Who’s Getting Globalized? The Size and Implications 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 trade does not start or stop at borders and ports.
  - Large intra-national trade costs and uncompetitive trading sector mean that the incidence of globalization varies within a country.
  - This may be especially true in Sub-Saharan Africa.
- Unfortunately we know very little about how large these intranational trade costs are and what they imply for the incidence of globalization.
Who’s Getting Globalized?

Questions:
1. How large are intra-national trade costs in Sub-Saharan Africa?
2. How does Sub-Saharan Africa compare to the US?
3. What do these costs imply for the incidence of globalization?
Estimating Trade Costs from Price Gaps

- Domestic traders buy an import at port-of-entry $o$ for price $P_o$, then sell it at destination $d$ for price $P_d$:

$$P_d - P_o = \tau(X_{od}) + \mu_d$$

where $\tau(\cdot)$ are intranational trade costs and $X_{od}$ are cost shifters (such as distance).

- Voluminous literature seeks to uncover $\frac{\partial \tau(X_{od})}{\partial X_{od}}$ from the distribution of prices over space.
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- Voluminous literature seeks to uncover $\frac{\partial \tau(X_{od})}{\partial X_{od}}$ from the distribution of prices over space.

- **Challenge #1**: Spatial price gaps may reflect differences in unobserved product characteristics.

- **Solution**: We collect new sample of micro-data on narrowly defined (i.e. barcode-level) products.
Estimating Trade Costs from Price Gaps

- Literature generally assumes $\mu_d = 0$ and then aims to estimate trade costs from the arbitrage inequality:

$$P_i - P_j \leq \tau(X_{ij})$$

- **Challenge #2**: This is only an equality if locations $i$ and $j$ are actually trading the product. But virtually never have data on trade flows at this level.
Estimating Trade Costs from Price Gaps

- Literature generally assumes $\mu_d = 0$ and then aims to estimate trade costs from the arbitrage inequality:

$$ P_i - P_j \leq \tau(X_{ij}) $$

- **Challenge #2:** This is only an equality if locations $i$ and $j$ are actually trading the product. But virtually never have data on trade flows at this level.

- **Solution:** We collect new data on the source location for each product in our sample and only use origin-destination pairs:

$$ \implies P_d - P_o = \tau(X_{od}) $$
Overcoming Challenge #2

Spatial price gaps are only rarely informative about the level (rather than range) of trade costs:

![Graph showing costs (2004 US$) vs. distance from origin location to destination market (miles, log scale) for Ethiopia, Nigeria, and USA.](image)

- **Ethiopia**
  - (15 products, 103 towns, 106 months)
  - Costs (2004 US$)
  - Distance from origin location to destination market (miles, log scale)
  - all pairs (i.e. $P_i - P_j$)
  - trading pairs (i.e. $P_d - P_o$)

- **Nigeria**
  - (18 products, 36 towns, 111 months)
  - Costs (2004 US$)
  - Distance from origin location to destination market (miles, log scale)
  - all pairs (i.e. $P_i - P_j$)
  - trading pairs (i.e. $P_d - P_o$)

- **USA**
  - (46 products, 1881 towns, 72 months)
  - Costs (2004 US$)
  - Distance from origin location to destination market (miles, log scale)
  - all pairs (i.e. $P_i - P_j$)
  - trading pairs (i.e. $P_d - P_o$)
Estimating Trade Costs from Price Gaps

- **Challenge #3**: But what if trading sector is not perfectly competitive? Price gaps then reflect both trade costs and intermediaries’ mark-ups:

\[ P_d - P_o = \tau(X_{od}) + \mu_{od} \]
Estimating Trade Costs from Price Gaps

- **Challenge #3:** But what if trading sector is not perfectly competitive? Price gaps then reflect both trade costs and intermediaries’ mark-ups:

\[ P_d - P_o = \tau(X_{od}) + \mu_{od} \]

- **Solution:** We show that there exists an observable sufficient statistic (price pass-through) that allows \( \frac{\partial \tau(X_{od})}{\partial X_{od}} \) to be identified from \( \frac{\partial (P_d - P_o)}{\partial X_{od}} \).
Estimating Trade Costs from Price Gaps

• **Challenge #3:** But what if trading sector is not perfectly competitive? Price gaps then reflect both trade costs and intermediaries’ mark-ups:

\[ P_d - P_o = \tau(X_{od}) + \mu_{od} \]

• **Solution:** We show that there exists an observable sufficient statistic (price pass-through) that allows \( \frac{\partial \tau(X_{od})}{\partial X_{od}} \) to be identified from \( \frac{\partial (P_d - P_o)}{\partial X_{od}} \).

