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Network Analysis of a Maritime Trade in Medieval Japan

Visualizing the 1445 Toll Register of Incoming Ships at the Hyōgo Northern Barrier (present-day Kobe)

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Keywords medieval Japan, ports, commercial agents, shipmaster, maritime trade, commodification

Abstract The 1445 *Toll Register* is the only surviving medieval customs register in Japan. As such, it is a precious window into Japan's medieval commercial revolution. While well studied using traditional methods, this article is the first attempt to submit this source to social network analysis (SNA) methods. It highlights the potential of statistical, spatial and network analysis, producing visualizations which nuance our understanding of the role of commercial agents in the medieval maritime trade. Starting from visualizing the overall network, this article probes into the legwork of a commodity network, much of which passed through the hands of the commercial agents. Our analysis also reveals that a group of 32 actors, who in the register appear to have been principally commercial agents, were in fact also shipmasters. A community detection method allows us to open up new avenues of understanding maritime trade clusters, while geo-spatial data visualization point to a historically irregular absence which requires further research.

Introduction

Between the end of the thirteenth century and the beginning of the fifteenth century, Japan underwent what has been called a commercial revolution, a process whereby the large sustenance economy of the archipelago, grounded in landed estates established in the eleventh century, transformed into a market-driven and commodity-based economy with the Kyoto Imperial Capital at its center. In the process, key economic institutions – landed estates, the imperial court, and monasteries – weakened and eventually lost their role as primary economic drivers of the realm as the interregional trade connections grew stronger.¹

This article seeks to shed light on Japan's medieval commercial revolution by applying quantitative historical methods and social network analysis to the only known and oldest surviving toll register: *The Register of Incoming Ships at the Hyōgo Northern Barrier of the Second Year of Bunan* (1445) (hereafter the 1445 Toll Register).² This document records a total of 1969 ship entries at one of the two toll gates of the port of Hyōgo (present-day Kōbe). The document is remark-

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- 1 While there are competing definitions of the medieval period in Japanese historiography, for the purpose of this article 'medieval' or 'Middle Ages' refers to the period from the first shogunate in Kamakura in 1192 to the beginning of the Ōnin war (1467–77), a conflict that triggered a period of over 100 years of archipelago-wide violence known as the Warring States period.
- 2 Japanese names are given with the surname first, according to the custom in East Asia. Modified Hepburn is used for the transcription of all Japanese terms in the text. By convention, a Buddhist institution is translated as 'temple' or 'monastery' and a Shintō institution as 'shrine.' This being said, the names of specific religious institutions are given as proper nouns, and after the first occurrence we speak of 'Tōdai-ji' or 'temple' and not 'the Tōdai-ji temple.' All references to the months indicate the months of the lu-

able in that it remains the sole extant record of activity at a toll barrier for this period in Japan, and to the best of our knowledge in East Asia.

Since its discovery in 1964, the 1445 *Toll Register* has been the subject of much research among medieval Japanese historians. However, in contrast to the uptake of historical network research (HNR) methods in continental Europe, with rare exception, the history of medieval Japan has been largely immune to social network analysis (SNA).³ While the benefits of applying SNA, alongside traditional historical methodology, in the history discipline as practiced in Europe are well recognized, this article is an attempt to extend this method to a field of the history of Japan, in particular the medieval period. Our goal is to model the use of SNA in the domain of Japanese history, with special attention to advancing our comprehension of the medieval commercial revolution. This being a pivotal period in the history of medieval Japan in which sources remain few and far between, historians of medieval Japan have much to gain by applying new methods to rare existing sources with an eye to nuancing our shared understanding of this revolution. For this purpose, the study of toll barriers is one of the key building blocks for understanding the process of increasing commodification of goods on a global scale.

In sum, the 1445 *Toll Register* provides a precious snapshot of what was the final act of the transition from tribute to commodity economy, which was the basis of the new political architecture put in place since the 1500s. The purpose of combining quantitative historical network analysis with more traditional data visualizations (graphs and figures) is to advance our understanding of this historical change, in the absence of qualitative sources that would enable deeper knowledge of the 52 commercial agents and just under 340 shipmasters who appear in this source. While we agree that a quantitative analysis alone cannot give a full sense of any historical transition, for this period of Japan's history qualitative sources remain extremely rare, and historical network analysis has not yet been used in its analysis. We postulate that network visualization is particularly useful for revealing: 1) the nature of the reconfiguration of coastal maritime trade and transport networks in Japan; 2) the process of transition from the transport of rents in kind to the transport of commodities; 3) the relationship between ground-level operators of this transition; and 4) the dynamic relationship between religious institutions, political power, and regional trade and transportation actors.

nisolar calendar in use in Japan until 1873. In this context, the third month (or moon) approximately corresponds to April (and not March).

3 For an exception, see the work-in-progress by Paula Curtis on the network analysis of the letter exchange of a warrior magistrate in sixteenth century Japan. Paula Curtis, "Network Analysis," last accessed January 25, 2024, https://prcurtis.com/DH/network_analysis/.

The Seto Inland Sea: The Economic Artery of Japan

A narrow body of water, stretching 400 km in length East-to-West and anywhere between 4 km and 60 km North-South, the Seto Inland Sea is the principal supply channel for the region of Kyoto, the political, economic, demographic and religious center of ancient and medieval Japan. Its population is estimated between 100,000 and 200,000 inhabitants, which would make Kyoto city the size of Venice or Paris at the same point in time.⁴ An analysis of the commercial activity in the Seto Inland Sea region is of the utmost importance to understand the trajectory of the socio-economic transformation of medieval Japan.

Historically, Hyōgo and Sakai were the two largest gateways to Kyoto until the destruction of Sakai in 1399.⁵ From the moment of Sakai's destruction, and up until the moment when Hyōgo itself was destroyed during the 1467–77 civil war, the latter was the primary hub for the circulation of goods from the Seto Inland Sea towards the centers of power and wealth in the broader Kyoto region.⁶ Initially, transportation of rents in kind to the Kyoto region, which included the town of Nara with its powerful Buddhist temples, was the basis for the flow of goods in Japan. The fourteenth century saw the first signs of decline in the frequency (and arguably also volume) of the transportation of rents in kind along the Seto Inland Sea routes. By the time of the 1445 *Toll Register*, the transregional maritime circulation was largely that of goods and not in-kind rents, a symptom of what has been referred to as the 'medieval commercial revolution.'⁷

Political Turmoil and Commercial Revolution

The tectonic shift in the nature of the transregional maritime circulation of goods and people was part of the medieval commercial revolution developing against the background of fierce political drama. The point of origin for the 1445 *Toll Register* was the 1308 imperial gift of the revenue from the port toll to a power-

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- 4 William Wayne Farris, *Japan's medieval population: Famine, Fertility and Warfare in a Transformative Age* (Honolulu: University of Hawai'i Press, 2006), 151. Yamamura Kozo, "The growth of commerce in medieval Japan," in *The Cambridge history of Japan* 3, ed. Yamamura Kozo (Cambridge: Cambridge University Press, 1990), 377. Suzanne Gay considers, however, that this figure is probably overestimated. Suzanne Gay, *The Money-lenders of Late Medieval Kyoto* (Honolulu: University of Hawai'i Press, 2001), 32.
 - 5 Sakai was almost entirely destroyed during the Ōei rebellion (1399) fomented by Ōuchi Yoshihiro 大内義弘 (1356–1400) against the Muromachi bakufu. After its destruction, Sakai became part of the Hosokawa warrior clan's governorship and gradually grew to rival Hyōgo during the fifteenth century.
 - 6 Takashima Masanori, *Keizai seichō no Nihonshi* (Nagoya: Nagoya daigaku shuppankai, 2017), 156–57.
 - 7 Suzanne Gay, "The lamp-oil merchants of Iwashimizu shrine," *Monumenta Nipponica* 64, no. 1 (Spring 2009): 1–51.

ful Buddhist temple located in Nara, near Kyoto. However, between 1308 and 1445, little remained the same in the political life of the realm. Twenty-five years after the revenues were granted, the Kamakura shogunate crumbled. The ensuing short-lived restoration of imperial primacy (Kenmu Restoration) and subsequent emergence of the Muromachi shogunate split the court into North and South Court, two rival imperial courts between 1335 and 1392. For almost 60 years, regular clashes, including military, between the two courts and their proxies caused much turmoil for the entire country. One manifestation of political tensions was the overwriting of the integrity of the imperial gift. In 1338, 30 years after the initial imperial gift, the shogun overwrote the court. Another Buddhist temple in Nara, Kōfuku-ji, lobbied the shogunate for the right to collect the tolls in Hyōgo to be taken away from Tōdai-ji and given to itself. The shogunate cut the pie in two, giving half of the port revenue to Tōdai-ji's rival⁸.

These unstable structures of authority lasted until the shogunate united the court by military power in 1392. The decades that followed, from the 1390s to the 1420s, were a period of relative stability when the shogunate exercised substantial economic and political power.⁹ The year 1428 marks the turning point when vassals started clashing among themselves, and increasingly challenged the primacy of the shogun. In 1441, in a decisive act of rebellion against the regime, shogun Ashikaga Yoshinori (足利義教) was assassinated by a disgruntled vassal. The 1445 *Toll Register* comes to us amidst this kind of escalating tension, which reached a climax with the Ōnin War, a decade that practically razed the region of Kyoto to the ground, including the city itself and its major port of Hyōgo. As violent as it was, the Ōnin War was merely the first act of a century and a half of intestine wars, known as the Warring States period (1467–1600).

Deeply embedded in the bipolar structure of Japanese politics were several dozen Buddhist temples. Hamstrung between the imperial court and the shogunate, they were formidable economic actors in their own right. Also known as *kenmon* 権門 in Japanese, they were part of the tripartite structure that characterized the medieval state.¹⁰ Mikael S. Adolphson has coined the term 'The Gates of Power' to describe this phenomenon in English in his pioneering monograph of the same title.¹¹ Traditionally, temples lived off land revenues, not toll

8 Tōdai-ji is a Buddhist temple of the Kegon sect, part of the Seven Great temples of Japan. Today it is renowned for being listed as a UNESCO World Heritage site and is the home of the Great Buddha, the largest bronze statue of Buddha.

9 Imatani Akira, *Muromachi no ōken: Ashikaga Yoshimitsu no Ōken sandatsu keikaku* (Tokyo: Chūō kōron shinsha, 1990), 217–18.

10 Kuroda Toshio, "Chūsei no kokka to tenno" (The Medieval State and the Emperor), in *Iwanami kōza Nihon rekishi* (Iwanami Japan History Textbook), t. 6, (Kyotokyo: Iwanami shoten, 1963), 261–302.

11 Mikael S. Adolphson, *The Gates of Power: Monks, Courtiers, and Warriors in Premodern Japan* (Honolulu: University of Hawai'i Press, 2000).

barriers. Revenues, in the form of annual rents in kind from landed estates scattered around the archipelago, provided a substantial portion of the operating costs for religious institutions. However, from the early thirteenth century, the estate stewards appointed by the shogunate had proven proactive in aggressively appropriating land revenues, thus siphoning resources away from the temple and partly redirecting them into shogunal coffers. In response, Tōdai-ji and other traditional landlords had to find alternative sources of income and appear to have turned to the imperial court for rescue. Arguably, the 1445 *Toll Register* is a rare indication of how the imperial court pushed back against the power grabbed by the warrior elites.

In 1308, the retired Emperor Fushimi 伏見上皇 (r. 1287–1298) made a so-called ‘perpetual gift’ of the proceeds from the customs at the Hyōgo port to Tōdai-ji in Nara. Buddhist temples receiving ‘perpetual imperial’ gifts were infrequent and when these gifts occurred, they were usually a-limited-time-only gifts. Nonetheless, the 1308 ‘perpetual gift’ by the emperor was the only one of its kind during this period.¹² The existence of the 1445 *Toll Register* testifies to the fact that it was in effect for at least 150 years, which although not perpetual, remains extraordinary.

In the beginning of the fifteenth century, international trade with Ming China, a major financial source for the shogunate since 1404, was interrupted in 1411.¹³ From then on, the shogunate was solely dependent on income from internal trade. Arguably, the financial need of the shogunate to compensate for the lost income from international trade was behind its push to impose its control over toll barriers on land, riverways, and sea routes in the broader Kyoto region. However, at least some large temples were able to maintain control over toll barriers and continue to draw revenue from them.¹⁴

12 In the twelfth and first half of the thirteenth centuries, the retired emperors (*in* 院) were sovereigns who voluntarily officially abdicated while retaining effective power over court affairs.

13 Although this international trade was reopened in 1432, it is likely that this had an influence on the direction of the shogunate’s fiscal policies. See Fukao Kyōji, Nakamura Naofumi and Nakabayashi Masaki, ed., *Nihon keizai no rekishi, 1:11 seiki kara 16 seiki kōhan* (Tokyo: Iwanami shoten, 2018), 30.

14 Adolphson, *The Gates of Power*, 288–345.

Landed Estates: The Source of the Goods and Actors

Between the twelfth and fifteenth centuries, landed estates (*shōen* 莊園) were the principal socio-economic units of production for both agricultural products and non-agricultural commodities. There were also key units of social interactions for the vast majority of the archipelago's population.¹⁵ In terms of structure, a landed estate came down to layers of rights (*shiki* 職) to collect annual rent (*nengu* 年貢) and concomitant responsibilities for its transmission.¹⁶ The lord (*ryōshu* 領主), the holder of the land right, belonged to court nobility or a powerful religious establishment and usually lived in the greater Kyoto area; mostly but not exclusively male, these lords were predominantly absentee landlords. The rights pertained to arable land as well as forest and sea resources. Each layer was embedded within a social hierarchy at both the level of the estate and the pecking order of the capital.¹⁷

Moving the annual rent from the estate to the landlord was a critical moment of the year for all parties involved, in particular for peasants and local estate managers. Upper-level peasants (*myōshu* 名主) were responsible for overseeing the collection and payment of rents and taxes from the tenants; they would then hand the collected rent to the estate manager, who in turn channeled the rent to the capital. Fragmentary evidence suggests that at least some of these upper-level peasants were responsible for transportation, and thus accompanied the cargo on the ships.¹⁸ By some indicators, the upper-level peasants in charge of, among other things, the transportation of rents in kind from the estate to Kyoto assumed the role of 'helmsman' (*kandori* 梶取), the person directly in charge of the transport.¹⁹ As the rent transports were once-in-a-year affairs, nothing allows us to assume that the rent transporters were anything but non-specialist transporters, men chosen among the peasants of the landed estates and charged with ensuring the safe delivery of rent to the landlord.

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- 15 Nitadori Yūichi, "Chūsei kōki no shōensei," in *Shōen kenkyū no Ronten to tenbō*, ed. Kamakura Saho Kimura Shigemitsu, Takagi Tokurō (Tokyo: Yoshikawa kōbunkan, 2023), 59–71.
 - 16 Nagahara Keiji, *Nihon no chūsei shakai* (Tokyo: Iwanami shoten, 2001 [1968]), 252–259. Amino Yoshihiko, *Chūsei Tōji to Tōji-ryō shōen* (Tokyo: Tokyo daigaku shuppankai, 1987 [1978]).
 - 17 At its apex was the patron (*honke* 本家), followed by the possessor (*ryōke* 領家/*ryōshu* 領主), each of whom might be the actual holder (*honjo* 本所) of the estate's administrative rights (*shōmu* 莊務). Next were the estate officers (*shōkan* 莊官), including the manager (*azukari-dokoro* 預所). The holders of units of production and payment of rents (*myōshu* 名主) made up the body of upper-level peasants that held a right to farm or exploit resources on assigned plots. Finally, tenants (*sakunin* 作人) and subcontracted farmers (*gesakunin* 下作人) were at the base of this pyramid.
 - 18 Shinjō Tsunezō, *Chūsei sui.un-shi no kenkyū* (Tokyo: Hanawa shobō, 1994), 71.
 - 19 *Nihon engyō taikei: Shiryō-hen, kodai, chūsei* I, ed. Nihon Engyō taikei henshū iinkai (Tokyo: Nihon senbai kōsha, 1982), doc. no. 173, 291–295.

During the course of this century, along with the monetizing of the economy, the rent payment system had been dramatically transformed.²⁰ The introduction of the system known as tax commutation (*daisennō* 代銭納) meant that rents were no longer payable in kind or *corvée*, but rather in copper currency. In practice, the estate products were sold locally, and rent collected at the estate from where it was sent in metal currency under the responsibility of the estate manager. The landowners could use the rent money to purchase commodities not produced from their own lands.²¹ In terms of the flow of goods from the domain, the change did not mean that agricultural products from the estate no longer traveled to the capital. These were first traded at a local fair to obtain the metallic currency used to pay dues to the landlords. Now commercial goods, the products could either be distributed in the regional market or sold to local intermediaries to be traded in Kyoto, whose market maintained its prominence.²² One consequence of this shift was the professionalization of transporting goods. From upper-level peasants accompanying a shipment to the capital once a year, we see the emergence of actors, outsiders to the estate, who move back-and-forth several times a year, all year round. For the purpose of this article, it is important to highlight that the 1445 *Toll Register*, although limited to a single year, provides an unprecedented data snapshot of the estate economic transition which underpinned the medieval commercial revolution.

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- 20 After a brief attempt at coinage in the eighth century, Japan abandoned attempts to monetize. It was only in the Tokugawa period that Japan restarted coinage. However, in the course of the twelfth century, large quantities of copper coins were injected into Japanese economic life via trade with Song China (960–1279). Even when international trade came to a halt for political reasons, Japan did not issue its own currency but continued using Chinese coinage, and developed a monetized market economy without issuing its own currency. This makes Japan a rare case of using a foreign currency to fuel the commercial revolution, which does not imply control over monetary policy by either the court or the shogunate. Ōyama Kyōhei argued that the initiative for the practice of tax commutation during the Kamakura period (1185–1333) was to be found in the peripheries and not the center. See Ōyama Kyōhei, “Chūsei sonraku ni okeru kangai to senka no ryūtsū; Tanba no kuni Ōyama no shō Nishita.i mura,” *Hyōgo shigaku* 27 (1961): 1–20.
- 21 Hayashima Daisuke, “Chūsei no kinyū,” in *Nihon keizai no rekishi I: 11 seiki kara 16 seiki kōhan*, ed. Fukao Kyōji, Nakamura Naofumi and Nakabayashi Masaki (Tokyo: Iwanami shoten, 2018), 116–45.
- 22 Ethan Isaac Segal, *Coins, Trade, and the State: Economic Growth in Early Medieval Japan* (Cambridge/London: Harvard University Press, 2011), 148–83.

Source and Methodology

The Source

What we refer to as the 1445 *Toll Register* is in fact a document pieced together from two manuscripts. A fragment of the register was known to exist and had been kept at the University of Tokyo since before the Second World War.²³ However, being a fragment, it was virtually unusable for large-scale historical analysis. In 1964, Hayashiya Tatsusaburō discovered a manuscript that turned out to be the bulk of the register, which is now kept at the Kyoto Municipal Archives.²⁴ This discovery made it possible to combine the two documents into a complete source, the transcription of which was published in 1981.²⁵ Taking these two existing documents of port traffic together and adding the data loss estimated by Sakurai Eiji, there were 3000 ships that came into the northern checkpoint of the port in 1445.²⁶ No comparable register has ever been found for the southern barrier or entry point, nor for any other port in this period.²⁷

The organizing principle of the *Toll Register* is the date of the ship's entry into the port. In addition to the date, for each ship, there are up to seven data points available:

- 1) Toponym
- 2) Cargo merchandise
- 3) Volume
- 4) Monetary value of copper coins (*mon* 文); when applicable, name of the *laissez-passer* holder
- 5) Date
- 6) Name of a person
- 7) Name of a person

23 *Tokyo daigaku bungaku-bu shozō bon.*

24 *Kyoto tōshin bunko shozō bon.*

25 Hayashiya Tatsusaburō ed., *Hyōgo kitazeki irifune nōchō* (Tokyo: Chūō kōron bijutsu shuppan, 1981).

26 Sakurai Eiji, "Chūsei no shōhin shijō," in *Shin taikei nihonshi, 12: Ryūtsū keizaishi*, ed. Sakurai Eiji and Nakanishi Satoru (Tokyo: Yamakawa shuppansha, 2002), 216.

