Industrial Policy Wars and Inequality: Who Loses and When?

Ziran Ding
Bank of Lithuania & Kaunas University of Technology

Adam Hal Spencer
University of Bonn

Zinan Wang
Tianjin University

RES 2025 Annual Conference
June 30^{th} 2025 @ University of Birmingham

The views expressed here do not necessarily reflect the position of Bank of Lithuania or Eurosystem.

Roadmap

1. Introduction
2. Model Environment and Equilibrium
3. Calibration
4. Quantitative Exercises
5. Concluding Remarks

Motivation

I will immediately begin the overhaul of our trade system to protect American workers and families.

- President Trump, Inaugural Address, January 20^{th} 2025

Question

- How does this supply chain decoupling affect worker inequality and does this effect vary over time?

Motivation

- 1^{st} Trump Administration (2017–2021)
  - Commencement of U.S./China Trade War. Show

Motivation

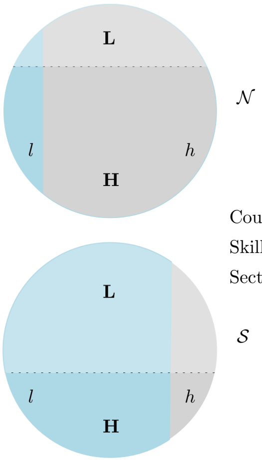
- 1^{st} Trump Administration (2017–2021)
  - Commencement of U.S./China Trade War. Show

- Biden Administration (2021–2025): “de-risking” of supply chains
  - Tariffs on targeted sectors,
  - Subsidy incentives for reshoring (e.g. CHIPS Act). Show
  - Bans on manufacturing targeted goods in China, Show

Motivation

- 1^{st} Trump Administration (2017–2021)
  - Commencement of U.S./China Trade War. Show
- Biden Administration (2021–2025): "de-risking" of supply chains
  - Tariffs on targeted sectors,
  - Subsidy incentives for reshoring (e.g. CHIPS Act). Show
  - Bans on manufacturing targeted goods in China, Show
- 2^{nd} Trump Administration (2025–)
  - General untargeted tariffs,
  - "Liberation Day": 10% baseline tariff + reciprocal tariff,

What We Do

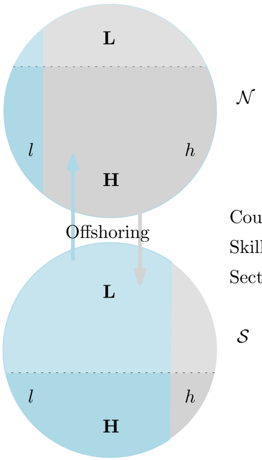


Country $\in \{\mathcal{N}, \mathcal{S}\}$

Skill $\in \{l, h\}$

Sector $\in \{\mathbf{L}, \mathbf{H}\}$

What We Do



Country $\in \{\mathcal{N}, \mathcal{S}\}$

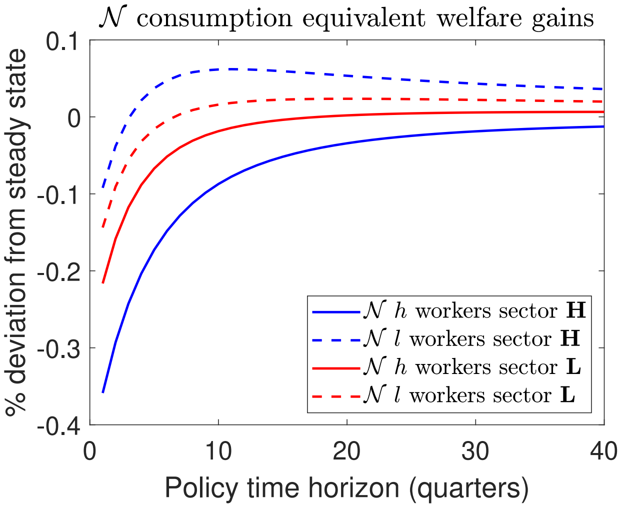
Skill $\in \{l, h\}$

Sector $\in \{\mathbf{L}, \mathbf{H}\}$

What We Do

- Firm heterogeneity + household heterogeneity
- Calibrate model to U.S. ($\mathcal{N}$) and China ($\mathcal{S}$).
- Implement untargeted and temporary shocks to policy instruments.
- Solve for joint dynamics of firm and worker distribution.

