Trade Costs and Global Sourcing: Evidence from Importers' Use of Customs Brokers

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May 17, 2024

Disclaimer

This material is based upon work supported by the National Science Foundation Graduate Research Fellowship Program under Grant No. 1256260. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author and do not necessarily reflect the views of the National Science Foundation.

The Census Bureau has ensured appropriate access and use of confidential data and has reviewed these results for disclosure avoidance protection (Project 7527352: CBDRB-FY23-CED006-0021, CBDRB-FY24-CED006-0010). Any views expressed are those of the author and not those of the US Census Bureau.

Motivation: Supply Chain disruptions/shocks and costly switching

- Supply chain disruptions over the last five years
- Firms in the U.S. are seeking alternative sources for inputs. Surveys
- But relationships are persistent and adjustments are costly (Monarch and Schmidt-Eisenlohr, 2017; Monarch, 2022)
- Much less is known about the customs brokers that manage and facilitate foreign sourcing decisions and switching. (NPR, 2019)

What is a customs broker?

U.S. Customs and Border Protection:

Customs Brokers are licensed by U.S. Customs and Border Protection (CBP) to conduct CBP business on behalf of importers. They take the burden of **filling out paperwork** and **obtaining a CBP bond** off of the importer's hands. The importer is always ultimately responsible for knowing CBP requirements and for ensuring their importation complies with all federal rules and regulations, but **using a Customs Broker can save you from making costly mistakes**.

If your goods are being imported via an express courier (Fed-Ex, DHL), **the courier automatically utilizes Customs Brokers** to clear your goods on your behalf. If you have any concerns about their charges for this service, please contact the courier company directly. Customs Brokers charge for their services, so you may want to contact a few to discuss rates."

Ten Largest Customs Brokers by Number of Locations

Broker Name	Number of Locations
FedEx Trade Networks Transport & Brokerage	106
UPS Supply Chain Solutions	94
DHL Global Forwarding	82
Expeditors International of Washington	51
Kuehne & Nagel Inc.	50
A N Deringer Inc.	44
Cole International USA Inc.	40
Livingston International Inc.	40
CEVA International Inc.	40
Vandegrift Forwarding Company Inc.	35

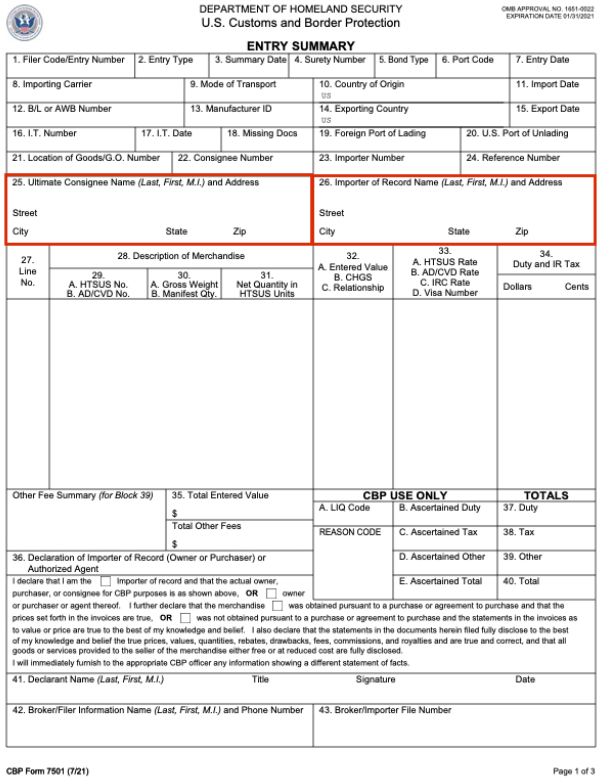
Note: Data publicly available on the U.S. Customs and Border Protection (CBP) website. There are 1,208 firms registered on CBP's site.

New Data and Evidence on Role of Customs Brokers in US

- New Data:
  - Construct a new dataset linking both customs brokers and importers from import transactions to firm characteristics (Building upon Kamal & Ouyang (2020)
  - Document key facts on customs brokers, the firms that use them, and the transactions they facilitate ‘
- Results
  - Brokers facilitate adjustment to new source countries.
  - Estimated switching costs lower with brokers in structural model

Identifying Brokers

- Universe of import transactions matched to US firms (U.S. Census LFTTD and LBD)
- Exploit post-9/11 change in data collection: from 2007 forward, both importer of record (IOR) and ultimate consignee (UC) are listed in a transaction.
- Where UC and IOR are different, IOR is a licensed U.S. customs broker.



DEPARTMENT OF HOMELAND SECURITY
U.S. Customs and Border Protection

OMB APPROVAL NO. 1651-0022
EXPIRATION DATE: 01/31/2021

ENTRY SUMMARY

1. Filer Code/Entry Number	2. Entry Type	3. Summary Date	4. Surety Number	5. Bond Type	6. Port Code	7. Entry Date

8. Importing Carrier	9. Mode of Transport	10. Country of Origin	11. Import Date
		US	

12. B/L or AWB Number	13. Manufacturer ID	14. Exporting Country	15. Export Date
		US	

16. I.T. Number	17. I.T. Date	18. Missing Docs	19. Foreign Port of Lading	20. U.S. Port of Unlading

21. Location of Goods/G.O. Number	22. Consignee Number	23. Importer Number	24. Reference Number

25. Ultimate Consignee Name *(Last, First, M.I.)* and Address	26. Importer of Record Name *(Last, First, M.I.)* and Address
Street City State Zip	Street City State Zip

27. Line No.	28. Description of Merchandise 29. A. HTSUS No. B. AD/CVD No.	30. A. Gross Weight B. Manifest Qty.	31. Net Quantity in HTSUS Units	32. A. Entered Value B. CHGS C. Relationship	33. A. HTSUS Rate B. AD/CVD Rate C. IRC Rate D. Visa Number	34. Duty and IR Tax Dollars Cents

Other Fee Summary *(for Block 39)*	35. Total Entered Value $ Total Other Fees $	CBP USE ONLY A. LIQ Code REASON CODE	TOTALS B. Ascertained Duty C. Ascertained Tax D. Ascertained Other E. Ascertained Total	37. Duty 38. Tax 39. Other 40. Total

36. Declaration of Importer of Record (Owner or Purchaser) or Authorized Agent

I declare that I am the ☐ Importer of record and that the actual owner, purchaser, or consignee for CBP purposes is as shown above, **OR** ☐ owner or purchaser or agent thereof. I further declare that the merchandise ☐ was obtained pursuant to a purchase or agreement to purchase and that the prices set forth in the invoices are true, **OR** ☐ was not obtained pursuant to a purchase or agreement to purchase and the statements in the invoices as to value or price are true to the best of my knowledge and belief. I also declare that the statements in the documents herein filed fully disclose to the best of my knowledge and belief the true prices, values, quantities, rebates, drawbacks, fees, commissions, and royalties and are true and correct, and that all goods or services provided to the seller of the merchandise either free or at reduced cost are fully disclosed.
I will immediately furnish to the appropriate CBP officer any information showing a different statement of facts.