27 Taken together, the two pieces of the register cover almost the entire second year of the Bunan era (1445 in the Gregorian calendar), with only minor gaps. The first manuscript spans from the first month to the ninth day of the second month of the second year of Bun.an. The second manuscript starts from the third day of the third month to the first month of the following year. Therefore, there is a gap of 23 days between the tenth day of the second month and second day of the third month.

Data point #1 is a place name and was first supposed to refer to the region of the origin of production,²⁸ or alternatively the last loading port through which the vessel had passed.²⁹ However, for a substantial number of entries, the toponym was identical as the toll barrier clearing port. As a consequence, the current consensus is that the toponym refers to the port of registry or the ‘home port’ of the vessel or its shipmaster. Although these nuances are important to keep in mind, it is also true that the distinction between the production area and the home port of the vessel was effectively tenuous, as ports were intrinsically connected to their hinterlands. This is particularly clear in the case of the salt and wood cargoes noted in the register. As a consequence, our analysis takes data point #1 as referring to what amounts to the port of registry – the home base of either shipmaster or ship owner.

The ports or registry noted in the register cover the entire Inland Sea, from the Buzen Province in the west to Sakai in the east. The large Shikoku Island to the south is also included in the commercial area indirectly described by our document, as far as the Awa and Tosa provinces, which are open to the Pacific Ocean (Fig. 1).

Data point # 4 is unanimously taken to refer to the amount of money paid for customs clearance fees (*sekiryō* 関料), and is expressed in copper coins. Data point #5, which is the second date in most entries, appears to be the effective toll payment date, anything between from several days to several weeks from the day of docking.³⁰

Data point #6 is considered to refer to the name of the shipmaster (*sendō* 船頭), that is the person physically involved in the transportation. Data point #7 is assumed to be the name of a commercial agent (*toimaru* 問丸) based in the port of landing, whose role is to organize the transport and manage the cargo upon arrival; this data point is absent in roughly one quarter of the entries. Historian Kobayashi Yasuo has suggested that shipmasters based in Hyōgo served as their own agents.³¹ More recently, Michelle Damian has suggested that shipmasters based in distant ports may have offloaded their goods before they reached Hyōgo to local shipmasters who worked without agents.³²

28 Tokuda Ken-ichi, *Chūsei ni okeru sui-un no hattatsu* (Tokyo: Gannandō shoten, 1966 [1936]). Abe Takeshi, “Chūsei no suiroseki ni kansuru ichi kōsatsu,” *Nihon rekishi* 135 (September 1959): 12–19.

29 Ono Kōji, “Oroshiuri ichiba toshite no Yodo ichi no hattatsu,” *Rekishi chiri* 65 (June 1935): 1–26.

30 Naturally, no date is given in the case of a transit tax exemption.

31 Kobayashi Yasuo, “Irifune nōchō ni miru kokuryō to kasho,” in *Hyōgo kitazeki irifune nōchō*, ed. Hayashiya Tatsusaburō (Tokyo: Chūō kōron bijutsu shuppan, 1981), 291.

32 Michelle Damian, “Late Medieval Japan’s Seto Inland Sea Seascape: Shipping, Sailors, and Seafaring” (PhD diss., University of Southern California, 2015), 184–85.

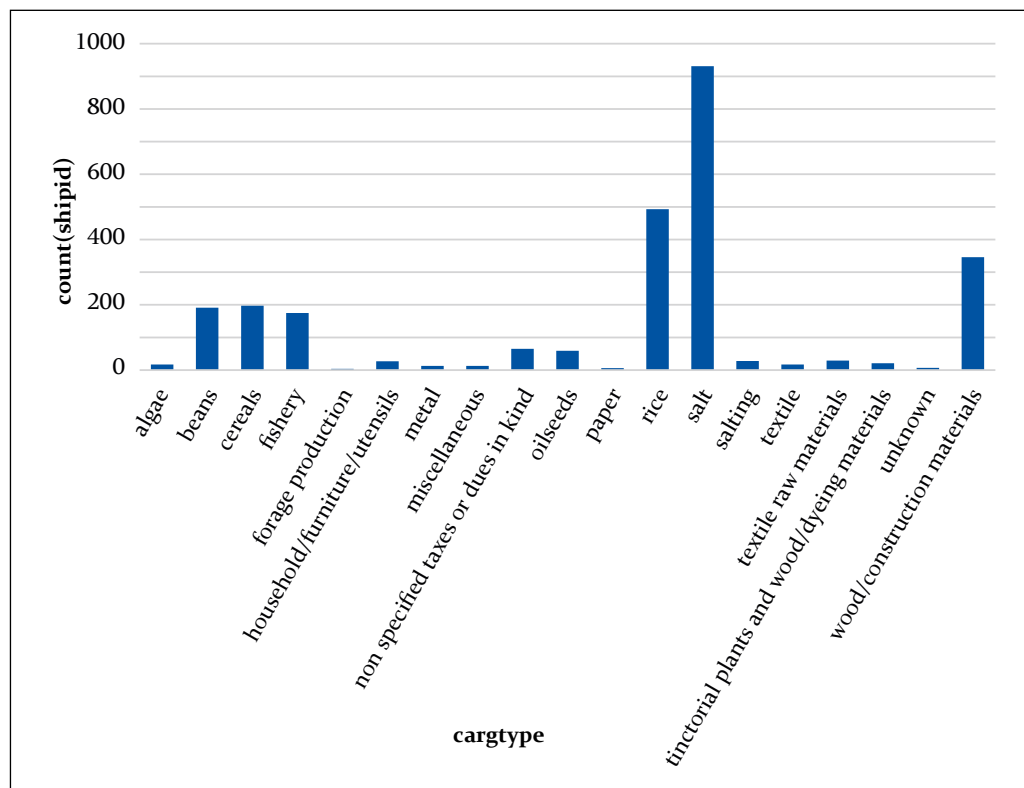


Fig. 1 Breakdown of the number of shipments for each product category (listed alphabetically). Salt was by far the most traded item, with rice and wood the second and third most common, respectively. (The ‘thirteenth’ month is the first lunar month of the following year [the third year of Bun.an or the beginning of 1446], for which we only have incomplete data.)

Data Extraction

In preparation for data extraction, we developed a protocol based on the requirement that it be traceable, accessible and reproducible (FAIR).³³ By this we mean that in addition to the raw sources, we sought to make accessible the relational model and the source code upon which it was built, so that subsequent scholarship can reproduce our analysis.

Data were extracted from the register and entered into a relational database built with Heurist.³⁴ The model was built to articulate between historical re-

33 Mark D. Wilkinson et al., “The FAIR Guiding Principles for scientific data management and stewardship,” *Scientific data* 3, no. 1 (2016): 1–9.

34 <https://github.com/HeuristNetwork/heurist> | <https://heuristnetwork.org/>.

search questions and the technical possibilities of the tool. The first step of this process of articulation was grounded in a sustained interdisciplinary dialogue between history and data science. The resulting relational model has the dual purpose of structuring the data input by the research team, as well as structuring the data itself. It was built on the basis of the categories within the 1445 *Toll Register*, and expresses a particular vision of the database: lines in the register connect ships with a port of registry, and these ships carry cargoes; these cargoes have characteristics related to the nature and volume of goods transported; each ship is connected with a shipmaster, and often with a commercial agent; in some cases the ships have a toll exemption letter (*laissez-passer*) when entering the port. In other words, the register is a snapshot of a relational and social network. The second step was a preliminary exploration of the dataset via the Heurist interface, which enables historians to efficiently construct relational databases with limited technical resources and query data (filtering, faceting, cartographic and temporal interrogation). The third and final step of our analysis was to use Gephi³⁵ to query the network, calculate indicators (degree, centrality, clustering) and produce network visualizations to develop hypotheses and, where possible, push the analysis further.

Beyond fulfilling the requirements of the open science and FAIR data approach, our goal was to support the reproducibility of analysis in this paper and thus model a new standard of data reuse and analysis reproduction for historians. The main challenge was to better support the reproductivity of our analysis. For this purpose, we have set up two technical tools: 1) a GitHub³⁶ which allows access to all versions of the datasets and Python code used in this article; and 2) a Jupyter Notebook, which is a Python runtime environment logged in the GitHub of the project.³⁷ Our methodological goal was not only for our data to be interoperable and therefore reusable, but more importantly for readers to be able to replicate our exploratory analysis with the above-mentioned tools and environment. By going to the J-InnovaTech Jupyter, it is possible to interactively query our data and reproduce our analysis of a given phenomenon about ships, cargoes or actors.

We are aware that these tools are not a guarantee of perennial reproductivity, and are subject to the end of the code infrastructure's lifecycle, in particular that of Python 3 (October 2029). To increase the possibility of medium to long-term reproductivity, the dataset itself is also slated for deposit in the CNRS institutional depository Nakala, which has guaranteed storage and maintenance until 2054. Unless otherwise noted, tables and graphs in this article were generated using Gephi, QGIS, and Jupyter Notebooks.

35 <https://gephi.org/>.

36 <https://github.com/j-innovatech/registry1445>.

37 The notebook is accessible via the GitHub project.

Challenges

In the course of data extraction, three main challenges were identified and had to be addressed in the modeling process prior to data input: 1) units of measurement; 2) the amount of toll (tax); and 3) *laissez-passer*.

The first challenge for quantitative analysis that draws on medieval sources is the issue of units of measurement. Between the twelfth and sixteenth century, the value of virtually all units of measurement is impossible to ascertain. The usage of units also tends to differ depending on the commodity concerned, meaning that only products whose volumes are expressed in the same units can be tentatively compared, albeit with an important caveat. The same unit of volume, for example, may have different values depending on the region, or even vary between two estates managed by the same landlord. In light of the above, any analysis must abstract the expression of values into international units of measurement.

The second challenge is the amount of the toll. As expected in a monetizing economy, the majority of tolls were paid in copper coins. The toll was applied to the ship as a whole, not to an individual cargo; a cargo systematically refers to a batch of a single commodity. As a consequence, this structure of the document makes it complex to assess tax rates on specific commodities. Some indications can be gained from an analysis of the cases of single-cargo ships, which represented about 75% of all ships registered. For the purpose of this article, which aims at historical social network analysis, tolls remain a secondary indicator that may be subject to further research, building on the work of Shinjō Tsunetzō (1986), Usami Takayuki (1999), Fujita Hirotsugu (2004), and Yamatoya Ikumi (2006).³⁸

The third challenge concerns the *laissez-passer*. There are two types of toll exemption in the register: perpetual and time-limited exemptions. These exemptions were likely given by the shogunate to powerful religious institutions, a particular warrior clan, or in rare cases an exemption from the toll that was applied to the transportation of the rent in kind from a particular landed estate. Whether perpetual or for a limited time, these exemptions are indicators of political power players of the period and have not, to date, been subjected to a historical network analysis. Their analysis, however, presents a number of challenges: first, the nature of the cargoes carried by exempted ships is not systematically recorded; second, the network analysis would require research outside the register data alone, in order to make deeper sense of the data; third, the structure of the

38 Shinjō, *Chūsei suiun-shi*. Usami Takayuki, *Nihon chūsei no ryūtsū to shōgyō* (Tokyo: Yoshikawa kōbunkan, 1999). Fujita Hirotsugu, “Hyōgo kitazeki irifune nōchō’ ni mieru sekisen wo meguru kōsatsu; shōmai setsu no saikentō,” *Kokuritsu rekishi minzoku hakubutsukan kenkyū hōkoku* 113 (March 2004): 89–107. Yamatoya Ikumi, “Hyōgo kitazeki irifune nōchō kara miru bukka no hendō,” *Hokudai shigaku* 46 (November 2006): 11–23.

model has to distinguish between ‘established’ and ‘newly acquired’ privileges, as well between different kinds of actors (religious institutions, warrior clans, or rents in kind from a particular landed estate). An added challenge was modeling the occasional interconnection between branch temples, which benefited from the exceptions through the main temple. Any analysis of the sphere of influence of a given temple required keeping track of the relationship between the main temple and its branches. This phenomenon was modeled by the introduction of the category of ‘major’ and ‘minor’ actors.

Analysis

Geography of a Network: What comes from Where?

Michelle Damian has done pioneering work on introducing the 1445 *Toll Register* to audiences outside Japan, providing a preliminary GIS analysis of the rice and salt shipping ports listed in the register.³⁹ Building on her analysis, this section seeks to provide detailed (although not comprehensive) analysis of the geographical origins of the commodities transported. While geospatial analysis is not the main focus of our analysis, it is an integral part of it, allowing us to map networks of actors onto particular places. In turn, this helps update our understanding of the dynamics between different ports within the Inland Sea.

The bulk of transported goods consisted of salt, agricultural products or food-stuffs, sea products and wood, with a trickle of what can be called miscellaneous goods. The cargoes can be subdivided into sixteen categories depending on their nature: algae, beans, cereals, fishery, foraged goods, utensils, metal, miscellaneous, oil seeds, paper, rice, salt, salted goods, textile raw materials, tinctorial plants, and wood and construction materials. These are referred to as CargType in our model, and were assigned manually. The cargo type can be further broken down into subcategories depending on the label of the cargo noted in the register. These are referred to as CargQual in our model.

In terms of a proportion of the overall traffic measured in the number of cargoes (which total 2638), salt is by far the most traded commodity (931), followed by rice (493) and wood (346). Salt thus accounts for 35% of cargoes that crossed the Inland Sea. Not only was salt 1 in 3 cargos on the maritime route, it was also the most mature commodity; the register distinguishes eighteen different types of salt, demonstrating the relatively high stratification of the industry, which can thus be considered mature. Among the many types of salt circulating,

39 Michelle Damian, “As Estates Faded: Late Medieval Maritime Shipping in the Seto Inland Sea,” in *Land, Power, and the Sacred; The Estate System in Medieval Japan*, ed. Janet R. Goodwin and Joan R. Piggott (Honolulu: University of Hawai’i Press, 2018), 351–74.

the so-called Bingo salt accounts for 46% of all salt being transported (51,493 of 109,540 *koku*).⁴⁰ No other product shows anything close to this level of stratification, including rice and wood. Most of the salt that passed through Hyōgo was in all probability destined for Nara (via the port of Sakai) or the ‘fish market’ of Yodo, via the eponymous river. The ancient capital of Nara was still home to influential Buddhist temples, in particular Kōfuku-ji, which patronized guilds of salt merchants. Yodo, located a few kilometers south of Kyoto, was the unloading fluvial port of the capital from the ancient period. The salt that was transported there was used both for the direct consumption of the population (salting was the principal means of preserving foodstuffs) and as a source of income for Kyoto based landlords as Tō-ji. The provinces of the Inland Sea are indicated as supplying salt to the capital as early as the period of compilation of the *Engi shiki*, completed in 927. Overall, the heart of the archipelago’s salt production up to the twentieth century – the area around the Inland Sea – was defined at an early stage. During the medieval period, the Inland Sea production sites, now part of the estate system, appear to have retained their salt supply role for the Kinki region. The best-documented case of this type of medieval salt making exploitation is the Yugenoshima estate (modern Ehime pref.), which appears as a port of registry in the 1445 *Toll Register* and whose detailed study highlights the commodification of salt between the first third of the fourteenth century and the middle of the fifteenth century.⁴¹ Not only did salt play a major role in daily life, either through direct consumption or derived uses, it also held a major place in the fiscal system of the salt-producing regions and in commercial transactions. Moreover, given that salt was vital for everyone, and that production areas were in fact geographically determined, the transportation of salt – even more so than foodstuffs, for example – was of the utmost importance. Considering this, it’s probably no exaggeration to say that salt was at the forefront of the commercial revolution of the Middle Ages.

Within the broad category of agricultural products, rice is the dominant cargo type, followed by grains (7.5%) and beans (7%). Wood amounts to 13% of cargoes and about 86% of these were designated as ‘raw wood’ likely used for construction. Sea products, including fish, crustaceans, and algae, amount to 8% of cargoes. Miscellaneous is a category that includes a relatively wide range of products circulating in rather small quantities, which relate to the production activities of what is usually referred to as non-farming peasants (*hi-nōgyōmin* 非農業民).⁴²

40 For about $\frac{1}{3}$ of shipments registered as Bingo salt, the product does not come from the actual province but rather from the production zone between Setoda, Yuge and Onomichi. Ships carrying ‘Bingo salt’ appear to have come from both Bingo and Iyo provinces.

41 Dimitri Tatoyan, “Économie et société du domaine de Yugenoshima en Iyo (XII^e–XV^e siècles): transformations du régime domanial et gestion du sel,” (PhD diss., EPHE PSL Research University, 2022).

42 Amino Yoshihiko, *Muen; Kugai; Raku – Nihon chūsei no jiyū to heiwa* (Tokyo: Heibonsha, 1982 [1978]). The importance of crops other than rice in the diet, and by extension the

Concretely, this category includes products as diverse as metals, ramie and indigo plants, as well as manufactured products such as paper, woven straw mats (*mu-shiro* 篋), hemp textiles, pots, and utensils.

From a geospatial analysis point of view, visualization demonstrates two points. First, the majority of the ports of registry were located in the eastern half of the Inland Sea, roughly east of Aki-Bingo provincial border (present-day Onomichi) on the north shore and east of Iyo Province on the south shore (Fig. 2). Second, while the register demonstrates an influx of traffic from all across the Inland Sea, including from as far away as the southern shores of Shikoku Island, the bulk of trade action takes place in the eastern part of the Inland Sea, relatively close to the toll barrier port of Hyōgo (Fig. 3). This highlights a puzzling relative absence of activity (volume of trade) in the western segment of the Inland Sea. The register is itself a demonstration of the sophisticated technical naval capabilities of the time, as is evident from the sheer size of the ships they operated for rice transportation (Fig. 5).⁴³ Therefore, the visualization leads to a hypothesis that the 1445 *Toll Register* does not fully encapsulate the western half of the Inland Sea traffic. One hypothesis is that Northern Kyūshū, which was politically, commercially, and demographically important, acted as the gravitation hub of the western segment. In this case, there are likely two types of maritime trade absent from the register. First, the circulation of commodities that were not destined for Kyoto, but were instead routed through a port on the Kyūshū Island and possibly aimed for regional trade. Second, the trade of commodities between ports of registry. The example of wood strongly suggests that what initially may have seemed to be the ‘port of origin’ of a commodity may in certain cases be a ‘transit hub’, with the first leg of the journey not being visible in the register. The series of visualizations (Fig. 2, 3, 5, 6) amount to a first step towards a reconstruction of the overall commodity trade activity in the Inland Sea. Michelle Damian explores these transshipment patterns for each of the major products transported, revealing several transit hubs across the Inland Sea.⁴⁴ Damien Peladan suggests that the strong presence of pirate groups (*kaizokushu* 海賊衆) in the islands between Iyo and Aki provinces should be considered as a plausible explanation for this east/west separation. These pirate groups created their own toll barriers in the central Inland Sea area, thus imposing limitations on ships’ movements be-

economy of ancient and medieval Japan has also been meticulously analyzed in Charlotte von Verschuer, *Rice, Agriculture, and the Food Supply in Premodern Japan*, trans. Wendy Cobcroft (London: Routledge, 2016).

43 The late fourteenth and early fifteenth centuries are considered to have been a turning point in the evolution of shipbuilding techniques in the archipelago. Damien Peladan, “La piraterie, moteur de l’innovation navale? Fin du XIV^e et début du XV^e siècle”, in *Japon Pluriel*, 14, 2024: 213–22 and Michelle Damian, “Late Medieval Japan’s Seto Inland Sea Seascape: Shipping, Sailors, and Seafaring” (PhD diss., University of Southern California, 2015): 51–55.

