Market Power at Sea and the Unequal Trade Costs: Evidence from Shipping Contracts

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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 terms. 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. following a demand shock, rather than capacity constraints and other cost considerations. Our results suggest that market power at sea can exacerbate trade cost inequality and call for renewed antitrust attention to discriminatory practices in maritime transportation.

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.

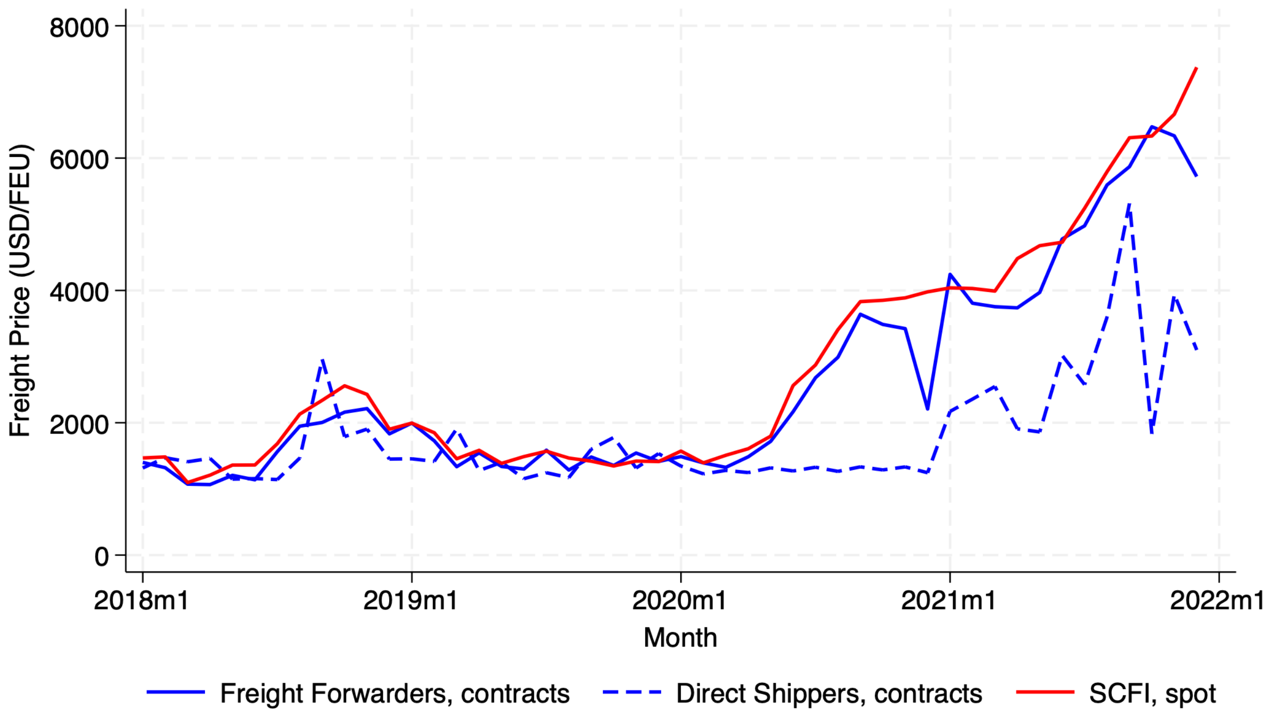

Figure 1: Heterogeneity in monthly average freight prices across firms and contracts

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 Data

2.1 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 2023. 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. The clients are buyers of transportation of two types: freight forwarders, which are intermediaries between shippers and transport companies, and shippers themselves. Because the benchmarks they receive from the platform 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 for transportation of a standardized 40 foot container (in US$) and the dates between which they remain valid. Table 1 presents the summary statistics of this data. There are in total 143 096 contracts for transportation of containers on 65 port-to-port routes between, on average, 19 transport companies and 39 buyers of transportation, 18% of which are freight forwarders. For a given transport company on a given route, there are, on average, 7 shipping contracts with distinct buyers, 70% of which are freight forwarders. The average freight rate is 2283 US$, while the average contract length is 45 days.

Figure 2 illustrates the rise in the average freight rate in the shipping contracts between 2018 and 2021. It becomes even more pronounced between 2019 and 2020, when we account for compositional changes in our sample by calculating the average freight rate only over buyer-seller-routes with shipping contracts in all years. Figure 2 also shows that, once corrected for sample selection, the average freight rate in our data closely follows the SCFI freight rate between Shanghai and US West Coast from Shanghai Shipping Exchange.

