

# The Margins of Intermediate-input Trade: Theory and Evidence

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## ■ Trade elasticity:

- An elasticity of imports with respect to variable trade costs, such as distances and tariffs
- One of sufficient statistics of welfare gains from trade (Arkolakis et al., 2012)

## ■ Gravity equation:

- For intermediate-input trade,

$$Imports_{ji}^I = Constant^I \times \frac{GDP_i^\alpha \times GDP_j^\beta}{(Trade\ barriers_{ji})^{\epsilon^I}}$$

- The trade elasticity is **endogenously** greater for intermediate-input trade than final-good trade,  $|\epsilon^I| > |\epsilon^F|$  (Ara, 2019)

# Purpose of the paper

## ■ Extension of Ara (2019):

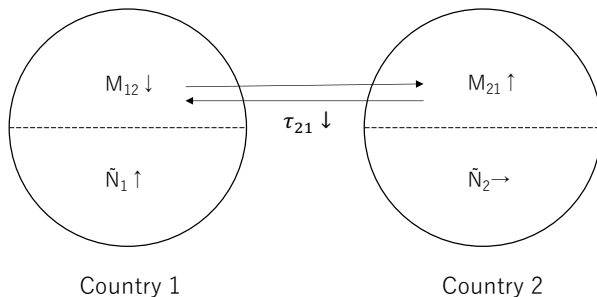
- Theory  $\Rightarrow$  Multiple-industry, asymmetric-country setup
- Evidence  $\Rightarrow$  Trade barriers  $\left\{ \begin{array}{l} \text{Distances (same across goods and years)} \\ \text{Tariffs (different across goods and years)} \end{array} \right.$

## ■ Main findings:

- Theory  $\Rightarrow$  Counter-intuitive welfare implications (Lemmas 1-2)
- Evidence  $\Rightarrow$  The trade elasticity is greater in intermediate inputs than final goods not only for distances but also for tariffs

# Theoretical results

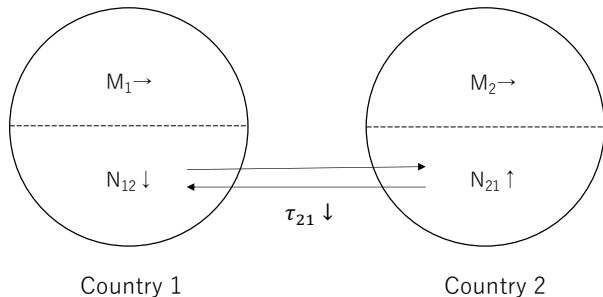
## ■ Intermediate-input trade liberalization:



- Liberalization gives rise to a **home market effect** in the upstream sector in country 2 and the downstream sector in country 1
- Country 1 (country 2) reallocates labor to final-good (intermediate-input) production

# Theoretical results (cont.)

## Final-good trade liberalization:



- Liberalization gives rise to a home market effect only in the downstream sector in country 2
- The input trade elasticity is greater due to **an extra adjustment in the extensive margin** (*not* because final goods require lots of inputs)

# Theoretical results (cont.)

- Trade elasticity of intermediate inputs:

$$\begin{aligned}\zeta^I &= \underbrace{(\sigma - 1)}_{\text{Intensive margin elasticity}} + \underbrace{\frac{(\sigma - 1)[k - (\sigma - 1)]}{2(\sigma - 1) - k}}_{\text{Input extensive margin elasticity}} + \underbrace{\frac{(\sigma - 1)[k - (\sigma - 1)]}{2(\sigma - 1) - k}}_{\text{Output extensive margin elasticity}} \\ &= \frac{k(\sigma - 1)}{2(\sigma - 1) - k}\end{aligned}$$

- Trade elasticity of final goods:

$$\zeta^F = \underbrace{(\sigma - 1)}_{\text{Intensive margin elasticity}} + \underbrace{k - (\sigma - 1)}_{\text{Output extensive margin elasticity}} = k$$

which implies that  $\zeta^I > \zeta^F$  if  $k > \sigma - 1$

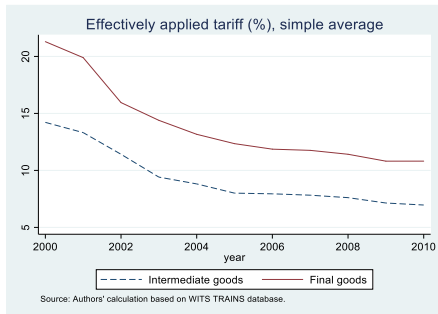
## ■ China's tariffs:

