Barcelona School of Economics

Master's Degree in Specialized Economic Analysis
Specialization in Competition, Regulation and Markets

"A Tale of Two Tides: Comparing the Price Effect of Market Concentration and Alliances in the Container Shipping Market"

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ABSTRACT IN ENGLISH:

This study investigates the impact of shipping alliances and market concentration on maritime freight rates. For this purpose, we analyse Peruvian containerized imports at the transaction level using customs data and public mergers, acquisitions, and shipping alliances announcements from 2014 to 2018. Using a modified price-concentration analysis (PCA), we find that higher carrier-level concentration raises prices, while greater alliance-level concentration lowers them, particularly on smaller routes. Additionally, mergers and acquisitions tend to increase prices. Our findings are robust to different specifications and can be applied to countries with similar characteristics to those of Peru.

ABSTRACT IN SPANISH:

Este estudio investiga el impacto de las alianzas navieras y la concentración del mercado en los fletes marítimo. Para ello, analizamos transacciones de importación de contenedores en el Perú utilizando información aduanera y anuncios públicos de fusiones, adquisiciones y alianzas navieras desde 2014 hasta 2018. Mediante un análisis de precios-concentración (PCA) modificado, encontramos que una mayor concentración de líneas navieras aumenta los precios, y una mayor concentración de alianzas los reduce, particularmente en rutas más pequeñas. Además, las fusiones y adquisiciones tienden a incrementar los precios. Nuestros hallazgos son robustos a diferentes especificaciones y aplicables a países similares al Perú.

KEYWORDS IN ENGLISH:

Shipping Alliances, Market Concentration, Price-Concentration Analysis

KEYWORDS IN SPANISH:

Alianzas Navieras, Concentración de Mercado, Análisis de Precios-Concentración

Master Project

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A Tale of Two Tides: Comparing the Price Effect of Market Concentration and Alliances in the Container Shipping Market

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Master Thesis

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Abstract

This thesis examines the importance of vessel sharing agreements and market concentration for freight rates in the maritime shipping market. Incorporating data from Peruvian Customs, web scraped information from `veritrade.com` and public information about mergers and acquisitions, this study analyzes individual transaction data of imported goods in Peru between 2014 and 2018. A modified price-concentration regression reveals that increasing market concentration raises prices, whereas higher alliance concentration leads to cost efficiencies and lower freight rates, particularly on smaller shipping routes. In addition, evidence is provided that mergers and acquisitions in the maritime shipping market tend to increase prices. These findings are robust across different selections of control variables. While the study has restricted external validity, its results can be extrapolated to countries with similar characteristics, such as Chile, Ecuador or Colombia.

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1 Introduction

Liner shipping provides regular scheduled maritime freight transport, primarily by container, between ports on specific routes. In 2020, approximately 70 percent of the international trade volume was shipped using maritime transport, with containers accounting for roughly two-thirds of the maritime sector (Notteboom et al., 2022).

Carriers often cooperate in consortia to provide liner shipping services. Consortia are joint service agreements between carriers designed to streamline operations. The most integrated form of consortium is a Vessel Sharing Agreement (VSA), where carriers pool a predetermined number of vessels and jointly operate them on various trades.

In 2009, the European Commission adopted *Regulation (EC) No 906/2009* - the Consortia Block Exemption Regulation - which defined more lenient conditions under which consortia are exempted from the prohibition of agreements between competitors, with specific focus on VSAs. Initially, the Commission's view was that the cost savings coming from joint service agreements should lead to pro-competitive effects (European Commission, 2020). However, it was decided not to extend this regulation in 2024. The Commission argued, it brought only limited compliance cost savings and no longer achieved higher competition by enabling smaller carriers to organise their costs more efficiently (European Commission, 2023b).

Interestingly, the Commission could not base its arguments on economic research, because economic literature has begun analyzing the relationship between market structure in the shipping industry and price dynamics only recently. Furthermore, there has not yet been a quantitative ex-post assessment of the impact of VSAs on prices for countries with smaller shipping markets. We will fill this gap by examining the impact of Vessel Sharing Agreements on routes with smaller market size and thin trading routes. Our research will complements Li et al. (2024), who found that the use of VSAs can result in lower prices on dense trading routes. Specifically, we use uniquely detailed freight price data from the Peruvian Customs Authority to study the role of VSAs on container freights within narrowly defined routes. By addressing this question, we provide insights that can inform future regulatory decisions and enhance the understanding of market dynamics in the liner shipping industry.

Using Hausman instrumental variables for market concentration and alliance concentration, we find that reducing market concentration by adding one more competitor to the market leads to a decrease of around 5.37 percent in prices. If market structure stays constant, and one shipping company enters a vessel sharing agreement, this will lead to cost efficiencies and a reduction in prices of around 8.19 percent. This makes sense, as competition is relatively high in the shipping market. With on average 9 shipping lines per route, gaining advantages through cost reduction has a larger effect on prices than adding further competition. The results for market concentration effects are stable across small

and large routes, whereas changes in alliance concentration show a particularly strong effect on freight rates in small routes. This can be pinpointed to the fact that on small routes, there are fewer economies of scale, thus VSAs present an attractive alternative option for cost efficiencies.
While we can show that our results are robust, our setting clearly limits the extend to which the findings can be extrapolated to other countries outside of South America.
Our paper proceeds with the following structure: Section 2 provides an overview of the container shipping market and discusses our research within the context of current literature. Section 3 describes the data used, while section 4 explains the empirical strategy and its assumptions. Section 5 presents the findings, and section 6 discusses their validity through robustness checks and analysis of heterogeneous effects. Finally, section 7 summarizes our main conclusions.

2 Research Context

2.1 General description of the industry

Maritime markets can be divided into two segments: transport markets, and asset and input markets, such as shipbuilding, fuel or repairs. Maritime transportation consists of two important types of shipping. The majority of the global fleet are liner vessels shipping containers, tankers shipping oil and tramp carriers shipping bulk cargo. Specialized cargo, such as the shipping of refrigerated goods make up the smaller part of the maritime transportation market. Our research focuses on container liner shipping, which involves transporting containers between two ports and is the intermediary industry between buyers and sellers of goods who use ships to send their merchandise. Liner shipping differs from tramp shipping in that it involves regular services and the obligation to sail, whether filled or not, on dates fixed by a predefined schedule. (Stopford, 2008).
A key characteristic of the container shipping industry is that vessels transport containers with standardized dimensions, regardless of the products they contain. Container vessels, whether loaded to capacity or not, are regularly deployed according to a fixed sailing schedule, with operations for loading and discharging cargo conducted at specified ports (Sys, 2009).
Shippers (typically importers and exporters of the goods being shipped) request container transport services from shipping companies in two ways: via a service contract, typically signed between large shippers and shipping lines, where freight rates and volume are agreed upon for a period between three and twenty-four months. The alternative option is through a spot quote, typically valid for 30 days or less (Sánchez, 2019).
Maritime freight rates depend on various supply and demand factors, market structure on each route or horizontal agreements like (Vessel Sharing) Alliances and trade imbalances,

economic cycles, and cargo seasonality. The cost structure (fuel, labour) or buyer power of shippers (through the service contracts and spot rates) can be additional reasons for price volatility. These services operate on fixed and regular schedules along trade lanes, allowing customers to plan shipments in advance. In this context, VSAs enable carriers to collaborate by pooling vessels while maintaining commercial independence, meaning each carrier sets its own prices. Without these agreements, each company would have to use its own vessel, but this would be economically unfeasible because there would not be enough cargo volume to achieve efficient scales.[1]

