The Elusive Pro-Competitive Effects of Trade

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How Large Are the Gains from Trade Liberalization?

- Arkolakis, Costinot, and Rodriguez-Clare (2012), have shown that for fairly large class of trade models, welfare changes caused by trade shocks only depend on two statistics:

    1. Share of expenditure on domestic goods, λ
    2. Trade elasticity, ε, in gravity equation

- Assume small trade shock so that, $d \ln \lambda < 0$: associated welfare gain is given by

$$d \ln W = -\frac{d \ln \lambda}{\varepsilon}$$

What About the Pro-Competitive Effects of Trade?

- Important qualification of ACR's results:
  - All models considered in ACR feature CES utility functions
  - Thus firm-level markups are constant under monopolistic competition
  - This de facto rules out "pro-competitive" effects of trade

This Paper

- **Goal:** Study the pro-competitive effects of trade, or lack thereof
  - Depart from CES demand and constant markups.
  - Consider demands with variable elasticity and variable markups.

- **Focus:** Monopolistic competition models with firm-heterogeneity

- **Experiment:**

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  - Depart from CES demand and constant markups.
  - Consider demands with variable elasticity and variable markups
- **Focus:** Monopolistic competition models with firm-heterogeneity
- **Experiment:**
  - Consider two classes of models with CES and without
    - Impose restrictions so that all these models have same macro predictions
    - What are the welfare gains under these two scenarios?

This Paper: Main Results

- Characterize welfare gains in this environment
  - Suppose small trade shock, $d \ln \tau$, raises trade openess, $d \ln \lambda < 0$
  - Welfare effect is given by

$$d \ln W = -\left(1 - \eta\right) \frac{d \ln \lambda}{\varepsilon}$$

  - $\eta \equiv$ structural parameter depends on
    - Degree of pass-through
    - Magnitude of GE effects

This Paper: Main Results (cont)

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    Incomplete pass-through (Direct effect of changes in trade costs)
    GE effects (Direct effect of changes in trade costs dominates)

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- **What is the sign of η in the data?**
  - Empirical literature points to incomplete pass-through
  - Demand parameter determines size of GE effects - non-parametric estimation

Related Literature

- Arkolakis Costinot Rodriguez-Clare '12 (ACR)
  - Characterize gains from trade with variable markups
- Large theoretical literature on markups and trade (e.g. Krugman '79, Feenstra '03, Melitz Ottaviano '07, Neary and Mrazova)
  - Consider a unified framework characterize gains from trade
- Large empirical literature on markups and trade (e.g. Levinsohn '93, Krishna Mitra '98, Loecker Warzynski '12, Loecker et al '12)
  - Consistent with Loecker at al '12: liberalization leads to MC declines but markup increases
- Feenstra Weinstein '10, Edmond Midrigan Xu '12 using Atkeson Burstein

Roadmap

1. Basic Environment
2. Trade Equilibrium
3. Welfare Analysis
4. Empirical Estimates

1. Basic Environment

Basic Environment

- World economy comprising $i = 1, \ldots, n$ countries, denote i the exporter, j the importer
- **Representative Consumers**
  - Continuum of differentiated goods $\omega \in \Omega$, variable elasticity demand
  - One factor of production, labor, immobile across countries
    - $L_i \equiv$ labor endowment, $w_i \equiv$ wage in country i
- **Firms**
  - Each firm can produce a single product under monopolistic competition
  - N_i is the measure of goods that can be produced in i
    - Free entry: potential entrants need to hire F_i^e units of labor

Consumers

- All consumers have same preferences. Marshallian demand for good ω of consumer with income w facing prices $\boldsymbol{p} \equiv \{p_\omega\}_{\omega \in \Omega}$ is given by

$$q_\omega(\boldsymbol{p}, w) = Q(\boldsymbol{p}, w)\, D\left(p_\omega / P(\boldsymbol{p}, w)\right)$$

- $Q(\boldsymbol{p}, w)$ and $P(\boldsymbol{p}, w)$ are aggregators of all prices and the wage s.t.

$$\begin{aligned} \int_{\omega \in \Omega} \left[H\left(p_\omega / P\right)\right]^\beta \left[p_\omega Q D\left(p_\omega / P\right)\right]^{1-\beta} d\omega &= w^{1-\beta}, \\ Q^{1-\beta} \left[\int_{\omega \in \Omega} p_\omega Q D\left(p_\omega / P\right) d\omega\right]^\beta &= w^\beta, \end{aligned}$$

with $\beta \in \{0, 1\}$ and $H(\cdot)$ strictly increasing and strictly concave

Examples

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Covers demands suggested by
Krugman (1979): Symmetric Additively Separable Utility Functions
Feenstra (2014): QMOR Expenditure Functions (Homoth.)
Klenow and Willis (2016): Kimball Preferences (Homoth.)

