The Macroeconomic Effects of Tariffs

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• Tariffs are common **international trade** policy tool
  — terms of trade manipulation (Bagwell & Staiger, 2002)
  — political economy of protection (Grossman & Helpman, 2001)
  — beggar-thy-neighbor policy
  — WTO mechanism to internalize the negative external effects
Introduction

- Tariffs are common international trade policy tool
  - terms of trade manipulation (Bagwell & Staiger, 2002)
  - political economy of protection (Grossman & Helpman, 2001)
  - beggar-thy-neighbor policy
  - WTO mechanism to internalize the negative external effects

- Can tariffs also be a macroeconomic policy tool?
  - to improve current account?
  - to manipulate exchange rate?
  - to shift (cyclical or secular) output gap abroad?
Lerner Symmetry

- Lerner’s (1936) seminal result:

  \[
  \text{Import tariff} = \text{Export tax}
  \]

- This perhaps suggests tariffs are not a macro policy tool.
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- follows from (intertemporal) budget constraint of a country

\[ \text{Import tariff} \Rightarrow \text{Imports} \downarrow \Rightarrow \text{CA imbalance} \Rightarrow \text{RER appreciation} \Rightarrow \text{Exports} \downarrow \]
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  - implies neutrality of *border adjustment taxes*, e.g., VAT, BAT (Grossman 1980, Feldstein & Krugman 1990)

- However: Lerner symmetry does not hold under sticky prices

  1. Fiscal devaluations (Farhi, Gopinath & Itskhoki 2014)

  2. BAT and VAT (Barbiero, Farhi, Gopinath & Itskhoki 2019)

  3. Output gap shifting in liquidity traps (Jeanne 2018)
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Neutrality of Border Adjustment

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- When prices are sticky, border adjustment is neutral provided:
  1. Floating exchange rate and conventional monetary policy
  2. Short-run pass-through symmetry for taxes and exchange rates
  3. Net foreign assets exclusively in foreign currency
  4. One-time permanent and unanticipated policy shift
  5. Uniform import tariff and export subsidy on all trade flows
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     — likely holds under LCP and PCP and likely violated under DCP
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• Arguably, implausible set of conditions
  Complex macroeconomic effects outside the case of neutrality
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- Special case: fixed exchange rate regime ⇒ fiscal devaluation
Empirical Evidence on Pass-through

- General consensus that pass-through of tariffs (taxes) > pass-through of exchange rate
  (Ruhl 2008, Fitzgerald & Haller 2018)
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• However, very different variation in the data for the two:
  — different statistical properties of variation
    (cross-section LR variation for tariffs vs volatile time-series for ER)
  — different general equilibrium comovement

• For United States, a case for DCP assumption in the SR:
  1. Border prices are sticky in dollars
  2. Pre-tariff for imports (and after-subsidy for exports)

• Consistent evidence from Trump tariffs
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Empirical Evidence on Pass-through
Amiti, Redding & Weinstein 2019 (ARW)

Figure 4
Twelve-Month Proportional Change in Import Prices by Tariff Wave
Simple Macro Model of Tariffs

- Households:

  \[
  \max \frac{1}{1-\sigma} C^{1-\sigma} - \frac{1}{1+\varphi} L^{1+\varphi} \quad \text{s.t.} \quad PC \leq WL + \Pi - T + B^p
  \]
  
  — special log-linear case: \( \sigma = 1 \) and \( \varphi = 0 \)
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- Cobb-Douglas demand:

  \[
  C = \left( \frac{C_H}{1-\gamma} \right)^{1-\gamma} \left( \frac{C_F}{\gamma} \right)^\gamma \quad \Rightarrow \quad P = P_H^{1-\gamma} P_F^\gamma
  \]

  \[
  C_H = (1-\gamma) \frac{PC}{P_H} \quad \text{and} \quad C_F = \gamma \frac{PC}{P_F}
  \]
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- Cash-in-advance:

\[
PC = M
\]
Simple Macro Model of Tariffs

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\[ \text{max} \quad \frac{1}{1-\sigma} C^{1-\sigma} - \frac{1}{1+\varphi} L^{1+\varphi} \quad \text{s.t.} \quad PC \leq WL + \Pi - T + B^p \]

