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A fuzzy set theory approach to flagging out: towards a new Chinese shipping policy

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Abstract

The paper seeks to model the benefits and costs involved in the decision to flag out, and to provide arguments for alternative policies, aiming to counteract this age-long phenomenon. Based on the analysis of the evolution of worldwide and Chinese flagging out, the emphasis in the paper is on the comprehensive effect assessment of flagging out and the required adjustment of Chinese shipping policy. To identify the determinants of such an adjustment, the paper introduces fuzzy set theory and related models, aimed to assess the economic effects of flagging out through the use of context-dependent economic and societal indicators (factors). The degree to which such indicators contribute to the choice of flag decision is assessed through a questionnaire survey. In parallel, and in the context of the determinant analysis of fuzzy models, the paper probes into the 'policy competition' and 'government intervention' policies to counteract flagging out. In the same context, a comparative analysis of shipping policies between China and traditional maritime countries is undertaken, in order to assess the current 'openness' of the Chinese shipping policy and explore possible policy alternatives. The paper concludes that the preferred policy alternative for China would be the establishment of second international ship register.

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Keywords: Flagging out; Flags of convenience (FOC); International ship registers; Shipping policy; Fuzzy set theory

1. Introduction

Changing a vessel's registry from an 'expensive' to a 'cheap flag' has long been a worldwide phenomenon. This 'internationalisation' strategy has mainly been adopted by traditional (*developed*) maritime countries (TMC) for reasons of reducing operating costs and fiscal pressures, as well as for enhancing overall operational flexibility.

Over the years, since the inception of the institution of open registries in the 1950s, a substantial number of studies have been carried out on this phenomenon, but their overriding focus on TMC policies has not always provided an adequate example to the different 'realities' of the new developing countries (NDC), such as China, who are also following suit at an increasing rate.

The flagging out of Chinese controlled vessels started to appear, due to a number of mainly political reasons, at the same time as in other nations (1950s), but it took massive dimensions and momentum with China's opening to the outside world in the 1980s, and particularly since the reform of the country's tax regime in the 1990s. As in many other countries, this evolution is becoming increasingly serious, in terms of its negative impacts on the country's economic development, particularly as flagging out continues unabated. Given the variety and eligibility of positive measures, taken predominantly in the European Union in order to reverse similar trends, China could by no means be accused as 'protectionist' were she to adopt more preferential shipping policies in order to reflag vessels to her national registry.

The paper consists of five sections. Section 1 discusses the background and objectives of the study and reviews the pertinent literature. Section 2 reviews international and Chinese experiences and developments in flagging out, looking at the same time at the impacts of flagging out on international shipping, national economies and

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society. China's motivations for flagging out are also addressed here. The objective of Section 3 is to identify the determinants of 'adjustment' in shipping policy. Here, the paper introduces fuzzy set theory and related models—as well as an international questionnaire survey—to assess the economic effects of flagging out through context-dependent economic and societal indicators (factors). The Section 4 is based on the determinant analysis of fuzzy models and it mainly probes into the 'policy competition' and 'government intervention' policies to counteract flagging out. In this context, a comparative shipping policy analysis is made between China and TMCs, in order to evaluate the degree of openness of China's shipping policy and explore possible policy alternatives. Some concluding comments follow in the last section.

2. The evolution and impact of flagging out

2.1. Worldwide situation of flagging out

The use of the FOC institution dates back to 1922 when the USA took the initiative to permit the registration of American ships in Panama. Presently, as a result of lower crewing costs, tax exemptions and minimal bureaucracy, the greatest proportion of the world merchant fleet is registered under FOCs (Fig. 1). At the beginning of 2000, 12,996 merchant ships with 442.1 million dwt, or 61.8% of world tonnage, were not registered in the country of domicile of the owner [1].

The share of tonnage beneficially owned by developing countries has also increased continuously since 1980, reaching the one-third of FOC tonnage in 1998. According to UNCTAD, the major developing maritime countries and territories—including China, Hong Kong (China), Republic of Korea, Saudi Arabia, UAE, etc., had more than half of their tonnage registered under foreign flags.

2.2. Evolution and extent of flagging out in China

2.2.1. The evolution and current status of flagging out in China

Chinese shipping has witnessed strong growth over the past decades. This was the result of rapid industrialisation, economic growth and trade. By the end of 1998, more than 300 companies were registered with the Ministry of Communications as offering international shipping services [2]. The number of vessels registered in China was 1,880, corresponding to 16 million dwt. This capacity ranked China ninth in the world and fifth if FOC registered tonnage is included. In the same year, the latter tonnage comprised 550 ships of 20.15 million dwt. Clearly, in terms of dwt, more than half of all Chinese owned or controlled tonnage was registered under FOCs and this trend is continuing. In 1991, the share of FOC tonnage was only 23%.