Preview: $\mathcal{N}$ Import Tariff & Offshoring Friction



Intuition

- Speed of adjustment affected by interacting forces:
  - Sluggish entry of firms,
  - Gradual re-allocation of workers across sectors.

Roadmap

1. Introduction
2. Model Environment and Equilibrium
3. Calibration
4. Quantitative Exercises
5. Concluding Remarks

Setup

- Discrete time $t \in \{0, 1, 2...\}$.
- Three sets of agents in each country
    - Households,
    - Firms,
    - Government.
- Focus on discussion of North $\mathcal{N}$.

Setup

- Discrete time $t \in \{0, 1, 2...\}$.
- Three sets of agents in each country
  - Households,
  - Firms,
  - Government.
- Focus on discussion of North $\mathcal{N}$.
- Four types of households divided along two dimensions (2x2)
  - Skill class $k \in \{l, h\}$
  - Sector of employment $s \in \{\boldsymbol{H}, \boldsymbol{L}\}$.

Households

- Endogenous worker distribution along sector $s \in \{\boldsymbol{L}, \boldsymbol{H}\}$.

$$\begin{array}{c|ccc} & & \multicolumn{2}{c}{\textbf{Skill class}} \\ & & h & l \\ \textbf{Sector} & \boldsymbol{H} & \omega_t(H,h) & \omega_t(H,l) \\ & \boldsymbol{L} & \omega_t(L,h) & \omega_t(L,l) \end{array}$$

$\omega_t(s,k)$ mass workers sector s, skill class k at t.

Households

- Endogenous worker distribution along sector $s \in \{\boldsymbol{L}, \boldsymbol{H}\}$.

Skill class

Sector	h	l
$\boldsymbol{H}$	$\omega_t(H, h)$	$\omega_t(H, l)$
$\boldsymbol{L}$	$\omega_t(L, h)$	$\omega_t(L, l)$

$\omega_t(s, k)$ mass workers sector s, skill class k at t.

- Total skill endowments fixed

$$\bar{h} = \sum_{s \in \{\boldsymbol{H}, \boldsymbol{L}\}} \omega_t(s, h)$$

$$\bar{l} = \sum_{s \in \{\boldsymbol{H}, \boldsymbol{L}\}} \omega_t(s, l)$$

Households

- Objective of households in sector $s \in \{\boldsymbol{H}, \boldsymbol{L}\}$ with skill class $k \in \{h, l\}$

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \overbrace{\beta^t}^{\text{Discounting}} \underbrace{\log\left(C_t^{sk}\right)}_{\text{Consumption}} \overbrace{\omega_t(s,k)}^{\text{Worker mass}}$$

Households

- Objective of households in sector $s \in \{\boldsymbol{H}, \boldsymbol{L}\}$ with skill class $k \in \{h, l\}$

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \overbrace{\beta^t}^{\text{Discounting}} \underbrace{\log\left(C_t^{sk}\right)}_{\text{Consumption}} \overbrace{\omega_t(s,k)}^{\text{Worker mass}}$$

- Consumption over $s' \in \{\boldsymbol{H}, \boldsymbol{L}\}$

$$C_t^{sk} = \overbrace{C_t^{sk}(H)^{\gamma_H}}^{\text{Consumption } H \text{ sector}} \times \underbrace{C_t^{sk}(L)^{1-\gamma_H}}_{\text{Consumption } L \text{ sector}}$$

Households

- Objective of households in sector $s \in \{\boldsymbol{H}, \boldsymbol{L}\}$ with skill class $k \in \{h, l\}$

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \overbrace{\beta^t}^{\text{Discounting}} \underbrace{\log\left(C_t^{sk}\right)}_{\text{Consumption}} \overbrace{\omega_t(s,k)}^{\text{Worker mass}}$$

