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

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Abstract

This paper introduces a new dataset mapping U.S. import transactions to foreign sources, domestic importers, and customs brokers for the first time in the literature. As shown in these data, customs brokers expedite shipping, are predominantly used by smaller importers, and are chosen for transactions of lesser value but incurring higher shipping charges. Firms engaging brokers are more likely to shift which countries they source their products from. To better understand this source-switching behavior, I estimate a structural dynamic discrete choice model of supplier switching that yields estimates of switching costs and responsiveness to price and quality. Additionally, using a dynamic difference-in-differences methodology, I analyze how responses to the U.S.–China trade war differed between firms using and those not using customs brokers. The findings suggest that customs brokers play a key role in firms' adaptive sourcing decisions during trade disruptions.

Keywords: key1, key2, key3

JEL Codes: key1, key2, key3

*abc

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1 Introduction

World trade peaked in 2008, following a decades-long period of trade liberalization and global openness to trade. Since then, beginning with the Great Recession and corresponding trade collapse, trade volume has stagnated, and there have been increasingly frequent trade disruptions. Large economies have started to turn towards protectionism, as evidenced by the United Kingdom's exit from the European Union and the US–China trade War; this geopolitical and geoeconomic fragmentation has been catalyzed by the Russo-Ukrainian War, leading to large-scale realignments and uncertainty in the global trade regime (Shekhar et al., 2023).

In response to these changes, firms continue to seek alternative sourcing options. Surveys of CEOs conducted by management consulting firms confirm that new sourcing strategies are front of mind for executives: in a global survey, 43% of CEOs polled stated that supply chain disruption will impact profitability over the next decade to a large or very large extent, and 46% reported considering adjusting their supply chains in the next 12 months to ameliorate their exposure to geopolitical conflict (PwC, 2023). In a survey of CEOs in the United States, 41% responded that they are currently adjusting their supply chains (EY, 2023).

Despite this widespread desire to adapt, firms' trade relationships are persistent and costly to maintain and adjust: firms pay not only traditional trade costs of duties and shipping but also administrative, legal, and regulatory costs in establishing and maintaining their sourcing networks (Anderson and van Wincoop, 2004). In some cases, firms will consult third-party firms with expertise in importing to assist them in adjusting their supply chains and reducing information costs and avoidable delays; customs brokers are one type of third party that importers might rely upon for expertise in trade (CBP, 2023). Customs brokers are individuals and firms licensed by U.S. Customs and Border Protection (U.S. CBP) to assist importers with all regulatory and legal requirements of conducting trade. As disruptions to supply chains have mounted, customs brokers have been assisting importers in making changes to reduce the impact of trade disruptions (Horsley, 2019).

In traditional datasets on U.S. imports, even in cases where an intermediary is involved in the transaction, transaction records specify only two parties: the importer and the exporter. This representation, however, neglects the crucial role of intermediaries that facilitate cross-border transactions. To address this gap, I construct a dataset that identifies a third-party entity—the customs broker—within U.S. Census trade transactions. The addition of this information allows us to derive a more nuanced and realistic view of the import process, reflecting customs brokers' integral function in ensuring compliance with regulatory demands, navigating complex tariff structures, and optimizing the logistics of entry, which are important yet underrepresented aspects of international trade flows. By considering the customs broker in the dataset, we can gain richer insights into the mechanics of trade, the networks of trade relationships, and the value added by trade-related service providers.

I open the black box of firm trade transactions to understand better the mechanisms by which importers choose their input sources and reduce the frictions associated with these choices; in doing so, I provide additional insight into the costs associated with firms' engaging in trade and adjusting their supply chain decisions. I construct a new dataset from underutilized variables in restricted U.S. Census import transaction data to identify the importer, broker (if relevant), and foreign source country for a given import shipment. Using these data, I document key facts on customs brokers themselves and the firms and shipments that use them. I then show empirically that firms using customs brokers are more likely to adjust their supply chains by ending existing trade relationships and beginning new ones. Then, using a dynamic difference-in-differences methodology, I show the policy implications of broker use by comparing the trade war responses of importers who use brokers with those of importers who do not. Finally, I estimate a discrete choice model of supply chain adjustment and find that switching costs are [lower/higher] for firms using brokers. This work supports existing evidence that substantial heterogeneity exists in the modalities by which firms engage in international trade and proposes an explanation for the value of trade-related services that firms provide to importers. Better understanding the microstructure of trade and the costs associated with firms adjusting their supply chains is essential for policymakers to understand the response of U.S. firms to trade disruptions, develop strategies to encourage supply chain flexibility, and avoid adverse outcomes for firms and consumers at home when implementing trade policy.

2 Literature

This paper speaks to prior work on importing and supplier selection (Antràs et al., 2017; Monarch, 2022; Antràs and Chor, 2022; Antràs and Helpman, 2006). Monarch (2022) builds and estimates a dynamic discrete choice model of sourcing in the context of U.S. importers choosing among individual manufacturers in China. I apply a similar model that differs in two key ways: I focus only on the geographic component of switching costs in the choice of source country, and, as necessitated by cross-country comparisons, I consider duty-inclusive prices.

I also contribute to the broad literature on creation, record linkage, and improvement of U.S. Census Bureau trade data (Jarmin et al., 2009; Kamal and Monarch, 2018; Kamal and Ouyang, 2020). I build upon the methods described in Kamal and Ouyang (2020) to construct a firm-level crosswalk for both importers and customs brokers acting as middlemen in their import transactions.

Customs brokers serve as a type of trade intermediary, facilitating transactions of behalf of the parties buying and selling the goods. There is an extensive body of literature on the role of intermediaries in international trade (Bernard et al., 2015; Ganapati, 2018; Akerman, 2018; Ahn et al., 2011; Utar, 2017; Abel-Koch, 2013; Bernard et al., 2019; Blum et al., 2018), and this work emphasizes the importance of intermediaries in global supply chains. However, most prior work focuses on merchant wholesalers acting as trade intermediaries by purchasing, reselling, and distributing imported or exported goods. In contrast, customs brokers, the firms identified in this paper, operate as service providers who ease the frictions of participating in global markets by assisting firms in the administrative and logistical tasks of importing. Customs brokers, and trade service providers in general, are an understudied component of international trade networks. Theoretical literature on middlemen provides frameworks for understanding the role that service-providing intermediaries such as customs brokers might play in sourcing. Petropoulou (2008) and Li (1998) describe informational intermediaries that ease frictions through their access to information. Biglaiser (1993) and Biglaiser and Friedman (1994) model middlemen as offering a form of quality assurance due to their expertise.

Customs brokers and other service providers facilitate trade through a mechanism similar to that driving the effects of trade promotion and customs modernization: their efforts reduce the frictions and administrative burden associated with participating in global markets, reducing the costs of information and customs clearance (Bondarenko et al., 2017; Pastor et al., 2015). Medin (2021) studies customs brokers in Norwegian data and finds that firms' use of brokers decreases with firm import value, consistent with my findings in U.S. data. Prior literature suggests that services are important for success in international trade: Debaere et al. (2013) find that local availability of services predicts a greater level of outsourcing for Irish firms. Unlike Debaere et al. (2013), who rely on importers' geographical proximity to service-providing firms, I link importers directly to the service providers whom they use to facilitate trade, document new facts about the importers, brokers, and transactions themselves, and show that brokers facilitate supply chain adjustments.