Table 1: Contracts for transportation 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	39	42	4
# Buyers/Year-Route-Transport company	7	6	3
Freight forwarders share/Year	0.18	0.17	0.05
Freight forwarders share/Year-Route-Transport company	0.69	0.75	0.31
N observations	143 096		

2.2 US Bills of Lading

Although the shipping contracts do not provide any characteristics of routes, buyers and sellers of transportation and minimal required or actual transported quantities under these contracts, we draw this information from US Bills of Lading from PIERS. This data describes the universe of containerized maritime imports from China from 2017 to 2023. For all shipments, it contains their ports of origin and destination, names of transport companies, 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 from PIERS 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 a freight forwarder or other ocean freight intermediary and it standardized alpha code for 80% of such shipments.

Firstly, we characterize transport companies and routes observed in our shipping contracts by finding them using their names in US Bills of Lading. In Table 2, we describe them in comparison to an average transport company and 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 an average route between China and the US. They are also much more competitive: on average, they are served by 14 transport companies, while an average route is served by only 4 transport companies. Overall, routes in the shipping contracts comprise only 5% of all routes from China to the US, but account for 55% of all US imports from China, by estimated value and volume.

Transport companies in the shipping contracts are mainly all largest transport companies (top-20) in maritime transportation. Panel B in Table 2 shows that they are 6 - 7 times

Figure 2: The evolution of the average freight rates

larger than the average transport company operating between China and the US, by volume, weight and imported value. On average, they serve 205 routes between China and the US, while the average transport company serves only 35 routes. Overall, transport companies that appear in our shipping contracts represent 15% of all transport companies transporting US imports from China, but carry more than 95% of their volume.

Secondly, we show that the distribution of buyer types (freight forwarders and shippers) in the shipping contracts is typical for maritime transportation between US and China. Panel A of Table 3 reports that, in 2017, transportation of US import shipments from China was arranged by 813 freight forwarders and either 6554 exporters or 5790 importers that never use freight forwarders. Therefore, in 2017, freight forwarders comprised either 11 or 12% of buyers of transportation from China to the US, in 2017. Panel B of Table 3 shows that, for transport companies on routes in our shipping contracts, 18% or 28% of their buyers in 2017 were freight forwarders, depending on whether exporters or importers are counted as buyers. This is similar to the 18% share of freight forwarders as buyers in the shipping contracts, as reported in Table 1.

We also show that average share of freight forwarders in transport companies' relationships on a route observed in the US Bills of Lading is close to 70% observed in our shipping

Table 2: Characteristics of routes and transport companies in the shipping contracts and in all US imports from China, 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.

contracts. For transport companies on routes in our sample, it is stable at around 75 - 80% and statistically indistinguishable from the freight forwarders’ share in all transport companies’ relationships on all China - US routes. In contrast, in the shipping contracts, the freight forwarders share in transport companies’ relationships on a route in our shipping contracts goes down from around 80% in 2018 to 60% in 2022. We account for this change in buyer types in our empirical analysis.

Thirdly, we use US Bills of Lading to characterize and compare freight forwarders and direct shippers (exporters or importers) in Table 3. Panel A shows that, across all US shipments from China, freight forwarders, on average, transports 30% smaller shipments but 400 times more frequently, which amounts to 300 times larger annually transported volume, relative to direct shippers (exporters or importers). Moreover, they operate on, on average, 48 routes between China and the US and interact with 11 transport companies. In contrast, average exporters and importers that do not use freight forwarders transport their goods on only 2 and 17 routes, respectively, using only one transport company. Panel B further shows that although buyers of transport companies on routes in our shipping contracts are larger than in the full sample, a similar comparison between them holds. Moreover, 90% of freight forwarders, 50% of Chinese exporters to the US and 30% of US importers from China use transport companies on routes that appear in the shipping contracts.

Table 3: Buyers of transportation from China to the US, 2017

	Freight forwarders		Exporters		Importers	
	mean	std	mean	std	mean	std
Panel A: 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	813		6554		5790	
Panel B: 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	740		3161		1878	

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.

