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Addressing the Trajectory of Cultural and Gender Discrimination among Marine Women Officers

Mahashweta Das[1]
Research Scholar, The University of Burdwan, India

CORRESPONDENCE
Mahashweta Das
Department of History
The University of Burdwan, Burdwan,
West Bengal, India
Email: mahashweta259@gmail.com

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Abstract: *Seafaring is openly challenging working circumstances for females. For the last twenty-two years, females in western countries have been interested in joining the fleet, but as the captaincy roles aboard, their numbers are minimal compared to other jobs. In every working place, females always face many unusual problems, which are more in seafaring. The manuscript derives the discrimination factors of marine women officers (MWOs) onboard due to cultural (or racial) or being a woman using the experiences of 149 women officers from 18 different countries. Two experiences such as onboard discrimination due to cultural reasons (DDCR) and not being promoted in the company as being women (NPCW) for MWOs are considered the responses in the present study. It was found out that mean DDCR is positively associated with age (P=0.0313), nationality (P=0.0047), current position onboard (P=0.1051), while it is negatively associated with cohabitation (P=0.0137) and type of contract (P=0.0719). Variance of DDCR is negatively associated with male companions' support (P=0.1432). Also, mean NPCW is negatively associated with her male companions' support (P<0.0001), while its variance is positively associated with professional qualification (P=0.1317). It was found out herein that MWOs from other nations (except Spanish) at older ages, second class officers, staying single with temporary contracts are highly discriminated against based on cultural (or racial) reasons. In addition, MWOs with higher male companions' support are very rarely promoted in the company.*

Keywords: Captaincy roles, Cultural and gender discrimination, Joint generalised linear models, Marine women officers, Racial discrimination, Seafaring.

1. Introduction

For the last two decades, females have been interested in joining the customary male transportation job vacancies such as air-force, air-space scientists, marine officers, air-pilot etc. In general, according to the electronics news, women are considered office attendants, cleaners, air-hostesses, and house-nurses that do not require any special academic skills (UIC, 2019). Though many females have reportedly registered in Western Europe Seafaring Academies, and they began to sail as Captains or Officers (International Labour Office [ILO], 2019). Still, the female participation in the captaincy roles aboard is abysmal compared to other works such as teaching, health-related areas, engineering, enterprise management, law, among others.

The United Nations recognised agency known as International Maritime Organization (IMO) is accountable for the maintenance, safety, security of navigation and marine pollution prevention from ships IMO (2019a). The IMO (2019a) has raised a women integration policy in managerial locations to perform these functions smoothly, both onshore and board. Currently, it is often to observe females as Officers, or Captains on board in Western European countries that the earnest IMO efforts have attained. IMO has opened some film series regarding female working environments to make it attractive to females. The IMO announces that many skilled females are required for captaincy, officers and leadership positions onboard IMO (2019a).

Moreover, the IMO Women Integration Program in the Maritime Sector (IMO, 2019b) inspires maritime academies to raise the female presence; consequently, they can attend the highest ability levels. The Busan announcement (IMO, 2013) rightly guides the IMO activities, and as a result, the institution is committed to struggling for effective female integration onboard with equal benefits as men. This activity verbally shows that awareness of the female's role onboard to be increased, which is a real worthy resource in the maritime industry (IMO, 2013). More than 3,000 females

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have been gathered from 40 different countries worldwide, around the maritime industry, by the Women's International Shipping & Trading Association (WISTA, 2019). These women have been trained not only as seafarers, but captains, officers and executives. A booklet is regularly published by the joint efforts of Anglo-Eastern Ship Management Limited and International Seafarers' Welfare and Assistance Network (ISWAN, 2019) to inspire the readers to fasten the variety of concepts onboard merchant ships. Especially, discussion on diversity topics in the booklets is in isolation, including gender discrimination, attitudes towards women and harassment on board.

