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

David Atkin[1] Dave Donaldson[2]

[1]Yale

[2]MIT

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).

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).

- **Question: How large are intra-national trade costs in developing countries?**
  - Lots of anecdotes but scarce evidence.

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).

- **Question: How large are intra-national trade costs in developing countries?**
  - Lots of anecdotes but scarce evidence.

- 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 (eg 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)

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:

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**

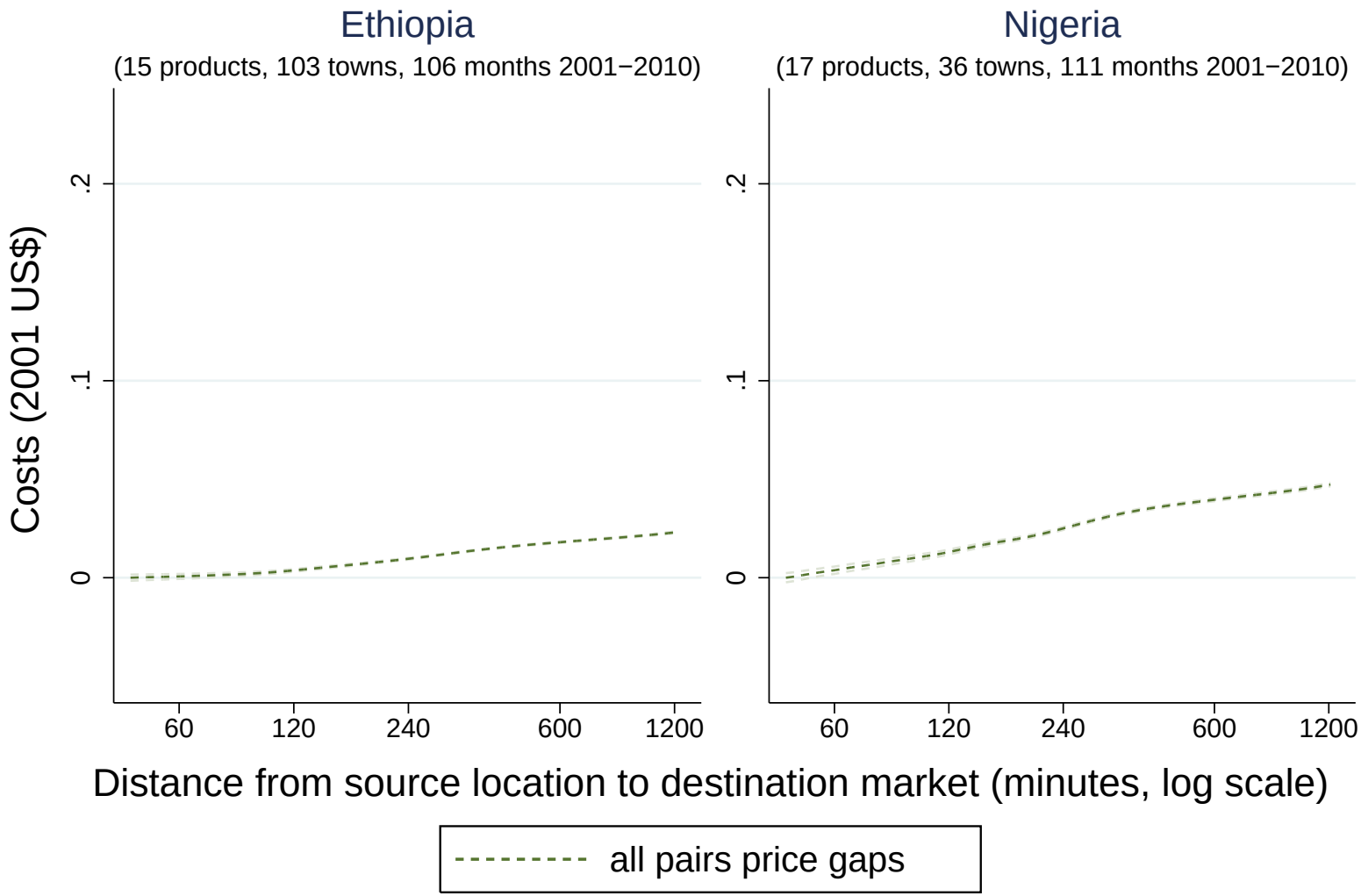
Estimating Trade Costs from Spatial Price Gaps: 3 Challenges

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:

