\psi)}{\sum_j \int_{\psi_{T,j}}^{\infty} \frac{\varepsilon_j}{\varepsilon_j - 1} \left[w_J l_j(\psi) + r_J k_j(\psi) \right] dG_j(\psi)}$$

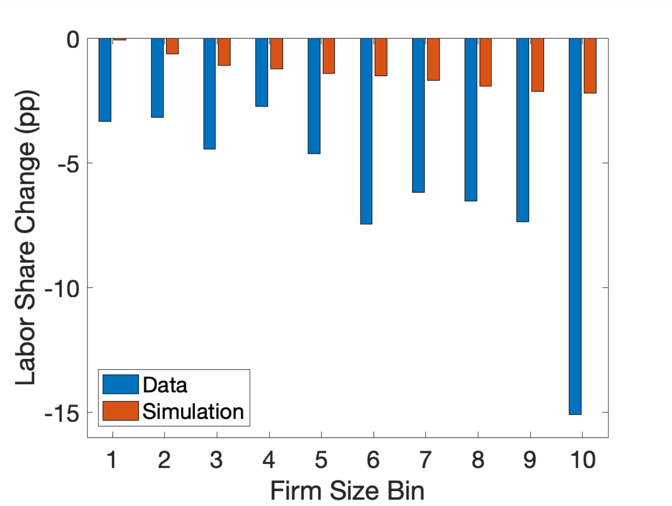
- Also, to obtain the effect fixing selection, we do the following exercise
  1. Solve the EHMA $\left(\hat{r}_J, \hat{w}_J, \hat{p}_T^M\right)$ with setting $\hat{\psi}_{T,j} = \hat{\psi}_{R,j} = 1$ exogenously
  2. Compute $\hat{S}_d^L$ with $\left(\hat{r}_J, \hat{w}_J, \hat{p}_T^M\right)$ and $\hat{\psi}_{T,j} = \hat{\psi}_{R,j} = 1$

Simulation Results



- Foreign productivity growths reduce LS by 1.4 pp (11.9% of observed reduction)
- The extensive-margin effect modestly amplifies the aggregate effect

Results across Firm-Size Bins Welfare



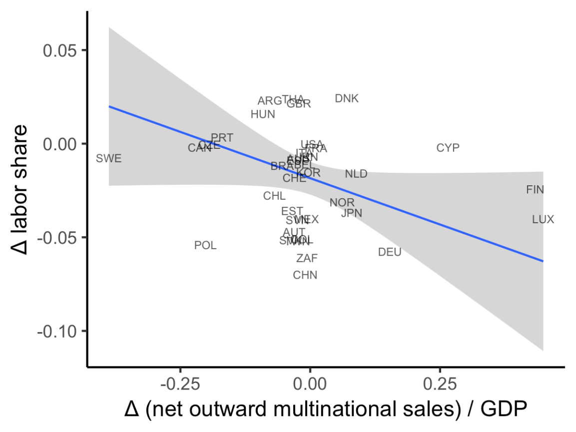
Wrapping Up

- We study how MNEs contribute to the decrease in the home-country's labor share
- Our empirical results show that firms affected by the floods decreased both employment and capital, with stronger effects on the latter
- We provide a heteregneous-firm model with multiple factor inputs and the extensive margin hat algebra to solve such a model
- Our estimated model implies that 1.4 pp decline in the labor share can be explained by the foreign factor productivity growth

