Market Power and the Price of Intermediation at Sea*

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PRELIMINARY AND INCOMPLETE

Abstract

We examine how market power in ocean shipping contributes to unequal trade costs using novel data from shipping contracts. During the COVID-19 pandemic, transport companies increasingly charged higher prices to freight forwarders—intermediaries typically used by smaller firms—despite identical routes and contract length. The freight forwarder premium rose from 5% pre-pandemic to 25% post-pandemic. We show that it is explained by the rise in the transport companies' market power to price discriminate, rather than capacity constraints and other cost considerations. This restricted the export growth of smaller firms that depended on freight forwarders and accounted for 16% of the US import price inflation during the pandemic.

JEL Classification: F1

Keywords: market power, transportation, price discrimination, trade costs, intermediaries

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1 Introduction

The efficient movement of goods across borders is the backbone of international trade. Yet, it is increasingly shaped by a small number of large transport companies — particularly in the ocean shipping sector, which carries around 80% of the world trade. Their market power has always been a concern for policy makers and academics, in light of frequent spikes in freight prices that contribute to inflation and economic slowdown (Alessandria et al., 2023; Bai et al., 2024; Dunn and Leibovici, 2025). Most recently, following the Covid-19 pandemic, when freight prices doubled, reaching the unprecedented levels, policymakers worldwide strengthened their oversight over ocean carriers.[1] However, detecting the role of market power at sea in freight price fluctuations is challenging for at least two reasons. First, they can be explained by cost-based mechanisms due to capacity constraints and limited infrastructure (Brancaccio et al., 2024, 2025). And second, the market power of transport companies can be mitigated by contractual relationships prevalent in ocean shipping.[2]

This paper shows how market power at sea shapes freight prices across firms and over time, using novel data from ocean shipping contracts between transport companies and shippers. This data has two unique features that allows us to overcome the two challenges. Firstly, it contains the date, when a freight price for transportation of a standardized 40-foot container on a given route was offered by a transport company in charge of transportation to a given shipper. Secondly, this dataset includes the duration (in the number of days) for which the freight price remains valid. Using these features, we document the rise in transport companies' market power to price discriminate during the Covid-19 pandemic, unexplained by capacity constraints on a given date or contract duration. We show, both theoretically and empirically, that, following a demand shock, such as during the pandemic, the market power at sea endogenously disportionately increases trade costs of smaller firms.

Our shipping contracts are provided by one of the largest ocean shipping benchmarking platforms. It collects freight price quotes from its clients in exchange for the benchmarking services and publishes an aggregate freight price index highly regarded by academics and professionals. Using the individual freight price quotes, we uncover substantial heterogeneity in freight prices hidden behind the aggregate freight price indexes used in previous research. Firstly, freight prices in longer-term contracts are expectedly lower than spot market freight rates. Secondly, even within longer-term contracts, freight prices offered to direct shippers are lower and increase less during the Covid-19 pandemic, than those offered to

[1] In 2022, the US President Joseph R. Biden signed into law the Ocean Shipping Reform Act that strengthens the Federal Maritime Commission's oversight over ocean carriers' practices. In 2023, the European Commission ended long-standing antitrust exemptions for shipping alliances starting from April 25, 2024.

[2] Ardelean and Lugovskyy (2023) estimate that contracts cover 75% of the global maritime transportation.

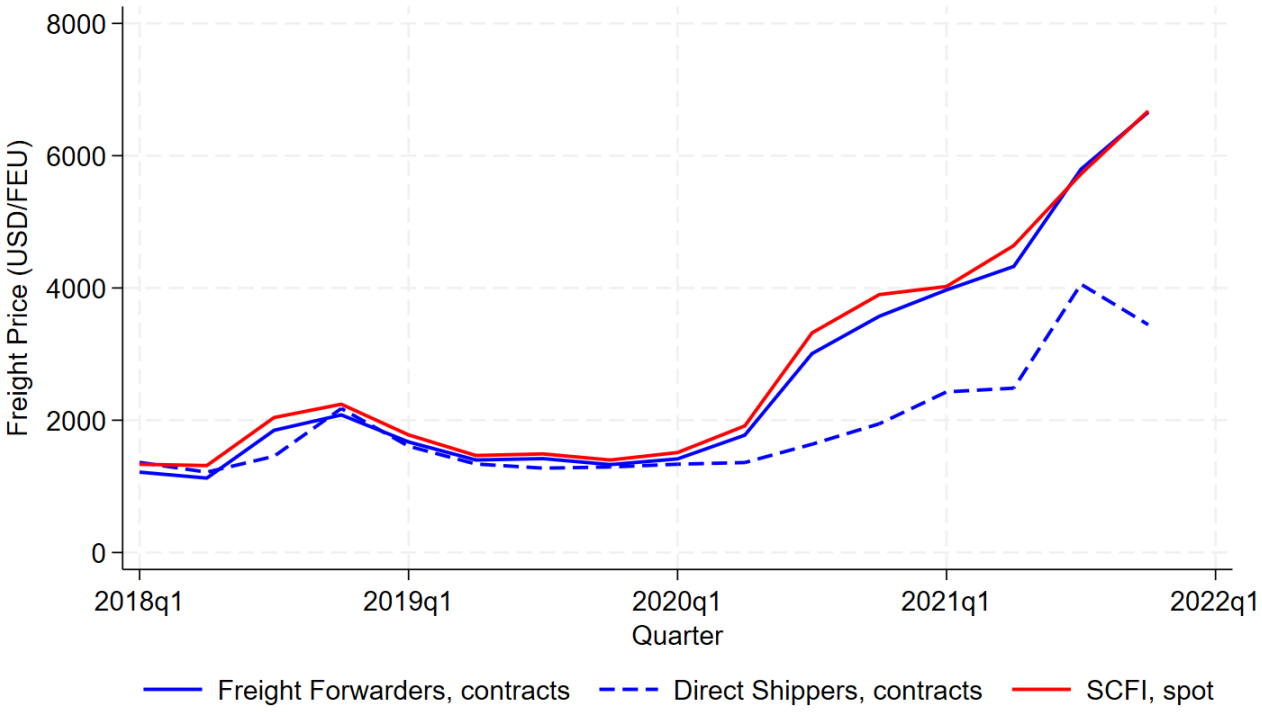


Figure 1: Heterogeneity in average quarterly freight prices across firms and contracts

freight forwarders that are shipping intermediaries. Figure 1 illustrates this by plotting the monthly average freight prices for transportation from Shanghai to US West Coast in contracts longer than 14 days against the Shanghai Containerized Freight Rate Index (SCFI) capturing the average spot prices on these routes.