Estimating Trade Costs from Spatial Price Gaps: 3 Challenges

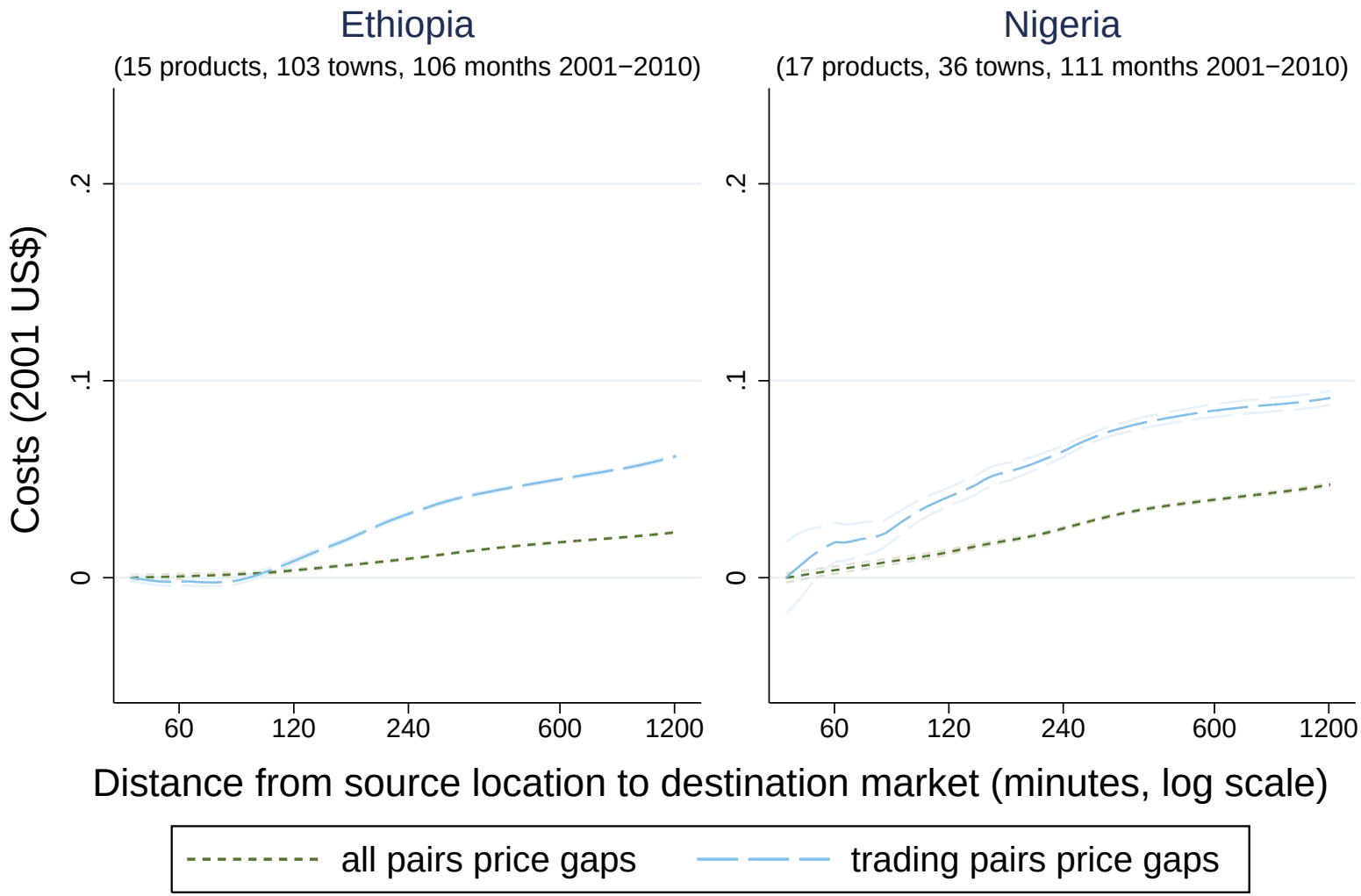
1. Spatial price gaps may reflect differences in product characteristics (eg quality):
   - We use newly collected CPI micro-data on extremely **narrowly defined** brand name consumer products (akin to barcodes)
2. Spatial price gaps are only rarely informative about the level (rather than the range) 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**

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



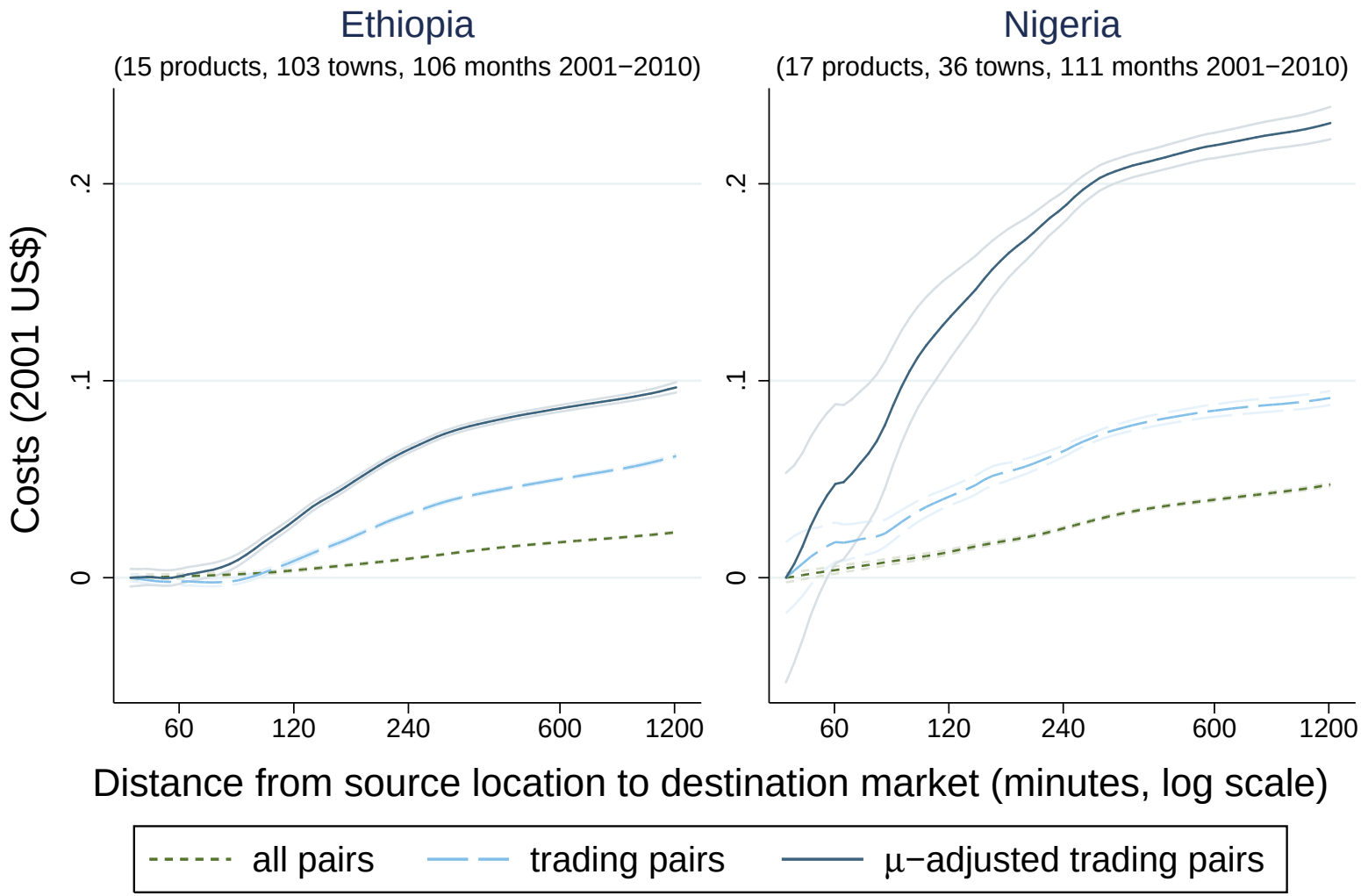
95% confidence intervals shown. Locally weighted polynomial (Epanechnikov kernel, bandwidth=0.5).
All plots are semiparametric and include product−time fixed effects (Baltagi and Li, 2002).

