Identity in Trade - Evidence from the Legacy of the Hanseatic League

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Abstract

We study trade networks and trader identity following the decline of the Hanseatic League, using a novel trade data set that covers cities in Northern Europe at high spatial resolution over 190 years. By the time of its dissolution in 1669, trade within the former Hansa network is within predictions from a gravity framework. However, the identity of merchants continues to shape the composition of trade: Hanseatic merchants' trade within the former network exceeds gravity predictions for centuries. Our paper highlights the important role of cultural ties and of the identity of traders in the formation and maintenance of networks.
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1 Introduction

The formation and maintenance of networks is a central part of much economic activity. In this paper we study what happens when a strong and old network of trading connections is disrupted, using granular city-level trade data over almost two centuries. An increasing body of evidence points towards past trade links as one important determinant of current trade patterns. Estimates of the degree of persistence of such past trade links differ and the relative importance of various possible channels is not clear. Some evidence points to long lasting 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 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 standard gravity benchmark (Head, Mayer and Ries, 2010). 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).

What drives these different degrees of persistence and what factors contribute more to its decline? In this paper, we study the role of formal trade institutions that lead to the accumulation of trading capital at the aggregate and at the individual level. Studies of the persistence of trade need to observe trade flows for a long period of time, and hence are usually limited in the spatial resolution of data. They also typically cannot distinguish the identities of different types of traders. We address both issues by using a historic laboratory: the demise of the Hanseatic League in the late 17th century. This confederation of merchant cities had dominated trade in the Baltic region during the Middle Ages, but was dissolved in 1669, after a long period of time and already gradual dissolution. We draw on Danish tax records that recorded seaborne transits between the North and the Baltic Seas over centuries, allowing us to develop and use a panel of city-level, high resolution trade flows in which we also observe the flag under which ships of trade sail.

We first consider trade between former Hansa cities and their key trading partners: Does the size of trade flows between two cities, measured by the number of ships sailing between them, depend on past membership in the Hanseatic League? Using city-level gravity equations based on data from the years 1668 to 1857, we do not find evidence for Hanseatic 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 (Bailey et al., 2021, Fang, Wang and Yang, 2020, Campante and Yanagizawa-Drott, 2017, Cristea, 2011, Rauch and Trindade, 2002, Rauch, 2001), we then add trader identity as a third dimension, measured by the flag under which a ship sails. In this specification, an observation is a combination of origin, destination, and ship ownership. Here, we find substantial and long-lasting persistence: trade between Hanseatic cities and on ships that were registered in a former Hansa city is considerably larger than simple gravity predictions until well in the 19th centuries, nearly two centuries after the end of the Hanseatic League. Thus, while trade persistence at the aggregate bilateral city-level was relatively short-lived, former trade institutions continued to shape the identity of the people that facilitated trade between cities. This implies that Hansa traders crowded out other merchants on routes that had been part of the Hanseatic League after the dissolution of this network.

Our main result shows that the identity of traders persists longer and more strongly than other forms of trading relationships we can measure. This relates to a long literature on the importance of identity, culture, and history in trade. For example, Greif, 1993 shows how a coalition of Maghribi traders could build a reputation mechanism to reduce transaction costs in trade relationships in the 11th century. 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. Head, Mayer and Ries, 2010 show how trade slowly declines after colonial breakup. More recently, 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. In the context of online labour markets, Xu, 2015 finds an important role of collective reputation as proxied by nationality. Our paper adds to this literature by estimating the role of a trader's identity in a large, high-resolution, long-period dataset that reveals that the identity of traders persists much longer than trade overall after the dissolution of a network. While total trade flows converge to levels predicted by gravity, the identity of the ships and captains engaging in the trade remains biased towards the Hanse network long after the Hanse disappeared.

Identity received recent attention in the field of economics by Akerlof and Kranton, 2000 and Akerlof and Kranton, 2010. It has since then also influenced the literature on trade. For example, cultural trade networks of migrants persist for decades (Parsons and Vézina, 2018, Gould, 1994, Rauch and Trindade, 2002, Dunlevy, 2006). Special interest groups have been documented to influence trade policy (Grossman and Helpman, 2001, Grossman and Helpman, 2002) and the identity of groups perceived to benefit or lose from trade influences political attitudes to trade (Grossman and Helpman, 2020). The identity of the traders themselves has found less attention, likely due to data limitations (There are exceptions such as Greif, 1993). What we add to this literature is to show that the identity of participants in trade is non-random and has measurable effects on the strength and persistence of trade flows. We also give an example of how elite families can maintain economic power for centuries, relating to Clark and Cummins, 2014.

Apart from our new quantitative and qualitative insights on the persistence of trade flows, our paper is also of historical interest, as it provides new and detailed information on the speed of decline of trade amongst members of the Hanseatic League. While there is an economic literature discussing the economic origins of the Hansa (Greif, Milgrom and Weingast, 1994, Greif, 2006), the decline has not received the same attention. This paper contributes to the debate on dating the decline and end of this trade network, and on the speed at which the Baltic region rearranged to the new political environment. Our results also contain new information on the impacts of the Great Northern War and the Continental Blockade on cities in the Baltic Region that may be of interest to historians.

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 is laid out in section 5, followed by our results in section 6 and robustness checks in section 7. 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 dozens of cities on the Baltic and North Sea[1]. It was primarily a commercial confederation, but it was was also able to engage in common military operations. At its height, the Hansa was a powerful independent political and economic entity, successfully taking

[1] The following discussion is mostly based on Dollinger, 1964. Other sources are cited where used.

on large kingdoms such as Denmark and England. Hanseatic networks played an important role in facilitating exchange by imposing a set of rules and guaranteeing their merchants' trading privileges abroad. 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. The list of member cities of the Hanseatic League changed over time. Figure 1 gives an overview of the main Hansa cities based on a list compiled by Dollinger, 1964.