The discriminations against females on board have been discussed by Carol-Dekker and Khan (2016), which makes the marine work situation very painful and stressful for females. Research shows that abusive practices against women cadets were common in the fleet (ISWAN, 2019; IMO, 2019a). In the same vein, Manzano (2014) pointed out that sexual harassment was not only directed at women seafarers, but that many male navigators became vulnerable if they did not fit into the male hegemonic category. Women are generally and physically appearing weaker than men, so females are not acceptable on board by some men. The World Maritime University (WMU, 2020) has collected a selection of articles in the book entitled Maritime women: Global leadership by Kitada et al. (2015). The paper by Cordon et al. (2020) has illustrated many problems connected with females' working conditions onboard. Marine researchers and readers may visit the article by Cordon et al. (2020), which are not reproduced herein.

There are few studies about the determinants of the discrimination against females due to cultural (or racial) or being a woman using appropriate scientific approaches. Cordon et al. (2020) tried to identify the discrimination against females determinants using some preliminary logical and statistical approaches, which are not appropriate as any diagnostic checking does not support such approaches. Therefore, the current manuscript focuses on the discrimination against females determinants marine women officers due to cultural (or racial), or being a woman using appropriate statistical modelling.

1.1 Research Question

To respond to the above objective, the following primary research question was answered via the following material & methods, statistical analysis & results, and discussion & conclusions:

- What are the determinants of discrimination against females/women marine officers due to cultural (or racial) or being women using statistical modelling?

2. Materials And Statistical Methods

2.1 Materials

The manuscript considers the responses of 149 marine women executives from 18 countries collected by Prof. Jose R Cordon, and it was published on 09-10-2019| with Version 1 | DOI: 10.17632/ 4ffk2hbz32.1. The data set is clearly illustrated in the paper by Cordon et al. (2020), and it can be found at https://forms.gle/f3GdmBLZkHfKDuFn6. The particular data set is suitable for examining the above-stated research question. It contains many explanatory variables/factors to explain the discrimination against females/women marine officers due to cultural (or racial) or being a woman. Several areas of marine women executives are considered in the data set. It focuses on some primary marine women executive's information such as Work-Life Balance, Socio-Demographic, Leadership Style, Harassment situations, Labour status, and an open paragraph for expressing their ideas. The data set includes 54 variables/ factors. Among them all, only ten variables/factors are associated as the suitable explanatory factors/variables of the two responses, such as "I have experienced onboard discrimination for racial or cultural reasons", which is shortly expressed as discrimination due to cultural reasons (DDCR) and "I feel that I cannot be promoted in this company because I am a woman", which is shortly expressed as not to be promoted in the company as being women (NPCW). The included 10 explanatory factors/variables are x1=Age; Fx2=Nationality (1= Spanish; 2 =Others); x3=Group; Fx4=Cohabitation (1= Single; 2= Couple); F5=Contract's type (1 = Temporary; 2= Permanent); Fx6 = Current posting on board (1= Not inboard; 2= 2nd Class Officers; 3= 1st Class Officers); Fx7= Professional qualification (1= Other; 2= Master); x8= Number of sailing years as Officer; Fx9= Route and vessel characteristics (1= Temporary; 2= Fixed); Fx10=My male companions support me. The other factors/ variables are not stated herein as most of the remaining factors/variables are treated as responses. For factors/ variables details, interested researchers may visit the article by Cordon et al. (2020).

2.2 Statistical Methods

The manuscript considers the data of marine women executives as reported above. This is shown that the responses DDCR and NPCW are heterogeneous, positive and non-normally distributed. These responses are not stabilised by any transformation, so they are modelled adopting the joint generalised linear models (JGLMs) that are described in the books by Lee et al. (2017) and by Das (2014). JGLMs are very shortly reported herein for ready reference.

Log-normal JGLMs: For a positive response DDCR=Y_i's, or NPCW=Y_i's with mean E(DDCR=Y_i, or NPCW=Y_i) = μ_i and Var(DDCR=Y_i, or NPCW=Y_i) = $\sigma_i^2 \mu_i^2 = \sigma_i^2 V(\mu_i)$ say, where σ_i^2 's denote dispersion parameters and $V(\cdot)$ represents the dispersion function. Generally, the log transformation Z_i = log(DDCR=Y_i, or NPCW=Y_i) is commonly applied in order to stabilise the variance Var(Z_i) ≈ σ_i^2, while the variance may not always be stabilised. For developing an improved model, JGLMs for the mean and dispersion can be considered. For the log-normal distribution, JGLM of the mean and dispersion of Z_i = log(DDCR=Y_i, or NPCW=Y_i) are given by

$E(Z_i)= \mu_{zi}$ and $Var(Z_i) = \sigma_{zi}^2$,

$\mu_{zi}=x_i^t \beta$ and $\log (\sigma_{zi}^2)= g_i^t \gamma$,

where x_i^t and g_i^t are the vectors of 10 explanatory factors/variables (as stated above) connected with the regression coefficients β and γ, respectively.

