



Analysis on influencing factors of career choice of Chinese students majoring in the navigation based on discrete choice model

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Abstract: In view of the current situation that the onboard employment rate of navigation students in China is declining year by year, this paper constructs a discrete choice model to empirically study the influencing factors of navigation students' employment. By analyzing the survey data of students from the Department of Navigation Technology and Department of Marine Engineering of a maritime undergraduate college in Shanghai, the study found that the love for navigation, the expected high income after graduation and the family's support for their children's maritime career are the main factors to promote the employment of navigation students working on board, while the strong social capital of the family is the biggest resistance. Based on this, this paper puts forward several targeted suggestions to promote the high-quality and sustainable development of the crew.

Keywords: Students majoring in the navigation; career choice; discrete choice model

1. Introduction

Currently, more than 80% of the world trade volume is transported by sea. As direct participants in the shipping industry, seafarers are not only an important factor in the continued development of the shipping industry, but also an important player in China's efforts to achieve the strategy of a strong transportation and maritime nation and the Belt and Road initiative. At the same time, the contribution of seafarers to the national economy cannot be underestimated. A study of British crew members shows that seafarers contribute more to economic growth than the general workforce of society, with a return on investment of 4.8 times (Shan, 2017).

However, the shortage of high-quality seafarers in China is restricting the development of China's shipping industry. According to the Ministry of Transport's development plan for China's seafarers, it is clear that the demand for seafarers will increase gradually in the next few years, but there are still various problems in the training and reserve of high-quality seafarers in China. According to the data of the National Collaborative Group for Employment of Graduates of Maritime Courses, the proportion of undergraduate graduates of maritime courses going to ships for employment has been decreasing year by year, from 66.4% in 2007 to 43.85% in 2017. This will directly affect the healthy and sustainable development of China's shipping industry and the construction of a strong transportation country. It is urgent to build a crew to meet the national strategic needs and adapt to China's shipping development. The above-mentioned situation has prompted this paper to consider what are the factors influencing the career choice behavior of maritime students? What factors play an important role in the choice of seafaring students to get on board for employment? How to promote the cultivation of high quality seafarers in the process of the National Maritime Power Strategy?

The research object of this paper is navigation students, including students from the Department of Navigation Technology and the Department of Engine Engineering. Although the literature has analyzed the factors affecting the employment of navigation students from different perspectives, most of them are qualitative in nature and are not combined with the latest national policies, navigation talent training theory and career choice theories. Based on this, this paper conducts an empirical analysis of the factors influencing the employment of navigation students working on board. Taking undergraduates of a maritime university in Shanghai with related majors as the research object, the paper uses a discrete choice model in combination with theories related to career choice to explore in depth the influencing factors of seafaring students' employment on board ships. The results show that motivation, environment and social capital factors were the main influencing factors on the career choice of the students, and the support of their families and their love for

sailing could promote their choice to work on board. Finally, the significance of the research to the career development theory of marine talents and constructive suggestions for promoting quality crew development are discussed.

2. Theoretical analysis

The career choice of navigation students is not only related to their personal situation, but also closely related to external environmental factors such as social development. Therefore, combined with the relevant career choice theory, this paper roughly divides the influencing factors of navigation graduates' employment on board into internal factors and external factors.

2.1. Internal factors

2.1.1. Motivational factor

Motivation factors are mainly divided into intrinsic motivation and extrinsic motivation. Intrinsic motivation includes the degree of love for the profession. Many students fill in navigation majors because they love navigation related occupations in the college entrance examination. Extrinsic motivation mainly includes salary and honor, and these rewards are also considered to be the most effective way to motivate and attract crew (Pauksztat, 2017). In recent years, with the continuous development of the economy, the salary gap between sea and land has decreased year by year, and the work of seafarers has lost its original attraction (Sulpice, 2011). Taking the deck officers of dry bulk carriers as an example, the wages of the master and the chief officer are quite different from those of the second officer and the third officer, and the former is three to four times that of the latter. According to statistics released by the National Bureau of statistics of the People's Republic of China (NBS-PRC), the national average monthly wage for non-private sector employees was US\$983 in 2017, while the salary of a new third officer is typically around US\$1,000, almost the same as the wage of a non-private sector employee. Most navigation graduates start as interns after boarding the ship. At this time, the salary is only \$300~\$500, which is significantly different from the salary of onshore occupations (Qi et al., 2018). In addition, the competition for promotion and promotion of navigation graduates is fierce, and the honors they can obtain in the short term are limited. Four years after graduation, the vast majority of navigation graduates still work as third officer or third engineer, while two years after graduation, the vast majority of graduates are still interns (Yao et al., 2020). Due to the above factors, navigation students with extrinsic motivation are more likely to choose land work and give up relevant marine work.