• **By-product:** Will characterize how markups vary across space (ie \( \frac{\partial \mu_{od}}{\partial X_{od}} \)).
Overcoming Challenge #3

Spatial price gaps reflect both trade costs and spatial differences in mark-ups:

- Ethiopia: 15 products, 103 towns, 106 months
- Nigeria: 18 products, 36 towns, 111 months
- USA: 46 products, 1881 towns, 72 months

Costs (2004 US$)

Distance from origin location to destination market (miles, log scale)

- All pairs
- Trading pairs only
- \(\mu\)-adjusted, trading pairs only
Implications for Incidence of Globalization

• Thought experiment: suppose the port price of an import falls due to “globalization”.

• Two implications of our estimates for incidence of this globalization shock:
  1. Higher \( \tau(X) \Rightarrow \text{Smaller quantity of social surplus generated.} \)
  2. Higher \( \tau(X) \) locations feature less entry, less competition.
     • \( \Rightarrow \text{Whatever surplus is generated, see smaller share of this surplus accrues to consumers.} \)
     • As in Weyl and Fabinger (2013), pass-through provides a sufficient statistic for calculating these shares without need for markup/price elasticity estimation.
Incidence of Globalization

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

Relative ratio of intermediary profits to consumer surplus

95% confidence intervals shown. Locally weighted polynomial (Epanechnikov kernel, bandwidth=0.5).
Related literature

• Using spatial price gaps to measure trade costs:
  • e.g. Engel and Rogers (1996); Parsley and Wei (2001); Broda and Weinstein (2008); Donaldson (2010); Simonovska and Waugh (2012).

• Implications of pass-through for market power:
  • e.g. Bulow and Pfleiderer (1983); Goldberg and Hellerstein (2008); Burstein and Jaimovich (2009); Nakamura and Zerom (2010); Li et al. (2011); and Weyl and Fabinger (2013).

• Estimating gains from trade with variable markups:
  • e.g. Feenstra and Weinstein (2010); Edmond et al (2011); Arkolakis et al (2012); de Loecker et al (2012); and Cosar et al (2013).

• International trade carried out by intermediaries:

• International trade with intranational trade costs:
  • Cosar and Fajgelbaum (2013); Ramondo et al (2012); Redding (2012).
Outline of Talk

Introduction

Data

Model Environment and Estimation Strategy

Empirics: How large are intranational trade costs?

Implications for the incidence of globalization

Concluding Remarks
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New Data: 3 Requirements

1. **Retail price of identical products** at many locations in space (challenge 1).

2. **Source location** (factory location or port of entry) of each of these goods in each country (challenge 2).

3. **High frequency** price data observed over a long duration (challenge 3).

- A core component of this paper is the creation of a new dataset satisfying these 3 requirements.

- **NB:** no data on quantities consumed (or produced or traded) is available for such narrowly-defined products.

- Our methodology is motivated by the need to understand intranational trade costs in absence of such quantity data.
Dataset 1: CPI micro-data

• 2 Sub-Saharan African countries:
  • Ethiopia (2001-2010): 15 products, 103 towns
  • Nigeria (2001-2010): 18 products, 36 towns

• Products are those for which:
  1. An exact product (with brand name) can be identified.
  2. Data are available over majority of towns and years.

• Comparison with developed country:
  • United States (2004-2009): 46 leading brands, 2856 counties (Nielsen Homescan data)
  • Top barcode in every ‘module’; company told us factory location; observed 7 times out of 72 months.
Dataset 2: Source Locations

- Conducted telephone surveys with the firms that produce (or distribute) each product.

- 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 Ethiopian Sample Locations
Map of US Source Locations

Source Locations
Primary Roads

0 500 Miles

Source Locations
Primary Roads
Descriptive Statistics

- Data cover a range of food and non-food items:
  - Ethiopia: Rothmans Cigarettes (20 pack), Harar Beer (330cc bottle), Zahra Detergent (50g packet), Lux Toilet Soap (90g packet), Zenith Hair Oil (330cc bottle), Saris Wine (750cc bottle) etc.
  - Nigeria: Titus Sardines (125g tin), Bournvita Drink (450g tin), Cerelac Baby Food (400g tin), Omo Detergent (100g packet), Lipton Tea (226g box), Peak Evaporated Milk (170g tin) etc.
  - USA: Dawn Liquid Ultra Dish Soap Original Scent (12.6oz), Kikkoman Soy Sauce (10oz), Crunch 'N Munch Butter Toffee (4oz) etc.