Gamma JGLMs: For the above DDCR=Y_i's, or NPCW=Y_i's, the variance has two components such as σ_i^2 (free of means) and $V(\mu_i)$ (depending on the mean parameters). The dispersion function $V(\cdot)$ reveals the GLM family distributions. For instance, if $V(\mu) = \mu^2$, it is gamma, normal if $V(\mu)= 1$, Poisson if $V(\mu) = \mu$, etc. Gamma JGLMs mean and dispersion models are

$$\eta_i = g(\mu_i) = x_i^t \beta \text{ and } \varepsilon_i = h(\sigma_i^2) = w_i^t \gamma,$$

where $g(\cdot)$ and $h(\cdot)$ are the GLM link functions for the mean and dispersion linear predictors, respectively, and x_i^t, w_i^t are the 10 explanatory factors/variables (as mentioned above) vectors related with the mean and dispersion parameters, respectively. The maximum likelihood (ML) method is used to estimate mean parameters, while the restricted ML (REML) method is adopted to estimate dispersion parameters, which are clearly described in the book by Lee et al. (2017). These two statistical modelling approaches have been used in the published data set given by Cordon et al. (2020). It is noted herein that Prof. Jose R. Cordon and his research team collected the data following research ethics, so they published the data set.

3. Statistical Analysis & Results

3.1 Statistical Analysis

The responses DDCR and NPCW are identified as heteroscedastic, which have been modelled by JGLMs adopting both the gamma and log-normal distributions. All the above ten explanatory factors/ variables are adopted to predict the mean and dispersion of DDCR and NPCW. Only the significant, partial significant and model fitting essential explanatory variables are included in both the models of DDCR and NPCW. The best model is approved based on the lowest Akaike information criterion (AIC) value (within each class) which minimises both the squared error loss and predicted additive errors (Hastie et al., 2009, p. 203-204). Following AIC criterion, JGLMs log-normal fit (AIC=235.2) of DDCR is better than gamma fit (AIC=255.646) (Table 1), as the AIC difference is greater than one, which is significant. Also, the gamma fit (AIC=471.969) of NPCW is better than log-normal fit (AIC=480.7) (Table 2). The mean and dispersion model for both the gamma and log-normal fittings are different for each of the two responses DDCR and NPCW, which support the results pointed by Das (2012) and Das and Park (2012). In the mean model of DDCR, Fx6(=Current posting on board) a partially significant (10.51%) factor is included, while for the mean model of NPCW, Fx2(=Nationality) (insignificant) and in the dispersion model of NPCW, Fx7(= Professional qualification) (13.17% partially significant) are included for better fitting due to Hastie et al. (2009). JGLMs fitting outcomes for DDCR and NPCW are shown in Table 1 and Table 2, respectively.

Table 1: *JGLMs gamma and lognormal fitted models for discrimination due to cultural reasons (DDCR) of women officers on board*

Model	Covariate	Gamma fit				Log-normal fit			
		estimate	s.e.	t(143)	P value	estimate	s.e.	t(143)	P value
Mean	Constant	-0.0131	0.19742	-0.066	0.9474	-0.0534	0.18653	-0.286	0.7752
	x1	0.0144	0.00596	2.408	0.0173	0.0123	0.00564	2.175	0.0313
	Fx2 2	0.2414	0.08282	2.915	0.0041	0.2251	0.07840	2.872	0.0047
	Fx4 2	-0.1881	0.07264	-2.590	0.0106	-0.1717	0.06878	-2.496	0.0137
	Fx5 2	-0.1543	0.07800	-1.978	0.0498	-0.1339	0.07383	-1.813	0.0719
	Fx6 2	0.1505	0.08735	1.723	0.0870	0.1350	0.08278	1.631	0.1051
	Fx6 3	-0.0665	0.08881	-0.749	0.4556	-0.0289	0.08396	-0.344	0.7313
Dispersion	Constant	-1.1193	0.4710	-2.377	0.0187	-1.1365	0.4658	-2.440	0.0159
	x13	-0.1748	0.1319	-1.325	0.1872	-0.1918	0.1303	-1.472	0.1432
AIC		**255.646**				**235.2**			