2.1.2. Environmental factor

Environmental factors are mainly divided into work environment and family environment. The working environment of seafarers is relatively special, which requires seafarers to carry out high-intensity work in a relatively closed environment. The biological clock disorder caused by temperature and regional time difference, the noise interference of ships (Wang et al., 2005) and the increased workload caused by frequent port calls (Smith et al., 2003) have a serious impact on the health status of crew members. At the same time, the shortage of crew and the streamlining of personnel have greatly increased the workload of crew. Ellis and Sampson (2013) found that only 23% of the crew were fully rested. In addition, crew members who have been away from their families and countries for a long time, with multi-ethnic and multi-cultural backgrounds, limited recreational activities (Carotenuto et al., 2012) and recent frequent pirate hijacking incidents have also caused great pressure on the mental health of crew members. The dual pressure of physical and psychological causes navigation students to give up the opportunity to work on board and change to other occupations.

Family environmental factors play an important role in the career choice of college graduates. Because the efforts and hard work of engaging in the navigation profession after graduation are much higher than those of other professions, and there are few opportunities for family reunion, and the lack of family companionship for a long time will have a significant negative impact on the mental health of myself and her family (Ulven et al., 2007), most parents are opposed to their children's engaging in the navigation profession, which also makes the navigation students more inclined to engage in land occupation after graduation.

2.1.3. Human capital factor

The shipping industry has the characteristics of high internationalization. Therefore, the language requirements for crew members are high. They not only need to read and write a large number of English materials, but also need to have good English expression ability to facilitate the communication within ships and between ships. The shipping industry has been a high-risk industry since ancient times, which puts forward

high requirements for the operation technology of the crew. At present, China national maritime authorities have great difficulty in the crew examination, and the examination questions are relatively uncommon (He, 2017), which leads to some navigation students unable to successfully pass the crew examination, so students with high human capital are more likely to meet the requirements of boarding and employment. However, navigation students with high human capital face greater opportunity cost when choosing a career. Compared with working on board, it is more likely to prefer land sunrise industry.

2.1.4. Social capital factor

Family social capital has a significant impact on the graduation destination of children (Wen, 2005). The relatives of navigation students have been or are engaged in work related to the shipping industry, which will not only make them have more social relations in the shipping industry, but also increase the navigation students' understanding of navigation, which will help to solve the problem of "information asymmetry" in the labor market. In addition, parents' education level and family income have different effects on their children's first job (Zheng, 2004).

2.1.5. Perceived factor of industry environment

Since the global financial crisis in 2008, the shipping market has been in a continuous downturn. The excess capacity of the global shipping industry and the intensification of market competition have made many shipping companies lose money and get into trouble for years. In this regard, many people sing down the prospect of the shipping industry and believe that the shipping industry is a sunset industry and does not have development potential. The influence of external factors on career choice mainly depends on the evaluation and perception of this factor (Vondracek, Lerner & Schulenberg, 1986). Therefore, navigation students will repeatedly evaluate whether the current shipping industry can give them enough development opportunities when choosing a career. As the navigation students do not have an in-depth understanding of the shipping industry, they will be affected by the overall evaluation of the industry by public opinion when choosing a job, and carefully consider whether to choose to work on board. If they believe that the future of the shipping industry is deteriorating, they will evaluate whether their career choice can meet their expectations and then choose to work on board or switch to other industries.

2.2. External factors

2.2.1. Professional prestige factor

Sánchez-Beaskoetxea and Coca García(2015) found that seafarers are viewed negatively by the public as most marine accidents and pollution are attributed to negligence and operational errors by seafarers. According to the professional reputation questionnaire issued by the Chinese Academy of Social Sciences in 2010, the social reputation of crew ranked 68th, behind sanitation workers and farmers. This has led many navigation students to choose jobs with higher social prestige and give up the opportunity to become seafarers.

2.2.2. Economic development factor

When the material is scarce and the level of economic development is low, crew members are sought after because of their better salary. With the continuous development of economy, the wage gap between sea and land has gradually narrowed, and the family concept has become stronger. At this time, the disadvantage of becoming a crew has become increasingly prominent, which also makes many navigation students no longer choose to work on board.

