Who's Getting Globalized? The Size and Nature of Intranational Trade Costs

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Who’s Getting Globalized?

- Massive reductions in barriers to international trade (tariffs, shipping costs, logistics, etc) in past decades.
  - But if intra-national trade costs are large, the impact may be minimal for consumers in remote locations.
  - This may be especially true in developing countries (poor roads, barriers to entry, etc).
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  - But if intra-national trade costs are large, the impact may be minimal for consumers in remote locations.
  - This may be especially true in developing countries (poor roads, barriers to entry, etc).

- Question: How large are intra-national trade costs in developing countries?
  - Lots of anecdotes but scarce evidence.
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- **Question:** How large are intra-national trade costs in developing countries?
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- Key idea here: differences in prices over space can reveal trade costs. But one has to be careful.
Estimating Trade Costs from Spatial Price Gaps: 3 Challenges

1. Spatial price gaps may reflect differences in product characteristics (e.g., quality):
Estimating Trade Costs from Spatial Price Gaps: 3 Challenges

1. Spatial price gaps may reflect differences in product characteristics (eg quality):
   - We use newly collected CPI micro-data on extremely narrowly defined brand name consumer products (akin to barcodes)

2. Spatial price gaps are only rarely informative about the level (rather than the range) of trade costs:
   - We obtain the source location for each product in our sample and only use source-destination pairs

3. Spatial price gaps may reflect both trade costs and differences in intermediaries' mark-ups across locations:
   - We use sufficient statistic (price pass-through) to uncover the true marginal costs of distance
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Spatial price gaps are only rarely informative about the level (rather than range) of trade costs:

- **Ethiopia**
  - (15 products, 103 towns, 106 months 2001–2010)

- **Nigeria**
  - (17 products, 36 towns, 111 months 2001–2010)

95% confidence intervals shown. Locally weighted polynomial (Epanechnikov kernel, bandwidth=0.5). All plots are semiparametric and include product–time fixed effects (Baltagi and Li, 2002).
Spatial price gaps are only rarely informative about the level (rather than range) of trade costs:

Costs (2001 US$)

Distance from source location to destination market (minutes, log scale)

95% confidence intervals shown. Locally weighted polynomial (Epanechnikov kernel, bandwidth=0.5). All plots are semiparametric and include product–time fixed effects (Baltagi and Li, 2002).
Spatial price gaps reflect both trade costs and spatial differences in intermediaries’ mark-ups:

95% confidence intervals shown. Locally weighted polynomial (Epanechnikov kernel, bandwidth=0.5).
All plots are semiparametric and include product–time fixed effects. Adjusted gaps control for market power.
Implication: 2 Effects of Remoteness on Social Surplus

1. We find extremely high marginal costs of distance (7-15X larger than CAN-US trucking from Hummels 2001).
   - \(\Rightarrow\) Less social surplus from trade available to remote consumers/intermediaries
Implication: 2 Effects of Remoteness on Social Surplus

1. We find extremely high marginal costs of distance (7-15X larger than CAN-US trucking from Hummels 2001).
   - \[\rightarrow\] Less social surplus from trade available to remote consumers/intermediaries

2. We also find that remote markets are less competitive.
   - \[\rightarrow\] Whatever social surplus from trade exists in remote locations sees smaller shares accruing to consumers (relative to intermediaries and deadweight loss)
   - Pass-through (again) provides a sufficient statistic for calculating these shares without need for (difficult) markup/elasticity of substitution estimation
Intermediary Profits over Consumer Surplus

95% confidence intervals shown. Locally weighted polynomial (Epanechnikov kernel, bandwidth=0.5).
Outline of Talk

Introduction

Data

How large are intranational trade costs?

Implication: Who is capturing the gains from globalization?

Concluding Remarks
Outline of Talk

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New Data: 2 Requirements

1. **Retail price of identical products** at many locations in space, observed at high frequency for a long duration.

2. **Source location** (factory location or port of entry) of each of these goods (in each country, for each time period).
Dataset 1: CPI micro-data from set of developing countries

• Sample for today:
  • Ethiopia (2001-2010): 15 products, 103 towns
  • Nigeria (2001-2010): 17 products, 36 towns
  • Products are those for which an exact product (with brand name) is identified.

• Ongoing data collection/cleaning for:
  • Philippines (2000-2010)
  • India (1985-2010)

• Additional hope for:
  • Zambia, Bangladesh, Rwanda, Senegal, Pakistan, Indonesia, Mozambique, Uganda, Ghana, Guinea-Bissau, Mexico and [Your Country Here?].
Dataset 2: Source Locations

- Conducted telephone surveys with the firms that produce (or distribute) each product.
  - e.g. Titus Sardines (125g Tin), Rothmans Cigarettes (20 Pack), Harar Beer (330cc), Zahra Detergent (50g).

- For domestically-produced goods, ask producers: where is product made each year.