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\[ C = \left( \frac{C_H}{1-\gamma} \right)^{1-\gamma} \left( \frac{C_F}{\gamma} \right)^\gamma \Rightarrow P = P_H^{1-\gamma} P_F^\gamma \]

\[ C_H = (1-\gamma) \frac{PC}{P_H} \quad \text{and} \quad C_F = \gamma \frac{PC}{P_F} \]

- Cash-in-advance:

\[ PC = M \]

- Production and goods market clearing:

\[ Y = AL = C_H + C_H^* \]
Simple Macro Model of Tariffs

cont’d

• Profits (with import tariff $\tau_m$ and export subsidy $\varsigma_x$):

\[
\Pi = PHCH + (1 + \sigma_x)E P^*_H C^*_H - WL, \\
\Pi^* = PF^*C^*_H + \frac{1}{(1 + \tau_m)E} PF C_F - W^* L^*
\]
Simple Macro Model of Tariffs
cont’d

• Profits (with import tariff $\tau_m$ and export subsidy $\varsigma_x$):

$$\Pi = P_H C_H + (1 + \sigma_x) \mathcal{E} P_H^* C_H^* - WL,$$

$$
\Pi^* = P_F^* C_H^* + \frac{1}{(1 + \tau_m) \mathcal{E}} P_F C_F - W^* L^*
$$

• Government:

$$T + TR = B^g, \quad TR = \frac{\tau_m}{1 + \tau_m} P_F C_F - \varsigma_x \mathcal{E} P_H^* C_H^*$$
Simple Macro Model of Tariffs

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• Monetary policy: float or peg

$$P = P^* = 1 \quad \text{or} \quad P^* = \mathcal{E} = 1$$
Simple Macro Model of Tariffs

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• Profits (with import tariff $\tau_m$ and export subsidy $\varsigma_x$):

$$\Pi = P_HC_H + (1 + \sigma_x)\mathcal{E}P^*_HC^*_H - WL,$$

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$$P = P^* = 1 \quad \text{or} \quad P^* = \mathcal{E} = 1$$

• Net Foreign Assets (by currency) and budget constraint:

$$B^p + B^g = B + \mathcal{E}B^* = -NX, \quad NX = \mathcal{E}P^*_H C^*_H - \frac{P_F C_F}{1 + \tau_m}$$
Simple Macro Model of Tariffs

cont’d

• Wage setting (Calvo parameter $\theta_w$):

$$W = \bar{W}^{1-\theta_w} \left[ \mu_w PC^\sigma L^\varphi \right]^\theta_w$$
Simple Macro Model of Tariffs

cont’d

• Wage setting (Calvo parameter $\theta_w$):
  \[ W = \tilde{W}^{1-\theta_w} [\mu_w PC^\sigma L^\varphi]^{\theta_w} \]

• Domestic price setting (Calvo parameter $\theta_p$):
  \[ P_H = \tilde{P}_H^{1-\theta_p} \left[ \mu_p \frac{W}{A} \right]^{\theta_p} \]

Assumption: no markup or productivity effects from tariffs (Amiti, Itskhoki & Konings 2019, ARW 2019, Baqaee & Farhi 2019)
Simple Macro Model of Tariffs

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  \[ P_H = \bar{P}_H^{1-\theta_p} \left[ \mu_p \frac{W}{A} \right]^{\theta_p} \]

- International price setting:
  \[ P_H^* = \left[ \frac{\bar{P}_H}{(1 + \varsigma_x)^{\delta_x} E^{\ell_x}} \right]^{1-\theta_p} \left[ \eta_p \frac{1}{(1 + \varsigma_x)E} \frac{W}{A} \right]^{\theta_p} \]
  \[ P_F^* = \left[ \bar{P}_F^* E^{\ell m} (1 + \tau_m)^{\delta_m} \right]^{1-\theta_p} \left[ \eta_p^* \frac{W^*}{A^*} E(1 + \tau_m) \right]^{\theta_p} \]

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  \[ P_F = \left[ \bar{P}_F^* E^{\delta_m} (1 + \tau_m) \right]^{1-\theta_p} \left[ \eta_p^* \frac{W^*}{A^*} E(1 + \tau_m) \right]^{\theta_p} \]

• Assumption: no markup or productivity effects from tariffs
Exchange Rate and Neutrality

