Market Structure and Policy Issues
in the Coastal Shipping Market in Japan

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1. Introduction

In this paper, we focus on the contemporary market structure and policies surrounding Japan's coastal shipping market. Coastal shipping (hereafter CS) in Japan is responsible for domestic sea transportation, and forms a domestic shipping network. According to the CS Industry Act of Japan, domestic shipping means the transportation of goods by sea, where both the port of loading and the port of discharge are within Japan. Compared to transportation by rail and road, maritime transportation carries the distinctive advantage of being able to transport large quantities of cargo to long distances.

Figure 1 shows the share of domestic transport modes (ton-kilometers) in Japan. In terms of ton-kilometers, CS accounts for about half of Japan's transport volume, compared to air, rail, road freight truck, etc. This means that CS plays an important role in domestic transport. It also has the second longest average transport distance after air. Therefore, it is said to have an advantage over truck transport in terms of environmental impact, such as CO_2 emissions, and a policy of "modal shift" from truck to CS has been proposed.

In this way, the CS industry contributes to the productivity of the Japanese economy by transporting long-distance and large-scale cargo. Therefore, historically, the Japanese government has protected the CS industry by imposing regulations on operators. That is, the CS market in Japan had been under a long period of economic regulations such as entry/exit regulations.

The CS has some policy issues that are common to other modes such as domestic road freight transport in Japan, as well as some issues that are unique to the CS industry. With respect to the former, the problem of securing labor

Figure 1: Share of domestic transport modes in Japan (ton-kilometer)
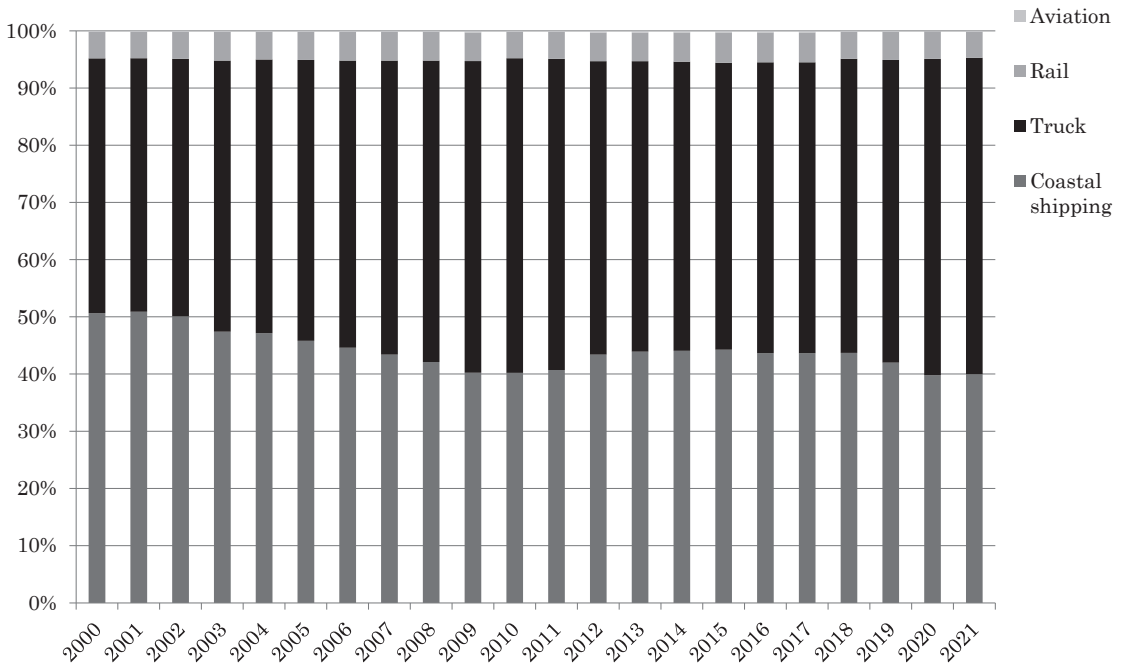
Source: Data collection of Costal shipping in Japan (2023) (NAIKO-KAIUN Data-Syu) Naiko Journal Co, Ltd.

force in recent years corresponds to it. As for the latter, the CS industry has faced has the own issues regarding investment to ships such as new shipbuilding, scraping and so on.