41. Declarant Name *(Last, First, M.I.)*	Title	Signature	Date

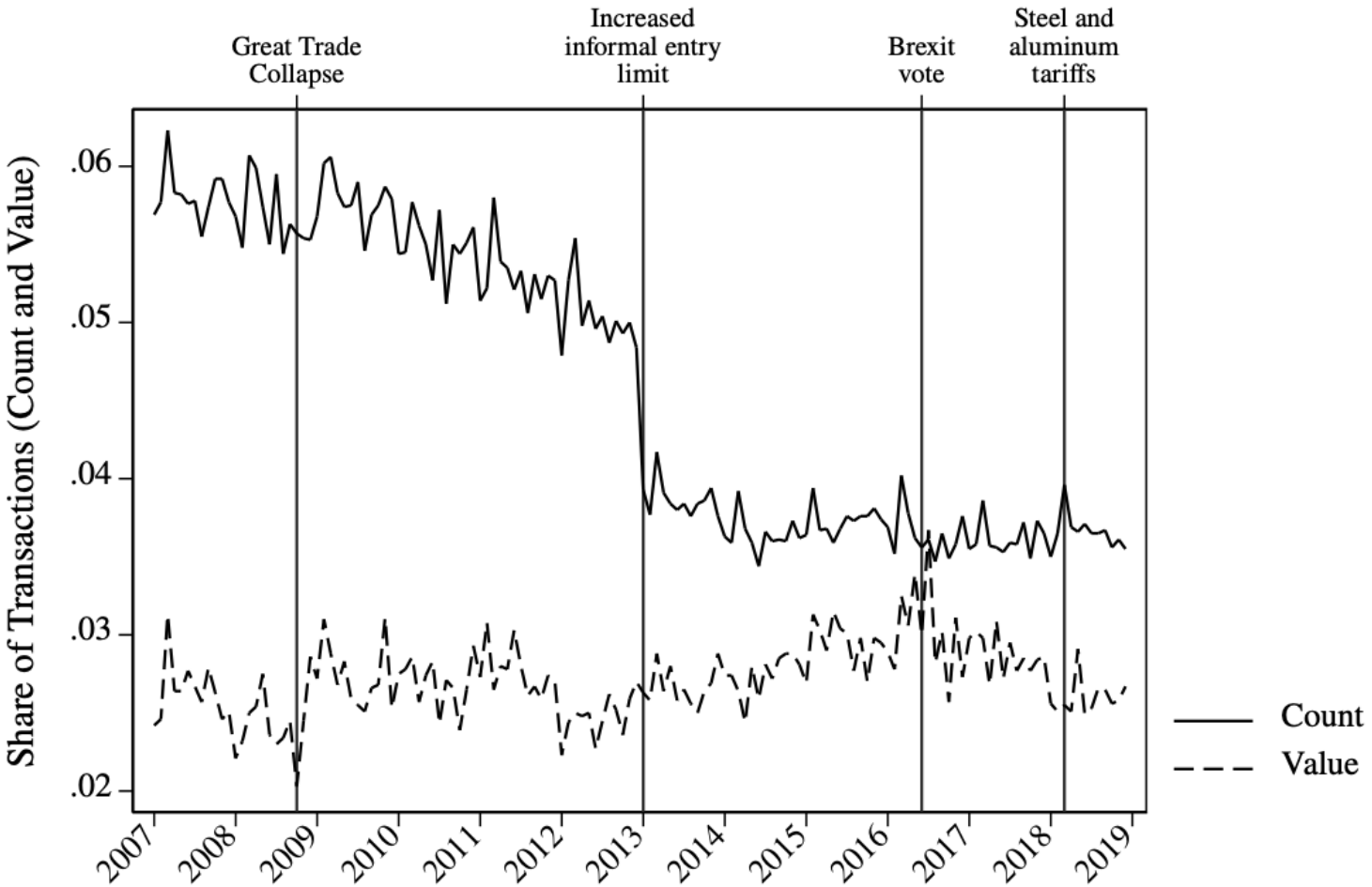
42. Broker/Filer Information Name *(Last, First, M.I.)* and Phone Number	43. Broker/Importer File Number

CBP Form 7501 (7/21) Page 1 of 3

Key facts on brokers

- **Using a broker is common**: Each year from 2007-2019, 55%-64% of "Ultimate Consignee" (UC) firms use a customs broker for at least one shipment.
- **Among set of importing firms, operating as broker is rare**: 4%-5% of unique "Importer of Record" (IOR) firms are acting as brokers in a given year.
- **Broker size premium**:
  - Average 2017 employment for a broker IOR: 2,053
  - Average 2017 employment for a non-broker IOR: 219.2
- **Broker utilization size premium**:
  - Average 2017 employment for an UC using a broker: 538.4
  - Average 2017 employment for an UC not using a broker: 44.45

Brokered share of transactions over time



Brokers are providing necessary trade services.

- Label the following as "trade-related services":
  - 488510: Freight Transportation Arrangement
  - 492110: Couriers and Express Delivery Services
  - 541614: Process, Physical Distribution, and Logistics Consulting Services
- Importers of Record:
  - 55.3% of IORs acting as brokers have employment in trade services.
  - 10.9% of IORs *not* acting as brokers have employment in trade services.
- Ultimate Consignees:
  - 8.5% of UCs using brokers have employment in trade services.
  - 10.9% of UCs *not* using brokers have employment in trade services.

Dynamics of Broker Use

Table: 3×3 Transition Matrix for Import Behavior

	State at $t+1$		
State at t	Import with Broker	Import w/o Broker	No Import
Import with broker	31.57%	7.89%	60.54%
Import w/o broker	3.69%	51.26%	45.05%
No Import	4.21%	6.4%	89.39%

- Importers using a broker in t are more likely not to import in time $t+1$
- Importers not using a broker in t are unlikely to begin using a broker in $t+1$

2x2 Matrix AR(3)

Documenting facts about disaggregated transactions

Want to know the relationship between customs brokers and:

- Shipping rates
- Shipping time

Need full information from individual shipments

Brokers are associated with lower shipping time

Dependent Variable: ln(Shipping Time)

$\mathbb{1}\{\text{Broker}_{c,j,t}^{m,x}\}$	-0.1042***	-0.1339***	-0.1364***	-0.1382***	-0.1397***	-0.1361***
	(3.234e-04)	(3.423e-04)	(3.407e-04)	(3.428e-04)	(3.465e-04)	(3.447e-04)
$\ln(\text{Employment}_t^m)$	0.004057***	0.001156***	9.574e-04***	8.252e-04***	0.001076***	0.001022***
	(1.021e-05)	(1.559e-05)	(1.553e-05)	(1.559e-05)	(1.597e-05)	(1.589e-05)
$\mathbb{1}\{Broker_{c,j,t}^{m,x}\}$	0.02268***	0.02592***	0.02602***	0.02605***	0.02589***	0.02535***
$\times\ln(\text{Employment}_t^m)$	(3.204e-05)	(3.498e-05)	(3.483e-05)	(3.498e-05)	(3.537e-05)	(3.519e-05)
Constant	1.303***	1.325***	1.326***	1.327***	1.326***	1.326***
	(7.716e-05)	(1.138e-04)	(1.135e-04)	(1.138e-04)	(1.164e-04)	(1.158e-04)
Observations	400000000	400000000	400000000	400000000	400000000	400000000
R-squared	0.873	0.875	0.877	0.878	0.88	0.882
Fixed effects						
Country	✓	✓	✓	✓	✓	✓
Date	✓	✓	✓	✓	✓	✓
HS4	✓	✓	✓	✓	✓	✓
Mode	✓	✓	✓	✓	✓	✓
NAICS		✓	✓	✓	✓	✓
Country x Date			✓	✓	✓	✓
HS4 x Date				✓	✓	✓
NAICS x Date					✓	✓
Mode x Date						✓

Eqn

Brokers are associated with higher shipping rates

	Dependent Variable: $\ln\left(\frac{\text{Shipping Charges}^m_{x,j,t}}{\text{Weight}^m_{x,j,t}}\right)$					
$\mathbb{1}\{Broker^m_{x,j,t}\}$	1.082***	1.078***	1.074***	1.077***	1.072***	1.067***
	(3.727e-04)	(3.830e-04)	(3.823e-04)	(3.816e-04)	(3.825e-04)	(3.810e-04)
Constant	-1.573***	-1.574***	-1.574***	-1.574***	-1.574***	-1.574***
	(7.484e-05)	(7.419e-05)	(7.397e-05)	(7.335e-05)	(7.254e-05)	(7.220e-05)
Observations	400000000	400000000	400000000	400000000	400000000	400000000
R-squared	0.608	0.62	0.622	0.629	0.638	0.641
Country FE	✓	✓	✓	✓	✓	✓
Date FE	✓	✓	✓	✓	✓	✓
HS4 FE	✓	✓	✓	✓	✓	✓
Mode FE	✓	✓	✓	✓	✓	✓
NAICS FE		✓	✓	✓	✓	✓
Country x Date FE			✓	✓	✓	✓
HS4 x Date FE				✓	✓	✓
NAICS x Date FE					✓	✓
Mode x Date FE						✓

Eqn

Documenting patterns in aggregated data

Want to know:

- The firm and product characteristics that influence the probability of using a broker

Construct data:

- Aggregate transactions to the firm-HS8-country-year level
- Assign $\text{Broker}^{m}_{c,j,t} = 1$ if the firm imports any value of product j from country c in time t.
- Vast majority of firms import all value or no value via broker at the product-country level.