Chinese flagging out started in the 1950s. As a result of western embargo policies, Chinese trade was carried by joint venture companies set up with socialist partners such as Poland, Czechoslovakia and Albania. By the

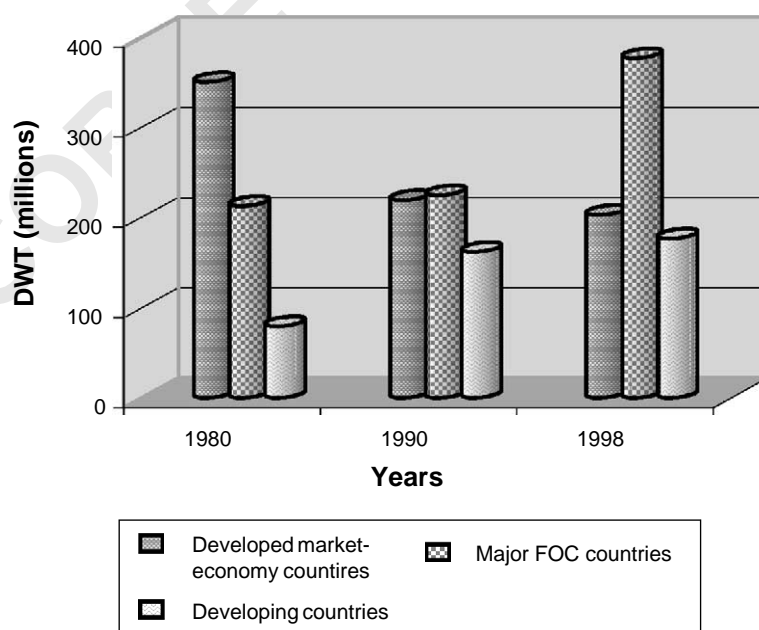


Fig. 1. Composition of the world fleet by groups of countries of registration. Source: Review of Maritime Transport (1999) [3].

- beginning of 2000, ships under national registers had an average age of 17.6 years compared to 15 years of FOC vessels. Only ships registered under the flags of Germany and Switzerland were, primarily as a result of taxation rules, on average much younger than their flagged out counterparts [1].
- The average age of the Chinese ocean going fleet was 18.5 years, at the end of 1998. Amongst them, passenger/containerships, crude oil tankers, chemical vessels, reefers and containerships (excluding cellular) were the youngest with an average age between 10 and 12 years. Passenger/cargo vessels, passenger/vehicle ro-ro, break bulk and LPG carriers were among the oldest with an average age of 20 years. On the contrary, the average age of FOC vessels under Chinese control was 12 years. Among them, passenger/container vessels were on average only 2.9 years, and the average age of passenger/vehicle ro-ro vessels, chemical vessels, oil tankers, multi-purpose vessels and full container vessels was from 9.2 to 13.6 years.
- ### 2.3. The impact of Chinese flagging-out
- The widespread flagging out phenomenon, affecting not only the merchant fleet of the vast majority of the traditional maritime countries but also the new developing maritime nations, has attracted a great deal of attention for a variety of reasons [4]. One of the main concerns has been the fact that open registry fleets have expanded at a rate faster than any other fleet in the world and, as a result, this expansion has limited the growth of national fleets, with all the related consequences for national defence, fiscal revenue and the disappearance of national seafarers. In addition, the occurrence in recent years of several alarming incidents involving environmental disasters has increased public awareness on this problem.
- In China, flagging out has not only exerted great influence on the 'cohesiveness' of the national ocean-going fleet, but it has also caused a series of problems to national macroeconomic control, tax revenues and employment of seafarers.
- As mentioned above, imported vessels are liable to import tariffs and value-added tax, totalling 27.53% of the price of the vessel. Such taxes have forced a number of shipowners to build or purchase vessels abroad and register them under foreign flags. This has deprived the country not only of tariff and tax revenues, but of registration and inspection fees as well. As a result of ineffective control over the flagged out ships, corporate taxes may also be lost to China. It is worth noting here that approximately five billion US dollars of shipping revenues per year are deposited and spent abroad, with all evident consequences on national foreign exchange reserves and the ability of the country to repay in foreign exchange.
- ### 3. Comprehensive assessment for the decision of flag choice: a fuzzy evaluation model
- #### 3.1. General analysis
- The decline in nationally owned and registered fleets of recent years has led many European countries to establish 'captive' international or second registers. Examples are UK's Isle of Man, France's Kerguelen Islands, Norway's NIS (Norwegian International Register), GIS in Germany, and DIS in Denmark.
- International registers such as these are often seen as placed in that 'grey area' between traditional registers, where legal, economic and administrative links are direct and tight, and open registers where they are very weak [5]. Seen in this way, they can serve the dual purpose of retaining some control over the national shipping industry and, at the same time, satisfying the need for a more competitive environment on the part of shipowners.
- For both shipowners and managers, flag choice is a high level decision involving a number of external experts such as lawyers, bankers, charterers, manning agencies and classification societies. Normally, shipowners and managers use a mixture of flags for their fleet although they generally have a 'preferred flag'. To a certain extent, shipowners and managers rely on experience and subjective views when making flagging decisions. Quite often, such decisions are frequently readjusted on the basis of such fuzzy perceptions as 'availability of skilled labour', 'maintenance and safety requirements', 'public relation considerations', 'likes and dislikes' and so on. Clearly, considerations such as these augment substantially the complexity of the choice of flag decision.
- To a certain extent, the shipping industry, seen in its entirety, constitutes a highly complex system characterised by uncertainty, both in structure and in measurement accuracy. In systems like these, piece-meal deterministic approaches to explaining individual behaviour (such as the flagging decision) are often inadequate. Stochastic (probabilistic) modelling of the overall system, despite its complexity, can achieve much more but, even here, there is a limit to the extent fuzzy perceptions like the above could be taken into account.
- The methodology suggested below addresses such concerns through the use of fuzzy set theory. This approach is able to link human perceptions (say, on the issue of flag selection), expressed in verbal propositions, with numerical measurement (indicators). The merit of the method is that it is completely independent of model structure which, in most cases, is only known with little degree of certainty.
- Fuzzy set theory was developed by Zadeh in 1965 to deal with imprecise and uncertain problems, which have no well defined, unambiguous meaning [6]. The theory