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



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.

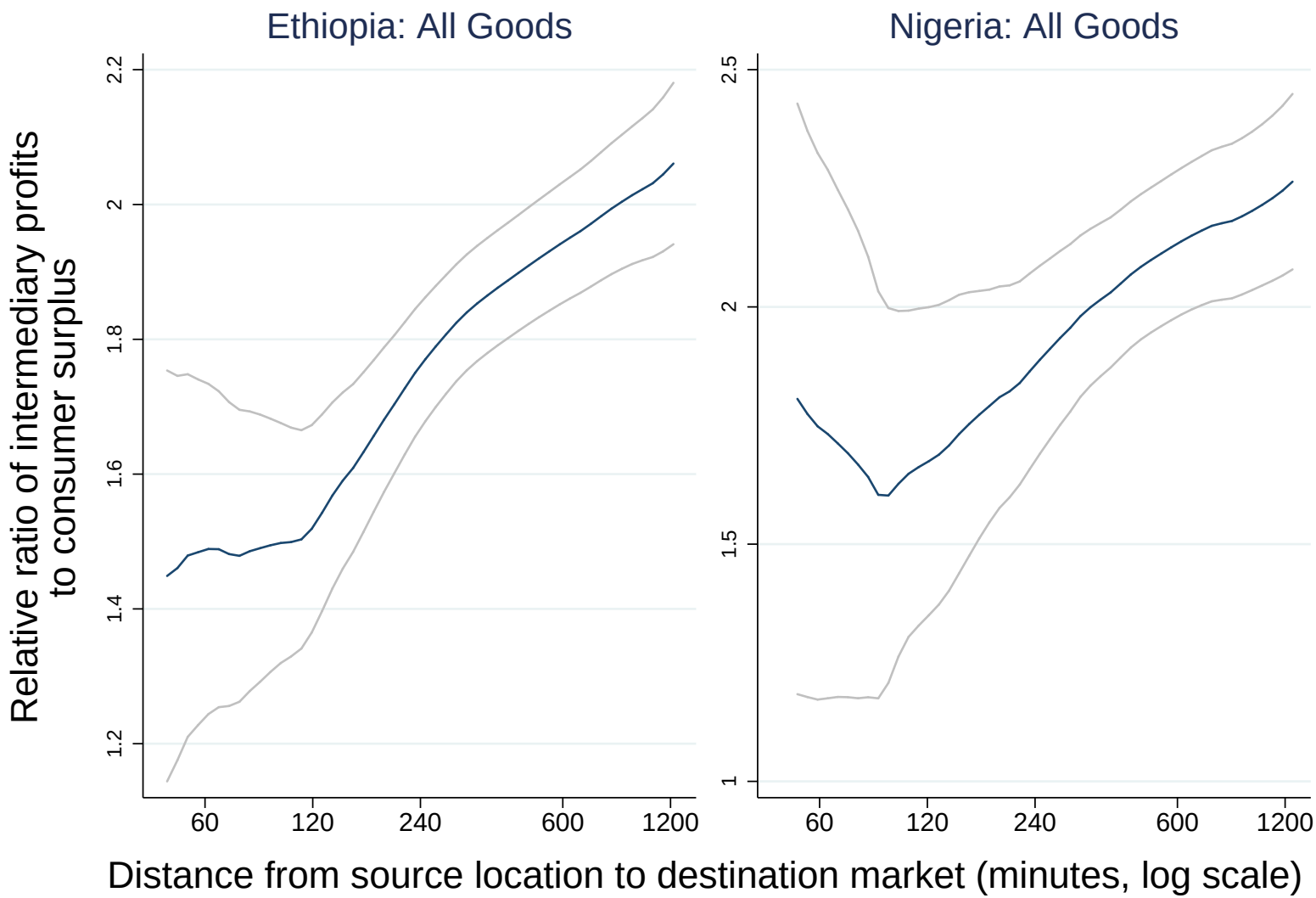
Implication: 2 Effects of Remoteness on Social Surplus

1. We find extremely high marginal costs of distance (**7-15X larger than** CAN-US trucking from Hummels 2001).
   - $\Longrightarrow$ 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).
   - $\Longrightarrow$ Less social surplus from trade available to remote consumers/intermediaries
2. We also find that remote markets are less competitive.
   - $\Longrightarrow$ 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

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).