- Consumption over $s' \in \{\boldsymbol{H}, \boldsymbol{L}\}$

$$C_t^{sk} = \overbrace{C_t^{sk}(H)^{\gamma_H}}^{\text{Consumption } H \text{ sector}} \times \underbrace{C_t^{sk}(L)^{1-\gamma_H}}_{\text{Consumption } L \text{ sector}}$$

$$\left(C_t^{sk}(s')\right)^{\frac{\theta-1}{\theta}} = \underbrace{\int_{\omega^s_{D,t}} c^{s'}_{D,t}(\omega)^{\frac{\theta-1}{\theta}} d\omega}_{\mathcal{N} \text{ domestic firms}} + \underbrace{\int_{\omega^s_{V,t}} c^{s'}_{V,t}(\omega)^{\frac{\theta-1}{\theta}} d\omega}_{\mathcal{N} \text{ offshoring firms}} + \underbrace{\int_{\omega^{s*}_{X,t}} c^{s'*}_{X,t}(\omega)^{\frac{\theta-1}{\theta}} d\omega}_{\mathcal{S} \text{ exporting firms}}$$

Households

- Budget constraint

$$\overbrace{C_t^{sk}\omega_t(s,k)}^{\text{Consumption}} + \overbrace{B_{t+1}^{sk}}^{\text{Domestic bonds}} + \overbrace{\frac{\eta}{2}\left(B_{t+1}^{sk}\right)^2}^{\text{Adjustment cost}}$$

$$= \underbrace{(1+r_t)B_t^{sk}}_{\text{Bond earnings}} + \underbrace{w_t^{sk}\omega_t(s,k)}_{\text{Labour earnings}} + \underbrace{T_t\omega_t(s,k)}_{\text{Government distributions}}$$

$$+ \underbrace{\Pi_t\omega_t(s,k)}_{\text{Net profits}} + \underbrace{T_t^{sk}\omega_t(s,k)}_{\text{Rebated adjustment costs}}$$

Households

- Workers retire at rate $r \in [0, 1]$.
- Newly-born worker of same skill replaces & makes sector choice.
  - Stays until retirement.

Households

- Workers retire at rate $r \in [0, 1]$.
- Newly-born worker of same skill replaces & makes sector choice.
  - Stays until retirement.
- Newborn at t with skill $k \in \{l, h\}$ chooses sector $\boldsymbol{H}$ when

$$\underbrace{V_t^{Hk}}_{\text{PV of consumption } \boldsymbol{H}} + \overbrace{\epsilon_t^k}^{\text{Non-pecuniary benefit to } \boldsymbol{H}} > \underbrace{V_t^{Lk}}_{\text{PV of consumption } \boldsymbol{L}}$$

where $\epsilon_t^k \sim J(\epsilon_t^k)$.

Firms

- Sector-specific $s \in \{\boldsymbol{H}, \boldsymbol{L}\}$ entry/fixed costs paid in units of labour. Show

Firms

- Sector-specific $s \in \{\boldsymbol{H}, \boldsymbol{L}\}$ entry/fixed costs paid in units of labour. Show
- Pay sunk cost f_E^s and draw productivity z from Pareto on $[z_m, \infty)$.

Firms

- Sector-specific $s \in \{\boldsymbol{H}, \boldsymbol{L}\}$ entry/fixed costs paid in units of labour. Show
- Pay sunk cost f_E^s and draw productivity z from Pareto on $[z_m, \infty)$.
  - Once and for all z, exit until hit by a death shock $\delta \in [0, 1]$.

Firms

- Sector-specific $s \in \{\boldsymbol{H}, \boldsymbol{L}\}$ entry/fixed costs paid in units of labour. Show
- Pay sunk cost f_E^s and draw productivity z from Pareto on $[z_m, \infty)$.
  - Once and for all z, exit until hit by a death shock $\delta \in [0, 1]$.
- Production requires two tasks

$$y_t^s = \underbrace{[y_{h,t}^s]^{\alpha_s}}_{\text{High skilled}} \overbrace{[y_{l,t}^s]^{1-\alpha_s}}^{\text{Low skilled}}$$

where intensity α_s varies by sector $\alpha_{\boldsymbol{H}} > \alpha_{\boldsymbol{L}}$.