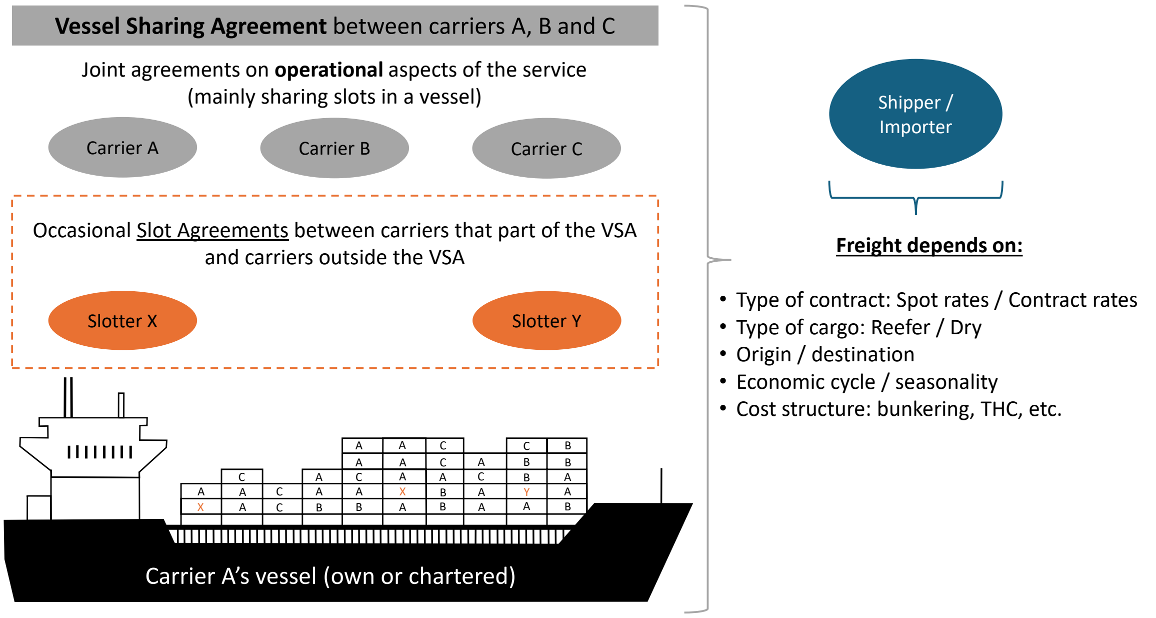


Figure 1: Container Liner Shipping and the Role of Vessel Sharing Agreements

Figure 1 simplifies the market's functioning, emphasizing the role of Vessel Sharing Agreements. Shipping lines A, B, and C entered a Vessel Sharing Agreement, where they incorporate vessels into a service and exchange slots. This means that, while A is the owner of the carrier, it shares container capacity on its ship with B and C. Shipping lines X and Y are not part of the Agreement, but have chartered a few slots from carrier owner A, agreed formally in a Slot Agreement. Consequently, maritime freight is offered independently to shippers by different shipping lines with slots on a fleet of vessels covering a defined itinerary, represented in the diagram by A, B, C, X, and Y. The shipping lines of a VSA jointly manage operational aspects of vessels and slots for a service, while independently and individually offering the transport service commercially to importers and

[1]The following terms are interchangeable:
- freight rate, prices
- volume, number of containers shipped, slots, freight, (capacity)
- Shipping Alliances, Vessel Sharing Agreements, VSAs
- Shipping Line, Shipping Company, Carrier

exporters. Ultimately, the shipper purchases the transport service on a spot or contract basis through a quote or agreement with one of the shipping lines A, B, C, X, or Y.
Vessels usually travel on routes, which include several ports and countries until they reache their destination (for example, a vessel could start its route in Singapore, unload and reload freight at Shanghai and then head for its destination in Los Angeles). In our analysis, we focus on Callao, the biggest port in Peru. Focusing on a single port has several advantages. First, there is a fixed point which all vessels pass sooner or later on their routes. Thus, we can focus only on those shipping companies, mergers and VSAs that operate in Peru, rather than having to model the global shipping market which becomes a lot more complex. Second, we can focus our analysis on smaller shipping routes, filling a gap in in the current economic literature, which has only explored the effect of VSAs in medium and thick trading routes. This is because the Peruvian maritime trade market is accounting for around 0.3 percent of shipped goods in the global shipping market in 2021 (The World Bank Group, 2024). Third, 86 percent of Peru's maritime trade took place in Callao, implying that our analysis covers the largest part of maritime Peruvian trade (Autoridad Portuaria Nacional, 2022). Thus, our results can be extrapolated for countries with similar endowments and size, such as Ecuador, Colombia and Chile.

2.2 Market consolidation in container liner shipping

The main global shipping lines include MSC, Maersk, CMA-CGM, COSCO, Hapag-Lloyd, Evergreen, ONE, HMM, Yang Ming, PIL, Zim, and Wan Hai Lines. The top seven carriers account for 75.7% of the market share, and the top twelve carriers combined account for 84.7% of the market share (Notteboom et al., 2022).
Figure A1 shows the most important mergers and acquisitions that are relevant for our analysis. The Acquisitions of both Chilean shipping companies in 2014 were of smaller nature, relative to the other mergers. On the other hand, the unification of COSCO and China Shipping Group in 2016 meant that both state-owned companies could combine resources to enhance their competitiveness and efficiency in the global shipping market. In addition, both the liquidation of Hanjin and the biggest merger between Maersk and Hamburg-Süd had major impacts on the shipping market. Later, in 2019, K-Line, MOL and NYK created the joint venture Ocean Network Express (ONE) which broadly replaced the individual shipping lines' presence in liner shipping. As the three companies set freight and capacity jointly in the venture, we treat ONE as if it was a normal merger in our analysis. In general, the mergers and acquisitions during those years were driven by low prices in the market, which forced firms to find new ways of operating profitably (see figure 3).
Since the 1990s, alliances have formed on major East-West routes, primarily focusing on organizing services through Global Vessel Sharing Agreements. Currently, there are three

major alliances: the 2M Alliance (MSC, Maersk/HSD), the Ocean Alliance (COSCO, Evergreen, CMA/CGM), and THE Alliance (ONE, Hapag-Lloyd, Yang Ming, HMM).
Figure A2 presents a summary of the evolution of most global alliances since 1995. Focusing on the relevant period between 2014 and 2019 we see that there were several periods of restructuring in the alliances. In early 2015, two of the largest shipping lines, MSC and Maersk, entered a global Vessel Sharing Agreement that persists in its structure until the end of 2018 (with the addition of Hamburg Süd after its acquisition by Maersk). The second major restructuring happened in late 2016 and early 2017. The Ocean Three alliance between CMA/CGM and China Shipping Group was suspended due to the China Shipping Group/COSCO merger. At the same time, CYKHE and the G6 alliances split up and formed THE Alliance and the Ocean Alliance. In 2019, THE Alliance saw another change with the creation of the Ocean Network Express joint venture.
In addition, there are more limited regional VSAs with shorter durations per service, typically including an operational agreement that outlines the geographic scope, number of vessels, port calls, and slots per carrier.