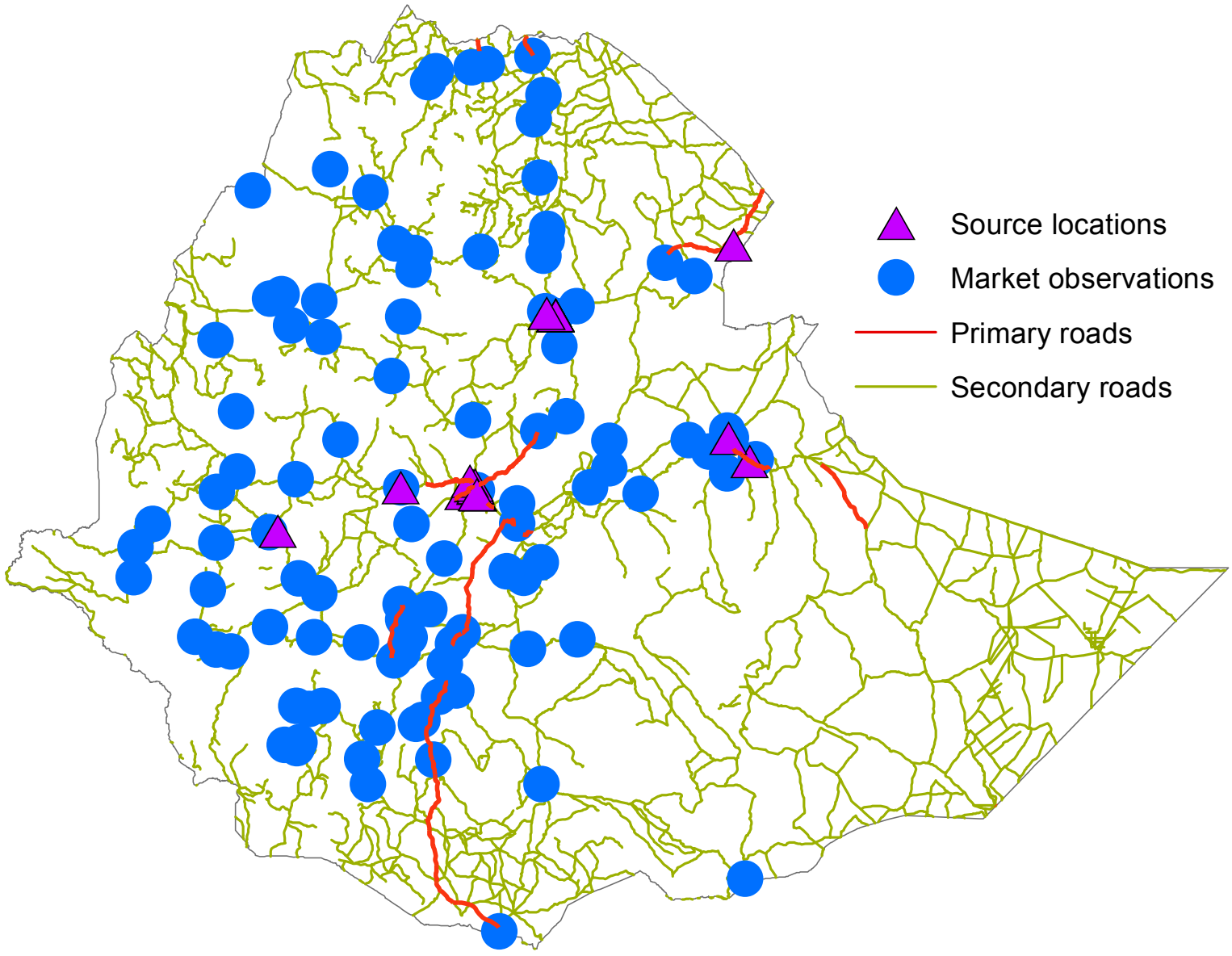
Dataset 1: CPI micro-data from set of developing countries

- 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*?].

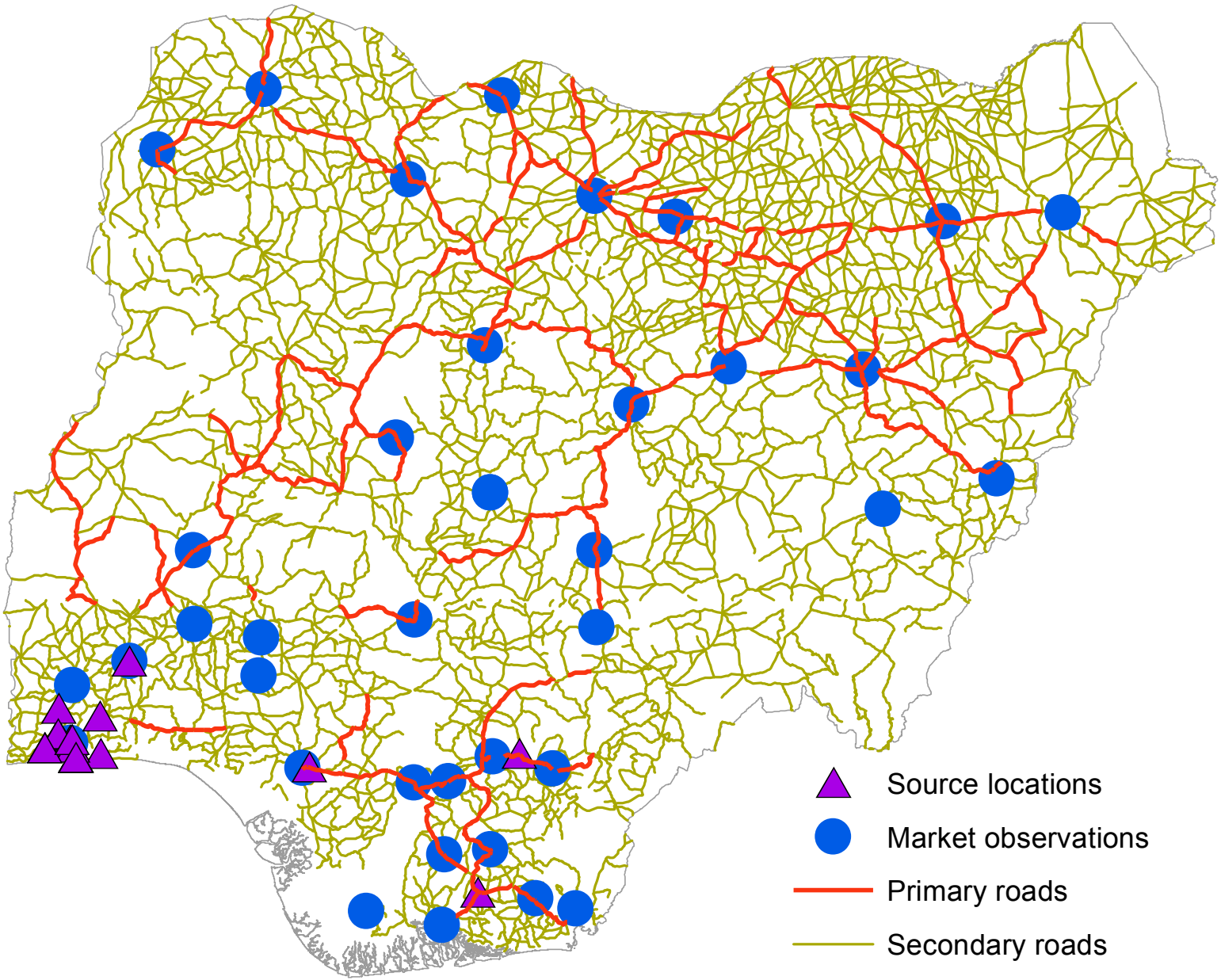
Dataset 2: Source Locations

- 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 Ethiopian Sample Locations



Map of Nigerian Sample Locations



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.