- TRAINS-WTO data from 2000-2007
- Effectively applied ad-valorem tariffs (6-digit HS level)
- For the distinction between input tariffs and output tariffs, we apply UN's Board Economic Categories ( $t_{pct}^i$ )

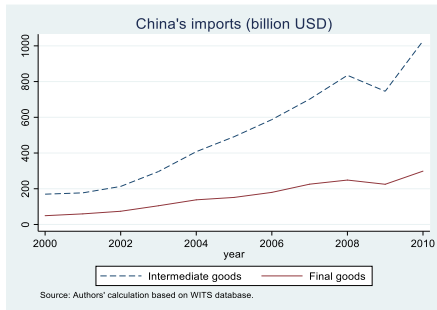
## ■ China's imports:

- China's Customs data from 2000-2007
- Product-country-year observations (8-digit HS level  $\Rightarrow$  6-digit HS level)
- Total import values ( $R_{pct}^i$ ), the number of importers ( $M_{pct}^i$ ), average imports per firms ( $\bar{r}_{pct}^i$ )

# China's import tariffs and import values



Import tariffs



Import values





# Specifications

- Extensive and intensive margins:

$$R_{pct}^i = M_{pct}^i \times \bar{r}_{pct}^i, \quad i \in \{F, I\}$$

- Main regressions:

$$\ln Z_{pct}^i = \beta_0^i + \beta_1^i \ln dist_c + \beta_2^i \ln tariff_{pct}^i + \beta_3^i \ln GDP_{ct} + \beta_4^i X_c + \beta_5^i Y_{ct} + \theta_p^i + \theta_t^i + \epsilon_{pct}^i$$

$$\ln Z_{pct}^i = \gamma_0^i + \gamma_1^i \ln dist_c + \gamma_2^i \ln \left( \frac{tariff_{pct}^i}{tariff_{ct}} \right) + \gamma_3^i \ln GDP_{ct} + \gamma_4^i X_c + \gamma_5^i Y_{ct} + \theta_p^i + \theta_t^i + \epsilon_{pct}^i$$

$$\begin{aligned} \ln Z_{pct} = & \delta_0 + \delta_1 \ln dist_c + \delta_2 \ln dist_c * inter_p + \delta_3 \ln \phi_{pct} + \delta_4 \ln \phi_{pct} * inter_p \\ & + \delta_5 \ln GDP_{ct} + \delta_6 X_c + \delta_7 Y_{ct} + \theta_p + \theta_t + \epsilon_{pct} \end{aligned}$$

where

$$Z_{pct}^i \in \{R_{pct}^i, M_{pct}^i, \bar{r}_{pct}^i\}, \quad tariff_{pct}^i = 1 + t_{pct}^i, \quad \phi_{pct}^i \in \left\{ tariff_{pct}^i, \frac{tariff_{pct}^i}{tariff_{ct}} \right\}$$