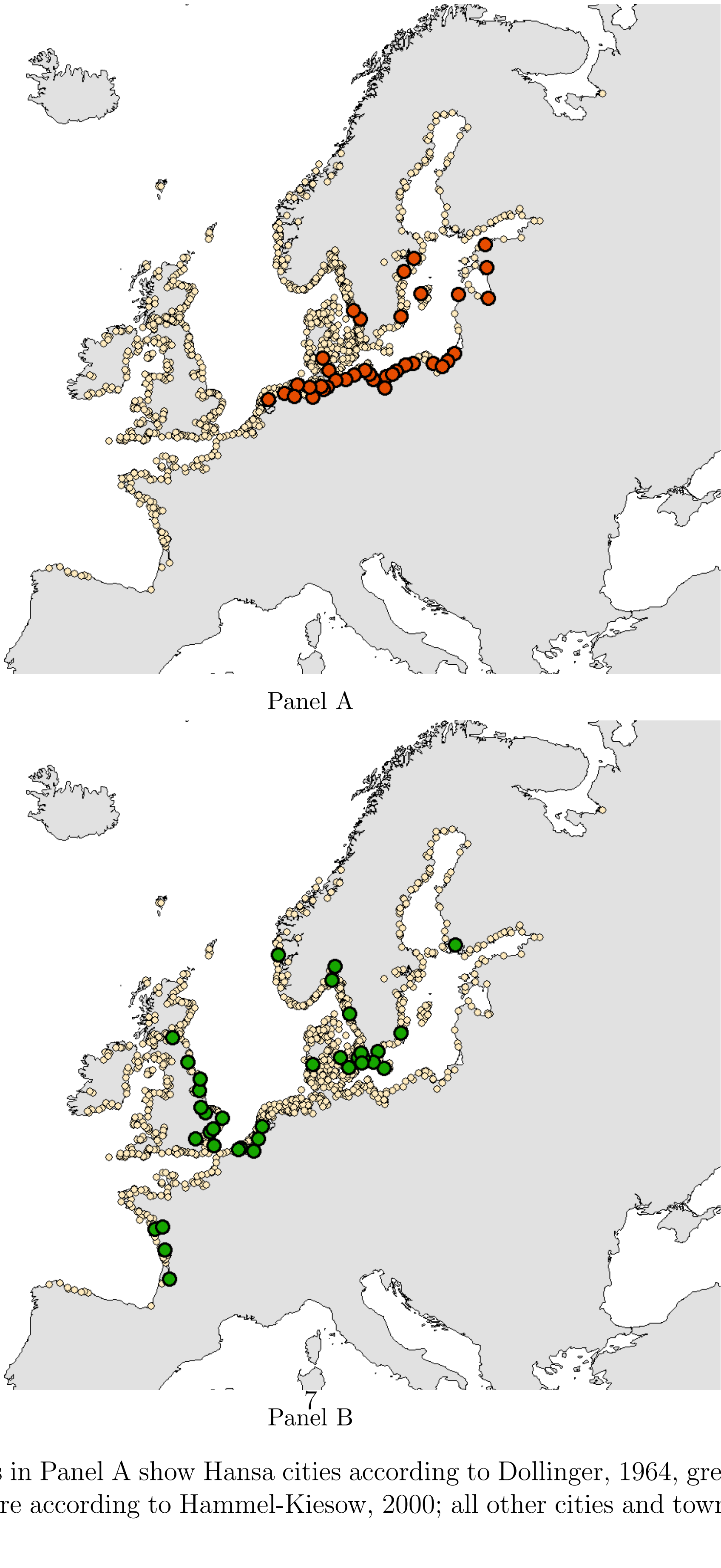
Until the mid 14th century, the Hanseatic League mostly existed abroad. During this time, the most salient feature of Hanseatic trade were the privileges granted to Hanseatic merchants abroad, to which there were two sides. Rulers would assure Hanseatic merchants politically and legally of certainty of justice concerning people and goods on the one hand and would further grant fiscal privileges to Hanseatic merchants. Generally speaking, treaties permitted trade to Hanseatic merchants, assured them of the legal enforceability of their contracts and protection against arbitrariness and even encouraged trade by granting financial privileges such as tax alleviations. Importantly, during Hanseatic centuries trade privileges granted to its member cities depended on the merchant's citizenship. Ultimately, the acquisition of a Hansa citizenship was too attractive and this privilege was overused, so that from 1434 on privileges were confined to merchants born in a Hanseatic city. Dollinger, 1964 calls this first period the "Hansa of merchants". In this period, the strongest links were created between Hanseatic cities and their trading posts abroad, most importantly the Kontore. Kontore grew out of initial trading posts when these trading posts grew in importance and benefited sufficiently from privileges. In most Kontor cities, with the exception of Bruges, Hansa merchants had to live in a particular part of town; they were only partially subject to the jurisdiction of the local ruler and elected their own administrators, the so called Olderleute. Figure 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.

After the mid 14th century, Dollinger, 1964 argues for the rise of a "Hansa of towns". City constitutions, a similar language, privileges linked to the citizenship of merchants 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 merchants 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, Hanseatic merchant networks relied on other coordination mechanisms such as a common language and cultural identity, law, 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, Ewert and Selzer, 2015).

The result of these processes was that Hanseatic cities were tied together not only through commercial links, but developed a shared identity and culture. 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, Corcoran and Pfaff, 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. In fact, a 2018 proposal by the Dutch government to form a new Hansa of eight Northern European countries, featured the three Baltic states and Scandinavia, but not Germany (Noels, 2018). This proposal was received favourably across Northern Europe, showing how a Hanseatic identity is detached from a German identity.

In the following centuries, two major trends led to the demise of the Hanseatic League. First of all, early modern states evolved throughout Europe, and their fiscal capacity began to outstrip the political and military potential of the Hanseatic League. In the spirit of mercantilism, these states were more inclined to favour their own merchants. As states imposed taxes and were able to strip the Hanseatic League of its privileges, membership became less and less valuable to cities in the region, illustrated by the decreasing attendance at the Hanseatic League's General Assemblies. Furthermore, the rise of the Atlantic powers, mostly Britain and the Netherlands, meant that Hanseatic merchants no longer enjoyed their monopoly power over some of the most lucrative trade routes. More generally, it is well documented that the economic centre of gravity moved towards Western Europe (Acemoglu, Johnson and Robinson, 2005). Based on voluntary cooperation rather than centralized power, the Hanseatic League was unable to compete with these two developments. The League was never formally dissolved, but its last



Panel A

Panel B

Figure 1: Red circles in Panel A show Hansa cities according to Dollinger, 1964, green circles in Panel B show Kontore according to Hammel-Kiesow, 2000; all other cities and towns in yellow.

General Assembly (*Hansetag*) which took place in 1669 is usually considered its last official event.

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"). These dues were an asset of the royal income until 1816, as clarified by Hill, 1926, who was also the first author to have traced the origin of the dues back to 1429/1430. 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.

The toll had flat fee elements (such as a fee for the maintenance of lighthouses) and proportional elements, relative to the value of goods as declared by captains (Degn, 2017a). In order to disincentivise declarations of low values, captains were obliged to be willing to sell to toll collectors at the declared prices. This mechanism ensured truth telling regarding the information on the value of cargo. The data are extensive, usually covering the origin and destination of a trading ship, the city in which it is being owned, the name of the captain, goods aboard, and further tolls levied. Danish (and up to breaking with the dynasty also Swedish) ships were subject to markedly lower tolls, yet also these vessels were recorded.

The aforementioned privileges for Hanseatic merchants extended, to a degree, also to the treatment of their vessels when passing the Sound. Hanseatic ships enjoyed, for example, the privilege of not paying the so called cargo toll, a privilege only enjoyed by Danish (and at the time also Norwegian and Swedish) ships (Degn, 2017a). Degn notes a hierarchical system in the collection of duties: ships from Denmark, Norway and Sweden made up the most privileged group, whereas the Wendish towns were a little less privileged. The second class consisted of the eastern Hanseatic cities, most notably Danzig. These ships paid both a reduced ship toll (lump-sum) and enjoyed lower ad valorem duties on copper, wine and salt. The third group covered the western Hanseatic cities and the Netherlands. Ships from England, Scotland, France and Emden enjoyed no privileges at all. 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. 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 toll conditions the Dutch had secured. From this time onwards, no further major changes in the toll system were introduced until its abolition in 1857. Information on destination cities is only consistently reported from 1668 onwards, such that the bilateral data are collected at a time when merchants from formerly Hanseatic cities enjoyed no particular privileges at the Sound any more; the toll conditions did not change in any comprehensive way throughout the period we are looking at, namely 1668 to 1857.

2.3 Notable events: Great Northern War and Continental Blockade

In the period and region we study, two events stand out that significantly affect trade. The Great Northern War (1700-1721) was a long lasting conflict over domination of the Baltic Sea that ended the Swedish Empire and increased the influence of the Tsardom of Russia. Apart from several battles in the region, the war coincided with several outbreaks of the Plague. It involved virtually all cities and countries in our dataset in some way. Exports of some of our larger cities drop to close to zero during this period. Cities that were members of the Hanseatic League were disproportionally affected by the events of this war due to their location.

A second event of importance is the Napoleonic Blockade from 1806 to 1814, which restricted trade in the region substantially. This event did not affect cities that were former members of the Hanseatic League disproportionally among the cities in our dataset.