Determinants of broker use

	Dependent Variable: $\mathbb{1}\{\text{Broker}^m_{c,j,t}\}$					
$\ln(\text{Value}^m_{c,j,t})$	0.04305***	0.04314***	0.05343***	0.06211***	0.04314***	0.04993***
	(0.001643)	(0.001637)	(0.003744)	(0.003454)	(0.001637)	(0.001761)
$\ln(\text{Weight}^m_{c,j,t})$	-0.05339***	-0.05339***	-0.07466***	-0.07816***	-0.05339***	-0.05495***
	(0.001522)	(0.001522)	(0.003315)	(0.003444)	(0.001522)	(0.001497)
$\ln(\text{Employment}^m_t)$	-0.003619***	-0.003642***	-0.01248***	-0.01482***	-0.003668***	-0.005944***
	(9.569e-04)	(9.516e-04)	(0.003088)	(0.003110)	(9.569e-04)	(6.006e-04)
$\text{Related}^m_{c,j,t}$	-0.1290***	-0.1290***	-0.1884***	-0.2065***	-0.1290***	-0.1438***
	(0.008084)	(0.008095)	(0.01237)	(0.01654)	(0.008097)	(0.01137)
$\ln(1+\tau_{c,j,t})$		0.1426***	0.1905***	0.2708***	0.1428***	0.1751***
		(0.03295)	(0.07804)	(0.1088)	(0.03295)	(0.04519)
$\text{NTM}_{c,j,t}$	-0.01098**	-0.01085**			0.00118	0.02554**
	(0.005425)	(0.005447)			(0.02600)	(0.01152)
USDA_j	0.03786***	0.04190***	0.02149***	0.03707***	0.02073***	
	(0.006751)	(0.01138)	(0.006786)	(0.006484)	(0.003881)	
HITECH_j	0.006868	0.01795	0.06615***	0.006926	0.06367***	
	(0.007288)	(0.01192)	(0.03255)	(0.007353)	(0.01399)	
$\lambda_{c,j,t}$					2.53e-04***	0.06368***
					(8.197e-05)	(0.01397)
Constant	0.2224***	0.2121***	0.2971***	0.2124***	0.2119***	0.1354***
	(0.01293)	(0.01200)	(0.03380)	(0.03089)	(0.01200)	(0.01765)
Observations	228000000	228000000	858700000	858700000	858700000	858700000
R-squared	0.513	0.513	0.292	0.290	0.292	0.290
Fixed effects						
t	✓	✓	✓	✓	✓	✓
c	✓	✓	✓	✓	✓	✓
j	✓	✓	✓	✓	✓	✓
m	✓	✓			✓	✓

Eqn Shipment level

- Controlling for weight, higher value imports are more likely to use broker
- Smaller firms are less likely to use brokers
- Related party transactions are less likely to use brokers
- Higher duty rate associated with higher probability of broker
- Agricultural and high tech goods are more likely to use brokers

Role of customs brokers in supply chain adjustments

Empirically estimate the role that brokers play in choosing country source.

Setup:

- Let $v^m_{j,t} = \sum_c v^m_{c,j,t}$
- Let $c^m_{j,t}$ be m's primary source for product j in time t
  - If m imports j from only one country, $c^m_{j,t}$ is that country.
  - If m imports j from multiple countries, $c^m_{j,t}$ the country with the highest share of $v^m_{j,t}$.
- Construct three indicator variables: $Stay^m_{j,t}$, $NewSource^m_{j,t}$, and $Reallocate^m_{j,t}$
- All indicators are conditional on $v^m_{j,t} > 0$ and $v^m_{j,t-1} > 0$

Source Selection: "Stay"

First, construct an indicator of staying with one's primary supplier:

$$Stay_{j,t}^{m} = \begin{cases} 1, & \text{if } c_{j,t}^{m} = c_{j,t-1}^{m} \\ 0, & \text{otherwise} \end{cases}$$

And estimate:

$$\begin{aligned} Stay_{j,t}^{m} = \beta_0 &+ \beta_1 \mathbb{1}\{Broker_{c,j,t-1}^{m}\} \\ &+ \beta_2 ln(p_{c,j,t-1}^{m}) + \beta_4 \tau_{c,j,t-1} + \beta_3 \lambda_{c,j,t-1} \\ &+ \boldsymbol{\beta_5} \mathbb{1}\{Broker_{c,j,t-1}^{m}\} \times \left\{ ln(p_{c,j,t-1}^{m}) + \tau_{c,j,t-1} + \lambda_{c,j,t-1} \right\} \\ &+ \gamma_t + \gamma_j + \varepsilon_{c,j,t} \end{aligned}$$

Source Selection: "Stay"

	$Stay^m_{j,t}$
$ln(p^m_{c,j,t-1})$	-0.0202***
	(0.0006)
$\mathbb{1}\{Broker^m_{c,j,t-1}\}$	-0.1216***
	(0.0094)
$\lambda_{c,j,t-1}$	0.0001
	(0.0001)
$\tau_{c,j,t-1}$	-0.4234***
	(0.0317)
$\mathbb{1}\{Broker^m_{c,j,t-1}\} \times ln(p^m_{c,j,t-1})$	0.0064***
	(0.0006)
$\mathbb{1}\{Broker^m_{c,j,t-1}\} \times \lambda_{c,j,t-1}$	0.0002**
	(0.0001)
$\mathbb{1}\{Broker^m_{c,j,t-1}\} \times \tau_{c,j,t-1}$	-0.2979***
	(0.0283)
Constant	0.6013***
	(0.0071)
Observations	3,224,000
R-squared	0.1177

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
HS8, country, year fixed effects.
Controls for firm size and country size,
as measured by import value, and number of country suppliers.

- Firms using brokers less likely to stay with primary supplier
- Firms using brokers are more responsive to duty rates.

Source Selection: "New Source"

Construct an indicator of beginning to import from a new country:

$$NewSource_{j,t}^{m} = \begin{cases} 1, & \text{if } c_{j,t}^{m} \neq c_{j,t-1}^{m} \ \& \ v_{c,j,t-1}^{m} = 0 \\ 0, & \text{otherwise} \end{cases}$$

And estimate:

$$\begin{aligned} NewSource_{j,t}^{m} = {} & \beta_0 + \beta_1 \mathbb{1}\{Broker_{c,j,t-1}^{m}\} \\ & + \beta_2 ln(p_{c,j,t-1}^{m}) + \beta_4 \tau_{c,j,t-1} + \beta_3 \lambda_{c,j,t-1} \\ & + \boldsymbol{\beta_5} \mathbb{1}\{Broker_{c,j,t-1}^{m}\} \times \left\{ ln(p_{c,j,t-1}^{m}) + \tau_{c,j,t-1} + \lambda_{c,j,t-1} \right\} \\ & + \gamma_t + \gamma_j + \varepsilon_{c,j,t} \end{aligned}$$

Source Selection: "New Source"

	$NewSource^m_{j,t}$
$ln(p^m_{c,j,t-1})$	0.0145***
	(0.0004)
$\mathbb{1}\{Broker^m_{c,j,t-1}\}$	0.1883***
	(0.0086)
$\lambda_{c,j,t-1}$	0.0000
	(0.0001)
$\tau_{c,j,t-1}$	0.2804***
	(0.0207)
$\mathbb{1}\{Broker^m_{c,j,t-1}\} \times ln(p^m_{c,j,t-1})$	-0.0042***
	(0.0004)
$\mathbb{1}\{Broker^m_{c,j,t-1}\} \times \lambda_{c,j,t-1}$	-0.0001**
	(0.0001)
$\mathbb{1}\{Broker^m_{c,j,t-1}\} \times \tau_{c,j,t-1}$	0.1741***
	(0.0205)
Constant	0.4024***
	(0.0060)
Observations	3,224,000
R-squared	0.1134

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
HS8, country, year fixed effects.
Controls for firm size and country size,
as measured by import value, and number of country suppliers.

- Firms using brokers more likely to switch to new source country
- Firms using brokers are more responsive to duty rates.

Source Selection: "Reallocate"

Construct an indicator of changing your primary source of product j to a source you imported from in $t-1$:

$$Reallocate_{j,t}^{m} = \begin{cases} 1, & \text{if } c_{j,t}^{m} \neq c_{j,t-1}^{m} \ \& \ v_{c,j,t-1}^{m} > 0 \\ 0, & \text{otherwise} \end{cases}$$

And estimate:

$$\begin{aligned} Reallocate_{j,t}^{m} = \beta_0 &+ \beta_1 \mathbb{1}\{Broker_{c,j,t-1}^{m}\} \\ &+ \beta_2 ln(p_{c,j,t-1}^{m}) + \beta_4 \tau_{c,j,t-1} + \beta_3 \lambda_{c,j,t-1} \\ &+ \boldsymbol{\beta_5} \mathbb{1}\{Broker_{c,j,t-1}^{m}\} \times \left\{ ln(p_{c,j,t-1}^{m}) + \tau_{c,j,t-1} + \lambda_{c,j,t-1} \right\} \\ &+ \gamma_t + \gamma_j + \varepsilon_{c,j,t} \end{aligned}$$

Source Selection: "Reallocate"

	$Reallocate^m_{j,t}$
$ln(p^m_{c,j,t-1})$	0.0057***
	(0.0002)
$\mathbb{1}\{Broker^m_{c,j,t-1}\}$	-0.0667***
	(0.0045)
$\lambda_{c,j,t-1}$	-0.0001***
	(0.0000)
$\tau_{c,j,t-1}$	0.1431***
	(0.0160)
$\mathbb{1}\{Broker^m_{c,j,t-1}\} \times ln(p^m_{c,j,t-1})$	-0.0022***
	(0.0003)
$\mathbb{1}\{Broker^m_{c,j,t-1}\} \times \lambda_{c,j,t-1}$	-0.0001
	(0.0000)
$\mathbb{1}\{Broker^m_{c,j,t-1}\} \times \tau_{c,j,t-1}$	0.1238***
	(0.0131)
Constant	-0.0037
	(0.0043)
Observations	3,224,000
R-squared	0.0506

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
HS8, country, year fixed effects.
Controls for firm size and country size,
as measured by import value, and number of country suppliers.