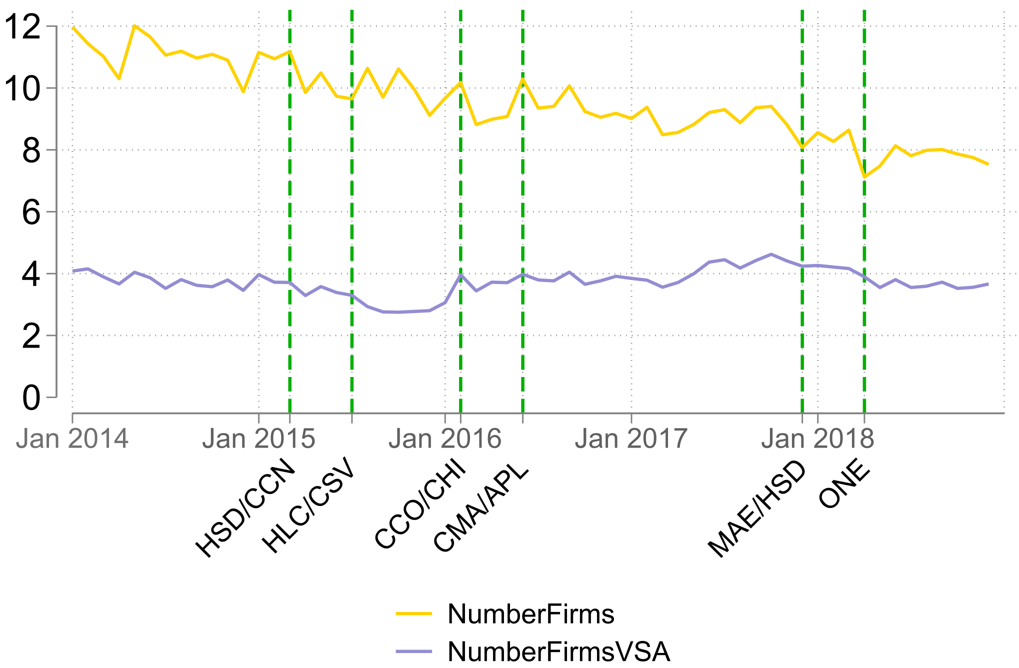


Figure 2: Average Number of Carriers (in VSAs) on a route

Figure 2 shows the average number of firms that engage in vessel sharing agreements per route over time. Usually, between three and five companies are part of a vessel sharing agreement and this is fairly stable. The merger between Hapag-Lloyd and CSV occurred between two companies that engaged in regional vessel sharing agreements specifically related to South America, thus explaining the increase in alliance concentration in late 2016. COSCO and China Shipping Group or CMA and American President Lines were mergers of companies which did not engage in the same global shipping alliances, thus explaining why the number of firms inside VSAs stayed roughly stable after the mergers. Yet, it is interesting to see is that the merger is followed by a drop in the number of firms operating on routes. After the Maersk/Hamburg Süd merger and ONE joint venture, the steady decline in companies in VSAs is accompanied by a reduction in the number of companies operating on specific routes, thus overall reducing competition. In summary, the number of shipping lines operating on a route has been declining from 12 in January 2014 to less then 8 in December 2018, indicating a reduction in the number of competitors.

2.3 Literature Review

The relationship between market concentration and market power has been widely studied in the last decades. Evans et al. (1993) observe that nearly a hundred such studies were conducted before Bresnahan (1989) introduced the new empirical industrial organization theory. Since then, researchers have continued to apply this technique to a wide range of industries, including airlines (Borenstein, 2005; Kim and Singal, 1993, bank deposits (Focarelli and Panetta, 2003; Prager and Hannan, 1998), movie theatres (Davis, 2005), supply superstores (Manuszak and Moul, 2008), gasoline (Zimmerman, 2012), health insurance (Dafny et al., 2012; Herring and Trish, 2015), and beer (Ashenfelter et al., 2015). The underlying problem with price-concentration regressions is that the relationship between prices and market concentration is not causal (Berry et al., 2019). Both price and market concentration are equilibrium outcomes. Market concentration is determined by demand, supply and factors that drive them. Likewise, prices are affected by the same factors. Thus, economic theory indicates that prices and market concentration are determined simultaneously and there is no identifiable causal effect of one on the other. Hence, price-concentration regressions can confound various possible correlations that exist due to variation in underlying factors related to demand and supply, without recovering a causal effect (O'Brien, 2017). Further proof on this matter is presented by Bresnahan (1989) and Demsetz (1973). In the last decades, a series of alternative methods for evaluating the effects of changes in market structure have been advanced, as discussed (together with various references) in Armstrong and Porter (2007). However, regressions of prices on concentration in form of HHIs have largely been abandoned in economic research, and have been replaced by more exogenous approaches using alternative variables such as the number of firms and instrumental variables that account for possible simultaneity in prices and market structure (Berry et al., 2019).

The effects of vessel sharing agreements and capacity sharing on prices are far less understood. The effects of horizontal agreements on prices are also unclear in the airline industry, one that is very similar to the maritime shipping industry. Brueckner and Whalen (2000) found no statistically significant effect of alliances between US airlines and non-

US airlines in overlapping international markets. In the transatlantic air travel markets, Wan et al. (2009) found that the Star Alliance and SkyTeam alliance had no statistically significant price impact, while the Oneworld Alliance significantly lowered business class airfares. Calzaretta et al. (2017) found no significant fare increase associated with antitrust-immunized airline alliances or joint venture partnerships on international routes departing from the United States between 1998 and 2015. Brueckner and Singer (2019) extended the work of Calzaretta et al. (2017) by dividing the samples into prior-2010 and post-2010 groups and found insignificant anticompetitive effects prior to 2010, but statistically significant anticompetitive effects after 2010.

While recent economic literature has begun analyzing the relationship between market structure in the shipping industry and price dynamics, the literature about the effect of market structure on prices in the shipping industry is still relatively scarce and the effects of VSAs on prices remain widely unclear.

Quartieri (2017) developed a theoretical model to analyse the impact of VSAs on prices and found that VSAs decrease the equilibrium freight rate in each partner's marginal cost. Hirata (2017) found that the effect of shipping company market concentration on prices is statistically insignificant. Barkley and Mcleod (2022) found weak evidence of price reductions following the merger of barge companies. According to Ignatenko (2023) and Ardelean and Lugovskyy (2023), buyer power can partially compensate for price increases in contract rates on routes with more than three carriers, but it has no effect on routes with three carriers or fewer. Li et al. (2024) found a negative correlation between concentration at the alliance level, measured using the HHI at the alliance level, and prices.

Many factors might contribute to the mixed empirical findings. First, as discussed above, the market power and the efficiency gains brought by the increased scale and market share can impose opposite impacts on prices. Second, the VSAs ability to exercise market power and raise prices would be affected by market entry barriers and the enforcement of antitrust laws. Finally, pricing strategies and buyer power in the container shipping sector may also play a role.

To isolate the effect of VSAs on price, it is important to account for other variables such as market structure, market size and pricing strategies. So far, there exist no economic studies that isolated the effect of VSAs controlling for these variables.

3 Data

We construct our data by using three different main sources. First, we gather data concerning Bills of Lading from the Peruvian Customs, which is processed and uploaded at `veritradecorp.com`, a website offering access to global trade databases containing details on imports and exports worldwide, including product, company, and country information. Bills of Lading are legal documents issued by carriers to acknowledge the receipt of shipping goods and serve as contracts between the shipping and importing companies. The information is reported daily, with approximately 200,000 Bills each year from 2014 to 2018. They are especially interesting for our analysis, as they contain crucial information on the specific vessel shipping the good, whether the good was being shipped in a shared vessel and the exporting company.

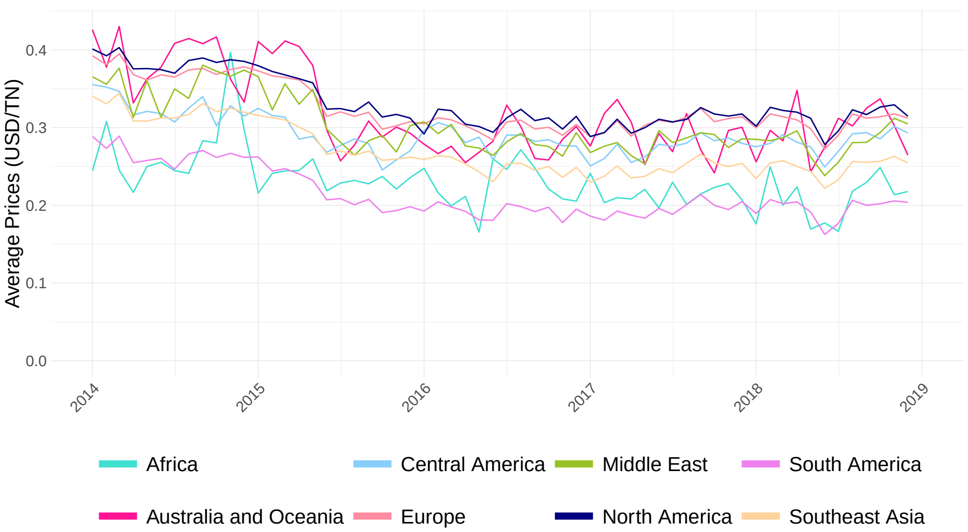
We integrate this information with data from `veritradecorp.com` and web scraped data from the website of the *Superintendencia Nacional de Aduanas y de Administración Tributaria*, the Peruvian Customs directly. This second data source allows us to extract information on the individual transactions of the shipped goods, including the freight rates per kilogram and the weight of the cargo. Additionally, it provides information on the internationally standardized HS code of the product that specifically classifies the good being shipped (later allowing us to use the HS8 code as product fixed effects). Furthermore, there is data on the importer, port of origin and port of destination. The information is reported daily, with approximately 5,000,000 transactions each year from 2014 to 2018. This data also allows us to calculate maritime trade imbalances on specific routes.

