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# Networks in trade — Evidence from the legacy of the Hanseatic league[☆]

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ABSTRACT

We study trade networks following the decline of the Hanseatic League, using a novel trade data set that covers cities and captains in Northern Europe over 190 years. By the time of its dissolution in 1669, trade on former Hansa routes is within predictions from a gravity framework. However, the Hansa continue to shape the composition of trade: Trade between cities in the Hanseatic network continues to be facilitated by Hanseatic captains for centuries. Our paper highlights the long-run stability of commercial and social networks, which persist when other economic effects do not.

## 1. Introduction

In this paper, we investigate how trade networks develop after their formal dissolution. Trade networks can reduce frictions and transaction costs, thereby fostering connections and increasing trade and welfare (Greif, 1993; Greif et al., 1994; Gomtsyan, 2022). However, the formation of networks is costly. In order to compare high set up costs to dynamic gains over time, we need to understand their long run behaviour. At the same time, investigating trade networks over a long period of time has been difficult due to demanding data requirements. On the one hand, researchers need to observe trade flows for a long time, which tends to limit the granularity at which they observe trade. On the other hand, one needs highly granular data to observe the names or networks of traders, or a reasonable proxy for it. Therefore, long-run trade studies such as O'Rourke and Williamson (2001) often speak more to unilateral determinants of trade.

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We address these issues by using a historic laboratory: the demise of the Hanseatic League in the 17th century. By overcoming trade frictions and weak contract enforcement, this confederation dominated trade in the Baltic region during the Middle Ages. It ended in 1669, after a long period of gradual dissolution.

We use Danish tax register data that records seaborne transits between the North and the Baltic Sears for the years 1668 to 1857. We use these data to build a panel of city-level, high resolution trade flows over 190 years. We not only observe origin and destination of ships, but also captains' home towns and last names, which we use as proxies for the captains' network memberships. This allows us to estimate how the former Hansa network shaped trade long after its dissolution. Our paper is among the first set of papers in economics that develop and use this dataset. Alder et al. (2020) and Waldinger (2022) use the Sound Toll Data to study the impact and consequences of environmental shocks, using more aggregated versions of this dataset than we do in this paper. Gomtsyan (2022) uses the Soundtoll data to study merchant networks in cities. Vedel (2024) investigates unilateral trade responses to a change in first-nature geography using these data. We believe that our paper is the first one that uses the Soundtoll data in its richness and in a fully specified gravity model.[1] The Soundtoll data only records trade that passes the Sound near Copenhagen. Trade between cities that are both to the east or both to the west of the Sound are missing. However, we verify below using simulations that this limitation does not introduce bias into the gravity framework.

Our main hypothesis is that trade between merchants and captains that all belonged to the Hanseatic network, which we define as trade by Hanseatic captains on Hanseatic routes, accumulated trading capital. Trading capital, broadly defined, encompasses physical, social, and human capital lowering bilateral trade costs (Beestermöller and Rauch, 2018). Forming relationships and building trust is also an integral part of trading capital. Its gradual depreciation has been used to explain persistent trade patterns (Head et al., 2010). During its existence, membership in the Hanseatic League brought tax and legal privileges that were linked to being a citizen of a Hansa town. This incentivized Hanseatic traders to build particularly large stocks of trading capital on their key routes, consisting of harmonized legal and economic institutions, a common language, family connections, and trust in captains. Such trading capital will have led to lower trade costs and thus more trade among the League's members. We test this hypothesis both for the network of cities and for the network of merchants and captains, incorporating a proxy for captains' identities.

We first consider trade between former Hansa cities and their key trading partners: Does the size of aggregate trade flows between two cities, measured by the number of ships sailing between them, depend on past membership in the Hanseatic League? A persistent trade effect of formerly shared institutions has for example been documented in other contexts by Head et al. (2010), Beestermöller and Rauch (2018) and Jacks et al. (2020). Using city-level gravity equations, we do not find evidence for such trade persistence. Motivated both by the historical literature (Dollinger, 1964) and the recent literature on the importance of social connections as a determinant of trade (Cristea, 2011; Munshi, 2014; Campante and Yanagizawa-Drott, 2017; Fang et al., 2020; Bailey et al., 2021), we then add captains' network membership as a third dimension, measured by the captain's residence or last name. We incorporate these by creating a larger dataset where an observation is a combination of origin, destination, and a captain's residence or last name. In line with our hypothesis that Hanseatic traders invested particularly strongly into accumulating trading capital within the network, we find that trade on Hanseatic-led ships between former Hanseatic cities is considerably larger until well into the 19th century, nearly two centuries after the end of the Hanseatic League. Our mean point estimate across time and different specifications is equivalent to a tariff reduction of 8.5%. Thus, membership in the network continues to shape trade flows within the network after its formal dissolution. These results are not driven by the fact that those facilitating trade between two cities (or countries) predominantly resided in one of the two cities. Our results are further robust to different codings of Hanseatic cities and to different measures of trade flows.

In terms of mechanisms, we do not find that Hansa-specific trading capital on Hanseatic routes was reflected in a more homogenized set of units and measures, which may have reduced trade costs. We do find, however, that ships led by Hanseatic captains carried a larger variety of goods on Hanseatic routes, showcasing their stronger integration. This finding also speaks against the hypothesis of correlated consumption preferences among Hanseatic cities.

Our paper contributes at least to four literatures. First, we add to a growing body of literature on trade networks. The role of networks in trade and development has received increasing attention (Munshi, 2014), in particular due to their capacity to overcome weak institutions (Nunn, 2007; Atkin and Khandelwal, 2020) and to reduce search frictions. Eaton et al. (2021) shows that networks increase welfare.[2] Our main result shows that the network status of traders and captains continues to shape trade composition for a long time. This finding amplifies the importance of networks in trade and development. However, our results also caution that network effects might not always be apparent in bilateral trade flows, and instead be more relevant for the identity of the intermediators of trade, i.e. for the "who" rather than the "how much".

Our paper also relates to a long literature on how institutions can be passed down from generation to generation (Spolaore and Wacziarg, 2009; Guiso et al., 2016). For example, Greif (1993) shows how a coalition of Maghribi traders built a reputation mechanism to reduce transaction costs in trade relationships in the 11th century. In a similar vein, Greif et al. (1994) interpret medieval merchant guilds such as the Hansa as a way of permitting effective collective action against rulers of trade centres, leading to more efficient trade. Puga and Trefler (2014) present evidence that a small group of merchants blocked access to trade in medieval Venice, using marriage alliance to build trust and monopolize trade. Our paper relates to this literature by estimating the role of

[1] A more recent paper by Raster (2024) uses the full Soundtoll data at the voyage level to study the role of pioneers in the creation of trade links.

[2] A more recent literature in trade also looks specifically at firm-to-firm networks, see for example Bernard et al. (2019), Atkin and Khandelwal (2020), and Boken et al. (2023)

networks in a high-resolution and long-period dataset. Hanseatic traders and captains remain biased towards the Hansa network long after its dissolution.

We further contribute to the literature that shows that social connectedness and cultural similarity have measurable effects on trade (Rauch, 2001; Rauch and Trindade, 2002). A common language facilitates trade (Melitz, 2008; Melitz and Toubal, 2014) and trust, arising from cultural similarity and a shared history, increases trade between European countries (Guiso et al., 2009). At the same time, Guiso et al. (2016) and Nunn and Wantchekon (2011) show how (mis-) trust and social capital can persist over many generations. Burchardi et al. (2018) find that reduced information frictions, rather than taste similarities or factor endowments, drive the effect of ancestry composition on foreign direct investment sent and received by US firms.[3] Burchardi and Hassan (2013) link individuals' social connections to regional economic growth. Bailey et al. (2021) find that countries that are better connected on Facebook trade more, while Felbermayr and Toubal (2010) highlight the relationship between trade and cultural proximity as measured by voting patterns in the Eurovision song contest. Furthermore, cultural networks of migrants persist for decades (Gould, 1994; Rauch and Trindade, 2002; Dunlevy, 2006; Parsons and Vézina, 2018).

Finally, we contribute to a literature on trade persistence. For example, centuries after the demise of the Roman Empire, regions that were better connected during Roman times still have more business links (Flückiger et al., 2021). Similarly, inter-German trade patterns persisted after German reunification (Nitsch and Wolf, 2013), a banking crisis in the late 19th century disrupted trade patterns for several decades (Xu, 2022), and trade flows in 1870 strongly predict trade flows in modern times, even conditional on modern gravity variables (Campbell, 2010). On the other hand, when colonies become independent, their trade volumes with their former metropolis revert gradually to a gravity benchmark (Head et al., 2010; Jacks et al., 2020). A similar decline arose in the case of former parts of the Austro-Hungarian Empire after the fall of the Iron Curtain (Beestermöller and Rauch, 2018). Overall, estimates of the degree of persistence of past trade links differ and the relative importance of various channels is unclear. We show that neither correlated consumption preferences, nor more homogeneous measures explain the persistent results we find. Our results show that even in situations where bilateral trade does not persist, trade composition can be shaped by the former network for centuries. Our results further suggest that trading capital at the level of individual members of a network could contribute to prior findings of trade persistence.

This paper proceeds as follows. In the next section, we provide a brief historic overview. Section 3 explains the dataset we assemble for this paper and discusses choices we make in its creation. In Section 4, we develop our research hypotheses. Our empirical strategy and aggregate bilateral results are laid out in Section 5, followed by our key results in Section 6. In Section 7, we probe potential mechanisms, and Section 8 concludes.

## 2. Historical overview

### 2.1. The hanseatic league

The Hanseatic league was initiated in the late 12th century in what is now Northern Germany and grew to incorporate the merchants of dozens of cities on the Baltic and North Sea.[4] The formal birth of the League is attributed to the 1161 Gotland Community of German merchants, bringing peace and fostering trade between German merchants and the citizens of the Baltic island of Gotland. Trade initially largely took place among cities on the Baltic Sea, with the cities of Saxony and Westphalia later also represented in the Gotland Community.