3 Data

3.1 The Sound Toll Data

The original Sound Toll records were digitized by a team of Dutch economic historians (Soundtollregisters, 2020). An important limitation of this data set is that observing a shipment depends on it passing through the Oresund. This is to say that trade flows between cities on either side of the Sound will not be observed: trade between Danzig and Stockholm or London and Amsterdam will not feature in this dataset; yet trade between Danzig and London will be, as it passes through the Sound. In our analysis, we only include trade flows that would, in theory, be observed, such that not observing a trade flow most likely implies a true zero. For trade between Danzig and Stockholm, we will not assume true zero trade, but rather not include these trade flows at all; it is, however, highly unlikely that any trade between Danzig and London occurred other than through the Sound. Other straits, such as the Little Belt between Jutland and Funen, were difficult and dangerous to navigate for larger ships such as the ones used for trading with the West and alternative transport over land was expensive (Raster, 2019). Note further that trade over land faced a high number of tolls, too: whereas a ship from Danzig to Amsterdam needed to only cross one border, so to speak, transport over land, even abstracting from the true transport cost, would become way less attractive due to the high number of land borders to be traversed and the tolls to be paid which were associated with them, as described for the case of the Holy Roman Empire by Mintzker, 2012.

The main alternative to passing the Sound was sailing through the Great Belt. Degn, 2017b makes a number of arguments for why this does not pose a major threat to our data set. Precisely because the Great Belt made it possible to avoid paying the Sound Toll duties, the Danish king introduced a prohibition on sailing through the Belt, directed specifically against the Prussian towns, extending this prohibition later on to all foreign nations. It is noted that it was mainly Hanseatic towns whose merchants were at times exempt from this prohibition and possessed the expert knowledge required to pass through the Great Belt, a route usually taken in case of storms and one on which, furthermore, a different toll was applicable, too. Degn, 2017b concludes that skippers only reluctantly evaded the Sound; it was particularly difficult for foreigners to evade the Sound, which means that, if anything, we underestimate the number of Hanseatic merchants as they were more likely to pass through the Great Belt. Finally, an inspection of toll records from the Great Belt reveals that the number of passages is small compared to the number of voyages through the Sound. We thus conclude that the difficulty of navigating the Great Belt and the prohibition on doing so, at times enforced with war ships, imply only a small number of unobserved vessels in our data. Hanseatic merchants were more likely to choose to avoid the Sound, such that if anything, we would be undercounting Hanseatic trade.

The original source from which we take these trade data is from the Soundtoll project (http://soundtoll.nl/), which also provided helpful material on commodities, units, currencies and city names, and for additional documentation and clarification Degn, 2017a proved a useful resource. Information on currencies, units and notation is based on this source, too[2]. Other sources are indicated.

[2] Waldinger, 2022 and Alder, Colmer and Coşar, n.d. use the Sound Toll Data to study the impact and consequences of environmental shocks. Gomtsyan, 2021 focuses on merchant networks in cities.

Our main source for identifying cities in the trade data are two files provided by the Soundtoll team, one of which maps every mentioning of a city, however cryptic or historic, to a unique identifier, the "soundcoding", and the other one linking these unique identifiers to a unified way of naming the city. Using these files, we convert 90,737 original city names to 3,085 unique place identifiers. 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 merchants benefited from Hanseatic privileges abroad. Kontore and Faktoreien (trading posts abroad) are based on Hammel-Kiesow, 2000. We use a different source here, as Dollinger, 1964 does not provide a list of Kontor cities.

Our general source for units is the Soundtoll project's information (Soundtollregisters, 2021). We work with a version of the full dataset which we downloaded on November 23rd 2019 from http://soundtoll.nl/. Historical units suffer from a lack of comparability (a ton from Danzig is not the same as a ton from Königsberg, a Faad is 930 liters or 950 kg, depending on the good), overlapping names in the data ("barrel" refers to both a unit and a good), overlaps with kinds of goods (boter/botter/boeter is a unit that butter, carrying the same names, is sometimes measured in) and poor documentation (many units are abbreviated to "D." or "F." leaving ambiguity whether this refers to the currencies of Daler and Faad or other units of measurement). Aggregation over all kinds of goods and several centuries and languages implies high degrees of noise. We therefore prefer to use a more aggregated unit of account, namely the number of ships, as our measure of bilateral trade[3].

In a robustness check, we will use taxed value as the dependent variable, which is recorded for about 80 per cent of voyages 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, as it is based on the latter and truth-telling mechanisms were in place. Due to flat fee elements and composition effects, shipped value is not just a simple multiple of taxes paid at the Sound, however. City-level differences, such as smaller ships facing a higher effective proportional tax rate due to flat fee elements, will be accounted for by fixed effects.

[3]In theory, other proxies could be used, say, the carrying capacity of vessels. As noted by Degn, 2017c, from 1632 to 1644 a specific duty was collected in proportion to a ship's carrying capacity, such that from the duty records carriage capacity can easily be recovered. This, however, does not extend to the entire time frame, as tolls and duties were constantly modified. Degn, 2017c notes how the size of ships varied by its origin, with Dutch ships being particularly large. In our estimation below, fixed effects absorb these differences.

The particular properties of our dataset, and the lens through which trade is observed, has implications on data selection. However, our regression specifications, described below, consider balanced datasets in which we follow the same bilateral trade links over time. Such a setting is more robust to selection problems than cross-sectional gravity results would be, especially when it comes to time-invariant differences.

3.2 Distance over sea

We compute cost distances for each city pair in our dataset using a raster approach and the CostDistance tool in ArcGIS similar to Bakker et al., 2021 or Nunn and Puga, 2012. As in the latter paper, our pixel resolution is 30 arc-seconds, corresponding to square cells of about 1 km side length (in fact, the longitudinal dimension is even less than that given our latitude). In total we compute 1,425 $\times$ 1,425 distances. Our key parameters are that we set land transportation to ten times the cost of transportation over water. For our sample of mainly coastal cities, most least-cost routes are overwhelmingly over water, but we occasionally may observe land transportation, typically from a large city a bit inland to the nearest port.

3.3 Sample restrictions

The time frame of our analysis starts in 1668, from which on destination cities were systematically recorded. It ends in 1857, when the Soundtoll was formally abolished.

We restrict our sample geographically to the region near the Sound, i.e. to Northern and Western Europe. Specifically, we only keep cities to the North of Bayonne[4]. We drop parts of Southern France and Italy that are to the north of Bayonne, but not on the Atlantic coast. We further restrict our sample to cities to the west of Saint Petersburg, with the exception of Arkhangelsk, as it was a major export harbour at times and in particular when the Baltic harbours were inaccessible for Russia. The Northern limit we choose is the Arctic Circle; to the West, our cut-off is Ireland. This selection is motivated by the fact that data for cities located further away from the Baltics are sparse. By this selection, we cut about 20 per cent of cities. In the next step, we only keep cities that are either 25 km or less away from the coast or are 100 km or less away from the coast, but only 25 km or less away from a major river (namely Loire, Seine, Rhine, Elbe, Oder, Vistula, Neman, and Daugava). By this selection, we cut a further

[4]This includes some cities in Northern Spain that are situated to the North of Bayonne.

40 per cent of cities. Overall, this leaves us with 1,425 cities and towns in sixteen modern day countries. Among these 1,425 cities, we observe 17,648 bilateral trade relationships over 190 years, with about 1.5 million passages. Our dataset is a balanced panel to begin with, such that if in any of the 190 years there was a passage connecting a pair of cities, this connection is included. Missing values for a given time period and city pair mean that in this time period, no passage from city A to city B across the Oresund was recorded. Hence, we set these missing values to 0.

In order to mitigate selection issues, we show that our results are robust to including all possible bilateral connections in our panel. In this exercise, all connections of cities which pass through the Sound are included, even though most of them are always equal to 0, whereas in our main specification only connections which are employed at least once over 190 years are included. We find similar results.

Overall, the Sound Toll data only features trade flows which enter or leave the Baltic Sea through the Sound near Helsingor. This introduces a number of selection problems. The first one is land transport around the Sound. On short distances around the Sound, we likely miss trade, as land transportation was a viable alternative. This potentially biases distance coefficients upwards. As a robustness check, we exclude short-distance connections for which we likely observe only part of trade due to land transport, finding similar results. One of our core specifications includes (route-time) fixed effects which account for time-varying bilateral selection problems. Overall, a lot of selection issues are alleviated by the fact that we use a balanced panel of trade connections.