	Minutes/Mile	
Road Quality	Ethiopia	Nigeria
National highway	1.2	1.2
Secondary road	1.4	1.4
Tertiary road	1.9	2.4

- Results robust to using road or great circle distance.

Outline of Talk

Introduction

Data

How large are intranational trade costs?

Implication: Who is capturing the gains from globalization?

Concluding Remarks

How large are intranational trade costs? 3 Steps

1. Importance of knowing the source location.

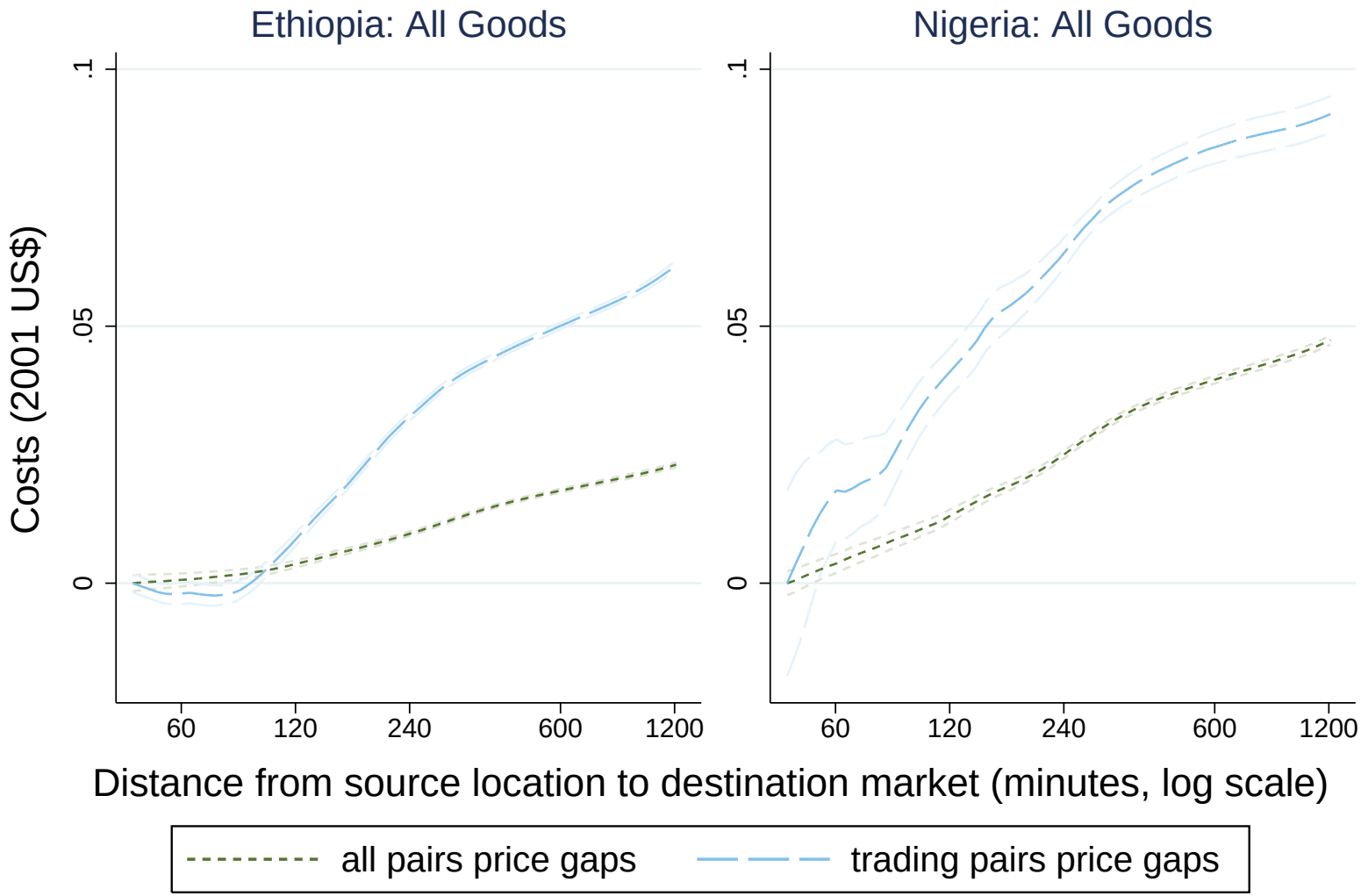
1. Estimates of 'pass-through' (denoted by ρ) for each location and product.

2. Use estimates of ρ 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: $P^k_{dt} - P^k_{ot} = \tau(\mathbf{X}^k_{odt})$
  - to **'all pairs'**: any pair of locations (i, j) which may or may not be trading; with perfect competition theory says: $P^k_{it} - P^k_{jt} = \tau(\mathbf{X}^k_{oit}) - \tau(\mathbf{X}^k_{ojt}) \lesseqgtr \tau(\mathbf{X}^k_{ijt})$

Step 1: Importance of Knowing the Source Location



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.

