

## **ORDINAL REGRESSION FOR MODELLING THE FAMILY WELL-BEING AMONG THE MALAYSIANS**

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### **ABSTRACT**

**Background and Purpose:** Understanding factors which affect the level of family well-being is important as it contributes to effective decision making among the policymakers to improve the family lives as well as to strengthen the family institution. Accordingly, this line of research is gaining attention. This study develops an ordinal regression model which identifies demographic, economic and social factors that are significant in explaining the status of family well-being.

**Methodology:** Data involving 2,808 respondents from a nationwide survey conducted by the National Population and Family Development Board of Malaysia in 2011 were used in this study. Ordinal regression model was implemented to describe the three levels of family well-being.

**Findings:** The national survey reported that high level of family well-being was experienced by 76.3 per cent of the respondents, followed by moderate (18.4%) and low (5.3%). The fitted ordinal regression model found that ethnic background, family relationship, community relationship, health and safety levels, economic situation of the family, religious practice, housing, and environment are significantly related to family well-being. Meanwhile, it was found that the level of income is not a significant factor in determining the level of family well-being.

**Contributions:** There are a limited number of studies on the application of ordinal regression for modelling the level of family well-being, particularly with covariates involving the demographic and social characteristics of the respondents. This study fills in the gap in the literature where the ordinal regression model provides useful information for policymakers to enhance the status of family well-being in Malaysia via various policy initiatives.

**Keywords:** Family well-being, Ordinal Regression Model, ordinal data, Proportional Odds Model.

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## 1.0 INTRODUCTION

The status of family well-being influences the level of happiness and prosperity in any particular society. A prosperous society would certainly be constituted mostly of families with a high level of well-being that lead to positive and significant quality of life (Thiyagarajan, Bagavandas, & Kosalram, 2019). Determining the level of family well-being is not straight forward since each individual member of the family has his or her own level of well-being that may contribute to the overall level of family well-being in a complex manner. In addition, family well-being can be seen as the product of multi factors which can be dynamic, possibly with respect to time and geographical location (Krys et al., 2019; Noor, Gandhi, Ishak, & Wok, 2012). This makes the study on family well-being remains interesting and challenging.

Measuring family well-being, which is multidimensional in nature, requires consideration of many factors which are either objective or subjective (Voukelatou et al., 2020). For instance, household income and education level are the most common factors that are measured as the objective factors. While subjective factors are usually being measured through the perception of respondents on the satisfaction level of the family well-being on different aspects of the family condition. The factors that are proposed in the literature involve various aspects of physical, spiritual, financial, social and health of the individuals and families (Australia Families, 2006; Cummins, Eckersley, Pallant, Vugt, & Roseanne, 2003; Krys et al., 2019; Michalos et al., 2011; Milligan, Fabian, Coope, & Errington, 2006; Thiyagarajan et al., 2019; Voukelatou et al., 2020; Wollny, Apps, & Henricson, 2010; Zubrick, Williams, Silburn, & Vimpani, 2000). According to Diener and Ryan (2015), high level of well-being and life satisfaction can significantly improve four different aspects of life, which are health and

longevity, work and income, social relation and societal benefit. Burton (2011) found that money and time are two important resources that are required for increasing the level of well-being among the members of the families. Income is used to provide the family needs that will certainly increase the level of family well-being, but on the other hand, less quality time is given by the bread winner to the family due to allocation of more time for income earnings, which will contribute to a lower status of family well-being. According to a study in Malaysia by Ramli, Masud, Haron, Othman, and Awang (2014), monthly income was identified as an important variable for measuring the financial well-being of an individual, and hence the well-being of the families. While Hassan, Yusoof, and Alavi (2012) found in their study that healthy families have a higher level of family well-being as compared to unhealthy families.