Roadmap

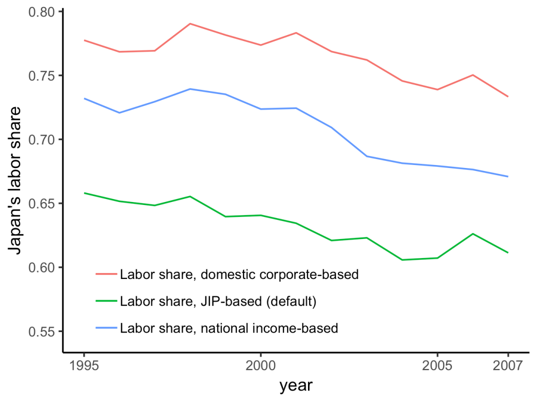
Backup

First-pass: Cross-country Net MNE Sales and Labor Share Back



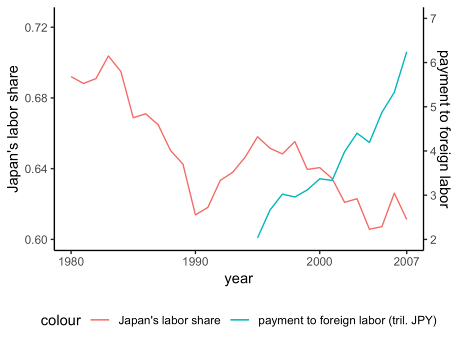
Note: Authors' calculation based on Karabarbounis Neiman (2014) and UNCTAD. The horizontal axis is the change in the sum of bilateral net outward multinational sales between 1991-1995 average and 1996-2000 average. The vertical axis is the change in labor share from 1991 to 2000. Singapore is dropped because it has an outlier value for the outward multinational sales measure.

Other Labor Share Measures go back



Source: Authors' calculation based on Japan Industrial Productivity (JIP) Database 2015, Cabinet Office Long-run Economic Statistics (COLES, https://www5.cao.go.jp/j-j/wp/wp-je12/h10_data01.html, accessed on May 13, 2019), and Japan's SNA, Generation of Income Account, 2009. JIP-based labor share is calculated by the share of nominal labor cost in nominal value added of JIP market economies. National income-based labor share is the fraction of nominal employee compensations over nominal national income from COLES. Domestic corporate-based labor share is net labor share of domestic corporate factor income, calculated from the SNA, by the fraction of the item "Wages and salaries" over the sum of "Wages and salaries" and "Operating surplus, net."

Japan’s LS and MNEs’ Foreign Labor Compensation Back



Source: Authors’ calculation based on Japan Industrial Productivity (JIP) Database 2015 and Survey of Oversea Business Activity (SOBA) 1996-2008. The labor share is calculated by the share of nominal labor cost in nominal value added of JIP market economies. The payment to offshore labor is the sum of worker compensation to foreign subsidiaries of all Japanese multinational corporations in SOBA.

Cross-country Evidence | Other definitions of LS | Other measures of MNEs | MNEs versus non-MNEs

Average and entry-exit effects Back

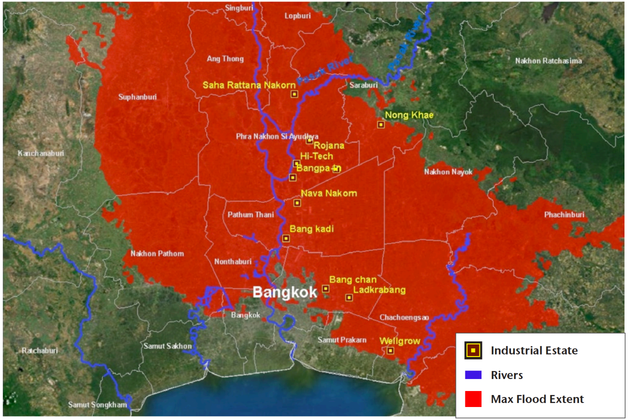
$$AV_t \equiv \left(\sum_{i \in \Omega_t} \frac{s_{it}^L}{|\Omega_t|} - \sum_{i \in \Omega_{t_0}} \frac{s_{it_0}^L}{|\Omega_{t_0}|} \right)$$

$$EN_t \equiv \left(\sum_{i \in \Omega_t \setminus \Omega_{t_0}} \omega_{it} s_{it}^L - \sum_{i \in \Omega_{t_0} \setminus \Omega_t} \omega_{it_0} s_{it_0}^L \right)$$

Floods Map

back

Exhibit 16: Selected Industrial Estates Embedded within the Maximum Flood Extent on November 15, 2011