3 Freight Price Dispersion

Using information in shipping contracts, we document a large and growing dispersion of container freight prices on routes between US and China, during Covid-19 pandemic. We calculate the coefficient of variation of container freight prices for each route and quarter of the year and plot their evolution over time in Figure 3. It shows that the dispersion of container freight prices on a route within a quarter remained stable before 2020, when the average coefficient of variation was around 20%, but increased dramatically in the fourth quarter of 2020, when the average coefficient of variation reached almost 50%. This means that, in this period, freight price dispersion grew faster than the average freight prices. We show that this increase is not driven by selection of buyers, transport companies, and routes into our sample over time. We calculate the coefficients of variation of freight prices on a route within a quarter using a subsample of buyers, transport companies and routes with freight prices observed in every quarter of every year in our sample. In Figure 3, we show that in this fixed subsample, from the beginning of 2020 to the end of it, the coefficient of variation increases from around 15% in the beginning of 2020 to 40%.

Most variation in freight prices on a route within a quarter in our data is driven by variation in freight prices within transport companies rather than across transport companies

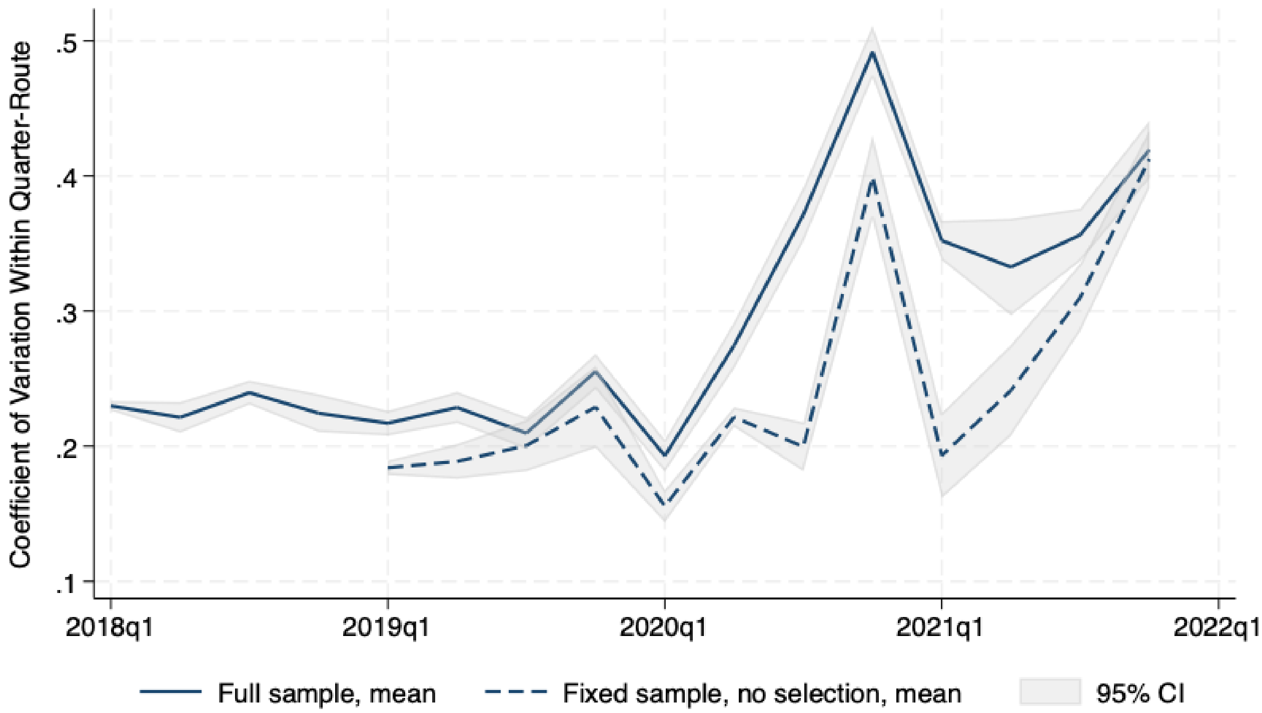

Figure 3: The rise of freight price variation within a quarter on a route

on a route (see Figure). Hence, within-seller freight price dispersion on a route has a similar trend as in Figure 3. Figure 4 shows that, between the first and last quarters of 2020, the average coefficient of freight price variation within a seller on a route increased from 15% to 38% in the full sample and to 45% in the fixed subsample without sample selection.