The third part of our data concerns Mergers and Vessel Sharing Agreements between 2014 and 2018. For Mergers and initial ownership of shipping companies, we use public information. For VSAs regarding South American trade to the United States of America, we process information of the archived agreement contracts published by the *Federal Maritime Commission*. Ju et al. (2023), Paz and Sánchez (2020) and Notteboom and Rodrigue (2023) provide further context on global and regional Vessel Sharing Agreements. In total we observe 25 active shipping companies, six mergers and acquisitions and eight global Vessel Sharing Agreements associated to Peruvian maritime trade between 2014 and 2018.

In order to have well-behaved data, we have dropped observations below the 5 percent quantile and above the 95 percent quantile for prices per ton. Due to computational restrictions, we take a 10 percent sample of each year.

Several unique features of Peru's customs data make it particularly well-suited for studying freight rates: On the one hand, this data processes freight information at the transaction level, allowing us to isolate the effect of market structure and VSAs on freights from many other sources of variation, such as specific product characteristics or buyer power. On the other hand, in contrast to most studies, we are able to identify the specific carriers and vessel owners related to traded goods and match them with the Bills of Lading. This allows us to analyze the impact of carrier competition on prices.

Figure 3 shows the average estimated values of a regression of prices per ton against product, month and continent fixed effects over time. The first thing that strikes is that there seems to be a drop in prices in the first half of 2015 that persists until the end of 2018. This led to reduction in profits of shipping companies and ultimately the merger



Notes: We calculated the fitted values of a regression of prices of shipped goods per ton against product-, month-, and continent fixed effects. This plot shows average fitted values of prices per continent and month against time.

Figure 3: Average Prices per Ton for each Continent

waves in the shipping market in the years after 2014. This trend might be explained by differences in price dynamics due to differences in factors not directly related to market power, such as route length, economies of scale or the macroeconomic situation in the country of origin. Secondly, we see that dense routes, such as to North America or Europe, show high prices. On the other hand, routes to South America and Africa show lower prices. While this makes sense for South America, where distances are short, for Africa this seems counterintuitive, as these routes are relatively smaller and according to Ardelean and Lugovskyy (2023) market power should be exercised stronger on thin routes, leading to higher prices. One can also already draw important conclusions with regard to the identification strategy. As prices change over time and price levels are different for different continents, one should account for this, for example by including fixed effects. The higher price volatility on African and Oceanian routes, relative to the more stable and bigger North American and Southeast Asian routes, also indicates that route size matters when assessing changes in prices.

Table A1 presents summary statistics of the most important variables. We find that the average price is 0.44 USD per ton on a route, with large variation coming from small routes, where low demand implies high prices. While there are on average around 9 shipping lines on a route, we observe approximately 8 on small, and 10 on big shipping routes. The difference is statistically significant, as commonly this varies between 4 companies on small and up to more than 13 shipping lines on dense routes. We expect to observe between 2 and 3 companies on other country-to-country routes. This speaks for the fact that usually shipping lines choose only one major route for trade between a country and Callao. The number of firms in a vessel sharing agreement varies less as its difference is also statistically different between routes with small and large market size. On average, we observe between 3 and 4 companies sharing vessels on a route and equally many on other country-to-country routes. One reason for this is that vessel sharing agreements are not route-bound, so there might be companies sharing a vessel whose cargo has a different origin or destination than Callao. The average buyer imports around 420 tons per route and month. On average, each route shows a trade surplus of approximately $12,000$ tons per route and month.

4 Identification Strategy

In order to isolate the effect of mergers and acquisitions and vessel alliances in the shipping market we propose a modified price-concentration approach. In our identification strategy the number of firms operating on a route at a given point in time affects prices per ton, similar to Brueckner and Whalen (2000), and we add a measure of vessel sharing concentration. Evans et al. (1993) argue, simple regressions of prices on market concentration are likely biased for many reasons (such as simultaneity). While we are positive that including fixed effects in the regression will control for the bias to some extent, we will also introduce instrumental variables in our analysis to account for possible sources of endogeneity. Hence, our regression of interest will be the following:

$$\begin{aligned}\ln p_{scrt} = \beta_1 \cdot \text{NumberFirms}_{rt} + \beta_2 \cdot \text{NumberFirmsVSA}_{crt} \\ + \mathbf{X'_{scrt}}\beta + \eta_s + \psi_{cr} + \varphi_{rt} + \rho_{ct} + \varepsilon_{scrt}\end{aligned}$$

In this regression, we estimate how prices per ton of product s shipped by carrier c on route r in month t are influenced by the number of shipping companies operating on that given route r at the time of shipping (β_1). β_2 measures the effect of the number of shipping companies that have entered a Vessel Sharing Agreement within the carrier c for the route and point in time that the product was being shipped. We add control variables that mainly account for trade imbalances between countries and buyer power of importing companies. η_s are product fixed effects and ψ_{cr}, φ_{rt}, ρ_{ct} are carrier-route, route-time and carrier-time fixed effects, respectively. The coefficients of interest are β_1 and β_2.

If this regression is estimated using Ordinary Least Squares, there are two sources of endogeneity. For example, Demsetz (1973) has shown that prices affect market concentration and vice versa. Overall, this simultaneity will lead to an upward bias of the Ordinary Least Squares coefficient for β_1. Similarly, there could be factors biasing the coefficient of β_2. For example, firm efficiency could play a role. More efficient shipping lines have lower costs and can set lower prices. At the same, companies that have already low cost levels are less likely to enter into a VSA, because they can improve their cost structure relatively less, compared to an inefficient firm. This would result in omitted variables and an upward bias of β_2.

We will address these concerns by instrumenting for these variables. For our instruments to be statistically valid, they need to fulfill two conditions: First, they need to be relevant, that is they have to affect the variable of concern (see discussion section 5 and table A2). Second, they need to be exogenous. In the style of a Hausman instrumental variable (Hausman and Taylor, 1981; Hausman et al., 1994), we use the number of firms operating on a specific country-to-country route, excluding the specific port of origin of the observation as instrument. These variables provide exogenous variation, as routes from the same country should be affected by the same underlying supply shocks and cost structure. At the same time routes from the same country are assumed to be independent of each other and belong to different markets on the demand side. It seems likely that this is the only channel through which this instrument affects prices, thus fulfilling the exogeneity assumption.

With regards to the number of firms in a Vessel Sharing Agreement, we compare two instruments. Analogous to the instrument of market concentration, one is a Hausman instrument for the average number of firms sharing vessels in a given month, carrier and route. Assuming that alliance concentration does not impact the concentration on other routes, the exogeneity assumption is fulfilled. Second, we use an identifier for shipping companies that are engaging in a global vessel sharing agreement to instrument the number of shipping companies. Peru is of relatively little importance compared to the global shipping market. As mentioned above, according to The World Bank Group (2024), the Peruvian shipping market accounted for around 0.3 percent of shipped containers in the global shipping market in 2021. Thus, we can assume that the decision of two shipping lines to enter a global VSA, is happening independent of Peruvian maritime trade and can be considered quasi-exogenous for our setting.

Since we are in a case with two endogenous variables and two instrumental variables, we are estimating our results using the Generalized Method of Moments.

Lastly, it needs to be said that we approximate the number of firms in a Vessel Sharing Agreement by the number of firms sharing a vessel. This is mainly due to the constraints of this project dimension and a reasonable approximation, as for only around 6 percent of cases, a company sharing a vessel is not part of a Vessel Sharing Agreement. Thus, the effect of capacity sharing that we calculate can be attributed to a large part to regional or global Vessel Sharing Agreements (European Commission, 2023a).