To explore the mechanisms of freight price variation across buyer types and over time, we employ a difference-in-difference identification strategy. We find that, in the pre-pandemic period, transport companies were charging freight forwarders a small 5% premium relative to direct shippers for transportation on the route at the same time. However, in the post-pandemic period, this premium increased to a substantial 25%. These effects cannot be explained by variation in capacity constraints, since they are estimated using contracts offered on the same date when a transport company faced the same capacity constraints. Neither can they be an outcome of differences in contractual relationships across firms, which we account for with the observed contract duration. they are also unexplained by the economies of scale at the shipment and firm-level measured with the average shipment and shipper sizes across buyer types.

By ruling out alternative explanations for the sharp increase in the freight forwarders' premium, we argue that it is explained by the rise in the transport companies' power to

price discriminate. Firstly, using the event-study design, we show that the freight forwarders premium started to grow relative to the third quarter of 2019 only in the third quarter of 2020. This period coincides with a large increase in the US consumer's demand for tradable goods, especially those imported from China. Secondly, our heterogeneity analysis suggests that the freight forwarders' premium increased much more on initially more concentrated and less competitive routes.

2 Theoretical Framework

We develop a simple framework to interpret the surge in freight prices during the pandemic. The framework highlights two points. First, the *magnitude* of a freight price spike cannot, by itself, distinguish whether it is driven by capacity constraints or market power. Second, differential changes in the prices paid by freight forwarders and direct shippers can identify the role of market power.

2.1 Freight Prices under Capacity Constraints and Market Power

Environment. Consider a representative route with the inverse demand for transportation services

$$t^d = t(Q, \varepsilon)$$

where ε is a demand shock. Transport companies' marginal costs of transportation $MC(Q)$ may be increasing in total quantity Q because of *capacity constraints*—for instance, limited vessel or container space, port congestion, or labor shortages:

$$MC(Q) \geq 0.$$

Market structures. Consider two extreme market structure in the transportation sector. Under perfect competition, the equilibrium freight prices are set equal to the transport companies' marginal costs:

$$t(Q) = MC(Q).$$

In contrast, under monopoly, freight prices are set as a mark-up, $\mu(Q)$, on top of the marginal costs $MC(Q)$:

$$t(Q) = \mu(Q) \times MC(Q),$$

The equilibrium freight prices under either market structure can be generalized as:

$$t(Q) = (\mu(Q))^{\theta} \times MC(Q), \tag{1}$$

where $\theta \equiv \{0, 1\}$ is a conduct parameter equal to 1 under monopoly and 0, otherwise.

Equilibrium freight price changes in response to a demand shock. Now suppose there is a positive demand shock. Taking logs and differentiating the equilibrium freight price in (1) with respect to ε, yields the following:

$$\frac{d \log t(Q)}{d \log \varepsilon} = \frac{d \log Q}{d \log \varepsilon} \left(\theta \frac{d \log \mu(Q)}{d \log Q} + \frac{d \log MC(Q)}{d \log Q} \right)$$

This expression shows that even under perfect competition ($\theta = 0$), capacity constraints ($MC'(Q) > 0$) can result in a steep increase in freight price, as depicted in Figure **??**. However, under monopoly, a transport company internalizes the slope of demand and adjusts quantity less than a competitive market would. This results in a larger freight price increase for the same outward shift in demand, as shown in Figure **??**.

Hence, both capacity constraints (through $MC'(Q) > 0$) and market power can generate sharp spikes in freight prices when demand increases. The magnitude of the spike alone is therefore not informative about which mechanism is at play.

2.2 Buyer Types and Identification of Market Power

Now suppose that there are two types of buyers observed (to both researchers and transport companies) on a given route at a given time: $Q_F + Q_D = Q$. Then the ratio of their equilibrium freight prices is

$$\frac{t_F(Q_F)}{t_D(Q_D)} = \left(\frac{\mu_F(Q_F)}{\mu_D(Q_D)} \right)^{\theta}.$$

Assuming that buyer-specific marginal costs of transport companies are fully controlled for, this ratio differs from unity only if a transport company has market power to charge and vary mark-ups across buyer types ($\theta = 1$).

Taking logs and then differentiating with respect to a demand shock, ε, we obtain the following:

$$\frac{d \log t_F / t_D}{d \log \varepsilon} = \theta \left[\frac{d \log \mu_F(Q_F)}{d \log Q_F} \frac{d \log Q_F}{d \log \varepsilon} - \frac{d \log \mu_D(Q_D)}{d \log Q_D} \frac{d \log Q_D}{d \log \varepsilon} \right] \tag{2}$$

This expression implies that the freight price ratio responds to a demand shock if and only if there is market power in the transportation sector: $\theta = 1$. Therefore, the differential change

in the prices of freight offered to two types of buyers at the same time when a transport company faced identical capacity constraints can be used to identify its market power.

Moreover, this freight price ratio increases in response to a positive demand shock if

$$\frac{d\log\mu_F(Q_F)}{d\log Q_F}\frac{d\log Q_F}{d\log\varepsilon} > \frac{d\log\mu_D(Q_D)}{d\log Q_D}\frac{d\log Q_D}{d\log\varepsilon}$$

This condition is satisfied if, all else equal, the demand of F-buyers is more elastic to the same demand shock than the demand of D-buyers, or, mark-up elasticity of F-buyers is greater than that of D-buyers.

3 Data

3.1 Data sources

Shipping contracts. We use a novel dataset of freight contracts between transport companies and their customers for container shipping from China to US West Coast from January 2018 to December 2021. The data is kindly provided by one of the world's largest ocean freight rate benchmarking platform, which offers benchmarks for the ocean freight rates to its clients in exchange for their freight rate quotes. Clients are buyers of transportation of two types: freight forwarders, which are intermediaries between shippers and transport companies, and direct shippers themselves. Since the benchmarks they pay to receive are based on their committed quotes, firms using this platform have incentives to report their freight rate quotes truthfully.

The ocean freight contracts include transport companies' names, identifiers of their customers, ports in the origin and destination, freight rates quoted for transportation of a standardized 40 foot container (in known currency, mainly US$) and the dates between which they remain valid. All freight rates are base rates – they do not include any surcharges and additional fees such as fuel surcharges, terminal handling charges, and security fees, which are reported separately. We observe freight rate quotes rather than the actually paid freight rates. Although this data does not provide the actually transported or minimal required quantities under these contracts, we approximate them using information from the US Maritime Bills of Lading.