- Firms using brokers less likely to use a pre-existing source country
- Firms using brokers are more responsive to duty rates

Model of supply chain adjustment (Monarch, 2022)

- Importers produce nontradeable final goods consumed by consumers with CES preferences.
- Importers choose which country to import from each period.
- Switching countries involves payment of a per-unit switching cost, which differs by broker or non-broker.

Expected input price

The expected price paid for input j from a given country c is $\mathbb{E}\left[\tau_{c,j,t} p^m_{c,j,t}\right]$. Importer m's expected per-unit cost of sourcing good j from country c can be written:

$$\bar{p}^m_{c,j,t} = \mathbb{E}\left[\tau_{c,j,t} p^m_{c,j,t}\right] \exp\left\{\zeta_{c,j} \mathbb{1}\left\{c^m_{j,t} \neq c^m_{j,t-1}\right\}\right\}$$

Importer m pays the expected duty-inclusive price of input j in time t and also pays a per-unit adjustment cost of ζ_c, j when they source product j from a country they did not source from in time $t-1$ (i.e, when $c^m_{j,t} \neq c^m_{j,t-1}$).

Country choice

For each input j, the importer considers all source countries and selects the country c associated with the highest expected profits.

$$\bar{\pi}_t^m\left(c_t^m, \boldsymbol{\beta}\right) = \beta_\lambda \ln \lambda_{c,t} + \beta_P \mathbb{E}\left[\ln \tau_{c,t} p_{c,t}^m\right] - \beta_C \mathbb{1}\left\{c_t^m \neq c_{t-1}^m\right\}$$

Estimation

- Estimate parameters $\boldsymbol{\beta} = \{\beta_P, \beta_c, \beta_\lambda\}$.
- I estimate these parameters product-by-product, and separately for firms importing using brokers and those who do not.
- Use maximum likelihood to solve, using the method in Su and Judd (2012) and Monarch (2023): inner loop to solve the fixed point problem and transition probs, outer loop to determine which combination of parameters maximizes likelihood
- Selection problem: broker "treatment" is not randomly assigned.

Preparing data for estimation: propensity score matching

- Choose approximately 300 largest products in 2015-2016.
- Use matching technique to condition on observables between the "treated" and "untreated" groups
- Basic idea: For each firm in the brokered group, find "statistical twins" in the non-brokered group with similar observed characteristics
- Use measures of firm size as characteristics
  - Employment
  - Total import value for firm m
  - Total import value of product j by firm m
- Estimate the probability (propensity) of a firm using a broker to import a given product based on firm size measures
- Keep firm using broker and two "nearest neighbor" firms Propensity Scores

Results: Parameter estimates

Estimate the model on the matched data.

$$\bar{\pi}_t^m\left(c_t^m, \boldsymbol{\beta}\right) = \beta_\lambda \ln \lambda_{c,t} + \beta_P \mathbb{E}\left[\ln \tau_{c,t} p_{c,t}^m\right] - \beta_C \mathbb{1}\left\{c_t^m \neq c_{t-1}^m\right\}$$

	Broker $= 0$	Broker $= 1$
Responsiveness to quality	$\hat{\beta}_\lambda = 0.0221$	$\hat{\beta}_\lambda = 0.029$
Responsiveness to price	$\hat{\beta}_P = -4.334$	$\hat{\beta}_P = -8.339$
Switching cost	$\hat{\beta}_c = 0.0197$	$\hat{\beta}_c = -0.0318$

Implications

- Brokered trade flows may be associated with lower import prices and lower tariff passthrough.
- Customs brokers offer an important path to entry into trade, especially for smaller firms.
- Smaller firms and firms importing smaller shipments may be less exposed to supply chain risk.

Conclusions

- Broker use is associated with higher shipping charges, and observed brokers operate in trade service categories.
- Firms using brokers are more likely to switch source country and more likely to begin importing from a new source country.
- Firms not using brokers are more likely to reallocate imports to an existing country relationship.
- Broker-facilitated imports face lower switching costs, and are more responsive to changes in duty-inclusive prices.
- Implications: imported input prices will be lower for firms using brokers, and passthrough of tariffs is lower.

Thank you

Supply Chain Outlook

- Leadership Surveys:
  - 43% said supply chain disruptions would impact profitability to a large or very large extent over the next decade. (2023 PwC CEO Survey)
  - 46% are considering adjusting supply chains in the next 12 months due to geopolitical conflict. (2023 PwC CEO Survey)
  - 41% say "we are reconfiguring our supply chains." (2023 EY CEO Outlook Pulse Survey)
- Nearshoring, Reshoring, and Diversion:
  - Mentions of "nearshoring," "reshoring," and "onshoring" having been increasing in quarterly earnings calls and presentations Bloomberg
  - Share of imports from China has fallen, while share of imports from Vietnam, South Korea, and India has increased.

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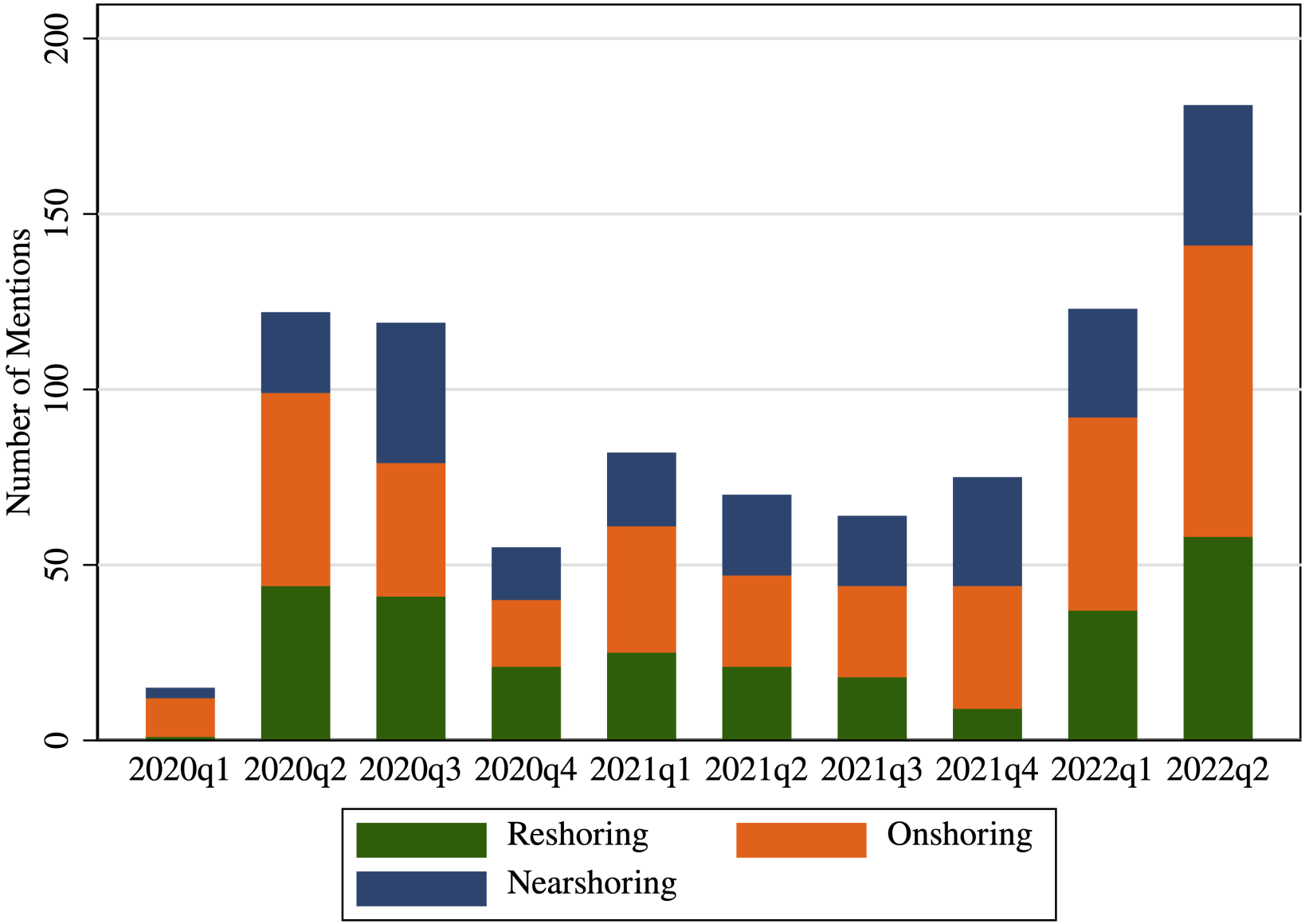
Earnings calls and conference presentations