44 Damian, “Late Medieval Japan’s Seto Inland Sea Seascape,” 121–55.

tween eastern and western Seto inland sea. According to the Korean envoy Song Hŭi-gyŏng 宋希璟, who kept a journal of his travels through this sea in 1420, in Kamagari 蒲刈 there were a group of ‘eastern pirates.’ When ships traveled from east to west, they had to pay a fee and board one of the pirates in order to be able to safely sail through the strait so that ‘western pirates’ would leave them alone. Conversely, when ships traveled in the other direction, they had to board a western pirate so that the eastern pirates (those in Kamagari) would let them through. Considering the existence of these unofficial checkpoints, merchants might have preferred to drop their cargo in places like Setoda and other ports in the area, which would have acted as hubs.⁴⁵

The port of Hyōgo was not only the destination of all the cargoes, but also the largest single port of registry in terms of the number of ships logged in the 1445 *Toll Register*: a total of 374 cargoes transported by 300 distinct ships, meaning 14% of overall cargoes and 15% of overall ships. The second-largest port of origin was Ushimado (191/121), followed by Yura (126/117), Onomichi (100/62), and Setoda (98/69). In sum, Hyōgo, Ushimado, Yura, Onomichi and Setoda – what we call ‘the five hubs’ – amount to key nodal ports for their respective hinterlands, and between them are responsible for 33% of all the trade logged in terms of the number of cargoes.

While much less traffic tended to come on ships registered in ports further away from the port of Hyōgo, the ships that did come from further away tended to be significantly larger, carrying cargoes between 400 and 1000 *koku* in volume. For example, there are only 16 ships, from a total of five ports, that belong to the province of Suō, located 380 km from Hyōgo; however, almost one third of them (5) have a tonnage between 400 and 1000 *koku*.⁴⁶ Another example is the port of Moji (Suō Province), which sent only six ships in 1445 to Hyōgo, but distinguishes itself by the fact that one third of these ships had a tonnage over 1000 *koku*. In contrast, the ports of registry located in Settsu Province (in which Hyōgo is lo-

45 Damien Peladan, personal communication, April 2024. See also Damien Peladan, “Le temps de la grande piraterie japonaise: Transformation des circulations maritimes en mer de Chine orientale, 1350–1419,” (PhD diss., Paris (Cité) University, 2020): 19–20.

46 The *koku* 石 is based on a volume measurement of rice. The container used for this measurement (*masu* 枡) was often constructed of wood, sometimes metal, in a cubic or cylindrical shape. Between the end of the twelfth century (the disappearance of the ancient model) and the end of the sixteenth century (‘measure of the capital’ instituted by Toyotomi Hideyoshi 豊臣秀吉 [1537–98]), this container and thus the actual value of the volume units of measurement varied greatly from one province to another, and even between estates or domains within the same province. It is therefore impossible to make a reliable conversion and we must rely on estimates, especially between the fourteenth and the sixteenth centuries. The reference to tonnage is therefore an approximation of the order of magnitude of volume transported. In fact, the units of volume in the register are not uniform and it is not possible to convert them to international values; these should also be taken as indicators of the order of magnitude, rather than actual measures.

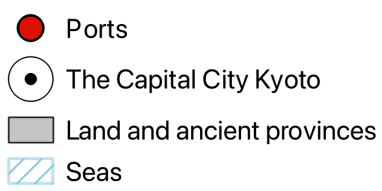
cated) accounted for 46 times more ships than Suō, but from over 763 ships registered only two have a tonnage over 1000 *koku*. In fact, most ships from Settsu were quite small (under 100 *koku*). Finally, from a total of 300 ships in what the register notes as ‘local transportation’ – meaning ships for which Hyōgo is both the port of registry and the port of arrival – only one was carrying more than 1000 *koku*.⁴⁷

The first step of network analysis of a toll register consists of looking into the link between ports of registry and commodities-port axes. The ports of registry for ships carrying salt are multi-clustered, with Bingo the largest hub (including production sites located in Iyo Province). It is followed by the cluster around Kojima (Bizen Province) and Akō (Harima Province), which are both the joint second-largest cluster (Fig. 4).

The ports of registry for ships transporting rice tend to be evenly distributed (Fig. 5), yet the role of super-sized ships from the distant port of Moji (Buzen Province, Kyūshū Island) is remarkable. A total of only seven ships transporting rice from Moji carried a total volume of 4704 *koku*, while the 87 ships that transported rice with Hyōgo as their port of registry transported a total volume of 4561 *koku*. In other words, the port of Moji shipped more rice than Hyōgo, yet using only a fraction of the ships.

Data visualization is a powerful tool to probe into the strength of the relationship between a port and a particular product. The strongest relationship that emerges from the register concerns what we can call the ‘wood ports’ (Fig. 6). The insular province of Awaji, and in particular the port of Yura, demonstrate the highest degree of exclusivity. In 1445, 97% of cargoes on ships registered at Yura were wood. When considering the product-port link, it is important to recall that the port of registry that manifests a strong connection to a particular product can also be the port of proximity to the production zone, but this is not necessarily the case. As the case of wood suggests, ‘wood port’ is not necessarily one that is close to the heart of production, but rather refers to an intermediary timber transportation hub. In other words, Yura was not the wood production center but rather a timber hub for an imperial capital that was perpetually in a state of reconstruction.

47 Mutō Tadashi, “Chūsei no Hyōgo no tsu to Setonaikai sui.un,” in *Hyōgo kitazeki irifune nōchō*, ed. Hayashiya Tatsusaburō (Tokyo: Chūō kōron bijutsu shuppan, 1981), 245.



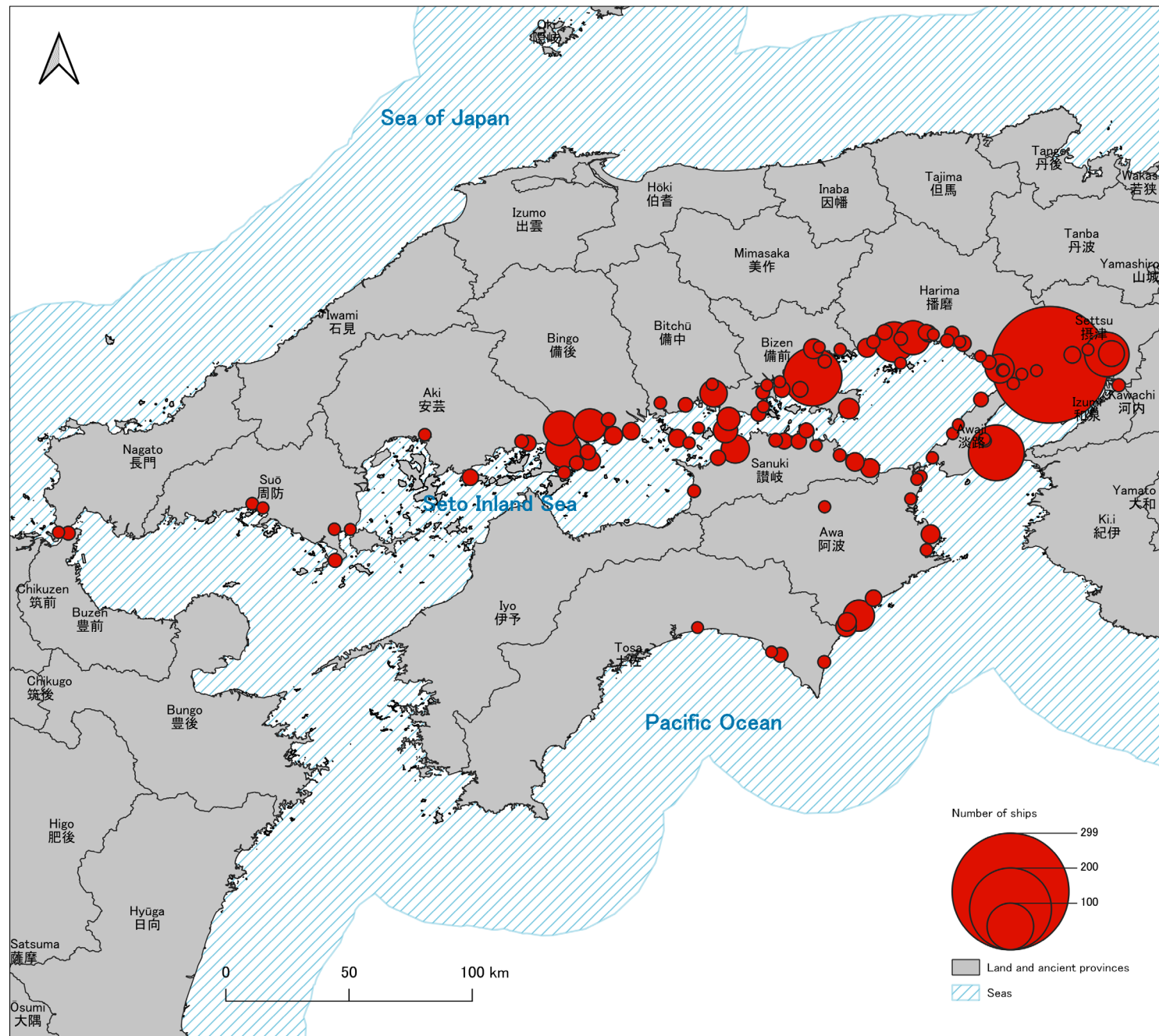
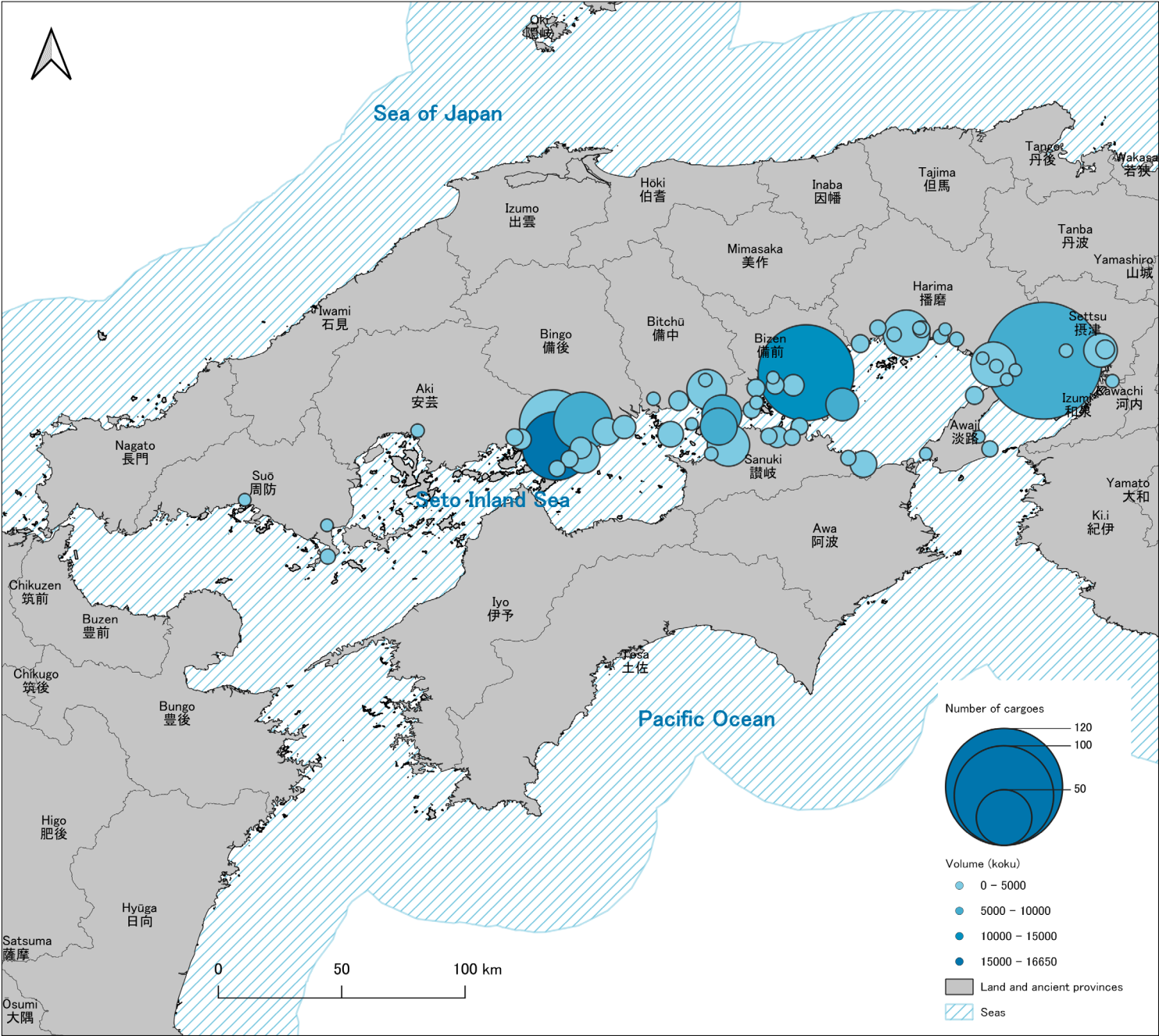


Fig. 3 Map displaying the number of ships by ports of registry. It is noteworthy that the port of the toll barrier is also the port with the largest number of ship registries noted in the document. (For details, see Damian, “Late Medieval Japan’s Seto Inland Sea Seascape,”: 184–85 and Damian, “As Estates Faded,” 362–63.)

Fig. 4 Map of the ports of registry for the ships carrying salt. The size of the circle corresponds to the number of cargoes, while the shades of blue correspond to the overall volume of salt trade per the 1445 *Toll Register*. As the figure indicates, the variety of ship sizes involved in trade made it possible to have a large number of cargoes while having either very little overall volume, or a great deal of it. For example, in the Bingo Province, Setoda sent a large number of cargoes, amounting to a large volume of salt transported, while neighboring ports sent a comparable number of cargoes but had a much lesser volume. In this context the reference to cargoes is an indicator of the average ship size. It follows that ships leaving Setoda were significantly larger than those leaving from the neighboring ports.



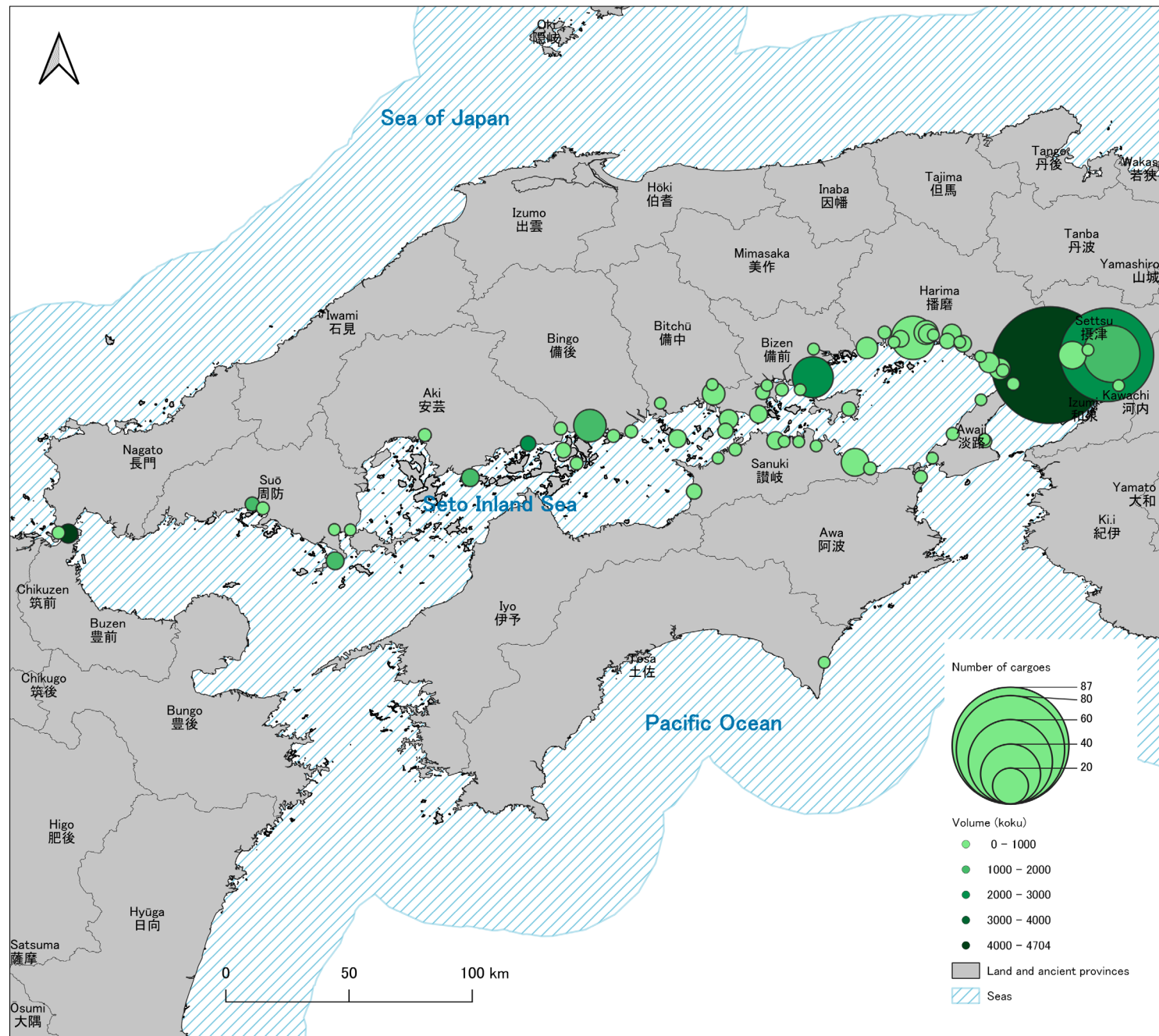


Fig. 5 Map of the ports of registry for ships carrying rice.

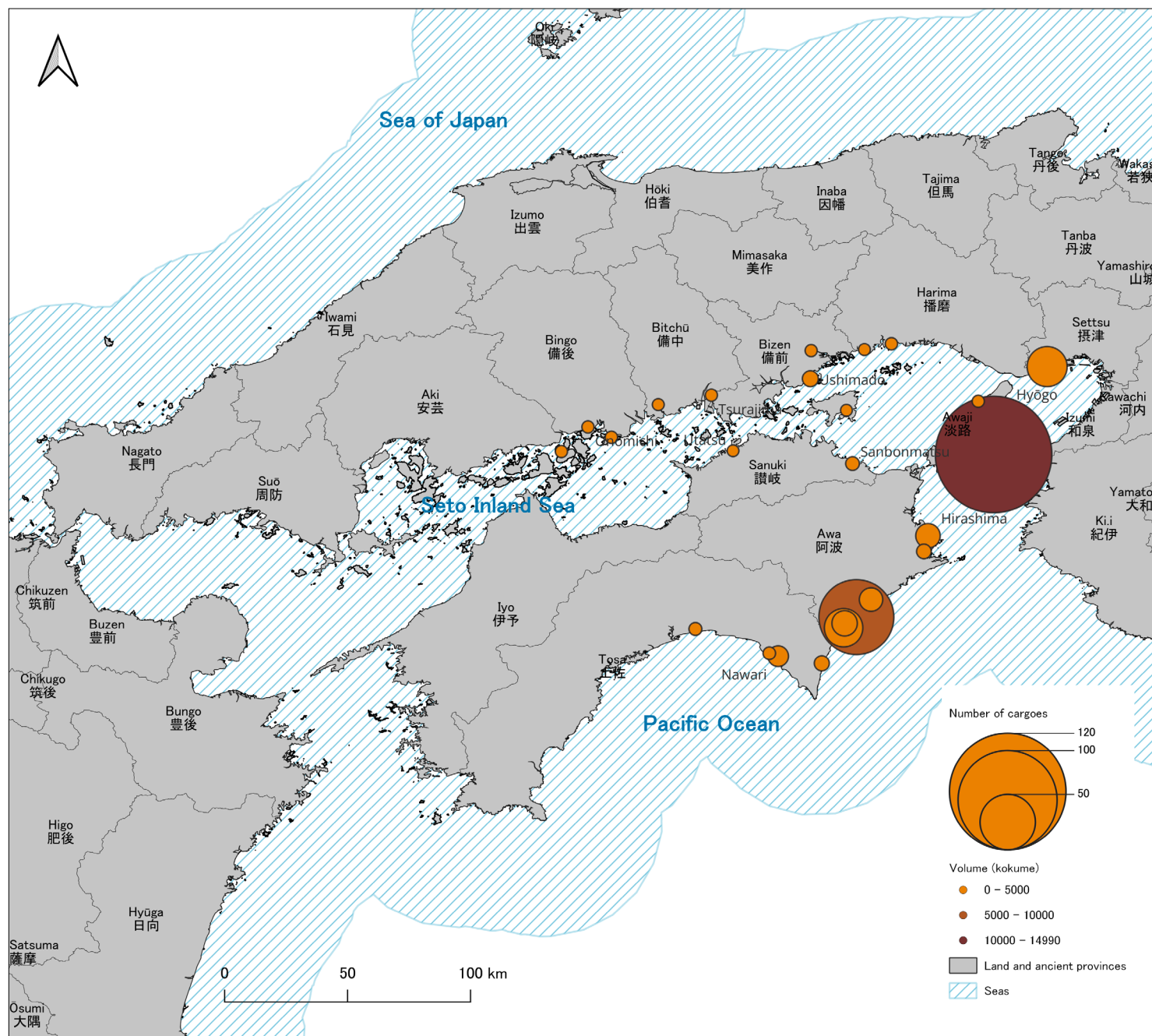


Fig. 6 Map of the ports of registry for ships carrying wood.