3 Data

I use data from the U.S. Census Bureau Longitudinal Firm Trade Transactions Database (LFTTD) for the period 2007–2019. I also use the Business Register (BR) to construct an establishment crosswalk between both importer and broker firms in the LFTTD to link the transactions to individual firm characteristics in the Longitudinal Business Database (LBD).

The LFTTD contains the universe of import transactions exceeding $2,500 in value.

For each shipment that enters the United States, customs entry Form 7501 must be filed with U.S. CBP within ten days of release of the shipment. This form, shown in Figure 1, collects a variety of information on an import transaction, including the value, quantity, weight, origin, and firms/parties involved in the transaction. As part of a slate of customs improvement measures enacted in 2001, U.S. CBP clarified policy on the parties that must be listed on Form 7501 (CBP", 2001): importers are required to include both the end user and the individual with legal liability for the shipment. Beginning in 2007, the LFTTD began including the "ultimate consignee" variable in addition to the "importer of record" variable that existed in prior versions.

These variables are crucial to my analysis, as their legal definitions allow me to identify brokers in the trade transactions. The ultimate consignee is defined as "the principal party in interest located abroad who receives the exported or reexported items" (748.5, 748.5). The importer of record is the party legally responsible for managing the shipment, including ensuring that it is properly classified, that it follows all regulations related to entry into the United States, and that all duties and fines are paid. The importer of record and the ultimate consignee are often the same party; however, when they are different firms and both can be linked to firms operating in the United States, the importer of record must be a licensed customs broker. Throughout, in cases where the ultimate consignee and importer of record differ, I refer to the former as the importer and the latter as the customs broker or 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

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

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
Street
City State Zip

26. Importer of Record Name *(Last, First, M.I.)* and Address
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 | B. Ascertained Duty
REASON CODE | C. Ascertained Tax
D. Ascertained Other
E. Ascertained Total

TOTALS
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 (5/22) Page 1 of 3

Figure 1: Customs Entry Form 7501

To create the dataset used for the empirical analysis and estimation, I follow a process similar to that used by the U.S. Census Bureau to create firm identifiers in the LFTTD, described in Kamal and Ouyang (2020). I first consider the string listed as the ultimate consignee and attempt to find an employer identification number (EIN) match for this establishment. The prioritization of candidate EINs for the ultimate consignee (UC) is as follows:

- For UC EINs that are nine digits, take the full EIN to perform the attempted match.
- For UC EINs longer than nine digits, the prioritization is as follows:
    1. The first nine digits
    2. The second nine digits
    3. The last nine digits

Similarly, for each importer of record (IOR):

- For IOR EINs that are nine digits, take the full EIN to perform the attempted match.
- For IOR EINs longer than nine digits, the prioritization is as follows:
    1. The first nine digits
    2. The second nine digits
    3. The last nine digits

For each candidate EIN for both the UC and the IOR, I attempt to find a match for the EIN in the Business Register in the following order of prioritization:

1. Same-year match
2. Prior-year match
3. Next-year match
4. $t-2$ to 1976 matches for those remaining unmatched

For the EINs for which a match is found, I check whether the firm associated with the EIN is a single- or multi-unit firm. I assigned `firmid` values according to Chow et al. (2021). For single-unit firms, I construct the firm identifier such that `firmid` is equal to "0" followed by the highest-priority matched EIN. For multi-unit firms, the `firmid` is equal to the matched `alpha` followed by "0000". I consider transactions to have involved a broker if the `firmid` associated with the importer of record is not equal to the `firmid` associated with the ultimate consignee. If the EINs differ but the establishments are within the same firm, I do not consider these brokered transactions.

Over the sample period, brokers facilitate approximately three percent of import value and five percent of import transactions, as shown in Figure 2. There was a substantial drop in the share of transactions facilitated by brokers in January 2013 as a result of a change in U.S. CBP customs policy. Prior to 2013, shipments above $2,000 in value had to be accompanied by a surety bond, a completed entry form, and a minimum processing fee of $25. Effective January 7, 2013, as part of the Beyond the Border Initiative to harmonize policy between the United States and Canada, this limit increased to $2,500. Firms importing shipments below this limit are not required to hold a customs bond, pay a reduced processing fee, and do not appear in the LFTTD import data. The share of import value facilitated by brokers increased in 2016, likely as a result of

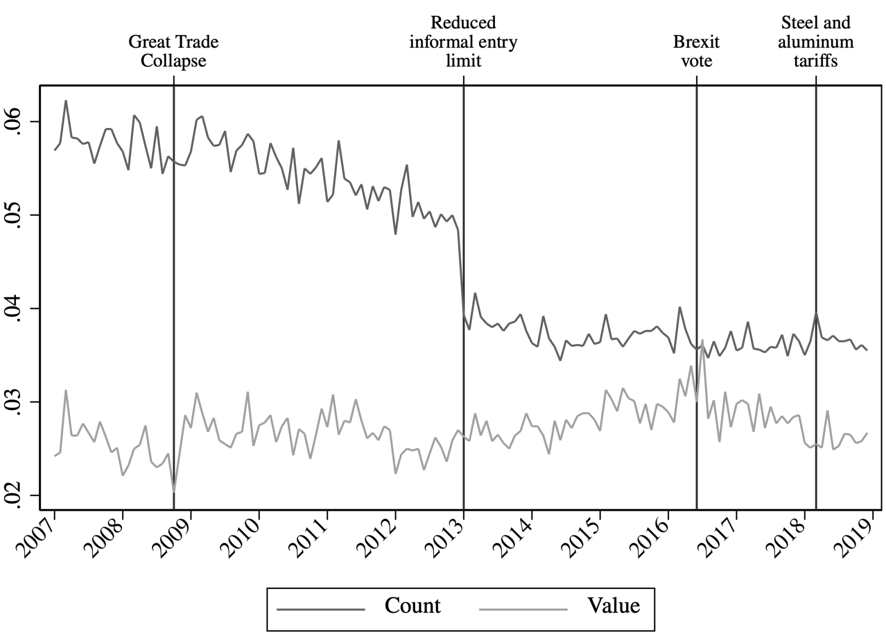

Figure 2: Broker Share of Imports

3.1 Broker choice

There are numerous reasons why firms may choose to employ the services of a customs broker as their importer of record. The first is for speed and convenience: international couriers and express delivery services automatically use customs brokers to clear goods on behalf of the importer (CBP, 2023). This allows the courier to handle the shipment from origin to destination and reduces potential lags in communication between parties.

Brokers may serve as the importer of record in situations of high complexity, when customs procedures are particularly difficult or when additional federal regulations on importation apply. This reduces the potential for delays and fines due to administrative mistakes.

A customs broker may also serve as the importer of record in cases when the importer itself is unwilling or unable to obtain its own customs bond. Importers of record must hold a customs bond through a licensed surety for a shipment to enter the United States. Customs bonds may be single-transaction bonds or continuous bonds. Single-transaction bonds are for one-time importation only and are in an amount equal to the value of the merchandise plus duties, taxes, and fees. Continuous bonds apply over multiple transactions and are for an amount equal to 10% of the duties, taxes and fees paid by the importer during the previous 12 months. Brokers often hold continuous bonds that may be applied to transactions for which they serve as importer of record (Chaplin, 1981).