- For imported goods, ask distributors and retailers: what is country of origin and port of entry.
  - Corroborate port with trade statistics.
Map of Nigerian Sample Locations

- Source locations
- Market observations
- Primary roads
- Secondary roads
Empirical Proxy for Distance

- Distance metric $x_{odt}$ is the log total travel time between locations calculated using Google maps.
- Assumes that traders are taking optimal routes so as to minimize travel time.

<table>
<thead>
<tr>
<th>Road Quality</th>
<th>Ethiopia</th>
<th>Nigeria</th>
</tr>
</thead>
<tbody>
<tr>
<td>National highway</td>
<td>1.2</td>
<td>1.2</td>
</tr>
<tr>
<td>Secondary road</td>
<td>1.4</td>
<td>1.4</td>
</tr>
<tr>
<td>Tertiary road</td>
<td>1.9</td>
<td>2.4</td>
</tr>
</tbody>
</table>

- Results robust to using road or great circle distance.
Outline of Talk

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Concluding Remarks
How large are intranational trade costs? 3

Steps

1. Importance of knowing the source location.

1. Estimates of ‘pass-through’ (denoted by $\rho$) for each location and product.

2. Use estimates of $\rho$ to correct for varying mark-ups over space.
Step 1: Importance of Knowing the Source Location

- We compare:
  - *trading pairs*: origin-destination \((o,d)\) pairs for which goods are definitely being traded; with perfect competition theory says: \(P_{dt}^k - P_{ot}^k = \tau(X_{odt}^k)\)
  
  - *all pairs*: any pair of locations \((i,j)\) which may or may not be trading; with perfect competition theory says: \(P_{it}^k - P_{jt}^k = \tau(X_{oit}^k) - \tau(X_{ojt}^k) \leq \tau(X_{ijt}^k)\)
Step 1: Importance of Knowing the Source Location

![Graphs showing costs (2001 US$) vs. distance from source location to destination market (minutes, log scale) for Ethiopia and Nigeria.](image)

- **Ethiopia: All Goods**
- **Nigeria: All Goods**

- Costs (2001 US$)
- Distance from source location to destination market (minutes, log scale)

95% confidence intervals shown. Locally weighted polynomial (Epanechnikov kernel, bandwidth=0.5). All plots are semiparametric and include product–time fixed effects (Baltagi and Li, 2002).
Step 2: Estimating Pass-Through

- **What is ‘pass-through’?**
  - Extent to which price charged by an intermediary changes when his marginal costs change.
Why is pass-through useful here?

If $\rho = 1$, then prices are changing one-for-one with marginal costs.

- This implies that mark-ups are not changing with marginal costs.
- That is, the way price gaps vary over distance measures how marginal costs vary over distance.

If $\rho < 1$, then prices are changing less than one-for-one with marginal costs.

- This implies that mark-ups are falling as marginal costs rise.
- That is, the way price gaps vary over distance understates how marginal costs vary over distance.
Step 2: Estimating Pass-Through

- **How do we estimate pass-through?**
  - We estimate how price shocks at the source location affect (ie ‘pass through into’) prices at destination locations.
  - We do this separately for each destination location and for each product using price variation over time.

- **NB: We do not estimate (nor need to estimate) the level of the mark-up.**
  - Doing so would require estimate of (residual) demand elasticity.
  - Paradoxically, this is arguably harder to estimate than pass-through (which depends on the second-order properties of residual demand).
Step 2: Estimating Pass-Through

Distance from source location to destination market (minutes, log scale)

95% confidence intervals shown. Locally weighted polynomial (Epanechnikov kernel, bandwidth=0.5).
Step 3: How large are intranational trade costs?

- Once we know pass-through for each location and product, it is straightforward to ‘correct’ spatial price gaps for varying mark-ups over space.
  - Insight is that an increase in source prices and an increase in distance-related costs are passed on in the same manner.
  - NB: if $\rho = 1$ then this correction does nothing.
Step 3: How large are intranational trade costs?

- Once we know pass-through for each location and product, it is straightforward to ‘correct’ spatial price gaps for varying mark-ups over space.
  - Insight is that an increase in source prices and an increase in distance-related costs are passed on in the same manner.
  - NB: if $\rho = 1$ then this correction does nothing.

- We also control for the possibility that the level of competition is lower in more remote locations
  - That is, the way price gaps vary over distance overstates how marginal costs vary over distance.
Step 3: How large are intranational trade costs?

All plots are semiparametric and include product–time fixed effects. Adjusted gaps control for market power.
### Step 3: How large are intranational trade costs?