The Leg Work of a Commodity Network

Beyond the product-port connection, the register is a rich source of data points on shipmasters (*sendō*) and commercial agents (*toimaru* or sometimes simply *toi* 問), both actors at the heart of the medieval coastal trade in Japan.⁴⁸ In terms of commercial agents and shipmasters, one important caveat is in order. While the existence of two distinct roles pointing to two relatively distinct but connected groups of actors is source-based, the label attributed to the roles – commercial agent and shipmaster – is not an actor category, but a historiographical convention that we chose to respect. With regard to shipmasters, by the fifteenth century, some of the helmsman (*kandori*) – previously responsible for accompanying the rent in kind on voyage from the estate to the capital – had turned into independent shipmasters and, in some cases, became fully fledged shipowners.⁴⁹ Some shipmaster's names are annotated in the register with the name of other shipmasters (for example Yūsō), or with the words 'money lender' *hizeniya* 日銭屋, suggesting their integration into larger economic structures. Damian also noted that the names of many shipmasters and commercial agents were functional names.⁵⁰ These titles, inherited from the penal and administrative code system (*ritsuryō sei*), effective between the eighth and eleventh centuries, were still common in the medieval period. The proximity of certain names, such as Tarōjirō or Tarōsaburō, combined with the fact that these individuals shared common trajectories, such as originating from the same place (in this case Tomo) and carried out their activity from the Onomichi platform, supports the idea that there were close networks of individuals. These were organized into groups headed by the person who owned the ships, and thus acted more like a company than as individual transporters. Onomichi was in this respect probably a particularly attractive site for navigators of the region, if not the whole of the Inland Sea, and consequently ideal for voyages to Hyōgo. Several members of the Yuso group were recorded at the passage of the northern barrier to Hyōgo, with the name 'Yūsō' in these cases appearing before that of the shipmaster or the ship itself.⁵¹

48 It is impossible to prove that the repetition of any given name in the register systematically refers to the same individual. Furthermore, it is possible that the same physical person has been noted down inadvertently with a different character. While we are aware of these possibilities, we have decided to consider that the same name refers to a single person and that names written differently for the same-sounding names designate different people. In the latter case, the name is followed by a number (i.e., Jirozaburo1).

49 In the "Register of rents of the Ōta estate in Bingo" included in the "Kongōbuji Archives," the expression "ship of" is used several times. Thus, transport was progressively provided not by members of the estate but by autonomous transporters who were providing a service. Ichimura Takao, "Chūsei Setouchi no minatomachi to senshu; toi no nettowāku," in *Saigoku ni okeru seisan to ryūtsū*, ed. Kawaoka Tsutomu and Koga Nobuyuki (Ōsaka: Seibundō, 2011), 184.

50 Damian, "Late Medieval Japan's Seto Inland Sea Seascape," 224–25.

51 Ichimura, "Chūsei setouchi," 187–88.

The existence of commercial agents is first attested in an 1135 journal of courier and poet Minamoto no Morotoki 源師時 (1077–1136).⁵² A shogunal order from 1340 mentions the use of these agents for the transporting of rent in kind between a particular landed estate and the capital city. These agents were intermediaries in trade, facilitating the routing, managing ship-to-ship or ship-to-land cargoes, handling and providing warehousing service.⁵³ Between the 1100s and the 1400s, the same term *toimaru* (or *toi*), translated as ‘commercial agent’, designates various social realities. Originally integrated into the estate system with the title of estate officer, their prerogatives have evolved as the economy monetized. However, in general commercial agents were port-based, developed financial tools such as bills of exchange, and did not themselves engage in long-distance transportation.⁵⁴ Navigating the seas in the first half of Japan’s medieval period was done by the so-called helmsman, and later was taken over by shipmasters. However, the multitasking of the majority of commercial agents attested in the 1445 *Toll Register* demonstrates that the division of roles was far from linear. Furthermore, it raises the question whether commercial agents eventually extended the scope of their activities and ventures into sailing, or the other way around. Hyōgo commercial agents of varying importance, such as Saburōjirō 三郎二郎, and especially Emonkurō, the third most active in terms of volume of activity, simultaneously appear to have been shipowners in Onomichi.

We created a purpose-built relational database, with some 1900 ship entries, involving 337 shipmasters and 52 commercial agents, excluding about 800 ships that carried fuel, which are noted in a separate register. To visualize the overall network of shipmasters (purple), commercial agents (orange), and ports of registry (red), we used Gephi and the Force Atlas 2 algorithm. The preliminary visualization (Fig. 7) allowed us to make three points. First, the importance of Hyōgo not only as the port of toll clearance, but also as a port of registry. As such, the port interacts with the largest total number of shipmasters and commercial agents.

52 Toyoda Takeshi, *Toyoda Takeshi chosakushū*, 2: *Chūsei Nihon no shōgyō* (Tokyo: Yoshikawa kōbunkan, 1982), 197.

53 A directive (*bugyō hōsho* 奉行奉書) from the Muromachi shogunate explicitly states the use of these agents for the routing of the dues in kind between a landed estate owned by Rinsen-ji, a temple in Kyoto, to the capital city: “Rinsenji ryō Kaga no kuni Ōno no shō nengu no koto” 臨川寺領加賀国大野庄年貢事 [On the rents of the Kaga Province Ōno Estate owned by Rinsen-ji], Ryakuō 3. (1340). 9. 11, Rinsenji monjo, in *Fukui ken shi shiryō hen: chūsei* (Fukui: Fukui Prefecture, 1986). See Usami Takayuki, “Kōshin no toi no tenkai”, in *Toshi to shōnin; geinōmin; chūsei kara kinsei e*, ed. Gomi Fumihiko and Yoshida Nobuyuki (Tokyo: Yamakawa shuppansha, 2001 [1993]), 37.

54 For example, this is made clear in a 1292 report from a commercial agent trading salt from the island estate of Yugenoshima: “Yugenoshima no shō toimaru mōshikotoba” 弓削島莊問丸申詞 [Report from a Commercial Agent related to the Estate of Yugenoshima], Shō. ō 5 (1292).10.14, *Nihon engyō taiki: Shiryō-hen, kodai, chūsei I*, ed. by Nihon Engyō taiki henshū iinkai (Tokyo: Nihon senbai kōsha, 1982), doc. no. 117, 178.

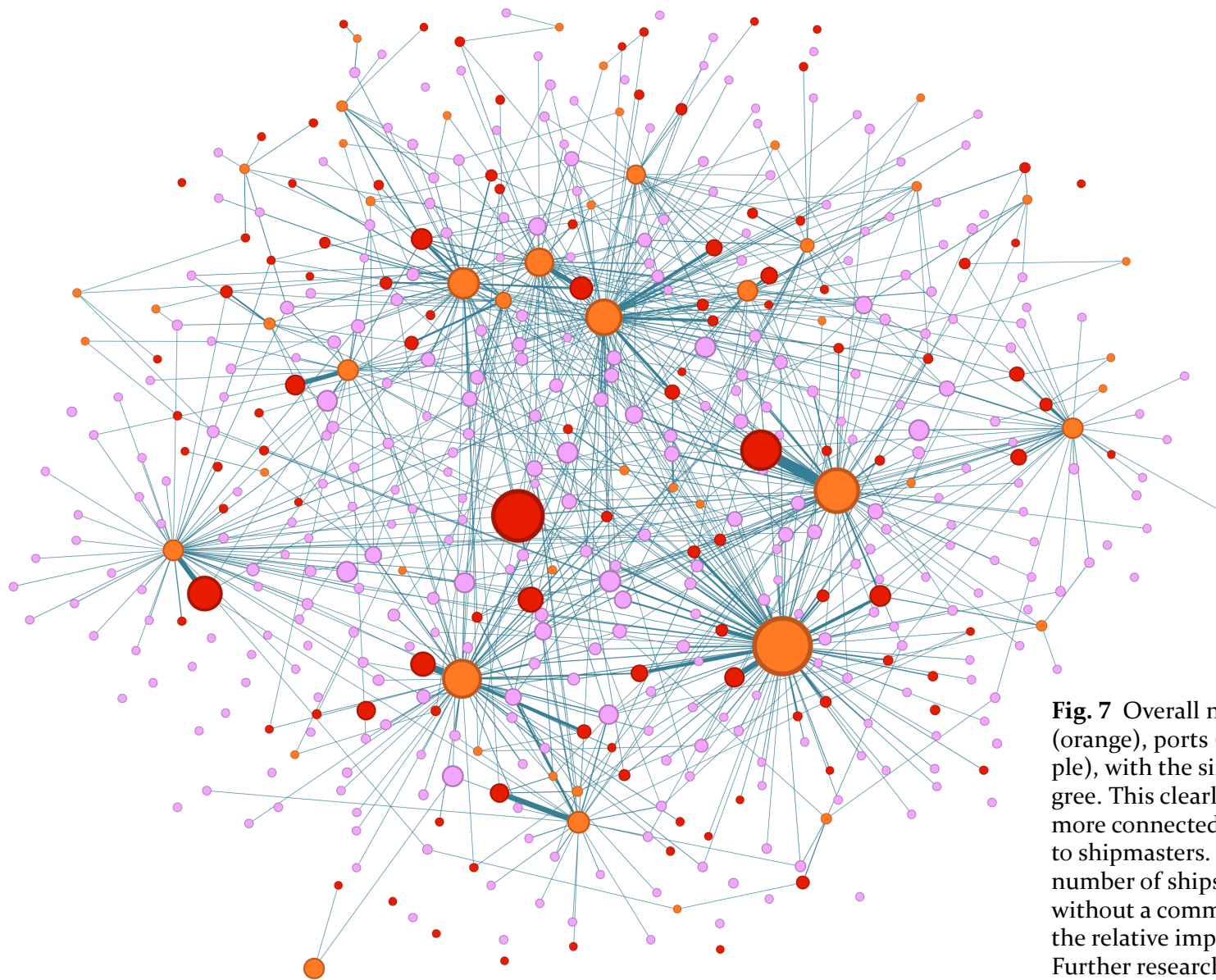


Fig. 7 Overall network of commercial agents (orange), ports (red), and shipmasters (purple), with the size of the node relating to the degree. This clearly demonstrates that agents are more connected by degree of centrality relative to shipmasters. Keeping in mind that a sizable number of ships operate with a shipmaster but without a commercial agent further highlights the relative importance of commercial agents. Further research is needed to compare the shape of the ego-networks of the most active commercial agents (orange). Links between shipmasters and ports are masked for reasons of readability.

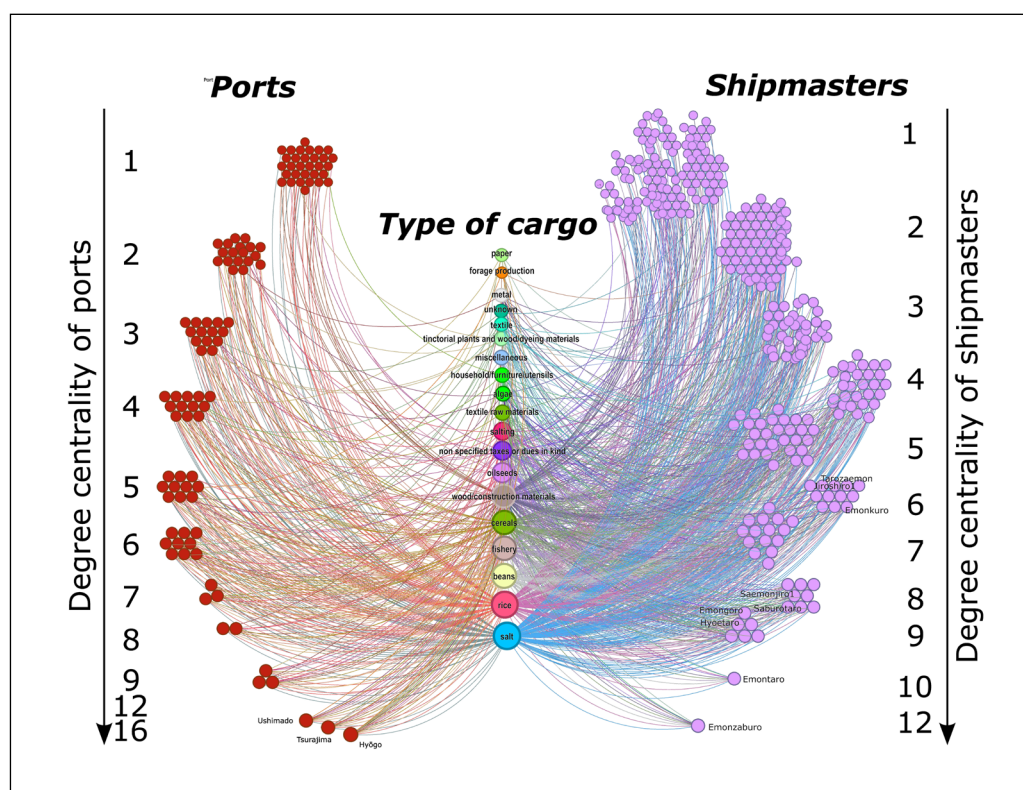


Fig. 8 Distribution of ports and shipmasters according to their Degree Centrality and linked to the type of cargo.

Second, with the exception of ships registered in Hyōgo, which often do not have a commercial agent associated with the cargo, the commercial agent-port link can be included. Particularly prominent are the examples of commercial agent Kiya 木屋 and the port of Yura, as well as those of commercial agent Bungoya 豊後屋 and the port of Muro. Kiya and Bungoya work almost exclusively with Yura and Muro, respectively. In contrast, other commercial agents such as Dōyū 道祐 may dominate the trade by ships of particular ports of registry, but do not have exclusive links with them. Dōyū manages all the traffic of the ports like Uozaki (Settsu Province), Tsurajima (Bitchū Province), and Tsurajima, but his activity is not limited to them. In other words, Dōyū is a strong pole of attraction – he manages extensive and diverse traffic from a range of ports, maintaining a balanced portfolio while not specializing in the transport of a particular commodity or cultivating a particular relationship with any given port. Jirozaburō 二郎三郎 operated only two ships registered in Hyōgo, from a total of 256 ships he controlled throughout the year.

Third, the centrality of commercial agents underlines their role as intermediaries. This is particularly the case for the biggest vertices, since their size is pro-

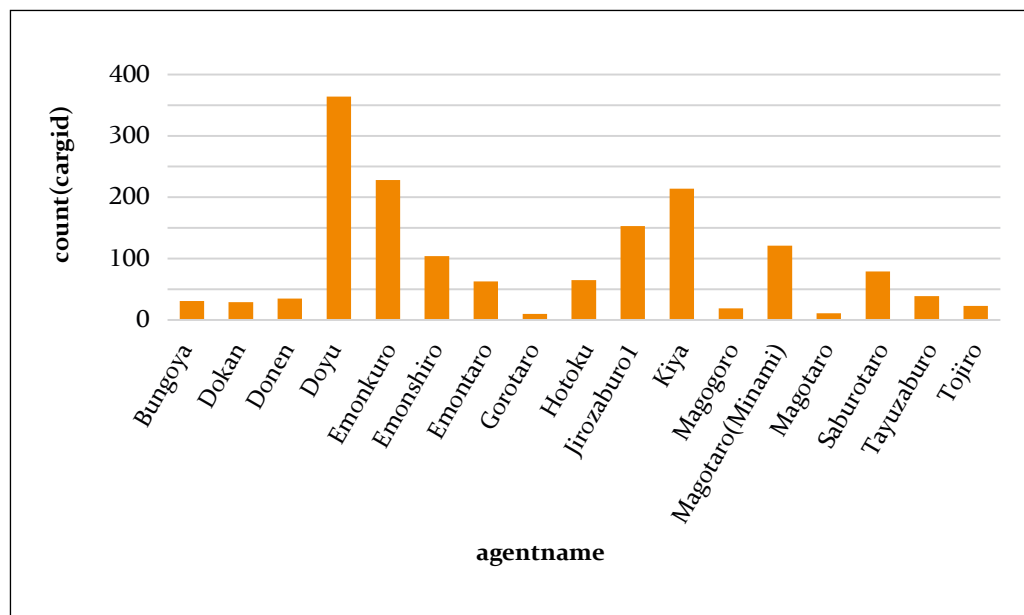


Fig. 9 Number of cargoes per commercial agent (agents handling at least 10 shipments, listed in alphabetical order).

portional to their maximum degree (i.e., the number of edges connected to them). To put it another way, the commercial agents displayed by large nodes are the most active as intermediaries or perhaps shipowners, working with the most shipmasters. Figure 8 shows the distribution of shipmasters and ports into groups based on their degree centrality, i.e., the number of links, in this case expressing the variety of the types of cargo transported during the year. With a score of 12, Emonzaburō has the most diversified transport activity in terms of the type of products transported. In terms of ports, Hyōgo is the most diverse, with a degree centrality of 16.

Commercial Agents & Shipmasters: A Rainbow

Between the two groups of actors involved in coastal trade – commercial agents and shipmasters – it was the commercial agents who were the most likely to connect actors with each other (Fig. 10). Particularly in the case of commercial agents, some of the names are likely to be trade organizations (similar to the commercial names *yagō* 屋号, which was in widespread use between the Late Middle Ages and the Edo period), rather than personal names. This is particularly evident in the case of Kiya or Bungoya. One way of categorizing commercial agents is by the volume of activity they were handling. Figure 9 shows the commercial agents that handled at least 10 shipments and the number of cargoes they handled during the year, as a way of gauging the relative scope of their activity.