This geographic organization and the role of the League's political leaders were continued when the association grew into the Hanseatic League, incorporating more towns and trading increasingly also with the North Sea.[5] The League was primarily a commercial confederation, but it also engaged in common military operations. At its height, the Hansa was a powerful independent political and economic entity. Hanseatic networks played an important role in facilitating exchange by imposing a set of rules and guaranteeing their traders' trading privileges abroad. The traders that were members of the League were called Hanseats. Membership in the League allowed traders to overcome the risk of expropriation and arbitrary taxation. The Hansa built a large and successful transnational trading network. Of great importance were the Hansa's trading posts abroad, called *Kontore* or *Faktoreien*. These hubs sometimes encompassed a whole neighbourhood within a foreign city and had their own jurisdiction. Establishing such trade representations abroad would have been prohibitively costly for small medieval trading firms. While harbour infrastructure such as docks and warehouses lowered exchange frictions unilaterally, legal certainty, similar units of measurement and currencies, and connections among traders lowered trading costs among Hanseats bilaterally. The list of member cities of the Hanseatic League changed over time. Fig. 1 gives an overview of the main Hansa cities based on a list compiled by Dollinger (1964). Appendix Table 1 lists both Hansa and Kontor cities.[6]

Dollinger (1964) argues for two dimensions to Hanseatic membership. The first, particularly important until the 14th century during the "Hansa of merchants", were the privileges granted to Hanseatic traders in foreign ports. Treaties with foreign rulers permitted trade to Hanseats, assured them of the legal enforceability of their contracts and protection against arbitrariness and

[3] In the context of online labour markets, Xu (2015) finds an important role of collective reputation as proxied by nationality.

[4] The following discussion is mostly based on Dollinger (1964). Other sources are cited where used.

[5] Unfortunately, we cannot test whether the Gotland Community, as a subset of the later Hanseatic League, shaped trade flows after its dissolution. The Community's members were all located on the Baltic Sea or too far inland, implying that we cannot observe trade among its members, as we only see ships passing through the Sound. See Section 3 below.

[6] In both cases, we do not show a list of all Hanseatic cities, but those that meet the criteria for inclusion in our dataset, detailed in Section 3.4.

even encouraged trade by granting tax alleviations. Crucially, trade privileges depended on a trader's citizenship. A non-Hanseat could pay substantially higher taxes than a Hanseat, even when trading the exact same goods on the exact same route. From 1434 onwards, these privileges were confined to traders born in a Hanseatic city. Owing to these privileges, strong links were created between Hanseatic cities and their trading posts abroad, most importantly the Kontore. Fig. 1 displays all cities with a Kontor on a map. The four most important Kontor cities were Novgorod in Russia, Bergen in Norway, London in England and Bruges in what is today Belgium.

The second dimension, rising to importance during the 14th century during the "Hansa of towns", concerned relationships within the network itself. City constitutions, a similar language, privileges within the network and common military and political objectives led to the creation of strong bilateral links between Hansa cities. Gaimster (2005) notes the importance of "social and genealogical links which developed between trading partners and towns and families the length and breadth of northern Europe"(p. 412). Hanseatic trade was usually carried out by self-employed traders or small firms. These firms were too small to establish trading outposts in many cities and therefore relied on networks. Partners could, for example, employ each other as commercial agents. This was often done without written contracts. Instead, the Hanseatic network relied on other coordination mechanisms such as a common language and cultural identity, habits, reciprocity, trust, and reputation. Ewert and Selzer (2015) Kinship also helped to make networks more dense: "[I]t was a common strategy of merchants to make occasional partners friends and friends relatives."(Ewert and Selzer, 2015, p. 184f.) Migration and return migration further supported this process (Gaimster, 2005). In line with this, Wurpts (2020) uses network analysis to analyse trading partnerships among merchants in Lübeck and finds a strong role of kinship.

The result of these processes was that Hanseatic cities were tied together not only through commercial links but developed a shared culture and economic practices within the network. As part of these, Gaimster (2005) notes the use of lower German dialect, similar urban outlines and shared styles in architecture and design, all alluding "to the shared religious and social values of the urban bourgeois elite of the region."(p.413) In a similar vein, Wurpts et al. (2018) argue that the Hanseatic network also facilitated the spread of the Protestant revolution among its members. They note that "structures of social relations and shared cultural identity enhanced solidarity among Hansards"(p.239). Through the German colonialisation of the Eastern Baltics, the Hansa expanded into non-German speaking territories, leading notably to the foundation of Riga in Latvia by citizens of Bremen. Hanseats therefore were not confined to being German, yet shared the aforementioned cultural links.

Initially, Hanseatic trade was carried out by men that were simultaneously merchants, ship owners, and ship captains. Over time, however, these roles differentiated. Merchants continued to own ships, but typically in the form of partnerships, diversifying their risk across shares of several ships. At the same time, captains went from being one of these co-owning merchants to professional, hired employees that were contracted by the merchants. Merchants did not anymore accompany their goods, but instead directed their trade operations from home. This differentiation of roles was marked by conflict, as the incentives of the two groups did not coincide anymore. Merchants were worried about their valuable cargo and distrusted the captains and their crews. To counterbalance the difficulty of supervising captains, they had to be married men with families and were liable with their possessions on land. This made absconding and migrating less attractive. In addition, maritime law became increasingly codified. (Dollinger, 1964; Jahnke, 2017).

In the following centuries, several major trends led to the demise of the Hanseatic League. Competition from Danish, English and especially Dutch merchants meant that Hanseatic traders no longer enjoyed their monopoly power over some of the most lucrative trade routes. The increased competition also laid bare internal conflict between the cities, for example in the question of whether to exclude Dutch merchants from the Baltic or not. Similarly, when England revoked Hanseatic privileges in the mid-16th century, Hamburg betrayed the League by granting English merchants special privileges. Based on voluntary cooperation rather than centralized power, the Hanseatic League also could not compete with the fiscal and military strength of the early modern states in Europe and struggled to form a common policy during the Thirty Years War. More generally, it is well documented that the economic centre of gravity moved towards Western Europe (Acemoglu et al., 2005). Lacking the support of a powerful state, Hanseatic merchants played only a very limited role in the increased trade with the colonies that caused this westward movement.

### *2.2. The danish sound toll*

To measure trade flows between cities in the Baltic region, we rely on Danish toll data. Introduced by the Danish King in 1429, the Sound Toll was levied on all ships entering or leaving the Baltic Sea at Helsingor (henceforth "the Sound"). At the time, both sides of the Sound were Danish, and the narrow strait between Denmark and what is now Sweden was protected by a fortress that would attack vessels unwilling to pay the duties. While Danish (and initially Swedish) ships paid lower fees, they were still recorded. Passing the Sound unnoticed was essentially impossible due to the narrowness of the strait.

The toll had flat fees and taxes disproportional to the values declared by captains (Degn, 2017a, Chapter 5). The data are extensive, covering the "homeport", the name of the captain, goods aboard, and tolls levied, as well as the port of departure of the ship (consistently since 1560) and its destination (consistently since 1668). There is a debate over the precise meaning of the recorded home port[7]: It either denotes the home port of a ship or the place of residence of its captain and was used to assign toll rates to ships or captains from different countries and regions. Degn (2017b) For our analysis, it is not important which of the two

[7] The Dutch team of researchers that digitized the Sound Toll data refers to the variable as "schipper plaatsnaam", i.e. "skipper's place name". Boon (1993) briefly summarizes the evolution of the debate since the 1940s.

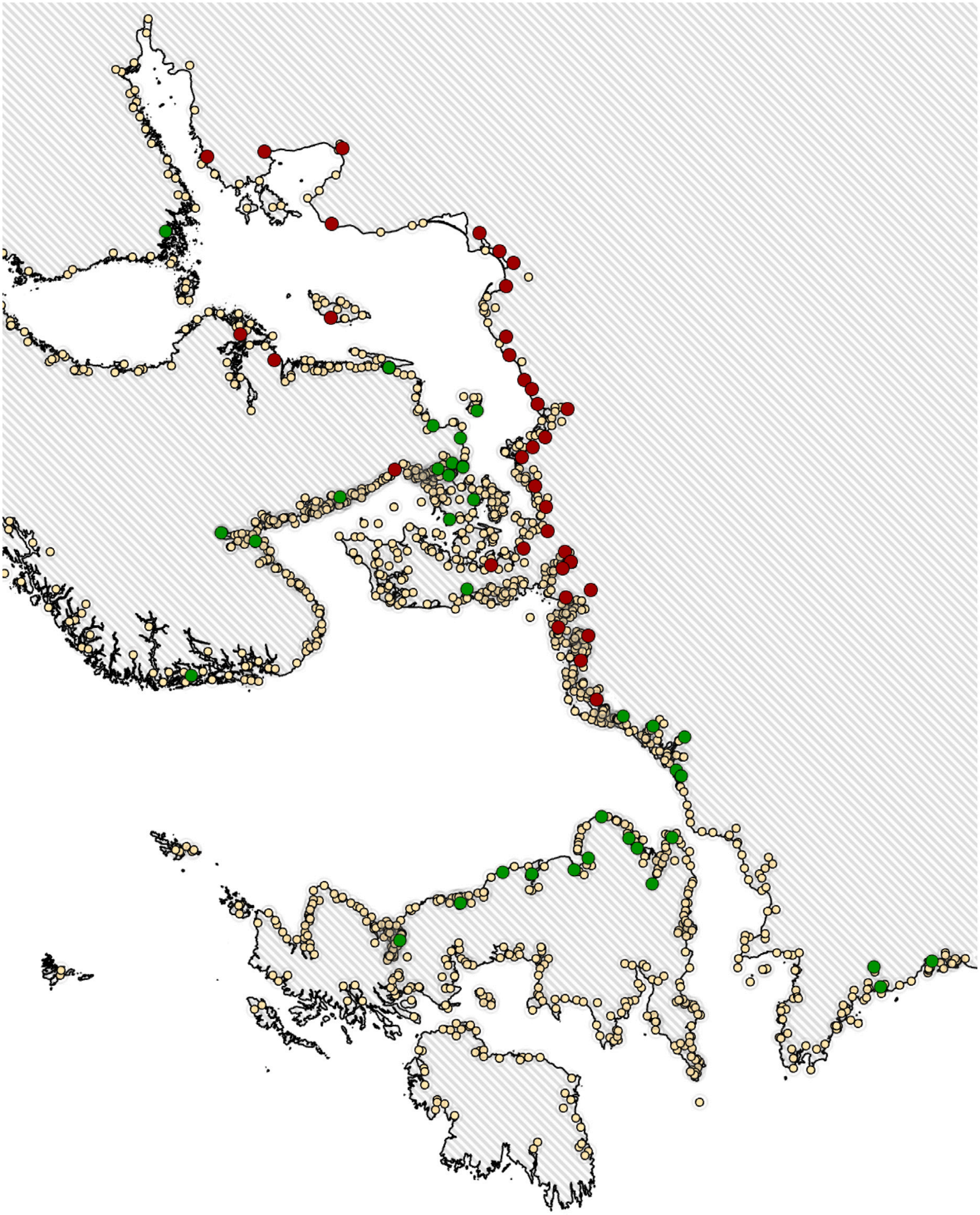


**Fig. 1.** Red circles show Hansa cities according to Dollinger (1964), green circles show Kontore according to Hammel-Kiesow (2000); all other cities and towns in yellow. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