- Mean (and SD) source price, 2001 US$:
  - Ethiopia: $0.40 (0.48), Nigeria: $0.97 (1.27), US: $0.62 ($0.82)

- Mean of distance metric $x_{od}$, log great circle distance between locations in miles:
  - Ethiopia: 5.24 log miles (221 miles), Nigeria: 5.69 log miles (350 miles), US: 6.14 log miles (674 miles)
Distribution of Population by Distance

Destination market population (mid sample period)

Distance from source location to destination market (miles, log scale)
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Model Environment

- Consider market for a single product in a single time period in destination location $d$
- Origin location (port or factory): indexed by $o$

**Basic scenario:**

- Consumers in location $d$ demand product:
  - Inverse demand curve $P_d = P(Q_d; D_d)$, where $Q_d$ is total quantity purchased and $D_d$ parameterizes demand.

- Intermediaries specialize in:
  - Buying product at location $o$ for (exogenous) wholesale price $P_o$.
  - Transporting and selling product to consumer at location $d$ for retail price $P_d$. 
Intermediaries: Technology and Market Structure

- **A1 [Technology]**: The cost to an intermediary of trading $q_d$ units is:
  \[ C(q_d) = (P_o + \tau(X_{od}))q_d + F_{od}. \]

- **A2 [Market structure]**: $m_d$ identical intermediaries trading the product from location $o$ to $d$ choose $q_d$ to maximize profits subject to a perceived response of other firms summarized by the parameter $\theta_d \equiv \frac{dQ_d}{dq_d}$. The ‘competitiveness index’, $\phi_d \equiv \frac{m_d}{\theta_d}$, is fixed and exogenous.
Price gaps and trade costs

- From intermediaries’ FOCs obtain:

\[ \mu_d \equiv P_d - c_{od} = c_{od} \left[ \frac{\phi_d}{-\eta(D_d, c_{od}, \phi_d)} - 1 \right]^{-1} \]

\[ = \mu(c_{od}, \phi_d, D_d) \]

- Hence:

\[ P_d - P_o = \tau(X_{od}) + \mu(c_{od}, \phi_d, D_d) \]
Price gaps and trade costs

- From intermediaries’ FOCs obtain:

\[ \mu_d \equiv P_d - c_{od} = c_{od} \left[ \frac{\phi_d}{-\eta(D_d, c_{od}, \phi_d)} - 1 \right]^{-1} = \mu(c_{od}, \phi_d, D_d) \]

- Hence:

\[ P_d - P_o = \tau(X_{od}) + \mu(c_{od}, \phi_d, D_d) \]

- Perturb this with small change in \( x_{od} \):

\[
\frac{d(P_d - P_o)}{dx_{od}} = \left(1 + \frac{\partial \mu_{od}}{\partial c_{od}}\right) \frac{\partial \tau(X_{odt}^k)}{\partial x_{odt}^k} + \frac{\partial \mu_{od}}{\partial \phi_d} \frac{\partial \phi_d}{\partial x_{od}} + \frac{\partial \mu_{od}}{\partial D_d} \frac{\partial D_d}{\partial x_{od}}
\]
Estimating trade costs from price gaps

\[
\frac{d(P_d - P_o)}{dx_{od}} = \left(1 + \frac{\partial \mu_{od}}{\partial c_{od}}\right) \frac{\partial \tau(x^k_{odt})}{\partial x^k_{odt}} + \frac{\partial \mu_{od}}{\partial \phi_d} \frac{\partial \phi_d}{\partial x_{od}} + \frac{\partial \mu_{od}}{\partial D_d} \frac{\partial D_d}{\partial x_{od}}
\]

**Note 1:**

- Only if mark-ups are constant across locations (ie \(\frac{\partial \mu_{od}}{\partial c_{od}} = \frac{\partial \mu_{od}}{\partial \phi_d} = \frac{\partial \mu_{od}}{\partial D_d} = 0\)), will the variation in price gaps with distance identify the true marginal costs of distance,

\[
\frac{d(P_d - P_o)}{dx_{od}} = \frac{\partial \tau(x^k_{odt})}{\partial x^k_{odt}}
\]
Estimating trade costs from price gaps

\[
\frac{d(P_d - P_o)}{dx_{od}} = \left( 1 + \frac{\partial \mu_{od}}{\partial c_{od}} \right) \frac{\partial \tau(X^k_{odt})}{\partial x^k_{odt}} + \frac{\partial \mu_{od}}{\partial \phi_d} \frac{\partial \phi_d}{\partial x_{od}} + \frac{\partial \mu_{od}}{\partial D_d} \frac{\partial D_d}{\partial x_{od}}
\]