In addition, Zubrick et al. (2000) and Noor et al. (2012) suggest that the accessibility of the housing amenities, quality schools, job availability and safety are the factors which determine the status of well-being among individuals and families. Only after these factors have been measured, the subjective factors of family well-being such as family resilience, family functioning and family satisfaction can be considered. Rahim, Ishak, Shafie, and Shafiai (2013), for example, have shown that parental involvement, family functioning, family resilience and time with family had a significant influence on determining family life satisfaction by using the Structural Equation Modeling (SEM). Tony, Patricia, and Ela (2012) reported that parents with a good relationship contributing to a stable family and high level of child well-being. Meanwhile, Wu, Chou, Chen, and Tu (2016) have adopted a hierarchical regression analysis to demonstrate that there is a high correlation between family support and love attitude among junior high school students. Therefore, the use of subjective factors is widely reported in the literature, complementing the objective factors in describing the family well-being.

Research work on family well-being among Malaysians is introduced by Noor et al. (2012), using a national data survey conducted by National Population and Family Development Board of Malaysia (NPFDB) in the year 2011. The purpose of the study is to determine the domains and indicators that can be used to evaluate the well-being of Malaysian families and to produce a composite Index of Family Well-Being. By using The Confirmatory Factor Analysis (CFA) they were able to identify the significant domains that significantly contributed to the family well-being, namely, the family relationship, economic situation, health and safety, spirituality, or religion, housing and environment, and community relationship. This work has motivated other local researchers to study important of factors that

are related to Malaysian family well-being using other method such as tree based clarification technique (Sapri, Ibrahim, Bakar, & Ariff, 2021).

Some studies have demonstrated that regression methods can be used to analyse the relationships between several independent variables and response variable, particularly with an ordered categorical scale. Noor et al. (2012), for example, used the linear regression analysis by assuming the Likert scale of the response variable to be continuous in order to determine the significant factors that contributed to the family well-being. Economic situation and family relationship have been identified being the two most significant factors in predicting the overall satisfaction on family well-being. Lall (2004) and Lall, Campbell, Walters, and Morgan (2002) applied three types of an ordinal regression model, namely proportional odds model, partial proportional odds model and stereotype model to analyse the quality of life assessment. Hajdu and Hadju (2014) considered an ordered ordinal model under the probit link function to model the association between subjective well-being and income.

It is now well established from a variety of studies that the ordinal regression model is the most common model for ordinal outcomes (Agresti, 2007, 2010; Grilli & Rampichini, 2014; Soukiazis & Ramos, 2016). However, the models considered may differ depending on which and how the response levels are compared (Hosmer, Lemeshow, & Sturdivant, 2013). The relationships in ordinal regression modelling are usually formulated by linear regression equations embedded with certain link function, e.g., logit, probit and clog-log. The advantages of ordinal regression as compared to those frequently applied statistical methods are the ability to identify the significant explanatory variables that affect the ordinal response variable and describe the direction of the relationship. Even though various methods for modelling the ordinal response variable have been proposed and discussed in the literature, the utilisation of the ordinal regression modelling in the family well-being literature has been quite limited, particularly in modelling the family well-being among Malaysians. Accordingly, our primary purpose is to develop an ordinal regression model which describes the demographic, economic and social factors that are significant for explaining the level of family well-being among Malaysians based on the data from a nationwide survey.

This paper is divided into four sections. Section 2 explains the methodology and application of the ordinal regression model on data of family well-being and provides a review of related work (Agresti, 2007, 2011; Liu & Agresti, 2005). Next, Section 3 presents the results and discussion of the analysis. Finally, the conclusion is given in Section 4.

## **2.0 METHODOLOGY**

### **2.1 Data Description**

The data set used in this study was gathered from the Family Well-Being Index survey (FWIS) conducted by the National Population and Family Development Board of Malaysia (NPFDB) in the year 2011 (LPPKN, 2011). The main purpose of the survey is identifying a set of indicators for measuring family well-being in Malaysia and to determine an index of the family well-being based on those indicators. Based on information obtained from the FWIS (LPPKN, 2011), the index score found for family well-being is 7.55, where the maximum score is 10.00. From seven domains identified, religion and spiritual practices show the highest score, which is 8.25. This is followed by community relationship (7.38), family relationship (7.39), safety (7.39), health (7.38), housing and environment (7.28) and economic situation (6.90). It was shown that the overall level of family well-being among Malaysians is moderate. NPFDB, as the centre of excellence on family and demography, continuously monitors the status of family well-being in Malaysia.