interpretations is correct, as long as the variable indicates close ties to the city, which we find likely. In the text, however, we follow the interpretation of Veluwenkamp et al. (2021) that the shipmaster generally lived in the town recorded and therefore refer to it as ‘‘captain's residence’’ or ‘‘home town’’. We think of this variable as indicative of the network membership of the captain.


**Fig. 2.** This map shows the Øresund, where the Sound tolls were collected and all ships recorded, and the Great and Little Belts, the main alternatives for entering or leaving the Baltic Sea.

The aforementioned privileges for Hanseatic traders no longer extended to the treatment of their vessels in the period we study.[8] Toll inspections were abolished for Dutch and Swedish ships and similar treaties followed with all major trading partners including the Hanseatic cities, all stating the same toll conditions. From this time onwards, no further major changes in the toll system were introduced until its abolition in 1857. The toll's abolition was a result of diplomatic pressure from Britain and the United States. As our data set begins in 1668, the data are collected at a time when Hanseatic traders enjoyed no privileges at the Sound compared to traders from other nations; the toll conditions did not change in any comprehensive way throughout the period study (1668 to 1857).

## 3. Data

### 3.1. Overview

For the digitized trade data, we rely on the Soundtoll project[9], while additionally drawing on Degn (2017a, Chapter 5). In identifying cities in the trade data, we are indebted to the Soundtoll project, which has linked historic port names to unique identifiers. We convert 90,737 original city names to 3,085 unique place identifiers. Other sources are indicated.

An important limitation of these data is that only ships passing the Øresund are recorded. This strait between Denmark and Sweden is displayed in Fig. 2. Trade between Danzig and Stockholm or London and Amsterdam will not feature in this dataset, yet trade between Danzig and London will be observed. We only include trade flows that should be observed, such that not observing a trade flow most likely implies a true zero.

As we explain in more detail in Appendix 1, it is highly unlikely that any trade between Danzig and London occurred other than through the Sound. Alternative routes were unsuitable and also faced taxes.[10] Tax records confirm that alternative routes played a very minor role (Bergsøe, 1853; Gøbel, 2010; Degn, 2017a).

In the vast majority of cases, the Sound Toll records one port of departure, and one port of destination. We of course cannot rule out multi-strop trips, for example from Bremen to Hamburg, thence across the Strait to Danzig and onwards to Riga. In these cases, it is likely that the departure and origin recorded refer to the last stop before and first stop after the Strait. The presence of

[8] In earlier centuries, Degn (2017a, Chapter 5) notes a hierarchical system in the collection of duties in which ships from different origins paid different duties. Importantly, this differentiated treatment ended in the 1640s and 1650s, after Denmark had signed a treaty with the United Provinces in 1645 reducing the toll to the level at which it was in the 16th century for Dutch traders.

[9] http://soundtoll.nl/ We work with a version of the full dataset which we downloaded on November 23rd 2019.

[10] One exception may be the Stecknitz Canal, constructed in the late 14th century to connect the Baltic Sea in Lübeck to the Elbe near Hamburg. The Canal was relatively flat, vessels had to have a draft of no more than 0.43 m. The prime commodity shipped was salt, and since the 15th century, commerce was controlled by merchants from Lübeck and their hired captains, who formed their own guild. Scheftel (1999). This renders our estimates a lower bound of the Hanseatic network effect as some of the network trade would have passed through this canal.

trip-chains would thus lead us to observe cities closer to the Sound at a relatively high frequency, but this is not the case. Only very rarely (412 out of 2.2 million voyages) are several cities mentioned on either side and we drop these observations. Similarly, we drop observations for which several captains's residences are recorded, and whenever any city is denoted by "Unknown". Appendix 1 holds the details of this discussion. In addition, the rich sets of fixed effects we use in our main estimations, including city-year and bilateral fixed effects, would absorb much of this type of selection bias.

### *3.2. Measuring trade flows*

We measure trade flows between two cities in a given time period by the number of ships that sail from city A to B. While more granular data were recorded, historical units suffer from a lack of comparability, overlapping names in the data, and poor documentation.[11] Aggregation over all kinds of goods and several centuries and languages would lead to high degrees of noise, making the number of ships our preferred measure of bilateral trade.

To alleviate concerns that ship sizes vary by the origin of the captain, we include (captain's residence × time) fixed effects throughout in our analysis below. Furthermore, we use tonnage information, which is recorded for about 17% of ships, and ask whether ships with a Hanseatic captain differed in size. Appendix Figure 2 finds no evidence for this. Counting ships has the further advantage of being robust against fraudulent or missing reporting of cargo. Degn (2017a, Chapter 5) describes the number of ships passing the Sound as a reliable variable. The Sound is narrow and passing through it unobserved is almost impossible.

In robustness checks, we use tax (or toll) value paid by the ship as the dependent variable. Value is recorded for about 70 per cent of voyages and 80 per cent of entries included in our panel. We use information on currency composition provided by the Soundtoll team and in the rare case of foreign gold coins convert these to Danish gold coins based on their respective gold content. The amount of taxes paid is a proxy for the value of goods shipped. Gøbel (2010) elaborates on the proportionality of these duties, which Waldinger (2022) summarizes as a duty of 1%–2% of cargo value. During our time of analysis, Hanseatic traders enjoyed no privileges at the Sound compared to traders from other nations.

Throughout our analysis, we code trade flows in a directed way, such that flows from A to B and flows from B to A are distinct observations. In our captain's residence-level analysis, we further distinguish trade flows from A to B by the home town of the ship's captain. This is to say that trade flows from A to B on ships with captains from town C are a separate observation from trade flows from A to B on ships with captains from town D. We control for own trade, that is for trade from A to B on ships with captains from either A or B, to avoid picking up mechanical own trade effects, prompting captains from A to sail more from or to A. Instead, we seek to identify the network effect: Did Hanseatic cities A and B predominantly have their trade facilitated by captains from another Hanseatic city?

### *3.3. Hanseatic cities and the hanseatic network*

We call a route "Hanseatic" when it connects Hanseatic cities, Hansa and Kontor cities, or Kontor cities. This captures the nature of these bilateral connections occurring within the group of Hansa-Kontor cities, displayed in Fig. 1. When adding the membership of captains in the Hanseatic League, proxied for by either their home town or their last name, we will speak of the Hanseatic network. This therefore encompasses trade on Hanseatic routes carried out by Hanseatic captains. For captains, we will not treat Hansa and Kontor citizens symmetrically, as citizens of Kontor cities were considered foreigners and not eligible for Hanseatic privileges. We do not observe captains' entire network but instead proxy for their membership in the Hanseatic network by looking at their home town or their last name.

Cities' membership in the Hanseatic league is determined based on Dollinger (1964). In his accounts, he explicitly includes cities as Hansa members under the condition that their citizens benefited from Hanseatic privileges abroad. The classification of Kontor cities is based on Hammel-Kiesow (2000).[12] A list of Hansa and Kontor cities is provided in Appendix Table 1.

As discussed above, it is still under debate whether the home recorded in the Soundtoll data refers to the home port of the ship or the home town of the captain. For our analysis, it is not important which of the two interpretations is correct, as long as the variable indicates close ties to the city, which we find likely. As captains were bound to their home ports in numerous ways, we consider it plausible to interpret a Hanseatic residence as an indicator of membership in the Hanseatic network. As an alternative proxy for being a Hanseatic captain, we use captains' last names, which the Soundtoll Data list throughout. To assess whether captains were Hanseatic, we gather data on the last names of eleven Hansa cities' mayors up to 1700 and add all recorded last names for attendees of the League's general assemblies.[13] A last name is deemed Hanseatic when exactly coinciding with a mayor's or general assembly attendee's last name, which is, however, only a lower bound on classifying Hanseatic last names. In total, we assemble 797 unique last names from mayors' lists and 104 unique last names from Hansetag attendees. Thus, 901 out of 23,108 last names in our data are coded as Hanseatic, covering 3.5% of trade flows. This compares to 21% of trade flows classified as Hanseatic when basing the classification on the captain's home town. Despite overlapping with German last names, we argue in Section 2 that being a Hanseat

[11] Examples for the problems in harmonizing historical units are that a ton from Danzig is not the same as a ton from Königsberg, a Faad is 930 litres or 950 kg, depending on the good, and many units are abbreviated "D". or "F". leaving ambiguity whether this refers to the currencies of Daler and Faad or other units of measurement.

[12] We use a different source here, as Dollinger (1964) does not provide a list of Kontor cities.