Example I

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Example I:

- Symmetric Additively Separable Utility, $U = \int u\left(q_\omega\right) d\omega$, as in Krugman '79
    - $\beta = 0$, $D = u'^{-1}$, $P = 1/\lambda$ ($\lambda \equiv$Lagrange mult.)
    - see also Behrens et al '09, '11, Zhelobodko et al. '11

Example II

- All consumers have same preferences. Marshallian demand for good ω of consumer with income w facing prices $\boldsymbol{p} \equiv \{p_\omega\}_{\omega \in \Omega}$ is given by

$$q_\omega(\boldsymbol{p}, w) = Q(\boldsymbol{p}, w)\, D\left(p_\omega / P(\boldsymbol{p}, w)\right)$$

Example II:

- Kimball preferences. Utility Q is implicitly given by $\int \Upsilon\left(\frac{q_\omega}{Q}\right) d\omega = 1$
- Manipulating the first-order conditions of this problem we get

$$q_\omega = Q \Upsilon'^{-1}\left(\frac{\lambda \int q_\omega \Upsilon'\left(\frac{q_\omega}{Q}\right) d\omega}{Q} p_\omega\right) \text{ for all } \omega.$$

  - $\beta = 1$, $D \equiv \Upsilon'^{-1}$, $P \equiv Q / \left(\lambda \int q_\omega \Upsilon'\left(\frac{q_\omega}{Q}\right) d\omega\right)$, and $H \equiv \Upsilon(D)$,

Additional Restrictions on the Demand System

- All consumers have same preferences. Marshallian demand for good ω of consumer with income w facing prices $\boldsymbol{p} \equiv \{p_\omega\}_{\omega\in\Omega}$ is given by

$$q_\omega(\boldsymbol{p}, w) = Q(\boldsymbol{p}, w)\, D\left(p_\omega / P(\boldsymbol{p}, w)\right)$$

- **[Choke Price]:** *There exists $a \in \mathbb{R}$ such that for all $x \geq a$, $D(x) = 0$.*
  - Comments:
    - CES can have welfare gains from new varieties but constant markup
    - Here variable markups but choke price guarantees that "cut-off" varieties have no welfare effect
    - Wlog we normalize $a = 1$ so that $P =$ choke price

Firms

- Monopolistic competition with free entry. N_i is measure of entrants in i
- Firms need to pay $w_i F_i^e$ to enter, production is subject to CRS
  - As in Melitz '03, firm-level productivity z is realization of r.v. Z_i
  - Z_i is drawn independently across firms from a distribution G_i
- G_i is Pareto with same shape parameter around the world:
- **[Pareto]** *For all* $z \geq b_i$, $G_i(z) = 1 - (b_i/z)^{\theta}$, *with* $\theta > \beta - 1$

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- Pareto assumption is central to our experiment:
- *In spite of differences in demand system, model considered in this paper will have same macro implications as model with CES in ACR*

Trade Costs

- Trade is subject to iceberg trade costs $\tau_{ij} \geq 1$
  - Good markets are perfectly segmented across countries (Parallel trade is prohibited)
- There are no exporting fixed costs of selling to a market
  - Selection into markets driven entirely by choke price

2. Trade Equilibrium

Firm-Level Markups

- Firm optimization problem is given by

$$\pi(c, Q, P) = \max_{p} \{(p - c)\, q(p, Q, P)\},$$

taking Q, P as given.