Firms

- For high-skilled task, $\mathcal{N}$ firms always hire local h labour

$$y^s_{h,t} = \overbrace{z}^{\text{Idiosyncratic productivity}} \underbrace{Z_t}_{\mathcal{N}\text{ aggregate TFP}} \overbrace{h^s_t}^{\text{Hired skill } h \text{ labour}}$$

Firms

- For high-skilled task, $\mathcal{N}$ firms always hire local h labour

$$y^s_{h,t} = \overbrace{z}^{\text{Idiosyncratic productivity}} \underbrace{Z_t}_{\mathcal{N}\text{ aggregate TFP}} \overbrace{h^s_t}^{\text{Hired skill } h \text{ labour}}$$

- For low-skilled task, Domestic (D) firms hire l labour

$$y^s_{l,t} = z \underbrace{Z_t}_{\mathcal{N}\text{ aggregate TFP}} \overbrace{l^s_t}^{\text{From } \mathcal{N} \text{ pool}}$$

Firms

- For high-skilled task, $\mathcal{N}$ firms always hire local h labour

$$y^s_{h,t} = \overbrace{z}^{\text{Idiosyncratic productivity}} \underbrace{Z_t}_{\mathcal{N}\text{ aggregate TFP}} \overbrace{h^s_t}^{\text{Hired skill } h \text{ labour}}$$

- For low-skilled task, Domestic (D) firms hire l labour

$$y^s_{l,t} = z \underbrace{Z_t}_{\mathcal{N}\text{ aggregate TFP}} \overbrace{l^s_t}^{\text{From } \mathcal{N} \text{ pool}}$$

- For low-skilled task, Offshoring (V) firms hire l^* labour

$$y^s_{l,t} = z \underbrace{Z^*_t}_{\mathcal{S}\text{ aggregate TFP}} \overbrace{l^{s*}_t}^{\text{From } \mathcal{S} \text{ pool}}$$

Firms

- Discrete choices of status (x_t^s, x_t^{s*}) contingent on state (z, A_t)

$$\max_{x_t^s \in \{D,V\}} \overbrace{\{d_{D,t}^s(z, A_t),\ d_{V,t}^s(z, A_t)\}}^{\text{1. Service } \mathcal{N} \text{ as domestic } (D) \text{ or offshorer } (V)?}$$

where $d_{\hat{x},t}^s(z, A_t)$ is dividends for status $\hat{x} \in \{D, V, X\}$.

Firms

- Discrete choices of status (x_t^s, x_t^{s*}) contingent on state (z, A_t)

$$\max_{x_t^s \in \{D,V\}} \overbrace{\{d_{D,t}^s(z, A_t),\ d_{V,t}^s(z, A_t)\}}^{\textbf{1.}\ \text{Service } \mathcal{N} \text{ as domestic } (D) \text{ or offshorer } (V)?} + \underbrace{\max_{x_t^{s*} \in \{0,1\}} \{d_{X,t}^s(z, A_t),\ 0\}}_{\textbf{2.}\ \text{Export to } \mathcal{S} \text{ or not?}}$$

where $d_{\hat{x},t}^s(z, A_t)$ is dividends for status $\hat{x} \in \{D, V, X\}$.

Firms

- General form of dividends for $\hat{x} \in \{D, V, X\}$

$$d^s_{\hat{x},t}(z, A_t) = \left[\underbrace{\rho^s_{\hat{x},t}(z, A_t)}_{\text{Real price}} - \underbrace{c^s_{\hat{x},t}(z, A_t)}_{\text{Marginal cost}}\right] \underbrace{y^s_{\hat{x},t}(z, A_t)}_{\text{Demand}} - \underbrace{f^s_{\hat{x}}(z, A_t)}_{\text{Fixed cost}}$$

Firms

- General form of dividends for $\hat{x} \in \{D, V, X\}$

$$d^{s}_{\hat{x},t}(z, A_t) = \left[\underbrace{\rho^{s}_{\hat{x},t}(z, A_t)}_{\text{Real price}} - \underbrace{c^{s}_{\hat{x},t}(z, A_t)}_{\text{Marginal cost}}\right] \underbrace{y^{s}_{\hat{x},t}(z, A_t)}_{\text{Demand}} - \underbrace{f^{s}_{\hat{x}}(z, A_t)}_{\text{Fixed cost}}$$

- Where do the policy instruments feature? Show
  - Offshoring friction: $c_{V,t}(z, A_t)$.
  - Import tariff: $y_{X,t}(z, A_t)$.