[13] The cities whose mayors' names we record are Lübeck, Hamburg, Bremen, Rostock, Greifswald, Danzig, Stettin, Stralsund, Anklam, Demmin, and Reval (Tallinn). Mayors' names have been collected from Wikipedia lists. Hansetag attendees compiled from Wikipedia and mostly based on Waitz (1870).

does not coincide with being German. In line with this, many of the Hanseatic last names exist in Dutch and the Scandinavian languages. Rather than excluding individual last names on these grounds, we prefer to rely on our data-driven approach based on the last names of Hanseatic mayors and diplomats.

### 3.4. Dataset

The time frame of our analysis starts in 1668, from which on destination cities were systematically recorded. This is one year before the Hanseatic League gathered for its last diet in 1669. Our trade data end in 1857, when the Soundtoll was formally abolished. Our model below will be fully time-varying, implying that parameter estimates for individual time periods are robust to dropping earlier or later years.

We restrict our sample geographically to coastal areas in Northern and Western Europe. Appendix 1 describes the geographical selection criteria and their implications for our dataset. Virtually all trade flows are between cities on the coast in the Northern half of Europe. These restrictions leave us with 1,425 cities in 16 modern day countries. Among these 1,425 cities, we observe 17,648 bilateral trade relationships over 190 years, with about 1.5 million passages. Accounting for the fact that only trade connections which cross the Sound are theoretically observable to the researcher would yield 485,616 theoretically possible city pairs, of which the vast majority is not observed. Zeros are common in trade flow datasets, amplified in our case by the granularity of the data, which are at the level of towns rather than countries. For our bilateral analysis, we create a balanced sample of all possible bilateral connections. Missing values for a given time period and city pair mean that in this time period, no passage from A to B across the Øresund was recorded. Hence, we set these missing values to 0. This is to say that we impose stability for a maximum set of cities. Unfortunately, the same approach is not possible for our trilateral dataset that consists of origin, destination, and captain's home town. With 1,425 cities, there are almost 700 million possible permutations (485,616 × 1,425) per time period. Trying to fill in the entire matrix of all possible trade connections is computationally infeasible. We therefore exclude combinations of origin, destination, and homeport that we never observe over our 190 years of analysis. We then address the potential selection of routes by incorporating origin–destination-time fixed effects. This absorbs never observed origin–destination pairs, as these would show trade flows of 0 for any captain's residence.

Other selection problems are created by the fact that the Sound Toll data only features trade flows which enter or leave the Baltic Sea through the Sound near Helsingor. On short distances around the Sound, we likely miss trade, as land transportation was a viable alternative. As a robustness check, we exclude short-distance connections for which we likely observe only part of trade due to land transport. Some selection issues are also alleviated by the fact that we use a balanced panel of trade connections.[14] Moreover, our main specification includes (origin × destination × time) fixed effects which account for time-varying bilateral selection.

Between the cities in our sample, we compute cost distances for each city pair using a raster approach and the CostDistance tool in ArcGIS, similar to Nunn and Puga (2012) and Bakker et al. (2021). As in the former paper, our pixel resolution is 30 arc-seconds, corresponding to square cells of about 1 km side length. We compute 1,425 × 1,424 distances for our sample of coastal cities. Most least-cost routes are over water, but we occasionally require short journeys over land when cities are located a bit inland. In those cases, we use a relative cost parameter of 10 for land transport over water transport as in Michaels et al. (2012) and Maurer and Rauch (2022). Table 1 holds key descriptives on the period we cover, the number of entries, ships, and cities, the coverage for tax value and last names, and the number of observations in the trade panels we construct.

## 4. Hypotheses

There is ample empirical evidence that shared institutions, languages and currencies increase trade flows (Jacks et al., 2020), and the same holds for trust (Guiso et al., 2009). Previous studies have also pointed out that the "trading capital"generated by such institutions or informal networks depreciates once the underlying institutions and networks disappear. There is little evidence as to how long this depreciation may take. To answer this question, we study the former network of Hanseatic traders and their intermediaries. Our main hypothesis is that Hanseatic traders had accumulated particularly large stocks of trading capital on Hanseatic routes. Therefore, the depreciation of this trading capital should have taken a longer time compared to other traders on the same routes. This would be reflected empirically in Hanseats trading significantly more within their networks, i.e. on Hanseatic routes and using Hanseatic intermediaries.

We begin by applying the notion of trading capital to the Hanseatic League. Beestermöller and Rauch (2018) classify the "trading capital"created by past interactions into three components: physical capital like infrastructure that reduces trade costs; capital related to personal networks and built-up trust; and other components that lower bilateral trade costs, but are unrelated to personal networks or physical capital. While we do not study road and railway construction, the accumulation of physical capital matters in our setting. Close trade links resulted in the construction of representations, warehouses, docks, and cranes and this accumulated physical capital may have continued to reduce bilateral trade costs after the dissolution of the League. General harbour investments, however, are to be viewed as a public good, reducing the destination cost component for all origins. The buildings representing the Hanseatic League reduced trade costs only for traders from Hansa cities. The contribution of this physical capital should have ceased, however, when

[14] We further address endogenous zeros by restricting estimation to a sample where observations are far from the truncation point. Specifically, we only include connections which are used at least 60 times throughout the 190 years of our data, so about one in three years. Our analysis on this sub-sample of frequently used connections produces virtually identical results. These results are available upon request.

**Table 1**
Key descriptives.

| Characteristic | Value | Comment |
|---|---|---|
| Coverage, origin information | 1560–1857 | first in 1497, but unsystematically |
| Coverage, destination information | 1668–1857 | first in 1536, but only for fraction of passages |
| Coverage, sample | 1668–1857 | we require destination information |
| # of entries | 3,503,612 | on average, three goods per ship entered |
| # of ships | 1,205,686 | |
| # of value entries | 2,678,236 | about 80% of entries |
| # of ships with value entries | 814,650 | about 70% of ships |
| # of cities in the data | 3,085 | 90,737 spellings mapped onto 3,085 unique cities |
| # of cities in the sample | 1,425 | See 3.4 for sample restrictions |
| # of home towns | 1,059 | |
| # of Hansa and Kontor cities | 71 | Dollinger (1964), Hammel-Kiesow (2000) |
| % of Hansa and Kontor cities | 5 | |
| % of Hansa cities in entire region's urban population, 1700 (1800) | 14 (11) | Population data for 273 out of 1425 cities from Bairoch et al. (1988) |
| # of Hansa home towns | 37 | Dollinger (1964) |
| % of trips on ships with Hansa home towns | 21 | |
| % of trips outside Hansa network by ships with Hansa home towns | 16 | |
| % of trips within Hansa network by ships with Hansa home towns | 33.5 | |
| # of last names | 23,108 | |
| # of Hansa last names | 901 | from Hansa mayors and Hansetag attendees |
| % of trips under Hansa last name | 3.5 | |
| % of trips outside Hansa network by captains with Hansa last names | 3.8 | |
| % of trips within Hansa network by captains with Hansa last names | 5 | |
| # of decades | 20 | 190 years collapsed into 20 decades[a] |
| # of non-zero bilateral connections | 17,648 | per decade, balanced panel |
| # of non-zero bilateral connections with value observation | 17,383 | per decade, balanced panel |
| # of observations in bilateral sample | 9,712,320 | balanced panel |
| % of zeros in bilateral sample | 99[b] | |
| # of bilateral connections | 485,616 | per decade, including unfrequented connections |
| Mean # of ships, bilateral | 0.11 | per bilateral connection and decade |
| Mean # of ships, non-zero | 15.9 | median at 2, 90th percentile at 29, among non-zero entries |
| Mean value, bilateral | 2.5 Daler | per bilateral connection and decade |
| Mean value, non-zero | 660 Daler | median at 39, 90th percentile at 736, among non-zero entries |
| # of trilateral connections | 136,164 | per decade |
| # of observations in trilateral sample | 2,723,280 | balanced panel |
| % of zeros in trilateral sample | 91 | |
| # of trilateral connections by last name | 460,487 | per decade |
| Mean # of ships, trilateral | 0.36 | per trilateral connection and decade |
| Mean # of ships, non-zero | 4 | median at 1, 90th percentile at 6 among non-zero entries |
| Mean value, trilateral | 18.8 Daler | per trilateral connection and decade |

*Notes:* City and trade descriptives in the restricted sample used throughout the paper.

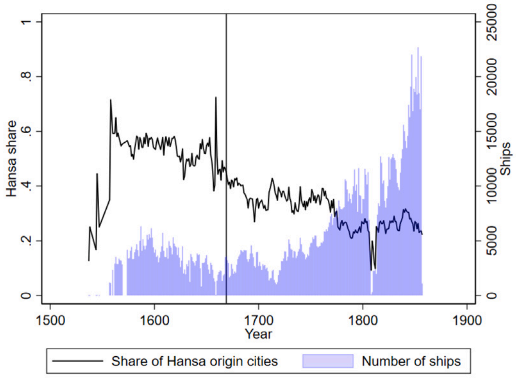
[a] The first and the last one do not count ten years. We aggregate to decades rather than using the annual data due to computational limitations encountered when adding the dimension of a captain's home town below.

[b] This compares to roughly 80 per cent zeros in Jacks et al. (2020) who study the Empire's trade enhancing effect in British bilateral export data at the country and commodity level. As our data are city-level and we have far more cities than (Jacks et al., 2020) has commodities, a higher share of zeros is to be expected.

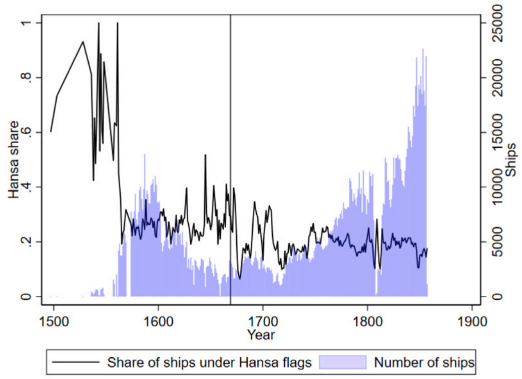
there was formally no League to be represented any more. We conclude that physical capital will have mattered for the accumulation of trading capital, but that it was insufficiently discriminatory to generate the network effects we focus on.