Choosing this identification comes with an additional interpretation and we can formulate certain expectations regarding the signs and relative magnitude of the coefficients. The number of shipping companies on a route is equivalent to firm level market concentration. Following basic economic reasoning, the market power of a shipping company decreases, the more competitors it faces on a given route. Thus an increase in the number of firms on a route by one leads to a decrease in market concentration and should should correspond to lower mark-ups and lower prices, resulting in a negative sign of β_1. When it comes to Vessel Sharing Agreements, things become more interesting. Increasing the number of firms in a shipping alliance increases by one (that is an outside company enters a VSA) and keeping the number of shipping lines on a route constant, this corresponds to an increase in concentration on the alliance level. Should sharing a vessel facilitate competition by optimizing vessel capacity utilization, reducing operational costs, and enhancing service reliability through coordinated schedules and shared resources, we would expect that higher market concentration relates to lower prices. In this case, VSAs represent efficiency gains and β_2 should be negative. There is also the other scenario, where the market power effect dominates the cost efficiencies from sharing a vessel, leading to an increase in prices, similar to a decrease in firm level market concentration. If jointly setting capacities is of less importance in the shipping market, we would expect the effect of firm market concentration to be larger: β_2 is positive and smaller than $-\beta_1$. Should β_2 be positive and not different from $-\beta_1$, then a reduction firm and alliance level concentration have the same price effect. This may be reasonable since container shipping companies operate with a fixed capacity in terms of vessel size and fleet, and their competition could revolve around optimizing the utilization of this capacity rather than directly adjusting prices in response to market conditions.

For our analysis, we use heteroskedastic robust standard errors clustered at the route level.

5 Results

Assessing the impact of market concentration is important for many reasons. On the one side, it is important for regulators to understand how market and alliance level concentration affect prices to create a setting where competition and fair pricing prevails. On the other side, it is crucial to understand which degree of cooperation in the container shipping industry leads to pro-competitive effects, such as economies of scale and cost efficiencies. Thus, antitrust assessment plays a critical role in this market, so that future decisions can be based on empirical reasoning and economic benefits can be estimated reliably.

Table 1 presents our baseline results. Column 1 is a standard Ordinary Least Squares regression with firm and alliance level market concentration and product fixed effects. While the effect of market level concentration is negative and significant, we see that it reduces by half its magnitude when adding two-way fixed effects in column 2. Similarly, in the case of Vessel Sharing concentration, the coefficient is negative and looses in magnitude between column 1 and 2. This speaks for the fact that product fixed effects are not enough to account for variation across routes, months and carriers and that two-way

Table 1: Baseline Results

	Dependent variable: $\ln p_{scrt}$				
	OLS		IV: Hausman		IV: global VSA
	(1)	(2)	(3)	(4)	(5)
NumberFirms_{rt}	-0.0211^{***}	-0.0165^{***}	-0.0809^{***}	-0.0552^{***}	-0.0530^{***}
	(0.0071)	(0.0049)	(0.0278)	(0.0130)	(0.0125)
$\text{NumberFirmsVSA}_{crt}$	-0.0464^{***}	-0.0337^{***}	-0.0156	-0.0855^{**}	-0.0355^{*}
	(0.0163)	(0.0081)	(0.0306)	(0.0389)	(0.0202)
FE: Product	✓	✓	✓	✓	✓
FE: Carrier-Route		✓		✓	✓
FE: Route-Month		✓		✓	✓
FE: Carrier-Month		✓		✓	✓
Observations	2,586,527	2,585,851	2,519,696	2,519,420	2,580,271
Clusters	991	984	970	969	978

Notes: The dependent variable is log prices of shipped goods per ton. Column 1 is an Ordinary Least Squares regression using only Product Fixed Effects. In column 2 we add Carrier-Route, Route-Month and Carrier-Month Fixed Effects. In column 3 and 4 we instrument NumberFirms and NumberFirmsVSA using two Hausmann instrumental variables. Column 3 only uses Product Fixed Effects and column 4 adds Carrier-Route, Route-Month and Carrier-Month Fixed Effects. Column 5 instruments NumberFirms using a Hausmann Instrument for market size and NumberFirmsVSA using an indicator for the participation in a global VSA. Column 5 uses Product, Carrier-Route, Route-Month and Carrier-Month Fixed Effects. Standard errors are heteroskedasticity robust and adjusted for clustering on route level.

*p<0.1; **p<0.05; ***p<0.01.

fixed effects are needed for an unbiased estimation. The Ordinary Least Squares regression estimates in both cases a significantly negative effect of alliance level concentration on prices, implying that VSAs are pro-competitive. Using both Hausman instrumental variables for market and alliance concentration in columns 3 and 4 leads to the same conclusion: When accounting for two-way fixed effects, the effect of adding an additional competitor on a shipping route decreases significantly. While the effect of sharing a vessel is not significant in column 3, it increases in magnitude and becomes significant on the 95 percent confidence level in column 4. On average, two companies entering a shipping alliance while leaving the number of competitors constant, is associated with a decrease in prices by approximately 8.19 percent.[2] Leaving everything else constant, increasing the market concentration by one competitor less on a shipping route, is expected to decrease prices significantly by 5.37 percent.

Comparing these findings with the results of the Ordinary Least Squares specification, we find that the coefficients change substantially. This aligns with the large body of evidence started by Demsetz (1973), whereby price-concentration regressions tend to have a posi-

[2]Due to the magnitude of some of our coefficients, and in order to be precise when interpreting the estimates, we will not use the Taylor approximation for a log-linear regression. The correct average treatment effect in percentages is: $(e^{\beta} - 1) \times 100\%$ (i.e. in this case: $(e^{-0.0855} - 1) \times 100\% \approx -8.19\%$).

tive bias when not accounting for endogeneity biases by using instrumental variables. A reason for that is that few very efficient firms may drive both a high concentration and a high performance in prices (Berry et al., 2019). In addition, this speaks for our argument of efficiency being an omitted variable, as β_2 is being overestimated in column 2.

The findings change in column 5 when instrumenting market concentration by the Hausman instrument and the number of shipping lines in a vessel sharing agreement by global VSA participation. In this case, increasing market concentration has an average positive price effect of around 5.16 percent. Increasing alliance concentration leads to a lower effect, a 3.48 percent decrease in prices, as well. This is interesting, in that if both instrumental variable specifications (columns 4 and 5) are consistent estimators for the coefficients of market and alliance concentration, this usually results not in two coefficients with this big of a discrepancy.

For instrumental variables to be valid, they need to be exogenous and relevant. Both our instruments fulfill the exogeneity assumption (for a discussion refer to section 4). Table A2 presents the results of both first stage regressions (estimated jointly) of our instrumental variables on the number of firms (columns 1 and 2) and participation of firms in global vessel sharing agreements (columns 3 and 4). What is striking is that there is a strong relationship for all four first stages. In the case of the two Hausman variables in columns 1 and 3, we see that both instruments influence their respective endogenous variables significantly, while not interfering with the other case. In column 2 and 4, we find that this is not the case for global vessel sharing agreements. Here, the instruments cross interfere with each other's first stage relationship, ultimately compromising validity. In addition to that, we computed the F-statistic (after Kleibergen and Paap (2006)) which can be used to test overall relevance for the system of first stage equations that we use in our Generalized Method of Moments estimation. The result is ≈ 29.39 for the case with both Hausman instruments and ≈ 8.64 for the case using global VSAs as instrument for the number of firms in shipping alliances. Comparing this to the critical values proposed by Stock and Yogo (2005), we can reject the hypothesis that our first stages are weakly identified in the case of both Hausman instrumental variables. However, we cannot reject said null hypothesis for the second case, when using participation in global VSAs. This comes with an interesting consequence: global vessel sharing agreements and the Hausman instrument for market concentration might be relevant and valid instruments in other settings (with regards to their respective channel), but in our Generalized Method of Moments setting, their combination does not result in validity of the instruments. Hence, we choose the IV specification from column 4 as our baseline specification.

Overall these results speak for the hypothesis that Vessel Sharing Agreements are procompetitive and their effect outweighs the one of a change in direct market level concentration! This is in line with the argument of the European Commission (2009) and the European Commission (2020) who argue for the case of the European maritime trade market that under certain conditions, ensured by the Consortia Block Exemption Regulation, the cost efficiencies of sharing vessels outweigh the market power effect of a reduction in alliance concentration. Our results are especially interesting in the context of Jimenez (2020). In this study, the median short-run pass-through rate of cost to freight rates is estimated to be almost 1-to-1. This implies that our estimates can be interpreted not only as an overall reduction in prices, but that they are a good estimate for the cost reduction associated to vessel sharing agreements, as well.