Table 2: *JGLMs gamma and log-normal fitted models for not to be promoted in the company as being women (NPCW) of female officers on board*

Model		**Gamma fit**				**Log-normal fit**			
		estimate	**s.e.**	**t(147)**	**P-value**	**estimate**	**s.e.**	**t(147)**	**P-value**
Mean	Constant	1.5472	0.14749	10.490	<0.0001	1.3816	0.15503	8.912	<0.0001
	x13	-0.1661	0.03985	-4.168	<0.0001	-0.1526	0.04188	-3.643	0.0004
	Fx2 2	-0.0932	0.09423	-0.989	0.3243	-0.1164	0.09907	-1.175	0.2418
Dispersion	Constant	-1.879	0.3430	-5.479	<0.0001	-1.754	0.3471	-5.053	<0.0001
	Fx7 2	0.555	0.3661	1.516	0.1317	0.574	0.3710	1.547	0.1240
AIC		**471.969**				**480.7**			

The derived DDCR's log-normal fitted model is better according to AIC rule, which is accepted based on diagnostic checking plots in Figure 1. Figure 1(a) reveals the absolute residuals plot for the DDCR log-normal fitted model (Table 1) against the fitted values, which is almost a flat straight line, except the left tail, concluding that variance is constant with the running means. The left tail is decreasing due to some smaller absolute residuals located at the left boundary. Figure 1(b) shows the normal probability plot of the residuals of DDCR log-normal fitted mean model (Table 1) that does not indicate any lack of fit, as all the points lie in a smooth curve. Therefore, Figure 1 shows that the derived DDCR log-normal fitted model is nearly a true unknown model.

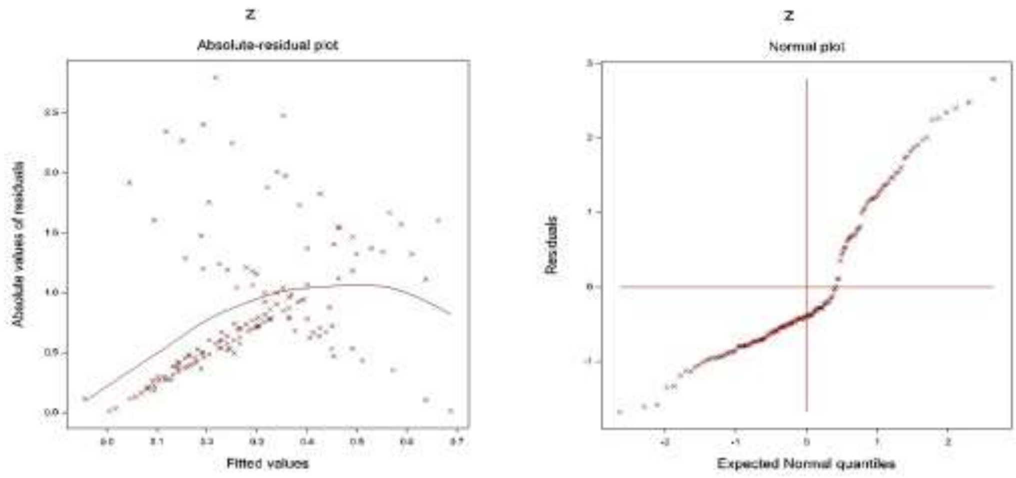

Figure 1(a) **Figure 1(b)**

Figure 1: *For the joint DDCR log-normal fitted model (Table 1), the (a) absolute student residuals plot with the fitted values, and (b) the normal probability plot for the mean model*

The derived NPCW's gamma fitted model is better according to AIC rule, which is accepted based on diagnostic checking plots in Figure 2. Figure 2(a) reveals the absolute residuals plot for the NPCW gamma fitted model (Table 2) against the fitted values, which is almost a flat straight line, concluding that variance is constant with the running means. Figure 2(b) shows the normal probability plot of the residuals of NPCW gamma fitted mean model (Table 2) that does not indicate any lack of fit, as all the points lie in a smooth curve. Therefore, Figure 2 shows that the derived NPCW gamma fitted model is nearly a true unknown model.