Finally, a customs broker often serves as importer of record in cases where the buyer and seller agree to the transaction under Delivered Duties Paid (DDP) Incoterms. Under these terms, the seller is required to take responsibility for customs clearance and payment of all duties and fees. This is a complex task, particularly for foreign firms that may not be familiar with domestic customs procedures, so a customs broker may serve as the importer of record to navigate this process on the seller's behalf (Neville, 2014).

Because it cannot be determined from the data whether the broker is chosen for reasons related to speed of processing, complexity, access to financial instruments, or access to the domestic market by foreign importers, I choose to remain agnostic on the broker choice mechanism. Instead, I leverage importer size, as measured by employment and import value, as a predictive factor for the likelihood of utilizing customs broker services.

4 Stylized Facts

4.1 Broker characteristics

It is crucial to discern whether firms I identify by comparing the UC and IOR indeed fulfill customs brokers' functions. Per CBP regulations, any party serving as the IOR that is neither the owner nor the purchaser must be a licensed customs broker. Customs brokerage services are often integrated within the operations of freight forwarders, shipping and logistics companies, or offered by importers managing logistics internally.

Under NAICS 2017, customs brokers are categorized within industry 488510, alongside freight forwarders and shipping agents, and are linked to 541614 for consulting services in logistics. Express couriers, classified under 492110, frequently undertake brokerage roles, as indicated by their promotional and legal documentation.

Analysis of the LFTTD import data reveals that 55.2% of broker-mediated imports involve an IOR associated with these industries, compared to just 10.7% for nonbrokered imports. Among UCs in brokered transactions, 7.7% have employment in these categories vs. 10.7% in nonbrokered transactions. These data suggest that entities acting as IORs in brokered transactions are likely to offer brokerage services and that UCs not employing the services of customs brokers may perform these tasks in-house.

Furthermore, examining the NAICS codes for firms acting as UCs and IORs, whether as brokers or not, reveals notable patterns. The Spearman rank correlations for 2017 presented in Table 1 indicate significant differentiation between brokers and other IORs, while UCs exhibit similar characteristics regardless of broker use. These findings imply a significant delineation in the services provided by brokers and highlight the tendency of importers to manage brokerage services internally when not employing external brokers.

Table 1: Spearman Rank Correlation of NAICS Codes

	Spearman Rank Correlation of NAICS Codes, 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

Table 2: Employment of the Importer of Record

Importer of Record				
	$Broker_t^m = 0$		$Broker_t^m = 1$	
VARIABLES	**mean**	**sd**	**mean**	**sd**
Employment 2012	243.4	6229	1932	22030
Employment 2017	219.2	4443	2053	23430
Log Employment 2012	2.616	1.803	3.570	2.651
Log Employment 2017	2.581	1.798	3.656	2.709

Table 3: Employment of the Ultimate Consignee

Ultimate Consignee				
	$Broker_t^m = 0$		$Broker_t^m = 1$	
VARIABLES	**mean**	**sd**	**mean**	**sd**
Employment 2012	38.71	881.6	443.1	8,012
Employment 2017	44.45	663.5	538.4	8,661
Log Employment 2012	2.105	1.470	3.019	1.972
Log Employment 2017	2.148	1.506	3.115	2.040

4.2 Shipment-Level Statistics

4.2.1 Shipping Time

I first provide statistics on broker use at the greatest degree of granularity possible: the individual shipments. Shipping time is calculated as the difference between the dates of export and import, that is, the dates when the shipment leaves the foreign port and arrives in the domestic port. Then, I run the following ordinary least squares (OLS) specification:

$$\ln(\text{Shipping Time}_{ijmt}) = \beta_0 + \beta_1 \mathbb{1}\left\{\text{Broker}_{ijmt}\right\} + \beta_2 \ln(\text{Employment}_{mt}) \tag{1}$$

$$+ \beta_3 \left(\mathbb{1}\left\{\text{Broker}_{ijmt}\right\} \times \ln(\text{Employment}_{mt})\right) \tag{2}$$

$$+ \mu_i + \gamma_j + \tau_t + \epsilon_{ijmt} \tag{3}$$

The results, summarized in Table 4, reveal several key insights into the relationship between shipping time, the use of customs brokers, and employment levels. The coefficients for the binary indicator variable $\mathbb{1}\left\{\text{Broker}^m_{x,j,t}\right\}$ are negative and statistically significant across all specifications. This suggests a robust inverse relationship between the use of brokers and shipping time. Specifically, employing a broker is associated with a reduction in shipping time, with other factors held constant. This finding aligns with the hypothesis that brokers, by virtue of their expertise and networks, can expedite the shipping process. Employment is positively correlated with shipping time, indicating that larger firm size is associated with longer shipping times. Similarly, the interaction between broker and employment yields positive coefficients. This result implies that the effect of using a broker on shipping time varies with the level of employment. Notably, while brokers generally reduce shipping time, this beneficial effect diminishes or reverses at higher employment levels.

Table 4: Shipping Time

	ln(Shipping Time)					
$\mathbb{1}\left\{\text{Broker}^m_{x,j,t}\right\}$	-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(Employment^m_t)	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)
$\mathbb{1}\{Broker^m_{x,j,t}\}$	0.02268***	0.02592***	0.02602***	0.02605***	0.02589***	0.02535***
$\times$ln(Employment^m_t)	(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						✓

Standard errors in parentheses.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Observation counts rounded in accordance with U.S. Census disclosure avoidance procedures.

4.2.2 Shipping Charges

4.2.3 Broker Probability

4.3 Quality estimation

I estimate the quality of supplier countries following the instrumental variables approach of Khandelwal (2010).

$$\ln(s_{cht}) - \ln(s_{0t}) = \lambda_{1,ch} + \lambda_{2,t} + \alpha p_{cht} + \sigma \ln(ns_{cht}) + \lambda_{3,cht},$$

where h is a Harmonised System 8-digit (HS8) variety and c is the import country of origin. "Quality" is the sum of the λ terms, $\lambda_{1,ch} + \lambda_{2,t} + \lambda_{3,cht}$, where s_{cht} is variety ch's market share and ns_{cct} is its market share within product h or the nest share. The outside variety (domestic variety) share is s_{0t}.

Total industry output is:

$$MKT_t = \sum_{ch \neq 0} q_{cht} / (1 - s_{0t}),$$

The imported variety market share is:

$$s_{cht} = q_{cht} / MKT_t.$$

Because p_{cht} is likely correlated with ns_{cht} or $\lambda_{3,cht}$, the unobserved component of quality, an instrumental variables approach is necessary. Specifically, I instrument for price using variety-specific transportation costs and for ns_{cht} with the number of varieties within product h and the number of varieties exported by country c. I use NBER–CES domestic production data to construct the "outside option" and LFTTD import and export data at the HS4 level.