Trade flows are measured in a directed way, such that flows from A to B and flows from B to A are stored as different observations in our dataset. Directed trade flows are helpful for two reasons. First, we keep valuable information by not turning the data into an undirected data set. Second, Feenstra, 2016 points out that the estimation method by Santos-Silva and Tenreyro, 2006 requires directed trade flows.

3.4 Smuggling, fraud and unobserved passages

Another potential concern is that smuggling to escape the tax could lead to selection bias. Several rules were in place to tackle smuggling: from 1708-1752, ship masters were paid 3.5 per cent of the calculated toll amount to give incentives for truthful reporting (Degn, 2017a); non-declared goods were confiscated; even after a ship had paid its duty at Helsingor, subordinate duty ships patrolled in the North Sea and could confiscate all goods on board that had not previously been declared at Helsingor. Over time, official papers documenting carried goods and proving the right to benefit from trade privileges were demanded in order to tackle untruthful reporting. Fraudulent or missing reporting seems to have been commonplace, however, further motivating our choice of only looking at the number of ships. This measure is described as reliable by Degn, 2017a: the Sound is narrow and passing through it unobserved is almost impossible. A particular duty, called guilt money, had to be paid when ships did not quickly enough lower their topsails to greet the fortress of Kronborg, and a cannon was fired to remind the ship master of his obligations. Degn, 2017a further notes that other water ways into the Baltic Sea were narrow and dangerous; we would add that all these straits have narrow points, such that the Danish Crown could have easily erected further toll fortresses if it had been desirable for it to do so. We conclude therefore that all ships passing through the Sound were counted. As fraudulent reporting and smuggling were commonplace, measures using the exact units given are unreliable in at least a good amount of cases, but this leaves the measure of number of ships untouched: it was basically impossible to smuggle an entire ship, that is, to pass Kronborg unseen and untaxed.

In a robustness check, we will use taxed value as a proxy for the value of goods shipped through the Sound. This is recorded for about 80 per cent of voyages included in our panel and produces similar results Units of weight can be reconstructed for only about 44 per cent of voyages and include substantial amounts of noise and assumptions on measurement, so we abstain from reporting our results here.

3.5 Ship ownership or captain's place of residence

To capture trader identity, we use the variable "schipper plaatsnaam". There is a debate over the meaning of this variable, documented by the Sound Toll team. It either denotes the home port of a ship or the place of residence of the captain. The latter might be harder to interpret. As pointed out by Raster, 2019, significant migration of ship masters was a common feature of Baltic trade. In particular, he notes the large number of captains with Dutch names with domiciles in the East. Dollinger, 1964 also speaks of sizeable immigration to Hansa cities and concludes that up to the 17th century, immigrants made up the majority of citizens of all Hansa cities, which suggests that having been a recent immigrant did not preclude the acquisition of citizenship. On the contrary, even high political offices were frequently filled with men who had only recently acquired citizenship.

Dollinger, 1964 goes on describing the particular attributes of captains. Captains were always (partial) owners of their ships and their main remuneration consisted of the share of profit accruing to their partial ownership of the ship. In order to counterbalance the impossible supervision of captains by other merchants, captains had to be married men and have children, as they were liable with their possessions on land. This measure was aimed at making the outside option of simply migrating to another city less attractive. For these reasons, we consider it plausible to link the city of ship ownership or the captain's place of residence to Hanseatic privileges. While Raster, 2019 is right in pointing out large migratory flows, a recent migratory past did not preclude the acquisition of citizenship; captains, in particular, were bound to their home ports in numerous ways, not least through their possessions on land.

Either view acknowledges that this variable is the equivalent of the modern principle of 'sailing under a flag'. In addition, we think it measures a cultural affiliation of captain and crew to former (German-speaking) Hansa cities[5]. This is why we interpret "schipper plaatsnaam" having been a Hanseatic city in the past as sailing under a flag that, in the past, would have come with Hanseatic privileges. Below, we will usually speak of "home port", "city under whose flag a ship is sailing" or "city of ship ownership" and this also encompasses the alternative interpretation as place of residence. We interpret it as a proxy for Hanseatic identity of the ship and its captain.

4 Hypotheses

There is ample empirical evidence that shared institutions, languages and currencies increase trade flows (Head, Mayer and Ries, 2010, Jacks, O'Rourke and Taylor, 2020), as well as capital flows (Ferguson and Schularick, 2006). However, 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.

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

[5]The five most common last names of captains commanding a ship under a former Hanseatic flag are Schultz, Meyer, Blanck, Schmidt and Schröder, whereas the five most common last names of captains commanding a ship under a non-Hanseatic flag are Hansen, Nielsen, Andersen, Jansen and Smith.

trade costs, but are unrelated to personal networks or physical capital. In the context of our paper, physical capital is of little interest as we study a setting with trade over water, where roads and railway lines do not improve bilateral trade. Personal networks and built-up trust, however, are likely to have outlived the Hanseatic league. As argued in section 2, Hanseatic trade relied heavily on merchants' networks, reciprocity and trust, and we would thus expect this category of trading capital to be particularly important in our setting. 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, but in some cases this is possible. A prime example are city constitutions.

In the context of the Hanseatic League, trading capital thus 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 merchants, features that become particularly salient in the latter phase of the Hansa of towns. 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 cities involved even after the dissolution of the league through better bilateral legal institutions; thus, trading capital was built up through these legal institutions. Privileges abroad created trading capital in the first era of the League's existence, in what Dollinger, 1964 refers to as the Hansa of merchants. Lower bilateral exchange rates and political and cultural similarities led to the creation of trading capital among Hanseatic cities in the latter phase of the League's existence, the Hansa of towns.

Given this discussion, we would expect a positive, but declining effect of common membership in the Hansa on city-level trade. Excess trade flows due to trading capital would thus go to zero over time, and in line with Head, Mayer and Ries, 2010 this process should not take longer than 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 has already eroded by the time we start observing trade flows. However, once we introduce trader identity, we expect a longer lasting effect of former membership in the Hanseatic network, conditional on the Hanseatic identity of merchants. We thus expect trade flows in excess of gravity predictions for a long time period if origin city, destination city, and merchant were all part of the former Hanseatic network.

5 Empirical strategy

We start by using a gravity equation framework to study aggregate city-to-city trade after the demise of the Hansa. For this, we draw on a bilateral dataset that consists of 17,648 directed trade flows, each over 190 years. These are aggregated to 20 decades (the first and the last one do not count ten years). Therefore, we count a total of 352,960 observations. In our balanced panel, 84 per cent are zeroes. (compared to roughly 80 per cent zeroes in Jacks, O'Rourke and Taylor, 2020) The panel is based on 953,600 ships passing through the Sound. Among the 56,011 positive entries, the mean is 14, the median is 2, and the 90th percentile is 25 ships. Our empirical model for this dataset follows standard gravity models:

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

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 both the origin and destination city were part of the Hanseatic network, 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 a standard gravity model. 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 harbors, dos_{ij}. As in the case of our main variables of interest, we interact these variables with decade dummies, thus allowing them to have time-varying effects. η_{it} and χ_{jt} are origin x decade and destination x decade fixed effects. Following Head and Mayer, 2013, these are included to take care of multilateral resistance terms.

We estimate this equation on the bilateral directed dataset, which is to say that trade flows from A to B are treated as different from trade flows from B to A, and use PPML (Santos-Silva and Tenreyro, 2006), clustering standard errors at the bilateral level (i.e. on a unique identifier of an origin-destination pair) throughout. The specific Stata package used throughout is PPML HDFE by Correia, Guimarães and Zylkin, 2019.