1 has been applied to complex (economic, societal, etc.)
 2 decision problems that can be controlled by humans but
 3 are hard to define exactly [7].

4 Ordinary (classical) sets are based on binary logic.
 5 For instance membership to the group of ‘tall’ people
 6 (the universal set) can only take two values: 1 for tall
 7 and 0 for ‘not tall’. Accordingly, a *membership function*
 8 simply assigns values of 0 or 1 to each individual
 9 element in the universal set. Simply, the membership
 10 function just distinguishes between non-members and
 11 members of the *crisp* set by a hard threshold. Middle
 12 values or partial memberships are not included in the
 13 crisp set [7]. However, a hard (crisp) threshold is often
 14 unrealistic in practice, because two nearly indistinguish-
 15 able measurements on either side of the hard threshold
 16 will be placed in complimentary subsets [6].

17 Contrary to classical set theory, fuzzy set theory is
 18 based on multi-valued logic. Let the universe of
 19 discourse U have a fuzzy set A described by a member-
 20 ship function μ_A that takes values in the interval $(0, 1)$,
 21 $\mu_A: U \rightarrow (0, 1)$. Thus, A can be represented by: $A =$
 22 $\{\mu_A(x)/x, \text{ where } x \in U\}$. The membership function μ_A
 23 defines a partial membership in a set. This means that μ_A
 24 assigns to each x a value from 0 through 1, indicating
 25 the degree to which x belongs to A . Transition between
 26 membership and non-membership, therefore, is gradual
 27 rather than abrupt.

28 The following part shows how to develop compre-
 29 hensive fuzzy evaluation models to assess the effects of
 30 flag choice, based on context-dependent economic,
 31 political and societal indicators or factors. Evidently,
 32 the methodology is able to define the degree to which
 33 such indicators contribute to the choice of flag decision.

34 3.2. Flag choice: qualitative analysis and fuzzy 35 assessment

36 The comprehensive fuzzy evaluation (CFE) model
 37 proposed here is based on fuzzy set theory as developed
 38 by Zadeh and on the analytic hierarchical process
 39 developed by [8]. Zadeh defined fuzzy logic as ‘the logic
 40 underlying models of reasoning which are approximate
 41 rather than exact’ [7]. Saaty advocated the use of
 42 deductive and systems approach in the analysis of
 43 complex decision problems. Along these lines, the
 44 scheme of a CFE model, to assess the effects of flag
 45 choice, is depicted in Fig. 3.