US Maritime Bills of Lading. To obtain additional information on routes, freight forwarders, direct shippers, and transport companies, we complement the shipping contracts data with US Maritime Bills of Lading. This data describes the universe of containerized US

Table 1: Ocean transportation contracts from China to US West coast, 2018 - 2021

	mean	med	std
Freight rate, USD/FEU	2283	1550	1725
Contract length, days	45	14	94
# Routes/Year	65	65	0
# Transport companies/Year	19	18	2
# Buyers/Year:	45	57	27
# Freight forwarders	9	12	6
# Buyers/Year-Route-Transport company:	7	6	3
Freight forwarders	0.69	0.75	0.31
N observations	143 096		

maritime imports from China from 2017 to 2022. For each shipment, it reports its ports of origin and destination, transport company's name, number of containers per shipment and their size (40- or 20-foot), their volume (in TEU), weight (in kilos), estimated value (in US$), and Harmonized systems' codes (4- or 6- digit) of transported products. US Bills of Lading also provide company names of US importers and Chinese exporters for most shipments (65% and 60%, respectively). Moreover, the data identifies shipments whose transportation was arranged by freight forwarders or other ocean freight intermediaries and their standardized alpha code for 80% of such shipments.

3.2 Summary Statistics

Shipping contracts. Table 1 presents the summary statistics of the data in our shipping contracts. There are in total 143 096 contracts for transportation of containers on 65 port-to-port routes between, on average, 19 transport companies and 39 buyers of transportation, 18% of which are freight forwarders. For a given transport company on a given route, there are, on average, 7 shipping contracts with distinct buyers, 70% of which are freight forwarders. The average freight rate is 2283 US$, while the average contract length is 45 days.

Figure 1 shows that the average quarterly freight rates observed in the shipping contracts closely follow the evolution of the SCFI freight rate index. Published by the Shanghai Shipping Exchange, this index is widely used by industry analysts as a measure of the average spot rate for transportation of a 40-foot container between Shanghai and US West Coast. Across all contracts for transportation from Shanghai, the average freight rates more than quadrupled from 1460 USD/FEU in January 2020 to 6336 USD/FEU in September 2021. The SCFI freight rate index exhibited the same growth but with higher average freight rates than in the contracts throughout 2020. The reason is that shipping contracts cover both spot and long-term contracts, while the SCFI freight rate index reflects the spot market

Table 2: Characteristics of routes and transport companies, 2017

	Shipping contracts			All shipments		
	mean	med	std	mean	med	std
Panel A: Routes						
Volume, '000 TEU	108	22	209	10	13	56
Weight, '000 Ton	605	192	1084	67	1	303
Estimated value, mln USD	3666	139	7313	338	2	1921
N transport companies	14	15	6	4	2	5
N routes	55			1107		
Panel B: Transport Companies						
Volume, '000 TEU	534	449	394	77	0	237
Weight, '000 Ton	3271	2661	2529	527	24	1468
Estimated value, mln USD	18049	15434	13066	2674	24	7947
N routes	205	221	122	35	2	84
N transport companies	20		140			

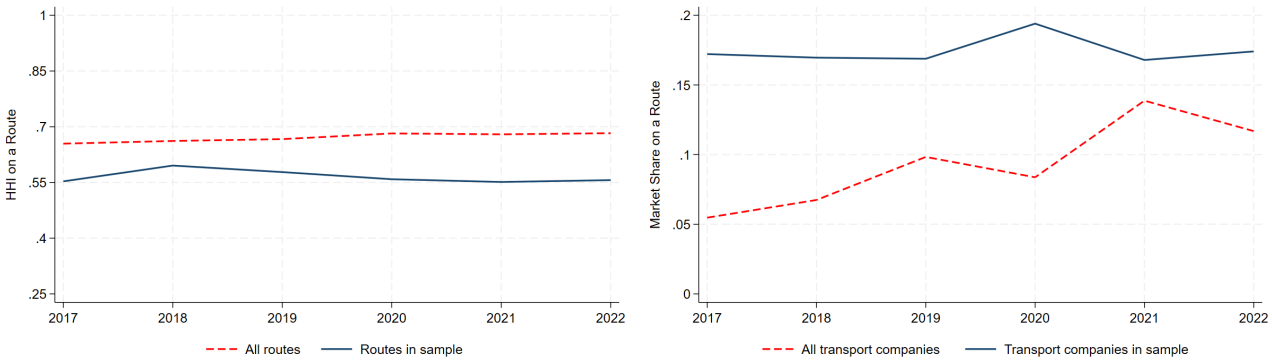
Notes: * exporter and importer counts are based on their company names. Exporters and importers with known names account for 60% and 65% of US imports by value, respectively.

rates only.[3]

Routes and transport companies in the shipping contracts. The routes we observe in the shipping contracts comprise 5% of all routes from China to the US, but represent 55% of all US imports from China, by estimated value and volume. In Table 2, we describe them in comparison to an average route between China and the US in 2017. Panel A shows that routes in the shipping contracts are, on average, about 10 times larger by volume, weight, and estimated value of transported goods, than the average route between China and the US. These routes are more competitive, as they are served by 17 transport companies on average, while the average route has only 4 transport companies. Yet, they are still highly concentrated. Figure 2a shows that the average Herfindahl-Hirschman Index of market concentration on these routes is 0.55-0.6, while the cutoff for high market concentration is 0.25. This high level of market concentration suggests that the market power of transport companies can at least partly explain the increase in freight prices during the pandemic.

The transport companies appearing in our shipping contracts represent 15% of all transport companies transporting US imports from China, but carry more than 95% of their vol-

[3]Other major global routes experienced a similar increase in the average freight rates. For example, Dunn and Leibovici (2025) report that the Drewry World Container Index, a measure of global shipping costs across major routes, increased from 2000 US$/FEU at the beginning of 2020 to almost 10 000 US$/FEU at the end of 2021. Carrière-Swallow et al. (2023) show that, in this period, the Freightos Container Index increased more than five times.



(a) Routes are highly concentrated

(b) Transport companies have high market shares

Figure 2: Routes' market concentration and transport companies' market shares

ume. These are mainly the largest (top-20) transport companies. Panel B in Table 2 shows that they are 6 - 7 times larger than the average transport company operating between China and the US, by volume, weight, and imported value, and serve 6 times more routes. Figure 2b shows that the average transport company in the shipping contracts has around 15-20% volume share on a route. This is higher than the average market share across all transport companies operating between China and the US, which grew from 5% to 15% between 2017 and 2021, and again suggests at least some degree of market power.