Equilibrium Definition

- Equilibrium is defined such that
  - All agents are optimising,
  - All markets are clearing,
  - Free entry condition holds, Show
  - Government budget constraint holds, Show
  - Balance of payments condition holds. Show

Roadmap

1. Introduction
2. Model Environment and Equilibrium
3. Calibration
4. Quantitative Exercises
5. Concluding Remarks

Calibration

- More than 40 parameters disciplined to match a set of micro and macro moments.

- Labor endowments reflect the patterns of comparative advantage across the U.S. ($\mathcal{N}$) and China ($\mathcal{S}$).

  - $\mathcal{N}$ more skill abundant: $H/L > H^*/L^*$.

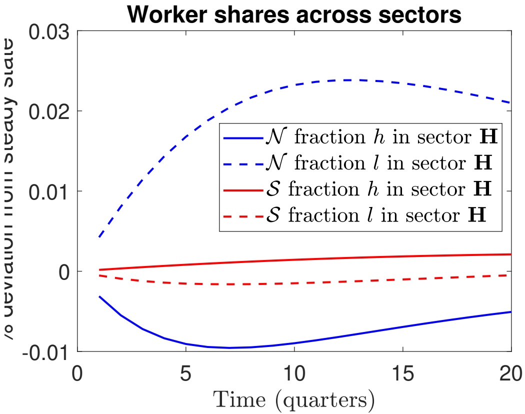
Roadmap

1. Introduction
2. Model Environment and Equilibrium
3. Calibration
4. Quantitative Exercises
5. Concluding Remarks

Design

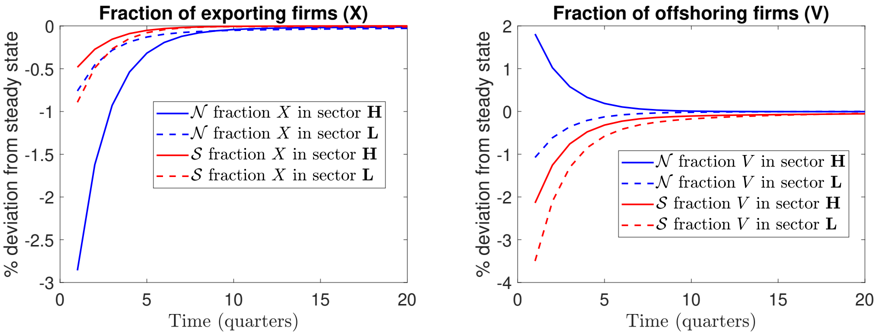
- 1% temporary shocks to policy instruments: AR(1) process.
- $\mathcal{N}$ tariff and offshoring friction: implemented simultaneously.

Transition Dynamics



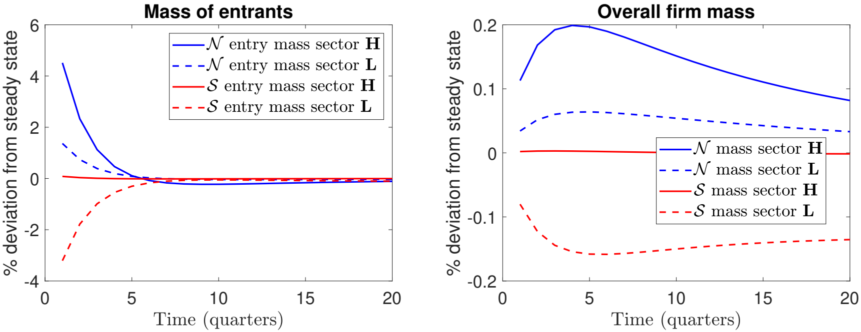
- $\mathcal{N}$ h workers **H**$\rightarrow$ **L**.
- $\mathcal{N}$ l workers **L**$\rightarrow$ **H**.
- Opposite in $\mathcal{S}$.