A total of 2,808 respondents from the selected households were involved in this survey. The selection of households for this survey was based on parents with children, aged 13 years old and younger using the stratified random sampling method, proportionate to the size of three main ethnic groups (Malay and Bumiputra, Chinese and Indian). The face-to-face interviews were conducted to obtain information on family well-being from the respondents. The questionnaire consists of two main sections, both of which involved measuring family well-being. Section A of the questionnaire is on demographic and socio-economic backgrounds, such as the locality, ethnicity, household type, education level and household income. Section B consists of information on a family condition which is based on social characteristics of each household, which the variable involved are the family relationship, economic situation, health, safety, community relationship, religious practice and housing and environment. The data were classified into two, which are profile of respondents and perception of social characteristics. The dataset on the profile of respondents was analysed in order to study the demographic characteristics of the respondents. The dataset on social characteristics provides the information on the level of perception of each respondent. Respondents were also asked to rate their perception on the level of well-being of their family at the time of the interview and for the next five years later, when the next interview is carried out. Complete information pertaining to the data can be drawn from the FWIS 2011 report (LPPKN, 2011).

## **2.2 Measures**

The ordered response variable ( $Y$ ) is expressed as a level of family well-being (FW) for the ordinal regression model. In this nationwide survey, the respondents were asked to rate their expectations regarding the family well-being of their family using a three-point ordered scale (1=low, 2=moderate, and 3=high). The independent variables considered in this study are demographic and socio-economic background, and social characteristics. The demographic and socio-economic background consist of locality (urban/rural), ethnic group (Bumiputra, Chinese and Indian), type of family (nuclear, blended, single, and extended), level of education (primary, secondary, tertiary, and no formal education) and household income group (<RM2,000, RM2,000-RM4,000, RM4,001-RM7,000, RM7,001-RM10,000, >RM10,000). Moreover, the social characteristics include the overall level of satisfaction on family relationship, economic situation, health, safety, community relationship, religious practice, housing and environment. All explanatory variables for a social characteristic are measured using a three-point scale (1=low, 2=moderate, and 3=high). Based on the questions, the list of variables and the respective measurement are as shown in Table 1.

Table 1: List of response and independent variables for the study

| Variable                           | Measurement  | Scale   |
|------------------------------------|--|---------|
| Level of Family Well-Being ( $Y$ ) | Low  | Ordinal |
|                                    | Moderate   |         |
|                                    | High   |         |
| Type of Locality ( $x_1$ )         | Urban  | Nominal |
|                                    | Rural  |         |
| Ethnic ( $x_2$ )                   | Bumiputra  | Nominal |
|                                    | Chinese  |         |
|                                    | Indian   |         |
| Household Type ( $x_3$ )           | Nuclear  | Nominal |
|                                    | Extended   |         |
|                                    | Single   |         |
|                                    | Blended  |         |
| Educational Level ( $x_4$ )        | Tertiary   | Nominal |
|                                    | Secondary  |         |
|                                    | Primary  |         |
|                                    | Other (No formal education, religious education, not finishing school) |         |
| Household Income ( $x_5$ )         | <RM2000  | Ordinal |
|                                    | RM2001-RM4000  |         |
|                                    | RM4001-RM7000  |         |
|                                    | > RM7000   |         |
| Family Relationship ( $x_6$ )      | Low  | Ordinal |
|                                    | Moderate   |         |
|                                    | High   |         |
| Economic situation ( $x_7$ )       | Low  | Ordinal |
|                                    | Moderate   |         |
|                                    | High   |         |
| Health ( $x_8$ )                   | Low  | Ordinal |
|                                    | Moderate   |         |
|                                    | High   |         |