  - $c \equiv \frac{w_i}{z} \tau_{ij}$ denotes marginal cost of this firm (production + shipping)

- Monopoly pricing implies:

$$(p - c)/p = -1/(\partial \ln q(p, Q, P)/\partial \ln p)$$

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- Define $m \equiv p/c$, $v \equiv P/c$ & use demand system:

$$m = \varepsilon_D(m/v)/(\varepsilon_D(m/v) - 1)$$

  where $\varepsilon_D(x) \equiv -\partial \ln D(x)/\partial \ln x$ measures the elasticity of demand

Firm-Level Markups

- Given our demand system, firm-level markups satisfy

$$m = \varepsilon_D(m/v)/(\varepsilon_D(m/v) - 1)$$

- This implies that in any market:
  - Firm relative efficiency in a market, $v \equiv P/c = P_j z/w_i \tau_{ij}$, is a sufficient statistic for firm-level markup, $m \equiv \mu(v)$
  - With a choke price the marginal firm ($v = 1$) has no markup ($m = 1$)
  - More efficient firms charge higher markups, $\mu'(v) > 0$, if and only if demand functions are log-concave in log-prices, $\varepsilon'_D > 0$
  - Mrazova and Neary (2013) provide further discussion

Firm-Level Decisions

- **Note:**
  - Pareto implies distribution of markups is unaffected by trade costs
  - In addition, extensive margin response here is irrelevant for welfare
  - Variable markups **do matter** for welfare, as we will see

Closing the Model

- Free entry condition (Π_{ij} : aggregate profits of firms from i in j):

$$\sum_j \Pi_{ij} = N_i w_i F_i^e.$$

- Labor market clearing condition (X_{ij} : bilateral trade):

$$\sum_j X_{ij} = w_i L_i$$

- Given firm choices, conditions pin down measure of entrants, N_i, wages, w_i

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- Given firm choices, conditions pin down measure of entrants, N_i, wages, w_i
- Pareto guarantees Π_{ij}/X_{ij} is constant (key restriction in ACR).
  - In turn, N_i does not change with different trade costs
  - This also implies that same results hold if entry is fixed

Bilateral Trade Flows and Pareto

- Under Pareto one can check that trade flows satisfy gravity equation:

$$\lambda_{ij} \equiv \frac{X_{ij}}{\sum_l X_{lj}} = \frac{N_i b_i^{-\theta} \left(w_i \tau_{ij}\right)^{-\theta}}{\sum_l N_l b_l^{-\theta} \left(w_l \tau_{lj}\right)^{-\theta}}$$

- The exact same structural relationship holds in ACR
    - see also Krugman '80, EK '02, Anderson van Wincoop '03, EKK '11

- Gravity equation has strong implications for welfare analysis
    - Changes in trade, relative wages caused by a trade shock same as in ACR (once calibrated to match initial trade flows, X_{ij}, and elasticity, θ)

3. Welfare Analysis

Welfare Analysis

- Consider a small trade shock from $\tau \equiv \{\tau_{ij}\}$ to $\tau' \equiv \{\tau_{ij} + d\tau_{ij}\}$
- Let $e_j \equiv e(\mathbf{p}_j, u_j)$ denote expenditure function in country j

Welfare Analysis

- One can show that changes in (log-) expenditure are given by:

$$d \ln e_j = \underbrace{\sum_i \lambda_{ij} d \ln(w_i \tau_{ij})}_{\text{Change in marginal costs}} + \underbrace{(-\rho) \sum_i \lambda_{ij} d \ln(w_i \tau_{ij})}_{\text{Direct markup effect}} + \underbrace{\rho d \ln P_j}_{\text{GE markup effect}}$$

  where

$$\rho \equiv \int_1^\infty \frac{d \ln \mu(v)}{d \ln v} \frac{(\mu(v)/v)\, D(\mu(v)/v) v^{-\theta-1}}{\int_1^\infty (\mu(v')/v')\, D(\mu(v')/v')\, (v')^{-\theta-1}\, dv'} dv.$$

- Consider a "good" trade shock s.t. $\sum_i \lambda_{ij} d \ln(w_i \tau_{ij}) < 0$:

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  - First term is what one would get if markups were constant
  - **Direct markup effect:** If $\rho > 0$ *lower* gains from trade liberalization (incomplete pass-through)
  - **GE markup effect:** If $\rho > 0$ tends to increase gains if good trade shocks lead to a lower P_j; see Melitz and Ottaviano '07

Welfare Analysis

- The rest of the analysis proceeds in two steps

- **Use labor market clearing condition**
  Relate change in choke price to overall magnitude of trade shock:

$$d \ln P_j = \frac{\theta}{1-\beta+\theta} \sum_i \lambda_{ij} d \ln(w_i \tau_{ij})$$

- **Use gravity equation, as in ACR**
  Relate trade shock to change in share of expenditure on domestic goods, level of trade elasticity:

$$\sum_i \lambda_{ij} d \ln(w_i \tau_{ij}) = d \ln \lambda_{jj} / \theta$$

- Putting things together, we obtain our new welfare formula

A New Welfare Formula

- **Proposition:** *Compensating variation associated with small trade cost:*

$$d \ln W_j = -\left(1-\eta\right)\frac{d \ln \lambda_{jj}}{\theta}, \text{with } \eta \equiv \rho\left(\frac{1-\beta}{1-\beta+\theta}\right)$$

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  - β and θ determine the GE effect.