Transition Dynamics



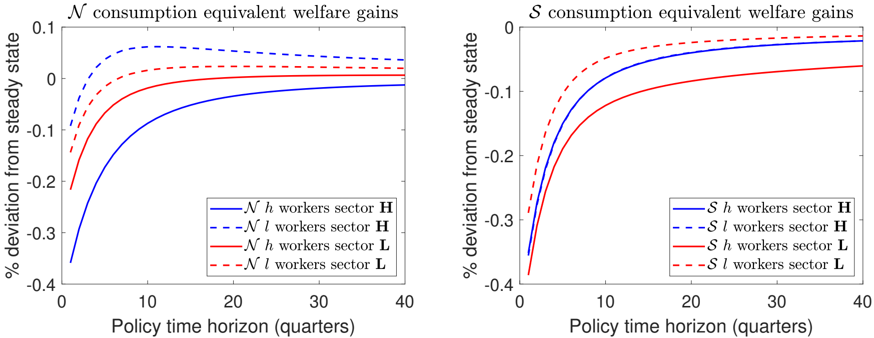
- Comparative advantage sector in $\mathcal{N}$ most responsive.
- Most productive firms export/offshore more.

Transition Dynamics



- More firm creation in $\mathcal{N}$ to fill the shortfall from decreased imports.
- Reverse in $\mathcal{S}$ due to lower firm value.

Transition Dynamics



- Largest differential effect within comparative advantage sector.

Roadmap

1. Introduction
2. Model Environment and Equilibrium
3. Calibration
4. Quantitative Exercises
5. Concluding Remarks

Summary

- Can use these instruments to address inequality.
- Gains can be slow to be realised.
- Losses to non-protected class are larger in the short run.
- Biggest divergence of effects in comparative advantage sector.

Thank You!

Rising Tariffs

These are 4 winners of the US-China trade war

By Katie Lobosco, CNN Business
3 minute read · Updated 5:14 PM EDT, Wed July 3, 2019

Washington (CNN Business) — Vietnam, Taiwan, Bangladesh and South Korea are coming out as victors in the US-China trade war.

Americans are buying less from China. But rather than leaning on US producers, they're avoiding President Donald Trump's tariffs by turning to suppliers in other Asian countries.

The trend, which has emerged throughout more than a year of inconclusive trade negotiations between Washington and Beijing, continued through May, according to data released Wednesday by the Census Bureau.

Back

Barriers to Global Value Chains

US bars 'advanced tech' firms from building China factories for 10 years

7 September

US Commerce Secretary speaks at White House briefing

Back

CHIPS and Science Act

The CHIPS and Science Act will:

- **Bolster U.S. leadership in semiconductors.** The CHIPS and Science Act provides **$52.7 billion** for American semiconductor research, development, manufacturing, and workforce development. This includes **$39 billion** in manufacturing incentives, including **$2 billion** for the legacy chips used in automobiles and defense systems, **$13.2 billion** in R&D and workforce development,and **$500 million** to provide for international information communications technology security and semiconductor supply chain activities. It also provides a 25 percent investment tax credit for capital expenses for manufacturing of semiconductors and related equipment. These incentives will secure domestic supply, create tens of thousands of good-paying, union construction jobs and thousands more high-skilled manufacturing jobs, and catalyze hundreds of billions more in private investment.

Back

Entry/Fixed Costs

- Sunk entry cost: $f_E^s \frac{1}{Z_t}\left(\frac{w_t^{sl}}{1-\alpha^s}\right)^{1-\alpha^s}\left(\frac{w_t^{sh}}{\alpha^s}\right)^{\alpha^s}$

- Fixed export cost: $f_X^s \frac{1}{Z_t}\left(\frac{w_t^{sl}}{1-\alpha^s}\right)^{1-\alpha^s}\left(\frac{w_t^{sh}}{\alpha^s}\right)^{\alpha^s}$

- Fixed offshoring cost: $f_V^s \frac{Q_t}{Z_t^*}\left(\frac{w_t^{sl*}}{1-\alpha^s}\right)^{1-\alpha^s}\left(\frac{w_t^{sh*}}{\alpha^s}\right)^{\alpha^s}$

Back

Policy Instruments

- Offshoring friction: $c^s_{V,t}(z) = \frac{1}{z}\left(\frac{\tau^s_V Q_t w^{sl*}_t}{Z^*_t(1-\alpha^s)}\right)^{1-\alpha^s}\left(\frac{w^{sh}_t}{Z_t\alpha^s}\right)^{\alpha^s}$
- Import tariff: $y^s_{X,t}(z) = \left[(1+\tau^{i*}_{IM})\rho^i_{X,t}(z)/\psi^{i*}_t\right]^{-\theta}\frac{\gamma^i C^*_t}{\psi^{i*}_t}$