The aggregate bilateral specification is an interesting starting point, as it allows to check for persistence in aggregate trade patterns similar to Head, Mayer and Ries, 2010 or Beestermöller and Rauch, 2018. However, it disregards the issue of trader identity. We therefore add ships' home ports to our analysis. In the resulting dataset, an observation is the number of ships sailing from city A to city B owned by merchants in city C in a particular time decade d. With 1,425 cities, there are in theory billions of possible permutations (1,425×1,424×1,425). However, most of these permutations never occur, and as before, we exclude combinations that we never observe over our 190 years of analysis. Trying to fill in the entire matrix of all possible trade connections is computationally infeasible. The restriction to all trilateral connections observed at least once throughout leaves us with 113,437 combinations for each 20 decades, so 2,268,740 observations, as before based on 953,600 passages through the Sound. In our balanced panel, 91 per cent are zeroes, and among the positive entries, the mean is 4, the median is 1, and the 90th percentile is 6 ships. Passages that are mapped onto several cities are dropped –this is the case if a ship is indicated to be owned in several cities, which we find hard to interpret –but this only concerns 412 out of 1,482,175 observations. There are further some unidentified cities ("Unknown") which we drop. As before, if in a given year no trade is reported for one of our remaining trilateral combinations, we set the trade flow to zero.

Our key variable of interest here is $AllHansa$, a dummy that is one when all of origin, destination and home port city are part of the Hanseatic network. We continue to treat Hansa and Kontor towns symmetrically on the bilateral level, as we are interested in trade flows within the network they used to form. Our discussion both of historical trading privileges in section 2 and the notion of trader identity we propose suggests a stricter view on the ship's flag, however. We will not treat Hanseatic and Kontor flags symmetrically, but insist on a Hanseatic flag. Kontor flags did not carry any past trading privileges and further merchants flying these flags did not identify as Hanseatic merchants and have thus to be regarded as distinct in our identity-driven analysis below. The triple Hansa dummy thus captures trade within the former Hansa network (among Hansa cities, among Kontor cities, and between Hansa and Kontor cities) under a Hanseatic flag, which is to say, carried out by merchants with a Hanseatic identity. Given the inclusion of the double Hansa dummy $ODHansa$, it estimates whether Hanseatic cities continued to trade with each other on Hanseatic ships only.

We employ several specifications on this dataset. A recent literature on multinational production, started by Arkolakis et al., 2018, models trade flows among countries and within global firms. Head and Mayer, 2019 have developed an alternative specification that is also grounded in the multinational production literature and is a generalised version of the model by Arkolakis et al., 2018 which only has data for US firms. In line with their model, in our first specification we estimate with (origin x time) and (destination x flag x time) fixed effects:

$$T_{ijnt} = exp(\alpha + \beta_t AllHansa_{ijn} + \gamma_t ODHansa_{ij} + \lambda_t dos_{ij} + \eta_{it} + \psi_{jnt}) \times \epsilon_{ijnt}. \quad (2)$$

The second specification is motivated by the literature on gravity with disaggregated data such as products or sectors. Based on Anderson and Wincoop, 2004, Yotov et al., 2016 suggest to model sector-specific multilateral resistance terms as exporter-product-time and importer-product-time fixed effects. A similar approach has also been used by Arkolakis et al., 2018. The equivalent in our data are origin-flag-time and destination-flag-time fixed effects. We thus estimate:

$$T_{ijnt} = exp(\alpha + \beta_t AllHansa_{ijn} + \gamma_t ODHansa_{ij} + \lambda_t dos_{ij} + \mu_{int} + \nu_{jnt}) \times \epsilon_{ijnt}. \quad (3)$$

Finally, in a third specification, we control for time-varying route characteristics by introducing (origin x destination x time) fixed effects. In order to avoid the "gold medal mistake"(Baldwin and Taglioni 2006), we further include (flag x time) fixed effects:

$$T_{ijnt} = exp(\alpha + \beta_t AllHansa_{ijn} + \chi_{ijt} + \xi_{nt}) \times \epsilon_{ijnt}. \quad (4)$$

In all cases, standard errors are clustered on the origin-destination pair level.

6 Results

We start our analysis in figure 2 by plotting 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 1669, and this trend continued afterwards. This decline could be explained by a general relative decline of the importance of Hansa cities, however in the Appendix we show that Hansa cities did not develop differently from other cities in our dataset in this period. It seems that they just became less active in trading activities. Former Hansa cites 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

Hansa share over time

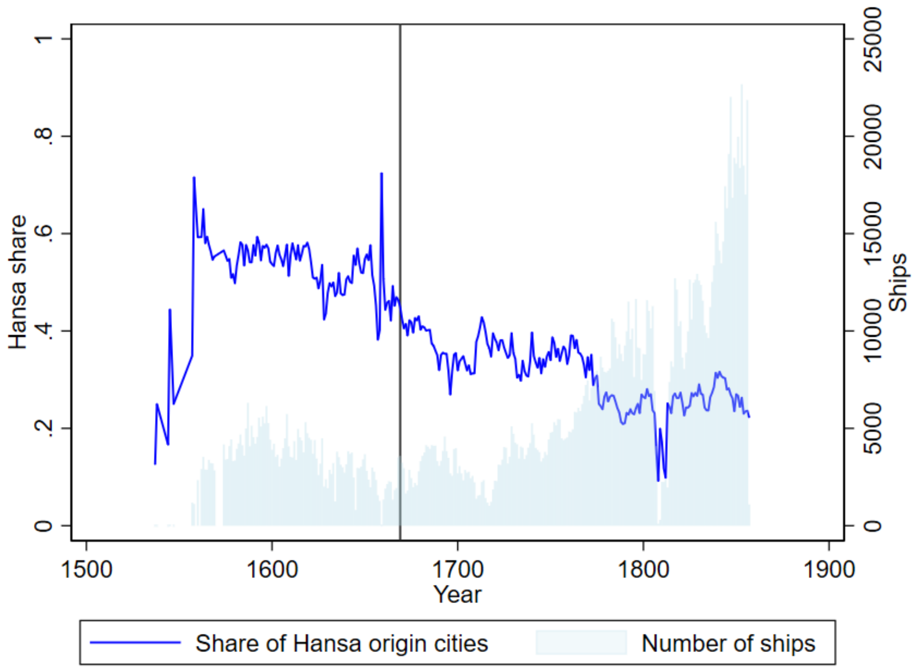


Figure 2: Share of trips originating in a Hanseatic city and number of ships recorded in the dataset. In the appendix, table 1 shows that Hanseatic cities were not larger than other cities, using population data by Bairoch, Batou and Chèvre, 1988.

Sound. So even though the Hansa were dissolved in 1669, Hanseatic trade continued.[6]

Given this continued importance, we next turn to our aggregate bilateral dataset to examine whether the Hanseatic network also persisted in city-to-city trade flows. Our main result from this estimation are 20 decadal parameters for the Hanseatic dummy from equation 1. Point estimates and their 95 percent confidence intervals are shown in figure 3. 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, Mayer and Ries, 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. The only exception to this

[6]Since we only require the origin and not the destination, we can plot these two 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.

pattern are the 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 the Great Northern War that disproportionately hit trade among former Hansa cities.[7] Generally speaking, though, trade converges to what we would expect from a gravity framework.

In the appendix, we show that also the value of trade converges to gracity predictions (see figure 6b).

However, these results disregard the identity of traders. As the historical discussion has shown, the identity of traders was important in medieval Baltic trade: During the existence of the Hanseatic League, privileges granted to its member cities depended on the merchant's citizenship (Dollinger, 1964), and merchants heavily relied on personal networks to facilitate transactions (Ewert and Selzer, 2015). The trading capital that was created during Hanseatic times thus likely hinged not only on trade routes, but also on the traders' identities. While we cannot ascertain a merchant's city of birth or their networks, we believe that a ship's home port is a good proxy for this trading capital: We expect ships from Hanseatic cities engaged in trade between Hanseatic cities or Hanseatic and Kontor cities to have accumulated more of this capital than others.