Step 2: Estimating Pass-Through

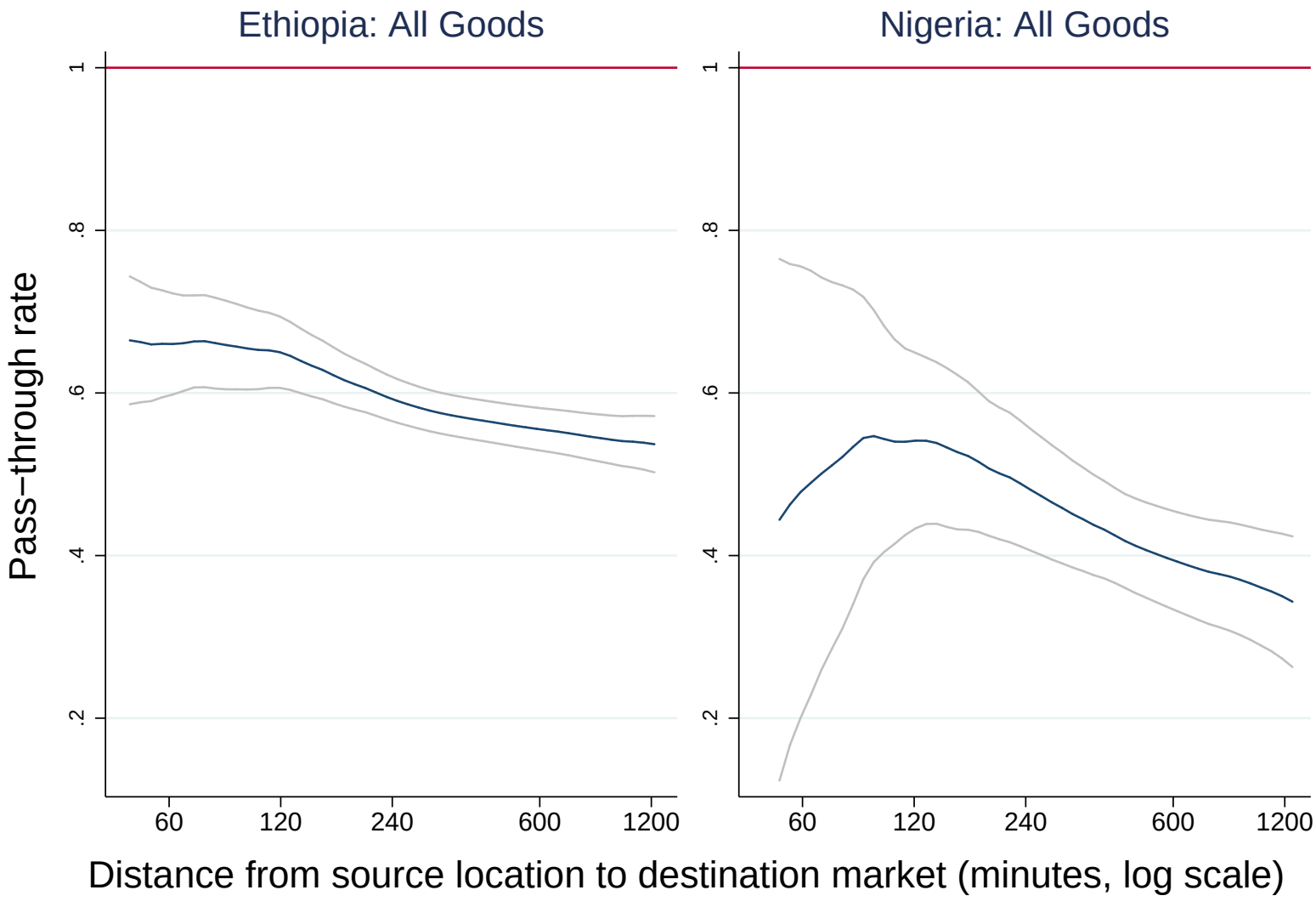
- **Why is pass-through useful here?**
  - If $\rho = 1$, then prices are changing one-for-one with marginal costs.
    - This implies that mark-ups are not changing with marginal costs.
    - That is, the way price gaps vary over distance measures how marginal costs vary over distance.
  - If $\rho < 1$, 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



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

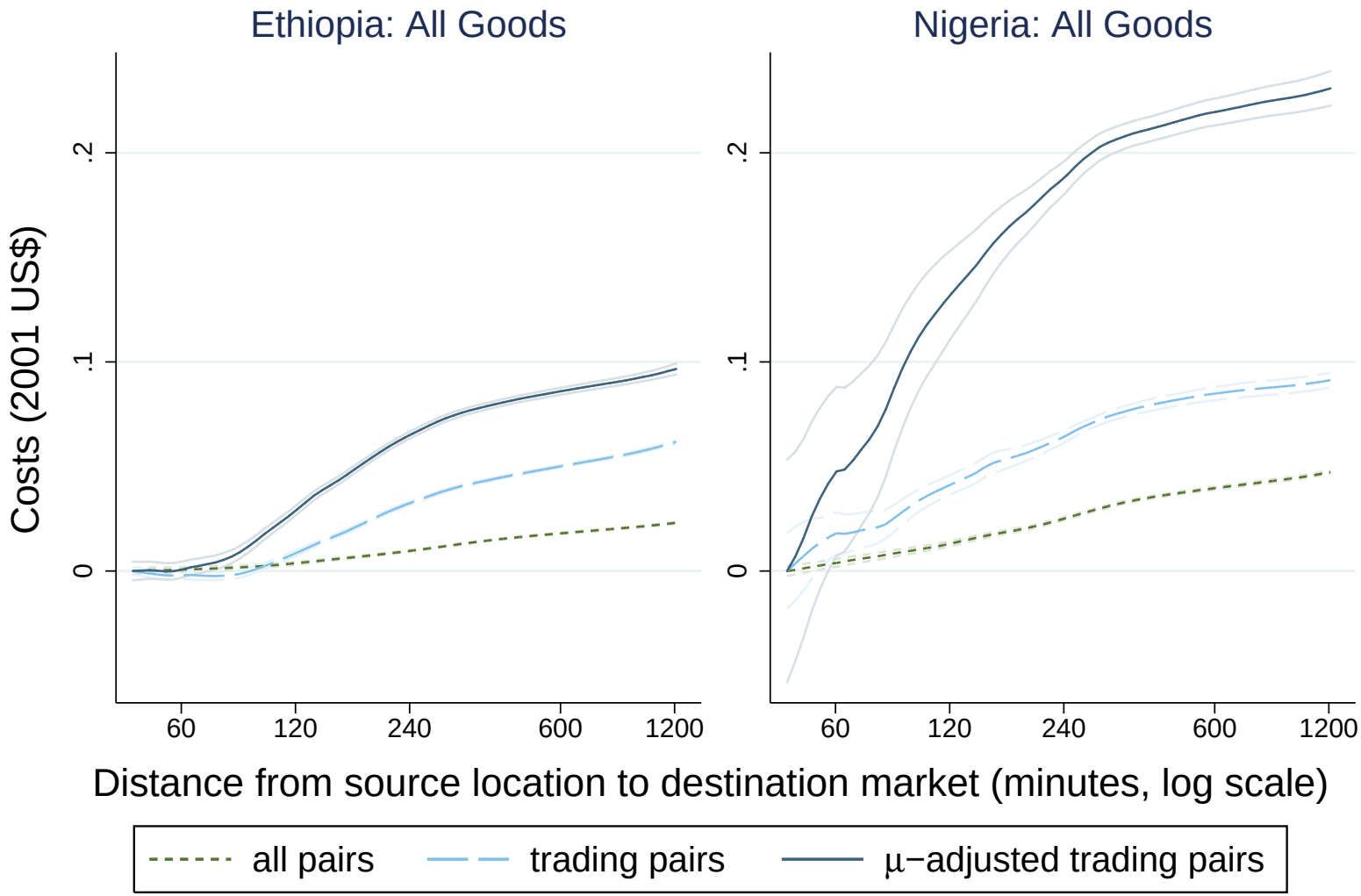
Step 3: How large are intranational trade costs?