4 Shipping intermediaries and contracts in international trade

Combined with the U.S. Bills of Lading, the shipping contracts reveal a large but previously neglected role of shipping intermediaries and contracts in international trade. Figure 3 shows that before the pandemic, freight forwarders, which are shipping intermediaries, intermediated 70-75% of U.S. import shipments from China, accounting for around 65-70% of imported volume and value. The importance of freight forwarders for the U.S. imports from China has increased even further during the pandemic, when they accounted for almost 80-85% of imports by shipment count, value, and volume.

Freight forwarders are logistics experts or third-party agents who coordinate the end-to-end movement of goods on behalf of the shippers. Specifically, they choose the most cost-effective routes, prepare the paperwork, consolidate smaller shipments into larger ones, and negotiate freight rates with the carriers. In exchange, they charge their clients freight forwarding fees on top of the carrier's freight charges, which are the focus of this paper. Therefore, when deciding whether to use a freight forwarder or ship directly, firms trade off lower fixed costs of exporting or importing and higher marginal logistics costs. Figure 4

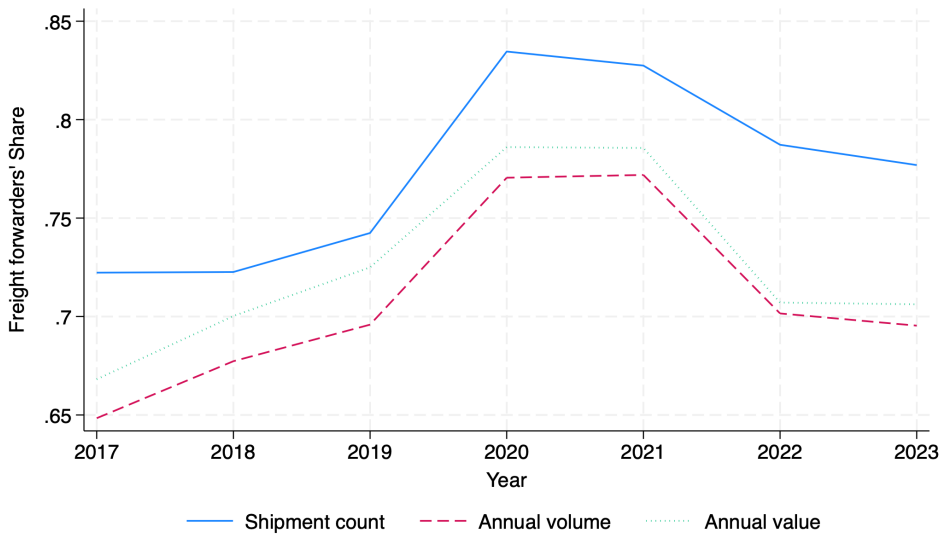


Figure 3: The role of freight forwarders in the U.S. imports from China

shows that, in line with this trade-off, firms that use freight forwarders are much smaller by annual volume, value, and shipment size than those shipping directly with the carrier.

We use U.S. Bills of Lading to characterize freight forwarders and direct shippers as buyers of maritime transportation on routes from China to the U.S. We identify freight forwarders using their alpha-numeric codes, and define direct shippers as either exporters or importers that did not use freight forwarders in any of their shipments in a given year. This approach partitions transportation buyers into mutually exclusive categories of freight forwarders and direct shippers. In 2017, there were 740 distinct freight forwarders, as well as 3161 exporters and 1878 importers that did not rely on freight forwarders in transportation of goods on routes and by transport companies in the shipping contracts Hence, depending on whether exporters or importers act as direct shippers, 19% or 28% of buyers in this sample are freight forwarders. This closely matches the 20% share of freight forwarders in a year, in the shipping contracts, reported in Table 1.

Table 3 compares the characteristics of freight forwarders and direct shippers operating on routes using transport companies in the shipping contracts in the pre-pandemic year 2018. Freight forwarders, on average, transport 30% smaller shipments but 200-300 times more frequently, which amounts to more than 265 - 456 times larger annually transported volume, relative to direct shippers (exporters or importers). Moreover, freight forwarders operate, on average, on 53 routes between China and the US contracting with 12 transport companies. In contrast, average exporters and importers that do not use freight forwarders transport their goods on only 2 and 50 routes, respectively, using only one transport com-

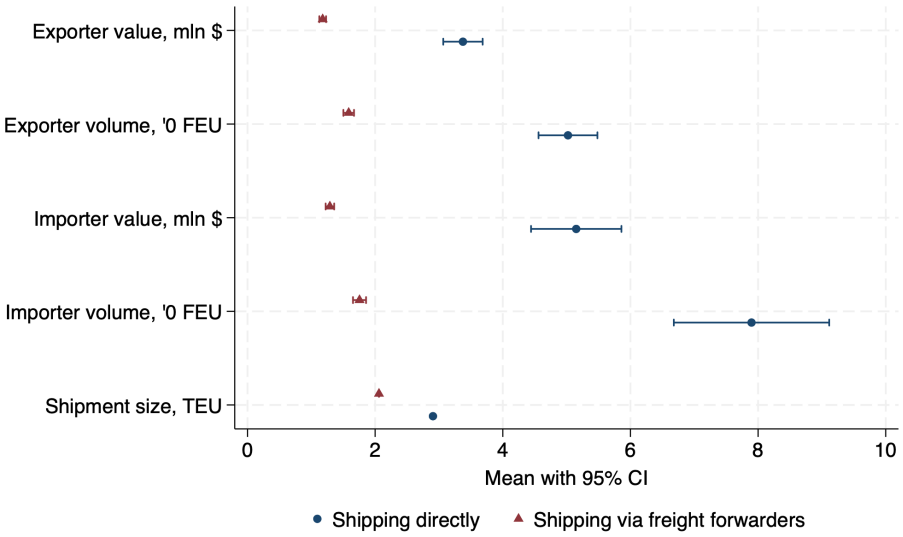


Figure 4: Characteristics of firms that use freight forwarders and ship directly, 2017

pany. Panel B of Table 3 shows that this comparison is not specific to the routes and transport companies observed in the shipping contracts but is representative of all routes and transport companies operating between China and the U.S. Since these firm and shipment characteristics can result in buyer-specific differences in transport companies' costs (through economies of scale or scope, for instance), we account for them in the empirical analysis.