Indeed, when looking at the most crowded routes, this becomes apparent. Over all years, 87 % of trade between Bergen and Rostock is carried out under a Hansa flag, and for trade between Riga and Bremen and between Stralsund and London, the Hansa share is 70 % and 72 %, respectively. Rostock, Riga, Bremen, and Stralsund were prominent members of the Hanseatic League and London and Bergen two of their most important Kontor cities, or trading posts abroad. On the other hand, Hanseatic merchants basically played no role on non-Hanseatic trade routes: only .5 % of trade between London and St. Petersburg is carried out by Hansa merchants, and for the connections Hull and St. Petersburg and also Amsterdam and Narva, these shares are .6 % and 2.7 %, respectively. Interestingly, London, Hull, and Amsterdam are all former Kontor cities, yet their trading partner in these connections was never a member of the Hansa network.

We now move to the regression analysis. Results from specifications 2, 3 and 4 are shown in figures 4a, 4b and 4c, respectively. All three specifications show the same pattern: A pair of cities having been part of the Hanseatic network in combination with a Hanseatic flag

[7]Relatively few Hansa cities were subject to direct war action, such as Riga in 1700, 1701, 1710. The war, however, 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. (Kroll, 2006)

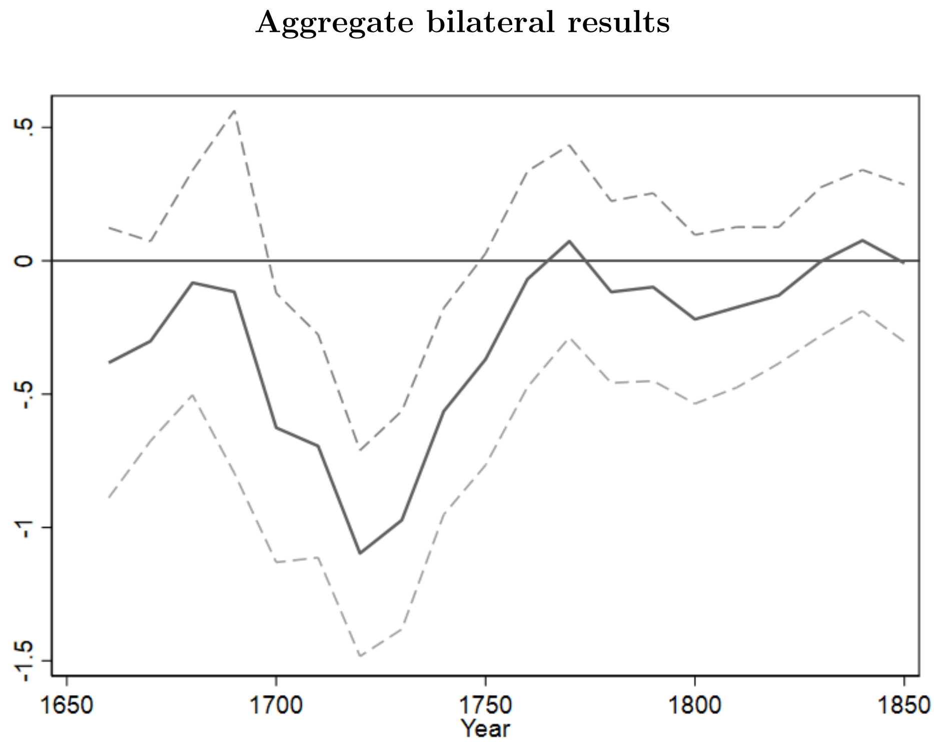


Figure 3: Aggregate bilateral estimation on decadal data. Estimation of equation 1 using PPML and a complete set of decade-interacted origin and destination fixed effects. Shown are point estimates of β_t accompanied by confidence intervals. Standard errors clustered on city pairs. Mean of flows: 2.3. When zooming in, we find that trade flows among Bremen, Hamburg, Lübeck, Rostock, and Danzig actually fall to zero for many years during the war. Comparing the first decade of the war to the last decade of peace, overall trade within the former Hansa network falls to about 60 percent, whereas all other trade falls only to about 75 percent. By the late stages of the war, trade within the former Hansa network had fallen to about a quarter of its pre-war level, and during the first decade of peace, the 1720s, Hansa trade recovered to the pre-war level, whereas all other trade overshot peace levels by 40 per cent.

implies trade flows larger than the predictions of a gravity model. These positive effects are economically large. They usually range between 0.5 and 1, implying excess trade of 65 to 172 percent. They also persist until well in the 19th century, with no apparent downward trend. Thus, even though the Hanseatic network had no lasting effect on aggregate city-to-city trade, it had a very strong and long lasting effect on the identity of traders and the composition of trade flows.[8]

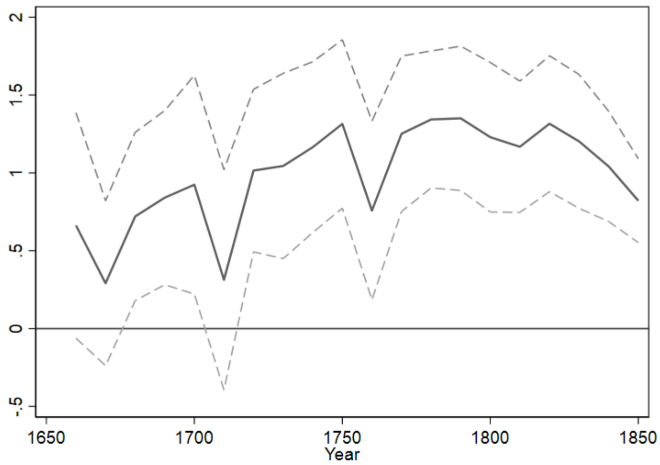
We believe that a ship's home port is a plausible measure of trader identity, but it is of course a rather coarse and indirect one. As an alternative measure, we therefore make use of the fact that the Sound Toll also registered the captain's last name. In order to code whether a last name is Hanseatic, we assemble a list of all last names of the mayors of eleven Hanseatic cities up to the year 1700 and also use all recorded last names for attendees of the Hanseatic League's general assemblies, the Hansetage.[9] When a captain's name coincides with a mayor's name, we deem this last name Hanseatic. This is a more direct, but also much more conservative measure of Hanseatic identity, as it it based on mayors from only eleven cities, the League's general assemblies and generally only on family names that made it to the very top of the respective societies. It is therefore likely a lower bound for Hanseatic identity. It is important to note that Hanseatic last names overlap, but do not coincide, with being German speaking. Most German last names are not classified as Hanseatic, and most Hanseatic last names exist in Dutch and the Scandinavian languages. In the history section, we illustrate why and how Hanseatic identity exists outside of German identity. In total, we assemble 797 unique last names from mayors' lists and 104 unique last names from Hansetag attendees. About 3.5 per cent of trade flows are carried out by captains with a Hanseatic last name according to this metric.

In figures 5a, 5b and 5c, we repeat our analysis, but replace the ship's home port dimension by the captain's last name. We generally find lower, but usually still positive, significant, and lasting effects of Hanseatic trade identity.

[8]In a placebo exercise, we randomly assign ten percent of cities to a placebo Hansa and find that this placebo Hansa identity does not display effects on trade.

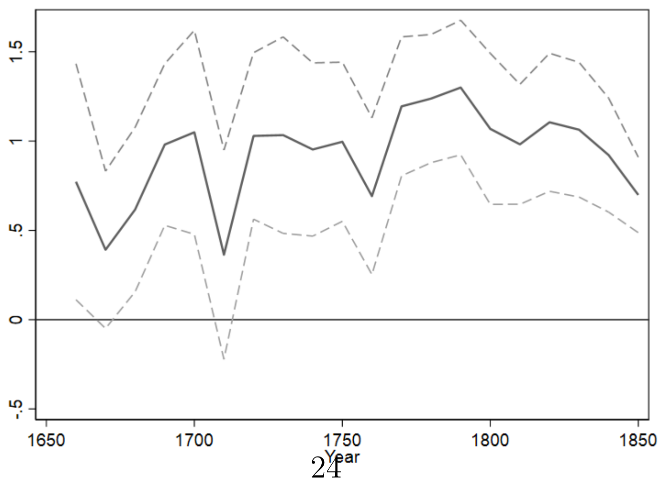
[9]The cities whose mayors' names we record are Lübeck, Hamburg, Bremen, Rostock, Greifswald, Danzig, Stettin, Stralsund, Anklam, Demmin, and Reval/Tallinn. Mayors' names have been collected from Wikipedia lists. Hansetag attendees compiled from Waitz, 1870.