46 Six steps are involved: Step 1 defines model input; the
 47 set of judgement factors U_i . These fall into three
 48 categories: economic, societal and political. Economic
 49 factors consist of operating/manning costs; capital costs;
 50 maintenance and safety compliance costs; tax-related
 51 expenses, the age and size of vessels, fiscal reasons, etc. It
 52 has been shown that, in the EU, manning or crew costs
 53 and corporate taxes are the most flag-sensitive cost
 54 categories, while capital costs seem to influence the

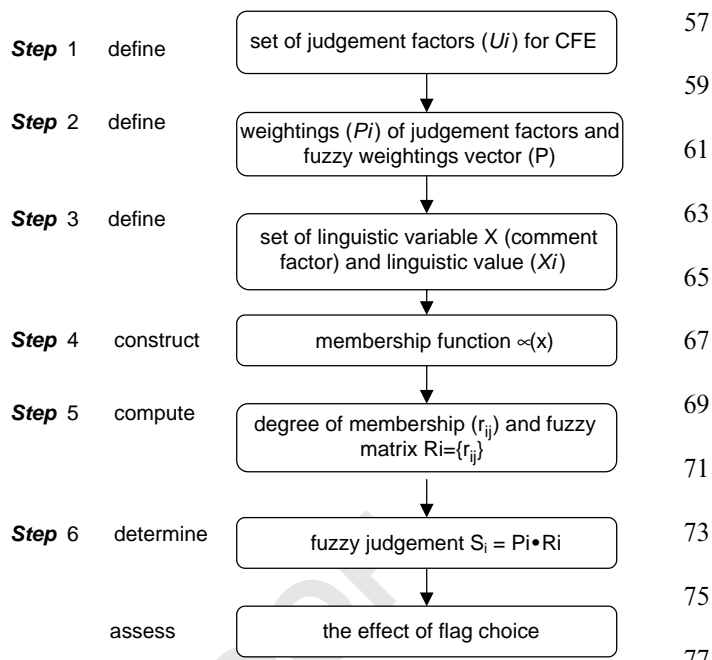


Fig. 3. The scheme of comprehensive fuzzy evaluation model to assess the effects of flag choice.

decision to change flag only marginally. For a Chinese shipowner, however, capital costs are perhaps the single most crucial factor in the flagging decision: high import tariffs and value added taxes, coupled with limited credit lines and unfavourable loan conditions for domestically built vessels can easily explain this.

Societal and political factors in the flagging decision are, however, much more intricate and difficult to assess than the relatively simple capital cost calculations above. These include such attributes as safety standards and requirements, protection of the environment, national defence, labour quality and availability, degree of control, level of bureaucracy, trade union considerations, the general economic and social situation of the home country, the country’s industrial structure, public relations, trade restrictions (e.g. embargoes), shippers’ preferences, and so on.

As already mentioned, political considerations too are still present, albeit to a lesser extent nowadays. These can be seen for instance in the direct seaborne trade between Chinese Mainland and Taiwan: according to existing regulations drawn by both sides of the Taiwan Straits, only Chinese (Mainland or Taiwan) vessels flying FOC flags are allowed to trade in the direct route across the Taiwan Straits.

To assess how the above factors can influence flag choice i.e. the choice between ‘national registry’, ‘second registry’ and ‘open registry’—through the CFE model developed here, a survey was conducted among more than 100 shipowners in major maritime countries. The survey, and related questionnaire, included ‘relative

importance factors' affecting the choice of flag, rated on a scale of 1 (important) to 5 (very important). 'Flag preference factors'—national-, second- or open registry—were rated 20–29 for preference degree 'very low', and 90–100 for preference degree 'very high'. The 12 judgement factors, on which the three alternatives were assessed, were: U_1 =crew costs saving advantages; U_2 =costs of meeting maintenance and safety requirements/bureaucratic control; U_3 =capital, insurance and other costs; U_4 =easiness of bank finance; U_5 =fiscal advantages; U_6 =labour quality and availability; U_7 =vessel characteristics (age, size, type, etc.); U_8 =trading region of the world; U_9 =public relations; U_{10} =country specific comparative advantages (subsidies, economic power, structure, etc.), U_{11} =political considerations, U_{12} =union considerations/recognition.