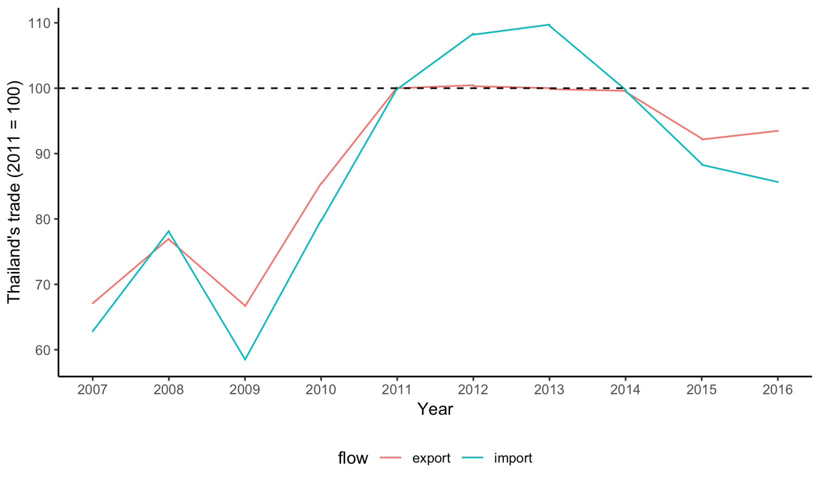


Source: GISTDA

Source: AON Benfield (2012) http://thoughtleadership.aonbenfield.com/Documents/

20120314_impact_forecasting_thailand_flood_event_recap.pdf

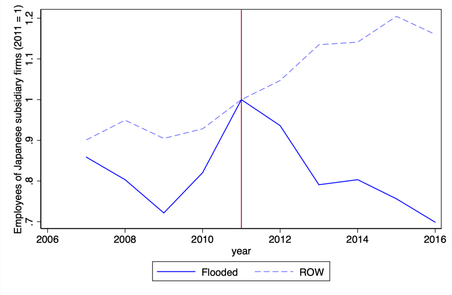
Trend of Thailand’s Trade back



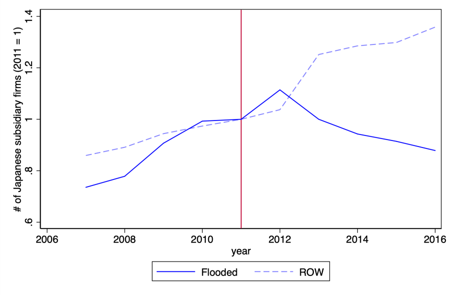
Source: Comtrade

The Floods and Aggregate Trends back

- Companies “move to avoid potential supply chain disruptions.” (Nikkei Asian Review, ’14)



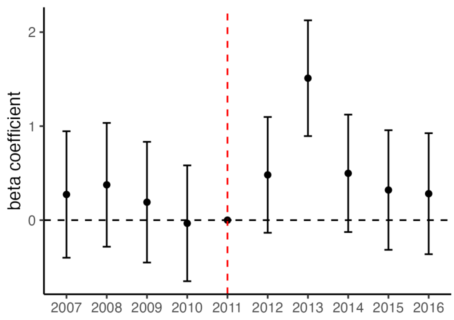
(g) Total employment



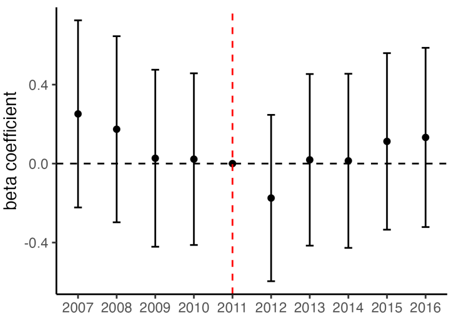
(h) Number of subsidiaries

Note: Authors’ calculation from SOBA 2007-2016. “Flooded” shows the evolution of total employment in plants located in the flooded area (*Ayutthaya* and *Pathum Thani* Province). “ROW” shows that out of the flooded area. Both trends are normalized to 1 in 2011.