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|                                      |          |         |
|--------------------------------------|----------|---------|
| Safety ( $x_9$ )                     | Low      | Ordinal |
|                                      | Moderate |         |
|                                      | High     |         |
| Community Relationship ( $x_{10}$ )  | Low      | Ordinal |
|                                      | Moderate |         |
|                                      | High     |         |
| Religious Practice ( $x_{11}$ )      | Low      | Ordinal |
|                                      | Moderate |         |
|                                      | High     |         |
| Housing and Environment ( $x_{12}$ ) | Low      | Ordinal |
|                                      | Moderate |         |
|                                      | High     |         |

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### 2.3 Data Analysis

In this study, information obtained from a total of 2,808 respondents was used in the analysis. Descriptive analysis and an ordinal regression model were used to identify the demographic, economic and social factors that are significant for explaining the level of family well-being in Malaysia. The model is based on the cumulative probabilities of the response variable. Here we consider the perceived level of family well-being as the response variable, which is given the ordered categories, with higher values indicating a higher level of family well-being, as given below:

$$(\text{level of family well - being}) = \left. \begin{array}{l} 1, \text{ if low level of family well - being} \\ 2, \text{ if moderate level of family well - being} \\ 3, \text{ if high level of family well - being} \end{array} \right\}$$

Generally, the ordinal regression model is also known as the proportional odds model. This model is considered suitable for describing the family well-being dataset since the response is given in the ordered categories. In this study, the cumulative logit models with proportional odds property were applied, where the logit of cumulative probabilities is assumed to be linearly related to the  $x$  variables. Let  $Y$  represents an ordinal response variable with  $J-1$  ordered categories. Hence, the ordinal regression model considered is given by



$$\text{logit}[\Pr(Y \leq j | x)] = \alpha_j + \beta_1 x_{i_1} + \beta_2 x_{i_2} + \dots + \beta_p x_{i_p} \quad [1]$$

where  $x_{i_1}, \dots, x_{i_p}$  are the explanatory variables,  $\alpha_j$  is the  $j^{\text{th}}$  intercept that represents the threshold or cut point for each split to the data and  $\beta_1, \beta_2, \dots, \beta_p$  are the regression coefficients for  $i = 1, 2, \dots, n$  and  $j = 1, 2, \dots, J - 1$ .

### **3.0 RESULT AND DISCUSSION**

#### **3.1 Descriptive Analysis**

In this section, the results of the descriptive analysis and ordinal regression modelling are presented. Table 2 presents the summary statistics for describing the characteristics of the respondents. About 62.0 per cent of the respondents are from urban areas, while 38.0 per cent are from rural areas. More than two-thirds of the respondents are Bumiputras (62.0 per cent), followed by 28.3 per cent Chinese, and 9.8 per cent Indians. The distribution of the ethnics group in the survey data closely follows the composition of three main ethnics in Malaysia.

Table 2: Summary statistics for the data from FWIS

| Variables           |  | No. of Respondents (%) |
|---------------------|--|------------------------|
| Total               |  | 100.0                  |
| Strata              | Urban  | 62.0                   |
|                     | Rural  | 38.0                   |
| Ethnic              | Bumiputra  | 62.0                   |
|                     | Chinese  | 28.3                   |
|                     | Indian   | 9.8                    |
| Educational Level   | Tertiary   | 32.7                   |
|                     | Secondary  | 43.9                   |
|                     | Primary  | 17.3                   |
|                     | Others (not attending formal education, religious education, not finishing school) | 6.1                    |
| Family Type         | Nuclear  | 81.2                   |
|                     | Extended   | 14.8                   |
|                     | Single-Parent  | 3.3                    |
|                     | Blended  | 0.7                    |
| Household Income    | ≤RM2000  | 47.7                   |
|                     | RM2001-RM4000  | 30.5                   |
|                     | RM4001-RM7000  | 14.8                   |
|                     | >RM7000  | 11.3                   |
| Family Relationship | Low  | 5.3                    |
|                     | Moderate   | 18.4                   |
|                     | High   | 76.3                   |
| Economic Situation  | Low  | 15.6                   |
|                     | Moderate   | 27.5                   |
|                     | High   | 56.8                   |
| Health              | Low  | 9.3                    |
|                     | Moderate   | 25.4                   |
|                     | High   | 65.4                   |
| Safety              | Low  | 7.8                    |
|                     | Moderate   | 23.7                   |