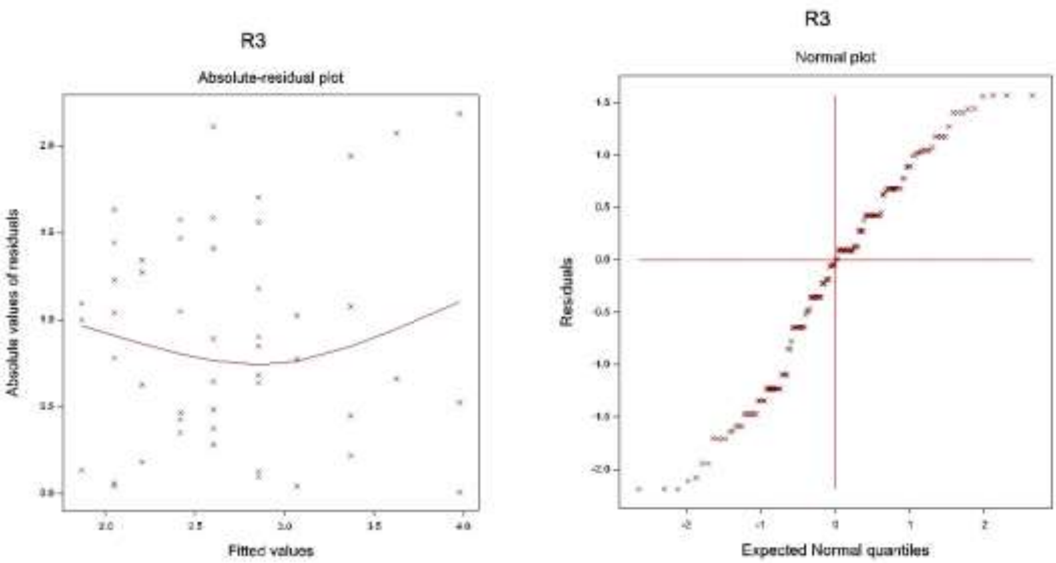

Figure 2(a) **Figure 2(b)**

Figure 2: *For the joint NPCW gamma fitted model (Table 2), the (a) absolute student residuals plot with the fitted values, and (b) the normal probability plot for the mean model*

3.2 Analysis of Results

3.2.1 DDCR analysis results

The summarised DDCR analysis findings using JGLMs for both the gamma and log-normal models are presented in Table 1. Based on AIC value, the derived DDCR's log-normal fitted model is the best model (Table 1). From the log-normal fitted model, it is seen that mean DDCR is positively associated with age (P=0.0313), nationality (P=0.0047), current position onboard (P=0.1051), while it is negatively associated with cohabitation (P=0.0137) and type of contract (P=0.0719). Variance of DDCR is negatively associated with her male companions' support (P=0.1432).

Log-normal fitted DDCR mean model (Table 1) is

$\hat{\mu}$ =exp(-0.0534 + 0.0123 x1(Age) + 0.2251 (Fx2)2 (Nationality) -- 0.1717(Fx4)2 Cohabitation -- 0.1339 (Fx5)2 (Type of contract) + 0.1350 (Fx6)2 (Current position on board) --0.0289(Fx6)3) .

Llog-normal fitted DDCR dispersion ($\hat{\sigma}^2$) model is

$\hat{\sigma}^2$ = exp(--1.1365 ---0.1918 x13 (My male companions support me)).

3.2.2 NPCW analysis results

The summarised NPCW analysis findings using JGLMs for both the gamma and log-normal models are presented in Table 2. Based on AIC value, the derived NPCW's gamma fitted model is the best model (Table 2). From the gamma fitted model, it is observed that mean NPCW is negatively associated with her male companions' support (P<0.0001), while its variance is positively associated with her professional qualification (P=0.1317). Note that in the mean model of NPCW, nationality (Fx2), an insignificant effect (P=0.3243) is included for better fitting of the model.