Furthermore, in terms of the CS policy, the government had implemented major regulatory reform, and amended the CS Industry Act, which is called the CS Industry Reform Act of 2005. In the regulatory reform, the supply and demand adjustment regulations (capacity regulations) were abolished, which intends to promote competition and market restructurings, and to improve market performance. Furthermore, the Act on Strengthening Maritime Industry were enacted in 2021 to strengthen the competitiveness of the maritime industry, and in that, the CS Industry Act was also further revised.

What are the policy issues regarding the market structure of CS in recent years? And what kind of policy responses can be considered and are actually being implemented for those issues? How can these policies be evaluated? To address these problems, we focus on the market structure and investment in the CS market, and provide some comments from the point of the economic efficiency.

The structure of the paper is as follows. In section 2, we see the current market structure of CS market in Japan, and describe the regulatory reform of 2005 in section 3. Then, we find the issues for investment in ships in section 4. In Section 5 and 6, we confirm the existence of economies of scale in the market, and evaluate the scheme of the ship management company from the point of market performance. Then current CS policy is mentioned in section 7. Finally, we conclude our results.

2. Current status for the market structure of CS

First, we introduce the market structure of CS, including some well-known facts. This structure is determined by various factors: the number of stakeholders (suppliers and consumers), distribution of them, the degree of product differentiation, the heights of entry barriers, and the degree of vertical integration and diversification, and so on. In the traditional industrial organization theory, the analysis has been conducted by utilizing S-C-P framework, which suggests the causal relationship that market structure specifies market conduct and market conduct specifies market performance. In short, we could evaluate market performance or outcome indirectly to see market structures.

As for explaining the CS industry in Japan, we have some literature such as Mori (ed.) (2014). We have also some papers that apply economics to the CS market, such as Takeuchi (1988), Nakaizumi (1999, 2004), and Hosoe (2009). In addition, Musso et al. (2010) have conducted a comprehensive review regarding CS or short sea shipping in the world.

According to the Japan Federation of Coastal Shipping Associations (hereafter JFCSA) the total number of CS operators was 3,290 at the end of March 2023. And among them, 2,999 operators were in business. With respect to the classification of CS operators, there is a distinction between registered operators and notified operators, and between transport operators (hereafter, we call simply operators) and lease operators (hereafter shipowners).

Focusing on the 1,984 registered operators, not only more than 90% of the operators have a capital of less than 300 million yen, but also about 80% of the operators have a capital of less than 50 million yen. The background of the large number of small- and medium sized operators is due to the large number of shipowners who build and own ships, put crew on them, and lease them out. In fact, among the 1,179 owners who are registered operators, one-ship owners, who own only "one ship" (and are called Ippai-senshu in Japanese), account for 57.3% of the total, and owners who own five or more ships account for only 8.1% (96 companies).

From these facts, it can be seen that the concentration of the CS market is low due to the large number of shipowners. However, regarding the distribution, it is not a market of only small- and medium sized shipowners, but also mixed with shipowners who own a large fleet. Therefore, the CS market is not necessarily uniform. This market structure seems to be similar to that of Japanese domestic road freight transport in some respects.

The relationship between the operator and the shipowner is based on a vertical contract. The operator charters a ship from the shipowner and operates it. This operator and shipowner have characteristic that they are affiliated. Specifically, it has a multiple contract structure that starts with the prime operator, followed by the second and the third operators, and then the shipowner. Generally, shippers conclude a "carriage contract (providing services for a fare)" with the prime operator, and the prime operator concludes a "trip contract" with the second- and third operators, and then all operators conclude a "charter contract (chartering ships for a charter fee)" with the shipowner. In fact, the prime operators handle about 80% of the transport with the top 60 companies. Also, the relationship between the shipowner and the operator tends to be long-term, continuous, fixed or stable, as they are affiliated, and they do not change their trading partners frequently.

In general, as the market structure of CS in Japan has the features that shippers and (prime) operators have strong bargaining power because the number of shipowners as suppliers is large, while the number of shippers or (prime) operators as consumers for their ships is quite small, which could express a kind of monopsony. Therefore, under the vertical transaction relationship, one of the issues is how to secure the bargaining power of the

shipowners from the point of promoting effective competition.