The second category of trading capital contains personal networks and built-up trust. Both are likely to have outlived the Hanseatic League. As argued in Section 2, Hanseatic trade relied heavily on networks, reciprocity and trust, and we expect this category of trading capital to be particularly important in our setting, especially given the distrust between merchants and captains. The last category encompasses cultural proximity, shared languages and trading habits. From our point of view, the last two categories can hardly be distinguished precisely.

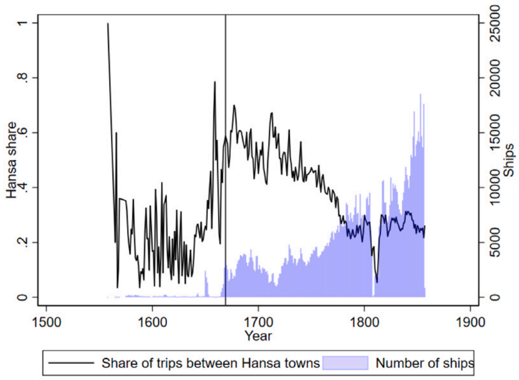
In the context of the Hanseatic League, trading capital consisted, among others, of a more symmetric distribution of information, well-aligned legal systems, similar units of measurement, a shared language and a close-knit network of traders and captains. Hanseatic networks were marked by kinship and traders pursued family connections as an informal means of accumulating trading capital. Wubs-Mrozewicz (2017) stresses the importance of the Hanseatic league as an institution of conflict management with formalized mediation mechanisms for conflict among individuals and conflict among cities. Such mechanisms and other legal principles, such as the symmetry of Hanseatic privileges abroad for all members, outlasted the League as concepts in law and are likely to have lowered trade costs for involved cities even after the dissolution of the league. Therefore, trading capital was built up through these legal institutions. Privileges abroad created trading capital in the first era of the League's existence (Dollinger, 1964). Lower bilateral trade frictions and political and cultural similarities led to the creation of trading capital among Hanseatic cities in the latter phase of the League's existence. Both privileges abroad, as these were historically linked to holding a Hansa citizenship,



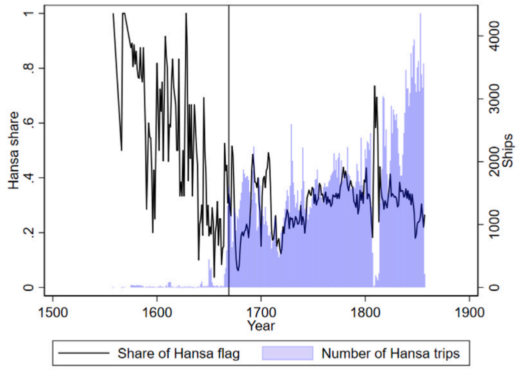

(a) Share of trips originating in a Hanseatic city and # of all ships recorded.




(b) Share of trips on ships with captains from Hanseatic towns and # of all ships.




(c) Share of trips on Hanseatic routes and # of all ships recorded in the dataset.




(d) Share of ships with captains from Hanseatic towns on Hansa routes, # ships on Hansa routes.

**Fig. 3.** Hansa trade over time. *Notes:* Descriptives on trade composition and Hansa share over time.

and cultural similarities between traders and captains suggest an important role for individuals. This motivates our hypothesis that trading capital had been accumulated at the level of individual traders and captains and their respective families.

Our hypothesis is that the accumulation of trading capital varied for historical reasons. We propose a mechanism in which social connectedness in networks, similar legal and economic institutions, and trust through repeated interactions accumulated trading capital between Hanseatic traders and captains. The fiscal and legal privileges conveyed by the Hanseatic League upon its members were linked to a trader's citizenship: only Hanseats benefited from lower tax rates, legal certainty, and military protection. Therefore, our hypothesis is that this gave Hanseatic merchants and captains particularly large incentives to invest into the accumulation of trading capital on Hanseatic routes. The returns on investment on Hanseatic routes were lower for non-Hanseatic traders than for Hanseats, given that non-Hanseats did not receive the financial and legal benefits Hanseats received when trading on Hanseatic routes. On the other hand, distrust between Hanseatic merchants and Hanseatic captains was lower due to cultural similarities (and maybe even extended kinship networks). Thus, we expect particularly large stocks of trading capital within the Hanseatic network.

Given this discussion, we expect a positive, but declining effect of common membership in the Hansa on trade. Excess trade flows due to trading capital would thus go to zero over time. In the case of Head et al. (2010), this process took only a couple of decades. However, our trade data begin only in 1668, one year before the formal dissolution of the Hanseatic League and already after a process of gradual decline, with many cities having dropped out informally. It may therefore be the case that the city-level trading capital had already eroded by the time we start observing trade flows. However, based on our above hypothesis, we expect a longer lasting effect of a route being Hanseatic conditional on captains being Hanseats. We thus expect trade flows in excess of gravity forces for a long time period if the origin and destination cities and the facilitators of trade were part of the former Hanseatic network.

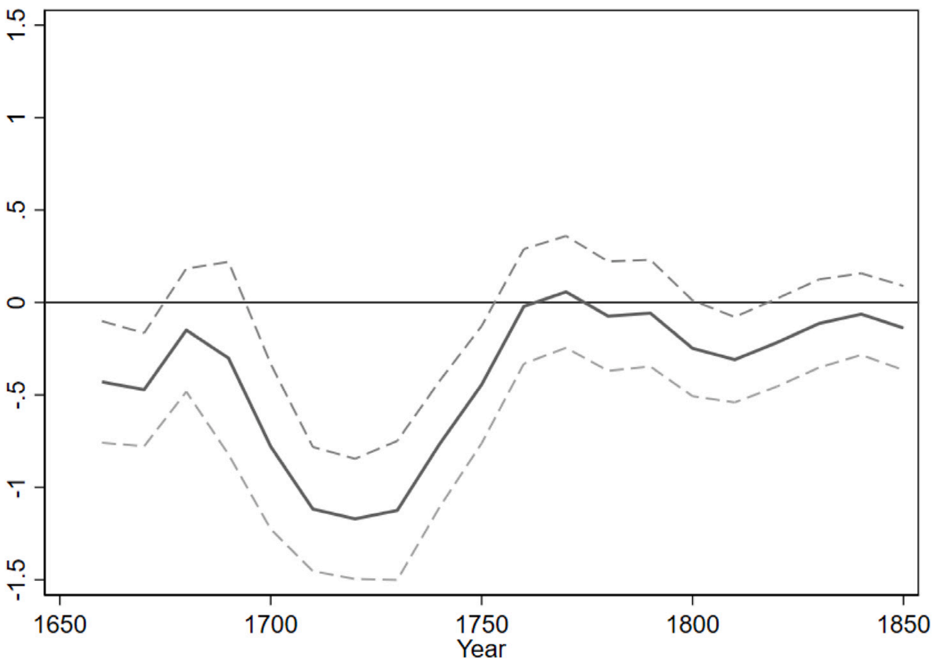



**Fig. 4.** Aggregate bilateral results.
*Notes:* Aggregate bilateral estimation on decadal data. Estimation of Eq. (1) using PPML and a complete set of decade-interacted origin and destination fixed effects. Shown are point estimates of $\beta_t$ accompanied by 95% confidence intervals. Standard errors clustered on city pairs. Mean of flows: 0.11. This regression result is presented in detail in Appendix Table 4.

## 5. Descriptives and bilateral trade data

We start our analysis by giving some descriptives. In Fig. 3(a) below, we plot the share of trips through the Sound that originated in a Hanseatic city (left axis) and the number of trips registered at the Sound Toll station (right axis). As can be seen, the Hansa had been losing ground already before its dissolution in 1669, and this trend continued afterwards. This decline could in theory be explained by a general relative decline of the importance of Hansa cities. However, in Appendix Tables 2 and 3 we show that Hansa cities were neither larger nor smaller than other cities in our dataset and seem to have remained wealthier, as expressed by higher levels of imports and higher import shares of luxury goods. Fig. 3(b) shows that Hansa cities became relatively less active in the facilitation of trade, as indicated by the declining share of captains from Hanseatic towns. Fig. 3(c) shows that following its dissolution, trade within the League as a share out of all trade declined from 60% in 1700 to 20% in 1800. Thus, both the overall volume of trade on Hanseatic routes and the share of trade carried out by captains from Hansa towns port indicate the reduced importance of the League. Nonetheless, former Hansa cities remained key players throughout most of the 18th and 19th century, being the origin of between 20 and 40% of all the trips through the Sound, as seen in Fig. 3(a). This is particularly true for trade on Hanseatic routes: Fig. 3(d) shows that on average 40% of trade flows on Hanseatic routes were carried out by Hanseatic captains. This share does not display the declining trend seen in Fig. 3(b) for trade overall. Thus, despite the League's dissolution in 1669 and its evidently reduced importance, Hanseatic trade continued.[15]

We next examine whether the Hanseatic League persisted in city-to-city trade flows. For this, we draw on a bilateral dataset that consists of 485,616 directed trade flows, each over 190 years. These are aggregated to 20 decades.[16] Therefore, we count a total of 9,712,320 observations. In our balanced panel, 99 per cent are zeros. This compares to roughly 80 per cent zeros in Jacks et al. (2020) who study the Empire's trade enhancing effect in British bilateral export data at the country and commodity level. As our data are city-level and we have far more cities than (Jacks et al., 2020) has commodities, a higher share of zeros is to be expected. Descriptives for this bilateral trade dataset can be found in Table 1. Our empirical model for this dataset follows standard gravity models:

$$T_{ijt} = exp(\alpha + \beta_t ODHansa_{ij} + \lambda_t dis_{ij} + \eta_{it} + \chi_{jt}) \times \epsilon_{ijt}, \quad (1)$$

[15] These graphs differ in the periods they cover due to data limitations. Since we only require the origin in Fig. 3(a), we can plot this series from 1537 onwards. Between 1497 and 1537, only a handful of ships are recorded. In our main analysis, we require data on both origin and destination, which limits our analysis to the period between 1668 and 1857. As evident in Figs. 3(c) and 3(d), few destinations are recorded before 1668. Home towns are systematically recorded throughout, as seen in Fig. 3(b).

