An Evaluation Transport Capacity Structure Adjustment Model on the Effect of Ship Standardization and Ship Dismantling Policy

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Abstract. Firstly, it introduces the background of ship form standardization and ship dismantling policy, and combs the previous research results. This paper establishes the model of ship capacity structure adjustment and the model of policy implementation effect, and then uses the model to analyze the change of ship capacity structure and its implementation effect in the process of policy implementation. Among them, the change of ship's capacity structure is analyzed by stages of ship types, including the change of ship's capacity increment and the change of ship's age structure along the coast. The implementation effect analysis is divided into three aspects: the proportion of old and new ships, the change of average tonnage and the change of average ship age.

Introduction
Ship form standardization is mainly through administrative means and economic incentive policies to restrict substandard ships passing through the lock, guide the dismantling of non-conforming ships, and encourage the construction of ships with superior performance, in short, to open the front door and close the back door. Opening the front door means building a new ship; closing the back door means dismantling the ship. Among them, the disassembly of old ships can achieve the purpose of transport capacity. Its main means is to subsidize ship-owners through economic incentive policies and promote the effect of policy implementation. In the past research process, more attention has been paid to the implementation effect of the overall policy of ship form standardization, such as document 1, from the perspective of the implementation of ship form standardization policy, to analyze the impact of management departments and industry practitioners; document 2, from the perspective of channel management, proposes the impact of ship form standardization on channel charges; document 3, from the perspective of ship manufacturing, proposes ship form standardization design. Document 4 is based on a shipping company's response to the ship form standardization policy, from the perspective of energy conservation and emission reduction, to analyze the effect of carrying out the old construction and new adjustment of the capacity structure; Document 5 is based on the perspective of policy implementation and managers, to analyze the main work of ship form standardization in the disassembly of old ships; Document 6 is based on the point of view of improving the actual capacity of lock. Analysis of the policy effect of ship form standardization; Document 7 is to analyze the policy effect of ship form standardization based on the change of ship transport capacity structure during the implementation of ship form standardization policy in an inland city. From the angle of ship capacity structure adjustment, this paper establishes a model of capacity structure adjustment by two eigenvalues, namely, the change of total capacity and the change of ship age structure in the near future. In the process of implementing the economic incentive policy, four eigenvalues are used to establish the effect model of policy implementation: the proportion of old ships, the proportion of new ships, the change of average tonnage of ships and the change of average age of ships. Finally, the model validation and analysis are carried out by taking the effect of adjusting the operation of coastal vessels as an example.
Transport Capacity Structure Adjustment Model

The main factors that can characterize the change of ship's capacity structure include the change of total capacity and the change of ship's age structure. The function relationship is expressed as follows: the change of ship's capacity structure is dependent variable, the change of total capacity and age structure are independent variables, and the change of ship's capacity structure changes with the change of total capacity and age structure. Then the model of ship capacity structure adjustment is:

\[
F(A, B) = F1(A) + f2(B). \tag{1}
\]

\[
A = F3(t). \tag{2}
\]

\[
B = F4(t). \tag{3}
\]

This formula is expressed as follows: \(F(A, B)\) represents the change of ship capacity structure with the change of \(A\) and \(B\), \(A\) represents the change of total ship capacity with the change of time \(t\), \(B\) represents the change of ship age structure with the change of time \(t\), and \(T\) represents the observation time of the main factor with year as the measurement node.

Policy Implementation Effect Model

Evaluate the effect of economic incentive policy implementation with the change of ship capacity structure before and after the implementation of the policy. In order to evaluate the effect better, on the basis of the ship capacity adjustment model, the main characteristics of some structural changes are added, including the proportion of old ships, the proportion of new ships, the change of average tonnage of ships and the change of average age of ships. The function relation is expressed as the dependent variable of the effect of policy implementation, the independent variable is the change of old ship proportion, the change of new ship proportion, the change of average tonnage of ship and the change of average age of ship. The effect of policy implementation varies with the change of old ship proportion, the change of new ship proportion, the change of average tonnage of ship and the change of average age of ship. Then the whole model for evaluate the effectiveness of policy implementation is:

\[
F(C, D, E, F)=f5(C)+f6(D)+ f7(E)+f8(F). \tag{4}
\]

\[
C=f9(t). \tag{5}
\]

\[
D=f10(t). \tag{6}
\]

\[
E=f11(t). \tag{7}
\]

\[
F=f12(t). \tag{8}
\]

This formula is expressed as follows: \(F(C, D, E, F)\) represents that the effect of policy implementation changes with the changes of \(C\), \(D\), \(E\) and \(F\), \(C\) represents that the proportion of old ships changes with time \(t\), \(D\) represents that the proportion of new ships changes with time \(t\), \(E\) represents that the average tonnage of ships changes with time \(t\), \(F\) represents that the average tonnage of ships changes with time \(t\).