# Estimation results: full samples

	$\ln R_{pct}$	$\ln M_{pct}$	$\ln \bar{r}_{pct}$	$\ln R_{pct}$	$\ln M_{pct}$	$\ln \bar{r}_{pct}$	$\ln R_{pct}$	$\ln M_{pct}$	$\ln \bar{r}_{pct}$
$\ln dist_c$	-0.757*** (0.015)	-0.549*** (0.007)	-0.208*** (0.010)	-0.758*** (0.015)	-0.549*** (0.007)	-0.208*** (0.010)	-0.752*** (0.015)	-0.546*** (0.007)	-2.05*** (0.010)
$\ln tariff_{pct}$				-0.148*** (0.018)	-0.085*** (0.007)	-0.064*** (0.014)			
$\ln \left( \frac{tariff_{pct}}{tariff_{ct}} \right)$							-0.158*** (0.020)	-0.082*** (0.008)	-0.076*** (0.014)
$\ln GDP_{ct}$	0.772*** (0.012)	0.481*** (0.006)	0.291*** (0.006)	0.773*** (0.012)	0.481*** (0.006)	0.292*** (0.006)	0.765*** (0.012)	0.477*** (0.006)	0.288*** (0.006)
$border_c$	-0.689*** (0.029)	-0.461*** (0.012)	0.228*** (0.020)	-0.696*** (0.028)	-0.466*** (0.012)	0.230*** (0.019)	-0.693*** (0.028)	-0.464*** (0.012)	0.229*** (0.019)
$Chinese_c$	0.713*** (0.030)	0.588*** (0.015)	0.125*** (0.018)	0.715*** (0.030)	0.589*** (0.015)	0.125*** (0.018)	0.704*** (0.030)	0.584*** (0.015)	0.120*** (0.018)
$WTO_{ct}$	0.080* (0.044)	0.047*** (0.017)	0.033 (0.031)	0.078* (0.044)	0.046*** (0.017)	0.033 (0.031)	0.063 (0.043)	0.038** (0.017)	0.025 (0.030)
$FTA_{ct}$	0.034 (0.025)	-0.113*** (0.009)	0.147*** (0.019)	-0.001 (0.026)	-0.133*** (0.010)	0.132*** (0.019)	00.21 (0.025)	-0.120*** (0.009)	0.141*** (0.019)
<b>No. of observations</b>	577,056	577,056	577,056	576,509	576,509	576,509	576,509	576,509	576,509
<b>Adj. <math>R^2</math></b>	0.403	0.497	0.390	0.403	0.498	0.389	0.403	0.498	0.389

Note: Standard errors clustered at product-level are in brackets. Product and year fixed effects are included.

\* $p < 0.10$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$

# Estimation results: subsamples

	$\ln R_{pct}^I$	$\ln M_{pct}^I$	$\ln \#_{pct}^I$	$\ln R_{pct}^F$	$\ln M_{pct}^F$	$\ln \#_{pct}^F$	$\ln R_{pct}^I$	$\ln M_{pct}^I$	$\ln \#_{pct}^I$	$\ln R_{pct}^F$	$\ln M_{pct}^F$	$\ln \#_{pct}^F$
$\ln dist_c$	-0.797*** (0.020)	-0.574*** (0.009)	-0.223*** (0.013)	-0.689*** (0.023)	-0.508*** (0.010)	-0.181*** (0.016)	-0.791*** (0.020)	-0.570*** (0.009)	-0.220*** (0.013)	-0.684*** (0.023)	-0.505*** (0.010)	-0.179*** (0.016)
$\ln tariff_{pct}^I$	-0.184*** (0.029)	-0.100*** (0.011)	-0.084*** (0.023)	-0.106*** (0.022)	-0.072*** (0.008)	-0.034*** (0.016)						
$\ln \left( \frac{tariff_{pct}^I}{tariff_{ct}} \right)$							-0.189*** (0.036)	-0.100*** (0.015)	-0.088*** (0.024)	-0.120*** (0.022)	-0.067*** (0.008)	-0.052*** (0.017)
$\ln GDP_{ct}$	0.820*** (0.017)	0.506*** (0.009)	0.314*** (0.009)	0.704*** (0.016)	0.445*** (0.009)	0.259*** (0.008)	0.811*** (0.017)	0.501*** (0.009)	0.310*** (0.009)	0.698*** (0.016)	0.441*** (0.009)	0.257*** (0.008)
$border_c$	-0.848*** (0.037)	-0.534*** (0.015)	-0.314*** (0.026)	-0.452*** (0.043)	-0.354*** (0.019)	-0.099*** (0.029)	-0.843*** (0.037)	-0.531*** (0.015)	-0.312*** (0.026)	-0.451*** (0.043)	-0.353*** (0.019)	-0.099*** (0.029)
$Chinese_c$	0.797*** (0.039)	0.648*** (0.019)	0.149*** (0.024)	0.592*** (0.045)	0.499*** (0.023)	0.093*** (0.028)	0.785*** (0.039)	0.642*** (0.019)	0.143*** (0.024)	0.585*** (0.046)	0.494*** (0.023)	0.090*** (0.028)
$WTO_{ct}$	-0.005 (0.062)	0.024 (0.023)	-0.029 (0.043)	0.224*** (0.053)	0.087*** (0.022)	0.137*** (0.038)	-0.022 (0.062)	0.015 (0.023)	-0.037 (0.043)	0.213*** (0.053)	0.081*** (0.022)	0.132*** (0.038)
$FTA_{ct}$	-0.098*** (0.033)	-0.179*** (0.012)	0.082*** (0.025)	0.157*** (0.041)	-0.060*** (0.016)	0.217*** (0.030)	-0.070** (0.032)	-0.164*** (0.012)	0.094*** (0.025)	0.170*** (0.040)	-0.049*** (0.015)	0.218*** (0.029)
No. of observations	354,976	354,976	354,976	220,693	220,693	220,693	354,976	354,976	354,976	220,693	220,693	220,693
Adj. $R^2$	0.372	0.510	0.343	0.443	0.478	0.446	0.372	0.510	0.343	0.443	0.478	0.446