Despite transporting larger annual volumes with higher frequency and having a wider set of competing transport companies, freight forwarders are charged higher base freight rates than direct shippers. Figure 5a illustrates the distribution of base freight rates charged to buyers of either type in 2018 observed in the shipping contracts. On average, transport companies charged freight forwarders 10% higher base freight rates for a 40-foot container on routes between China and the U.S. These base freight rates are the per-container rate from load port to discharge port. They do not include any additional carrier's surcharges such as terminal handling, destination delivery, war risk or peak-season surcharges, which are recorded separately in the data.

As we show later, the surprisingly higher base rates charged to freight forwarders are due to a much shorter duration of contracts that they use. In ocean transportation, shippers can sign a long-term contract with one or more carriers, locking in a minimum quantity commitment at a fixed base rate. Alternatively, they can use spot bookings with spot rates benchmarked against published indexes. Figure 5b shows that, on average, in 2018, new contracts of freight forwarders were 22 days long, while direct shippers contracts were 238 days long. While direct shippers predominantly use long-term contracts longer than 2

Table 3: Buyers of transportation from China to the U.S., 2017

	Freight forwarders		Direct			
			Exporters		Importers	
	mean	std	mean	std	mean	std
Panel A: Routes and transport companies in shipping contracts						
TEU/shipment	2	3	3	3	3	4
TEU/buyer	14589	215838	32	132	55	230
N shipments/buyer	3607	11634	11	42	18	64
N routes/buyer	53	64	2	2	50	441
N transport companies/buyer	12	8	1	1	1	1
N buyers in U.S. Bills of Lading	740		3161		1878	
Panel B: All routes and transport companies						
TEU/shipment	2	3	3	5	3	6
TEU/buyer	6108	22686	19	95	25	137
N shipments/buyer	3285	11146	7	30	9	38
N routes/buyer	48	59	2	2	17	214
N transport companies/buyer	11	7	1	1	1	1
N buyers in U.S. Bills of Lading	813		6554		5790	

Notes: * exporter and importer counts are based on their company names. Exporters and importers with known names account for 60% and 65% of US imports by value, respectively.

weeks, 60% of contracts of freight shippers are spot contracts, which are usually defined as contracts with duration less than 2 weeks. Since freight forwarders accounted for 70% U.S. imports from China, they expose around 40% of U.S. imports from China to the spot freight rate fluctuations, leaving the remaining 60% dependent on long-term shipping contracts.

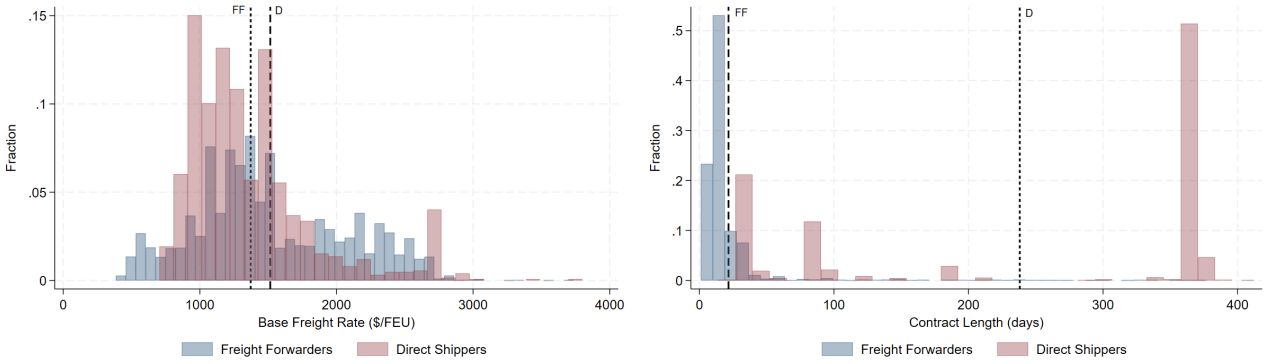
5 Mechanisms of freight price variation

5.1 Empirical strategy

Our shipping contracts' data allow us to document the role of freight forwarders in freight price variation of a given seller on a route. To do this, we employ a differences-in-differences identification strategy and estimate the following equation:

$$\log Price_{srbt} = \alpha Freight\ Forwarder_b + \beta Freight\ Forwarder_b \times Post_t + \gamma X_{srbt} + \theta_{srt} + \epsilon_{srbt} \quad (3)$$

where $Freight\ Forwarder_b$ is a dummy variable equal to 1 when buyer b is a freight forwarder; $Post_t$ is an indicator for periods t after January 2020, and X_{srbt} is a vector of control variables;



(a) Base freight rates

(b) Contract length

Figure 5: Characteristics of contracts of freight forwarders and direct shippers, 2018

θ_{srt} is a set of seller-route-time fixed effects, and ϵ_{srbt} is an error term. Coefficients α and β, estimate, respectively, the pre-Covid-19 freight price differentials across freight forwarders and direct shippers and their change with the onset of the pandemic.

Our empirical strategy allows us to attribute most of these freight price differentials to transport companies' market power rather than to cost variation. First, seller-route-time fixed effects ensure that our estimates are not driven by transport company and route heterogeneity, as well as over-time variation in transport companies' capacity on a route and other costs. Second, a set of control variables additionally account for the differences in average characteristics across freight forwarders and direct shippers, to rule out an omitted variable bias. Importantly, we control for the contract length in days directly observed in our shipping contracts. We also control for other buyer-specific characteristics that can result in price dispersion for cost-based reasons. These include the average shipment size, shipment frequency, number of routes, and transshipment probability by buyer type observed in the US Bills of Lading. Finally, we experiment with buyer and buyer-seller-route fixed effects to account for any unobserved firm heterogeneity and endogenous selection of routes and transport companies by buyers. This precludes the estimation of freight price differentials in the pre-pandemic period but eliminates any effects of buyer characteristics and selection on price differentials in the post-pandemic period.

A key assumption that causally identifies the effect of Covid-19 on freight price differentials is the absence of pre-trends prior to the pandemic. To test this assumption, we implement an event-study design and estimate the following equation:

$$\log Price_{srbt} = \sum_{k \neq -1} \beta_k Freight\ Forwarder_b \times D\{t = k\} + \gamma X_{srbt} + \theta_{srt} + \psi_{bsr} + \epsilon_{srbt}, \qquad (4)$$

where $D\{t = k\}$ is a set of event-time dummies indicating quarters relative to the last quarter of 2019, and ψ_{bsr} is a set of buyer-seller-route fixed effects. The coefficients β_k capture the differences in freight prices between freight forwarders and direct shippers in each quarter.