Note 2:

- The nuisance parameter \( 1 + \frac{\partial \mu_{od}}{\partial c_{od}} \) is equal to the equilibrium pass-through rate \( \rho_d \):

\[
\rho_d \equiv \frac{\partial P_d}{\partial c_{od}} = 1 + \frac{\partial \mu_{od}}{\partial c_{od}}
\]

- But in our case A1 implies:

\[
\rho_d = \frac{\partial P_d}{\partial P_o}
\]

- We therefore use estimates of \( \rho_d \) obtained from \( P_o \) shocks (in time series) to correct for fact that intermediaries may not pass on costs of distance one for one (in cross section).
Estimating trade costs from price gaps

\[
\frac{d(P_d - P_o)}{dx_{od}} = \left(1 + \frac{\partial \mu_{od}}{\partial c_{od}}\right) \frac{\partial \tau(X_{odt}^k)}{\partial x_{odt}^k} + \frac{\partial \mu_{od}}{\partial \phi_d} \frac{\partial \phi_d}{\partial x_{od}} + \frac{\partial \mu_{od}}{\partial D_d} \frac{\partial D_d}{\partial x_{od}}
\]

Note 3:

- Also need controls for possibility that mark-ups vary over space through effects that are independent of the effect of distance on marginal costs.

  - i.e., control for \(\frac{\partial \mu_{od}}{\partial \phi_d} \frac{\partial \phi_d}{\partial x_{od}}\) and \(\frac{\partial \mu_{od}}{\partial D_d} \frac{\partial D_d}{\partial x_{od}}\).

  - e.g., long-run entry decisions may mean remote locations are less competitive, \(\frac{\partial \mu_{od}}{\partial \phi_d} \frac{\partial \phi_d}{\partial x_{od}} < 0\).
Further Progress...Constant pass-through demand

- Previous expressions always locally true (assuming spatial smoothness).
- For these to be global (and not require spatial smoothness) we need a specific demand system.
- A demand system also allows us to specify explicit controls for fact that competitiveness/tastes may vary with distance (i.e. $\frac{\partial \mu_{od}}{\partial \phi_d} \frac{\partial \phi_d}{\partial x_{od}}$ and $\frac{\partial \mu_{od}}{\partial D_d} \frac{\partial D_d}{\partial x_{od}}$).
Further Progress…Constant PT demand

- For any demand system

\[ \rho_d = \frac{\partial P_d}{\partial P_o} = \frac{dP_d}{d\tau(X_{od})} = \left[ 1 + \frac{1 + E_d(P_d)}{\phi_d} \right]^{-1} \]

where \( E_d(P_d) \equiv \frac{Q_d}{\partial P_d/\partial Q_d} \frac{\partial(\partial P_d/\partial Q_d)}{\partial Q_d} \geq 0. \)
Further Progress...Constant PT demand

• For any demand system

\[ \rho_d = \frac{\partial P_d}{\partial P_o} = \frac{dP_d}{d\tau(X_{od})} = \left[ 1 + \frac{(1 + E_d(P_d))}{\phi_d} \right]^{-1} \]

where \( E_d(P_d) \equiv \frac{Q_d}{\partial P_d/\partial Q_d} \frac{\partial (\partial P_d/\partial Q_d)}{\partial Q_d} \leq 0. \)

• A3 [Bulow-Pfleiderer demand]:

\[ P_d(Q_d) = a_d - b_d (Q_d)^{\delta_d} \]

• For this (and only this) demand system, pass through is constant over quantities: \( \rho_d = \left[ 1 + \frac{\delta_d}{\phi_d} \right]^{-1} \leq 1. \)

• CES, linear and quadratic demand are special cases.
From theory to estimation

- Extend model to multiple products $k \in K$ selling in locations $d \in D$ at multiple time periods $t \in T$. 

- A4 [Static Pass-Through]: The pass-through rate is fixed over time within a product-destination ($\rho_{kd} = \rho_{kd} \forall t \in T$).

- Step 1: Under A1-A4:
  
  $$P_{kd}^{t} = \rho_{kd} P_{kd}^{0} + \rho_{kd} \tau(X_{kd}^{t}) + (1 - \rho_{kd}) a_{kd}^{t}$$

  Regression of $P_{kd}^{t}$ on $P_{kd}^{0}$ identifies $\rho_{kd}$ (conditional on $\tau(\cdot)$, $a_{kd}^{t}$ controls).