4.4 Probability of using a broker

I estimate the following linear probability model to provide evidence on the characteristics that impact broker use:

$$\begin{aligned}\mathbb{1}\left\{\text{Broker}^m_{c,j,t}\right\} = {} & \beta_0 + \beta_1 \ln\left(v^m_{c,j,t}\right) + \beta_2 \ln(wt^m_{c,j,t}) + \beta_3\lambda_{c,j,t} \\ & + \beta_4 \ln\left(emp^m_t\right) + \beta_5\mathbb{1}\left\{Related^m_{c,j,t}\right\} \\ & + \beta_6\mathbb{1}\left\{NTM_{c,j,t}\right\} + \beta_7\mathbb{1}\left\{USDA_j\right\} \\ & + \beta_8\mathbb{1}\{HITECH_j\} + \beta_9\tau_{c,j,t} \\ & + \gamma_t + \gamma_c + \gamma_j + \gamma_m + \varepsilon_{cjtm},\end{aligned} \tag{4}$$

where $v^m_{c,j,t}$ is the value of imports of product j that firm m purchases from country c, $wt^m_{c,j,t}$ is the total log weight of firm m imports of product j from country c, $\lambda_{c,j,t}$ is the estimated quality of product j from c, emp^m_t is the employment of firm m, $Related^m_{c,j,t}$ is an indicator denoting related-party trade flows, $NTM_{c,j,t}$ is a binary variable equal to one when there is a nontariff measure affecting product j from country c, $USDA_j$ indicates whether j is an agricultural product, $HITECH_j$ indicates whether j is classified as an advanced technology product, and $\tau_{c,j,t}$ is the iceberg-equivalent duty rate. The results of this regression are reported in Table ??.

			$\mathbb{1}\left\{\text{Broker}^{m}_{c,j,t}\right\}$			
$\ln(v)$	0.04305***	0.04314***	0.05343***	0.06211***	0.04314***	0.04993***
	(0.001643)	(0.001637)	(0.003744)	(0.003454)	(0.001637)	(0.001761)
$\ln(ut)$	-0.05339***	-0.05339***	-0.07466***	-0.07816***	-0.05339***	-0.05495***
	(0.001522)	(0.001522)	(0.003315)	(0.003444)	(0.001522)	(0.001497)
$\ln(emp)$	-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)
$1\{Rel\}$	-0.1290***	-0.1290***	-0.1884***	-0.2065***	-0.1290***	-0.1438***
	(0.008084)	(0.008095)	(0.01237)	(0.01654)	(0.008097)	(0.01137)
$\ln(1+\tau)$		0.1426***	0.1905***	0.2708***	0.1428***	0.1751***
		(0.03295)	(0.07804)	(0.1088)	(0.03295)	(0.04519)
NTM	-0.01098**	-0.01085**			0.00118	0.02554**
	(0.005425)	(0.005447)			(0.02600)	(0.01152)
USDA	0.03786***	0.04190***	0.02149***	0.03707***	0.02073***	
	(0.006751)	(0.01138)	(0.006786)	(0.006484)	(0.003881)	
HITECH	0.006868	0.01795	0.06615***	0.006926	0.06367***	
	(0.007288)	(0.01192)	(0.03255)	(0.007353)	(0.01399)	
λ					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	✓	✓			✓	✓

Note: Standard errors are robust and clustered at the cj level.

*** p<0.01, ** p<0.05, * p<0.1

Table 5: Broker Probability

$NTM_{c,j,t}$, $USDA_j$, $HITECH_j$, and $\tau_{c,j,t}$ are all measures of trade costs, and all are associated with a higher probability of broker use. $\ln(wt^m_{c,j,t})$, $\ln\left(v^m_{c,j,t}\right)$, and $\ln\left(emp^m_t\right)$ are measures of import size or firm size. Higher values of $\ln(wt^m_{c,j,t})$ and $\ln\left(emp^m_t\right)$ predict a lower probability of broker use, while higher values of $\ln\left(v^m_{c,j,t}\right)$ predict a higher probability of broker use.

4.5 Shipping charges

I construct a measure of shipping charges as follows:

$$cif_{c,j,t} = ln\left(1 + \frac{charges_{c,j,t}}{v_{c,j,t}}\right). \tag{5}$$

I then estimate the following OLS specification:

$$\begin{aligned} cif^m_{c,j,t} = \beta_0 + \beta_1 \mathbb{1}\{Broker^m_{c,j,t}\} + \beta_2 \tau_{c,j,t} \\ + \beta_3 \ln(wt^m_{c,j,t}) + \gamma_t + \gamma_c + \gamma_j + \varepsilon_{cjtm}. \end{aligned} \tag{6}$$

The results of this regression are reported in Table 6.

Table 6: Shipping Charges

	(1)	(2)	(3)	(4)
$\ln(Weight^m_{c,j,t})$	-0.006097***	-0.006066***	-0.006064***	-0.002707***
	(3.192e-04)	(3.208e-04)	(3.212e-04)	(1.637e-04)
$\ln(1+\tau_{c,j,t})$		0.06477***	0.06466***	0.07952***
		(0.008411)	(0.008385)	(0.007277)
$\mathbb{1}\{Broker^m_{c,j,t}\}$	0.04634***	0.04628***	0.04627***	0.01278***
	(0.007607)	(0.007597)	(0.007600)	(0.002320)
$NTM_{c,j,t} \in \{0,1\}$			-0.008266*	-0.01133***
			(0.004360)	(0.003695)
$HITECH_{j,t} \in \{0,1\}$			0.001860	0.008595
			(0.006181)	(0.005314)
$USDA_{j,t} \in \{0,1\}$			0.01482**	-3.067e-06
			(0.006643)	(0.003061)
$\lambda_{c,j,t}$				-5.427e-05**
				(2.188e-05)
Fixed Effects:				
t	✓	✓	✓	✓
c	✓	✓	✓	✓
j	✓	✓	✓	✓
m	✓	✓	✓	✓
Constant	0.1094***	0.1060***	0.1053***	0.07886***
	(0.002032)	(0.001985)	(0.001952)	(0.001413)
Observations	18910000	18910000	18910000	7031000
R-squared	0.285	0.285	0.285	0.284

Robust standard errors in parentheses clustered at the product– year level.

*** p<0.01, ** p<0.05, * p<0.1

5 Empirical Analysis of Supply Chain Adjustment

To measure the potential outcomes of an importer–country relationship, I construct three binary outcome variables: $Stay^m_{j,t}$, $NewSource^m_{j,t}$, and $Reallocate^m_{j,t}$. Let $v^m_{j,t} = \sum_c v^m_{c,j,t}$ or the sum of importer m's imports of product j in time t over all countries. Let $c^m_{j,t}$ be m's primary source for product j in time t. That is, if m imports j from only one country, $c^m_{j,t}$ is that country. If m imports j from multiple countries, $c^m_{j,t}$ is the country with the highest share $v^m_{c,j,t}$ of $v^m_{j,t}$.