NPR Customs Broker Interview

- "It's such a messy business that there are always problems. So to have experts on board to manage them is essential."
- "Our job really has been education and navigation, recognizing the opportunities that are available and the strategies that are available to try to address unexpected surprises."
- "Some companies are looking to shift production to other countries, such as Vietnam. [...] rebuilding a supply chain like that is a major undertaking and not something you can do overnight."
- "Indeed Hiring Lab has seen a noticeable spike in help-wanted ads for both tariff and supply chain experts since the beginning of the year."

Source: "Companies Look For Workarounds To Avoid Trump's Tariffs As Trade War Grinds On", 2019 Back

Data

- U.S. Census Longitudinal Firm Trade Transactions (LFTTD) imports
- U.S. Census Business Register (BR)
- U.S. Census Longitudinal Business Database (LBD)
- Supplemental Data
  - UNCTAD TRAINS: The Global Database on Non-Tariff Measures
  - NBER-CES Manufacturing Industry Database
- Data contribution: linking LFTTD and LBD to correct linkage and reveal information on brokers

Identifying brokers

DEPARTMENT OF HOMELAND SECURITY
U.S. Customs and Border Protection

OMB APPROVAL NO. 1651-0022
EXPIRATION DATE 01/31/2021

ENTRY SUMMARY

1. Filer Code/Entry Number	2. Entry Type	3. Summary Date	4. Surety Number	5. Bond Type	6. Port Code	7. Entry Date

8. Importing Carrier	9. Mode of Transport	10. Country of Origin	11. Import Date
		US	
12. B/L or AWB Number	**13. Manufacturer ID**	**14. Exporting Country**	**15. Export Date**
		US	

16. I.T. Number	17. I.T. Date	18. Missing Docs	19. Foreign Port of Lading	20. U.S. Port of Unlading

21. Location of Goods/G.O. Number	22. Consignee Number	23. Importer Number	24. Reference Number

25. Ultimate Consignee Name *(Last, First, M.I.)* and Address	26. Importer of Record Name *(Last, First, M.I.)* and Address
Street	Street
City State Zip	City State Zip

27. Line No.	28. Description of Merchandise: 29. A. HTSUS No. B. AD/CVD No.	30. A. Gross Weight B. Manifest Qty.	31. Net Quantity in HTSUS Units	32. A. Entered Value B. CHGS C. Relationship	33. A. HTSUS Rate B. AD/CVD Rate C. IRC Rate D. Visa Number	34. Duty and IR Tax: Dollars	Cents

Other Fee Summary *(for Block 39)*	35. Total Entered Value	CBP USE ONLY		TOTALS
	$	A. LIQ Code	B. Ascertained Duty	37. Duty
	Total Other Fees	REASON CODE	C. Ascertained Tax	38. Tax
	$		D. Ascertained Other	39. Other
			E. Ascertained Total	40. Total

36. Declaration of Importer of Record (Owner or Purchaser) or Authorized Agent

I declare that I am the ☐ Importer of record and that the actual owner, purchaser, or consignee for CBP purposes is as shown above, **OR** ☐ owner or purchaser or agent thereof. I further declare that the merchandise ☐ was obtained pursuant to a purchase or agreement to purchase and that the prices set forth in the invoices are true, **OR** ☐ was not obtained pursuant to a purchase or agreement to purchase and the statements in the invoices as to value or price are true to the best of my knowledge and belief. I also declare that the statements in the documents herein filed fully disclose to the best of my knowledge and belief the true prices, values, quantities, rebates, drawbacks, fees, commissions, and royalties and are true and correct, and that all goods or services provided to the seller of the merchandise either free or at reduced cost are fully disclosed.
I will immediately furnish to the appropriate CBP officer any information showing a different statement of facts.

41. Declarant Name *(Last, First, M.I.)*	Title	Signature	Date

42. Broker/Filer Information Name *(Last, First, M.I.)* and Phone Number	43. Broker/Importer File Number

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Data Matching Process

Relationship between broker use and shipping time

$$\ln(\text{Shipping Time}_{c,j,t}^{m,x}) = \beta_0 + \beta_1 \mathbb{1}\left\{\text{Broker}_{c,j,t}^{m,x}\right\} + \beta_2 \ln(\text{Employment}_{mt}) + \beta_3 \left(\mathbb{1}\left\{\text{Broker}_{c,j,t}^{m,x}\right\} \times \ln(\text{Employment}_{mt})\right) + \gamma_i + \gamma_j + \gamma_t + \gamma_c + \epsilon_{c,j,t}^{m,x}$$

- m: importing firm
- x: exporting firm
- c: country of origin
- i: mode of transport
- t: date (week)
- j: product (HS10)
- $\ln(\text{Shipping Time}_{c,j,t}^{m,x})$: number of days between "date of export" from country c and "date of import" for product j imported by firm m from exporter x using mode i
- $\mathbb{1}\left\{\text{Broker}_{ijmt}\right\} == 1$ if UC ! = IOR
- $\ln(\text{Employment}_{mt})$: employment of firm m in time t

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Relationship between broker use and shipping charges

$$\ln\left(\frac{\text{Shipping Charges}_{c,j,t}^{m,x}}{\text{Weight}_{c,j,t}^{m,x}}\right) = \beta_0 + \beta_1 \mathbb{1}\{Broker_{c,j,t}^{m,x}\} + \gamma_t + \gamma_j + \gamma_c + \gamma_{c,t} + \varepsilon_{c,j,t}^{m,x}$$

- m: importing firm
- x: exporting firm
- c: country of origin
- i: mode of transport
- t: date (week)
- j: product (HS10)
- $\text{Shipping Charges}_{c,j,t}^{m,x}$: cost of insurance and freight for a transaction of product j imported by firm m from exporter x using mode i from country c
- $\mathbb{1}\{\text{Broker}_{ijmt}\} == 1$ if UC ! = IOR

Back

Environment

- Different countries c supply the same product j at different prices and different duty rates, and have heterogeneous quality λ.
- Importers choose which country to import from each period.
- Switching countries involves payment of a per-unit switching cost, which differs by broker or non-broker.
- $c_{j,t}$: country c that supplies product j at time t
- $c_{j,t}^{m}$: match between importer m and country $c_{j,t}$

Importer's problem

- Importer m produces a single non-tradeable final good variety and produces according to Cobb-Douglas production function:

$$Q_m = L^{\alpha}\left(\Pi_{j=1}^{J} I_j^{\gamma_j}\right)^{1-\alpha}$$

  where L is units of labor, and $\{I_j\}_{j=1}^{J}$ denotes quantity of intermediate inputs.
- Must choose source country for each required input j and price for final good.

Final good pricing

Let $C_t = \{c_{j,t}\}_{j=1}^{J}$ be the vector of supplier choices for each input. The cost of the input bundle for the final good m:

$$c_m\left(C_t^m\right) = w^{\alpha}\left(\prod_{j=1}^{J}\left[\bar{p}_{c,j,t}^{m}\right]^{\gamma_j}\right)^{1-\alpha}$$

The marginal cost of production:

$$MC\left(C_t^m\right) = \frac{1}{\Phi_m\left(C_t^m\right)} c_m\left(C_t^m\right)$$

Profit:

$$\pi_t^m = \max_{p_m, C_t^m} p_m Q_m - MC\left(C_t^m\right) Q_m$$

CES utility $\implies$ optimal price is $p_m = \frac{\sigma}{\sigma-1} MC\left(C_t^m\right)$

Expected input price

The expected price paid for input j from a given country c is $\mathbb{E}\left[\tau_{c,j,t} p^m_{c,j,t}\right]$. Importer m's expected per-unit cost of sourcing good j from country x can be written:

$$\bar{p}^m_{c,j,t} = \mathbb{E}\left[\tau_{c,j,t} p^m_{c,j,t}\right] \exp\left\{\zeta_{c,j} \mathbb{1}\left\{c^m_{j,t} \neq c^m_{j,t-1}\right\}\right\}$$

Importer m pays the expected duty-inclusive price of input j in time t and also pays a per-unit adjustment cost of ζ_c, j when they source product j from a country they did not source from in time $t-1$ (i.e, when $c^m_{j,t} \neq c^m_{j,t-1}$).