- **Result 1**: Equilibrium exchange rate

\[ E = \frac{1}{1+\tau_m} \frac{M - B/\gamma}{M^* + B^*} \]

— follows directly from the intertemporal budget constraint (see generalization in Itskhoki and Mukhin 2019)

- **Result 2**: Border adjustment neutrality

If (i) \( \tau_m = \sigma_x \), (ii) \( M \) and \( M^* \) s.t. \( P = P^* = 1 \), (iii) \( B = 0 \), (iv) \( \iota_x = \delta_x \) and \( \iota_m = \delta_m \), then

\[ E(1 + \tau_m) = E(1 + \sigma_x) = \text{const} \]

and macro allocations do not change with \( \tau_m \).

- **Result 3**: Fiscal Devaluations

Macro allocations are equivalent under any \( E \) and \( \tau_m = \sigma_x \) such that

\[ E(1 + \tau_m) = \frac{M - B/\gamma}{M^* + B^*} \]

and the effects of \( E \uparrow \) can be achieved with \( \tau_m, \sigma_x \uparrow \).
Exchange Rate and Neutrality

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Macro allocations are equivalent under any \( E \) and \( \tau_m = \sigma_x \) such that \( \mathcal{E}(1 + \tau_m) = \mathcal{E}(1 + \sigma_x) = \text{const} \), hence the effects of \( E \uparrow \) can be achieved with \( \tau_m, \sigma_x \uparrow \).
Exchange Rate and Neutrality

• **Result 1**: Equilibrium exchange rate

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\mathcal{E} = \frac{\frac{1}{1+\tau_m} M - B/\gamma}{M^* + B^*}
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• **Result 2**: Border adjustment neutrality

If (i) \(\tau_m = \sigma_x\), (ii) \(M\) and \(M^*\) s.t. \(P = P^* = 1\), (iii) \(B = 0\), (iii) \(\iota_x = \delta_x\) and \(\iota_m = \delta_m\), then \(\mathcal{E}(1 + \tau_m) = \mathcal{E}(1 + \sigma_x) = \text{const}\) and macro allocations do not change with \(\tau_m\).

— Fiscal surplus: \(TR = -\tau_m NX = \frac{\tau_m}{1+\tau_m} B^*\)
Exchange Rate and Neutrality

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  \[
  \mathcal{E}(1 + \tau_m) = \frac{M}{M^* + B^*/\gamma},
  \]

  hence the effects of \( \mathcal{E} \uparrow \) can be achieved with \( \tau_m, \sigma_x \uparrow \)
Tariffs under Flexible Prices

- Flexible prices and wages \((\theta_p = \theta_w = 1)\), no NFA \((B = B^* = 0)\):

\[
W = M, \quad P_H = P_H^* \mathcal{E}(1 + \sigma_x) = \frac{M}{A} \quad \text{and} \quad P_F^* = \frac{P_F}{\mathcal{E}(1 + \tau_m)} = \frac{M^*}{A^*}
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Tariffs under Flexible Prices

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• Monetary policy $P = P^* = 1$ implies

$$e = -\hat{\tau}_m + (m - m^*),$$
$$p = (1 - \gamma)p_H + \gamma p_F = (1 - \gamma)m + \gamma(m^* + e + \hat{\tau}_m) = 0,$$
$$p^* = (1 - \gamma)p_F^* + \gamma p_H^* = (1 - \gamma)m^* + \gamma(m - e - \hat{\sigma}_x) = 0$$
Tariffs under Flexible Prices

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- Monetary policy $P = P^* = 1$ implies

  \[ m = 0, \]

  \[ m^* = -\gamma(\hat{\tau}_m - \hat{\sigma}_x), \]

  \[ q = e = -\hat{\tau}_m + (m - m^*) = -(1 - \gamma)\hat{\tau}_m - \gamma\hat{\sigma}_x, \]

  \[ s = (p_F - e - \hat{\tau}_m) - p_H^* = -(\hat{\tau}_m - \hat{\sigma}_x), \]

  \[ c = y^* = 0, \]

  \[ c^* = y = -\gamma(\hat{\tau}_m - \hat{\sigma}_x) < 0. \]
Tariffs under Flexible Prices