Subsequently, Step 2 defines the weightings of the judgement factors and a corresponding fuzzy weightings vector P . Based on questionnaire results, the weightings of the 12 factors are:

3.917, 3.750, 1.600, 2.250, 3.000, 3.500, 2.800, 2.900, 2.350, 3.000, 3.300, 3.300

Weightings must satisfy the normalisation requirement:

$$0.1098 + 0.1052 + 0.0449 + 0.0631 + 0.0841 + 0.0981 + 0.0785 + 0.0813 + 0.0659 + 0.0841 + 0.0925 + 0.0925 = 1. \quad (1)$$

The fuzzy weightings vector P is simply

$$P = [p_1, p_2, p_3, p_4, p_5, p_6, p_7, p_8, p_9, p_{10}, p_{11}, p_{12}] = [0.1098, 0.1052, 0.0449, 0.0631, 0.0841, 0.0981, 0.0785, 0.0813, 0.0659, 0.0841, 0.0925, 0.0925]. \quad (2)$$

Step 3 defines the set of comment factors (linguistic variable X and linguistic value X_i). The linguistic variable refers to the preference degree of flag alternatives, which consist of 'very high', 'quite high', 'rather high', 'high', 'low', 'rather low', 'quite low', 'very low'. According to the importance of the judgement factors, as perceived by the respondents, each factor is given a linguistic value ranging from 20–100. These appear in Table 3.

Step 4 constructs the membership function $\mu(x)$. Membership functions are at the core of fuzzy models. The membership function is considered to be the strongest and the weakest point of fuzzy set theory [7]. It is strongest because a membership function defines a soft threshold, which allows a smooth and practical assessment of the contribution of the judgement factors to the decision of flag selection, in contrast to a characteristic function, which defines a hard threshold in classical set theory. It is the weakest, because the membership function is regarded as too subjective in

Table 3
Linguistic values of judgement factors

Judgement factors	National registry (X_1)	Second registry (X_2)	Open registry (X_3)
U_1	45.75	53.00	72.50
U_2	56.25	52.50	53.75
U_3	60.50	65.00	81.75
U_4	53.75	51.25	56.25
U_5	54.50	58.00	70.00
U_6	72.00	57.50	57.50
U_7	52.50	54.25	53.00
U_8	56.25	55.00	61.25
U_9	71.25	61.25	55.00
U_{10}	71.25	60.75	49.00
U_{11}	72.00	58.25	56.50
U_{12}	55.25	50.75	61.25

relation to its construction. A membership function can be either discrete or continuous. In most cases, membership functions assume continuous forms. There are several alternatives of the functional form: triangular, trapezoidal, Gaussian, bell and sigmoidal membership functions are the most commonly used [9].

Several studies discuss empirical methods to construct a membership function based on expert knowledge. With regard to the latter, a number of aspects must be considered for the practical application of fuzzy models to the flag decision [6]. These include the necessary

qualifications of experts, the proper elicitation of expert knowledge for the construction of the membership function, and the methods to test the reliability of membership functions. Reliability is also important with regard to verification and validation of the fuzzy model.

In the case of CFE, membership is given in Gaussian form [10] by

$$\mu(x) = e^{-0.000278(x-100)^2} (0x100). \quad (3)$$

Step 5 computes the degree of membership (r_{ij}) and the fuzzy matrix $R_i = \{r_{ij}\}$. Based on the membership function (3), the degree of membership for the three registry alternatives can be calculated as follows:

$$\begin{aligned}
 \{r_{1j}\} &= (r_{11}, r_{12}, r_{13}) = (0.4412, 0.5411, 0.8104), \\
 \{r_{2j}\} &= (r_{21}, r_{22}, r_{23}) = (0.5874, 0.5341, 0.5518), \\
 \{r_{3j}\} &= (r_{31}, r_{32}, r_{33}) = (0.6481, 0.7114, 0.9116), \\
 \{r_{4j}\} &= (r_{41}, r_{42}, r_{43}) = (0.5518, 0.5165, 0.5874), \\
 \{r_{5j}\} &= (r_{51}, r_{52}, r_{53}) = (0.5624, 0.6124, 0.7786), \\
 \{r_{6j}\} &= (r_{61}, r_{62}, r_{63}) = (0.8042, 0.6052, 0.6052), \\
 \{r_{7j}\} &= (r_{71}, r_{72}, r_{73}) = (0.5341, 0.5589, 0.5411), \\
 \{r_{8j}\} &= (r_{81}, r_{82}, r_{83}) = (0.5874, 0.5695, 0.6587), \\
 \{r_{9j}\} &= (r_{91}, r_{92}, r_{93}) = (0.7947, 0.6587, 0.5695), \\
 \{r_{10j}\} &= (r_{101}, r_{102}, r_{103}) = (0.7947, 0.6516, 0.4853), \\
 \{r_{11j}\} &= (r_{111}, r_{112}, r_{113}) = (0.8042, 0.6160, 0.5909), \\
 \{r_{12j}\} &= (r_{121}, r_{122}, r_{123}) = (0.5731, 0.5095, 0.6587).
 \end{aligned}$$