|                        |          |      |
|------------------------|----------|------|
|                        | High     | 68.5 |
| Community Relationship | Low      | 9.4  |
|                        | Moderate | 25.2 |
|                        | High     | 65.4 |
| Religious Practice     | Low      | 9.5  |
|                        | Moderate | 24.4 |
|                        | High     | 66.1 |
| Housing & Environment  | Low      | 15.3 |
|                        | Moderate | 26.5 |
|                        | High     | 58.2 |

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Furthermore, regarding the level of education attained, almost half of the respondents completed secondary school, while one-third obtained tertiary level and the remaining obtained primary school education (17.3 per cent). Respondents who came from a nuclear family made up the highest percentage, at 81.2 per cent. This is followed by respondents from extended family at 14.8 per cent, single parents at 3.3 per cent, and from blended families at 0.7 per cent. Majority of them earned less than RM 4,000 a month, while 11.3 per cent earned an income of higher than RM 7,000 a month. In terms of family relationship, the majority of the respondents (76.3%) replied having high level of family relationship, followed by moderate (18.4%) and low (5.3%). It can also be seen that perception on the other factors such as health, safety, community relationship and religious practice follows the same pattern. The results of the perception on economic situation, housing and environment are slightly different, where less than 60% of the respondents perceived highly on those factors.

Table 3: Cross Classification of the level of family well-being by demographic factors

| Demographic Factors   |                     | Level of Family Well-being |             |              |
|-----------------------|---------------------|----------------------------|-------------|--------------|
|                       |                     | Low                        | Moderate    | High         |
| Locality              | Urban               | 101 (5.8%)                 | 394 (22.6%) | 1247 (71.6%) |
|                       | Rural               | 55 (5.2%)                  | 268 (25.1%) | 743 (69.7%)  |
| Ethnic group          | Bumiputra           | 87 (5.0%)                  | 383 (22.0%) | 1271 (73.0%) |
|                       | Chinese             | 53 (6.7%)                  | 197 (24.8%) | 544 (68.5%)  |
|                       | Indian              | 16 (5.8%)                  | 83 (30.3%)  | 175 (63.9%)  |
| Family type           | Nuclear             | 119 (5.2%)                 | 540 (23.7%) | 1622 (71.1%) |
|                       | Extended            | 2 (10.5%)                  | 9 (47.4%)   | 8 (42.1%)    |
|                       | Single              | 12 (12.9%)                 | 28 (30.1%)  | 53 (57.0%)   |
|                       | Blended             | 23 (5.5%)                  | 85 (20.5%)  | 307 (74.0%)  |
| Educational Level     | No formal education | 14 (8.1%)                  | 29 (16.9%)  | 129 (75.0%)  |
|                       | Primary             | 28 (5.8%)                  | 115 (23.7%) | 342 (70.5%)  |
|                       | Secondary           | 75 (6.1%)                  | 274 (22.2%) | 884 (71.7%)  |
|                       | Tertiary            | 39 (4.2%)                  | 244 (26.6%) | 635 (69.2%)  |
| Household Income (RM) | ≤ 2,000             | 89 (6.6%)                  | 275 (20.5%) | 976 (72.8%)  |
|                       | 2001-4000           | 46 (5.4%)                  | 237 (27.7%) | 574 (67.0%)  |
|                       | 4001-7000           | 16 (3.9%)                  | 112 (27.0%) | 287 (69.2%)  |
|                       | >7000               | 5 (2.6%)                   | 38 (19.4%)  | 153 (78.1%)  |