5.1 Staying with the same source country

I first construct an indicator of staying with one's primary supplier:

$$Stay^m_{j,t} = \begin{cases} 1, & \text{if } c^m_{j,t} = c^m_{j,t-1} \\ 0, & \text{otherwise} \end{cases}$$

and estimate:

$$\begin{aligned} Stay^m_{j,t} = {} & \beta_0 + \beta_1 \mathbb{1}\{Broker^m_{c,j,t-1}\} \\ & + \boldsymbol{\beta_2} \mathbb{1}\{Broker^m_{c,j,t-1}\} \times \left\{ ln(p^m_{c,j,t-1}) + \tau_{c,j,t-1} + \lambda_{c,j,t-1} + ln(v^m_{c,j,t-1}) \right\} \\ & + \boldsymbol{\beta_3} \left(1 - \mathbb{1}\{Broker^m_{c,j,t-1}\}\right) \times \left\{ ln(p^m_{c,j,t-1}) + \tau_{c,j,t-1} + \lambda_{c,j,t-1} + ln(v^m_{c,j,t-1}) \right\} \\ & + \gamma_t + \gamma_j + \varepsilon_{c,j,t}. \end{aligned} \tag{7}$$

As shown in Table 7, I find that firms using brokers are less likely to stay with their primary supplier in general and that this affect is more pronounced with higher duty rates.

5.2 Shifting to a new source country

Analogously, I construct an indicator of beginning to import from a new country:

$$NewSource_{j,t}^{m} = \begin{cases} 1, & \text{if } c_{j,t}^{m} \neq c_{j,t-1}^{m} \text{ \& } v_{c,j,t-1}^{m} = 0 \\ 0, & \text{otherwise} \end{cases} \tag{8}$$

and estimate:

$$\begin{aligned} &NewSource_{j,t}^{m} = \beta_0 + \beta_1 \mathbb{1}\{Broker_{c,j,t-1}^{m}\} \\ &+ \boldsymbol{\beta_2} \mathbb{1}\{Broker_{c,j,t-1}^{m}\} \times \left\{ln(p_{c,j,t}^{m}) + \tau_{c,j,t-1} + \lambda_{c,j,t-1} + ln(v_{c,j,t-1}^{m})\right\} \\ &+ \boldsymbol{\beta_3} \left(1 - \mathbb{1}\{Broker_{c,j,t-1}^{m}\}\right) \times \left\{ln(p_{c,j,t-1}^{m}) + \tau_{c,j,t-1} + \lambda_{c,j,t-1} + ln(v_{c,j,t-1}^{m})\right\} \\ &+ \gamma_t + \gamma_j + \varepsilon_{c,j,t}. \end{aligned} \tag{9}$$

Firms using brokers are more likely to begin importing from a new source country.

5.3 Reallocating import sourcing

I construct an indicator for a firm's changing its primary source of product j to a source it imported from in $t-1$:

$$Reallocate_{j,t}^{m} = \begin{cases} 1, & \text{if } c_{j,t}^{m} \neq c_{j,t-1}^{m} \text{ \& } v_{c,j,t-1}^{m} > 0 \\ 0, & \text{otherwise} \end{cases} \tag{10}$$

and estimate:

$$\begin{aligned} &Reallocate_{j,t}^{m} = \beta_0 + \beta_1 \mathbb{1}\{Broker_{c,j,t-1}^{m}\} \\ &+ \boldsymbol{\beta_2} \mathbb{1}\{Broker_{c,j,t-1}^{m}\} \times \left\{ln(p_{c,j,t-1}^{m}) + \tau_{c,j,t-1} + \lambda_{c,j,t-1} + ln(v_{c,j,t-1}^{m})\right\} \\ &+ \boldsymbol{\beta_3} \left(1 - \mathbb{1}\{Broker_{c,j,t-1}^{m}\}\right) \times \left\{ln(p_{c,j,t-1}^{m}) + \tau_{c,j,t-1} + \lambda_{c,j,t-1} + ln(v_{c,j,t-1}^{m})\right\} \\ &+ \gamma_t + \gamma_j + \varepsilon_{c,j,t}. \end{aligned} \tag{11}$$

	Broker	"New Source"				
$\mathbb{1}\{Broker\}$		0.0248***	0.0073**	0.2377***	0.2129***	0.2082***
		(0.0031)	(0.0034)	(0.0088)	(0.0085)	(0.0099)
$\ln(p)$	0	0.0206***	0.0207***	0.0187***	0.0188***	0.0151***
		(0.0006)	(0.0006)	(0.0005)	(0.0005)	(0.0004)
$\ln(p)$	1	0.0211***	0.0205***	0.0154***	0.0152***	0.0111***
		(0.0008)	(0.0008)	(0.0007)	(0.0007)	(0.0006)
λ	0	-0.0028***	-0.0027***	-0.0020***	-0.0020***	-0.0001
		(0.0003)	(0.0003)	(0.0002)	(0.0002)	(0.0001)
λ	1	-0.0028***	-0.0029***	-0.0019***	-0.0020***	-0.0000
		(0.0004)	(0.0004)	(0.0003)	(0.0003)	(0.0001)
$\ln(1+\tau)$	0		0.2181***		0.1559***	0.3082***
			(0.0182)		(0.0195)	(0.0251)
$\ln(1+\tau)$	1		0.7078***		0.4444***	0.4819***
			(0.0378)		(0.0324)	(0.0379)
$\ln(v_m)$	0			-0.0217***	-0.0218***	-0.0191***
				(0.0004)	(0.0004)	(0.0003)
$\ln(v_m)$	1			-0.0427***	-0.0415***	-0.0374***
				(0.0008)	(0.0008)	(0.0008)
$\ln(v_x)$	0					-0.0149***
						(0.0003)
$\ln(v_x)$	1					-0.0175***
						(0.0005)
N_x	0					-0.0001
						(0.0001)
N_x	1					0.0006***
						(0.0001)
Constant		0.0458***	0.0353***	0.2808***	0.2744***	0.4782***
		(0.0040)	(0.0037)	(0.0035)	(0.0035)	(0.0065)
Observations		2182000	2182000	2182000	2182000	2182000
R-squared		0.0659	0.0678	0.0998	0.1005	0.1093
FE		[j t]	[j t]	[j t]	[j t]	[j t]
SE		[cluster j]	[cluster j]	[cluster j]	[cluster j]	[cluster j]
years		pre-2018	pre-2018	pre-2018	pre-2018	pre-2018

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 3: "New Source" Regressions

	Broker	"Reallocate"				
$\mathbb{1}\{Broker\}$		-0.0007	-0.0043**	-0.0288***	-0.0428***	-0.0771***
		(0.0019)	(0.0019)	(0.0040)	(0.0041)	(0.0045)
$\ln(p)$	0	0.0077***	0.0077***	0.0087***	0.0087***	0.0055***
		(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0002)
$\ln(p)$	1	0.0042***	0.0041***	0.0065***	0.0063***	0.0038***
		(0.0005)	(0.0005)	(0.0005)	(0.0005)	(0.0004)
λ	0	-0.0013***	-0.0013***	-0.0017***	-0.0017***	-0.0002***
		(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0001)
λ	1	-0.0011***	-0.0012***	-0.0015***	-0.0016***	-0.0001**
		(0.0001)	(0.0001)	(0.0002)	(0.0002)	(0.0001)
$\ln(1+\tau)$	0		0.0426**		0.0825***	0.2066***
			(0.0170)		(0.0167)	(0.0189)
$\ln(1+\tau)$	1		0.1445***		0.2457***	0.3304***
			(0.0232)		(0.0241)	(0.0269)
$\ln(v_m)$	0			0.0128***	0.0128***	0.0154***
				(0.0003)	(0.0003)	(0.0003)
$\ln(v_m)$	1			0.0159***	0.0166***	0.0188***
				(0.0004)	(0.0004)	(0.0005)
$\ln(v_x)$	0					-0.0132***
						(0.0002)
$\ln(v_x)$	1					-0.0111***
						(0.0003)
N_x	0					0.0006***
						(0.0001)
N_x	1					0.0006***
						(0.0001)

6 Conclusion

This paper constructs a novel dataset that maps individual U.S. import transactions to their corresponding foreign sources, domestic importers, and notably, to customs brokers. This unique contribution allows me to explore customs broker usage within the United States, shedding light on the operational choices of domestic firms engaged in international trade.