Then, the fuzzy matrix is:

$$R_i = \begin{pmatrix} 0.4412 & 0.5411 & 0.8104 \\ 0.5874 & 0.5341 & 0.5518 \\ 0.6481 & 0.7114 & 0.9116 \\ 0.5518 & 0.5165 & 0.5874 \\ 0.5624 & 0.6124 & 0.7786 \\ 0.8042 & 0.6052 & 0.6052 \\ 0.5341 & 0.5589 & 0.5411 \\ 0.5874 & 0.5695 & 0.6587 \\ 0.7947 & 0.6587 & 0.5695 \\ 0.7947 & 0.6516 & 0.4853 \\ 0.8042 & 0.6160 & 0.5909 \\ 0.5731 & 0.5095 & 0.6587 \end{pmatrix}.$$

Step 6 determines the fuzzy judgement $S_i = P_i \cdot R_i$ so as to assess the effects of the selected flag.

The fuzzy judgement is

$$\begin{aligned}
 S_i = P_i R_i &= [0.1098, 0.1052, 0.0449, 0.0631, \\
 &0.0841, 0.0981, 0.0785, 0.0813, 0.0659, \\
 &0.0841, 0.0925, 0.0925] R_i = [0.6366, 0.5835, 0.6398]
 \end{aligned}$$

and as a result, alternative 2, i.e. 'second registry' is the optimal choice for ship registry.

4. Reversing Chinese flagging out: government intervention and policy competition

In China, as indeed in many other countries in the world, international shipping furnishes benefits to the economy that go far beyond the short-term commercial results of the shipping companies themselves. Unfortunately, despite a number of successful policy examples in many countries—especially in the European Union—China has so far failed to realise that the provision of an attractive operational environment to shipping companies, and the pursuant improvement in the competitive-

ness of its flag, can generate multiplicative benefits to the State that would by far outweigh any costs (or foregone revenues) involved in the provision of such an environment.

4.1. The EU experience: policy competition and the attractiveness of national flags

In most EU countries, the national register drain is continuing, and this development is assuming alarming dimensions with painful consequences. To maintain a large and strong national fleet, most governments of traditional maritime countries have modified their policies moving closer to the situation created by the legislation of open registers. The FOC legislation is often used as a benchmark against which to measure the effects of policies of traditional maritime countries [5]. In this way, 'policy competition' is being developed between traditional maritime countries and open registers.

Usually, policy competition for attracting and retaining national fleets falls into two main categories [11]: one is an 'incentive-based' approach, aiming to influence flag choice directly by such things as flag preference/discrimination (including cargo reservation), exclusion of foreign flags (cabotage, bilateralism, multilateralism), port surcharges/discriminatory fees, and maritime subsidies such as operating and building subsidies, investment/modernisation grants and tax benefits.

The other category consists of a 'rule-based' approach, having a more indirect impact on flag choice by affecting the regulatory and operating environment of a shipowner. Examples comprise various special regimes with particular rules and regulations putting national fleets on more equal footing with those of other countries [12].

The first approach has been used frequently in the past but it has been unable to prevent the decline of national-flag fleets. The second policy option became increasingly popular during the late 1980s and one of its manifestations is the establishment of what has come to be known as 'international registries': policy solutions aiming to reconcile private profitability considerations and national economic welfare.

At the level of the individual firm, the flag decision should be viewed as similar to any other strategic decision of the profit maximising firm and should therefore be taken solely on commercial criteria. On the other hand, every national economy has to maximise its benefits from shipping. When evaluating the economic and social effects of flagging out, governmental authorities ought to consider its welfare effects on the overall economy. Policy solutions should derive from such an evaluation. To this end, the second policy approach represents, at least theoretically, the best of both worlds by combining the advantages of FOCs with

Table 4
Comparing the protective degree of shipping policy between typical maritime countries and China

Mean protective degree	USA			France			S. Korea			China		
	1982	1992	2000 ^a	1982	1992	2000 ^a	1982	1992	2000 ^a	1988	1994	2000 ^a
\bar{P}	0.85	0.71	0.62	0.81	0.56	0.16	0.75	0.59	0.25	0.88	0.14	0.59

^aExpected for typical maritime countries and suggested for China.

Source: Journal of Wuhan Transportation University (China), December 1998.

those of the traditional maritime countries. International registries should thus be viewed as the point where both the private interests of shipping companies and the wider ones of the national economy are reconciled.