To provide additional evidence in favor of the market-power mechanisms behind the change in freight price differentials, we conduct a heterogeneity analysis across routes. Specifically, we estimate the following equation:

$$\begin{aligned}\log Price_{srbt} = \beta Freight\ Forwarder_b \times Post_t + \rho Freight\ Forwarder_b \times Post_t \times Z_{r(s)} \\ + \theta_{srt} + \gamma X_{srbt} + \psi_{bsr} + \epsilon_{srbt},\end{aligned} \tag{5}$$

where $Z_{r(s)}$ is a vector of average route (or seller) characteristics measured in the pre-pandemic period (from 2017 to 2019). Here, β captures the effect of the pandemic on freight price differentials across freight forwarders and direct shippers on routes (or sellers) with the average characteristic $Z_{r(s)}$. In addition, ρ captures the change in the freight price differentials on routes with above average (or zero) characteristics. We consider such characteristics as the pre-pandemic market concentration, transport company's share on a route, and route's exposure to the Covid-19 demand shock, which we discuss in the next Section.

5.2 Baseline Results

We begin by examining the effect of the Covid-19 pandemic on freight price differential between freight forwarders and direct shippers. Table 4 presents the results of estimating equation (3). In absence of any additional controls, column (1) shows that with the onset of the pandemic, the premium charged to freight forwarders by the same transport company on the same route and date increased from 15% to 50%. Column (2) suggests that freight price differences in the pre-pandemic period were entirely explained by differences in contract length across buyer types. Freight forwarders were charged a higher price because they were using shorter-term contracts (22 days, on average), while direct shippers enjoyed substantial discounts due to their longer-term contracts (301 days, on average). Doubling the contract length results in 3% lower freight prices offered by the same transport company on the same date for transportation on the same route. Yet, the 37% premium charged to freight forwarders in the post-pandemic period, estimated, conditional on the contract length, remains unexplained by differences in contract duration.

In the remaining columns of Table 4, we argue that this increase in the freight forwarders' premium is due to the rise of the transport companies' market power to price discriminate. Firstly, we show that it is not explained by a transport companies' cost variation across buyer types. If direct shippers transport larger shipments, more frequently, using more transport

Table 4: The effect of the Covid-19 pandemic in freight price dispersion

Dependent variable:	log *Freight Price*				
	(1)	(2)	(3)	(4)	(5)
Freight Forwarder	0.148***	0.057	0.113		
	(0.042)	(0.050)	(0.097)		
Freight Forwarder X *Post*	0.373***	0.372***	0.380***	0.399***	0.261***
	(0.094)	(0.093)	(0.082)	(0.089)	(0.080)
Log *Contract Length*		-0.030***	-0.027***	-0.041***	-0.042***
		(0.008)	(0.008)	(0.008)	(0.011)
Log *Shipment Size*			-0.074*	-0.070*	-0.125***
			(0.043)	(0.038)	(0.040)
Log *Shipment Frequency*			-0.035***	-0.031***	-0.043***
			(0.007)	(0.008)	(0.008)
Log # *Sellers/Buyer-Route*			0.017	0.045	0.200*
			(0.027)	(0.033)	(0.113)
Log # *Routes/Buyer*			-0.009	-0.023	-0.111**
			(0.027)	(0.022)	(0.051)
Transshipment Probability			-0.142	-0.114	-0.089
			(0.105)	(0.115)	(0.117)
Constant	7.283***	7.456***	7.617***	7.755***	8.159***
	(0.040)	(0.061)	(0.069)	(0.069)	(0.149)
Seller-Route-Date	✓	✓	✓	✓	✓
Buyer				✓	
Buyer-Seller-Route					✓
N obs	87871	87871	66329	66322	24451
N clusters	67	67	66	60	19
Adj. R^2	0.857	0.857	0.854	0.888	0.907

Robust standard errors clustered at buyer level in parentheses.
* p<0.10, ** p<0.05, *** p<0.01

companies, and on more routes, they could be offered discounts because of economies of scale and scope. If they are more likely to ship directly, without a transshipment, they could be charged a higher price. To account for this, we compute these characteristics averaged across buyer type, year, quarter, transport company, and route, using the US Maritime Bills of Lading. Although they have the expected effects on freight prices, adding these buyer-type-specific cost controls in column (3), does not affect the rise in the freight forwarders' premium in the post-Covid period.

Secondly, we show that the freight forwarders' freight price premium is not explained by unobserved buyer heterogeneity and endogenous entry and exit. In column (4), we add a set of buyer fixed effects, which absorbs the pre-pandemic freight forwarders' premium. By accounting for buyer selection and unobserved heterogeneity, we find an even larger increase in the freight forwarders' premium post-pandemic. In column (5), we include buyer-seller-route fixed effects to account for buyers' endogenous selection of transport companies and routes, following the pandemic. Additionally, we restrict out sample to buyers observed in both years following the onset of the pandemic, to eliminate the effect of endogenous entry and exit of buyers as a result of Covid-19. After accounting for these effects, in column (5), we find a 26 percentage points increase in the freight forwarder's premium following the pandemic. Since it is estimated while holding all possible sources of cost variation constant, it can only be explained by the rise in the transport companies' market power to price discriminate.

Before moving on to the heterogeneity analysis that provides further evidence of this, we confirm the causal effect of the pandemic on the freight forwarders' premium in an event study. We estimate coefficients β_k in equation (4) and plot them together with their 95% confidence intervals in Figure 6. Focusing on buyers who are observed in both, 2020 and 2021, as in column (5) of Table 4, we are left with four quarters before and eight quarters after the onset of the pandemic. All estimated coefficients in the pre-pandemic periods are small and statistically insignificant. This implies no evidence of differential trends in the freight prices between freight forwarders and direct shippers before the pandemic. After the onset of the pandemic, the estimated coefficients become positive and statistically significant, starting with the third quarter of 2020. These patterns are in favor of the parallel trends assumption and lend credibility to our identification strategy.