<table>
<thead>
<tr>
<th></th>
<th>Ethiopia (Trading Pairs)</th>
<th>Nigeria (Trading Pairs)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Price Gap</td>
<td>Adjusted Gap</td>
</tr>
<tr>
<td>Log distance to source (minutes)</td>
<td>0.0289***</td>
<td>0.0411***</td>
</tr>
<tr>
<td></td>
<td>(0.00147)</td>
<td>(0.00246)</td>
</tr>
<tr>
<td>Time-Product FE</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Time-Product $\times \frac{1-\rho_{kod}^k}{\rho_{kod}^k}$</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Destination $\times \frac{1-\rho_{kod}^k}{\rho_{kod}^k}$</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>100762</td>
<td>100762</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.258</td>
<td>0.933</td>
</tr>
</tbody>
</table>

**Notes:** Standard errors clustered at the time-product level. * significant at 10 percent level, ** at 5 percent and *** at 1 percent.

- Additional cost to reach the most remote locations (20 hours away, 97-99th percentile) compared to the least remote locations (1 hour away, 2nd percentile):
  - 12 US cents (30% of mean $P_o$) in Ethiopia, 17 cents in Nigeria (14% of mean $P_o$).
Step 3: How large are intranational trade costs?

- Rough comparison to international trade costs:
  - Use these estimates to calculate additional ad valorem cost to reach locations 3 log units further away:

<table>
<thead>
<tr>
<th>Mode of Transport</th>
<th>Implied ∆ad-valorem transport cost for ∆ln(distance) of 3 units (by mode of transport for cargo of mean kg/$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>US Imports (Truck from CAN)</td>
<td>2.0 percent</td>
</tr>
<tr>
<td>US Imports (Rail from CAN)</td>
<td>2.7 percent</td>
</tr>
<tr>
<td>US Imports (Ocean)</td>
<td>4.9 percent</td>
</tr>
<tr>
<td>US Imports (Air)</td>
<td>14.6 percent</td>
</tr>
</tbody>
</table>

- Compare to: 30 percent in Ethiopia, 14 percent in Nigeria.
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How large are intranational trade costs?

Implication: Who is capturing the gains from globalization?

Concluding Remarks
Who is capturing the gains from globalization? Shares of surplus

- Thought experiment: suppose the port price of an import falls by 20% due to “globalization”.
- Two effects of remoteness:
  1. High marginal cost of distance $\implies$ remote locations see smaller increases in the *quantity* of surplus available to consumers/intermediaries.
  2. Markups vary across space $\implies$ whatever surplus is generated, remote locations see different *shares* of this surplus accruing to consumers (compared to intermediaries and deadweight loss).
Who is capturing the gains from globalization? Shares of surplus

- How to measure the distribution of surplus?

- Turns out that (under conditions that we lay out in the paper) pass-through is all one needs to know.

- Pass-through can also be used to estimate measures of (relative) ‘competitiveness’ in each market.
  - Intuitively, all else equal, if pass-through is close to one then competitiveness must be high.
Who is capturing the gains from globalization? Competitiveness Index

Relative competitiveness index of intermediaries at destination market

Distance from location to capital city (minutes, log scale)

95% confidence intervals shown. Locally weighted polynomial (Epanechnikov kernel, bandwidth=0.5).
Who is capturing the gains from globalization? Distribution of Surplus

95% confidence intervals shown. Locally weighted polynomial (Epanechnikov kernel, bandwidth=0.5).
Who is capturing the gains from globalization?

<table>
<thead>
<tr>
<th></th>
<th>Ethiopia</th>
<th>Nigeria</th>
<th>Ethiopia</th>
<th>Nigeria</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Relative Competitiveness</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Index of Intermediaries (All Locations)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Log distance to capital (minutes)</td>
<td>-0.230** (0.106)</td>
<td>-0.707*** (0.169)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Log distance to source (minutes)</td>
<td>3.459*** (0.621)</td>
<td>8.004*** (1.012)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>0.161 (0.359)</td>
<td>-0.0103 (0.73)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>100</td>
<td>36</td>
<td>1418</td>
<td>489</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.027</td>
<td>0.150</td>
<td>0.014</td>
<td>0.019</td>
</tr>
</tbody>
</table>

Notes: Robust standard errors in parentheses. * significant at 10 percent level, ** at 5 percent and *** at 1 percent.

- Ratio of intermediary/consumer surplus in the least remote locations (1 hour away) compared to the most remote locations (20 hours away):
  - Between 40%-64% higher in Ethiopia, 40%-74% in Nigeria.
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Concluding Remarks
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• How large are intra-national trade costs in developing countries?
  • The marginal costs of distance in our sample appear to be very high. (Approximately 7-15X larger than CAN-US trucking.)
  • Appear to be under-estimated by standard spatial price gap methods
    • MC of distance approximately double when only use source-destination pairs
    • MC of distance approximately double again when spatial variation in mark-ups accounted for by using sufficient statistic (pass-through) approach

• 2 Implications for costs of remoteness:
  1. Trade generates less social surplus for consumers/intermediaries in remote locations
  2. Additionally, consumers in remote locations capture a smaller share of whatever surplus is generated