I document that larger firms, while less likely to engage customs brokers, still maintain significant usage, suggesting nuanced decision-making processes that may balance in-house capabilities with the specialized services that brokers provide. Moreover, I provide empirical evidence that brokers facilitate faster shipping times, indicating that customs brokers provide value for firms prioritizing speed in their supply chain operations. The benefits that brokers offer are offered at a premium, as shipping charges are also higher for brokered transactions.

Further, the importance of broker usage in supply chain decisions is highlighted by the tendency of firms employing brokers to switch their import source countries more frequently. This suggests that brokers may play a strategic role in firms' supply chain adaptability, especially in a landscape marked by trade uncertainties and geopolitical shifts. In the context of the recent U.S.–China trade war, casual estimation using a dynamic difference-in-differences approach analyzes whether there was a differential response among importers that utilize customs brokers versus those that do not. This variation would speak to the broader question of how services can moderate the effects of economic shocks and trade policies, providing a buffer or an accelerator for firms' adaptive measures.

Using a structural dynamic discrete choice model of supplier switching, I delve into the decision-making calculus of firms contemplating changes in their sourcing strategies.

This research has several implications. For practitioners, the insights into broker usage can inform more strategic engagement with such services, potentially reshaping sourcing strategies. For policymakers, the findings suggest that brokers play a substantive role in international trade dynamics, which may be crucial in the design of trade policy and anticipation of its impacts.

It is evident that customs brokers are not merely bureaucratic facilitators but also are strategic partners in global sourcing. Further research is warranted to investigate the mechanisms through which brokers impact trade flows and to explore the potential for policy interventions that can enhance the positive effects of their services. This study lays the groundwork for such inquiries and opens several avenues for future research. Future work will examine customs broker use beyond brokers serving as importers of record. In understanding the importance of shipping time, further work is warranted on the role of inventory management in the choice of shipping mode and customs broker usage. In closing, this paper contributes to a deeper understanding of the logistics that underpin international trade, providing both a theoretical and empirical foundation for further inquiry into the economic implications of the use of customs brokers.

Appendix A Theoretical Model of Supply Chain Adjustment

A.1 Environment

Different countries supply the same product j at different prices and different duty rates, and they have heterogeneous quality. Importers decide in each period which country to import from, based on both their current supplier and information about other available price, duty, and quality menus. Switching suppliers involves payment of a per-unit switching cost. Each individual country that supplies product j at time t is denoted as $c_{j,t}$, and countries are distinguished by the price that importer m pays for product j, $p^m_{c,j,t}$, the duty rate imposed on product j, $p_{c,j,t}$, and by the quality of their individual variety, $\lambda_{c,j,t}$. If importer m chooses the country indexed $c_{j,t}$, this match is denoted $c^m_{j,t}$.

A.2 Domestic consumers

A representative consumer with constant-elasticity-of-substitution (CES) preferences over varieties maximizes their utility:

$$U = \left(\sum_{m=1}^{M} \alpha_m Q_m^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}} . \tag{12}$$

This yields demand for variety m:

$$Q_m = B p_m^{-\sigma} . \tag{13}$$

A.3 Foreign suppliers

Multiple different countries produce varieties of product j. They set the price at time t based upon their own marginal cost, which also depends on their quality $\lambda_{c,t}$. The optimal price is

$$p_{c,j,t} = \mu_{c,j} MC_{c,t} = \mu_c \frac{w_{c,j,t}}{z_c} \left(\lambda_c \right),$$

where z is the idiosyncratic productivity of supplier c, w is the wage, and λ is quality. Suppliers set a constant markup μ_c.

A.4 Importer's problem

Importers must decide whether to stay with their current source country or choose a new source country based on the switching costs, price, and quality of the available menu of input sources. Selecting a new source country is associated with paying the duty-inclusive input price of that country plus the switching cost. Importer m maximizes profits by choosing a vector of countries from which to source each of its required inputs to production and by setting the optimal price of its final good variety. Each importer produces a single nontradeable final good variety m and requires labor and a bundle of J inputs to produce this variety according to a Cobb–Douglas production function:

$$Q_m = L^{\alpha}\left(\Pi_{j=1}^{J} I_j^{\gamma_j}\right)^{1-\alpha}, \tag{14}$$

where L is units of labor and $\{I_j\}_{j=1}^{J}$ denotes the quantity of intermediate inputs. Importers choose the source country based on the expected duty-inclusive price and the frictions associated with moving to a different source country.

The expected price paid for input j from a given country c is $\mathbb{E}\left[\tau_{c,j,t}p^{m}_{c,j,t}\right]$, where $p^{m}_{c,j,t}$ is the price that firm m pays for good j from county c in time t and $\tau_{c,j,t}$ is the duty rate applied to good j from country c at time t. Import prices from countries for a given good may differ by importing firm, but the duty rate does not. Importer m's expected per-unit cost of sourcing good j from country c can be written:

$$\bar{p}^{m}_{c,j,t} = \mathbb{E}\left[\tau_{c,j,t}p^{m}_{c,j,t}\right]\exp\left\{\zeta_{C,j}\mathbb{1}\left\{c^{m}_{j,t} \neq c^{m}_{j,t-1}\right\}\right\}. \tag{15}$$

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

Importer m requires a bundle of inputs j to produce unique final good variety m, and $C_t = \{c_{j,t}\}_{j=1}^{J}$ is the vector of supplier choices for each of those inputs made by importer m at time t.