6 Heterogeneous Effects and Robustness

6.1 Route Size

We found that market level concentration effects are on average lower than the effect of a change in alliance level concentration. In this section, we will look at how the effects change for different route sizes. This is particularly interesting from an economic point of view because basic microeconomic theory tells us that when markets are small, costs are higher due to a lack in economies of scale. At this point, sharing capacities becomes substantially more attractive because they present an option to reduce average costs while keeping each company's commercial decision independent. At the same time, lower costs create a competitive advantage over both, other competitors in the market that are not part of a VSA and potential entrants.

Indeed, table 2 seems to confirm this hypothesis. We split our data into two sub-samples, depending if the route is above or below the median average shipping volume per month. This allows us to analyze the effect depending on market sizes of routes. Column 1 presents the main specification from table 1. Column 2 shows the results of this regression specification for below median market size, column 3 for above median market size. The effect of a market concentration reduction is similar in significance and lower in magnitude compared to the full sample in both, column 2 and 3. However, these differences are not statistically different from each other. As hypothesised, the effect of vessel sharing agreements is stronger on small routes: Ceteris paribus, two shipping lines entering a VSA will lead to cost savings that result on average in a price reduction of approximately 15.3 percent. On larger shipping routes, the effect of a vessel sharing agreement is around a 6.99 percent price reduction, closer to the baseline result. This means that because large routes represent a larger share of total cargo, the overall average effect of vessel sharing agreements (column 1) is mainly driven by cost efficiencies on large routes (column 3). As already mentioned, only a marginal share of the containers shipped worldwide was handled by the Peruvian shipping market (The World Bank Group, 2024). Nonetheless, we observe in our data that a major portion of trade is happening with large countries, such as the United States of America or China. Therefore, we provide more context to

Table 2: Route Density Heterogeneity

	Dependent variable: $\ln p_{scrt}$		
		Route Size	
	All Routes	Below Median	Above Median
	(1)	(2)	(3)
NumberFirms_{rt}	-0.0552^{***}	-0.0360^{***}	-0.0438^{***}
	(0.0130)	(0.0124)	(0.0125)
$\text{NumberFirmsVSA}_{crt}$	-0.0855^{**}	-0.1661^{***}	-0.0725^{***}
	(0.0389)	(0.0717)	(0.0252)
FE: Product	✓	✓	✓
FE: Carrier-Route	✓	✓	✓
FE: Route-Month	✓	✓	✓
FE: Carrier-Month	✓	✓	✓
Observations	2,519,420	1,226,406	1,292,306
Clusters	969	679	666

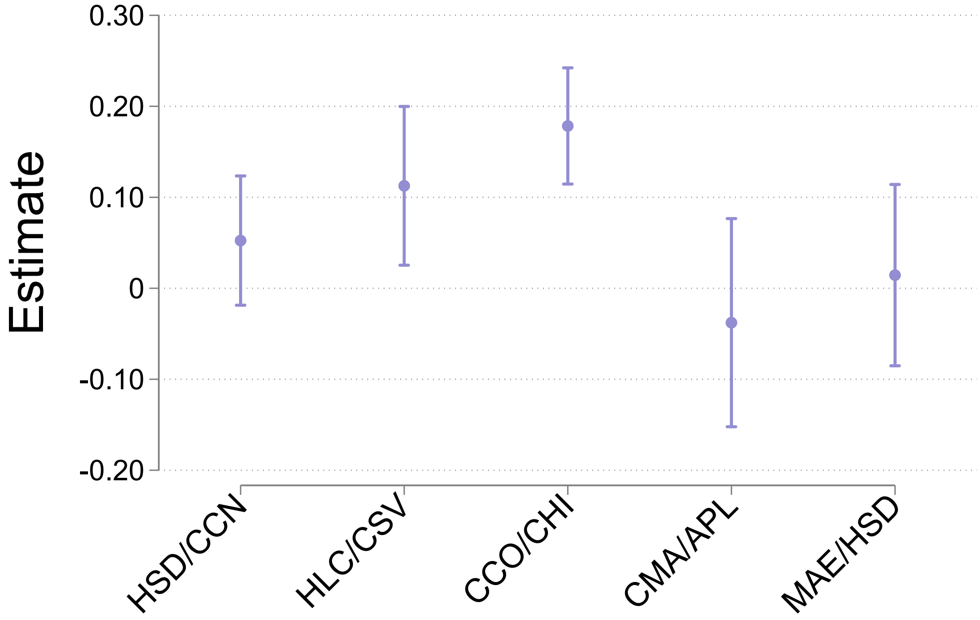
Notes: The dependent variable is log prices of shipped goods per ton. We instrument NumberFirms and NumberFirmsVSA using two Hausman instrumental variables. Column 1 shows the baseline IV model (Column 4 from Table 1). Column 2 presents the results for a sub-sample of routes with below median average shipping volume per month and column 3 for a sub-sample of routes above median average shipping volume per month. The median is at approximately 17,200,000 tons per month. Standard errors are heteroskedasticity robust and clustered on the route level.

*p<0.1; **p<0.05; ***p<0.01.

our argument by specifically differentiating for market size in the already small Peruvian shipping market and distinguishing the market and alliance concentration effects for small-to-big country routes (in column 3) and small-to-small country routes in column 2.

6.2 Mergers

In this section, we take a step back and look at the mergers in the shipping market. We aim to understand how each merger affected the shipping market separately. Mergers and acquisitions always go in hand with a reduction of market concentration, while not every reduction in market concentration can be traced back to a merger or acquisition. We modify our price concentration regression in such as to add a term for each transaction of a merged entity that happened after a unification. The Ocean Network Express merger is omitted due to multicollinearity. Ultimately, we can disentangle the effects of a general reduction in market concentration from those that can be attributed to a specific merger. Figure 4 shows the results of this specification. What is striking is that most mergers seem to have increased prices. Most mergers seem to have increased prices, such as the two most significant cases Hapag Lloyd/CSV and COSCO/China Shipping Group, which



Notes: This plot displays the price concentration effect for each merger. The dependent variable of this regression is log prices of shipped goods per ton. Standard Errors are heteroskedasticity robust and adjusted for clustering on route level. The point is the estimated coefficient of a regression, where dummies for each post-merger transaction are added. The lines correspond to the 95% confidence intervals.

Figure 4: The market level concentration effect of each merger

led to a price increase of 10 percent and 18 percent respectively.
CMA-CGM/American President Lines and Maersk/Hamburg Süd were competitively neutral, as prices did not change significantly after the acquisitions. In conclusion, this speaks for the fact that the majority of mergers had a tendency to (marginally in)significantly increase prices in the shipping markets.

6.3 Robustness

In this part, we will show that our hypothesis is robust to adding further control variables. Therefore, we will add Dummies for the port terminals in Callao at which a transaction was conducted and control for market size. This may potentially affect our results since the APM Terminal Callao is owned by one of the members of the 2M alliance. Table 3 presents the regression results. Column 1 presents again the baseline regression from table 1. In column 2 we add the port dummies and exclude trade imbalances. The coefficients for both, market and alliance concentration, stay almost the same in terms of sign, magnitude and significance. Column 3 replaces trade imbalances with market size, as these two variables might be correlated to some extent and potentially lead to a bad control problem. In this case, the effect of sharing a vessel increases to a 9.03 percent reduction in prices, relative to column 1. The effect of market concentration loses in terms of magnitude but is still significantly negative on the 90 percent confidence level. Column 4 uses all control variables (importer market power, trade imbalances, port dummies and market size). In this specification, market concentration gains again in terms of significance and magnitude, while alliance concentration is mostly unchanged compared to column 3. Thus, we can conclude that our hypothesis about the pro-competitiveness of vessel sharing agreements is robust to choosing different control variables.