[16] The first and the last one do not count ten years. We aggregate to decades rather than using the annual data due to computational limitations encountered when adding the dimension of a captain's home town below.

where $T_{ijt}$ denotes the number of ships sailing from city i to city j at time t, our measure of trade between cities. $ODHansa$ is a dummy that codes whether the origin and destination city formed a Hanseatic route, meaning they were either a Hanseatic or a Kontor city. The coefficient for this dummy indicates by how much aggregate city-to-city trade flows are beyond or below the prediction of the other gravity factors. The dummies are time-invariant, so we interact them with a complete set of decade dummies to see how the effect of Hanseatic trade linkages evolves over time. As a control variable, we include the log distance over sea between the two harbours, $dis_{ij}$, also interacted with decade dummies. $\eta_{it}$ and $\chi_{jt}$ are origin $x$ decade and destination $x$ decade fixed effects. As shown by Fally (2015), estimating a gravity equation with PPML and including importer and exporter fixed effects solves the problem of multilateral resistance terms pointed out by Anderson and van Wincoop (2003). $\epsilon_{ijt}$ is the error term. We estimate this equation on the bilateral directed dataset and use PPML[17] (Santos-Silva and Tenreyro, 2006), clustering standard errors on origin–destination pairs throughout to allow for serial correlation at the bilateral level.

Our main result from this estimation are 20 decadal parameters for the Hanseatic dummy from Eq. (1). Point estimates and their 95% confidence intervals are shown in Fig. 4. Appendix Table 4 presents all regression details. Persistence in aggregate bilateral trade flows would manifest itself in statistically significant and positive coefficients in the decades following the end of the Hanseatic league, in line with Head et al. (2010) or Beestermöller and Rauch (2018). As can be seen, we do not find such persistence. The coefficients are usually statistically insignificant and close to zero.[18] The only exception to this pattern are the first decades of the 18th century, when the coefficients even turn negative. This is likely due to the severe trade disruptions in the wake of the Great Northern War that disproportionately hit trade among former Hansa cities.[19] The estimated coefficients turn negative at the beginning of this conflict in 1700 and reach their lowest point in the 1720s, when the war ended. The recovery to pre-war levels of insignificance takes about three decades. This is longer than the 8 years found by the study on war and trade by Glick and Taylor (2010), though it should be noted that their study only extends back to 1870, when greater economic integration may have already reduced the costs of war. Further, the Great Northern War's effects were aggravated by a severe plague outbreak (Marczinek, 2024). Apart from these decades of war and recovery, trade volumes between Hanseatic cities are similar to those of other routes across the Sound.[20] In the appendix we show robustness estimations for this result.[21]

The aggregate bilateral specification allows to check for persistence in aggregate trade patterns similar to Head et al. (2010) or Beestermöller and Rauch (2018). However, it does not allow us to dissect the identity of the traders and their intermediaries. We therefore next turn to our main analysis that incorporates the captain's home towns.

## 6. Results

### 6.1. Main results

Our results so far disregard the network of traders and captains. As the historical discussion has shown, traders' network membership was important in medieval Baltic trade, and distrust between merchants and captains was rife. While we cannot ascertain a trader's entire network, we argue that a captain's residence is a good proxy for him belonging to the Hanseatic network. Our alternative proxy is the captain's last name. We expect captains from Hanseatic cities to have accumulated more trading capital than others when trading on Hanseatic routes.

We therefore add captains' home towns to our analysis, which we argued above is a proxy for a captain belonging to the Hanseatic network. In the resulting dataset, an observation is the number of ships sailing from city A to city B owned by captains in city C in a decade $d$.

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[17] The specific Stata package used throughout is PPML HDFE by Correia et al. (2019).

[18] Through a simulation exercise, we rule out that this is driven by sample selection. The Soundtoll Data only include trade flows that pass through the Sound. Therefore, we run 100 simulations of all trade flows and impose a positive effect for $ODHansa_{ij}$ by setting $\beta = 1$. We then run the PPML estimation of Eq. (1) on the entire simulated sample and on the sub-sample that would be observed, namely all flows that pass through the Sound, for the 100 simulated trade flows. The histogram of estimates on $ODHansa_{ij}$ is presented in Appendix Figure 4. The mean value of $\beta$ estimated in the simulated sample is 0.999986 with a standard deviation of 0.002334, which compares to a mean estimate of 1.0023 with a standard deviation of 0.00315 in the observed sub-sample. Each estimate is within the 95% confidence interval of the other estimate. In both cases, the simulated $\beta$ coefficient on $ODHansa_{ij}$ is in the range of supported estimates and no bias is detected as arising from this sample selection.

[19] While few Hansa cities were subject to direct war action, the war was associated with a severe outbreak of the plague, which afflicted almost half of all Hansa cities, and in particular important Hansa cities such as Stettin, Königsberg, Elbing, Hamburg, Stralsund, Greifswald, Pernau, Kiel, Reval, Visby, Riga, Malmö, and Danzig. The Southern and Eastern Baltic were at the centre of the plague outbreak and most Hansa towns were located there. Kroll (2006) Exports even of some of the larger Hansa cities drop to close to zero during this period. However, as the entire Baltic region was involved in the war and the Hanseatic League was not an active political entity any more, there is no evidence that Hanseatic cities were targeted by either the war or the plague.

[20] The Napoleonic Blockade coincides with the period and region we study, but does not influence results strongly as it did not affect Hanseatic cities proportionally.

[21] For the bilateral dataset, we show that also the value of trade does not show any persistent effect of the Hanse (Appendix Figure 5). We establish robustness to PPML by showing results from using OLS and trade in logs (Appendix Figure 6). Furthermore, we show that time or intensity variation in membership of the League does not matter. Even among the cities attending the League's last general assembly in 1669 (Bremen, Hamburg, Lübeck, Rostock, Danzig) no trade persistence can be found (Appendix Figure 7), with results virtually identical to those in Fig. 4. Similarly, we use data on Hansetag attendance between 1492 and 1516 from Poeck (2010) (also used by Wurpts et al., 2018-we thank Bernd Wurpts for making the data of Poeck (2010) available to us in electronic format.) A total of 47 cities in our sample actively attended the League's general assemblies in these years, which we interpret as the most active members. Results are shown in Appendix Figure 12b and again virtually identical to those in Fig. 4. Finally, we present results from an aggregated specification without any time dimension, on which we can also apply the bias-correction for PPML suggested by Weidner and Zylkin (2021) (Appendix Table 5). The aggregated specification also allows us to more easily compare results across different specifications and robustness checks.

Our key variable of interest is $AllHansa_{ijn}$, a dummy that is one when the origin and destination were either Hansa or Kontor towns, and when the home town was a Hansa town. For origin and destination, we continue to treat Hansa and Kontor towns symmetrically, as we are interested in trade flows on Hanseatic routes specifically. Our discussion both of historical trading privileges in Section 2 and the notion of trading capital at the level of traders and captains we propose suggests a stricter view on the captain's home town, however. We do not treat Hanseatic and Kontor home towns symmetrically, but insist on a Hanseatic one. Ships with captains from Kontor towns did not belong to the Hanseatic network and have to be regarded as distinct. The triple Hansa dummy thus captures trade within the Hansa network: among Hansa cities, among Kontor cities, and between Hansa and Kontor cities, and carried out by ships with a Hanseatic captain.

To focus on the network effect, we control for a same harbour dummy, $Harbour_{ijn}$, that takes on the value of 1 whenever a captain's home town coincides with the origin or the destination of the journey. As captains are generally more likely to sail from and to their home town, this is an important control variable to rule out mechanical effects. The dependent variable is now $T_{ijnt}$, denoting the number of ships sailing from city i to city j with captain's home town n at time t. In our main specification, we control for time-varying route characteristics by introducing origin $x$ destination $x$ time fixed effects. This is very important, as it addresses the selection of bilateral routes into our dataset, as well as worries that the rise of the Atlantic trade and the general westward shift of trade drive our estimates on the $AllHansa_{ijn}$ dummy. Furthermore, this controls for possibly correlated consumption preferences among residents of former Hansa cities, as we compare Hansa ships to non-Hansa ships trading between the same towns. To further absorb multilateral resistance terms (Baldwin and Taglioni, 2007), we also include home town $x$ time fixed effects:

$$T_{ijnt} = exp(\alpha + \beta_t AllHansa_{ijn} + \delta_t Harbour_{ijn} + \chi_{ijt} + \xi_{nt}) \times \epsilon_{ijnt}, \tag{2}$$

where $T_{ijnt}$ denotes the number of ships sailing from city i to city j with home town n at time t, $Harbour_{ijn}$ is a dummy equal to 1 whenever a captain's home town coincides with a journey's origin or destination. $\epsilon_{ijnt}$ is the error term. The coefficients $\beta_t$ on $AllHansa_{ijn}$, a dummy that is one when all of origin, destination and home town are part of the Hanseatic network, are what we are most interested in, as it measures by how much trade on Hanseatic routes overshoots gravity predictions when executed by Hanseatic captains. $AllHansa_{ijn}$ and $Harbour_{ijn}$ are interacted with decade dummies. $\chi_{ijt}$ and $\xi_{nt}$ are origin $x$ destination $x$ decade and home town $x$ decade fixed effects. Note that $\chi_{ijt}$ absorbs the bilateral Hansa dummy, $\gamma_t ODHansa_{ij}$, and distance over sea, $\lambda_t dis_{ij}$. Generally, the time-varying bilateral fixed effect absorbs all bilateral variation, in particular distance between origin and destination, commonality variables such as language similarity, the network structure of bilateral trade, and changing bilateral trade patterns due to the steam ship (see for example Pascali, 2017). The origin $x$ destination $x$ time fixed effect also nests origin $x$ time and destination $x$ time fixed effects, accounting for the fact that Fig. 3(a) below shows that Hansa towns' exports grow more slowly. As $\chi_{ijt}$ effectively controls for total trade on a route ij in time t, $\beta_t$ captures the relative importance of Hansa cities in bilateral city-level trade. The home town $x$ time fixed effect further addresses the issue of a declining Hanseatic role in shipping overall, as documented in Fig. 3(b) below. While $\chi_{ijt}$ absorbs the distance between origin and destination, additionally controlling for decade-interacted distances between home town and origin and between home town and destination produces virtually identical results.[22] These controls capture some of the multilateral logic of trade and the estimated distances are significant and negative throughout. Throughout, standard errors are clustered on origin–destination pairs. This allows errors for different home towns and different years, but on the same bilateral route, to be arbitrarily correlated. Results clustering standard errors on the origin–destination-home town level are virtually identical and available upon request.