- Step 2: Under A1-A4, "adjusted price gap" satisfies:
  
  $$P_{kd}^{t} - \hat{\rho}_{kd} P_{kd}^{0} = \tau(X_{kd}^{t}) + (1 - \hat{\rho}_{kd}) \hat{\rho}_{kd} a_{kd}^{t}$$

  Use $\hat{\rho}_{kd}$ to calculate adjusted price gap and regress on distance to uncover marginal costs of distance (conditional on $((1 - \hat{\rho}_{kd}) / \hat{\rho}_{kd}) a_{kd}^{t}$ controls).
From theory to estimation

- Extend model to multiple products $k \in K$ selling in locations $d \in D$ at multiple time periods $t \in T$.

- **A4 [Static Pass-Through]:** The pass-through rate is fixed over time within a product-destination ($\rho_{dt}^k = \rho_d^k \ \forall t \in T$).
From theory to estimation

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- **A4 [Static Pass-Through]:** The pass-through rate is fixed over time within a product-destination ($\rho_{dt}^k = \rho_d^k \forall t \in T$).

- **Step 1:** Under A1-A4:

  $$P_{dt}^k = \rho_d^k P_{ot}^k + \rho_d^k \tau(X_{odt}^k) + (1 - \rho_d^k) a_{dt}^k$$

  Regression of $P_{dt}^k$ on $P_{ot}^k$ identifies $\rho_d^k$ (conditional on $\tau(\cdot)$, $a_{dt}^k$ controls).
From theory to estimation

- Extend model to multiple products \( k \in K \) selling in locations \( d \in D \) at multiple time periods \( t \in T \).

- **A4 [Static Pass-Through]**: The pass-through rate is fixed over time within a product-destination \( (\rho_d^k = \rho_d^k \forall t \in T) \).

- **Step 1**: Under A1-A4:
  \[
P_{dt}^k = \rho_d^k P_{ot}^k + \rho_d^k \tau(X_{odt}^k) + (1 - \rho_d^k) a_{dt}^k
  \]
  Regression of \( P_{dt}^k \) on \( P_{ot}^k \) identifies \( \rho_d^k \) (conditional on \( \tau(\cdot), a_{dt}^k \) controls).

- **Step 2**: Under A1-A4, “adjusted price gap” satisfies:
  \[
  \frac{P_{dt}^k - \hat{\rho}_d^k P_{ot}^k}{\rho_d^k} = \tau(X_{odt}^k) + \frac{(1 - \hat{\rho}_d^k)}{\rho_d^k} a_{dt}^k
  \]
  Use \( \hat{\rho}_d^k \) to calculate adjusted price gap and regress on distance to uncover marginal costs of distance (conditional on \( ((1 - \rho_d^k)/\rho_d^k) a_{dt}^k \) controls).
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Concluding Remarks
A first look at spatial price gaps

- Recall the equilibrium pricing formula:

\[
P^{k}_{dt} = \rho^{k}_{d} P^{k}_{ot} + \rho^{k}_{d} \tau(X^{k}_{odt}) + (1 - \rho^{k}_{d}) a^{k}_{dt}
\]

- Begin with perfect competition, \( \rho^{k}_{d} = 1 \):

\[
P^{k}_{dt} - P^{k}_{ot} = \tau(X^{k}_{odt})
\]

- We compare:
  - 'trading pairs': origin-destination \((o, d)\) pairs for which goods traded; theory: \( P^{k}_{dt} - P^{k}_{ot} = \tau(X^{k}_{odt}) \)
  - to 'all pairs': any pair of locations \((i, j)\) which may or may not be trading; theory:

\[
P^{k}_{it} - P^{k}_{jt} = \tau(X^{k}_{oit}) - \tau(X^{k}_{oijt}) \leq \tau(X^{k}_{ijt})
\]
A first look at spatial price gaps

- **Ethiopia**
  - 15 products, 103 towns, 106 months

- **Nigeria**
  - 18 products, 36 towns, 111 months

- **US**
  - 46 products, 1881 towns, 72 months

**Costs (2004 US$)**

**Distance from origin location to destination market (miles, log scale)**

- **all pairs (i.e. \( P_i - P_j \))**
- **trading pairs (i.e. \( P_d - P_o \))**
Step 1: Pass-Through Estimates

- Under A1-A4: \[ P_{dt}^k = \rho_d^k P_{ot}^k + \rho_d^k \tau(X_{odt}^k) + (1 - \rho_d^k) a_{dt}^k \]