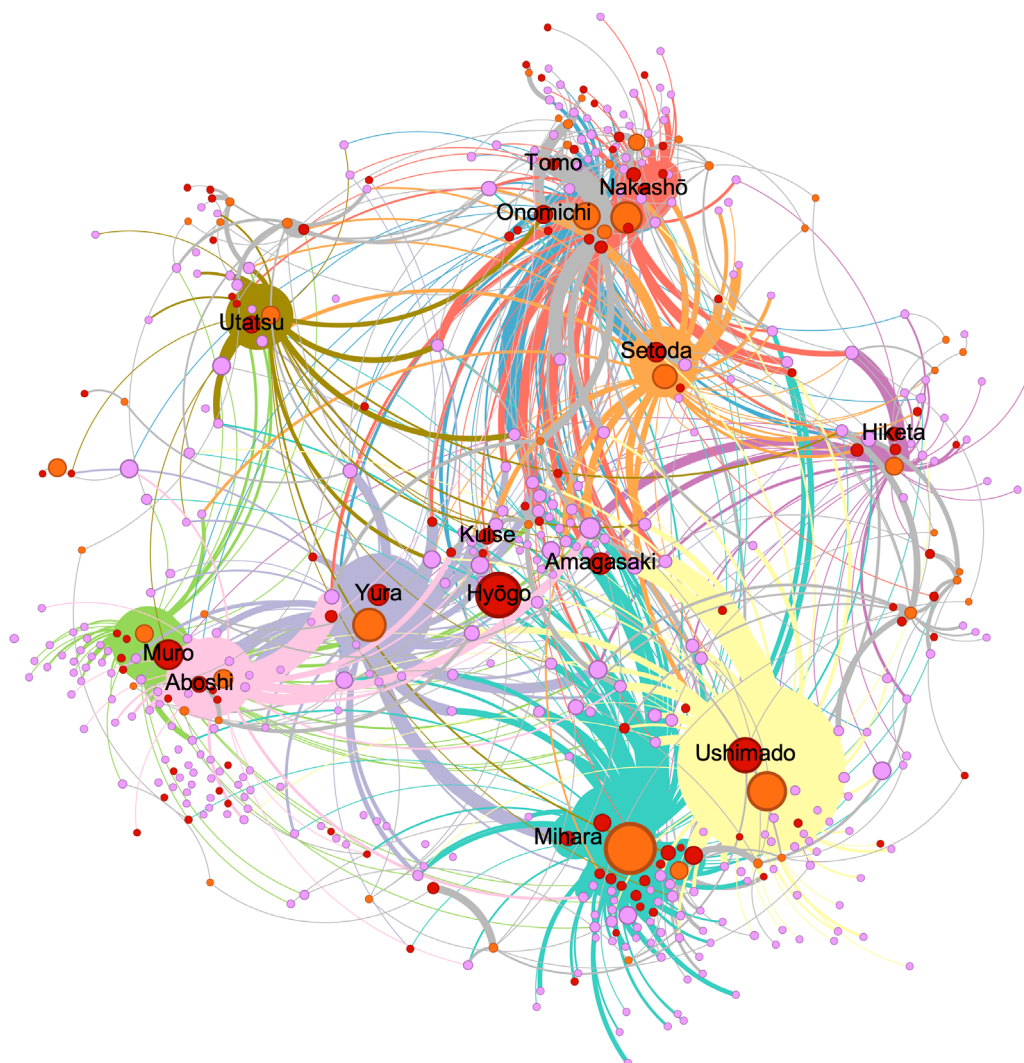


Fig. 10 Overall network with an emphasis on clusters, signifying the network of shipmasters (purple) working with a given commercial agent (orange). The edge colors illustrate the network of shipmasters working with a given agent. Immediately visible is the hierarchy of agents and ports and, to a lesser extent, shipmasters. While further analysis is indispensable, this image allows us to detect clusters of agents that work with certain shipmasters as they interact with ports.

Super-Agents

Following the typology proposed by Naruhito Shinnō, our analysis distinguishes five types of commercial agents, based largely on the scale and nature of their activity (how many cargoes/ships they handled, and of what types).⁵⁵ Group A comes down to a single super-agent – Dōyū, who handled by far the most incoming cargoes (15%) and had the most diverse portfolio – from the most traded commodities such as rice, salt to more niche goods such as paper, tinctorial plants, and textiles. It is remarkable that of the three overall most traded commodities in

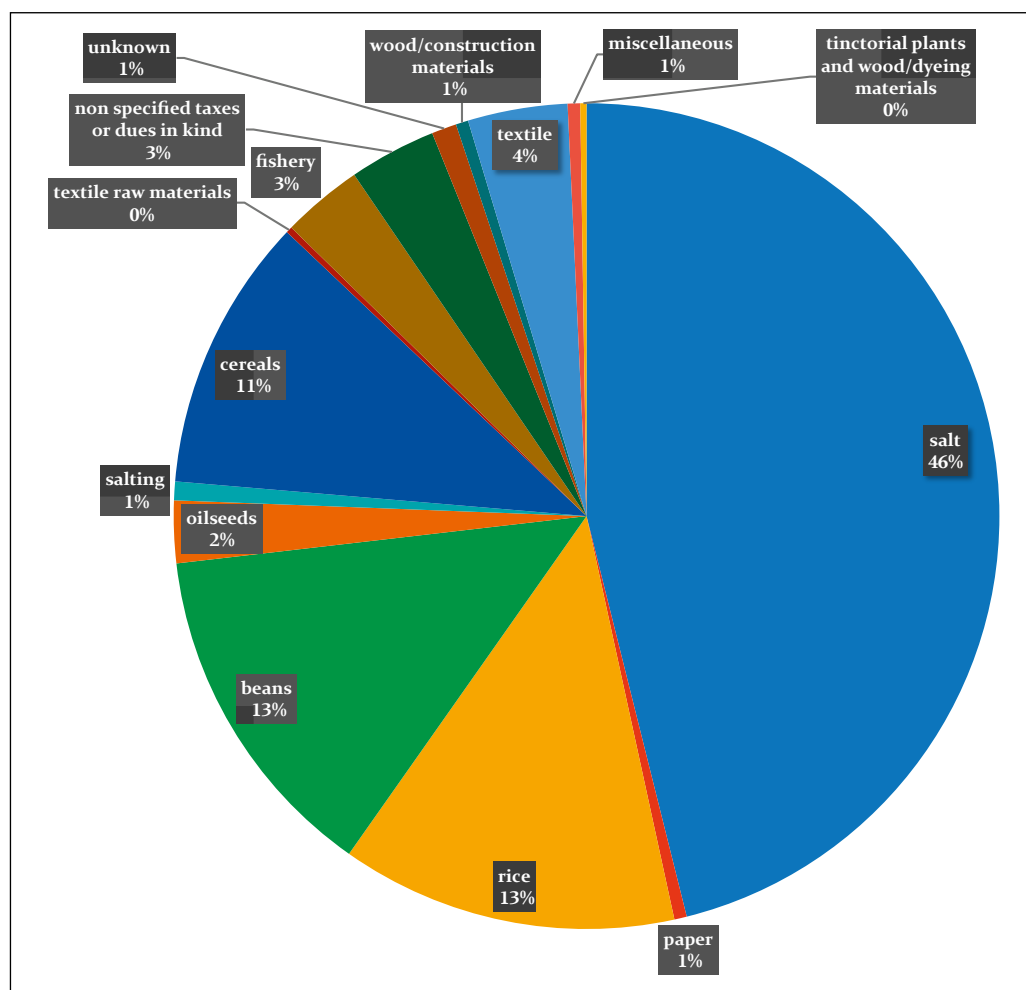


Fig. II An overview of Dōyū's portfolio by the number of cargoes per category of commodity handled.

55 Naruhito Shinnō, "Hyōgo kitazeki irifune nōchō no ichi kōsatsu – toimaru o chūshin ni shite," *Kōtsūshi kenkyū* 8 (1982): 30–55.

the register, he almost never handled wood. The ships he handled during the year 1445 transported only 365 *koku* of wood, less than 1% of the total (Fig. 11). Dōyū also has the particularity of being the only actor whose existence is corroborated by another source, related to the management of the oil warehouses of Tōdai-ji.⁵⁶

According to the register, Dōyū chartered 265 ships out of nearly two thousand, or around 13% of the total. He alone accounted for 40% (9,865 *koku*) of the rice trade and about 22% (24,078 *koku*) of the annual salt trade. The comparison with the second-largest commercial agent – Emonkurō 衛門九郎 – is instructive: Dōyū managed 1.6 times the volume of salt and 2.5 times the volume of rice managed by Emonkurō, and traded in diverse goods including 2973 *koku* of soybeans and 1745 *koku* of grains other than rice. The same applies regarding Dōyū's geographical area of activity, which extended over almost the entire Inland Sea, with no particular region standing out.⁵⁷

Dōyū's ego network (Fig. 12) features 86 shipmasters (purple) linked to him, demonstrating the extent to which he worked with a large number of shipmasters. In conclusion, while being exceptional at the level of the register, Dōyū is arguably a prototype of a generalist port-based commercial agent who acted as an interface between sea and land.⁵⁸

Specializers

Group B consists of a group of four commercial agents whose volume of trade amounted to around 15,000 *koku* for each of the three key commodities traded in the Inland Sea, namely salt, rice, and wood. These commercial agents tend to specialize in a particular commodity. The wood trade is one example where one commercial agent alone (named Kiya) handled about 44% of shipments throughout the year (16,230 *koku* out of 37,205), while Jirōzaburō also handled 35% (13,030 *koku* out of 37,205) of the trade. Between the two, they handled 79% of all incoming wood, which was essential for the construction and renovation of the capital. Another example is salt: Emonshirō 衛門四郎 handles nearly 17% of the salt trade (16,933 *koku* out of 100,659), while Emonkurō handled 15%. Jointly, these two handled over one third of the entire salt trade. Together with Dōyū, who handles 22% of salt, the three of them administer more than half of all salt entering the port (Fig. 13).

56 “Amagasaki toimarū ukebumi anbum”, *Tōdaiji monjo*, 4. 71, Kanshō 2 (1461). 08. See also Suzuki Atsuko, *Nihon chūsei shakai no ryūtsū kōzō* (Tokyo: Azekura shobō, 2000), 262.

57 Toita Masanori, “Muromachi ki ni okeru Hyōgo toimarū no katsudō,” *Kyūshū shigaku* 九州史学 168 (March 2014): 25.

58 Sakurai, “Chūsei no shōhin,” 218.

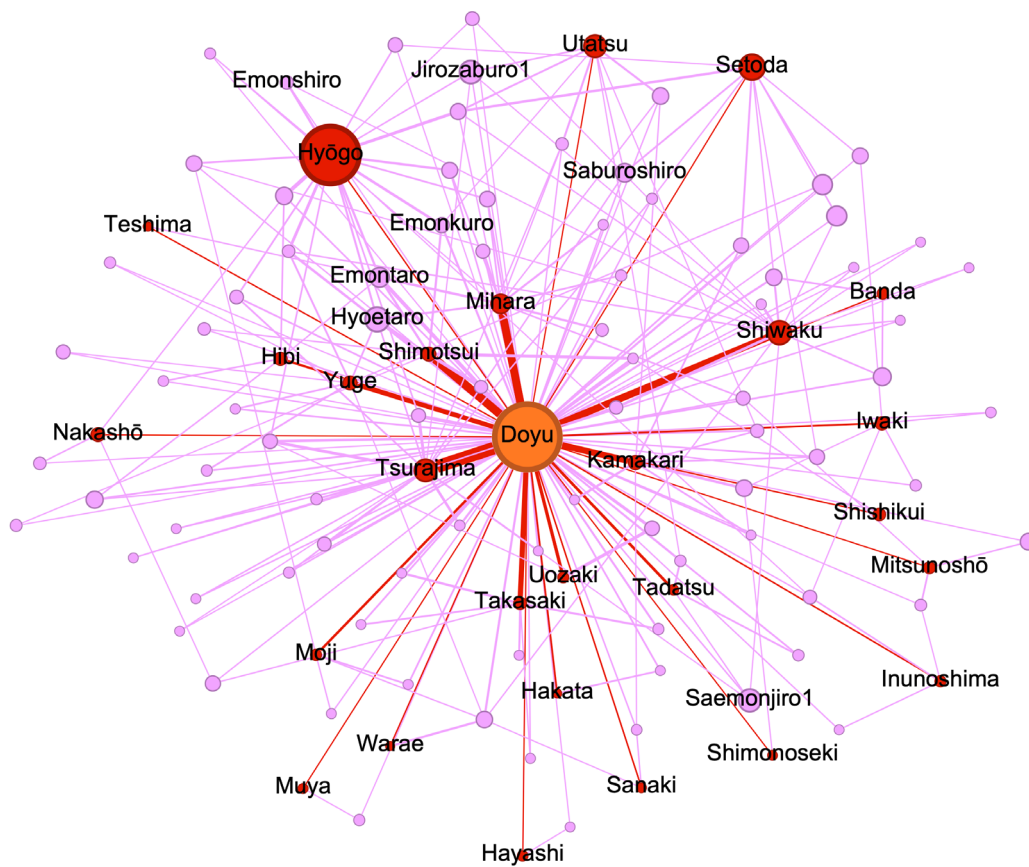


Fig. 12 Ego Network of the Commercial Agent Dōyū (depth of 1). The size of the vertices is relative to their degree centrality, which is the number of edges they have in the overall network figure (Fig. 7).

In terms of the link between the four commercial agents in this group and particular ports or regional hubs, two points must be noted. First, the nature of the wood hubs – which were relatively few in number – predicts a strong relation of commercial agents with the ports, compounded by a small number of agents who specialized in wood. There is a strict division of territory between the two wood tycoons: the territory of Jirōzaburō, the ‘number 2’ of the wood trade, does not touch that of Yura, the ‘number 1’ wood hub, which seems to be the territory of Kiya. Instead, Jirōzaburō built his runner-up status by cultivating a special relationship with the port of Kaifu while also working with nine other ports, including two where Kiya has a minor activity. Second, for the two commercial agents in Group B who specialize in salt, there is a similar division of territory. Emonshirō, the larger of the two in terms of the number of ships, operates out of Setoda, while Emonkurō works with Ushimado. In addition, he had seven smaller ports of salt in his portfolio. Between all these ports, it is notable that he trades almost exclusively in a particular type called Bingo salt, the most traded of the 18 varieties.

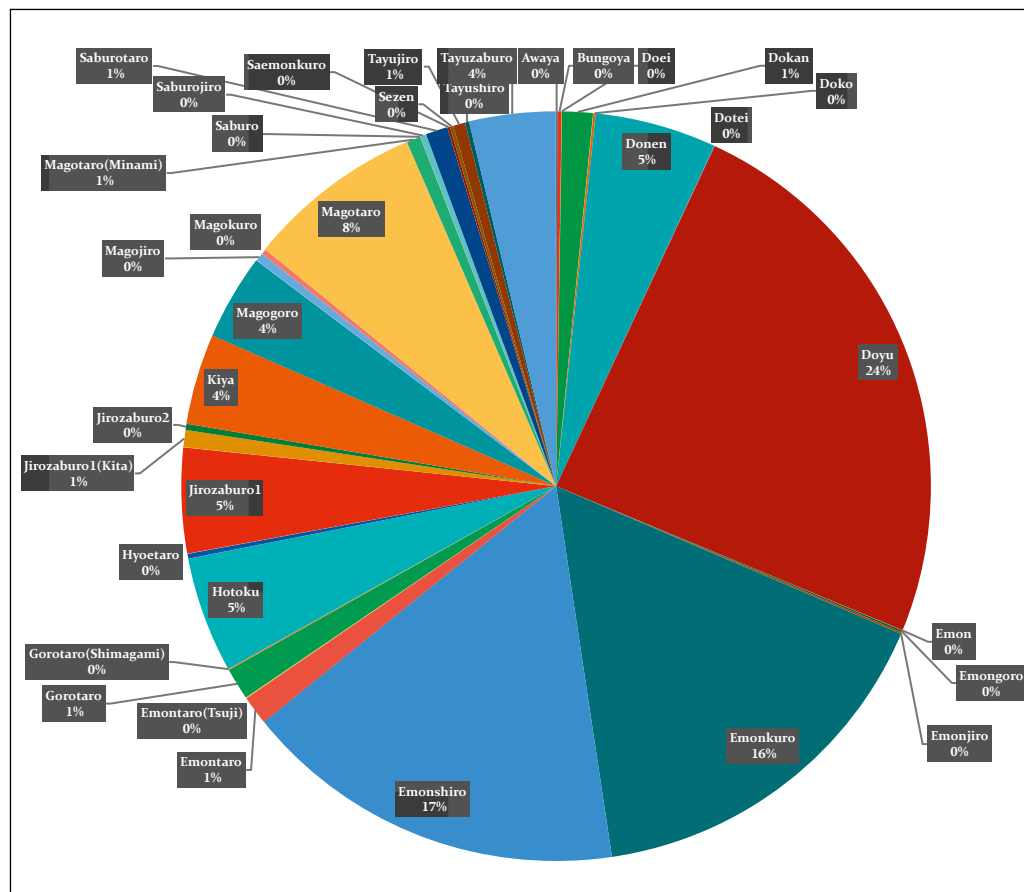


Fig. 13 Breakdown of market share of salt handling between all commercial agents listed in the *Toll Register*. Dōyū, Emonkurō and Emonshirō handle over half of the entire volume traded.

Emonkurō – who traded slightly less salt – sourced most of it from Ushimado, with 11 other minor source ports. It is notable that not only do they clearly divide their principal ports of trade, but they also have no overlap in their minor ports. Interestingly, there is a single point of convergence: the major for one is one of the minors for the other, and the only point of encounter between the two. One particularity of this group is that they all belong to the group of 32 commercial agents who were also, in certain cases, acting as shipmasters, a category we call dualizers (see below).

The analysis of the ego network of Kiya (Fig. 14) reflects the strong connection (edge weight) with the port of Yura (11 cargoes), and weaker connection (37) with the port of Matsue, followed by the secondary ports of Mihara (15), Tosadomari (4), and Setoda (1). The large number of purple points (shipmasters) is an indicator that Kiya worked with a variety of shipmasters of varying importance. This

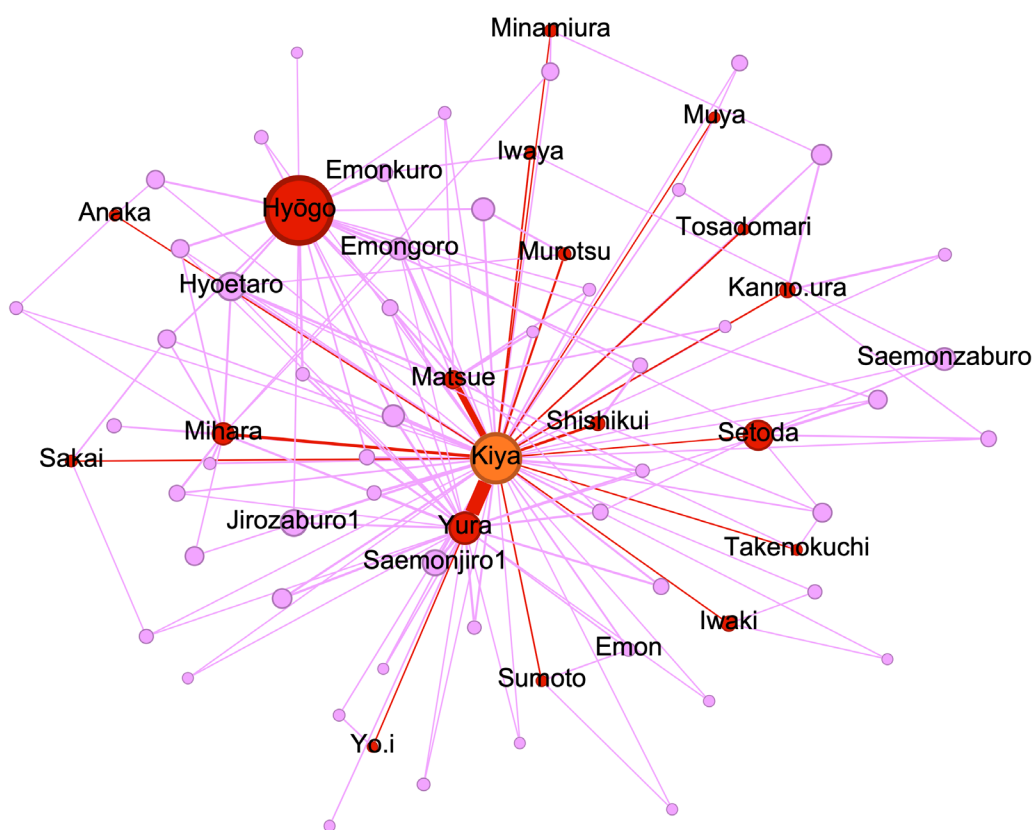


Fig. 14 Ego Network of commercial agent Kiya (depth of 1); the size of the vertices is relative to their degree centrality, which is the number of edges they have in the overall network figure (Fig. 7).

importance is defined by the number of cargoes Kiya deals with (represented by edges). Finally, certain shipmasters, such as Emon, only have a relationship with Kiya; from the available samples, Emon appears to be a shipmaster from the island of Awaji. In addition to wood, Emon carried about 200 *koku* of salt and 35 *koku* of rice for Kiya.