Some examples can illustrate the comparison that we are making here: On average, we see 1.3 captains from Hansa city Lübeck doing the trip from the Hansa city Hamburg to the Hansa city Riga per decade. However, on the same route, we only see 0.1 ships per decade with a captain from the non-Hansa city St. Petersburg. As another example involving the Kontor city of London, there are no vessels with captains from Amsterdam that ever sail from Lübeck to London, but we see each decade on average 0.75 ships on that route with a captain from Hamburg. Specification (2) allows us to examine whether these examples are generalizable, i.e. whether we do see a general pattern that trade between Hanseatic cities is facilitated by Hanseatic intermediators.

Our results are displayed in Fig. 5(a) and show that this is indeed the case. A pair of cities on a Hanseatic route in combination with a Hanseatic captain implies significant excess trade flows. Appendix Table 6 presents all regression details. Note that the inclusion of $Harbour_{ijn}$ means that these results are not driven by captains from a pair of cities generally sailing more between these two cities, independent of Hansa status. Further, these positive effects are economically large: They average 0.52 with little time variation, implying excess trade of 68.2%, and amounting to an equivalent tariff reduction of 9.9%.[23] They also persist until well in the 19th century, with a weak downward trend. Thus, even though the Hanseatic League had no lasting effect on aggregate city-to-city trade, it had a strong and long lasting effect on the composition of trade flows operating via individual traders and their facilitators.[24] In terms of magnitudes, the average value of shipments originating in a Hansa or Kontor port on a ship captained by

22 Results available upon request.

23 Excess trade is calculated as $exp(\beta) - 1$. Following Anderson and van Wincoop (2004) and Wolf (2009), the tariff equivalent is calculated as $exp(\beta / - \sigma) - 1$. For the elasticity of substitution, we assume $\sigma = 5$, a typical value taken in the literature. Trade costs are trilateral and we control for a bilateral Hansa dummy throughout. Thus, this captures reduced trade costs for Hanseatic captains on Hanseatic routes.

24 In a placebo exercise in the home town-level analysis, we randomly assign 5% of cities to a placebo Hansa home town, in line with the share of cities in the Hansa-Kontor group according to Table 1. We repeat this exercise 100 times and run our main model Eq. (2), including the same harbour dummies, on each simulated placebo network, with $AllHansa_{ijn}$ defined for each placebo network instead. Histograms for the estimated coefficients on $AllHansa_{ijn}$ are presented in Appendix Figure 8. Collapsed across decades for ease of comparison, the mean estimate, with standard deviation in brackets, is −1.066 (1.041). We conclude that the placebo Hansa membership does not display effects on trade.

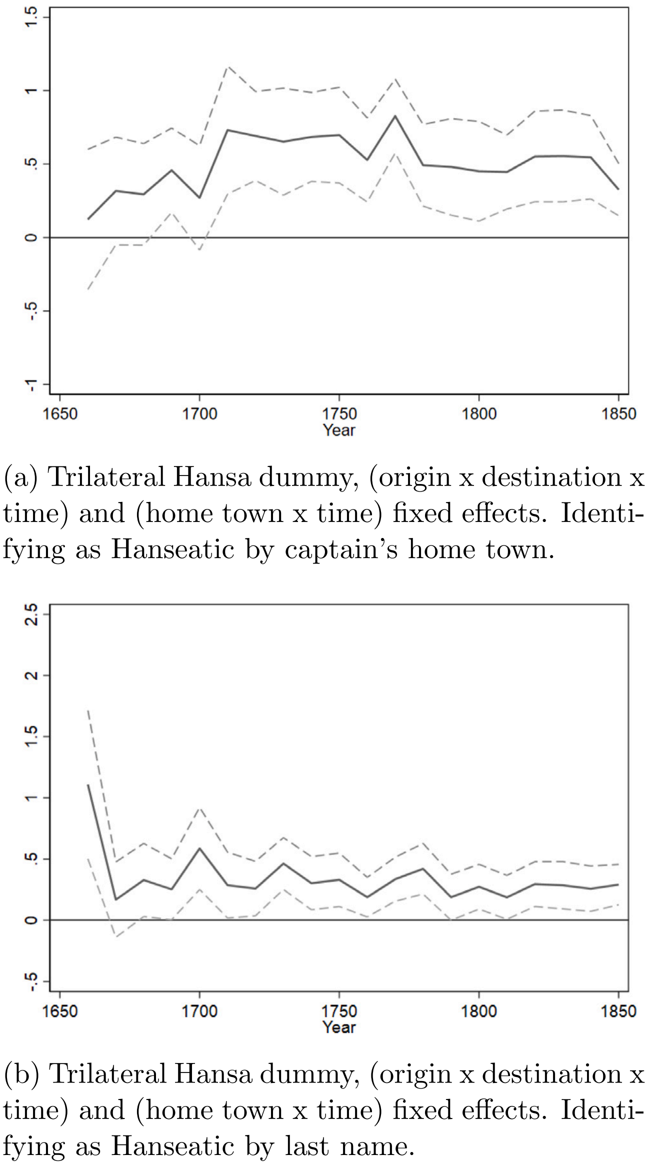


**Fig. 5.** Hometown-level results.

*Notes:* PPML estimation including same harbour dummies (equal to one when either origin or destination coincide with the home town) of Eq. (2) with (origin $x$ destination $x$ time) and (home town $x$ time) fixed effects in Fig. 5(a) and of Eq. (2) with (origin $x$ destination $x$ time) and (last name $x$ time) fixed effects in Fig. 5(b). Shown are point estimates of $\beta_t$ accompanied by 95% confidence intervals. Standard errors clustered on city pairs. The regression result for Fig. 5(a) is presented in detail in Appendix Table 4.

a skipper from a Hanseatic town and going to a non-Hanse and non-Kontor destination is 17.6 Danish dalers per decade. Changing the destination to a Hansa or Kontor one moves this average shipment value up to 75 dalers. In terms of the count of ships, the average is 0.37 per decade for Hansa ships originating in a network port and sailing to a non-network port, and 1.19 for Hansa ships originating in a network port and sailing to another network port. This is even true when conditioning on any trade flow taking place between the cities over a decade, with the averages at 3.8 and 7.6, respectively.

While we argue that a captain's home town is a plausible proxy for being a Hanseat, our results do not depend on this specific approach to identifying captains. In Fig. 5(b), we replace the captain's home town dimension by his last name. We compare these last names to a list of Hanseatic mayors' and diplomats' last names in order to judge whether a trade flow was carried out by a Hanseat. We find lower but still significant positive effects of captains being Hanseats. The average estimate in Fig. 5(b) is half the average estimate in Fig. 5(a), which we attribute partially to the much lower share of Hanseatic captains: Only 3.5% of trade flows are identified as Hanseatic based on last names, which compares to 21% when identification as Hanseatic is based on a captain's home town.

### 6.2. Robustness

We show that these results are robust to using the value of the tax paid on the traded goods, rather than the number of ships, as the outcome variable (Appendix Figure 9). This has the advantage of directly measuring the value of trade flows, but was potentially subject to fraudulent underreporting by the captains. As for the aggregate bilateral results, we check robustness to PPML by using trade in logs as an outcome and using OLS (Appendix Figure 10). We further check robustness to the issues of land transport around the Sound and of circumventing the Sound via the Great or Little Belt by excluding short-distance connections (Appendix Figure 11). Moreover, our results are also similar when looking at Hanseatic cities that attended the last general assembly (Appendix Figure 12a) or those that more actively attended general assemblies (Appendix Figure 12b). Similarly, we find no evidence for heterogeneity in the Hanseatic network effect when excluding the five largest Hansa cities (Bremen, Hamburg, Lübeck, Rostock, Danzig — see Appendix Figure 13). This controls for the possibility that the network effect is driven by unobserved factors that determine city size and trade patterns. We also check that our results are robust to accounting for endogenous zeros by restricting estimation to a sample of frequently used connections that are unlikely to feature zero trade (Appendix Figure 14). We further add as controls time-interacted distances over sea, either between the origin and the home town or the destination and the home town, whichever is shorter (Appendix Figure 15). We also include a dummy for the origin or destination country coinciding with the captain's country of origin to control for a measure of the rise of the nation state. This goes further than our usual control for origin or destination ports coinciding with the captain's home town. As can be seen in Appendix Figure 16, we find very similar results. Thus, we do not simply find that captains sail more from their own home country to another country. As in the bilateral case, we also create an aggregated dataset without time dimension, which allows us to easily compare different specifications and models (Appendix Table 7). Across all these alternative specifications, we find that Hanseatic captains traded significantly more on former Hanseatic routes. This confirms our hypothesis that trading capital on Hanseatic routes was accumulated mostly by Hanseatic traders and captains. Finally, we establish the robustness of our findings to alternative specifications, equivalent to existing gravity models in the multinational production literature (Head and Mayer, 2019; Arkolakis et al., 2018). The estimation equations and results for these specifications are presented and discussed in Appendix 3.