- Empirical analogue to estimate \( \rho_d^k (\forall d \text{ and } k) \),
  \[ P_{dt}^k = \rho_d^k P_{ot}^k + \gamma_{od}^k + \gamma_{od}^k t + \varepsilon_{dt}^k , \]
  where \( \gamma_{od}^k \) are fixed-effects, \( \varepsilon_{dt}^k = \rho_d^k \zeta_{odt}^k + (1 - \rho_d^k) \nu_{odt}^k \) is error term.
Step 1: Pass-Through Estimates

- **Under A1-A4:**  \( P_{dt}^k = \rho_d^k P_{ot}^k + \rho_d^k \tau(X_{odt}^k) + (1 - \rho_d^k) a_{dt}^k \)

- **Empirical analogue to estimate** \( \rho_d^k \) (\( \forall d \text{ and } k \)),

  \[ P_{dt}^k = \rho_d^k P_{ot}^k + \gamma_{od}^k + \gamma_{od}^k t + \varepsilon_{dt}^k, \]

  where \( \gamma_{od}^k \) are fixed-effects, \( \varepsilon_{dt}^k = \rho_d^k \zeta_{odt}^k + (1 - \rho_d^k) \nu_{odt}^k \) is error term.

- **Orthogonality:** Temporal variation in (detrended) product-location \( \tau(X_{odt}^k) \) or \( a_{dt}^k \) must be independent of \( P_{ot}^k \).

- **Identifying variation:** product-specific input price shocks, origin-product specific demand shocks.

- **Formally:**

  \[ \tau = \beta_{1od}^k + \beta_{2od}^k t + \zeta_{odt}^k, \quad \mathbb{E} \left[ P_{ot}^k \zeta_{odt}^k \right] = 0 \]

  \[ a_{dt}^k = \alpha_{1d}^k + \alpha_{2d}^k t + \nu_{dt}^k, \quad \mathbb{E} \left[ P_{ot}^k \nu_{dt}^k \right] = 0. \]
Step 1: Pass-Through Estimates

- Under A1-A4: \( P_{dt}^k = \rho_d^k P_{ot}^k + \rho_d^k \tau(X_{odt}^k) + (1 - \rho_d^k) a_{dt}^k \)

- Empirical analogue to estimate \( \rho_d^k \) (\( \forall d \) and \( k \)),
  \[
P_{dt}^k = \rho_d^k P_{ot}^k + \gamma_{od}^k + \gamma_{od}^k t + \varepsilon_{dt}^k,
  \]
where \( \gamma_{od}^k \) are fixed-effects, \( \varepsilon_{dt}^k = \rho_d^k \zeta_{odt}^k + (1 - \rho_d^k) \nu_{odt}^k \) is error term.

- **Orthogonality:** Temporal variation in (detrended) product-location \( \tau(X_{odt}^k) \) or \( a_{dt}^k \) must be independent of \( P_{ot}^k \).

- Identifying variation: product-specific input price shocks, origin-product specific demand shocks.

- Formally: \( \tau = \beta_{1od}^k + \beta_{2od}^k t + \zeta_{odt}^k, \ E[P_{ot}^k \zeta_{odt}^k] = 0 \) and \( a_{dt}^k = \alpha_{1d}^k + \alpha_{2d}^k t + \nu_{dt}^k, \ E[P_{ot}^k \nu_{dt}^k] = 0 \).

- **Robustness:** Omit towns <100/200 miles from source to avoid spatially correlated \( \nu_{dt}^k \); include time-destination fixed effects; instrument import \( P_{ot}^k \) with exchange rates; oil price controls; estimate \( \rho_d^k \) every 2.5/5 years, with 3 lags or quarterly.
Step 1: Pass-Through Estimates

95% confidence intervals shown. Locally weighted polynomial (Epanechnikov kernel, bandwidth=0.5).
Step 2: How large are intranational trade costs?

- Under A1-A4: 
  \[ \frac{P^k_{dt} - \rho^k_d P^k_{ot}}{\rho^k_d} = \tau(X^k_{odt}) + \frac{(1-\rho^k_d)}{\rho^k_d} a^k_{dt} \]

- Empirical analogue traces out the true marginal costs of \( X^k_{odt} \) (e.g. distance, etc):

  \[ \frac{P^k_{dt} - \rho^k_d P^k_{ot}}{\rho^k_d} = \tau(X^k_{odt}) + \gamma^k_t \left( \frac{1-\rho^k_d}{\rho^k_d} \right) + \gamma^k_d \left( \frac{1-\rho^k_d}{\rho^k_d} \right) + \gamma^k_t + \varepsilon^k_{dt}, \]

  where \( \rho^k_d \) is an estimate of pass-through, \( \gamma^k_t \) and \( \gamma^k_d \) are fixed-effects, and \( \varepsilon^k_{dt} = \frac{(1-\rho^k_d)}{\rho^k_d} \nu^k_{dt} \) is an error term.
Step 2: How large are intranational trade costs?