More Subsidiary-level Results Back



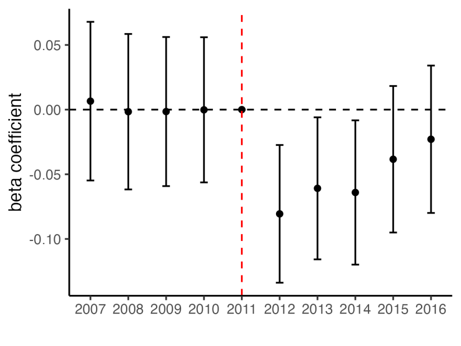
(i) Log Investment



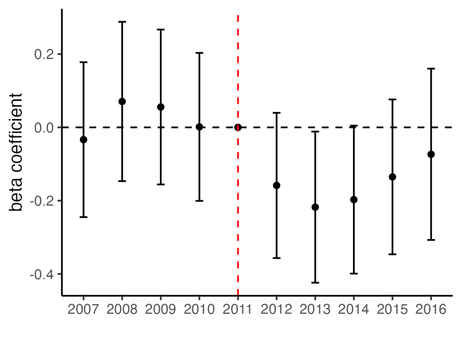
(j) Log Employment

Subsample Analysis – Children or Grandchildren

Back



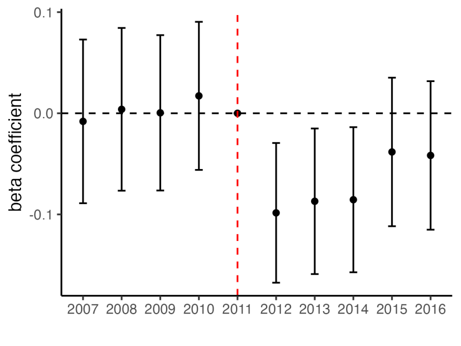
(k) Children



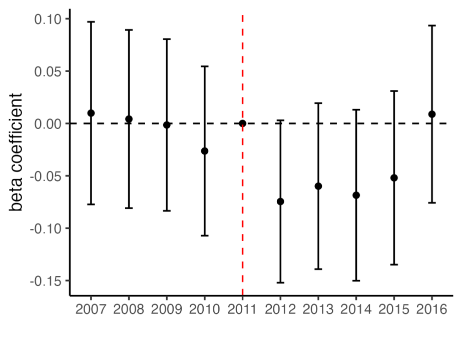
(l) Grandchildren

Subsample Analysis – Ownership Levels

Back



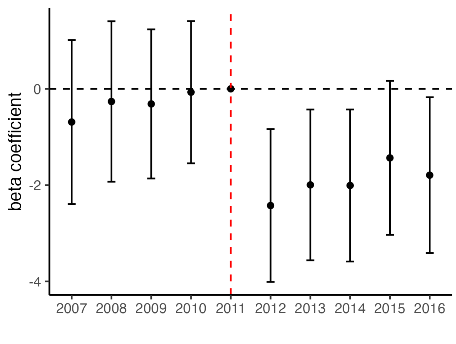
(m) 100% Ownership



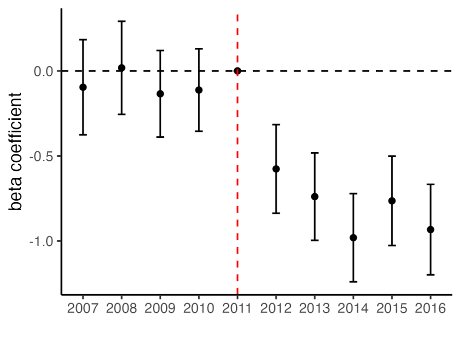
(n) Less than 100% Ownership

Headquarter-level Results on RoW Activities

Back

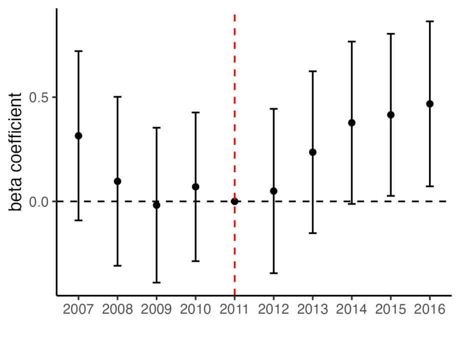


(o) Non-Thai Foreign Subsidiaries

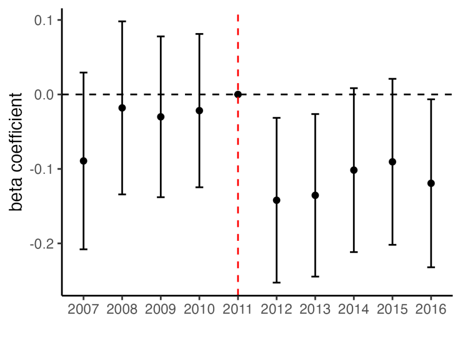


(p) Non-Thai Foreign total employment

Further Headquarter-level Results Back



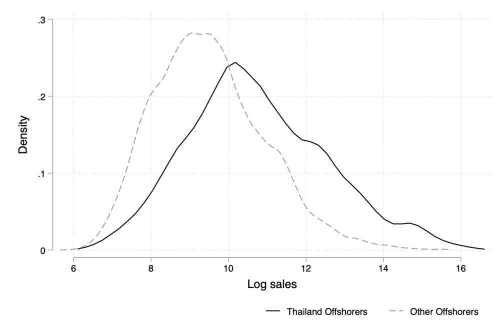
(q) Number of Non-regular Employees



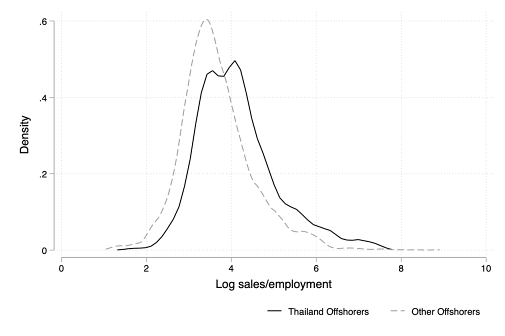
(r) Fixed Asset

Thai Investors Sales Distribution vis-a-vis Other MNEs Back

- Thai investors are more productive than non-Thai investors



(s) Log Sales



(t) Log Sales per Employment