Others, such as Jirōzaburō and Emonkurō, are shipmasters with a larger and more varied activity, who were themselves mostly commercial agents the rest of the time. As shipmasters, they tend to collaborate with the most important commercial agents like Dōyū, Hōtoku, Bungoya, etc. Unsurprisingly, their collaboration with Kiya is clearly focused on transporting timber from the port of Yura. Indeed, after examining the record of entries for the first three months, we can see that all of the nine vessels credited to Kiya during the first month were from Yura. For the third month, the ratio is 13 to 16 between the fourth and twenty-fifth days. Kiya is thus an example of a double specialization, with regard to both the product (wood), and its origin (the port of Yura). To be precise, this special-

ization is not absolute. For example, a shipment of salt from Mihara and another of rice and salt were recorded on the fourth day of the third month. In addition, on the sixteenth and twenty-fifth days of the same month, two ships from Matsue and Iwaya (north of Awaji) were recorded. Also, on the fourth day of the second month, a ship attached to the port of Shishikui loaded with 120 *koku* of raw wood arrived in Hyōgo. On the basis of this sample, it would seem that Kiya managed the connection primarily with the port of Yura, eventually extending his activity to the island of Awaji and the eastern part of the Inland Sea. We can assume that this specialization is twofold because of a logical link between the required product and the region likely to supply it. However, it is difficult to know which of the two orientations may have led to the other.

The commercial agents in group C, composed of 5 names, operate with a volume of 1000 *koku* of salt, rice or wood and about 100 *koku* of other goods, totaling between 50 and 100 ships. The overall volume is indeed significantly lower than what we could observe in the case of the previous group, and none of them reaches the share of activity seen before, which was almost 44% in the case of Kiya. The number of vessels chartered by each is relatively high: the five actors in group C are ranked between fifth (Magotarō 孫太郎) and tenth (Hōtoku 法徳) in terms of the number of ships handled. Within this group, Magotarō is at the top as he handles 7267 *koku* of salt, or 7.2% of the traffic at the Hyōgo North Barrier over the year, and 1830 *koku* of rice (7.3%). In addition, there are actors in this category who tend to mostly operate out of specific ports. The case of Hōtoku is distinctive, because in addition to having overall responsibility for a sizable share of annual traffic, he also specializes in shipments from Utatsu (Sanuki Province). In fact, of the 52 vessels with which he is associated, 44 have Utatsu as their home port.

Group D is composed of 10 individuals who share a similar profile to group C, except for the fact that they deal with a total of 5 to 30 ships. In a nutshell, groups C and D consist of mid-size commercial agents. Group E is the largest in terms of the number of actors, and contains those who handled small volumes (under 100 *koku*) and had a limited number of ships (5 or less). The above categorization provides a framework for understanding the diversity of profiles behind the label of ‘commercial agent’, as well as offering insight into their trading habits.

Among agents who are approximately the same size, we note that their network of shipmasters was relatively independent of one another. For example, there are about 30 shipmasters linked to Kiya who are not connected to the other commercial agents shown in figure 15 (Dōyū and Emonkurō). From there, there is also a small but important number of shipmasters working with two agents, and some even with all three agents. The degree centrality (based on the overall network figure) of shipmasters working with only one of these three agents suggests that they were far from exclusive, and instead must have commonly worked with several commercial agents.



Fig. 15 Ego Networks of Dōyū, Kiya and Emonkurō using Yifan Hu algorithm. The size of the vertices is relative to their degree centrality, that is the number of edges they have in the overall network figure (Fig. 7).

Dualizers

One of the most fascinating aspects of deploying SNA methods to analyze the 1445 *Toll Register* is that it gives us an opportunity to probe into a group of actors who sometimes appeared as agents, and at other times as shipmasters. Because these actors are attested as embodying two aspects of a different nature, we call this group of actors ‘dualizers’.⁵⁹ The group consists of 32 individuals who were involved as commercial agents in 985 of the total 1969 voyages, 1445 times (50%) as shipmasters, and 442 as other voyages (22%). In terms of an absolute

59 Kobayashi Yasuo, “Irifune nōchō ni miru kokuryō to kasho,” in *Hyōgo kitazeki irifune nōchō*, ed. Hayashiya Tatsusaburō (Tokyo: Chūō kōron bijutsu shuppan, 1981), 289–302.

number, most agents are also shipmasters (61% of the agents). The norm seems to be that when dualizers assumed the role of shipmasters, they worked with other agents for the voyage they were undertaking, thus avoiding simultaneously being a shipmaster and a commercial agent for the same voyage. There are, however, exceptions when it comes to sailing in convoys, especially ‘private’ ones, i.e., those entirely handled by the same actor. The case of Emonkurō, on the sixteenth day of the seventh month, is a particularly good example: he transports (as shipmaster) 150 *koku* of salt (Bingo) and is accompanied by an auxiliary boat (*edabune*) carrying wood and seaweed.⁶⁰ The information recorded for both shipmaster and agent is indicated as ‘same,’ i.e., Emonkurō in this context.

Figure 16 is a visualization of the behavior of the same actors in different roles. It shows the interaction of the dualizers, with ports represented in red. They are split into two distinct networks – first in their role as agents (orange, on the left), and then as shipmasters (purple, on the right); the nodes’ relative locations are the same in both cases. The two networks’ respective trends can thus be compared.

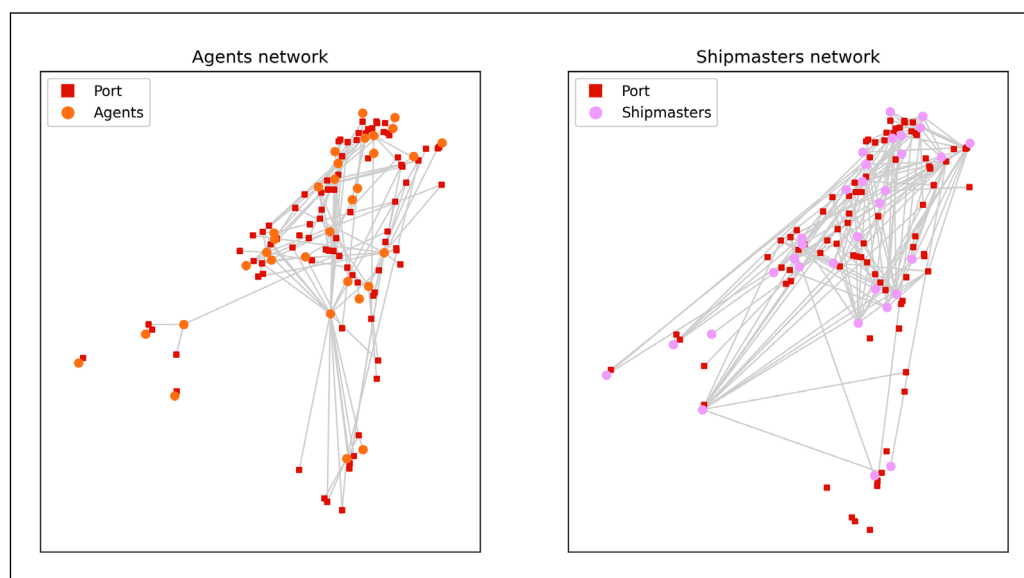


Fig. 16 The network of 32 dualizers as commercial agents (left) and shipmasters (right). Ports are in red, and nodes are positioned according to their geographic coordinates.

⁶⁰ Around ten different patterns of convoys can be observed in the register, indicating the importance of grouped shipping for all those involved in maritime trade. This article does not deal with convoys or auxiliary boats. On this topic in Englishsee Damian, “Late Medieval Japan’s Seto Inland Sea Seascape,” 222–38.

The most striking observation is that the activity profiles of these dualizers do not overlap – they used different ports depending on whether they were operating as commercial agents or as shipmasters. This observation applies not only to behavior at the level of the individual (or entity), which is not centered around the same port depending on its role, but also to general trends. As shipmasters, dualizers work mostly with Hyōgo, Ushimado and Mihara, but when they are agents, their interactions mainly concern the ports of Ushimado, Yura and Aboshi. For example, when Jirozaburō was assuming the role of a shipmaster, it was mostly by ship registered in Hyōgo itself; when his role was that of a commercial agent, however, he was working with ships registered at Ushimado. The ratio of cargoes per ship does vary according to the role, and averages 1.3 cargoes per ship.

Among the dualizers, Emonkurō can be considered a representative example of a dualizer (Fig. 17). He is first and foremost a major commercial agent. However, when he took on the role of shipmaster, he occasionally moved within the network of other shipmasters, working with other prominent agents such as Dōyū, Kiya and Hōtoku. This visualization does not include the twelve occasions when Emonkurō worked as a shipmaster without a commercial agent.

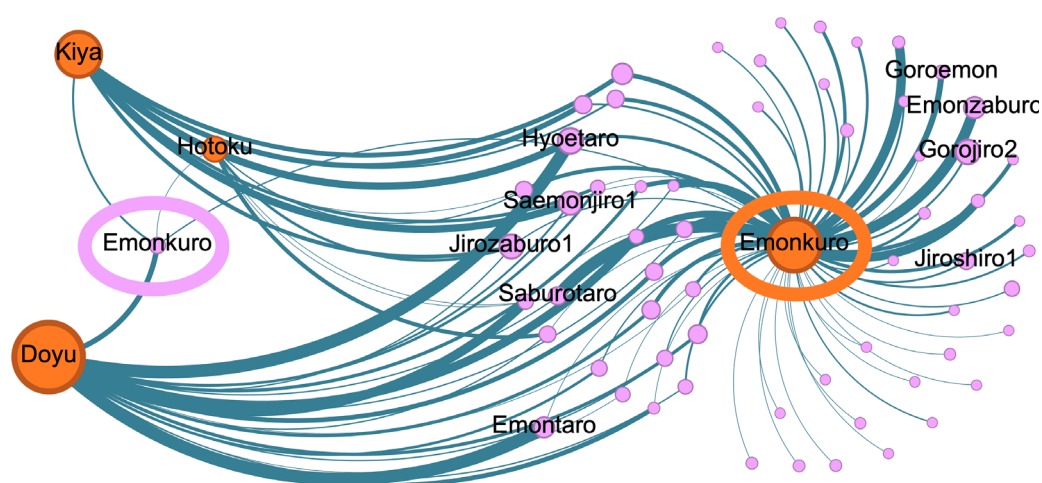


Fig. 17 Emonkurō's network as a commercial agent (orange vertex) and as a shipmaster (purple vertex) when working in tandem with an agent.

Community detection

One of the most fascinating findings comes from adopting a community detection approach. While traditional historical analysis has tended to structure the analysis of the register by actor categories, modularity analysis follows a different logic, and in this case reveals the following preliminary results.⁶¹ The dataset concerning the shipmasters and ports was submitted to the Louvain algorithm with a resolution of 2.0, which detected a total of nineteen communities; of these, we have retained only the eight most significant, thus excluding from our analysis eleven communities that consisted solely of one or two nodes (Fig. 18). These communities, representing groups of entities detected using an algorithm, go beyond the initial categorization and bring together ports and shipmasters that are closely linked.

To examine what the communities detected represent, we looked into the geographical proximity of ports, the concentration of active commercial agents, and the goods transported in each community. These are all listed in Table 1. Community numbers were given from 1 to 8, corresponding to the number of nodes in the communities from largest to smallest. Geographical proximity was operationalized by averaging the distance of all combinations of ports in a community, with the exception of Imago 今郷 and Kajishima 梶嶋, where exact locations were not identifiable. At this stage, several points stand out as remarkable.

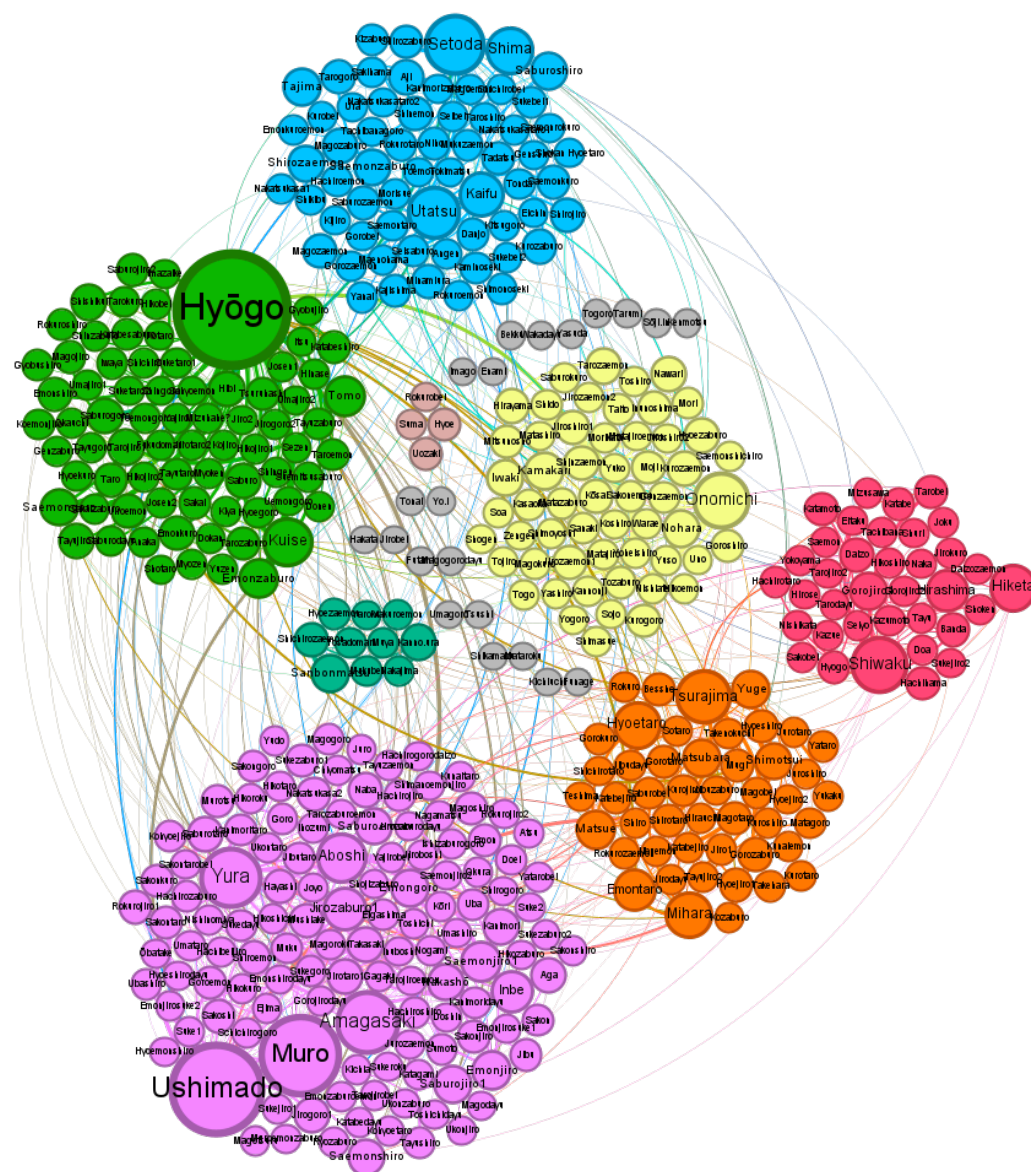
First, communities are for the most part not determined by geography. Looking at ports in each of the communities detected, the communities only loosely correspond to the geographical proximity of the ports – with the exception of the smallest community (community 8 with Suma 須磨 and Uozaki 魚崎, which are both right next to Hyōgo). The largest and second-largest communities were mostly concentrated on the eastern part of Seto Inland Sea, while the third-largest community was mostly on the western side, and the fourth largest was situated in the middle. Second, communities can hardly be said to be uniquely characterized by the goods they transported. One exception is community 7, which is characterized by the goods transported by the shipmasters in the community. This is the only community where the most frequently transported goods were wood.

The rest of the communities can more clearly be characterized by the commercial agents operating within them. If we leave aside counts for shipmasters operating without a commercial agent, the six largest communities all have different commercial agents as the most active within them. Notable, albeit unsurprising, is the fact that the super-agent Dōyū was very active across the communities de-

61 Vincent D. Blondel et al., “Fast unfolding of communities in large networks,” *Journal of statistical mechanics: theory and experiment* 10 (2008), accessed January 25, 2024, <https://iopscience.iop.org/article/10.1088/1742-5468/2008/10/P10008>.

Communi- ty	Color in Figure 18	Number of ports	Number of shipmasters	Average distance be- tween ports (in km)	Most active commercial agents (Number of ships operated by the agent)		Goods transported by shipmasters (Number of cargos for the goods)	
1	purple	24	102	88,54	No agent	124	salt	228
					Kiya	115	rice	163
					Emonkuro	91	wood/construction materials	114
					Bungoya	55	fishery	93
					Saburotaro	50	beans	44
2	green	13	62	82,72	No agent	234	salt	176
					Magotaro	28	rice	109
					Doyu	28	wood/construction materials	54
					Kiya	25	cereals	53
					Emonkuro	14	beans	37
3	light blue	15	47	129,73	Emonshiro	50	salt	143
					Jirozaburo1	40	wood/construction materials	60
					Hotoku	34	rice	36
					Doyu	18	beans	27
					Donen	15	cereals	18
4	yellow	17	39	82,05	Jirozaburo1	39	salt	117
					Doyu	34	rice	49
					No agent	19	beans	40
					Magotaro	18	cereals	23
					Emonshiro	9	wood/construction materials	19
5	orange	11	36	98,22	Doyu	107	salt	167
					Kiya	48	rice	48
					Aucun	46	wood/construction materials	37
					Jirozaburo1	12	cereals	36
					Emonkuro	10	beans	28
6	pink	7	29	54,52	Emonkuro	31	salt	59
					Doyu	22	cereals	22
					Emontaro	19	rice	20
					No agent	14	wood/construction materials	17
					Magotaro	6	non specified taxes or dues in kind	10
7	emerald green	4	6	47,59	Jirozaburo1	15	wood/construction materials	23
					Emontaro	10	rice	11
					Kiya	3	salt	4
					Tojiro	3	cereals	3
					No agent	1	tinctorial plants and wood/dyeing materials	2
8	hazel	2	2	15,98	Doyu	10	rice	11
					No agent	2	cereals	3
					Emonkuro	1	salt	3
					Emontaro	1	fishery	1
					Hotoku	1	beans	1

Tab. 1 List of characteristics of the eight most significant communities identified by the Louvain algorithm.