- Flexible prices and wages \((\theta_p = \theta_w = 1)\), no NFA \((B = B^* = 0)\):

\[
W = M, \quad P_H = P_H^* \varepsilon (1 + \sigma_x) = \frac{M}{A} \quad \text{and} \quad P_F^* = \frac{P_F}{\varepsilon (1 + \tau_m)} = \frac{M^*}{A^*}
\]

- Monetary policy \(P = P^* = 1\) implies

\[
m = 0, \\
m^* = -\gamma (\hat{\tau}_m - \hat{\sigma}_x), \\
q = e = -\hat{\tau}_m + (m - m^*) = -(1 - \gamma)\hat{\tau}_m - \gamma \hat{\sigma}_x, \\
s = (p_F - e - \hat{\tau}_m) - p_H^* = -(\hat{\tau}_m - \hat{\sigma}_x), \\
c = y^* = 0, \\
c^* = y = -\gamma (\hat{\tau}_m - \hat{\sigma}_x) < 0.
\]

1. Improvement in terms of trade shifts DWL of tariff to foreign
2. Reduce employment at home \(\sim\) welfare gain in the model
3. Effects proportional to \(\gamma \times (\hat{\tau}_m - \hat{\sigma}_x)\)
Tariffs under Sticky Wages ($\propto$ PCP)

- Sticky wages $\theta_w < 1$ and flex prices $\theta_p = 1$

\[
\begin{align*}
    w &= \theta_w m, \\
    w^* &= \theta_w m^*, \\
    p_F &= \theta_w m^* + (e + \tau_m) \\
    m - m^* &> 0
\end{align*}
\]
Tariffs under Sticky Wages ($\propto$ PCP)

- Sticky wages $\theta_w < 1$ and flex prices $\theta_p = 1$
  \[ w = \theta_w m, \quad w^* = \theta_w m^*, \quad p_F = \theta_w m^* + e + \tau_m \]

- Monetary policy $P = P^* = 1$ now $\Rightarrow m^* < m < 0$
  \[ c = m \propto -(1 - \theta_w)\gamma \hat{r}_m < 0, \]
  \[ y = (1 - \theta_w)m - \gamma \tau_m < 0, \]
  \[ c^* = m^* \propto -\gamma \hat{r}_m < 0, \]
  \[ y^* = (1 - \theta^*_w)m^* < 0 \]
Tariffs under Sticky Wages ($\propto$ PCP)

- Sticky wages $\theta_w < 1$ and flex prices $\theta_p = 1$
  \[ w = \theta_w m, \quad w^* = \theta_w m^*, \quad p_F = \theta_w m^* + e + \tau_m \]
  \[ m - m^* > 0 \]

- Monetary policy $P = P^* = 1$ now $\Rightarrow m^* < m < 0$
  \[ c = m \propto -(1 - \theta_w)\gamma\hat{\tau}_m < 0, \]
  \[ y = (1 - \theta_w)m - \gamma\tau_m < 0, \]
  \[ c^* = m^* \propto -\gamma\hat{\tau}_m < 0, \]
  \[ y^* = (1 - \theta_w^*)m^* < 0 \]

1. in addition to DWL, the negative shock from tariff creates an output gap in both countries, shifted more towards foreign
2. LCP case if more favorable for home and less for foreign
3. optimal monetary policy: lean against the wind?
Tariffs under Sticky Prices

- With $w = m$ and $w^* = m^*$, prices are given by:

  \[
  \begin{align*}
  p_H &= \theta p m, \\
  p_H^* &= \theta (m - e) - (1 - \theta) \iota_x e, \\
  p_F^* &= \theta p m^*, \\
  p_F &= \theta (m^* + e + \tau_m) + (1 - \theta)[\iota m e + \delta_m \tau_m].
  \end{align*}
  \]

- Consider DCP: $\iota_x = \delta_m = 1$ and $\iota_m = \delta_x = 0$

- In the limit of fully sticky prices ($\theta p = 0$, short run):

  \[
  p_F = \tau_m > 0 \quad \text{and} \quad p_H^* = -e > 0.
  \]

1. Tariff under DCP leads to $m, c, y < 0$ in both countries — global recession (cf. Gopinath et al. 2019, Mukhin 2019)
Summary

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• Optimal monetary accommodation/response to tariffs?