CES factor demands Back

$$r_J k_j(\psi; d^*) = \left(\frac{r_J}{c_j^*}\right)^{1-\sigma_j} \left(\frac{\varepsilon_j}{\varepsilon_j - 1}\right)^{1-\varepsilon_j} (c_j^*)^{1-\varepsilon_j} P_j^{\varepsilon_j - 1} Q_j$$

$$w_J l_j(\psi; d^*) = \left(\frac{w_J}{p_j^{m,P*}}\right)^{1-\lambda} \left(\frac{p_j^{m,P*}}{c_j^*}\right)^{1-\sigma_s} \left(\frac{\varepsilon_j}{\varepsilon_j - 1}\right)^{1-\varepsilon_j} (c_j^*)^{1-\varepsilon_j} P_j^{\varepsilon_j - 1} Q_j$$

$$p_T^m m_{T,j}(\psi; d^*) = \left(\frac{p_T^m / a_T}{p_j^{m,P*}}\right)^{1-\lambda} \left(\frac{p_j^{m,P*}}{c_j^*}\right)^{1-\sigma_j} \left(\frac{\varepsilon_j}{\varepsilon_j - 1}\right)^{1-\varepsilon_j} (c_j^*)^{1-\varepsilon_j} P_j^{\varepsilon_j - 1} Q_j$$

where $c_j^* \equiv c_j(\psi; d^*)$ and $p_j^{m,P*} \equiv p_j^{m,P}(d^*)$

Change in the price of production input Back

$$d\ln\left(p_j^{m,P}\right) = s^L d\ln w + s_T^m \left(d\ln p_T^m - d\ln a_T\right) - s_R^m d\ln a_R$$

where s^L, s_T^m, and s_R^m are the shares of domestic labor, subsidiary input from T and R, respectively