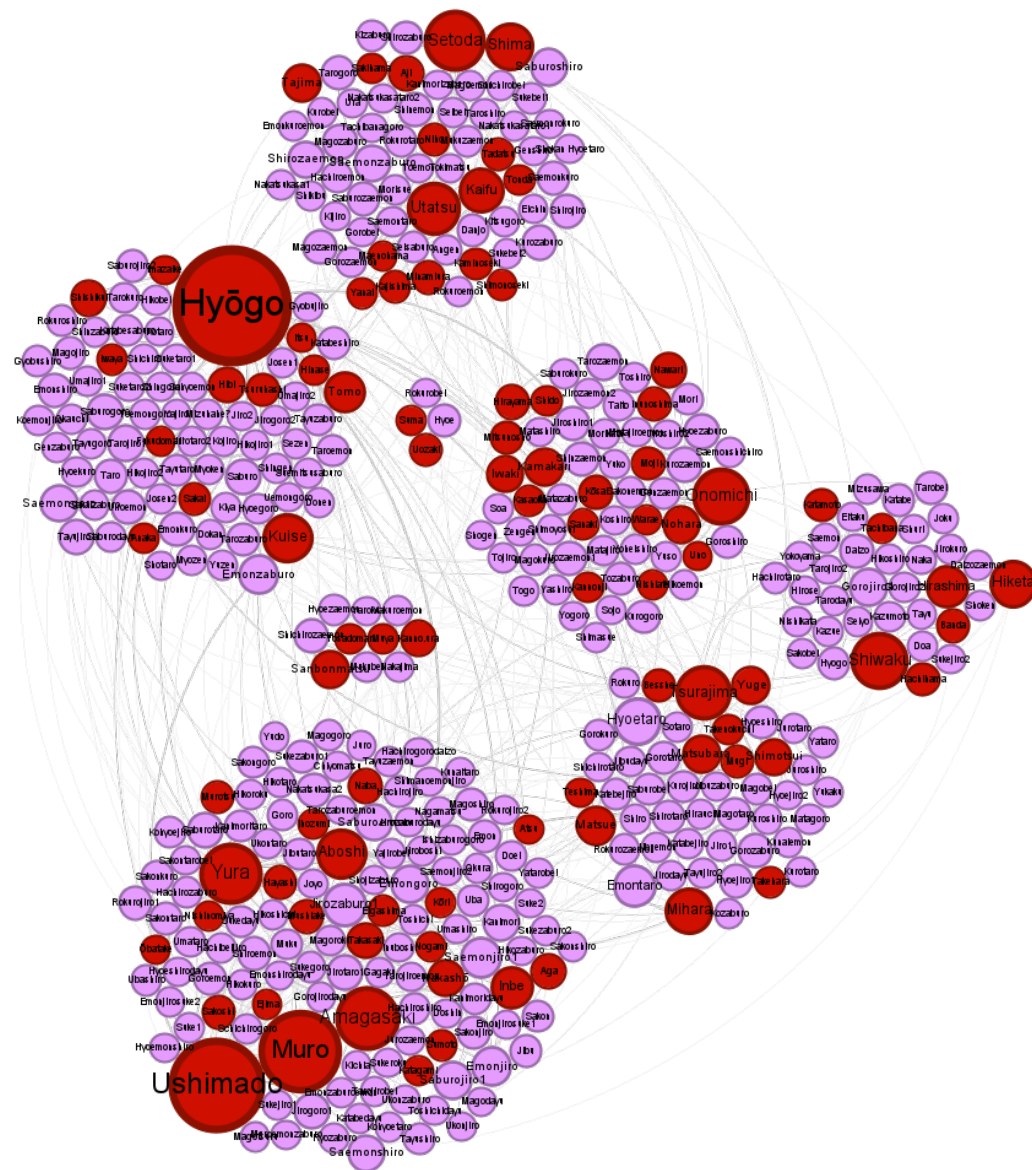


Fig. 19 Eight 'Communities' from the 1445 *Toll Register*, the color code distinguishing between shipmasters (purple) and ports (red). The node size represents the degree centrality.

tected. He appears to be one of the five most active commercial agents in six of the eight communities. In addition, we counted the number of ships operating with a shipmaster from a port whose communities are different. Of 516 such ships, 67 were operated by Dōyū. This shows Dōyū's particularity of being a cross-community operator. From these preliminary results, we have shown that none of the factors thus far examined – geographical, transported goods, nor operating commercial agents – were enough by themselves to explain the structure of the network between the people and the ports. It also suggests a special status for Dōyū as a commercial agent who operated across various different communities.

Politics and trade in the medieval Seto Inland Sea: Toll barrier and exemptions

The toll exemptions were supposed to distinguish commercial goods from rent in kind at a barrier (*sekisho* 関所) on the land or sea route. Tax exemption for rents in kind came into existence by the mid-fifteenth century, although there are some indications of attempts to put in place an exemption of temple-labeled cargoes in the early fourteenth century.⁶² The systematization of toll exceptions for goods labeled by religious institutions and selected warrior clans was arguably a consequence of an explosion in the number of toll barriers, each run by a different authority and with different rules. Both phenomena, the toll barrier boom and the exemption system, were a symptom of the rise in the sheer volume of commercial traffic which constituted the fabric of the medieval commercial revolution. As part of this process, transportation of rent in kind went from being the rule to being an exception. The 1445 *Toll Register* is a perfect showcase of the end point for this transformation, in that a little over 10% of the traffic registered – 248 of 1969 ships – were subject to toll exemption in our dataset.⁶³

For the purpose of quantitative analysis, this exemption constitutes a challenge, because the nature and volume of the cargoes are not always noted in the register. As a consequence, it is difficult to precisely establish the overall volume of trade. However, for the purpose of historical network analysis, a close examination of institutions that were given these exemptions can shed new light on the political landscape of medieval Japan.

The exemptions can be divided into two groups. First, a small number (13%) of customs exemptions for official ships (*kokuryōsen* 国料船) carried rents in

62 In 1306 (Kagen 4. 09), Tō-ji, a temple of Kyoto promoted the use of a distinctive mark, *kasajirushi* 笠符, to avoid the inconvenience of lengthy inspections of its shipments at the Yodo barrier. *Nihon engyō taikēi: Shiryō-hen, kodai, chūsei* 1, ed. Nihon engyō taikēi henshū iinkai (Tokyo: Nihon senbai kōsha, 1975), doc. no. 148, 223.

63 Ueda Takafumi, “Hyōgo kitazeki irifune nōchō kara mita Onomichi shūhen ni tsuite,” *Kokushi danwakai zasshi* 47 (2006): 10–28.

kind from the various estates. Customs exemptions referred to ships that literally carried ‘public taxes’, and applied to the entire ship’s cargo. In this case, a special entry specifies the name of the recipient and the associated pass, as well as the province of origin of the levy proceeds. The second group was composed of a much larger number of diverse groups of ad hoc *laissez-passer* (*kasho* 過書), granted on a case-by-case basis to ships affiliated with: 1) Buddhist and Shintō religious establishments (36%); 2) commercial ventures linked to religious establishments (30%); and 3) the shogunate, or central military government (21%). In the case of ad hoc *laissez-passer*, the exemption applied to a specific cargo. There were 33 customs exemptions (*kokuryōsen*), and 141 of the ad hoc *laissez-passer* type.

For our analysis, we have postulated the relevance of analyzing and producing visualizations relative to exemptions by the type of holder, as opposed to the type of *laissez-passer*, in order to provide an overall analysis of the maritime networks affected by the exemptions due to what it tells us about politics and trade within the medieval Seto Inland Sea.

Religious establishments are the single largest category of *laissez-passer* holders, accounting for 35% of all the ad hoc *laissez-passer*. For example, on the sixth day of the third month, a single-cargo ship under the responsibility of the commercial agent Dōyū and carrying 150 *koku* of rice is registered with the notation: “Shōkokuji-Shōjōin *laissez-passer*, rents from Bitchū.”⁶⁴ However, within this apparently narrow category lies a diverse and fragmented group of institutions and actors. Consistent with the known preference of the Ashikaga shoguns for the Zen school of Buddhism, the largest number of exemptions given to the religious institutions went to the so-called Five Mountains (*gozan* 五山), referring to the five largest Zen temples, all located in Kyoto. This most recent Buddhist sect, a relatively new arrival in Japan, was not only given sizable estates but were also exempted from tolls concerning the movement of rent in kind and the trade of commodities from these estates. The 1445 *Toll Register* shows that of all the ad hoc *laissez-passer* given to religious institutions, 50% were granted to the five great monasteries (all of which have been in continuous operation and remain active today): Nanzen-ji, Shōkoku-ji, Tenryū-ji, Tōfuku-ji, Rokuon-in, Tōdai-ji, Sanmon and Sennyū-ji.⁶⁵ The second-largest group of exonerated religious estates were the Shintō shrines dedicated to Hachiman, divinity protector of the Imperial Court (30%). The major shrines in this category were Iwashimizu Hachimangū 岩清水八幡宮, Rokujō Wakamiya 六条若宮八幡宮, and Nyakuōji-sha 若王子社, all of which also exist to this day. The remaining 19% of exemptions

64 *Shōkokuji-Shōjōin kasho*. *Bitchū nengu* 相国寺勝定院過書 備中年貢.

65 Rokuon-in is affiliated with Shōkoku-ji of Kyoto. Tōdai-ji of Nara is affiliated with the Kegan sect. Sanmon (山門) is another name for Enryaku-ji of Mount Hiei (Tendai sect).

for religious establishments are divided between four non-Zen Buddhist temples and one Shintō shrine.

The second largest category of beneficiaries were commercial ventures linked to religious establishments. These businesses, which had links to the temples and shrines, amount to roughly one third of all ad hoc exemptions (34%). There were three notable enterprises connected to religious establishments: Yodo transportation (40.5%), Yamazaki oil seeds (33.7%), and Kurōbei, an enterprise of unknown specialization (16.2%). The enterprise named ‘Il ships of Yodo’ was a river transportation venture, affiliated with the Iwashimizu hachimangū shrine in Ōyamazaki. They were likely an all-purpose transportation business operating on the Yodo River, the principal artery connecting Daimotsu Bay with the capital, Kyoto. Yamazaki refers to a group of merchants that depended on the same Iwashimizu hachimangū shrine in Ōyamazaki. These merchants were officially affiliated with the shrine (*jinin* 神人), and traded in the products labeled ‘Yamazaki goods’, ‘Yamazaki oil seeds’, or ‘Yamazaki perilla seeds’.⁶⁶ However, as Suzanne Gay noted, the exemptions accorded to Yamazaki ships were not systematic. The 1445 *Toll Register* shows that less than $\frac{1}{5}$ of shipments of lamp oil produced at Iwashimizu shrines were fully exempt.⁶⁷ At present, Kurōbei remains a little-known establishment, and further research is necessary to clarify the nature of this enterprise.

The third category of beneficiaries of exemptions was the vassals of the Ashikaga shogunate, who benefited from about 20% of all *laissez-passer*. A quantitative analysis of the structure of the exemptions given to the different warrior clans points to a division of their portfolios into approximately 40% of the customs exemptions for ships (and convoys), or a total of 33 ships carrying the annual tribute from the estates to the landlords, and 60% of ad hoc exemptions pertaining to the internal estate trade. Among the warrior clans, three vassal clusters of influence emerge as the largest beneficiaries of exemptions: Hosokawa 細川⁶⁸, Yamana 山名, and Ōuchi 大内. Contrary to most of the ships benefiting from exemption, which tended to *not* have an assigned commercial agent in the port, all of the warrior clan ships, including their vassals, systematically had an agent in the port. The

66 Other mentions such as ‘Yamazaki’s perilla’ (*yamazaki egoma* 山崎荏胡麻) also appear in the register. See Gay, “The lamp-oil merchants,” 1–51.

67 Ibid., 21.

68 Hosokawa patronage does include the shogunal prime minister (*kanrei* 管領), appearing in the register as “former shogunal prime minister” (先管領) until the fourth month, then “thousand *koku* of the shogunal prime minister” 管領千石. See Kobayashi, “Irifune nōchō,” 293. The shogunal prime minister (*kanrei*) was Hatakeyama Mochikuni 畠山持国 (1398–1455) until 1445.03.04, then Hosokawa Katsumoto 細川勝元 (1430–1473) occupied the position between 1445.03.24 and 1449.09.05. We can also distinguish between true Hosokawa 細川ships and those of Kagawa 香川, Sogō 十河, and Yasutomi 安富, which are subordinated to Hosokawa.

issue of why clan ships benefiting from *laissez-passer* always have an agent was raised by historian Kobayashi Yasuo.⁶⁹ Part of the answer lies in the fact that, at the end of the fourteenth century and the beginning of the fifteenth century, the shogunate was looking for ways to develop legal and administrative means to capture part of the benefits coming from the commercial and financial activity of the archipelago. At the same time, the authorities had to deal with a wave of fraudulent uses of exemptions. On the twenty-first day of the fourth month of the year 1404 (Ōei 11), the shogun Ashikaga Yoshimochi issued a decree exempting from tolls the official ships (*kokuryōsen*) carrying the proceeds of taxes and dues from landed estates, as well as those that had an ad hoc *laissez-passer*. In essence, this decree announced that if any commercial goods were discovered in the cargo they were to be seized, and their value allocated to the maintenance costs of the Kasuga shrine.⁷⁰ On the twenty-fifth day of the following month (1404.05.25), a second decree made similar provisions, this time citing commercial agents (*toimaru*) as potential offenders, forbidding them to “load commercial products onto the ships of major temples and shrines” (i.e., holders of *laissez-passer*).⁷¹ This strongly suggests that commercial agents were making arrangements to smuggle commercial goods on board and take advantage of port tax and toll exemptions. However, local political powers were also involved: there are documentary traces of a case involving the Kobayakawa warrior clan, which in the twelfth month of 1422 (Ōei 29) had obtained the privilege of a tax exemption for its ships, whose loads were marked “Ships of Ikuchi.” The fraud is described in the seventeenth day of the third month of 1423 (Ōei 30), mentioning that the clan had tried to get Setoda’s commercial ships through the two Hyōgo barriers (north and south) by taking advantage of their exemption on estate rents.⁷² In this context, Kobayashi had suggested that the commercial agents connected to warrior clan shipments sailing under the *laissez-passer* regime were somehow supposed to serve as guardians against such abuse.⁷³ Alternatively, it could also be the case that these agents were only connected to cargoes for which Hyōgo was not the final destination. The argument for agents having the responsibility to ensure the nature of the shipment is supported by small number of extant documents there are concerning the trade outside the 1445 *Toll Register*. In 1423, three commercial agents were commissioned to oversee the recovery of unpaid debts which stemmed from fraud charges.⁷⁴

69 Kobayashi, “Irifune nōchō.”

70 The Kasuga Shrine is one of the country’s three main shrines (*sansha*), along with Ise Shrine and Iwashimizu Hachiman-gū. The warrior divinities Takemikazuchi no mikoto and Futsunushi no mikoto are worshipped here.

71 Archives of the Kasuga shrine (Kasuga jinja monjo 春日神社文書), cited by Toyoda Takeshi, Toyoda Takeshi chosakushū, 2: Chūsei Nihon no shōgyō (Tokyo: Yoshikawa kōbunkan, 1982), 225.

72 Suzuki Atsuko, *Nihon chūsei shakai no ryūtsū kōzō* (Tokyo: Azekura shobō, 2000), 264–65.

73 Kobayashi, “Irifune nōchō,” 293.

74 Suzuki, *Nihon chūsei shakai no ryūtsū kōzō*, 264–65.

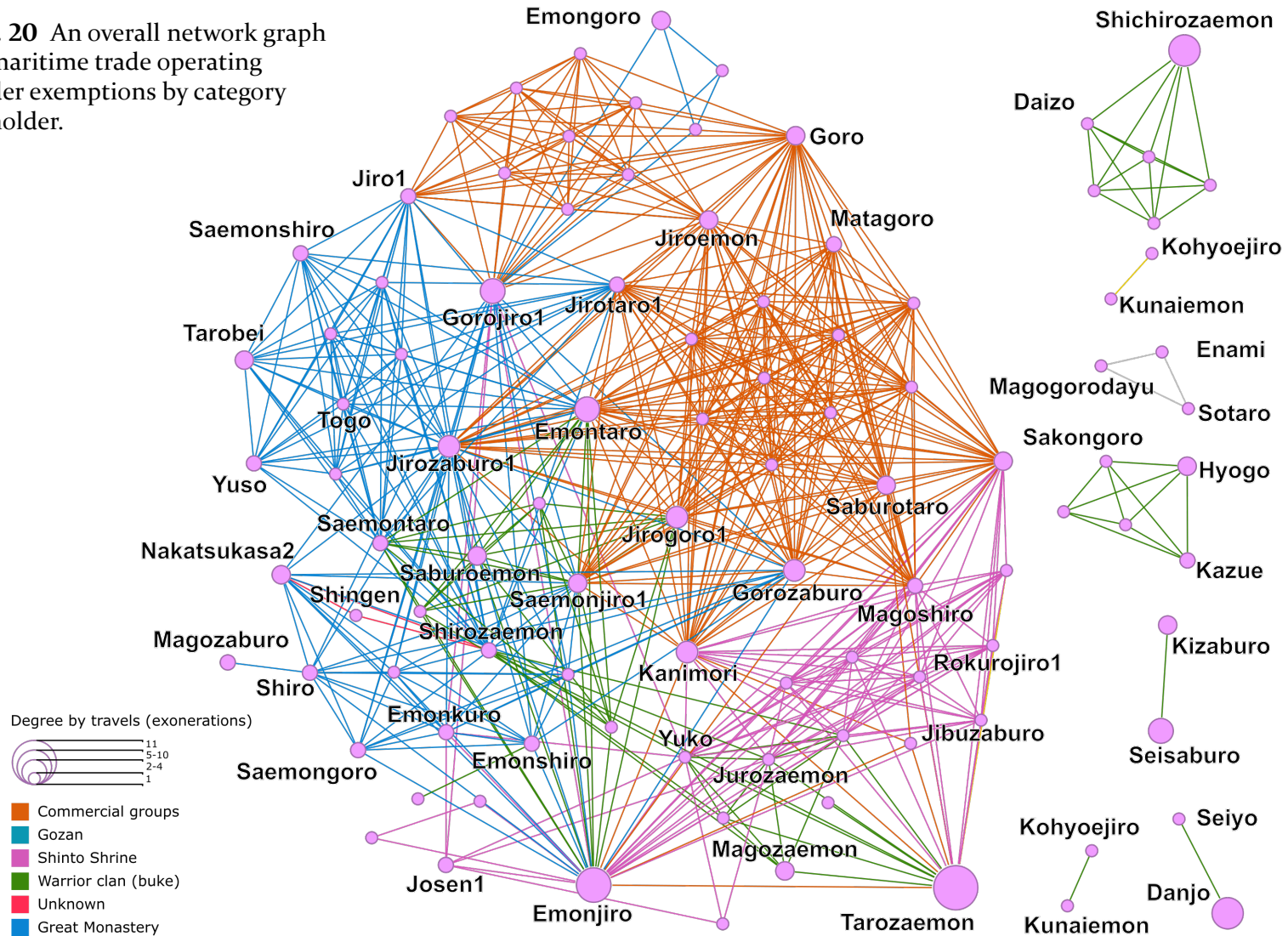
Beyond the commercial agents, a look at the relationship between shipmasters and the holders of exemption rights allows us to materialize the networks of the official toll-exempt traffic. Figure 19 shows the relationships between shipmasters who transported loads at least once for the same exemption rights holders, classified by type of holder (i.e., warrior clans).

The overall network graph of exemption trade points to 1) the limited import of the warrior clans (green) in the overall volume of activity in the maritime trade subject to exemptions. In addition, 2) a good deal of their existing maritime network is separate from the rest of the trade. Outside of the limited sphere of maritime trade linked to the warrior clans, there was great diversity in the maritime trade subject to exemptions. At the heart of this sliver of trade 3) were the shipmasters, in part because only half of the exonerated cargoes had a designated agent. The absence of commercial agents in the trade under *laissez-passer* is remarkable in light of the fact that, among the rest of the trade, only 19% of ships were agentless. The SNA analysis highlights the shipmasters as key interfaces between different networks benefiting from exemptions. For example, Jirōtarō I, Emontarō, Gorōjirō, Saemonjirō I together constituted the interface between two categories of exempted cargoes, namely Zen temples and the commercial ventures linked to Shintō shrines. These ‘interface captains’ were in a league apart in comparison to shipmasters, who remained involved with only one particular category. Regarding an overall trend, if we exclude activity subjected to exemptions, then despite the existence of a super-agent (as Dōyū was) among commercial agents or a super-specializer (such as Kiya and Emonkurō), there is no super-captain or leader who concentrates a significant part of the trade in a given network. While they were a diverse group, they remain less stratified than the commercial agents.