Incidentally, the relationship between the prime operator and the shipper could vary depending on the types of cargo. There are cases where few major shippers exist, such as steel, cement, and oil, and cases where many shippers exist, such as chemicals. The shipper and the prime operator have a direct and limited relationship in some cases, while the shipper requests multiple prime operators in the other cases. Especially under a direct and limited relationship, competition could not occur among the prime operators, but among the shippers.

3.　Regulatory reform of the CS market

As for the economic regulation of the CS industry, there are the following characteristics. Formerly, from 1967 to 1998, the CS industry was subject to a severe demand and supply adjustment regulation called the capacity (of fleet/tonnage) adjustment policy. The policy was to set the maximum- and the standard amount of the fleet in Japan, and adjust the number of ships in the whole market accordingly. The specific adjustment methods include 1) the scrap and build policy, which obliges to scrap the allocated ships that are replaced by new shipbuilding, and 2) joint scrap, which concentrates to scrap the excess capacity for a certain period. Through these policies, the demand and supply of CS were controlled by the government.

Note that regulatory reform was carried out in the CS Industry Reform Act of 2005. This policy was intended to create a competitive market environment for CS. The specific contents are as follows: first, the market entry requirements were relaxed, and the registration system was introduced instead of the permission system based on the standard fleet/tonnage and other criteria; second, the business classification of CS and CS leasing was abolished, and the same entry standards were applied to them ; third, the announcement of the appropriate fleet and the setting of the maximum limit of the fleet were abolished; and fourth, the setting of the standard fare and lease fee was abolished.

These include both entry/exit- and price regulations, which are called economic deregulation. However, even after the deregulation, the multiple contract structure among shippers, operators and shipowners itself has unchanged in the market, because shippers and operators as buyers are considered to still have strong bargaining power. Also, even after the regulatory reform was carried out and the scrap-and-build scheme was abolished, the interim measure (Zantei-sochi in Japanese) was implemented instead of them.

The interim measure is a transitional scheme that was implemented from 1998. It is a mechanism to adjust the supply and demand of the entire market by paying and receiving money and to prevent excess tonnage. Roughly speaking, when an owner builds a new ship, it has to pay levy to the JFCSA. The JFCSA pools them and gives a grant to the owner who scraps the ship. This is intended to prevent excess tonnage by transferring funds, and was promoted as a gradual transitional scheme to introduce market competition. The interim measure ended at the end of August 2021.

4.　Investment issues of shipbuilding

Next, we confirm some features of the investment in shipbuilding in the CS market. From an economic point of view, a basic model of CS is to provide a "service" of maritime transportation by inputting production factors such as "capital" such as ships and "labor" such as crew members. Therefore, shipbuilding and securing crew members are important elements. Among them, some features can be pointed out regarding the investment in ships. The first

is that no matter what size of ship it is, a large amount of cost occurs at once for its construction. The more it costs, the more risk is involved in financing and other aspects for new shipbuilding. The second characteristic is the length of the service life of ships. Once built, the use of the ship will last for a long period of time.

In relation to this point, ships that have been built for more than 14 years are called old ships. According to the JFCSA, the proportion of these old ships is about 69% of the total of 5,213 ships as of the end of March 2023, with 3,588 ships. In addition, there is also a characteristic that the average tonnage of old ships over 14 years old is 659 tons, which is low compared to the size of 1,506 tons for less than one year, 1,375 tons for one year to less than seven years, and 1,421 tons for seven years to less than 14 years.

In fact, for small- and medium sized operators and shipowners, even if the ship is aging and there is a need to make new investments, alternative construction is not easy. This is because shipbuilding requires a large amount of capital, and it is difficult to raise funds from the private sector due to the high investment risk. Moreover, once the funds are raised and the ship is built and owned, the risk of business income due to market changes also could increases until at least the repayment is completed. In fact, it has been pointed out that while the profitability of operators has been stable in recent years, the profitability of shipowners was greatly affected by the Lehman shock in 2008. Also, since shipbuilding is conducted by shipowners, while operators buy services, the risk of construction is essentially borne by shipowners. These facts suggest the difficulty of shipbuilding investment by small shipowners. In other words, under a market environment with high uncertainty, if the preference of shipowners for risk is risk-averse, the incentive for alternative construction investment could be decreased.