5.3 Heterogeneity Analysis

To provide additional evidence of the rise in the transport companies' market power to price discriminate, we perform heterogeneity analysis across routes and transport companies. We estimate equation (5) and present the results in Table 5. In column (1), using the number of sellers on a route as a measure of competition, we find that the freight forwarders premium increased less on more competitive routes in the pre-pandemic period (years 2017 – 2019). In column (2), we use the (volume-based) Herfindal-Hirschman Index (HHI) of market concentration and show that the freight forwarders' premium increased more on initially more concentrated routes. In column (3), we use transport companies' volume share on a route to measure its market power and find that initially larger transport companies increased

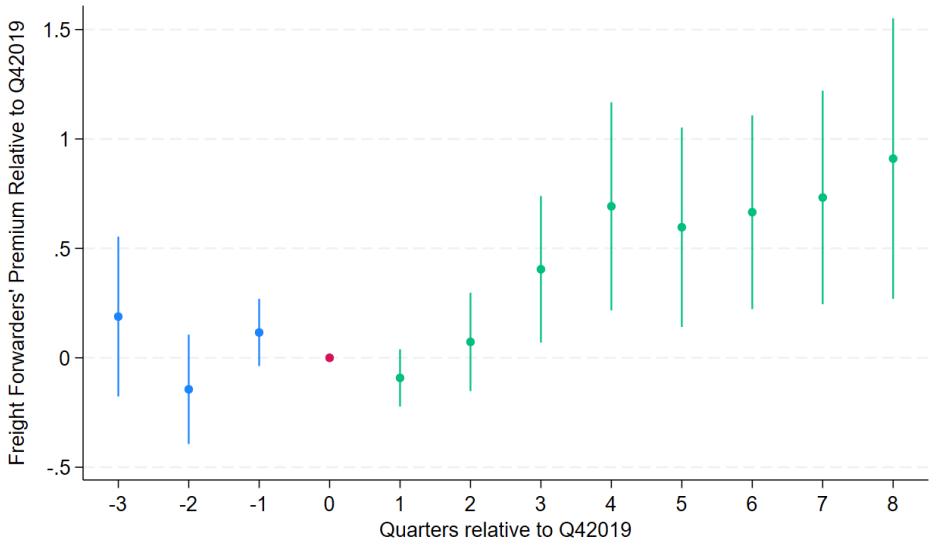
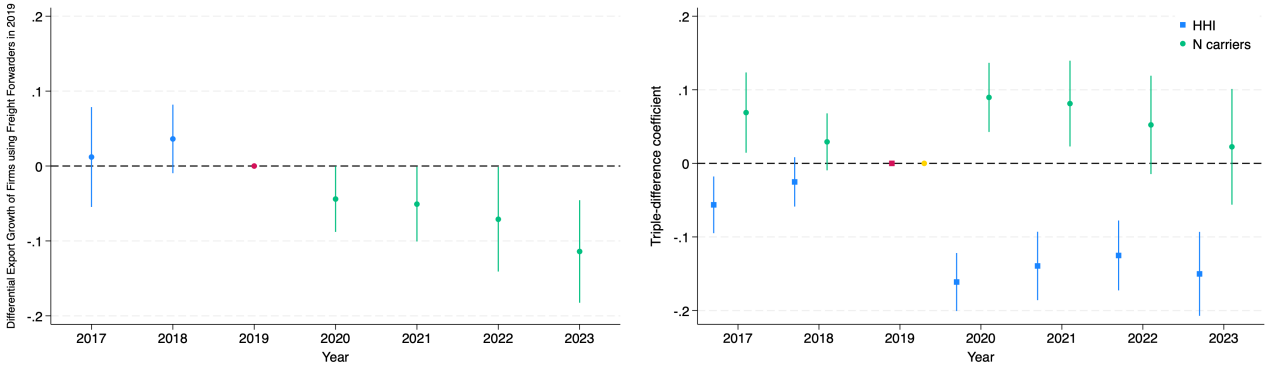


Figure 6: Event study of the rise of the freight forwarders' premium



(a) (b)

Figure 7: Differential export growth of firms using and not using freight forwarders in 2019

freight forwarders' premium more. These heterogeneous effects confirm the market power of transport companies as a driving force behind the rise of the freight forwarder's premium.

6 Quantifying the Effects

6.1 The role of freight forwarders in firm export growth

6.2 The rise in transport companies' markups

We use the difference-in-differences estimates of the relative freight price increase faced by freight forwarders to quantify the contribution of rising carrier markups to the increase in

Table 5: Heterogeneous effects of the pandemic across transport companies and routes

Dependent variable:	log *Freight Price*			
	(1)	(2)	(3)	(4)
Freight Forwarder X *Post*	0.272***	0.293***	0.285***	0.291***
	(0.076)	(0.074)	(0.060)	(0.061)
Freight Forwarder X *Post* X Log # *Sellers*	-0.178*			
	(0.096)			
Freight Forwarder X *Post* X Log *HHI*		0.064***		
		(0.022)		
Freight Forwarder X *Post* X Log *Share*			0.391	
			(0.264)	
Freight Forwarder X *Post* X Log *Share/Route*				0.204**
				(0.095)
Log *Contract Length*	-0.042***	-0.042***	-0.043***	-0.043***
	(0.011)	(0.011)	(0.011)	(0.011)
Log *Shipment Size*	-0.125***	-0.126***	-0.117***	-0.121***
	(0.041)	(0.041)	(0.034)	(0.038)
Log *Shipment Frequency*	-0.043***	-0.043***	-0.047***	-0.044***
	(0.008)	(0.008)	(0.008)	(0.008)
Log # *Sellers/Buyer-Route*	0.203*	0.204*	0.229**	0.206*
	(0.113)	(0.113)	(0.099)	(0.110)
Log # *Routes/Buyer*	-0.111**	-0.111**	-0.125**	-0.117**
	(0.050)	(0.051)	(0.044)	(0.049)
Transshipment Probability	-0.088	-0.088	-0.105	-0.080
	(0.118)	(0.119)	(0.137)	(0.126)
Constant	8.152***	8.148***	8.202***	8.205***
	(0.149)	(0.149)	(0.155)	(0.149)
Seller-Route-Date	✓	✓	✓	✓
Buyer-Seller-Route	✓	✓	✓	✓
N obs	24451	24451	24451	24391
N clusters	19	19	19	19
Adj. R^2	0.907	0.907	0.908	0.907

Robust standard errors clustered at buyer level in parentheses.
* p<0.10, ** p<0.05, *** p<0.01

freight prices during the pandemic. In our empirical design, carrier–route–time fixed effects absorb marginal costs for a given carrier on a given route at a point in time. Under this

assumption, all residual price differences within a carrier–route–date cell reflect markup differences, so that

$$\Delta \log \frac{t_F}{t_D} = \theta \left(\Delta \log \mu_F - \Delta \log \mu_D \right).$$

Our most conservative difference-in-differences estimate shows that the freight price ratio t_F/t_D increased by 27% after 2020. Since μ_D may also have increased, we use the fact that $\Delta \log \mu_D \geq 0$ to obtain a lower bound:

$$\Delta \log \mu_F \;\geq\; \Delta \log \frac{t_F}{t_D} = 0.27.$$

Given that total freight prices for forwarders increased by 84% over the same period, we obtain a lower bound on the contribution of carrier markups to freight price inflation:

$$\frac{\Delta \log \mu_F}{\Delta \log t_F} \;\geq\; \frac{0.27}{0.84} \;\approx\; 0.32.$$

Thus, at least 32% of the observed increase in freight prices paid by freight forwarders during the pandemic is attributable to rising carrier markups rather than marginal costs. We next show that, besides increasing transportation costs for most firms, this has distributional consequences for importers and exporters that differ in their reliance on freight forwarders.