The cost of the input bundle for the final good m, based on expected input prices, is:

$$c_m\left(C_t^m\right) = w^{\alpha}\left(\prod_{j=1}^{J}\left[\bar{p}_{c,j,t}^m\right]^{\gamma_j}\right)^{1-\alpha}. \tag{16}$$

The productivity of firm m depends on both the firm's productivity draw φ_m and the input-specific quality parameter λ for each of its suppliers, combined to yield $\Phi_m\left(C_t^m\right) = \varphi_m \Pi_{j=1}^J \lambda_{c,j,t}$. The marginal cost of production for importer m can be written as:

$$MC\left(C_t^m\right) = \frac{1}{\Phi_m\left(X_t^m\right)} c_m\left(X_t^m\right) \tag{17}$$

and profits as:

$$\pi_t^m = \max_{p_m, X_t^m} p_m Q_m - MC\left(X_t^m\right) Q_m \tag{18}$$

The importer must choose the country of origin for each input j and optimal price for final good m. Consumer preferences (CES) provide the profit-maximizing final good pricing:

$$p_m = \frac{\sigma}{\sigma-1} MC\left(X_t^m\right). \tag{19}$$

Plugging in this expression for optimal price p_m and marginal cost $MC\left(X_t^m\right)$ yields:

$$\pi_t^m = \max_{X_t^m} \frac{1}{\sigma} B\left(\frac{\sigma}{\sigma-1}\right)^{1-\sigma}\left[\Phi_m\left(X_t^m\right)\right]^{\sigma-1} c_m\left(X_t^m\right)^{1-\sigma} \tag{20}$$

Taking logs demonstrates that expected profit is separable by each input j:

$$\ln \pi_t^m = A^m + \ln \pi_{j,t}^m + \sum_{k \neq j} \ln \pi_{k,t}^m, \tag{21}$$

where

$$\ln \pi_{j,t}^m = \max_{x_t^m} v(\sigma-1)\ln \lambda_{x,j,t} + \omega_j\left(\mathbb{E}\left[\ln \tau_{x,j,t} p_{x,j,t}^m\right] + \zeta_{X,j}\mathbb{1}\left\{x_{j,t}^m \neq x_{j,t-1}^m\right\}\right). \tag{22}$$

This separability allows me to solve the profit-maximizing source selection problem separately for each input j, so I drop the j subscripts. For each input j, the importer selects the source country

x associated with the highest expected profits. Define $\bar{\pi}_t^m(x_t^m, \boldsymbol{\beta})$ as follows:

$$\bar{\pi}_t^m(x_t^m, \boldsymbol{\beta}) = \xi \ln \lambda_{x,t} + \beta_P \mathbb{E}\left[\ln \tau_{x,t} p_{x,t}^m\right] - \beta_X \mathbb{1}\left\{x_t^m \neq x_{t-1}^m\right\}, \tag{23}$$

where

$$\xi = v(\sigma - 1), \beta_P = -(1-\alpha)(\sigma-1)\gamma, \beta_X = (1-\alpha)(\sigma-1)\gamma\zeta_X. \tag{24}$$

I want to estimate the vector of unknown parameters $\boldsymbol{\beta} = \{\beta_P, \beta_X, \xi\}$, where β_P represents the responsiveness of the importing firm to changes in price and ξ to changes in quality and β_X is the per-unit switching cost. I estimate these parameters product by product and separately for firms importing with and without brokers.

A.5 Solving the importer's problem

A.5.1 Value function

The importer's expected profit maximization problem can be expressed as a value function. Importer m knows the value of state variables c_{t-1}, the country used as m's source for a given input in the prior period, $\mathbf{p_{t-1}}$, the vector of all duty-inclusive prices for that input in time $t-1$, and $\varepsilon_{c,t}^m$, the structural shock (unobserved by the econometrician) to profit. The values of parameters β are also known to the importer at the time of its sourcing decision. Given this information, the importer chooses source country c_t^m at the beginning of period t. At the end of period t, after sourcing choices are made for all inputs, $\mathbf{p_t}$ and $\varepsilon_{c,t+1}^m$ are realized.

The solution to the importer's problem is the choice of source country c, chosen to maximize the present discounted stream of expected profits. This problem can be represented by the value function:

$$V(c_{t-1}, \mathbf{p_{t-1}}, \boldsymbol{\epsilon}_t) = \max_{\{c_t, c_{t+1}, \dots\}} \mathbb{E}\left[\sum_{\tau=t}^{\infty} \delta^{\tau-t}\left(\bar{\pi}_\tau\left(x_\tau, \mathbf{p}_{\tau-\mathbf{1}}, c_{\tau-1}, \boldsymbol{\beta}\right) + \varepsilon_{c,\tau}\right)\right]. \tag{25}$$

The value function $V(c_{t-1}, \mathbf{p_{t-1}}, \boldsymbol{\epsilon}_t)$ can be rewritten recursively as a Bellman equation to break the dynamic optimization problem down into a sequence of single-period decisions:

$$V\left(c, \mathbf{p}, \boldsymbol{\epsilon}'\right) = \max_{c'} \bar{\pi}\left(c', \mathbf{p}, c, \boldsymbol{\beta}\right) + \varepsilon'\left(c'\right) + \delta EV\left(c', \mathbf{p}, c, \boldsymbol{\epsilon}'\right) \, and \tag{26}$$

$$EV\left(x', \mathbf{p}, x, \boldsymbol{\epsilon}'\right) = \int_{\mathbf{p}'} \int_{\boldsymbol{\epsilon}''} V\left(x', \mathbf{p}', \boldsymbol{\epsilon}''\right) h\left(\mathbf{p}', \boldsymbol{\epsilon}'' \mid \mathbf{p}, x, x', \boldsymbol{\epsilon}'\right) d\mathbf{p}' d\boldsymbol{\epsilon}'', \tag{27}$$

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

A.5.2 Distributional assumptions

Conditional independence The joint density of $\{p_{c,t}, \varepsilon_{c,t+1}\}$, can be written:

$$\Pr[p_t, \varepsilon_{t+1} | \mathbf{p_{t-1}}, \varepsilon_t, c_{t-1}] = \Pr[\varepsilon_{t+1} | p_t] \Pr[p_t | p_{t-1}, c_{t-1}].$$

Conditional independence is a common assumption in the discrete choice literature.

IID error terms The εs are distributed i.i.d. (across choices and periods) according to the type I extreme value distribution.

$$\Pr\left(\varepsilon_{t+1} \mid p_t\right) = \Pr\left(\varepsilon_{t+1}\right).$$

A.6 Likelihood

Appendix B Preparing the Data for Model Estimation

Two primary concerns arise when I consider the sample for structural estimation of the discrete choice model. First, the selection of products must be suitable for estimation; the products must constitute a large enough share of the import market to be representative, the selection must be small enough in number to make estimation feasible given computational limits, and it must provide enough (broker and nonbroker) observations for model convergence. Second, estimation of parameters that differ for broker and nonbroker "draws" requires consideration of the firms included in the sample.

B.1 HS8 selection

B.2 Firm matching

I estimate propensity scores for assignment to customs broker usage based on observable firm characteristics that influence the likelihood of employing the services of a customs broker. For firm m at time t, these characteristics include the total imports (logtotval$_{mt}$), imports of product j ($\ln(v_{mtj})$), and employment ($\ln(Employment_{mt})$). The propensity score estimation facilitates the construction of a new matched dataset, representing approximately X% of the total import value. The propensity score model is specified as:

$$\log\left(\frac{P(\text{broker} = 1|\mathbf{X}_{mt})}{1 - P(\text{broker} = 1|\mathbf{X}_{mt})}\right) = \beta_0 + \beta_1 \cdot \text{logtotval}_{mt} + \beta_2 \cdot \text{logval}_{mtj} + \beta_3 \cdot \text{logemp}_{mt}, \tag{28}$$

where $\mathbf{X}_{mt}$ denotes the covariates specific to firm m at time t and $\beta_0, \beta_1, \beta_2, \beta_3$ are the parameters to be estimated.