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- **What is the sign of** η under common alternatives to CES?
  - Kimball preferences or QMOR expenditure functions correspond to $\beta = 1$ (same gains as in ACR). In this case, $\eta = 0$
  - Additively separable utility corresponds to $\beta = 0$, $\rho \in (0,1)$. In this case, $\eta > 0$. Thus, lower gains from trade liberalization

Intuition

- If all countries are symmetric, compensating variation can be written as

$$
\begin{aligned}
d\ln W_j &= -\sum_i \lambda_{ij} d\ln \tau_{ij} + \underbrace{\rho \sum_i \lambda_{ij} d\ln \tau_{ij}}_{\text{Direct markup effect}} + \underbrace{-\rho d\ln P_j}_{\text{GE markup effect}} \\
&= -\sum_i \lambda_{ij} d\ln \tau_{ij} + cov\left(\mu_{\omega,i}, \frac{dL_{\omega,i}}{L_j}\right)
\end{aligned}
$$

where $cov\left(\mu_{\omega,i}, \frac{dL_{\omega,i}}{L_j}\right) = \sum_i \int_{\omega \in \Omega_{ji}} \left[\mu_{\omega,i} d\left(L_{\omega,i}/L_j\right)\right] d\omega$

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  - Covariance term only appears if markups are variable

- A new source of gains or losses depending on reallocation of labor and correlation with markups

4. Empirical Estimates

What is the value of η in the data?

- In the homothetic case ($\beta = 1$) we then have $\eta = 0$, and hence no pro-competitive effects, irrespective of other parameters.
- In the non-homothetic case ($\beta = 0$) the value of η depends on $1/(1+\theta)$ and ρ.
    - θ is equal to the elasticity of aggregate trade flows with respect to trade costs. We use $\theta = 5$, in line with recent estimates of "trade elasticity"
    - This implies that η lies between zero (for homothetic demand) and $\rho/6$ (for non-homothetic demand).
- If we want tighter bounds, we need to estimate ρ

Estimation of ρ: Approach I

- **Approach I =** Estimate $D(\cdot)$ directly and use estimate to evaluate ρ (under monopolistic competition)
- We focus on the the case of additively separable preferences in the "Pollak family". This corresponds to

$$D(p_\omega/P) = (p_\omega/P)^{1/\gamma} - \alpha.$$

- This nests the CES case (if $\alpha = 0$) but also allows for the possibility of either $\rho > 0$ (if $\alpha > 0$) or $\rho < 0$ (if $\alpha < 0$)
- We estimate the inverse demand relation given by

$$\Delta_t \Delta_{gi} \ln p^k_{git} = \gamma \Delta_t \Delta_{gi} \ln(q^k_{git} + \alpha) + \Delta_t \Delta_{gi} \ln \epsilon^k_{git},$$

- Non-linear IV estimate is $\widehat{\gamma} = -0.347$ $[-0.373, -0.312]$ and $\widehat{\alpha} = 3.053$ $[0.633, 9.940]$. This leads to $\hat{\rho} = 0.36$ and $\hat{\eta} = \hat{\rho}/6 = 0.06$ (using $\theta = 5$)

Estimate of ρ: Approach II

- **Approach II =** Use estimates of pass-through of costs into prices
- GKLP '12: cross-sectional regression of (log) prices on (log) mc yields 0.35
  - With $\rho = 0.65$ and $\theta = 5$, we now get $\eta = 0.11$
- Burstein and Gopinath (2014): time series evidence on long-run exchange rate pass-through between 0.14 and 0.51
  - This gives ρ between 0.49 and 0.86 and, in turn, η between 0.08 and 0.14
- **Conclusion**: small downward adjustment in gains from trade liberalization (though with homotheticity, gains could be the same)
  - Hence the title "The Elusive Pro-Competitive Effects of Trade"