Back

Free Entry Condition

- Expected entry value equals post-subsidy sunk cost

$$\underbrace{\tilde{v}_t^s}_{\text{Exp. entry value}} = \overbrace{(1 - s_E^s)}^{\text{Subsidy to entry}} \underbrace{f_E^s}_{\text{Sunk cost}} \overbrace{\frac{1}{Z_t} \left(\frac{w_{l,t}^s}{1 - \alpha^s} \right)^{1-\alpha^s} \left(\frac{w_{h,t}^s}{\alpha^s} \right)^{\alpha^s}}^{\text{Effective cost of labour}}$$

Back

Government Budget Constraint

- Tariff revenues equal subsidies plus transfers to households

$$\overbrace{\sum_{s=H,L}\left[\tau_{IM}^{s} N_{X,t}^{s*}\tilde{\rho}_{X,t}^{s*}\left((1+\tau_{IM}^{s})\frac{\tilde{\rho}_{X,t}^{s*}}{\psi_t^s}\right)^{-\theta}\frac{\gamma^s}{\psi_t^s}C_t\right]}^{\text{Tariffs on final good imports}}$$

$$=\overbrace{T_t(H+L)}^{\text{Transfers}}+\overbrace{\sum_{s=H,L}\left[s_E^s N_{E,t}^s\frac{f_E^s}{Z_t}\left(\frac{w_t^{sl}}{1-\alpha^s}\right)^{1-\alpha^s}\left(\frac{w_t^{sh}}{\alpha^s}\right)^{\alpha^s}\right]}^{\text{Subsidies on entry}}$$

$$+\overbrace{\sum_{s=H,L}\left[s_D^s N_{D,t}^s\left(\frac{\tilde{\rho}_{D,t}^s}{\psi_t^s}\right)^{-\theta}\frac{\gamma^s C_t}{\psi_t^s Z_t\tilde{z}_D^s}\left(\frac{w_t^{sl}}{1-\alpha^s}\right)^{1-\alpha^s}\left(\frac{w_t^{sh}}{\alpha^s}\right)^{\alpha^s}\right]}^{\text{Subsidies on production}}.$$

Back

Balance of Payments

- Trade balance defined as

$$TB_t \equiv \sum_{i=H,L} \Bigg[\underbrace{N^i_{X,t}\tilde{\rho}^i_{X,t}\left((1+\tau^{i*}_{IM})\frac{\tilde{\rho}^i_{X,t}}{\psi^{i*}_t} \right)^{-\theta} \frac{\gamma^i}{\psi^{i*}_t} C^*_t Q_t}_{\text{Regular exports}} + \underbrace{N^{i*}_{V,t} w^{ih}_t \tilde{h}^{i*}_{V,t} \tau^{i*}_V}_{\text{Offshoring exports}}$$

$$- \underbrace{N^i_{V,t} w^{il*}_t \tilde{l}^i_{V,t} \tau^i_V Q_t}_{\text{Offshoring imports}} - \underbrace{N^{i*}_{X,t}\tilde{\rho}^{i*}_{X,t}\left((1+\tau^i_{IM})\frac{\tilde{\rho}^{i*}_{X,t}}{\psi^i_t} \right)^{-\theta} \frac{\gamma^i}{\psi^i_t} C_t}_{\text{Regular imports}} \Bigg]$$

Balance of Payments

- Aggregate net fixed offshoring costs

$$FC_t = \sum_{i=H,L} \left[N^i_{V,t} f^i_V \frac{Q_t}{Z^*_t} \left(\frac{w^{il*}_t}{1-\alpha^i} \right)^{1-\alpha^i} \left(\frac{w^{ih*}_t}{\alpha^i} \right)^{\alpha^i} \right.$$
$$\left. - N^{i*}_{V,t} f^{i*}_V \frac{1}{Z_t} \left(\frac{w^{il}_t}{1-\alpha^i} \right)^{1-\alpha^i} \left(\frac{w^{ih}_t}{\alpha^i} \right)^{\alpha^i} \right]$$

- Balance of payments

$$TB_t = FC_t$$

Back