Profit

Taken together, these yield a separable expected profit function. Log expected profits from a single good j is given by:

$$\ln \pi_{j,t}^{m} = \max_{c^m} v(\sigma - 1) \ln \lambda_{c,j,t} + \omega_j \left(\mathbb{E} \left[\ln \tau_{c,j,t} p_{c,j,t}^{m} \right] + \zeta_{c,j} \mathbb{1} \left\{ c_{j,t}^{m} \neq c_{j,t-1}^{m} \right\} \right)$$

For each input j, the importer considers all source countries and selects the country c associated with the highest expected profits.

$$\bar{\pi}_{t}^{m} \left(c_{t}^{m}, \boldsymbol{\beta} \right) = \beta_{\lambda} \ln \lambda_{c,t} + \beta_{P} \mathbb{E} \left[\ln \tau_{c,t} p_{c,t}^{m} \right] - \beta_{C} \mathbb{1} \left\{ c_{t}^{m} \neq c_{t-1}^{m} \right\}$$

Matching Process (Kamal & Ouyang, 2020)

- Strip ultimate consignee (importer) EIN of all non-numeric characters
- Construct three alternative EINs: the first 9 characters of EIN, the second nine characters of EIN, and the third nine characters of EIN. Example:
  - Suppose ultimate consignee EIN is "01234567890"
  - First alternative EIN: "012345678"
  - Second alternative EIN: "123456789"
  - Third alternative EIN: "234567890"
- Attempt to match these to the same-year BR EINs.
- Attempt to match these to $t-1$ BR EINs.
- Attempt to match these to $t+1$ BR EINs.
- Check multi-unit firms to check for intra-firm transactions.
- Merge 2x with LBD for firm characteristics

Back to Data Slide

Similarities between IOR and UC industries

	Spearman Rank Correlation of NAICS, ranked by import share, 2017			
	Importer of Record, Broker = 0	Importer of Record, Broker = 1	Ultimate Consignee, Broker = 0	Importer of Record, Broker = 1
Importer of Record, Broker = 0	1.0000	——	——	——
Importer of Record, Broker = 1	0.4175	1.0000	——	——
Ultimate Consignee, Broker = 0	1.0000	0.4175	1.0000	——
Ultimate Consignee, Broker = 1	0.7949	0.4454	0.7949	1.0000

Dynamics of Broker Use (2x2 Transition Matrix

Table: 2×2 Transition Matrix for Import Behavior

	State at $t+1$	
State at t	Import with broker	Import without broker
Import with broker	$p^c_{11} = 78.53$	$p^c_{12} = 21.47$
Import without broker	$p^c_{21} = 7.81$	$p^c_{22} = 92.19$

Back to 3x3 Slide

Dynamics of Broker Use

	$Broker^m_{c,j,t}$		
$Broker^m_{c,j,t-1}$	0.3910***	0.3858***	0.2879***
	(0.0017)	(0.0017)	(0.0020)
$Broker^m_{c,j,t-2}$	0.2102***	0.2061***	0.1474***
	(0.0012)	(0.0012)	(0.0014)
$Broker^m_{c,j,t-3}$	0.1607***	0.1562***	0.1058***
	(0.0010)	(0.0010)	(0.0012)
$\ln(p^m_{c,j,t-1})$	0.0096***	0.0060***	0.0058***
	(0.0006)	(0.0006)	(0.0007)
$\ln(\text{Value}^m_{j,t})$	-0.0021***	-0.0019***	0.0003
	(0.0003)	(0.0003)	(0.0003)
$\ln(\text{Value}^m_{j,t-1})$	-0.0011***	-0.0011***	0.0008***
	(0.0003)	(0.0003)	(0.0002)
$\ln(\text{Value}_{c,j,t})$	0.0030***	0.0049***	0.0050***
	(0.0003)	(0.0004)	(0.0003)
$\ln(\text{Value}_{c,j,t-1})$	-0.0040***	-0.0033***	-0.0021***
	(0.0003)	(0.0003)	(0.0002)
Constant	0.0649***	0.0348***	0.0093*
	(0.0045)	(0.0047)	(0.0048)
Observations	2,961,000	2,961,000	2,938,000
R-squared	0.5843	0.5867	0.6266
Fixed effects:			
Year	✓	✓	✓
HS8	✓	✓	✓
Country		✓	✓
Firm			✓

Robust standard errors in parentheses.
SEs clustered at the firm-product level.
*** p<0.01, ** p<0.05, * p<0.1

Back to 3x3 Slide

Determinants of broker use at the transaction level

$$\Pr\left(\text{Broker}^{m}_{x,j,t} = 1\right) = \beta_0 + \beta_1 \ln(\text{Employment}^{m}_{t}) + \beta_2 \ln(\text{Age}^{m}_{t}) + \beta_3 \text{FTA}^{m}_{c,t} + \gamma_t + \gamma_j + \gamma_c + \varepsilon^{m,x}_{c,j,t}$$

- m: importing firm
- x: exporting firm
- c: country of origin
- i: mode of transport
- t: date (week)
- j: product (HS10)
- $\text{FTA}^{m}_{c,t}$: a trade agreement exists between the U.S. and country c in time t
- $\ln(\text{Age}^{m}_{t})$: age of firm m in time t (from LBD)

Determinants of broker use at the transaction level

	Dependent Variable: $\mathbb{1}\{Broker^{m}_{x,j,t}\}$				
$\ln(\text{Employment}^{m}_{t})$	-0.008838***	-0.008892***	-0.008421***	-0.007449***	-0.01398***
	(4.249e-06)	(4.254e-06)	(4.509e-06)	(4.439e-06)	(6.351e-06)
$\ln(\text{Age}^{m}_{t})$	-0.01475***	-0.01368***	-0.01444***	-0.01324***	-0.002853***
	(1.839e-05)	(1.866e-05)	(1.866e-05)	(1.830e-05)	(1.898e-05)
$\text{FTA}^{m}_{c,t}$	-0.003432***	0.004275***	0.01082***	0.01258***	0.01292***
	(1.267e-04)	(1.282e-04)	(1.251e-04)	(1.226e-04)	(1.186e-04)
Constant	0.1564***	0.1504***	0.1471***	0.1356***	0.1472***
	(6.853e-05)	(7.035e-05)	(6.988e-05)	(6.860e-05)	(7.221e-05)
Observations	400000000	400000000	400000000	400000000	400000000
R-squared	0.04	0.04	0.09	0.126	0.188
Country FE	✓	✓	✓	✓	✓
Date FE		✓	✓	✓	✓
HS4 FE			✓	✓	✓
Mode FE				✓	✓
NAICS FE					✓

Back to Aggregate Slide

- Larger firms are less likely to use customs brokers
- Older firms are less likely to use customs brokers
- Transactions under FTAs are more likely to use customs brokers

Determinants of broker use

$$\mathbb{1}\{\text{Broker}^m_{c,j,t}\} = \beta_0 + \overbrace{\beta_1 \ln\left(v^m_{c,j,t}\right) + \beta_2 \ln(\mathit{Weight}^m_{c,j,t}) + \beta_3 \ln\left(\mathit{emp}^m_t\right)}^{\text{size}}$$

$$+ \beta_4 \lambda_{c,j,t} + \beta_5 \mathbb{1}\left\{\mathit{Related}^m_{c,j,t}\right\}$$

$$+ \underbrace{\beta_6 \mathbb{1}\left\{\mathit{NTM}_{c,j,t}\right\} + \beta_7 \mathbb{1}\left\{\mathit{USDA}_j\right\} + \beta_8 \mathbb{1}\{\mathit{HITECH}_j\} + \beta_9 \tau_{c,j,t}}_{\text{trade costs}}$$

$$+ \gamma_t + \gamma_x + \gamma_j + \gamma_m + \varepsilon_{cjtm}$$

- $v^m_{c,j,t}$: value of firm m imports of product j from x
- $\mathit{Weight}^m_{c,j,t}$: weight of firm m imports of product j from x
- $\lambda_{c,j,t}$: estimated quality of product j from x
- emp^m_t: employment of firm m
- $\mathit{Related}^m_{c,j,t}$: related party
- $\mathit{NTM}_{c,j,t}$: non-tariff measure
- USDA_j: agricultural product
- HITECH_j: advanced technology product
- $\tau_{c,j,t}$: ad valorem duty rate