Table 3: Adding Controls

	Dependent variable: $\ln p_{scrt}$			
	(1)	(2)	(3)	(4)
NumberFirms_{rt}	-0.0552^{***}	-0.0552^{***}	-0.0159^{*}	-0.0177^{**}
	(0.0130)	(0.0130)	(0.0096)	(0.0076)
$\text{NumberFirmsVSA}_{crt}$	-0.0855^{**}	-0.0900^{**}	-0.0958^{***}	-0.0946^{***}
	(0.0389)	(0.0403)	(0.0361)	(0.0366)
$\mathbf{X}'\beta$: Buyer Power	✓	✓	✓	✓
$\mathbf{X}'\beta$: Trade Imbalances	✓			✓
$\mathbf{X}'\beta$: Port Callao		✓	✓	✓
$\mathbf{X}'\beta$: Market Size			✓	✓
FE: Product	✓	✓	✓	✓
FE: Carrier-Route	✓	✓	✓	✓
FE: Route-Month	✓	✓	✓	✓
FE: Carrier-Month	✓	✓	✓	✓
Observations	2,519,420	2,519,420	2,519,420	2,519,420
Clusters	969	969	969	969

Notes: The dependent variable is log prices of shipped goods per ton. We instrument NumberFirms and NumberFirmsVSA using two Hausman instrumental variables. Column 1 shows the baseline IV model (Column 4 from Table 1). Column 2 uses buyer power and port dummies as control variables. Column 3 adds market size and column 4 controls for buyer power, trade imbalances, port dummies and market size. Standard errors are heteroskedasticity robust and clustered on the route level.

*p<0.1; **p<0.05; ***p<0.01.

Further robustness checks include running the specification with one-way fixed effects (Table A3) for both, Ordinary Least Squares and instrumental variables. We find that the effect for market level concentration is a little higher in magnitude and still significant for one-way fixed effects in the Ordinary Least Squares model, thus overall leaning towards the bias with only product fixed effects. The effect of alliance level concentration becomes statistically not different from zero in column 2. In the case of the instrumental variables approach using one-way fixed effects, the market concentration effect loses in magnitude and is only significantly negative on the 90 percent confidence level. The alliance concentration effect changes, too: it loses in magnitude as well, but stays significant on the 95 percent confidence level. Putting this in context: a biased Ordinary Least Squares (such as the one-way fixed effects Ordinary Least Squares in column 2) should be overestimating the consistent estimator (Evans et al., 1993), in this case, the baseline in column 3. Similarly, if one-way fixed effects in the instrumental variable approach would be enough to account for endogeneity, we should see the same upward bias in column 2 relative to column 4, which we do not. Hence we can conclude that our specification is as simple as possible, as complex as necessary to deliver consistent estimators.

We have shown that our results are in line with economic theory, robust and likely fulfill internal validity. Nonetheless, we must acknowledge that our analysis can be extrapolated to other markets and contexts only to a certain amount. Maritime shipping markets are highly complex and show strong regional dependencies. Besides that, every country has its own antitrust authority with its own view on competition and assessment of the efficiencies of Vessel Sharing Agreements. While the European Commission presumed that sharing vessels is pro-competitive for the European market provided that they are in line with the consortia block exemption regulation, China blocked one of the biggest proposed global VSAs, P3, in 2015. This is just one example from a much longer list, where what is considered to increase competition in one country, can be anti-competitive in another country. Ultimately, the Peruvian market is defined by several distinct features that make the generalisation of our results difficult: First, the biggest part of maritime trade in Peru goes through a single port, Callao. Second, a substantial portion of its trade goes through the Panama Canal and is therefore heavily dependent on the seasonality and volatility of its sea levels. Third, the main trading partners of Peru are big countries like China and the United States of America. Therefore, typical routes in Peru are big-to-small country routes. Nonetheless, there are countries, such as Chile, Ecuador or Colombia, that fit these characteristics as well, and hence our findings could potentially hold for these countries, too.

In summary, we can show that our results are internally valid. Yet, external validity is hard to prove and remains a subject for further investigation.

7 Conclusion

Disentangling the effect of vessel sharing agreements and market concentration has been a missing link in modern industrial organizational research. Theoretical work from Quartieri (2017) shows that sharing capacity in the shipping market can lead to reductions in freight rates, and research by Hirata (2017) shows that overall market concentration is positively correlated with prices. However, there has not been any empirical research looking at the effect of shipping alliances and comparing it to the one of market concentration. We fill this gap by constructing a unique dataset using web scraped information from the Peruvian Customs and combining this with shipping data from `veritradecorp.com` and public information on mergers, acquisitions and vessel sharing agreements. Following

Brueckner and Whalen (2000), we suggest a novel modification of the price-concentration regression equation to include shipping alliance concentration. In order to account for the endogeneity bias of Ordinary Least Squares (argued by Demsetz (1973) and Evans et al. (1993)), we propose to use (two) Hausman instruments for market concentration and alliance concentration.

In addition, we can show that the participation in global Vessel Sharing Agreements could theoretically fulfill the relevance and exogeneity assumptions, making it a valid instrument for alliance concentration in other settings. However, in our case, there is significant interference with the market concentration instrument, leading to weak identification problems related to the system of first stages in our Generalized Method of Moments estimation.

We find that, while keeping the market conditions constant, an additional competitor decreases prices by 5.37 percent significantly. The effect of two companies engaging in a VSA and increasing alliance concentration is larger: a significant price reduction of 8.19 percent. This is because competition plays an important role for prices in the maritime shipping market, but also due to the fact that reducing costs makes a larger difference in the already very competitive market. While it seems that these effects are mainly driven by big-to-small country routes, the effect is especially large on small-to-small country routes. Here, shipping alliances can lead to cost savings and ultimately price reductions of more than 15 percent, as substantial economies of scale cannot be achieved on these routes. Our identification strategy does not only account for buyer power and trade imbalances, but we can also show that the overall picture stays robust when accounting for further controls.

These results are substantial for three reasons. First, we can provide evidence that VSAs show pro-competitive effects also on small routes, which are particularly affected by market power (Ardelean and Lugovskyy, 2023). Second, our results are aligned with the European Commission (2020), and other antitrust authorities who argue that vessel sharing agreements can be pro-competitive, if implemented correctly. Third, we have shown that mergers in the container liner market have a tendency to increase prices, therefore antitrust authorities need to be careful when assessing mergers and acquisitions in the shipping market.

We acknowledge that our approach will lead to restricted external validity. It is possible that the effects of sharing capacities are different from what we find for large countries and denser routes. Subsequently,a per-se statement about the cost reduction and market power effects of VSAs cannot be made. Yet, we believe that our results are indeed representative of countries with a similar shipping market environment, such as Chile, Ecuador or Colombia. Ultimately, to understand the implications of vessel sharing agreements on a global scale, further research and case studies on other countries are needed to shed light on this topic.

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A Appendix

A.1 Figures

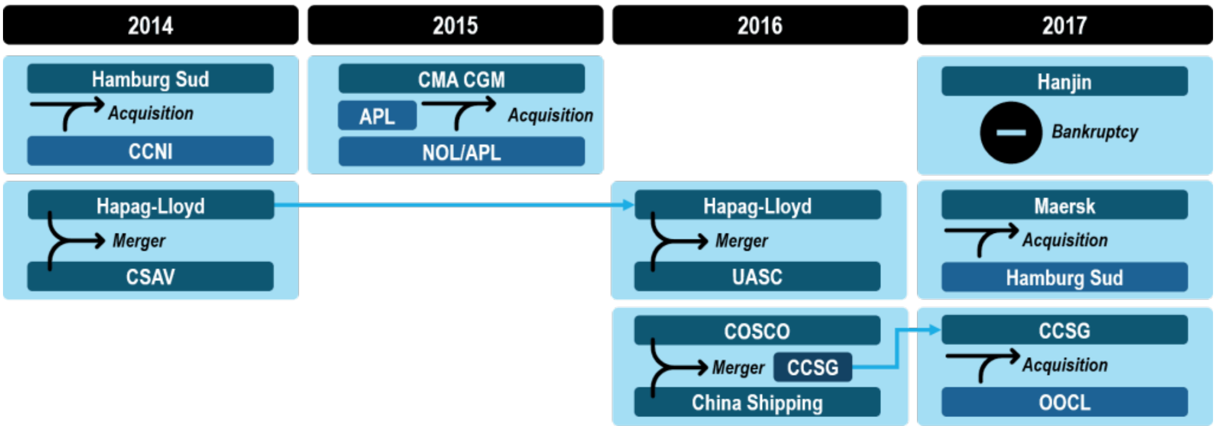

Figure A1: Market Entry and Exit due to Mergers between 2014 and 2018 (Notteboom, 2023)