Most of EU countries have long-standing maritime traditions and in the last decade the EU has developed a comprehensive and active approach to maritime affairs. By the 1990s, European 'traditional' registers and seafaring employment had declined so precipitously that the Union had to reappraise its maritime strategy. The EU's response to the decline of European shipping, in the face of international structural change in the industry, was set out in its Paper entitled 'Towards a New Maritime Strategy' [13].¹

One of the main objectives of the revised policy was to ensure, through a Community framework for enhancing shipping competitiveness, that ships are '...preferably registered in EU Member States with Community nationals employed on board...'. The competitiveness framework encompassed policies on training and employment, research and development, and state aids. As to the latter, the means by which Member States could intervene in the market to encourage EU ship registration and employment were defined in the Commission's maritime state aid guidelines (Community Guidelines on State Aid to Maritime Transport). The guidelines establish a more liberal regime for shipping than in any other sector in the EU economy [14].

Examples of state aids in shipping can be found in most traditional maritime nations of Europe, from the early Norwegian initiative to the German package approved only in 1998. In these initiatives, common elements are fiscal relief measures such as tonnage-based corporate taxation, and the exemption of social charges for seafarers. A notable initiative is the comprehensive

¹The, then, EU Transport Commissioner Neil Kinnock described the Paper as 'A Green Paper with White Edges'. The Paper was drafted by Kinnock's Core Group on Maritime Transport—one of the authors was a member of that group—and subsequently debated at the Roundtable Conference of Erasmus University Rotterdam in October 1996. It is considered as one of the most important shipping documents ever drafted by the EC and it is recommended reading for every student of shipping policy.

package of measures introduced by the Netherlands which, as the Dutch authorities claim, has succeeded in establishing the circumstances in which their maritime industry is now enjoying an economic recovery. The new approach of The Netherlands focuses on creating an attractive business and investment climate in which shipping is seen as the core of the country's maritime business cluster. The central element of the Dutch maritime initiative, reflecting the new focus on Dutch ownership rather than on the Dutch flagged fleet, is an optional tonnage-based tax regime. The new policy was introduced at the beginning of 1996. Results include a 25% increase in the Dutch merchant fleet, full employment of Dutch seafarers, a renewal of shipbuilding in local yards and the return or relocation to The Netherlands of some 40 ship owning or ship management companies [14].

4.2. A proposed shipping policy for China to change the situation of flagging out

As noted above, policy competition and government intervention are becoming worldwide instruments to attract and retain national fleets. In this light, China also needs to retain a strong Chinese presence in shipping and where possible a strong Chinese registered fleet to ensure the development of national economy and security. To this end, China should use the experience of developed maritime countries as a reference. This means that China will have to adjust its shipping policy, making it more appealing to Chinese shipowners and encourage them to register their vessels domestically.

Zhang [15] quantified and compared the protective (or openness) degree of shipping policy for typical maritime countries by an integrated Delphi and comprehensive fuzzy evaluation method. According to his results, as shown in Table 4, the present protective degree of China's shipping policy is not only lower than that of USA, but also lower than that of traditional open economies such as France and South Korea. This is consistent with China's general policy of economic openness and its aspirations within WTO. The country has already undertaken a series of important liberalisation initiatives in shipping including abolition of preferential treatment of Chinese companies, cargo

1 reservation, favourable interest rates for ship finance,
 2 etc. However, as far as the competitiveness and
 3 endurance of Chinese shipping companies are con-
 4 cerned, Zhang argued that the degree of openness of the
 5 Chinese shipping policy is over-advanced.

6 However, despite the openness of its economy, China
 7 is still a developing country requiring appropriate non-
 8 discriminatory policies in order to boost its international
 9 competitiveness, shipping sector included. With regard
 10 to the latter, government policy should focus its efforts
 11 in expanding those activities that create the highest
 12 value added [5]. In certain traditional maritime coun-
 13 tries, such as The Netherlands, shore-based maritime
 14 activities, most prominently shipping management,
 15 contribute the most of the value added generated by
 16 the shipping industry. This is not however the case in
 17 China where activities such as multimodal transport,
 18 shipbroking, insurance, etc. are far less developed.
 19 Shipping value added in China is generated by the ship
 20 itself and thus any shipping policy should be geared
 21 towards attracting and retaining the national fleet.

22 Shipping policy in China, as in most other countries,
 23 should aim at levelling the playing field in international
 24 competition through such measures as fiscal relief,
 25 shipbuilding terms similar to those offered to foreign
 26 buyers, abolition or lowering of ship import tariffs and
 27 value added taxes on international trades, waivers on
 28 social charges for seafarers, tonnage-based tax regime,
 29 etc. In addition, the government should increase
 30 investments in maritime education and training in order
 31 to encourage the development of a skilled and flexible
 32 maritime labour force.