## 7. Probing mechanisms

We interpret our results as evidence for the importance of trading capital accumulated by Hanseatic merchants and captain's on Hanseatic routes: Merchants from Hanseatic towns were more likely to use captains from other Hanseatic towns as facilitators of their trade. As a further corroboration for this, we ask whether Hanseatic captains on former Hanseatic routes were particularly successful in holding on to their market shares. We construct a data set of trade shares in the first years of our sample, 1668 to 1679, for trips where the captain's home town did not coincide with the trip's origin or destination. The median market share of a city A actively trading between cities B and C lies at 12.5% in that period. We construct dummies for having the highest market share and interact this with a dummy for a Hanseatic captain trading on a former Hanseatic route. Similarly, we look at initial market share and interact it with the dummy for a Hanseatic captain on a former Hanseatic route. In Table 2 we present results of regressing market shares from 1680–1857 on initial market shares, the highest market share dummy, and their interaction with the dummy for Hansa captains on Hansa routes. These results show that, overall, a city that dominated trade on a given route in 1668–1679 is predicted to have a lower market share in the following decades. This decline, however, is relatively weaker for Hanseatic captains on former Hanseatic routes. Within the network, Hanseatic captains may have held on to their competitive advantage over other captains, suggesting a role for the transportation sector as in Brancaccio et al. (2020). As we have excluded observations where a trade route is served by a ship from either the origin or the destination, this result is indicative of a network effect.

An alternative explanation of this finding could be intergenerational transmission of navigational knowledge that disproportionately took place among Hanseats. We find in Appendix Table 8 that Hanseatic routes connect more similar cities in terms of ruggedness and temperature. This suggests that they are if anything easier to navigate than other routes, providing evidence against this alternative explanation. Further, the most narrow point of any journey, the Sound itself, has to be crossed on all routes, limiting the variation in required sailing skills. A final argument against this alternative explanation is provided by Fig. 3(d): Hanseatic routes were increasingly operated by non-Hanseatic captains, implying that these captains should also accumulate the required sea faring knowledge. After almost two centuries of both Hanseats and non-Hanseats sailing on Hanseatic routes, it appears implausible that only Hanseats would have learned how to sail on these routes.

We now differentiate Hansa-specific trading capital on Hanseatic routes from Hansa-specific trading capital in Hanseatic origins or destinations. The latter encompasses, in particular, physical capital in harbours exclusively used by Hanseatic traders and captains, such as docks, warehouses, and trade representations that would have lowered shipping costs from and to these harbours but only for Hanseats. To investigate this, we extend model (2) by including origin-home town-time and alternatively or additionally destination-home town-time fixed effects. For ease of comparison, we collapse the data across decades. These additional fixed effects absorb trading capital specific to Hanseatic captains in individual harbours. Appendix Table 9 holds the results. We find that the estimated coefficients attenuate, but remain significant and positive. The estimated tariff equivalent of the Hanseatic network effect lies at 9.9%. When including destination $x$ home town (origin $x$ home town) fixed effects, the average estimated tariff equivalent drops to 9.1% (7.6%). When including both origin $x$ home town and destination $x$ home town fixed effect, the tariff equivalent drops to 3.5%. The finding is still significant. Overall, these results suggest that Hansa-specific trading capital in harbours played a role, but it does not overrule our findings on the network effect.

**Table 2**
Hanseatic captains continued to relatively dominate their old trade routes.

| | Share of a home town A on a trade route B to C | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Home town share 1668–1679 | −0.0121*** | −0.0138*** | −0.0221*** | | | |
| | (0.000970) | (0.00133) | (0.000972) | | | |
| Home town share 1668–1679 × All Hansa | 0.00553* | 0.00650* | 0.000350 | | | |
| | (0.00294) | (0.00356) | (0.00299) | | | |
| Highest Share 1668–1679 | | | | −0.0158*** | −0.0133*** | −0.0122*** |
| | | | | (0.00106) | (0.00126) | (0.000935) |
| Highest Share 1668–1679 × All Hansa | | | | 0.00725** | 0.00742** | 0.00200 |
| | | | | (0.00309) | (0.00335) | (0.00269) |
| *Fixed Effects:* | | | | | | |
| – Origin × Time | ✓ | ✓ | | ✓ | ✓ | |
| – Destination × Time | ✓ | | | ✓ | | |
| – Destination × Home town × Time | | ✓ | | | ✓ | |
| – Origin × Destination × Time | | | ✓ | | | ✓ |
| – Home town × Time | ✓ | | ✓ | ✓ | | ✓ |
| – All Hansa × Time | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Observations | 405,978 | 302,549 | 405,924 | 957,778 | 764,719 | 949,942 |

*Notes:* Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. The dependent variable is the share of a home town on a trade route in the decades 1680 to 1850. The independent variables in columns 1–3 are that home town's share on the trade route in the initial decade, 1668–1679, and the interaction of this share with a dummy for Hansa captains on former Hansa routes. The independent variables in columns 4–6 are a dummy indicating whether that home town had the highest share on a trade route in the initial decade, 1668–1679, and the interaction of this dummy with a dummy for Hansa captains on former Hansa routes. Across specifications, the first coefficient therefore measures how having dominated trade initially predicts trade shares in later decades and the second adds how this differs for Hansa captains on former Hansa routes. Estimation via OLS.

We next attempt to distinguish different components of trading capital at the level of individual traders and captains. One factor that is stressed by the historical literature (Dollinger, 1964) is that Hanseatic traders used a more homogenized set of units and measures. This would have lowered bilateral trade costs specifically for those Hanseatic traders, in particular when keeping in mind our discussion in Section 3 about the variety and idiosyncrasy of historical units of account. We clean these units to the best of our abilities and construct a dataset of 59 historical weight, volume, and count measures. As goods may vary in the variety and dimension of applicable units, we also clean the good information and code 227 different commodities. 90% of observations are neatly mapped onto a cleaned commodity and 97% of the remaining 10% are empty ships, undefined goods, and mercery. Two variables capture the variety of units used: first, the standard deviation of units' shares by origin–destination-home town-decade observation. Whenever only one unit is used, this takes the value of 0. Second, we count how many units are used per observation. In Appendix Table 10 we show results from regressing these two measures on a dummy for a Hansa captain on a Hansa route. We find no evidence that Hanseatic captains used a smaller number or more homogenized set of units — if anything, our evidence points to the opposite. This suggests that harmonized units of account did not contribute to the trading capital that we see.

Using the cleaned goods information, we construct similar measures of commodity concentration, i.e. the standard deviation of goods' shares and the number of goods shipped. In Appendix Table 11, we find that Hanseatic captains on Hanseatic routes shipped a larger variety of goods. We interpret this as evidence for greater integration in the Hanseatic network and as evidence against the hypothesis of correlated consumption preferences. This result also speaks against a competing explanation, namely decaying Hanseatic monopoly power in a few goods. We show that, to the contrary, Hanseatic trade was characterized by a larger set of goods.[25] Trading a more varied basket of goods may indicate higher levels of trust between Hanseatic merchants and captains, supported by our finding that this result is not driven by more standardized units.

We have argued that our empirical findings are not explained by navigational knowledge and do not find evidence that this trading capital consisted of more similar units employed by Hanseatic captains on Hanseatic routes. Instead, we show that trading capital was largely specific to Hanseatic captains on Hanseatic routes rather than in individual Hanseatic harbours. Similarly, we show in Appendix Figure 17 that we find no persistence when only the home town and either the origin and destination (and not both) were Hanseatic. We interpret this as the network effect: captains that belonged to the Hanseatic network facilitated significantly more trade on routes connecting this network. Our finding in Fig. 5(b), identifying individual captains as Hanseats by their last names, comes closest to testing this hypothesis at the level of individuals. We find that captains with Hanseatic last names traded significantly more on routes within the network. This suggests that trading capital had been accumulated at the level of individual traders and captains, or their families. While we cannot explicitly test for this, this result is consistent with the existence of a Hanseatic identity that persisted in the network.

In Appendix Figure 18, we analyse whether the networks effects differ for routes where all of origin, destination and captain's residence are actual Hansa towns as opposed to those where at least one of origin and destination is a Kontor town. We find

[25] In results available upon request, we further find significant positive estimates in each decade, again speaking against decaying monopoly power driving our result.

initially positive effects for both groups, but on the pure Hansa routes, the effects decline to zero by the early 1700s, whereas they stay positive and significant for the routes involving at least one Kontor city. These results could imply that trading capital is particularly important when managing at larger (physical or cultural) distances.

## 8. Conclusion

In this paper, we employ an extensive city-level trade panel to investigate the long-run behaviour and stability of social and economic networks. We study trade for 190 years after the demise of the Hanseatic League, a confederation of traders in Northern Europe. After the League was dissolved in 1669, we find that former Hanseatic cities did not trade significantly more with each other. All bilateral trading capital that had been created between member cities seems to have depreciated completely by the time the League was formally dissolved.

Rather than focusing on Hanseatic cities, we then analyse the network of traders and captains. The quality and high resolution of our data allow us to distinguish captains by their home town and last name. Guided by the historical narrative, which highlights the role of maritime networks and privileges granted to traders from Hanseatic cities, and the importance of trust between traders and captains, we incorporate the captains' network membership into our analysis. Our hypothesis is that Hanseatic captains and traders built particularly large stocks of trading capital on Hanseatic routes. We determine network membership either by captains' home towns or by comparing captains' last names to a list of Hanseatic mayors' and diplomats' last names. We find that Hanseatic captains continued to trade significantly more on routes within the former network. This result holds more than a century after the end of the League and is established by estimating different gravity models and robust to several measures of trade and sample restrictions. Our finding illustrates the dynamic gains from networks, as they continued to shape trade flows for over a century. Networks have been shown to promote trade and development by lowering frictions. Our results on the long run stability of such networks underscore the scope of these findings. Social and economic networks are hard and costly to build, but once established they can survive for centuries.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Appendix A. Supplementary data

Supplementary material related to this article can be found online at https://doi.org/10.1016/j.jinteco.2025.104102.

## Data availability

Networks in Trade --- Evidence from the Legacy of the Hanseatic League (Original data) (Mendeley Data)

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