To understand the sources of this variation of freight prices within seller on a route, we perform a variance decomposition, using the methodology of Abowd et al (1999). Specifically, we estimate the following two-way fixed effects model:

$$\log P_{srbt} = \theta_{srt} + \psi_b + \epsilon_{srbt}, \tag{1}$$

where $\log P_{srbt}$ is a freight price of transport company s on route r charged to buyer b on date t, normalized by the quarterly average for a given transport company on a route. In this model, θ_{srt} is a seller-route-specific date fixed effect, ψ_b is a time-invariant buyer fixed effect, and ϵ_{srbt} is a time-varying match-specific residual. The estimates of θ_{srt} and ψ_b allow us to quantify the contributions of unobserved time shocks and buyer characteristics, respectively, to the observed within-seller freight price variation on a route. To compare the importance of these components before and after Covid-19, we estimate them separately for the periods before December 2018 and after January 2019.

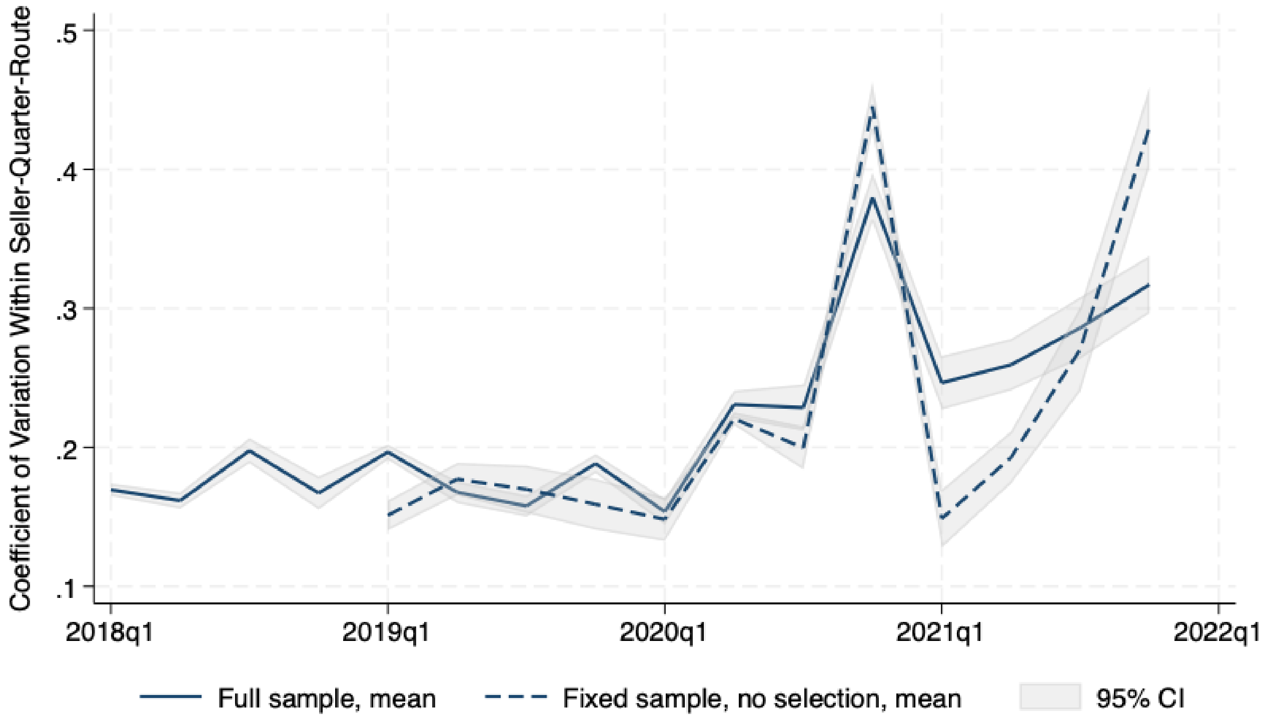

Figure 4: The rise of freight price variation within a seller-quarter on a route

Table 4 reports shares of the within-seller freight price variation on a route explained by seller-route-specific time fluctuations and time-invariant buyer characteristics, before and after Covid-19. Panel A shows that before Covid-19, time fluctuations accounted for 64% of within-seller freight price variation on a route, while buyer characteristics accounted for only 16%. However, after Covid-19, buyer characteristics became a major source of this variation, accounting for 32% of within-seller freight price variation on a route, while time fluctuations explained only 23% of this variation. Besides buyer heterogeneity, we also observe a substantial increase in the role of a match-specific component in within-seller freight price variation on a route. As it follows from Table 4, this component explained around 20% of the observed within-seller freight price variation on a route before Covid-19 and 45% after Covid-19.