Gamma fitted NPCW mean model (Table 1) is

$\hat{\mu}$ =exp(1.5472 -- 0.1661 x13 (My male companions support me) --0.0932 (Fx2)2 (Nationality).

Gamma fitted NPCW dispersion ($\hat{\sigma}^2$) model is

$\hat{\sigma}^2$ = exp(---1.879 + 0.555 (Fx7)2 (Professional qualification)).

4. Discussions

The manuscript has developed JGLMs of DDCR and NPCW under both the gamma & lognormal distributions. The best models are selected based on graphical diagnosis (Figure 1 & Figure 2), comparing two probability distributions such as log-normal and gamma for fitting of DDCR, or NPCW (Table 1 & Table 2), smallest AIC value, along with the stable estimates having small standard errors (Table 1 & Table 2). The research should have a higher faith in the present results of DDCR and NPCW.

From the derived log-normal fitted model of DDCR (Table 1), it is seen that mean DDCR is positively associated with age (P=0.0313), concluding that discrimination against women due to cultural or racial reasons is higher at older ages. In practice, older marine women officers are discriminated against very highly. Mean DDCR is positively associated with nationality (Spanish = 1; Others = 2) (P=0.0047), implying that discrimination against women due to cultural or racial reasons is higher for marine women officers from other nations than Spanish. Mean DDCR is positively associated with the current position onboard (Fx6)2 (1= Not inboard; 2= 2nd Class Officers; 3= 1st Class Officers) (P=0.1051), interpreting that discrimination against women due to cultural or racial reasons is higher for marine 2nd Class women officers than 1st Class officers. Mean DDCR is negatively associated with cohabitation (1= Single; 2= Couple) (P=0.0137), showing that discrimination against women due to cultural, or racial reasons is higher for single marine women officers than couple. Also, mean DDCR is negatively associated with the type of contract (1 = Temporary; 2= Permanent) (P=0.0719), an indication that discrimination against women due to cultural or racial reasons is higher for temporary marine women officers than permanent women officers. The variance of DDCR is negatively associated with her male companions' support (P=0.1432), concluding that discrimination values against women due to cultural or racial reasons are lower scatteredness for the women marine officers having higher her male companions' support. This shows that marine women officers with higher supports from their male companions' have smaller scattered discrimination values. Implying that marine women officers with higher supports from their male companions' have almost the same discrimination values against women due to cultural or racial reasons.

From the derived gamma fitted model of NPCW (Table 2), it is observed that mean NPCW is negatively associated with her male companions' support (P<0.0001), implying that the marine woman executive has a very low chance to be promoted in the company if she has higher her male companions' support. In practice, the marine women officers are not harassed by the authority, who has the higher male companions' support. So, such marine women officers are punished without promotions. In addition, variance of NPCW is positively associated with her professional qualification (1= Other; 2= Master) (P=0.1317), concluding that marine women officers' promotional cases are higher, or lower for the master degree qualified officers than the others.

There is no parallel study for the DDCR, or NPCW using any advanced statistical modeling, so the present outcomes cannot be compared with the earlier published articles. Earlier studies regarding the marine women officers' harassment conditions in the working places are made only based on simply percentage values. Based on our experience, there is not a single manuscript about the harassment of marine women officers based on advanced statistical modelling that can only identify the causal factors of women harassment in the working environments. The present derived outcomes and models of DDCR and NPCW are clearly verified by Figure 1 and Figure 2, respectively.

5. Conclusions

The current article has derived the determinants of discrimination against females/women marine officers due to cultural (or racial), or being a woman using statistical modelling under both the log-normal and gamma distributions. Here both the models show similar outcomes. In addition, the final models have been accepted based on diagnostic checking. Therefore, the currently derived determinants are almost true. One can verify the reported results based on the data set on the website. It is expected that similar outcomes may be obtained for any similar data set from any country. It is also concluded that MWOs from other nations (except Spanish) at older ages, second class officers, staying single with temporary contracts are highly discriminated against based on cultural (or racial) reasons. In addition, MWOs with higher male companions' support are very rarely promoted in the company. This report is helpful to the IMO and the related organisations to improve the working environments of the marine women officers.

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