- Empirical analogue traces out true marginal costs of $X_{odt}^k$:

$$\frac{P_{dt}^k - \rho_d^k P_{ot}^k}{\hat{\rho}_d^k} = \tau(X_{odt}^k) + \gamma_t^k \left(1 - \frac{\hat{\rho}_d^k}{\rho_d^k}\right) + \gamma_d \left(1 - \frac{\hat{\rho}_d^k}{\rho_d^k}\right) + \gamma_t^k + \varepsilon_{dt}^k,$$

where $\hat{\rho}_d^k$ is an estimate of pass-through, $\gamma_t^k$ and $\gamma_d$ are fixed-effects, and $\varepsilon_{dt}^k = \frac{(1 - \rho_d^k)}{\rho_d^k} \nu_{dt}^k$ is an error term.

- **Orthogonality:** Spatial variation in (product-time and destination demeaned) demand shifters $a_{dt}^k$ must be independent of $X_{odt}^k$.

- Identifying variation: variation across both goods and locations in distance between $o$ and $d$.

- Formally: $a_{dt}^k = \alpha_t^k + \alpha_d + \nu_{dt}^k$ and $E[ X_{odt}^k \nu_{dt}^k] = 0$.

- **Robustness:** destination-time interactions, include destination FE directly.
Step 2: How large are intranational trade costs?

Ethiopia
(15 products, 103 towns, 106 months)

Nigeria
(18 products, 36 towns, 111 months)

US
(46 products, 1881 towns, 72 months)

Costs (2004 US$)

Distance from origin location to destination market (miles, log scale)

- trading pairs only
- μ–adjusted, trading pairs only
Channel decomposition: variation in trade costs and demand shifters across space

Under A1-A3: $\mu_d = (1 - \rho_d)(a_d - \tau(X_{od}) - P_0)$
## Step 2: How large are intranational trade costs?

<table>
<thead>
<tr>
<th></th>
<th>(1) Ethiopia</th>
<th>(2) Ethiopia</th>
<th>(3) Nigeria</th>
<th>(4) Nigeria</th>
<th>(5) USA</th>
<th>(6) USA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log distance to source (miles)</td>
<td>0.0248*** (0.00125)</td>
<td>0.0374*** (0.00223)</td>
<td>0.0254*** (0.00437)</td>
<td>0.0558*** (0.00759)</td>
<td>0.00437*** (0.000731)</td>
<td>0.0106*** (0.00100)</td>
</tr>
<tr>
<td>Time-Product FE</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Time-Product $\times \frac{1-\beta}{\beta}$</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Destination $\times \frac{1-\beta}{\beta}$</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>100,761</td>
<td>100,761</td>
<td>26,025</td>
<td>26,025</td>
<td>175,782</td>
<td>175,782</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.252</td>
<td>0.932</td>
<td>0.500</td>
<td>0.964</td>
<td>0.408</td>
<td>0.928</td>
</tr>
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</table>

**Notes:** Time-product clustered standard errors in round parentheses. Time-product block bootstrapped standard errors in curly parentheses, product-destination block bootstrapped standard errors in square parentheses.

- Additional cost to reach the most remote locations (500 miles away, 99th percentile in Ethiopia, 77th in Nigeria, 45th in USA) compared to the least remote locations (50 miles away, 3rd-4th percentile):
  - 9 cents (20% of mean $P_o$) in Ethiopia, 13 cents in Nigeria (12% of mean $P_o$), 2 cents in USA (4% of mean $P_o$).
Decomposing the costs of distance

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<td></td>
</tr>
<tr>
<td>Ethiopia</td>
<td>Nigeria</td>
<td></td>
</tr>
<tr>
<td>Great circle distance</td>
<td>3.53</td>
<td>5.26</td>
</tr>
<tr>
<td>Quickest route road distance</td>
<td>3.19</td>
<td>5.40</td>
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<td>Quickest route travel time</td>
<td>2.46</td>
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- Ratios also similar (2.31 and 4.19) with destination FE so not just location-specific factors correlated with distance (productivity, wages).
- High African costs plausibly due to: waiting times for loading and checkpoints; bribes and theft; low payload utilization and total miles traveled; high fuel costs; old inefficient trucks; poor roads; bad logistics.
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<th>(4)</th>
</tr>
</thead>
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<tr>
<td></td>
<td>Ratio relative to US trucking costs (Teravaninthisorn and Raballand, 2009)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>East Africa (Mombasa-Nairobi)</td>
<td>West Africa (Bamako-Accra)</td>
</tr>
<tr>
<td>Per km for one truckload</td>
<td>1.88</td>
<td>3.28</td>
</tr>
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Outline of Talk

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Model Environment and Estimation Strategy

Empirics: How large are intranational trade costs?