Change in threshold

Back

$$d\ln\psi_{i,j}(\alpha) \equiv s^K(\alpha)\, d\ln r_J + \left(1 - s^K(\alpha)\right)\Delta d\ln p_j^{m,P}$$

where

$$\begin{aligned}\Delta d\ln p_j^{m,P} \equiv & \left(\frac{c_j\left(\psi_{T,j}(\alpha), \alpha; 1, D_R\right)}{CS_j(\alpha)}\right)^{1-\varepsilon_j} d\ln p_j^{m,P}(1, D_R) \\ & - \left(\frac{c_j\left(\psi_{T,j}(\alpha), \alpha; 0, D_R\right)}{CS_j(\alpha)}\right)^{1-\varepsilon_j} d\ln p_j^{m,P}(0, D_R)\end{aligned}$$

Initial Cost Shares (Aggregate) Back

$$S_j^K = \frac{r_J K_j}{\sum_k r_J K_k}, \;\; S_j^L = \frac{w_J L_j}{\sum_k w_J L_k}, \;\; S_j^{M_T} = \frac{p_T^m M_{T,j}}{\sum_k p_T^m M_{T,k}},$$

$$S_j^K(d) = \frac{\int_{\psi \in d} r_J k_j(\psi)\, dG_j(\psi)}{r_J K_j}, \;\; S_j^L(d) = \frac{\int_{\psi \in d} w_J l_j(\psi)\, d\psi}{w_J L_j}$$

Initial Cost Shares across Factors Back

$$s_{d,j}^{K} = \frac{\int_{\psi \in d} r_J k_j(\psi)\, d\psi}{\int_{\psi \in d} c_j q_j(\psi)\, d\psi}, \quad s_{d,j}^{m_T|m^P} = \frac{\int_{\psi \in d} p_T^m m_{T,j}(\psi)\, d\psi}{\int_{\psi \in d} p^{m,P} m^P(\psi)\, d\psi}$$

K-L Elasticity σ, with Census of Manufacture, Japan go back

- By the first order condition, we can show

$$\ln\left(rK/p^M M\right) = (\sigma - 1)\ln\left(w/r\right) + \text{const.}$$

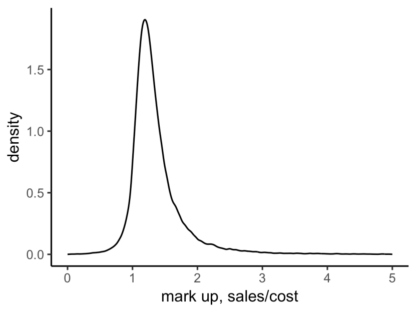
- Oberfield-Raval uses the location $m(i)$-level variation to estimate

$$\ln\left(rK/p^M M\right)_i = b_0 + b_1 \ln\left(w_{m(i)}\right) + X_i b_2 + \varepsilon_i,$$

with a shift-share instrument $z_{m,t} = \sum_{j \in \mathcal{J}^{NM}} \omega_{mj,t-10}\, g_{jt}$.

Demand Elasticity ε with Census of Manufacture, Japan

- Following OR, $\varepsilon = m/\left(m-1\right)$, where $m \equiv sales/cost$ is the measured markup.
- The average markup implies $\varepsilon \in [3.98, 4.88]$, depending on the treatment of extreme values. go back

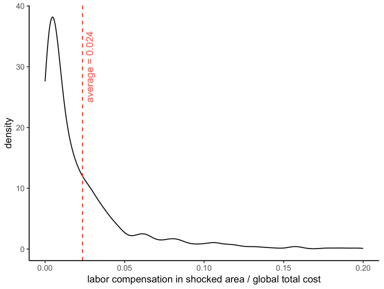


Source: Census of Manufactur, 1997. Estimates are obtained from inverting the markup, following Oberfield and Raval (2014). The markup is defined as sales divided by the sum of costs from capital, labor, and materials.