Note: Standard errors clustered at product-level are in brackets. Product and year fixed effects are included.

\* $p < 0.10$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$

# Estimation results: interaction term

	$\ln R_{pct}$	$\ln M_{pct}$	$\ln \bar{r}_{pct}$	$\ln R_{pct}$	$\ln M_{pct}$	$\ln \bar{r}_{pct}$
$\ln dist_c$	-0.718*** (0.022)	-0.516*** (0.010)	-0.202*** (0.015)	-0.716*** (0.023)	-0.514*** (0.010)	-2.01*** (0.015)
$\ln dist_c * inter_c$	-0.064** (0.029)	-0.054*** (0.013)	-0.010 (0.019)	-0.058** (0.029)	-0.052*** (0.013)	-0.007 (0.019)
$\ln tariff_{pct}$	-0.151*** (0.022)	-0.082*** (0.008)	-0.069*** (0.017)			
$\ln tariff_{pct} * inter_c$	0.006 (0.032)	-0.010 (0.012)	0.016 (0.025)			
$\ln \left( \frac{tariff_{pct}}{tariff_{ct}} \right)$				-0.101*** (0.022)	-0.058*** (0.009)	-0.043*** (0.017)
$\ln \left( \frac{tariff_{pct}}{tariff_{ct}} \right) * inter_c$				-0.126*** (0.042)	-0.056*** (0.019)	-0.070*** (0.028)
$\ln GDP_{ct}$	0.773*** (0.012)	0.481*** (0.006)	0.292*** (0.006)	0.764*** (0.012)	0.477*** (0.006)	0.288*** (0.006)
$border_c$	-0.695*** (0.028)	-0.465*** (0.012)	0.230*** (0.019)	-0.691*** (0.028)	-0.462*** (0.012)	0.229*** (0.019)
$Chinese_c$	0.715*** (0.030)	0.589*** (0.015)	0.126*** (0.018)	0.703*** (0.030)	0.583*** (0.015)	0.120*** (0.018)
$WTO_{ct}$	0.081* (0.044)	0.046*** (0.017)	0.033 (0.031)	0.063 (0.043)	0.038** (0.017)	0.025 (0.030)
$FTA_{ct}$	0.001 (0.026)	-0.132*** (0.010)	0.134*** (0.019)	0.026 (0.025)	-0.118*** (0.009)	0.144*** (0.019)
<b>No. of observations</b>	575,669	575,669	575,669	575,669	575,669	575,669
<b>Adj. R<sup>2</sup></b>	0.403	0.498	0.388	0.403	0.498	0.388

Note: Standard errors clustered at product-level are in brackets. Product and year fixed effects are included.

\* $p < 0.10$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$

# Conclusion

## ■ Summary:

- The trade elasticity is greater in intermediate inputs than final goods not only for distances but also for tariffs
- In contrast to distances, tariffs are a policy variable and hence our result may be useful from policy perspectives
- The fact the trade elasticity is different between the type of trade is important for understanding the difference in the welfare gains from trade