6.3 Aggregate implications for import price inflation

We quantify the contribution of *transport companies' market power* to import price inflation using a simple exposure-weighted aggregation. Let i denote routes combinations in the pre-pandemic baseline year 2019, and define:

$$w_{i,2019} \equiv \frac{\text{CIF value}_{i,2019}}{\sum_j \text{CIF value}_{j,2019}}, \qquad \Omega_{i,2019} \equiv \frac{\text{Freight}_{i,2019}}{\text{CIF value}_{i,2019}}, \qquad s^F_{i,2019} \equiv \frac{\text{CIF via F}_{i,2019}}{\text{CIF value}_{i,2019}}.$$

Here $w_{i,2019}$ is the import expenditure share, $\Omega_{i,2019}$ is the freight share in CIF value, and $s^F_{i,2019}$ is the value share of trade intermediated by freight forwarders.

To construct a conservative lower bound on the role of market power in import price inflation, we make four assumptions:

(i) **No markup growth for direct shippers.** We set $\Delta \mu_D = 0$, so the observed change in t_F/t_D maps directly into markup growth for forwarders.

(ii) **Fixed exposures (Laspeyres weights).** We hold $w_{i,2019}, \Omega_{i,2019}, s^F_{i,2019}$ fixed at pre-pandemic levels to abstract from re-sorting and composition effects.

(iii) **Full pass-through into import prices.** We assume that changes in freight charges pass through one-for-one into CIF import prices. This is theoretically justified if neither exporters relying on freight forwarders nor freight forwarders themselves have market power to adjust their markups.[4]

(iv) **Only markup changes are counted.** We exclude cost-based drivers of freight price increases (fuel, congestion, surcharges).

Under these assumptions, the contribution of transport companies' market power to import price inflation satisfies:

$$\Delta^{MP} \ln P^{\text{import}} \geq \left(\sum_i w_{i,2019} \cdot \Omega_{i,2019} \cdot s^F_{i,2019} \right) \times \Delta \ln \left(\tfrac{tF}{t_D} \right), \tag{6}$$

where $\Delta \ln(t_F/t_D)$ is our estimated increase in the freight forwarder price premium.

We compute $w_{i,2019}$ and $\Omega_{i,2019}$ using U.S. import data from Schott (2008). Since these data report U.S. port of entry and partner country (not origin port), we define a route as a U.S. port × partner country. The freight forwarder share $s^F_{i,2019}$ is observed from U.S. Maritime Bills of Lading but only for imports from China (distributions of $\Omega_{i,2019}$ and $s^F_{i,2019}$ are shown on Figure **??**). We therefore first compute the markup contribution for China–U.S. imports only, and then extend to total U.S. imports by assuming that freight forwarder exposure is U.S. port-specific. For U.S. ports without imports from China, we assign the freight forwarders' value from the nearest port with observed data.

We find that the rising markups of transport companies contributed 1.07 percentage points to the price inflation of goods imported to the US from China, and 0.89 percentage points to the overall U.S. import price inflation. We compare these estimates to the cumulative change in U.S. import prices reported by the Bureau of Labor Statistics (BLS). According to the BLS Import Price Index, total import prices rose by approximately 5.6 percent between the 2018–2019 and 2020–2022 periods (Table 6). Our back-of-the-envelope calculation therefore implies that the increase in transport companies' markups accounted for roughly 21% of import price inflation for Chinese goods and 16% of the total rise in U.S. import prices. These findings are consistent with Isaacson and Rubinton (2023), who use a very different strategy and estimate that rising freight prices explain at least 68% of U.S. import price inflation during the pandemic. Combining this with our estimate that 30% of the freight price increase reflects markups implies that carriers' market power accounts for

[4]This is empirically plausible given the small size of exporters that rely on freight forwarders (Table **??**) and highly competitive freight forwarding markets with low entry barriers (Federal Maritime Commission (2024).)

Table 6: Cumulative change in U.S. import prices, 2018–2019 to 2020–2022

	Cumulative Import Price Inflation (%)	
Source	All imports	Imports from China
BLS Import Price Index	5.6	5.2

Notes: Author's calculations based on the Bureau of Labor Statistics (BLS) Import Price Index, excluding fuels. Series codes: IR142300000 (all imports) and IR142300200 (imports from China). For each series, cumulative import price inflation is computed as the log difference between the average index value for 2020–2022 and that for 2018–2019: $\Delta \ln P^{\text{import}} = \ln\left(\overline{P}_{2020\text{–}2022}\right) - \ln\left(\overline{P}_{2018\text{–}2019}\right)$. Numerically, the BLS Import Price Index for all imports rose from an average of 99.4 (2018–2019) to 104.9 (2020–2022), implying $\Delta \ln P^{\text{import}} = 0.056$ (5.6%). For imports from China, the index increased from 99.7 to 104.9, yielding $\Delta \ln P^{\text{import}} = 0.052$ (5.2%).

roughly 20% of total import price inflation. Therefore, market power in ocean transportation is a quantitatively meaningful driver of import price inflation.

7 Conclusions

Our study reveals that market power in ocean shipping results in unequal trade costs across firms. By leveraging detailed data from ocean shipping contracts, we show that freight forwarders—who predominantly serve smaller exporters and importers—faced rising price discrimination during the COVID-19 pandemic. This premium cannot be explained by shipment size, contract duration, or capacity constraints. Instead, it reflects transport companies' growing ability to price discriminate, especially in less competitive markets. As maritime transport becomes more consolidated, these discriminatory practices may amplify trade barriers for smaller firms. Our findings underscore the need for enhanced regulatory oversight and greater transparency in shipping markets to ensure fair access to global trade logistics.

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