Another issue that should be referred is the customization of ships. As mentioned above, when the relationship between the shipowner and the operator is long-term and continuous, the ship could be operated for a specific transaction, and may customize the ship to suit the operation. If such customization investments accumulate, the investment costs will become sunk costs, making it difficult for the shipowner to decommission the ship. Also, if the assets invested for customization are only effective for a specific partner (i.e., operator), and their value drops significantly when the trading partner changes, then those assets become relation-specific assets.

Such relation-specific assets have a risk of causing the so-called "hold-up problem", as they are difficult to divert to other uses. Therefore, investing in relation-specific assets may weaken the owner's bargaining power. As such, if the shipowner's ship is more customized and less versatile, it can be expected that these alternative constructions will be less promoted.

To promote alternative constructions, it is necessary to reduce the risk raised by the shipowners who build ships, and share the risks with other parties. One way is the Ship-sharing Construction System introduced by the Japan Railway Construction, Transport and Technology Agency (hereafter JRTT).

This system is that a shipowner who wants to build a ship and the JRTT share the cost of building a ship, and the completed ship is jointly owned by the shipowner and the JRTT for a certain period of time according to the cost-sharing ratio, and they share the risk. In that case, the shared ship is used and managed by the shipowner, and pays the construction cost to the JRTT by paying an amount equivalent to the principal and interest as a usage fee for the JRTT 's share during the sharing period. Finally, when the sharing period expires, the shipowner buys out the JRTT's share at the residual book value after depreciation, and becomes its own ship.

Through this system, each shipowner has the advantage of not only avoiding the risk of the initial investment for shipbuilding, but also making it easier to repay the investment by allowing the choice of interest rate at the

Figure 2: the amount of domestic shipbuilding in Japan
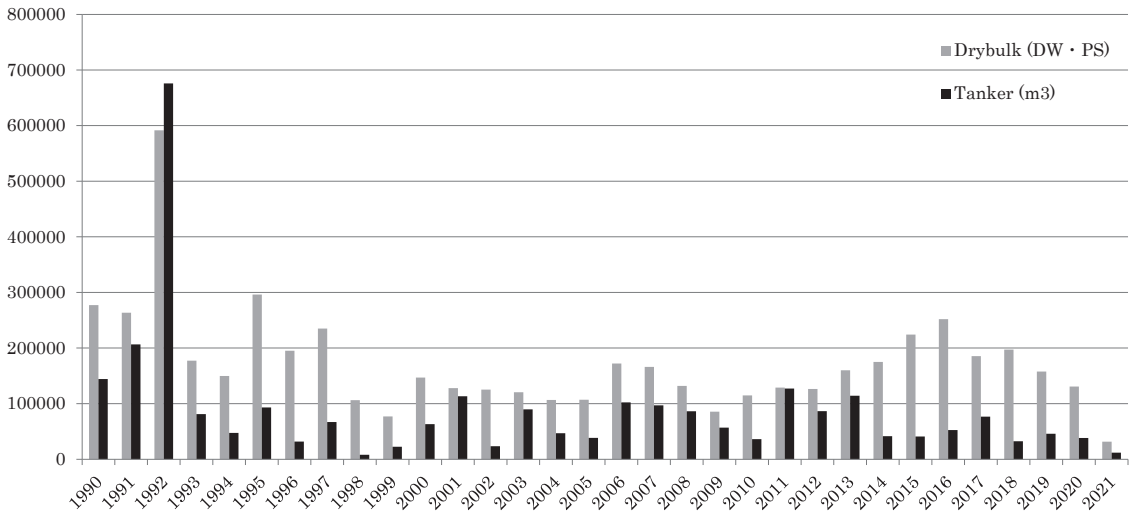
Source: Data collection of Costal shipping in Japan (2023) (NAIKO-KAIUN Data-Syu) Naiko Journal Co, Ltd.

time of repayment. In addition to them, there are also attempts to examine the risk sharing of ship investment between operators and owners, assuming a long-term and continuous relationship.

The figure 2 shows the amount of domestic shipbuilding (by fiscal year, bulkers and tankers). We find a large-scale construction in 1992, but after that, it can be seen that a certain number of constructions have been maintained. This may be due to several possibilities, such as the fact that the ship itself has become larger, and the Ship-sharing Construction System and other systems have been functioning. These verifications require separate empirical analysis.