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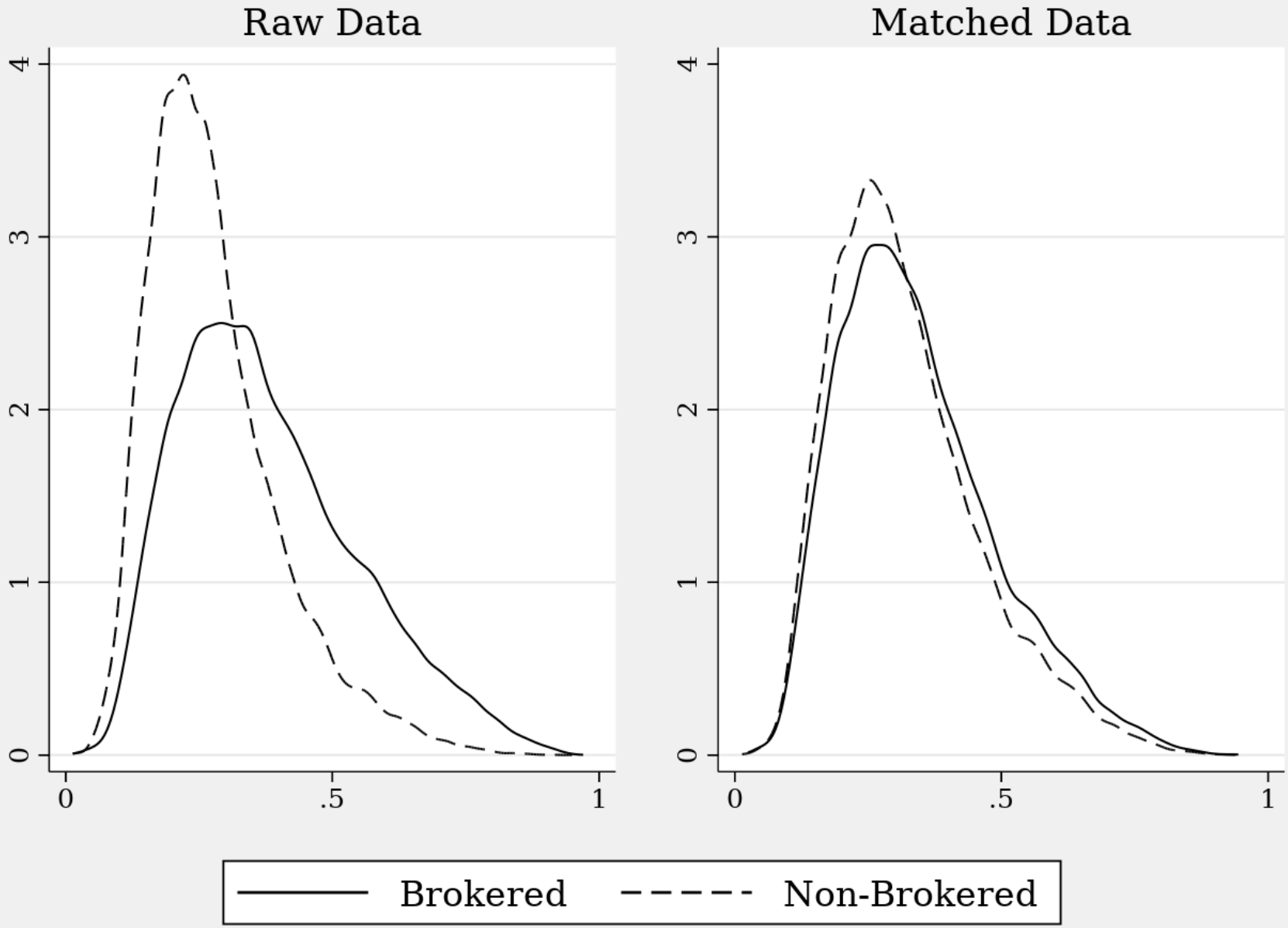
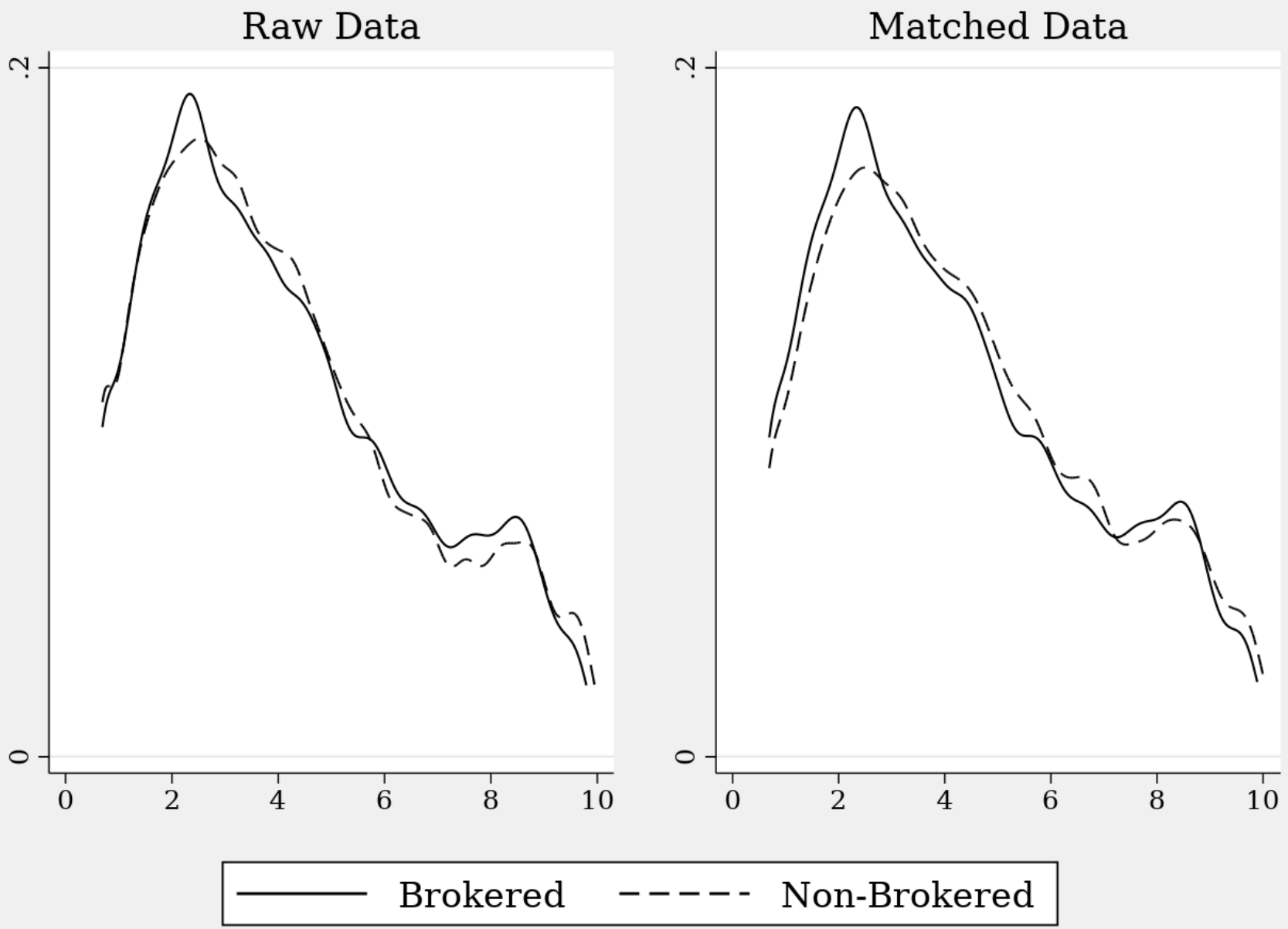
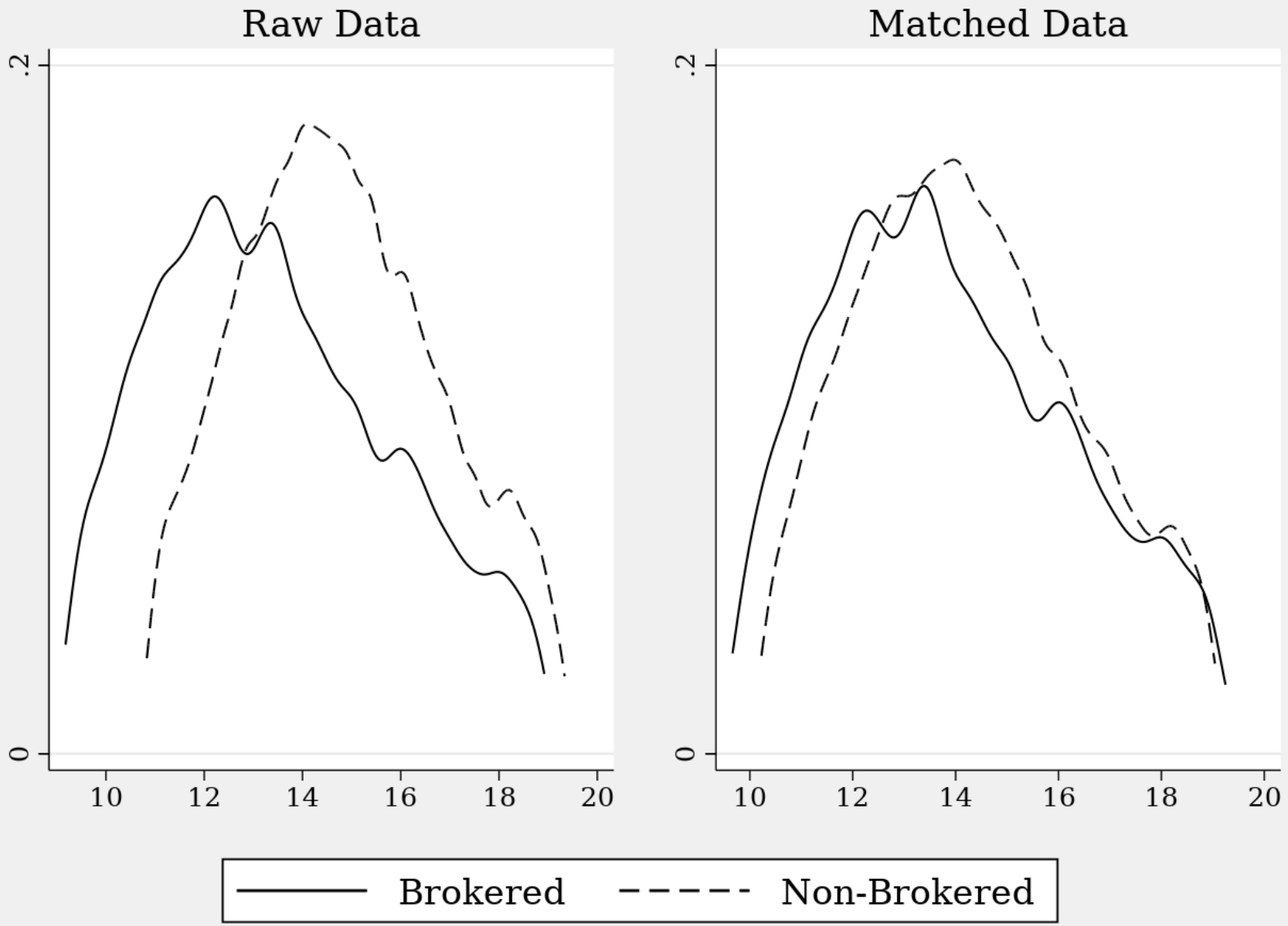
Propensity Scores: Probability of Broker Use