- 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?



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.

Step 3: How large are intranational trade costs?

	Ethiopia (Trading Pairs)		Nigeria (Trading Pairs)	
	Price Gap	Adjusted Gap	Price Gap	Adjusted Gap
Log distance to source (minutes)	0.0289***	0.0411***	0.0343***	0.0570***
	(0.00147)	(0.00246)	(0.00529)	(0.00862)
Time-Product FE	Yes	Yes	Yes	Yes
Time-Product $\times \frac{1-\widehat{\rho^k_{od}}}{\widehat{\rho^k_{od}}}$	No	Yes	No	Yes
Destination $\times \frac{1-\widehat{\rho^k_{od}}}{\widehat{\rho^k_{od}}}$	No	Yes	No	Yes
Observations	100762	100762	23084	23084
R-squared	0.258	0.933	0.504	0.964

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:
  - Hummels (2001) estimates elasticity of ad valorem freight costs with distance using customs records.
  - Use these estimates to calculate additional ad valorem cost to reach locations 3 log units further away:

Implied Δad-valorem transport cost for Δ ln distance of 3 units (by mode of transport for cargo of mean kg/$)	
US Imports (Truck from CAN)	**2.0 percent**
US Imports (Rail from CAN)	2.7 percent
US Imports (Ocean)	4.9 percent
US Imports (Air)	14.6 percent

- Compare to: **30 percent** in Ethiopia, **14 percent** in Nigeria.

Outline of Talk

Introduction

Data

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:

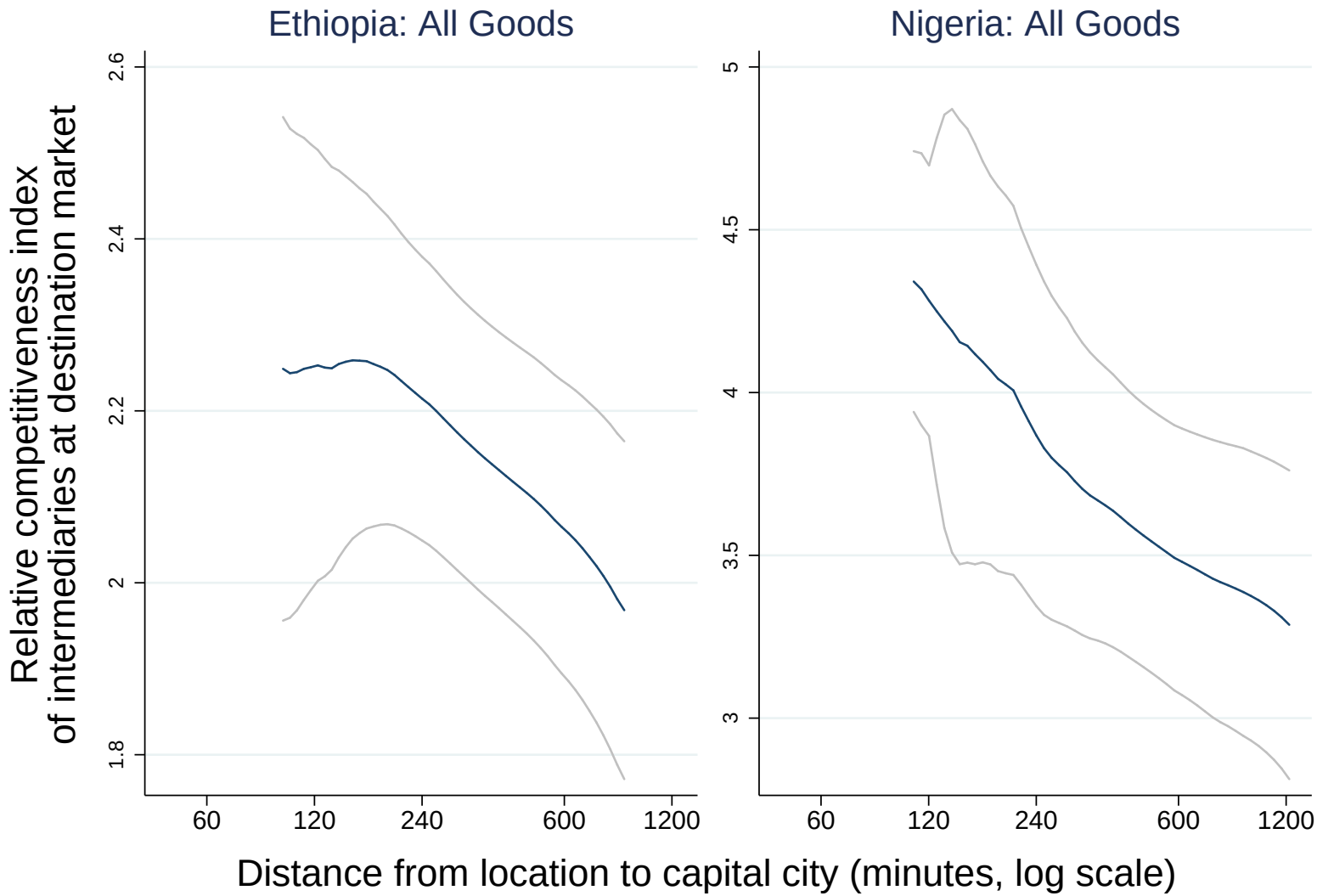
1. High marginal cost of distance $\Longrightarrow$ remote locations see smaller increases in the *quantity* of surplus available to consumers/intermediaries.