33 Finally, the possibility of establishing an international
 34 ship register, as suggested in this paper, should be
 35 seriously considered, especially in order to attract back
 36 those vessels which have already been registered over-
 37 seas.

38 As mentioned above, international-, parallel-, or
 39 offshore ship registers, as they are often called, are
 40 widely adopted in Europe. Their main objective is to
 41 level operating costs with those prevailing under FOC
 42 registration, while, at the same time, maintaining high
 43 technical standards and effective implementation of
 44 international conventions. By also flying the national
 45 flag, ships in the parallel register enjoy high reputation
 46 by shippers and charterers.

47 In the case of China, such a register should have the
 48 following characteristics: the type of vessels registered
 49 should be Chinese-owned (including domestic and
 50 FOC), the manning system should be eased and the
 51 required number of national seafarers reduced, the
 52 taxation policy streamlined with the tonnage tax policies
 53 of other countries or FOCs. Such tax policies may
 54 include exemptions from tonnage dues, annual tax, and
 55 income tax by seafarers. A suitable reform of company
 and contract law to norms familiar to western ship

finance banks would, at the same time, facilitate and
 enhance financing possibilities considerably.

5. Conclusion

In China, as in most other countries, flagging out has
 shown to have serious negative impacts on China's
 shipping development and national economy. To change
 the situation, China has to adjust its shipping policy
 according to experiences in countries that have faced
 this unfavourable development earlier. Such policy
 reorientation should be based on the evaluation of the
 economic, social and political effects of shipping registry
 alternatives. China should adopt more preferential
 shipping policies such as favourable shipbuilding
 arrangements, tax exemptions for ships in international
 trades, waivers of social charges on seafarers, tonnage-
 based corporate taxation, and greater support to
 maritime education and training in order to maintain
 skills and a flexible labour force. Finally, the establish-
 ment of a parallel register, along the lines of the
 European experience, as suggested in this paper, would
 help in attracting back Chinese-owned vessels.

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References

- [1] Institute of Shipping Economics and Logistics. Market analysis
 2000: ownership patterns of the world merchant fleet. Bremen:
 ISL, 2000. 93
- [2] Ministry of the Communication—MOC. China shipping devel-
 opment Annual Report 1998. Beijing: The People's Publishing
 House, 1999. 95
- [3] United Nations Conference on Trade and Development (UN-
 CTAD). Review of maritime transport. New York: United
 Nations, 1999. 97
- [4] Bergantino AS, O'Sullivan P. Flagging out and international
 registries: main development and policy issues. International
 Journal of Transport Economics 1999;26:446–71. 101
- [5] Veenstra AW, Bergantino AS. Changing ownership structures in
 the Dutch fleet. Maritime Policy and Management 2000;27:175–
 89. 103
- [6] Cornelissen AMG, Van den Berg J, Koops WJ, Grossman M,
 Udo HMJ. Assessment of sustainable development: a novel
 approach using fuzzy set theory. Rotterdam: Erasmus University
 Rotterdam, 2000. 105
- [7] Mansur YM. Fuzzy sets and economics: application of mathe-
 matics to non-cooperative oligopoly. Aldershot, England: Edward
 Elgar Publishing Limited, 1995. 107
- [8] Saaty TL. The analytic hierarchy process: planning, priority
 setting, resource allocation. New York: McGraw-Hill, 1980. 111

- 1 [9] Dubois D, Prade H. Fundamentals of fuzzy sets. Boston: Kluwer Academic Publishers, 2000. 11
- 3 [10] Liu, (Shuyan). Systematic engineering theory on transport. Beijing: The People's Transport Publishing House, 1998. 13
- 5 [11] Raines P, Brown R. Policy competition and foreign direct investment in Europe. Aldershot, England: Ashgate Publishing Ltd, 1999. 15
- 7 [12] Sletmo GK, Holste S. Shipping and the comparative advantages of nations: the role of international shipping registers. *Maritime Policy and Management* 1993;20:243–55. 17
- 9 [13] Commission of the European Communities. Towards a new maritime strategy. COM(96) 81 final. Luxembourg: Office for Official Publications of the European Communities, 1996.
- [14] Department of the Environment, Transport and the Regions, UK. *British shipping: charting a new course*. London, 1998.
- [15] Zhang, (Peilin). Optimal options on our civil international shipping economic policy. *Journal of Wuhan Transportation University* 1998; 22: 651–55.

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