Firm Size: Employment

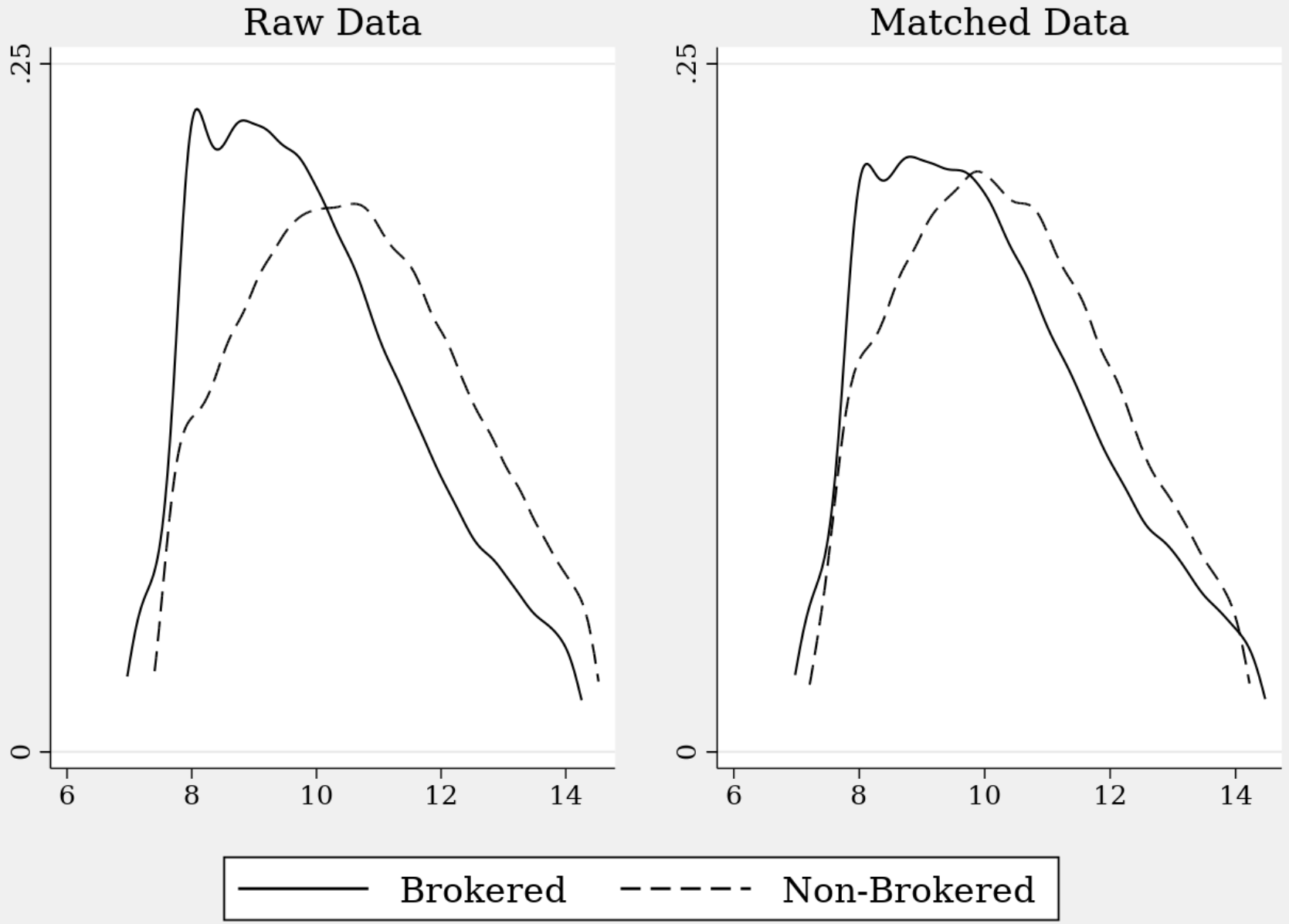


Firm Size: Total Imports



Firm Size: Product Imports

Back



Value function

$$V\left(c_{t-1}, \mathbf{p_{t-1}}, \epsilon_t\right) = \max_{\{c_t, c_{t+1}, \ldots\}} \mathbb{E}\left[\sum_{\tau=t}^{\infty} \delta^{\tau-t}\left(\bar{\pi}_\tau\left(c_\tau, \mathbf{p}_{\tau-1}, c_{\tau-1}, \beta\right) + \varepsilon_{c,\tau}\right)\right]$$

Which can be rewritten recursively as a Bellman equation to break the dynamic optimization problem down into a sequence of single-period decisions:

$$V\left(c, \mathbf{p}, \epsilon'\right) = \max_{c'} \bar{\pi}\left(c', \mathbf{p}, c, \beta\right) + \varepsilon'\left(c'\right) + \delta EV\left(c', \mathbf{p}, c, \epsilon'\right)$$

$$EV\left(c', \mathbf{p}, c, \epsilon'\right) = \int_{\mathbf{p}'} \int_{\epsilon''} V\left(c', \mathbf{p}', \epsilon''\right) h\left(\mathbf{p}', \epsilon'' \mid \mathbf{p}, c, c', \epsilon'\right) d\mathbf{p}' d\epsilon''$$

where $\mathbf{p_t}$ and ε_{t+1} are jointly distributed according to $h(\mathbf{p_t}, \varepsilon_t)$.