2. Markups vary across space $\Longrightarrow$ 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

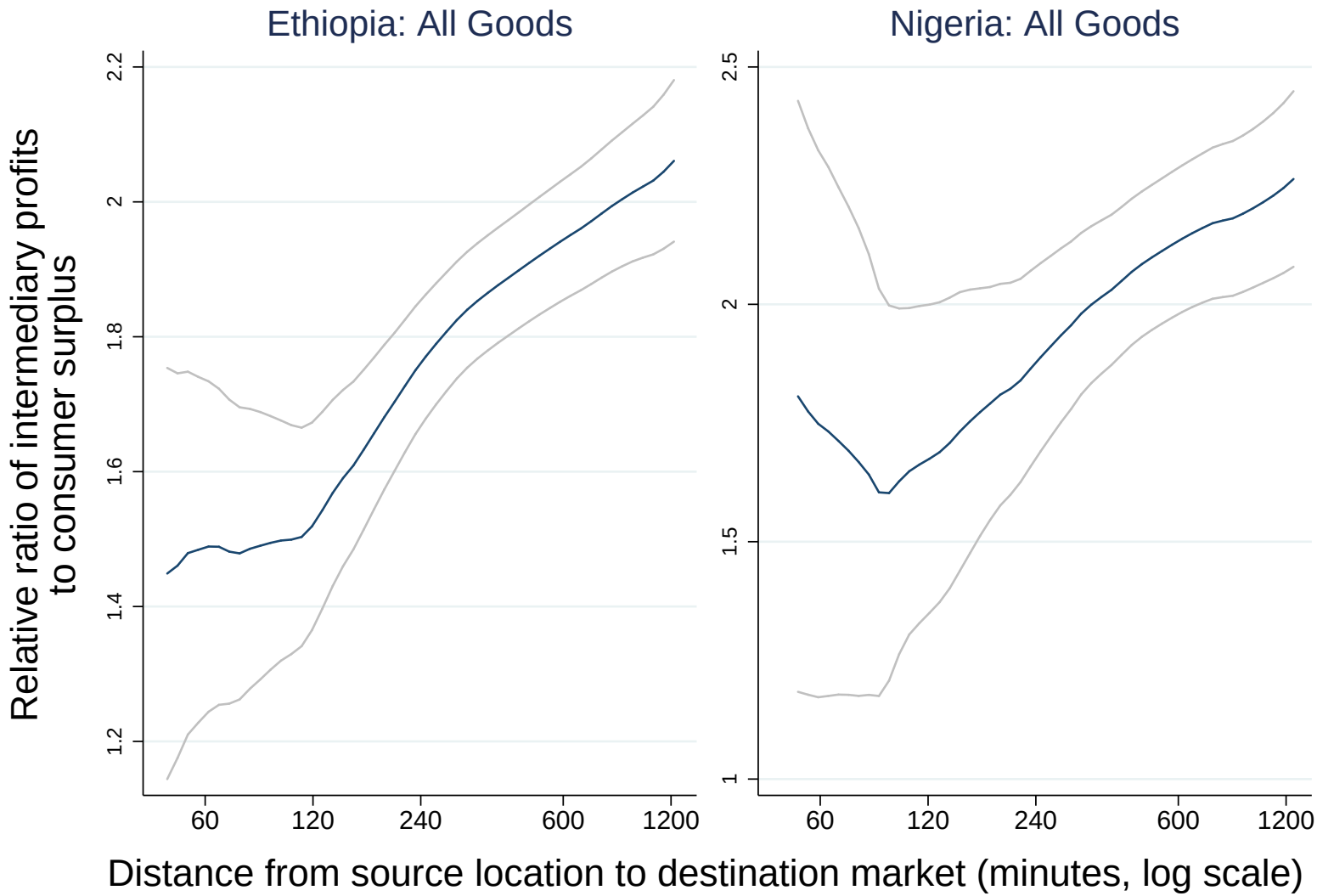
- How to measure the distribution of surplus?
- Turns out that (under conditions that we lay out in the paper) pass-through is all one needs to know.
- Pass-through can also be used to estimate measures of (relative) 'competitiveness' in each market.
  - Intuitively, all else equal, if pass-through is close to one then competitiveness must be high.

Who is capturing the gains from globalization? Competitiveness Index



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?

	Ethiopia	Nigeria	Ethiopia	Nigeria
	Relative Competitiveness Index of Intermediaries (All Locations)		Intermediary Profits/ Consumer's Surplus (All Good-Location Pairs)	
Log distance to capital (minutes)	-0.230**	-0.707***		
	(0.106)	(0.169)		
Log distance to source (minutes)			0.284***	0.336***
			(0.0606)	(0.116)
Constant	3.459***	8.004***	0.161	-0.0103
	(0.621)	(1.012)	(0.359)	(0.73)
Observations	100	36	1418	489
R-squared	0.027	0.150	0.014	0.019

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.

Outline of Talk

Concluding Remarks

- **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