Share of Foreign Labor Cost in Total Cost s^F go back

- To calculate s^F, we focus on firms located in the flooded region.
- We then calculate, for each headquarter firm f,

$$s_f^F = \frac{\sum_{l \in treated} \text{total payroll}_{f,2011}^{l}}{\sum_{l \in world} \text{total cost}_{f,2011}^{l}}.$$



Note: Global total cost is calculated by the sum of domestic cost and multinational cost. The domestic cost is the sum of the following items: advertising expense, information processing communication cost, mobile real estate rent, packing and transportation costs, total payroll, depreciation expense, welfare expense, taxes, interest expense, and lease payments. The international cost is the sum of each subsidiaries total

Other Measures of Foreign Factors go back

- Measure the value added by

$$VA_{it}^{ROW} = \sum_{s \in i} \left(sales_{st} - purchases_{st} \right).$$

- Regress

$$\ln\left(l_{it}^{JPN}\right) = a_i^{VA} + a_t^{VA} + b^{VA} \ln\left(VA_{it}^{ROW}\right) + e_{it}^{VA}.$$

VARIABLES	(1) $\ln VA_{it}^{ROW}$	(2) $\ln l_{it}^{JPN}$	(3) $\ln l_{it}^{JPN}$	(4) $\ln sales_{it}^{ROW}$	(5) $\ln l_{it}^{JPN}$
Z_{it}	-0.762***	-0.132***		-0.549***	
	(0.105)	(0.0374)		(0.0849)	
$\ln(VA_{it}^{ROW})$			0.173***		
			(0.0494)		
$\ln(sales_{it}^{ROW})$					0.240***
					(0.0685)
Observations	5,460	5,460	5,460	5,460	5,460
Model	2SLS-1st	2SLS-reduced	2SLS	2SLS-1st	2SLS
Firm FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES

Robust standard errors in parentheses

Extensive Margin

go back

- Alternative extensive-margin instrument

$$Z_{it}^{EXT} = \mathbf{1}\left\{L_{i,2011}^{treated} > 0 \cap t \geq 2012\right\}.$$

- Idea: did firms located in the flooded region change the employment relative to those in other regions?

	(1)	(2)
VARIABLES	$\ln l_{it}^{JPN}$	$\ln l_{it}^{JPN}$
$\ln l_{it}^{ROW}$	0.284***	0.0271***
	(0.00394)	(0.00435)
Observations	22,795	22,795
Model	OLS	FE
Firm FE	-	YES
Year FE	-	YES

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Sample Selection go back

- Firms in the flooded region are affected. To which firms should we compare?
- Different control groups
  - all firms in Japan
  - all firms in Japan with Bartik specification (Desai et al. 2009)

	(1)	(2)	(3)	(4)
VARIABLES	extensive	intensive	extensive	intensive
shock	-0.0497***	-0.172***	-0.0490***	-0.249***
	(0.0126)	(0.0667)	(0.0139)	(0.0774)
Observations	185,703	185,703	91,690	91,690
Firm FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Balanced panel?			YES	YES

Robust standard errors in parentheses

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Regression by Industries go back

- Estimates with the intensive margin instrument.

VARIABLES	(1) 2SLS	(2) 2SLS	(3) 2SLS	(4) 2SLS	(5) 2SLS	(6) 2SLS
Log Subsidiary Employment	0.120**	-0.00447	0.168***	0.0774	-0.184	0.507*
	(0.0501)	(0.610)	(0.0486)	(0.0694)	(0.162)	(0.292)
Observations	3,704	773	540	563	521	915
Firm FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Industry	manuf	chem	metal	machine	elec	auto

Robust standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

1st stage and reduced form

By Industries, 1st Stage go back

- Estimates with the intensive margin instrument.

VARIABLES	(1) 1st	(2) 1st	(3) 1st	(4) 1st	(5) 1st	(6) 1st
Thai Flood Shock	-0.730***	-0.152	-1.655***	-2.223**	-0.655***	-0.303**
	(0.169)	(0.173)	(0.358)	(1.101)	(0.161)	(0.132)
Observations	3,704	773	540	563	521	915
Firm FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Industry	manuf	chem	metal	machine	elec	auto

Robust standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

By Industries, Reduced Form

go back

- Estimates with the intensive margin instrument.