We show that this increase in the role of buyer heterogeneity and match-specific component in within-seller freight price variation on a route is not driven by differences in firms and routes across the two time periods. For that, we estimate the two-way fixed effects model in (1) using a subsample of transport companies, buyers and routes with observed freight prices in both periods. Accounting for sample selection, Panel B of Table 4 reports an even larger increase in the share of within-seller freight price variation explained by buyer char-

Table 4: Decomposition of freight price variation

	Before Covid-19		After Covid-19	
	Seller-Route-Date	Buyer	Seller-Route-Date	Buyer
	(1)	(2)	(3)	(4)
Panel A: Not accounting for sample selection				
$\log Price$	0.636***	0.160***	0.226***	0.320***
	(0.003)	(0.002)	(0.002)	(0.003)
N obs	43813	43813	41603	41603
Panel B: Accounting for sample selection				
$\log Price$	0.692***	0.084***	0.232***	0.269***
	(0.003)	(0.002)	(0.004)	(0.004)
N obs	26720	26720	19343	19343

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

acteristics from 8% before Covid-19 to 27% after Covid-19. It also shows a larger increase in the share of a match-specific component in within-seller freight price variation on a route from 22% before Covid-19 to 50% after Covid-19.

4 Mechanisms of freight price variation

4.1 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:

$$\log Price_{srbt} = \alpha Freight\ Forwarder_b + \beta Freight\ Forwarder_b \times Post_t + \gamma X_{srbt} + \theta_{srt} + \epsilon_{srbt} \quad (2)$$

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; 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:

$$\log Price_{srbt} = \sum_{k\neq -1} \beta_k Freight\ Forwarder_b \times D\{t=k\} + \gamma X_{srbt} + \theta_{srt} + \psi_{bsr} + \epsilon_{srbt}, \tag{3}$$

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:

$$\begin{aligned} \log Price_{srbt} = \beta Freight\ Forwarder_b \times Post_t + \rho Freight\ Forwarder_b \times Post_t \times Z_{r(s)} \\ + \theta_{srt} + \gamma X_{srbt} + \psi_{bsr} + \epsilon_{srbt}, \end{aligned} \tag{4}$$

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.

4.2 Baseline Results

We begin by examining the effect of the Covid-19 pandemic on freight price differential between freight forwarders and direct shippers. Table 5 presents the results of estimating equation (2). 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 5, 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 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 con-

Table 5: 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

stant, 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 (3) and plot them together with their 95% confidence intervals in Figure 5. Focusing on buyers who are observed in both, 2020 and 2021, as in column (5) of Table 5, we are left with four quarters before and eight quarters

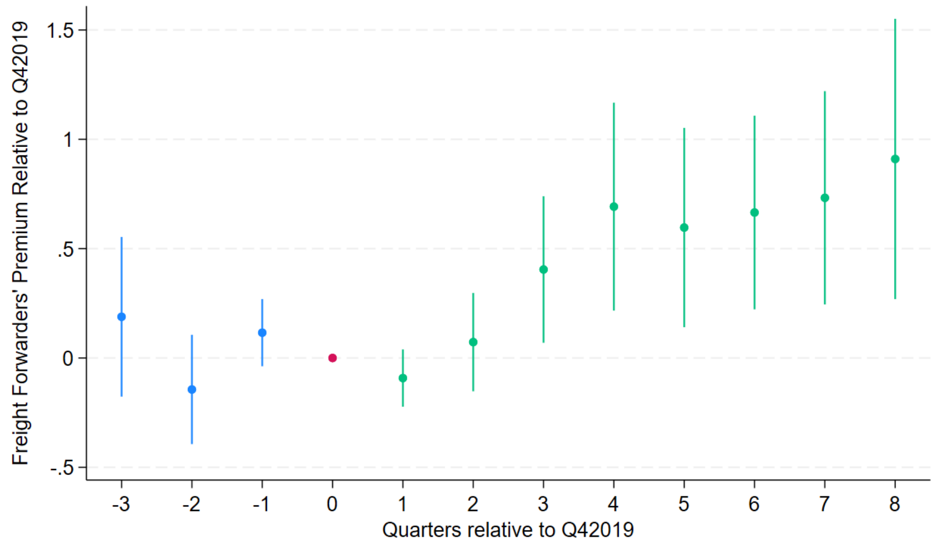

Figure 5: Event study of the rise of the freight forwarders' premium

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.