Implications for the incidence of globalization

Concluding Remarks
Who is capturing the gains from globalization?

- Thought experiment: suppose the port price of an import falls due to “globalization” (e.g. tariffs or shipping prices fall).

- We consider the implications of our estimates for the impact of this globalization event on different groups (consumers and intermediaries).

- Two caveats:
  1. We are constrained by the lack of quantity data here.
  2. All estimates so far obtained from a sample of largely (but not entirely) domestic goods. (But many of the domestic goods are produced at a main port city and the same intermediaries are likely to trade domestic and foreign goods.)
Implication 1: Remoteness and the size of the surplus

- In the extreme, high MC of distance may prevent goods from reaching remote locations.
  - No increase in quantity of surplus from price reduction at border.

- We lack quantity data, but provide suggestive evidence from product availability regressions:
  - CPI Enumerators record no price when cannot find product in particular month-location.
Implication 1: Remoteness and the size of the surplus
Implication 2: Remoteness and the distribution of surplus

- Inland consumers benefit from price reduction at port/factory.
- But how much of this additional surplus do they enjoy, as opposed to intermediaries or deadweight loss?
- Once again, the pass-through rate is key determinant.

- Following logic in Weyl and Fabinger (2013), under A1-A3 intermediary profits consumer surplus is:

\[
\frac{\Pi_d}{CS_d} = \frac{1}{\rho_d} + \frac{1 - \phi_{od}}{\phi_{od}}
\]

- Can also derive expression for consumer surplus social surplus (see paper).
Implication 2: Remoteness and the distribution of surplus

- Under A1-A3, profits are decreasing in distance, \( \frac{\partial \Pi_{od}}{\partial x_{od}} < 0 \), if \( \delta_{od} > -1 \) (e.g. \( \rho_d < 1 \) sufficient).
  - Competitiveness index likely to be decreasing in distance due to long-run entry.
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- A5 [Identification of \( \delta^k_{d} \) and \( \phi^k_{od} \)]: The competitiveness index parameter is location-specific, \( \phi^k_{od} = \phi_d \), the “super elasticity” parameter is product \( k \)-specific, \( \delta^k_{d} = \delta^k \).

- Result 3(b): Under A1-A5, can use \( K \times D \) estimated \( \rho^k_{d} \)s to estimate \( K + D \) unknown \( \phi_d \) and \( \delta^k \)s from \( \rho^k_{d} = \left(1 + \frac{\delta^k}{\phi_d}\right)^{-1} \).
  - Transform \( \ln\left(\rho^k_{d}^{-1} - 1\right) = \ln \delta^k - \ln \phi_d \) and normalize lowest \( \phi_d = 1 \).
Estimated competitiveness index

Relative competitiveness index $\phi$ of intermediaries at destination market (with lowest $\phi$ normalized to 1)

Distance from location to commercial capital (miles, log scale)
Comparison of competitiveness index estimates with outside data

Ethiopia Distributive Trade Surveys (2001 and 2008)

\[ \beta = 0.0057 \quad (t \text{-stat}=4.49) \]

95% confidence intervals shown. Locally weighted polynomial (Epanechnikov kernel, optimal bandwidth).

Plot of competitiveness index against number of wholesalers from 2001 and 2008 Distributive Trade Survey.
Implication 2: Remoteness and the distribution of surplus

Ethiopia: Intermediary profits over consumer surplus

Nigeria: Intermediary profits over consumer surplus

US: Intermediary profits over consumer surplus

Ethiopia: Share of consumer surplus in total surplus

Nigeria: Share of consumer surplus in total surplus

US: Share of consumer surplus in total surplus

Distance from origin location to destination market (miles, log scale)
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  - (Approximately 4-5 X larger than US costs.)
- Under-estimated by standard spatial price gap methods.
  - MC of distance doubles when only use trading pairs, doubles when account for spatial variation in $\mu$ using sufficient statistic $(\rho)$ approach.
- Methodological Contribution:
  - Results do not require estimating price elasticities or markups.
  - Valuable where price data available but quantity data scarce.
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  1. Trade generates less surplus for remote consumers/intermediaries.
  2. Additionally, consumers in remote locations capture a smaller share of whatever surplus is generated.

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