2.2.3. Navigation Education Investment Factor

Compared with teaching in other majors, sailing education highlights students' practical ability, which makes investment in sailing education particularly important. In 2004, the average annual teaching cost for students majoring in navigation in my country was about 18,000 yuan, while the average annual government funding for students majoring in navigation was less than 10,000 yuan (Wang et al., 2005).The shortage of funds for sailing education still exists. In addition, a large part of domestic sailing colleges do not have the conditions to develop sailing practice (Xu et al., 2019). These factors lead to the fact that the current maritime education cannot meet the requirements of shipping enterprises for maritime talents, which in turn affects the work ability and international competitiveness of maritime students, which makes them more inclined to work on land when choosing a career.

3. Methodology

3.1. Data sources and descriptions

3.1.1. Data sources

The research data in this paper comes from a questionnaire survey of students from the Department of Navigation Technology and the Department of Marine Engineering in a maritime undergraduate college in Shanghai. This paper uses a combination of electronic questionnaires and offline questionnaires to investigate the first-year to fourth-year undergraduates majoring in navigation technology and marine engineering in this school from April to May 2021, and a total of 242 valid samples were received. There are 84 first-year students, 93 second-year students, 25 third-year students, and 40 fourth-year students. Among them, 76 students (accounting for 31.4%) chose to work on board after graduation. This result is consistent with the previous survey on the career choices of navigation students in undergraduate colleges (Qi et al., 2018). The sample data of this study were mainly male, with a total of 214 people (88.4%).

3.1.2. Variable

(1) Navigation students choose to work on board (onboard)

The questionnaire designed a question to ask navigation students whether they are willing to choose to work on board after graduation. The specific question is "According to your current wishes, what kind of work do you want to engage in after graduation?" (1 = prepare to work on board, 2 = prepare to apply for postgraduate or civil servant, 3 = prepare to study abroad, 4 = prepare to work on land, 5 = prepare to start their own business). Based on the research purpose of this paper, we divide the career choice of navigation students at graduation into choosing to work on board and other aspects. If the student chooses to work on board, onboard is 1, otherwise it is 0.

(2) Motivation-related variables (love, salary, honor)

In this paper, a five-point scale (1 = very small, 5 = very large) is used to express the influence of motivation factors on the decision of navigation students to work on board, and the motivation factors are divided into intrinsic motivation and extrinsic motivation. The intrinsic motivation mainly includes the love for navigation. The corresponding question in the questionnaire is "Do you like navigation?". Extrinsic motivation mainly includes salary and honor. The questions in the questionnaire are "What is your expected salary after graduation?" and "Do seafarers have room for promotion?".

(3) Environment-related variables (danger, challenge, support)

The paper divides environmental factors into work environment and family environment. The working environment mainly includes the navigation students' cognition of seafarers' working environment. The corresponding question in the questionnaire is "Do you agree that seafarers are a high-risk occupation?" and "Is the work of seafarers challenging?". The family environment mainly includes the degree of support of family members for navigation students to work on board. The corresponding question in the questionnaire is "What attitude do family members hold towards your work on board?".

(4) Human capital related variables (prize, English, certificate)

This paper describes students' human capital from the perspectives of school performance reward, English and certificate. Among them, the school performance reward is defined as whether the student has won a scholarship so far. If he has won a scholarship, prize is 1, otherwise it is 0; English proficiency is defined as whether students have obtained corresponding English certificates so far. If they have obtained CET-6 certificate, English is taken as 1; If CET-4 certificate is obtained, English takes 2; If you have never obtained the corresponding certificate, take 3 for English; Navigation level is defined as whether students have obtained relevant certificates of crew members so far. If they have obtained all certificates, certificate is taken as 1; If some certificates are obtained, certificate takes 2; If the corresponding certificate has never been obtained, certificate takes 3.

(5) Social capital related variables (education, income, shipping)

This paper describes the social capital of students from the perspectives of father's education, family income and whether relatives have working experience in the shipping industry. Among them, the father's education level is divided into 7 grades, namely primary school, junior high school, technical secondary school, high school, junior college, undergraduate and postgraduate (including master and doctoral students), and they are assigned in turn; the annual family income is divided into 7 grades, respectively Below 10,000 yuan, 10,000 to 30,000 yuan, 30,000 to 80,000 yuan, 80,000 to 150,000 yuan, 150,000 to 300,000 yuan, 300,000 to 1,000,000 yuan, and 1,000,000 yuan above, and assign values to them in turn. Whether relatives have work experience in

the shipping industry corresponds to the question in the questionnaire “Has any relatives ever (or are) working in the shipping industry?”.

(6) Perceived variables of industry environment (future, recognition)

The questionnaire asks respondents to answer whether they agree with the judgment on the industry environment (1 = very disagree, 5 = very agree), including the judgment on the future of the shipping industry and the public's recognition of engaging in the shipping industry. The corresponding question in the questionnaire is "Do you agree that the shipping industry is a sunset industry?" and "Do you agree that the public has a high degree of recognition for engaging in the shipping industry?".