4.3 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 (4) and present the results in Table 6. 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 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.

Table 6: 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

5 Implications for importers and exporters

We now study how documented mechanisms of freight price variation impact firms participating in international trade. First, we determine how exporters', importers' and shipments' characteristics affect the probability of a shipment's intermediation by a freight forwarder. We estimate the following linear probability model:

$$Intermediated_{sriet} = \theta_{sry} + \rho_1 \log V_{ey} + \rho_2 \log V_{iy} + \lambda \Gamma_{sriet} + \varsigma_{sriet}, \tag{5}$$

where θ_{sry} is a fixed effect for transport company s on route r in year y, $\log V_{ey}$ and $\log V_{iy}$ are (log) volume transported by exporter e and importer i in year y, while Γ_{sriet} is a vector of shipment characteristics, and ς_{sriet} is an error-term. By estimating coefficients ρ_1, ρ_2, and λ in the pre-Covid period, we establish which firms and shipments were more likely to rely on freight forwarders in transportation. These firms and shipments are then more affected by the rise in the premium charged to freight forwarders by the transport companies.

We present the results of estimating this model in Table 7. Column (1) shows that larger exporters, on average, are less likely to use freight forwarders in transportation. Doubling the average annual volume exported by a firm is associated with a 2% reduction in the probability that its shipments are intermediated by freight forwarders. However, this effect becomes insignificant, when, in column (2) we also take importer's size into consideration. Instead, we find that doubling importer's annually imported volume reduces the chance that the imported shipments are intermediated by freight forwarders by 4%.

We also allow for shipment's characteristics to affect whether its transportation is intermediated by a freight forwarder. Column (3) shows that doubling shipment's volume is associated with a 2% lower probability that it is intermediated by freight forwarders. Moreover, shipments that contain hazardous materials are 3% more likely to involve freight forwarders, while those in refeers (refrigerated containers) are 22% less likely to be intermediated by freight forwarders. In column (4), we account for other unobserved shipments characteristics for shipments of products from only one HS4 product category with HS4 product fixed effects. This does not change the effect of importer's size on the use of freight forwarders, but reduces the role of the observed shipment characteristics, except for Roll-on/Roll-off (RoRo) indicator (wheeled cargo) whose effect becomes negative and significant. Column (5) shows that the same effects of firm and shipment characteristics hold in a subsample of transport companies and routes in our shipping contracts' data.

These results suggest that, firstly, overall larger exporting and importing firms and firms with larger shipments gain an additional advantage in their product markets through direct negotiation of freight prices with transport companies. Secondly, they imply that smaller

Table 7: Determinants of intermediation by freight forwarders at the shipment level

Dependent variable:	*Intermediated Shipment*				
	(1)	(2)	(3)	(4)	(5)
log *Exporter's Annual Volume*	-0.02***	-0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
log *Importer's Annual Volume*		-0.04***	-0.04***	-0.03***	-0.03***
		(0.00)	(0.00)	(0.00)	(0.00)
log *Shipment Volume*			-0.02***	-0.01***	-0.01***
			(0.00)	(0.00)	(0.00)
Hazmat			0.03***	0.02	0.03*
			(0.01)	(0.02)	(0.02)
Reefer			-0.22***	-0.05***	-0.03***
			(0.02)	(0.01)	(0.01)
RoRo			0.01	-0.05**	-0.04
			(0.01)	(0.02)	(0.04)
Constant	0.96***	1.07***	1.06***	1.01***	1.03***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Seller-Route-Year	Y	Y	Y	N	N
Seller-Route-HS4-Year	N	N	N	Y	Y
N obs	3089457	3086428	3058424	2884628	1688666
Adj. R2	0.157	0.209	0.216	0.472	0.427

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

firms and firms with smaller shipments were more negatively affected by the increase in the premium charged to freight forwarders by transport companies. If freight prices account for a reasonable share of firms' exporting costs, trade flows that involve a freight forwarder increase less in response to a common demand shock.

6 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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