Homeport-level results



(a) Trilateral Hansa dummy, multinational production

(b) Trilateral Hansa dummy, sector-level gravity



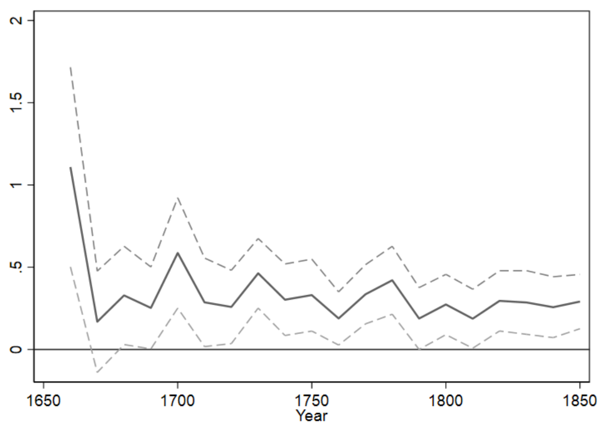
(c) Trilateral Hansa dummy, (route-time) fixed effects

Figure 4: PPML estimation of equation 2 with (origin-time) and (destination-flag-time) fixed effects in figure 4a, of equation 3 with (origin-flag-time) and (destination-flag-time) fixed effects in figure 4b, and of equation 4 with (origin-destination-time) and (flag-time) fixed effects in figure 4c. Shown are point estimates of β_t accompanied by confidence intervals. Standard errors clustered on city pairs.

Last name-level results

(a) Trilateral Hansa dummy, multinational production

(b) Trilateral Hansa dummy, sector-level gravity



(c) Trilateral Hansa dummy, (route-time) fixed effects

Figure 5: PPML estimation of equation 2 with (origin-time) and (destination-last name-time) fixed effects in figure 5a, of equation 3 with (origin-last name-time) and (destination-last name-time) fixed effects in figure 5b, and of equation 4 with (origin-destination-time) and (last name-time) fixed effects in figure 5c. Shown are point estimates of β_t accompanied by confidence intervals. Standard errors clustered on city pairs. In figure 5b, data are in thirty year intervals, not in decades, as too few observations lead to computational issues on decadal data.

7 Robustness

Our results so far were based on restricted samples: In the city-level case, we only included city pairs where we see at least one trip over our data period. Similarly, when introducing a ship's homeport, we only include origin x destination x home port combinations that appear at least once in the data. These restrictions make the datasets considerably smaller. In the aggregate case, we have 17,648 directed city pairs that we actually observe. Accounting for the fact that only trade connections which cross the Sound are theoretically observable to the researcher would yield 414,123 theoretically possible city pairs. In order to investigate the degree to which city pairs' selection into this restricted sample poses a problem, we fill in the matrix of trade flows to cover all potentially observable bilateral trade connections. Figure 6a shows our bilateral results for this filled-in sample. As can be seen, the results are very similar to the ones for the restricted sample: No trade persistence of the Hanseatic network, and even a negative effect during the years of and following the Great Northern War. Thus, selection into the restricted sample of trade flows which are not zero throughout the twenty decades we study does not seem to be an important issue for the investigation of bilateral persistence[10].

Unfortunately, we cannot repeat the same exercise for the home port analysis. The triple combination of more than a thousand possible cities leads to billions of possible permutations, making the filling in of the whole matrix computationally infeasible. However, given the aggregate results, we find it plausible to assume that using the restricted sample does not pose problems on the flag-level either.

Another issue that relates only to the results based on the home port is that the effect there could simply be due to the fact that ships owned in a certain city usually trade between this city and another one, independent of former Hansa status. In the appendix, we therefore additionally control for a dummy that is one if the home port is the same as either the origin or destination port[11]. Results are shown in figures 7a and 7b. Results are similar and indicate a strong role for trader identity.

We further check robustness to the issue of land transport around the Sound by excluding short-distance connections in figures 8a, 8b, and 8c. Results are similar to before. To rule out

[10]Selection, however, shows up in our distance estimates. In the sample containing all possible bilateral connections, we find strongly negative estimates on log distance over sea between origin and destination harbour. In our main sample, we tend to find positive estimates. While estimates on Hansa dummies are not affected by selection, distance estimates are.

[11]We only run this check for specifications 2 and 4: In specification 3, the (origin x home port x time) and (destination x home port x time) fixed effects absorb this potential confounder.

that our unit of account, the number of ships, is mechanically driving these results, we further report results on using taxed value, a proxy for the value of goods, as the dependent variable. This is recorded for about 80 per cent of voyages included in our panel[12]. These results are displayed in figures 9b, 9a and 9c. Effects are somewhat imprecise in the first decade, but in line with our results afterwards.

8 Conclusion

In this paper, we employ an extensive city-level trade panel to shed light on the factors that contribute to the persistence of trade. We study the consequences of the demise of the Hanseatic League, a confederation of merchant cities in Northern Europe. After the Hanseatic League was dissolved in 1669, we do not find that former members of the Hanseatic network traded more with each other than predicted by a gravity framework. This is weaker than similar findings by Head, Mayer and Ries, 2010 in the case of former colonies and Beestermöller and Rauch, 2018 regarding the former Austro-Hungarian Empire. All bilateral trading capital that had been created between members of the Hanseatic network therefore seems to have depreciated completely by the time the League was formally dissolved.

The quality and high resolution of our data allow us to further analyse the origins of such trading capital. Guided by the historical narrative which highlights the role of merchant networks and privileges granted to traders from Hanseatic cities, we incorporate traders identity into our analysis, measured as the city of origin of the ship's captain. We find that former Hanseatic trade patterns persisted much longer, but only if not only origin and destination cities were part of the Hansa-Kontor trade network, but also the captain owning the ship was of Hanseatic identity. This highlights the role of social networks and trader identity in shaping trade flows, a point further illustrated by the prevalence of German last names among captains of ships sailing under Hanseatic flags. Our results illustrate that trading capital may be hidden in specific relationships and may sometimes only be uncovered by using high-resolution data and careful investigation of historical circumstances.

Our paper highlights the important role of social and cultural ties and the identity of traders in the formation and maintenance of networks. Economic control of resources can be maintained

[12] Due to composition effects and flat fee elements, the amount of taxes paid is not a constant fraction of true value; we argue, however, that our rich set of fixed effects accounts for a substantial part of concerns. (e.g. smaller ships paying a higher effective proportional tax rate due to flat fee elements).

within small groups for centuries. Networks are hard and costly to build, but once established they can survive for centuries.

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A Appendix

A.1 Hansa and city populations

We use data by Bairoch, Batou and Chèvre, 1988 to investigate whether Hanseatic cities were larger than other cities. 273 cities in our trade data have matching population data, and we add information on city constitutions, the presence of a university, some geographic data, and a city's legal status as controls, building on the data set provided by Bosker, Buringh and Zanden, 2013. In table 1, we use this unbalanced sample of cities to see whether Hanseatic cities were different in terms of population than other cities in our dataset. We find that they were not significantly larger than other cities, neither over the long run, nor in the time frame in which we observe trade data.

A.2 Aggregate Bilateral Estimation - Further Results and Robustness checks

To address selection of trade flows, we fill up the matrix and include all possible bilateral trade connections by decade. In our main estimation, only trade connections which are observed at least once in 190 years are included. In this robustness check, we include all bilateral combinations, even if trade flows are zero throughout. Results are shown in 6a and are very similar to our baseline results.