VARIABLES	(1) reduced	(2) reduced	(3) reduced	(4) reduced	(5) reduced	(6) reduced
Thai Flood Shock	-0.0874**	0.000677	-0.277***	-0.172	0.120	-0.154**
	(0.0428)	(0.0923)	(0.0594)	(0.225)	(0.105)	(0.0700)
Observations	3,704	773	540	563	521	915
Firm FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Industry	manuf	chem	metal	machine	elec	auto

Robust standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Delta Method for $se\left(\widehat{\lambda}\right)$ go back

- Note

$$\widehat{b} = \frac{\varepsilon s_0^F}{\widehat{\lambda} - 1 + \varepsilon s_0^F} \Leftrightarrow \widehat{\lambda} = \frac{\varepsilon s_0^F}{\widehat{b}} + 1 - \varepsilon s_0^F.$$

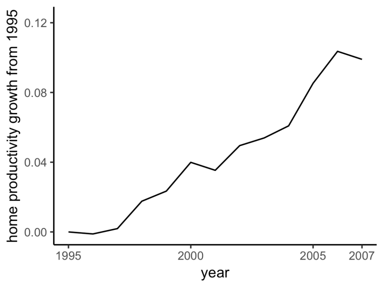
- If $\widehat{b}$ satisfies $\sqrt{n}\left(\widehat{b} - b_0\right) \to_d N(0, \Sigma)$, then by the delta method we have

$$\sqrt{n}\left(\widehat{\lambda} - \lambda_0\right) \to_d N\left(0, \left(\frac{\varepsilon s_0^F}{b_0^2}\right)^2 \Sigma\right).$$

- In our case $se\left(\widehat{\lambda}\right) = \frac{\widehat{\varepsilon s_0^F}}{\widehat{b}^2}\sqrt{\widehat{\Sigma}} = \frac{4 \times 0.024}{(0.19)^2} \times 0.05 \approx 0.133$
- $\widehat{\lambda} = 1.40 \Rightarrow$ Test $H_0 : \lambda_0 = 1$ gives $t = 0.40/0.133 \approx 3.008$.

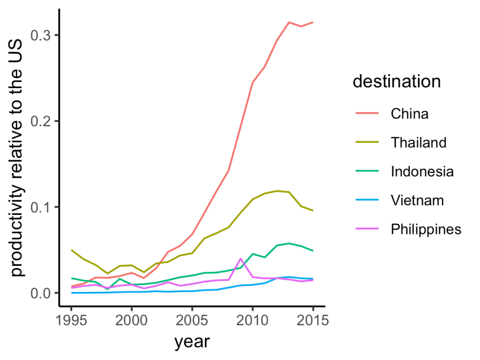
Japan's Labor Productivity $d\ln a_t^L$ go back

- The relative productivity needs to sort out component a_t^L
- We use JIP database's "Quality of Labor" measure.
  - This reflects changes in the composition of the type of workers–gender, age, education, employment status.
  - We interpret this affects the efficiency units of labor, thereby labor-augmenting productivity.
- We find that the growth $d\ln a_t^L$ is much smaller than $d\ln a_t^M$



Productivity Growth in Each Destination Country go back

- We can apply the model inversion for each destination country.
- Productivity growth relative to the base country, US, shows the growth of developing economies.



Welfare Back

- To consider welfare, we need to introduce a consumer
  - Suppose, for simplicity, there is a representative consumer in J
- In our small-open setting, the welfare change can be measured by the nominal income change
- Between 1995 and 2016, we can compute the changes in national income

$$\hat{GDP}_J = (r_J K \hat{+} w_J L) = 5.2\%$$

$$\hat{GNI}_J = \left(r_J K + w_J L + \hat{p}_T^M M_T + p_R^M M_R\right) = 5.3\%$$

or 0.2% annually