Kernel-based matching is then applied, using the estimated propensity scores to retain in the sample those firms with nonzero match weights, while firms with a match weight of zero are excluded. This approach to sample selection ensures that the structural estimation is restricted to firms with comparable observed characteristics within the region of common support, thus enhancing the credibility of my causal inferences.

Following the selection of HS8 products and firms with comparable observed characteristics, the estimation sample comprises approximate X% of total import value.

Appendix C Empirical results pending U.S. Census Bureau disclosure

C.1 Dynamics of broker use

Table 8: 3×3 Transition Matrix for Import Behavior

	State at $t+1$		
State at t	Import with broker	Import without broker	Do not import
Import with broker	p_{11}	p_{12}	p_{13}
Import without broker	p_{21}	p_{22}	p_{23}
Do not import	p_{31}	p_{32}	p_{33}

To examine the dynamics of import behavior, I calculate firms' probabilities of transitioning between three distinct states: 1) importing with the aid of a broker, 2) importing independently without a broker, and 3) not importing or exiting. The matrix is structured such that each element p_{ij} delineates the probability of transitioning from state i at time t to state j at time $t+1$.

The diagonal elements (p_{11}, p_{22}, p_{33}) represent the probabilities of remaining in the same state across two consecutive periods, signifying the persistence of behavior. Off-diagonal elements reflect the likelihood of changing states, providing insights into firms' probability of moving between import modalities.

Interpretation of the transition probabilities offers a wealth of understanding regarding the stability of import behaviors. For instance, a high p_{11} suggests a strong propensity for firms to continue importing with a broker, potentially indicating persistence in the importer–broker relationship or ongoing complexities in import procedures that necessitate expert assistance. Conversely, a high p_{22} may imply a degree of confidence or established efficiency in handling imports without support from a customs broker. The high probabilities of transitions to "Do not import" (p_{13}, p_{23}) indicate high probabilities of exiting the import market, which implies either a switch to sourcing domestically or ceasing operations entirely.

Then, limiting the sample to only "continuers," or firms that continue importing a given product, I also calculate a 2×2 transition matrix:

$$\begin{bmatrix} p_{11}^c & p_{12}^c \\ p_{21}^c & p_{22}^c \end{bmatrix}$$

where p_{11}^c and p_{22}^c denote firms' probabilities of remaining in the same state and p_{12}^c and p_{21}^c represent their probabilities of switching between states. The analysis of this matrix offers insights into the consistency of each state and the propensity of firms to modify their importing practices. For instance, a larger p_{11}^c relative to p_{21}^c suggests that firms tend to continue employing brokers once they have initiated this practice, implying a sustained benefit from broker mediation. In contrast, a higher p_{22}^c may indicate that firms not using brokers see little reason to alter their approach to importing.

To further understand the persistence of broker use, I estimate an autoregressive model of the form:

$$\begin{aligned} \mathbb{1}\left\{\text{Broker}_{cjt}^m\right\} &= \beta_0 + \beta_1 \mathbb{1}\left\{Broker_{cjt-1}^m\right\} + \beta_2 \mathbb{1}\left\{\text{Broker}_{c,j,t-2}^m\right\} \\ &\quad + \beta_3 \mathbb{1}\left\{Broker_{c,j,t-3}^m\right\} + \gamma_m + \gamma_j + \gamma_t + \gamma_c + \varepsilon_{cjt}^m \end{aligned} \tag{29}$$

I estimate the coefficients in Equation 29 to understand the relationship between lagged broker indicators, fixed effects, and the likelihood of current broker use. β_0, represents the baseline expectation of $\mathbb{1}\left\{\text{Broker}_{cjt}^m\right\}$. β_1, β_2, and β_3 capture the effects of prior broker use on current broker use, while controlling for other factors. A positive coefficient indicates that using a broker in prior years is associated with a higher likelihood of using a broker in the current year, holding all else constant. Conversely, a negative coefficient suggests a decrease in likelihood of broker use with past broker use.

From this point, I focus not on the choice of broker usage or the transition to and from broker usage. Instead, I consider the use of a broker in time $t-1$ as a characteristic of the firm-product pair and limit my focus to the impact of this characteristic on outcomes.

C.2 Empirical Application: U.S.–China Trade War

I use a dynamic difference-in-differences (DiD) methodology to estimate the effects of trade war tariffs on trade values. I limit this portion of the analysis to HS codes corresponding to goods classified as advanced technology products (ATPs), a category defined by the U.S. Census Bureau (source). By restricting the sample to these high-technology categories, I focus on a product category that was particularly affected by the U.S.–China trade war.

Separate dynamic DiD estimations are conducted for firms that utilize customs brokers (`broker == 1`) and for those that do not (`broker == 0`).

Figure 5: Event Study Plot Placeholder

C.3 Quality Estimation

Table 9: Summary Statistics for Quality Estimation

	Mean	Std Dev
OLS Price Coefficient	—-	—-
IV Price Coefficient	—-	—-
Own-Price Elasticity	—-	—-
Overidentifying Restriction Test, p-Value	—-	—-
1st Stage f-Statistic p-Value, Price	—-	—-
1st Stage f-Statistic p-Value, Nest Share	—-	—-
Conditional Market Share Coefficient	—-	—-
R^2	—-	—-
Observations per Estimation	—-	—-
Estimations with Statistically Significant [a] Price Coefficient	—-	—-
Observations with Statistically Significant [a] Price Coefficient	—-	
Total Estimations	—-	
Total Observations	—-	

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Table 7: "Stay" Regression Results

	(1)	(2)	(3)	(4)	(5)
1{Broker}		-0.0241***	-0.0030	-0.2089***	-0.1702***
-0.1311***					
		(0.0043)	(0.0046)	(0.0094)	(0.0086)
(0.0107)					
$\ln(p)$	0	-0.0283***	-0.0284***	-0.0274***	-0.0275***
-0.0255***					
		(0.0008)	(0.0008)	(0.0008)	(0.0008)
(0.0006)					
$\ln(\overline{p})$	1	-0.0254***	-0.0246***	-0.0219***	-0.0215***
-0.0149***					
		(0.0012)	(0.0011)	(0.0011)	(0.0011)
(0.0009)					
λ (0)		0.0041***	0.0040***	0.0037***	0.0036***
0.0003*					
		(0.0004)	(0.0004)	(0.0004)	(0.0004)
(0.0001)					
λ (1)		0.0039***	0.0041***	0.0034***	0.0036***
0.0001					
		(0.0005)	(0.0005)	(0.0004)	(0.0005)
(0.0002)					
$\ln(1+\tau)$ (0)			-0.2607***		-0.2384***
-0.5148***					
			(0.0309)		(0.0317)
(0.0403)					
$\ln(1+\tau)$ (1)			-0.8523***		-0.6901***
-0.8123***					
			(0.0555)		(0.0511)
(0.0598)					
$\ln(v_m)$ (0)				0.0089***	0.0091***
0.0037***					
				(0.0004)	(0.0004)
(0.0003)					
$\ln(v_m)$ (1)				0.0268***	0.0248***
0.0186***					
				(0.0008)	(0.0007)
(0.0006)					
$\ln(v_c)$ (0)					
0.0282***					
(0.0005)					
$\ln(v_c)$ (1)					
0.0286***					