This paper also includes variables of student demographic characteristics, including major, gender, grade, whether it is an only child, and the place of origin.

3.2. Model

Since the explained variable, navigation students’ choice to work on board, is a dummy variable, this paper uses the discrete choice model to analyze the influencing factors of navigation students’ choice of work on board. Our model to be estimated is specified as follows:

$$\text{onboard} = \alpha_0 + \alpha_1\text{love} + \alpha_2\text{salary} + \alpha_3\text{honour} + \alpha_4\text{danger} + \alpha_5\text{challenge} + \alpha_6\text{support} + \alpha_7\text{prize} + \alpha_8\text{english} + \alpha_9\text{certificate} + \alpha_{10}\text{education} + \alpha_{11}\text{income} + \alpha_{12}\text{shipping} + \alpha_{13}\text{future} + \alpha_{14}\text{recognition} + \sum X + \varepsilon \quad (1)$$

where X represents a series of student demographic characteristic variables of navigation students, ε is a random error term. The dependent variable in this paper is a dummy variable, which needs to be estimated by logit model or probit model.

4. Results and discussion

4.1. Descriptive analysis

In this paper, the data is divided into two groups for descriptive statistics according to whether navigation students choose to work on board or not, in order to compare the characteristic differences between the two types of students.

As shown in Table 1, about 30% of navigation students hope to work on board after graduation. Column (1) and column (2) give descriptive statistics of the samples of choosing to work on board and not choosing to work on board respectively, and column (3) shows the difference between the two mentioned above. Through simple comparison, we can get some preliminary understanding. First, students who choose to work on board have stronger internal and external motivation. Second, among environmental factors, family environment is the main factor affecting students' work on board, while working environment is not the decisive factor. Third, strong social capital has a negative impact on students' choice to work on board. Fourth, the perception of the overall environment of the shipping industry has a significant impact on students' choice of boarding work. Next, this paper further analyzes the influencing factors through the econometric model.

Table 1 Descriptive statistics

	Not selected to work on board (1)				Choose to work on board (2)				Diff:(1)-(2) (3)
	Mean	S.D.	Min	Max	Mean	S.D.	Min	Max	
love	2.909	0.879	1	5	3.750	0.834	1	5	-0.840***
salary	2.843	1.100	1	4	3.579	0.853	1	4	-0.736***
honour	2.952	1.014	1	5	3.565	1.050	1	5	-0.614***
danger	3.771	0.944	1	5	3.605	0.924	1	5	0.166
challenge	3.783	0.947	1	5	3.986	0.945	1	5	-0.204
support	2.608	0.865	1	5	3.328	1.100	1	5	-0.721***
prize	0.343	0.476	0	1	0.329	0.473	0	1	0.014
english	2.301	0.766	1	3	2.566	0.639	1	3	-0.265***
certificate	1.952	0.667	1	3	1.763	0.690	1	3	0.189**
education	4.024	1.842	1	7	3.105	1.756	1	7	0.919***

income	3.904	1.659	1	7	3.329	1.427	1	7	0.575***
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shipping	0.133	0.340	0	1	0.078	0.271	0	1	0.054
future	2.939	1.110	1	5	2.421	1.146	1	5	0.519***
recognition	3.090	1.037	1	5	3.381	1.177	1	5	-0.291*
Observations	166				76				

continued Table 1

Notes: ***, **, * denote the significance at 1%,5% and 10%, respectively.

4.2. Regression results

The regression results are shown in Table 2. From the perspective of motivation factors, the love of navigation students for navigation significantly promotes their willingness to go on board, which shows that the internal motivation factor is an important factor driving navigation students to go on board. The expected income after graduation is significantly positive at the 1% confidence level, indicating that the higher the expected income of navigation students after graduation, the more likely they are to work on board, which is contrary to the expectation. The possible reason for the above situation is that although the salary during the internship period is much lower than that of the onshore occupation, the internship period is short, and the salary has increased significantly after the internship, which improves the enthusiasm of navigation students to work on board.

From the perspective of environmental factors, the coefficient before the risk and challenge of navigation is negative, but not significant, which shows that the risk and challenge of navigation are not the main factors affecting the boarding work of navigation students. The degree of support of family members significantly promotes the willingness of navigation students to work on board, which shows that compared with the difficulty of working on board, the care and support of family members for students is the main factor to promote their work on board.