The limited importance that the warrior clan trade had in overall maritime commercial activity notwithstanding, their activity presents certain specificities worth noting. First, for this category of exemption holders, the port of origin is consistent with the domain of influence (Fig. 21). Yamana ships consistently leave only from Yamana territories, and the same is true for all the other warrior clans. In addition, the official ships (*kokuryōsen*) benefiting from a customs exemption systematically left from specific ports within the vassal domain of influence. For example, the official cargoes of the Yamana clan originated in the port of Warae 蕨江 in Bingo, while the official shipments of the three Hosokawa vassals came from three ports in the Sanuki Province: Aji, Katamoto and Tadatsu. The cartography of ports of departure for the specific purpose of official shipments that emerges from the 1445 *Toll Register* confirms and highlights the political geography of the routes of resource extraction within the region.

Furthermore, a close examination of the interface between the political power actors and the maritime trade networks using SNA methods highlights the tendency of large commercial agents to be assigned the handling of official ship-

Fig. 20 An overall network graph of maritime trade operating under exemptions by category of holder.



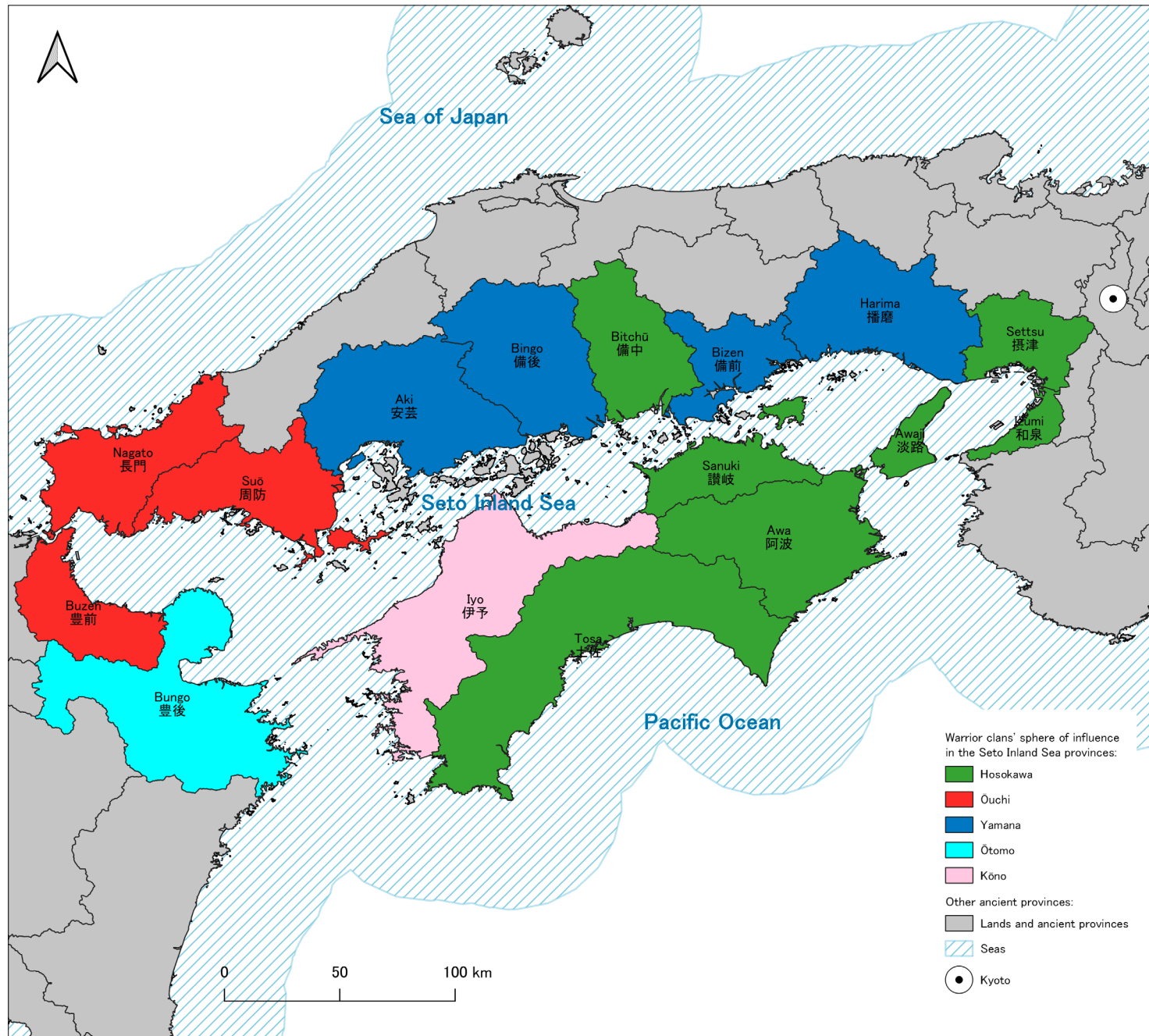


Fig. 21 Map of Seto Inland Sea warrior clans' spheres of influence

ments. Analysis also demonstrates a strong tendency for the clans to use only one or two shipmasters for their ships. For example, the Yamana clan relies on a single shipmaster, by the name of Tarōzaemon 太郎左衛門, for its eight official cargoes. The Kagawa, a Hosokawa dependent, employs only two shipmasters (Seisaburō 勢三郎 and Kizaburō 紀三郎) to handle seven cargoes. The same can be said for the nine Yasutomi cargoes. As a Hosokawa dependent, Yasutomi also rely on just two shipmasters (Seiyo 成葉 and Danjō 弾正).⁷⁵

The fact that there are no shipmasters that registered transactions with two different clans suggests a form of exclusive partnership between a clan and a group of shipmasters, who were arguably subject to a functional, albeit likely tacit, equivalent of a medieval non-compete clause. In concrete terms, this meant that the clans operated in silos, i.e., in a sort of loose sub-network, expressed in technical terms in graphs by connected components (Fig. 22). Among the three categories of *laissez-passer* holders, this kind of closed circle is unique to ships involving clans and vassals. For example, the eighteen cargoes dispatched by the Hosokawa clan were handled by a total of eight shipmasters, who worked with no other clans. Similarly, the 15 shipments by the Yamana clan were handled by 11 different shipmasters, of which only one worked with the Ōuchi clan. Arguably, this exception can be explained by the fact that two decades later, Ōuchi came out as an ally of Yamana in the defining conflict of the Late Middle Ages. While Hosokawa and Yamana were not the only vassals to keep things in a small circle of exclusive shipmasters, it is tempting to read more into their separation. Two decades after the 1445 *Toll Register*, Hosokawa and Yamana went to war. The ensuing decade-long armed conflict, called the Ōnin War (1467–77), ended up being a prelude to a destructive century-long conflagration known as the Warring States period (1467–1600), which brought Japan's Middle Ages to an end. The SNA analysis of the parallel networks of Yamana and Hosokawa vassals and their respective shipmasters demonstrates a remarkable degree of separation between their maritime trade networks. This separation speaks to a rivalry that would end up reshaping the end of the Middle Ages in Japan.

The silos are less pronounced when it comes to commercial agents, but there was nonetheless a clear tendency towards separate commercial spheres. For example, of the eighteen cargoes dispatched by the Hosokawa clan, nine were handled by commercial agent Emontarō – the principal interlocutor of the clan – and two by Tōjirō. One Hosokawa cargo each was processed by Emonkurō and Dōyū, who were themselves principal agents for Yamana and Ōuchi, respectively. Thirteen of fifteen ships dispatched by the Yamana clan were handled by the commercial agent Emonkurō, who was their principal agent and is recorded as trading with Hosokawa on just one occasion.⁷⁶ It follows that the maritime trade cir-

75 The shipmaster's name is illegible for one entry.

76 See Ueda, "Hyōgo kitazeki irifune," 27 and Kobayashi, "Irifune nōchō," 293–98.

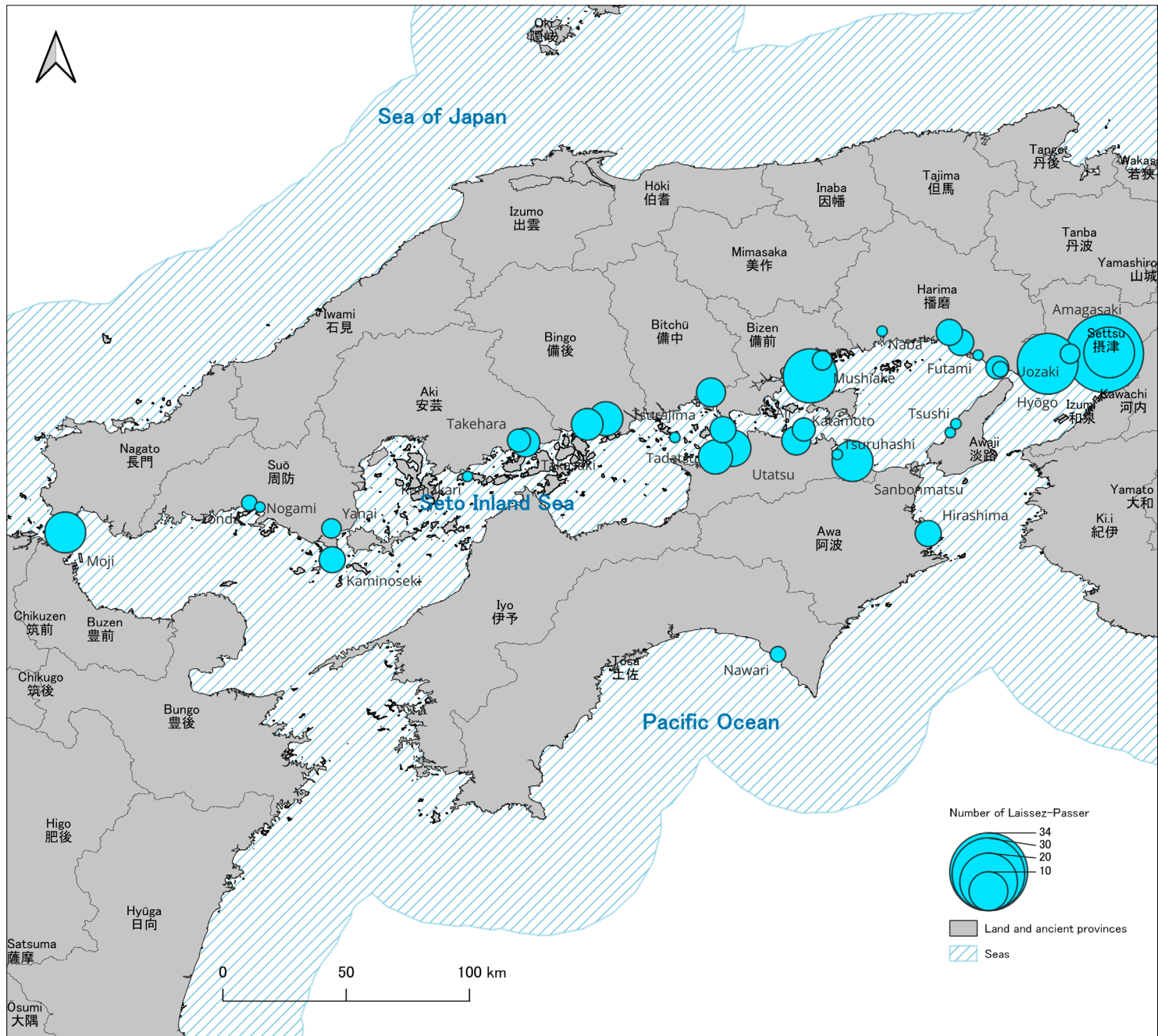


Fig. 22 The medieval clan silos and maritime ‘non-compete clauses’. There are seven connected components, representing the parallel networks of the ship-masters working with six clans, including their vassals.

cuit of medieval clans was not airtight, but the contact points remained rather limited.

Such a tendency for separation of networks was exceptional *per se*. No other category of actors – regardless of their known competing attitudes – cultivated a separate network of shipmasters that were not involved with their ostensible rivals. As such, the separation between shipmasters dealing with two clans that would face each other in a war two decades later suggests that tensions were visible in the maritime trade long before the first military clashes.

Finally, perhaps the most fascinating aspect with regard to exonerated trade is the fact that the single most pertinent variable in the segment of *laissez-passer* ships without attributed commercial agents was the location of the port of registry (Fig. 23). At first glance, the non-use of agents is massively concentrated in the segment of trade concerning large temples and commercial ventures linked to Shintō shrines. For example, among the seventeen ships sent to Hyōgo in 1445 under the *laissez-passer* of ‘Nanzen-ji,’ the largest of the five Zen temples that constituted the ‘Five Mountains,’ not a single one had a commercial agent. How-

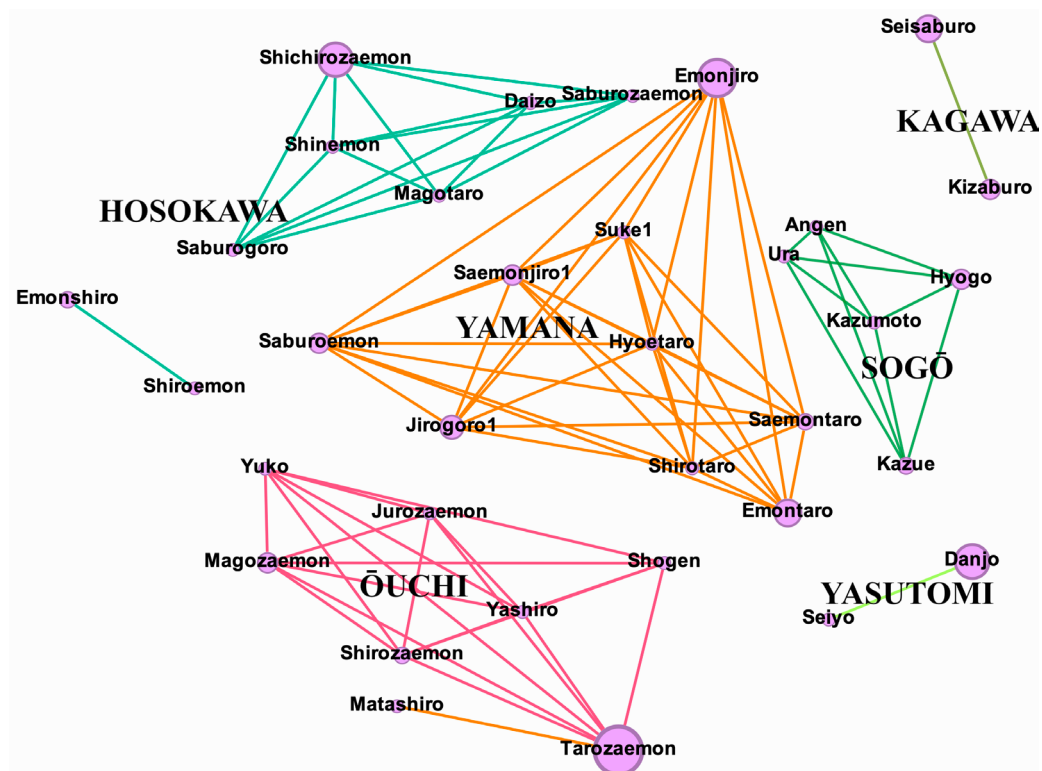


Fig. 23 Geographical distribution of ships benefiting from a *laissez-passer* (all types).

ever, building on Ueda's analysis, a closer look demonstrates that this was not about the category of beneficiaries of a *laissez-passer*, but rather about the port of registry of the ship. About 70% of exonerated ships came from ports of registry in the Settsu Province. A large majority of excepted ships were from four ports within a single province: Amagasaki 尼崎 (33), Uozaki 魚崎 (2), Kuise 杭瀬 (16) and Hyōgo 地下 (19).

Conclusions

The transportation of rents in kind to the capital region, the center of consumption and political power, had been the primary basis for the flow of goods in Japan since the classical era (the eighth to the twelfth centuries). However, the 1445 *Toll Register* reflects the rise of the commodification of goods. The first signs of this trend can be dated back to over a century before the register was penned. The transregional maritime circulation of goods, along with the network of regional ports engaged in the process of channeling the production of the Seto Inland Sea region, testify to what is referred to as a “medieval commercial revolution.” In other words, it provides a snapshot of the tail end of the early medieval economy and brings concrete data to the new paradigm that took shape in the second half of the Japanese Middle Ages. This new paradigm was based on a myriad of actors working as shipmasters or commercial agents of various types, and also implies political changes, which are partly observable in the 1445 *Toll Register*. The analysis of the commercial network reveals the preeminent political forces of the time, allowing us to reconstruct, to some extent, their spheres of influence.

Visualizations of geospatial and statistical analyses highlight a relative absence of activity in the ports of the western Inland Sea, while also demonstrating the maturity of their navigational and technical maritime capability (Fig. 2, 3, 5). However, the absence of proof of activity in the western ports cannot be taken as proof of the absence of maritime trade activity. While there is a general understanding, within the confines of medieval Japanese history, that the register cannot be taken to give a comprehensive picture, our analysis provides a preliminary demonstration of the contours of the missing segment. In sum, we argue that the 1445 *Toll Register*, a rich and unique source on maritime commodity networks in medieval Japan, depicts roughly one half of the overall maritime circulation in the Inland Sea.

An analysis of the relationship between a port and the commodity coming out of that port, adjusted for shipments on vessels for which the port of registry and port of arrival are the same, suggests that a port is as likely to be closely related to the region of production as it is to be an intermediary hub. The case of wood is a good example of the latter. There is little reason to believe that the island province of Awaji is the throbbing heart of timber production that feeds the imperial capital's hunger for construction material. The fact that the vast majority of the

timber comes to Hyōgo from Awaji strongly suggests that its ports were in fact transit hubs for timber coming from Shikoku, which was a historical source of construction wood (Fig. 6). This provides an additional data point demonstrating the scope of the maritime trade activity not depicted in the register.

The social network analysis of commercial agents gives new nuance to the leg work of a medieval commodity network. While the Japanese term *toimaru*, commonly translated as commercial agent, covers a diversity of realities, the SNA method allows us to detect patterns that are not readily discernible by classical methods. First, complementing the traditional categorization of agents into five groups, this article introduces a categorization of agents into two groups: 1) a group of commercial agents who also engage in maritime trade as shipmasters, which we designate as ‘dualizers’; and 2) the commercial agents who shy away from handling ships in the role of shipmasters. This new categorization allows us to note that, contrary to the idea that commercial agents themselves did not commonly engage in long-distance transportation, by the mid fifteenth century, most of them did (32 of 54). Interestingly, their behavior is very different based on the role they assumed, tending to work with entirely different ports whether they were commercial agents or shipmasters for a given ship. As such, they never occupied both roles for the same ship. In their role as shipmasters, they tended to work with fewer ports in comparison to their activity as commercial agents (Fig. 15).

The SNA method also allows us to detect the extent of separation between the maritime networks involved in trade by warrior clans. Not only was their trade separate from the rest of the maritime network (Fig. 19), but it was also entirely segmented among the clans themselves (Fig. 21). One of the most fascinating aspects of our analysis pertains to community detection. Contrary to traditional historical methods, which have analyzed the maritime network in terms of categories of actors (in particular the five types of commercial agent), our community detection isolated nineteen communities of trade, which partially dismantles the traditional understanding (Fig. 18). Further collaborative research will be required to probe into each of these communities, and especially the eight most significant ones as identified by the Louvain algorithm, in order to bring forth a new typology of Seto Inland Sea communities of trade.

The authors have no competing interests to declare.

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