Analysis of Ship Capacity Structure Change

According to the implementation period of the policy from 2013 to 2017, the first year of the policy, the middle year of the policy and the last year of the policy can be divided into three stages: first, the increase of the capacity, then the decline of the capacity for the first time, and finally, the continuous decline of the capacity. 2013 is the first year of the implementation of the policy, and the capacity of
various types of domestic coastal cargo ships continues to grow. 2014 is the middle year for the implementation of the ship dismantling policy. In 2014, the total capacity of dry bulk carriers declined for the first time, and the decline rate was slightly faster in the second half of the year. In addition, the growth momentum of container ship capacity and liquid dangerous goods ship capacity has been curbed, and the scale of domestic coastal inter-provincial oil tanker capacity has also declined for the first time. The market downturn has affected the state's policy to encourage the scrapping and renewal of old transport ships in advance. Shipping enterprises have actively adjusted their capacity structure and further optimized their age structure. By the end of 2014, the average age of domestic dry bulk carriers with 10,000 tons or more was 7.20 years, which was 0.8 years lower than that of the same period last year; the average age of container ships was 9.96 years, which was 1.54 years lower than that of the same period last year; and the age of old transport vessels with 12 years or more in liquid dangerous goods vessels and special inspection vessels with 26 years or more decreased year on year.

In the first half of 2015, compared with the end of 2014, the inter-provincial dry bulk carriers with a tonnage of more than 10,000 tons decreased by 0.76%, the inter-provincial container carriers with a tonnage of more than 700 TEU increased by 8.03%, and the inter-provincial oil tankers, chemical tankers and liquefied gas tankers decreased by 32, 12 and 6, respectively. A total of 129 dry bulk carriers withdrew from the market in advance.

2017 is the end of policy implementation. In the first half of 2017, 197 ships delisted in advance. Ship-owners initiative to adjust the capacity structure and scrap and renew ships in advance is an important reason for the decline of the capacity of dry bulk carriers and chemical carriers in the first half of the year.

Ship Dismantling Policy Implementation Effect

The effect of policy regulation can be analyzed from the proportion of old ships and new ships. At first, we compared the beginning of policy implementation with the end of policy implementation, under the stimulation of policy the result show that the proportion of newly built ships dropped from 6.14% to 0.66% and the tonnage ratio dropped from 9.06% to 1.00%. After policy implementation, the proportion of old ships decreased from 18.24% to 10%, and the tonnage ratio decreased from 24.13% to 16%. The effect of policy regulation can be analyzed from the change of average tonnage. 2013 is the initial year for the implementation of the policy of early abandonment of old transport ships and single-hull tankers, and 2017 is the year for the implementation of the policy of early abandonment of old transport ships and single-hull tankers. Compared with the initial stage and the final stage of policy implementation, the average tonnage of dry bulk carriers increased from 32,000 to 33,000 under policy stimulation. It is mainly to promote the construction of new large tonnage ships during the implementation of the policy, to raise the average tonnage level from the overall capacity of ships, and to dismantle a large number of small tonnage old ships. The tonnage of old ships is generally lower than the original average tonnage level, thus improving the overall average tonnage level.

The effect of policy regulation can be analyzed from the change of average ship age. At the beginning of policy implementation, compared with the end of policy implementation, the average age of dry bulk carriers increased from 8 years to 9 years under policy stimulation. It is mainly to promote new ships during the implementation of the policy, reduce the average age level of ships in general from the capacity of ships, and dismantle a large number of old ships of old age. The age of old ships is generally higher than the original average age level, thus reducing the overall average age level. If there is no change in ship capacity, the average ship age in 2017 will increase by four years compared with the average ship age in 2013. Under the influence of the policy, the average ship age of some ships will not increase but decrease, or only increase by one to two years. It can be seen that the policy has an impact on the average age of ships.

By eliminating a batch of old ships with high energy consumption and maintenance costs, and building a batch of new ships with good seaworthiness, good cargo, energy saving and environmental
protection, the capacity structure of China's marine fleet has been further adjusted and optimized, the trend of fleet younger, larger and more specialized is obvious, the international competitiveness of the fleet has been improved, and the structural contradiction between shipping supply and demand has been alleviated since the financial crisis.

Ship tonnage continues to be large-scale. At the end of 2013, compared with the end of 2017, the average tonnage (box space) of the three major coastal ships changed from 31 952.1 tons, 3068.2 TEU and 7418.9 tons to 3 3045.4 tons, 3103.5 TEU and 7666.3 tons, respectively.

The age of the boat remains younger. At the end of 2013, compared with the end of 2017, the average age of the three main types of coastal dry bulk carriers, container ships and oil tankers remained stable, changing from 8 years, 11.5 years and 7 years to 9 years, 10.2 years and 9.2 years, respectively, which was lower than the natural growth rate of ship age.

In the first half of 2015, the capacity of coastal inter-provincial dry bulk carriers with a capacity of more than 10,000 tons was reduced by nearly 700,000 tons compared with the beginning of the year. This is the first decline after the rapid development in recent years. The growth rate of the capacity of coastal dry bulk carriers was only 0.87% in the whole year of 2015. In 2016 and the first half of 2017, the capacity of coastal dry bulk carriers decreased by 1.75% and 0.44% respectively. The capacity of coastal dry bulk carriers has maintained steady development and preliminary stability The shipping market has been established.

Summary

Through the establishment of model and calculation, it can be concluded that the ship dismantling policy plays a positive role in promoting the healthy adjustment of shipping capacity structure and improving the development of shipping capacity.

Evaluation of the two models is established. To a certain extent, the model of ship's capacity structure adjustment can calculate the specific value of ship's capacity structure adjustment quantitatively. To some extent, the effect model of ship dismantling policy implementation can be used to quantitatively calculate the specific value of the effect of ship dismantling policy implementation. The next step of the research plan is to increase the applicability of the model by extending the independent variables of the two models.

References


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