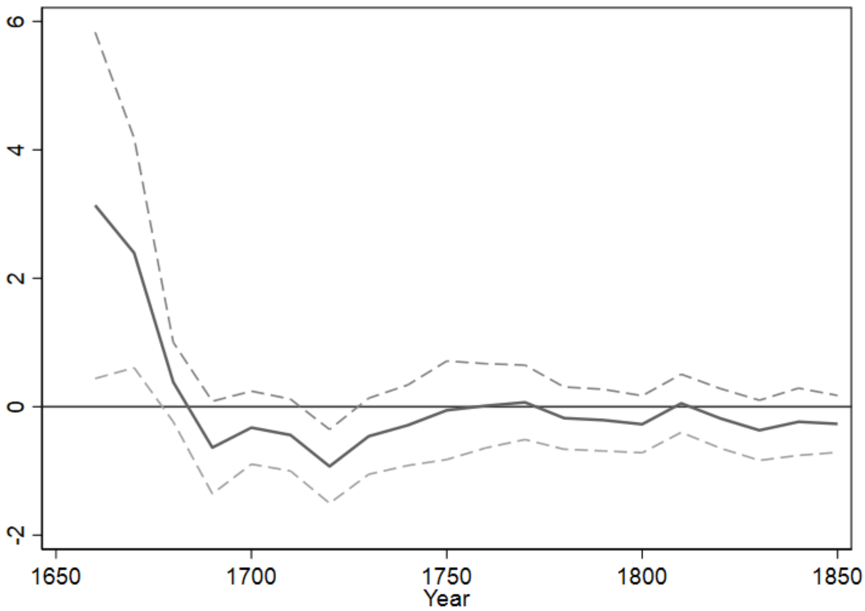
Variables	(1) lnpop	(2) lnpop
	800-1850	1600-1850
Hanse	0.231	0.241
	(0.221)	(0.269)
Elevation	0.024	0.023
	(0.014)	(0.015)
Suitability	-1.050***	-1.178***
	(0.260)	(0.289)
West of Sound	0.252	0.167
	(0.183)	(0.199)
Reichsstadt	0.896***	1.037***
	(0.223)	(0.304)
University	1.192***	1.205***
	(0.233)	(0.250)
Lübisch constitution	0.665*	0.560
	(0.263)	(0.356)
Magdeburger constitution	0.799**	0.782*
	(0.307)	(0.377)
Observations	1,310	891
Number of cities	273	273

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

Table 1: Column 1: Regressions of ln population of 273 cities and centuries 800 to 1800 and 1850. Standard errors clustered at city level are below estimates in brackets. Results obtained for pooled OLS. Additional control variables included, but not displayed: time dummies for centuries from 800 to 1800 (the constant captures 1850), the inverse hyperbolic sine of distance to the coast, the inverse hyperbolic sine of distance to the river, the inverse hyperbolic sine of ruggedness, the inverse hyperbolic sine of average annual temperature, latitude and longitude. Elevation and suitability are also transformed using the inverse hyperbolic sine. Column 2: Like column 1, but only for 1600-1850; time dummies for 1700, 1800 and 1850; the constant captures 1600. Standard errors clustered at city level are below estimates in brackets. Pooled OLS.

Aggregate bilateral results on all connections and on taxed value

(a) Bilateral Hansa dummy. All possible connections



(b) Bilateral Hansa dummy on taxed value

Figure 6: Aggregate bilateral estimation, including all possible bilateral trade connections by decade in figure 6a and using taxed value as the dependent variable in figure 6b. PPML estimation with (origin-time) and (destination-time) fixed effects, controlling for log distance over sea interacted with decades. Shown are point estimates of β_t accompanied by confidence intervals. Standard errors clustered on (origin, destination) pairs.

A.3 Homeport-level Estimation- Further Results and Robustness checks

Results controlling for same harbour dummies (equal to one when either origin or destination coincide with the flag) are shown in figures 7a and 7b. The sectoral-gravity specification does not lend itself to this specification, as its fixed effects absorb the same harbour dummies.

Figures 8a, 8b and 8c show results excluding the ten per cent of shortest trips in order to address the issue that for short-distance trips, land transport was potentially viable alternative, so that we might not capture all trade for these trips.

Figures 9a, 9b and 9c show results from regressing on taxed value rather than on the number of ships.

Homeport-level results with same harbour dummies

(a) Trilateral Hansa dummy, multinational production

(b) Trilateral Hansa dummy, (route-time) fixed effects

Figure 7: PPML estimation including same harbour dummies (equal to one when either origin or destination coincide with the flag) of equation 2 with (origin-time) and (destination-flag-time) fixed effects in figure 7a, and of equation 4 with (origin-destination-time) and (flag-time) fixed effects in figure 7b. Shown are point estimates of β_t accompanied by confidence intervals. Standard errors clustered on city pairs.

Homeport-level results excluding short distances

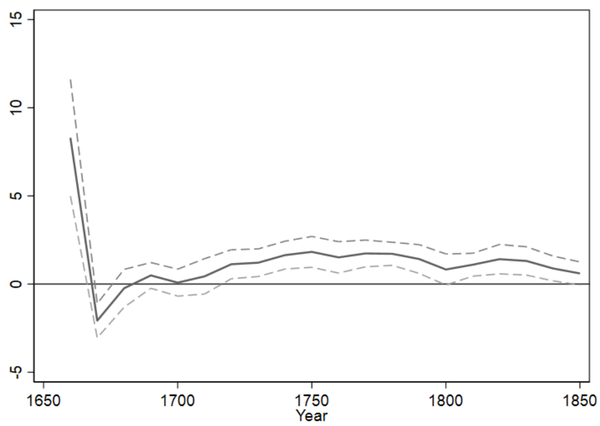
(a) Trilateral Hansa dummy, multinational production

(b) Trilateral Hansa dummy, sector-level gravity

(c) Trilateral Hansa dummy, (route-time) fixed effects

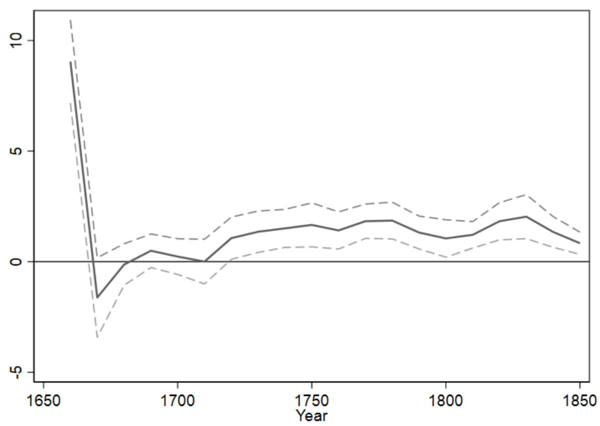
Figure 8: PPML estimation excluding the ten percent of shortest trips of equation 2 with (origin-time) and (destination-flag-time) fixed effects in figure 8a, of equation 3 with (origin-flag-time) and (destination-flag-time) fixed effects in figure 8b, and of equation 4 with (origin-destination-time) and (flag-time) fixed effects in figure 8c. Shown are point estimates of β_t accompanied by confidence intervals. Standard errors clustered on city pairs.

Homeport-level results on taxed value



(a) Trilateral Hansa dummy, multinational production

(b) Trilateral Hansa dummy, sector-level gravity



(c) Trilateral Hansa dummy, (route-time) fixed effects

Figure 9: PPML estimation of equation 2 with (origin-time) and (destination-flag-time) fixed effects in figure 9a, of equation 3 with (origin-flag-time) and (destination-flag-time) fixed effects in figure 9b and of equation 4 with (origin-destination-time) and (flag-time) fixed effects in figure 9c. Shown are point estimates of β_t accompanied by confidence intervals. Standard errors clustered on city pairs. In figure 9b, data are in twenty year intervals, not in decades, as too few observations lead to computational issues on decadal data.