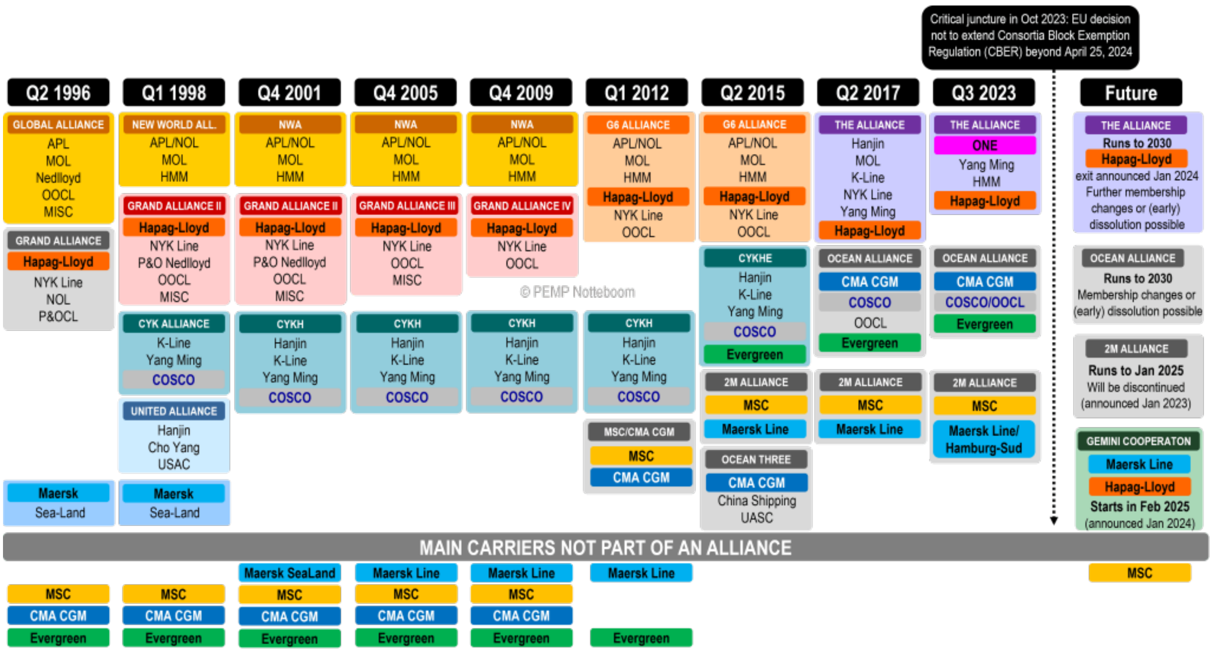

Figure A2: The Development of the biggest global Vessel Sharing Agreements (Notteboom et al., 2022)

A.2 Tables

Table A1: Summary Statistics

	Mean	Route Size below Median	Route Size above Median	p-value of Welch's t-test
Freight (US$ / t)	0.4401 (98.1748)	0.5328 (138.8820)	0.3477 (4.3622)	0.13002
NumberFirms	9.0248 (4.5369)	8.1621 (4.4977)	9.8882 (4.4100)	$< 0.0001^{***}$
NumberFirmsVSA	3.5867 (1.5697)	3.4179 (1.4757)	3.7555 (1.6413)	$< 0.0001^{***}$
HIV Market level Route	2.7200 (1.1463)	1.9915 (0.5040)	3.4458 (1.1465)	$< 0.0001^{***}$
HIV Alliance level Route	3.9694 (1.6697)	3.7220 (1.5553)	4.2052 (1.7393)	$< 0.0001^{***}$
Buyer Power (t)	422.7552 (1158.8960)	418.4124 (1074.3510)	427.1009 (1237.7160)	$< 0.0001^{***}$
Trade Imbalances (t)	12138.12 (12579.02)	10487.66 (11745.44)	13789.70 (13155.56)	$< 0.0001^{***}$

Notes: The table presents mean values for the whole shipping market (column 1), for a sub-sample of routes with below median avg. shipping volume per month (column 2), and for a sub-sample of routes above median average shipping volume per month (column 3). The median is at approximately $17,200$ tons per month on a route. We run a Welch's t-test for differences in means and unequal variances in columns 2 and 3 and present its $p-$value in column 4.

*p<0.1; **p<0.05; ***p<0.01.

Table A2: First Stage Results for the Baseline Regression

	Dependent variable:			
	NumberFirms_{rt}		$\text{NumberFirmsVSA}_{crt}$	
	(1)	(2)	(3)	(4)
$\text{HIVNumberFirms}_{rt}$	-3.882^{***}	-3.132^{***}	0.0200	0.1390^{**}
	(0.6085)	(0.5505)	(0.0672)	(0.063)
$\text{HIVNumberVSA}_{crt}$	-0.0067		0.2266^{***}	
	(0.0406)		(0.0456)	
VSA G6_{crt}		1.0900^{***}		1.1904^{***}
		(0.3185)		(0.0993)
VSA THE All. $1^{\text{st}}{}_{crt}$		1.0830^{***}		0.7204^{***}
		(0.3323)		(0.1836)
VSA THE All. $2^{\text{nd}}{}_{crt}$		0.5713^{**}		-0.2265^{**}
		(0.2551)		(0.1304)
VSA P3_{crt}		0.9550^{*}		-0.2722
		(0.5784)		(0..2110)
VSA OCEAN 3_{crt}		0.9796^{**}		1.0985^{***}
		(0.4057)		(0.1246)
VSA OCEAN All._{crt}		1.0877^{**}		1.7098^{***}
		(0.4771)		(0.1465)
VSA CYKH_{crt}		0.6975^{***}		1.1304^{***}
		(0.2407)		(0.2260)
VSA 2M $1^{\text{st}}{}_{crt}$		-0.1498		1.1577^{***}
		(0.2537)		(0.1369)
VSA 2M $2^{\text{nd}}{}_{crt}$		0.5455^{***}		1.9012^{***}
		(0.1755)		(0.2126)
FE: Product	✓	✓	✓	✓
FE: Carrier-Route	✓	✓	✓	✓
FE: Route-Month	✓	✓	✓	✓
FE: Carrier-Month	✓	✓	✓	✓
Observations	2,519,420	2,580,271	2,519,420	2,580,271
Clusters	969	978	969	978

Notes: This table reports the first stage results of table 1. Columns 1 and 3 are the first stage coefficients corresponding to column 4 of table 1. Columns 2 and 4 are the first stage coefficients corresponding to column 5 of table 1. Standard errors are heteroskedasticity robust and adjusted for clustering on route level.

*p<0.1; **p<0.05; ***p<0.01.

Table A3: Results using oneway Fixed Effects.

	Dependent variable: $\ln p_{scrt}$			
	OLS		IV	
	(1)	(2)	(3)	(4)
NumberFirms_{rt}	-0.0165^{***}	-0.0191^{***}	-0.0552^{***}	-0.1917^{*}
	(0.0049)	(0.0057)	(0.0130)	(0.1083)
$\text{NumberFirmsVSA}_{crt}$	-0.0337^{***}	-0.0031	-0.0855^{**}	0.0617^{**}
	(0.0081)	(0.0075)	(0.0389)	(0.0334)
FE: Product	✓	✓	✓	✓
FE: Carrier-Route	✓		✓	
FE: Route-Month	✓		✓	
FE: Carrier-Month	✓		✓	
FE: Carrier		✓		✓
FE: Route		✓		✓
FE: Month		✓		✓
Observations	2,585,851	2,586,510	2,519,420	2,519,693
Clusters	984	991	969	970

Notes: The dependent variable is log prices of shipped goods per ton. Column 1 is an Ordinary Least Squares regression using Product and two-way fixed effects. Column 3 uses Hausman instruments for NumberFirms and NumberFirmsVSA and uses Product and two-way fixed effects. These regressions are equal to column 2 and 4 of table 1. Columns 2 and 4 of this table, run the same regressions but using one-way fixed effects. Standard errors are heteroskedasticity robust and adjusted for clustering on route level.

*p<0.1; **p<0.05; ***p<0.01.