5. Economies of scale and SMCs in the CS market

From the perspective of market structure of the CS industry, shippers and operators (prime operators) have strong bargaining power. Whereas, the bargaining power of small shipowners such as one-ship owner is extremely low, and they are greatly affected by the market environment. This low bargaining power causes a reduction in charter rates, especially during recessions and a shortage of supply during booms, resulting in large fluctuations in charter rates. In order to increase the bargaining power of the shipowners who provide ships and to stabilize the market, policies that promote consolidation of ships.

One of the attempts was the introduction of the ship management company (hereafter SMC). Here, SMCs are operators who perform the tasks of maintenance management, operation management, employment, and crew management of ships. By managing multiple ships owned by small shipowners collectively, and consolidating their operations, scale merits are expected to be realized, not only improving the efficiency of operations, but also strengthening their bargaining power. However, at present, we have few shipowners who participate in SMC.

If so, would this collective management by ship management companies not be useful for efficiency? To confirm this, it is necessary to check whether economies of scale exist in the CS industry. Economies of scale means

increasing return to scale, i.e., decreasing long-term average costs. In terms of ships, if the long-term average cost decreases due to the increasing size of a ship or fleets, it can be said that there exist economies of scale. In this case, it makes sense from the perspective of efficiency to promote consolidation by measures such as SMCs.

6. Estimation results and the existence of economies of scale

To verify the existence of economies of scale, Hashimoto and Tezuka (2017) estimated a trans-log cost function as shown in equation (1). The details are left to this paper, and here we only show the results. For the estimation, we used a fixed effects model with time trend and firm dummy variables. The estimated equation is as follows.

$$ln\,TC = \alpha_0 + \sum_{i=k,l,m} \alpha_i\,ln\,p_i + \alpha_q\,ln\,Q + \frac{1}{2}\sum_{i=k,l,m}\sum_{j=k,l,m}\beta_{ij}\,ln\,p_i\,ln\,p_j + \frac{1}{2}\beta_{qq}(ln\,Q)^2 + \sum_{i=k,l,m}\gamma_{qi}\,ln\,p_i\,ln\,Q + \mu \quad (1)$$

where, P_i : price $(k:capital,\ l:labor,\ m:raw\ materials)$, $Q:output$, $\mu:error\ term$.

The estimation results of the trans-log cost function are shown in the table below.

Table 1: Estimation results

Variable	Coefficient (t-value)
Constant	-1.622***(-5.538)
Q	0.755***(9.889)
P_k	0.370***(30.610)
P_l	0.350***(35.652)
P_m	0.280***(65.288)
Q^2	0.080***(2.981)
P_k^2	-0.224**(-6.451)
P_l^2	-0.258(-1.153)
P_m^2	0.844***(6.198)
P_kP_l	0.167***(6.295)
P_kP_m	-0.567***(-3.888)
P_lP_m	-0.141***(-14.193)
P_kQ	0.228***(4.576)
P_lQ	-0.049***(-11.955)
P_mQ	0.257***(14.629)
Overseas-Dummy	1.986***(5.799)
Passenger-Dummy	-2.835***(-8.232)
Time-Trend	0.036***(12.985)
(Observations)	153
(Cost Function)	R-squared=0.996
(Cost Share: K)	R-squared=0.310
(Cost Share: L)	R-squared=0.761

(Parentheses: *** 1% significant, **5% significant, ***1% significant)

Source: Hashimoto and Tezuka (2017)

Further, we measure the economies of scale using the estimated parameters. Following Caves et al (1984), we define the returns to scale (RTS) as follows.

$$RTS = \frac{1}{eq} \qquad eq = \frac{\partial \ln TC}{\partial \ln Q} \qquad \text{where } Q : output, TC : total\ cost$$

Here, if *RTS* is greater than 1, it means that there exist economies of scale in the shipping industry. From the estimation results, we obtain $eq=0.755$, which implies $RTS=1.324$, indicating the existence of economies of scale. This result suggests that, although quite limited, the existence of economies of scale has been confirmed in CS market.