From the perspective of human capital factors, whether to obtain scholarships, English level and navigation technology are not the main factors affecting navigation students' boarding work.

From the perspective of social capital, the higher the father's education and annual household income, the less willing his children are to go on board. This may be due to the fact that the higher the father's education and annual household income, the higher his human capital and the stronger social network he possesses, and the more job opportunities he can offer to his children, thus leading to an increase in the opportunity cost for the children to choose to work on board and reducing their motivation to work on board.

From the perspective of the perceived factors of the industry environment, students who think that the shipping industry is a sunset industry are less willing to work on board; It is considered that the public's high recognition of the shipping industry will promote the navigation students' willingness to work on board, which is consistent with the expectation, but it is not significant, indicating that the perception factor of the industry environment is not the main factor affecting the navigation students' work on board.

Table 2 Regression results

VARIABLES	(1) Onboard (probit model)	(2) Onboard (logit model)
love	0.716*** (4.02)	1.203*** (3.44)
salary	0.421*** (3.64)	0.786*** (3.31)
honor	0.119 (0.89)	0.262 (0.97)
danger	-0.095 (-0.71)	-0.178 (-0.71)
challenge	-0.038 (-0.25)	-0.081 (-0.27)
support	0.317** (2.41)	0.569** (2.05)

continued Table 2

prize	0.163 (0.62)	0.387 (0.75)
english	0.282 (1.43)	0.466 (1.23)
certificate	-0.079 (-0.41)	-0.178 (-0.51)
education	-0.147* (-1.86)	-0.247 (-1.50)
income	-0.158** (-2.17)	-0.279** (-2.11)
shipping	0.065 (0.20)	0.138 (0.23)
future	-0.033 (-0.30)	-0.066 (-0.31)
recognition	-0.047 (-0.38)	-0.080 (-0.32)
constant	-5.629*** (-3.77)	-10.123*** (-3.18)
demographic variables	Yes	Yes
observations	242	242

Notes: ***, **, * denote the significance at 1%, 5% and 10%, respectively.

5. Conclusions and policy implications

Combined with the analysis of the influencing factors of navigation students' career choice, this paper first expounds the significance of career development theory for navigation talents. In the process of career choice of navigation students, idealistic motivation rather than utilitarian motivation is the main driving force for such students to choose to work on board. In addition, choosing a career as a seafarer requires more care and support from family members. If the family has a strong social network and can provide employment opportunities, it will inhibit the willingness of sailing students to become seafarers. In addition, choosing a career as a seafarer requires more care and support from family members. If the family has a strong social network and can provide employment opportunities, it will inhibit the willingness of sailing students to become seafarers. This result is a mixed blessing for the cultivation of maritime talents and the shipping industry. On the one hand, engaging in shipping work requires the professionalism and enthusiasm of the employees, and the professional training has created a strong professionalism and familiarity with the industry for navigation students. With firm support and endogenous motivation, students are more willing to integrate into the construction of a shipping power. On the other hand, idealistic pursuits and endogenous factors are difficult to compete with objective factors. Subjective factors are very easy to change after students are employed. Factors such as marriage and future career planning will make crew work a short-term transitional occupation.

Therefore, this paper puts forward the following suggestions to promote the cultivation of high-quality crew members:

(1) Multi-channel training of high-quality crew. The government should formulate a more scientific enrollment plan for sailing majors, optimize the medical examination conditions for sailing majors, and encourage non-nautical college students to participate in seafarer vocational skills training. To train students through the school-enterprise combination model, schools should connect with high-quality resources from enterprises to promote the smooth employment of professionals. In addition, relevant departments can help fishermen and demobilized soldiers to work as merchant mariners through peer-to-peer recognition and remedial training.

(2) Strengthen the publicity of navigation characteristics. Universities, primary and secondary schools promote maritime culture through literature, film and television, music and art, encourage the construction of maritime culture and education bases in various places, and organize activities such as summer camps for maritime colleges and boat trips. The whole media used agenda setting to strengthen public opinion guidance, publicize navigation culture.

(3) Improve the protection of crew rights and interests and service support. The management department can innovatively drive the construction of a high-quality crew team with a system based on extensive solicitation of opinions. Promoting the internet technology service is an important logistical support for crew work, so crew members have the right to enjoy low-cost communication network services in the sea area. Under the leadership of the government, trade unions, and industry associations, various departments have linked many shipping companies to build a service platform for crew career development, and optimize service mechanisms such as rights protection, welfare implementation, training and promotion. The whole society should promote the crew culture, so as to form a good social atmosphere that respects the crew's labor and cares about the growth of the crew, and enhances the social recognition and reputation of the crew.

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