The estimation confirmed the existence of economies of scale, but some caution is required in interpreting the policy implications. Kanemoto and Yamauchi (eds) (1995) point out the possibility of the Bertrand paradox in industries where there are economies of scale and a large number of firms. This is because, if each firm engages in Bertrand-type competition based on price competition in a market where there are economies of scale, the equilibrium price set will be equal to the marginal cost, which will be lower than the average cost, and as a result, a stable equilibrium state cannot be established. Therefore, it is possible that shipping companies are staying in the CS market despite making losses, and as a result, they are impairing efficiency.

However, although these results are quite limited, if the existence of economies of scale is confirmed, the policy for CS such as the development of SMCs may have significance from the viewpoint of enhancing efficiency or market performance.

7. Recent policies and the Act on Strengthening Maritime Industry in 2021

As mentioned above, the market structure of CS is composed of a large number of small- and medium sized owners and a few operators or shippers. Carriage contracts are concluded between shippers and prime operators, and charter contracts are concluded between operators and shipowners. In addition, there are relationships such as second- or third contract among operators. Therefore, small- and medium sized owners have weak bargaining power. This is especially evident in the case of one-ship owners. On the other hand, it is suggested that there may be economies of scale in the CS industry. Therefore, it is considered that development of SMCs in Japan is a meaningful policy to increase the market performance by aggregating shipowners and gaining market power against shippers or operators.

As a recent CS policy, the Act on Strengthening Maritime Industry was enacted on May 14, 2021. The Act aims to strengthen the foundation of the entire maritime industry by enhancing the competitiveness of the shipbuilding and shipping sectors, reforming the working style of seafarers, and improving the productivity of domestic shipping. Among them, improving the trading environment and productivity of CS is related to them. With the enforcement of the Act on Strengthening Maritime Industry, the CS Industry Act was also revised, and the following things were introduced.

First, it was made obligatory to deliver a document for contracts related to CS industry, that is, carriage contracts are concluded between shippers and operators, and charter contracts are concluded between operators and shipowners. These contracts are obliged to be clarified by writing. This is intended to increase the bargaining power of shipowners who are relatively weak in their positions.

Second, a recommendation/publication system for shippers was established. This is a system that obliges

shippers to consider operators' compliance with laws and regulations. If an operator is punished for violating laws and regulations, and if there is a cause for the shipper as well, the government can take measures to prevent recurrence for the shipper if it is difficult to prevent recurrence with only the operator's power.

These first and second points are intended to give bargaining power to parties who are relatively weak in their positions. On the other hand, the third point is intended to strengthen the function of SMCs. Specifically, a registration system for SMCs was established. This means that SMCs are recognized as new entities in addition to operators and shipowners.

This is a measure to increase the bargaining power of shipowners who have relatively low publicity power. As mentioned above, if economies of scale are recognized in CS market, SMCs that manage multiple ships are effective in terms of strengthening shipowners' bargaining power. However, in order to enjoy scale merits, a certain scale must be realized. In other word, the success of the policy could depend on the number of participants in SMCs.

8. Concluding remarks

This paper sees the market structure of CS in Japan, and focuses on the CS policies of Japan from the point of investment in ships and management of ships. As a result, it was shown that the CS industry consists of shipowners who own ships, operators who rent and operate ships, and shippers who contract with operators, and that they have a vertical relationship. The number of shipowners is large and the scale is small, so the bargaining power is quite low. Moreover, shipbuilding requires a large amount of capital, and shipowners face a high degree of risk. In response to these challenges, the government has been protecting the CS industry and shipowners by imposing economic regulations since the 1960s.

However, the government had implemented major regulatory reform, and amended the CS Industry Act, which is called the CS Industry Reform Act of 2005. By the regulatory reform, the supply and demand adjustment regulations (capacity regulations) were abolished, which intends to promote competition and market restructurings, and to improve market performance.

Following the reform, the government espoused various measures without resorting to economic regulations in order to support shipowners and strengthen their bargaining power. The ship management company (hereafter SMC) scheme is one such initiative. From the point of view of market performance, the scheme would prove to be effective as long as SMCs are able to enjoy merits of scale.

Finally, the following comments are added. This paper focused on the investment and management of ships, which are capital-side among capital and labor. However, there are various issues left on the labor side. In particular, the recent shortage of crew members is extremely serious. Crew members are suffering from a shortage of human resources and aging, and prompt response should be required. Among the above-mentioned Maritime Industry Strengthening Act, the rationalization of human resource management for crews is emphasized. These issues are left as our future research.

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