Tables 3 and Table 4 provide the contingency tables for mapping the correlation between the levels of family well-being and demographic factors, and between the level of family well-being with social factors, respectively. As shown in Table 3, most respondents, either living in urban or rural areas, rate their level of family well-being as high. This finding indicates that people tend to have a higher perception of their level of family well-being regardless of their locality. Meanwhile, we can observe similar patterns as well in all demographic factors except for family type. More than two-thirds of the respondents who live with nuclear and blended families perceived a high level of family well-being and about 20% and 5% of them indicate a moderate and low level of family well-being, respectively. However, almost half of the respondents who live in the extended family reported that their level of family well-being is

moderate, and a slightly lower percentage of respondents perceived it as high. Around 13.0% of the respondents admitted that their family well-being is low for the single-family group, while 57.0% indicated a high level. This finding indicates that those living with single-family tend to have a slightly lower level of family well-being. For the demographic factor of locality, comprising rural and urban areas, the percentages of respondents perceiving low, moderate, and high level of family well-being is relatively close for respondents from these two types of localities.

From Table 4, for the social factor of the family relationship of low, moderate, and high levels, it is clear that high proportions of respondents indicate low, moderate and high levels of family well-being respectively. This suggests a positive correlation between these two variables. This pattern of associations also applies between family well-being and other social factors, but with a lesser proportion of respondents in the (low, low) cell categories, as shown in Table 4.

Table 4: Cross Classification of the level of family well-being by social factors

| Social Factors |          | Level of Family Well-Being |             |              |
|----------------|----------|----------------------------|-------------|--------------|
|                |          | Low                        | Moderate    | High         |
| Family         | Low      | 81 (54.0%)                 | 46 (30.7%)  | 23 (15.3%)   |
| Relationship   | Moderate | 41 (7.9%)                  | 352 (68.2%) | 123 (23.8%)  |
|                | High     | 34 (1.6%)                  | 264 (12.3%) | 1844 (86.1%) |
| Economic       | Low      | 114 (26.0%)                | 156 (35.5%) | 169 (38.5%)  |
| Situation      | Moderate | 24 (3.1%)                  | 366 (47.3%) | 383 (49.5%)  |
|                | High     | 18 (1.1%)                  | 140 (8.8%)  | 1438 (90.1%) |
| Health         | Low      | 94 (36.2%)                 | 101 (38.8%) | 65 (25.0%)   |
|                | Moderate | 33 (4.6%)                  | 383 (53.8%) | 296 (41.6%)  |
|                | High     | 29 (1.6%)                  | 178 (9.7%)  | 1629 (88.7%) |
| Safety         | Low      | 96 (43.6%)                 | 74 (33.6%)  | 50 (22.7%)   |
|                | Moderate | 25 (3.8%)                  | 388 (58.3%) | 252 (37.9%)  |
|                | High     | 35 (1.8%)                  | 200 (10.4%) | 1688 (87.8%) |
| Community      | Low      | 100 (37.6%)                | 95 (36.0%)  | 69 (26.1%)   |
| Relation       | Moderate | 31 (4.4%)                  | 374 (52.9%) | 302 (42.7%)  |
|                | High     | 25 (1.4%)                  | 193 (10.5%) | 1619 (88.1%) |
| Religious      | Low      | 104 (38.8%)                | 102 (38.1%) | 62 (23.1%)   |
| Practice       | Moderate | 26 (3.8%)                  | 387 (56.5%) | 272 (39.7%)  |
|                | High     | 26 (1.4%)                  | 173 (9.3%)  | 1656 (89.3%) |
| Housing and    | Low      | 116 (26.9%)                | 139 (32.3%) | 176 (40.8%)  |
| Environment    | Moderate | 19 (2.6%)                  | 379 (50.9%) | 346 (46.5%)  |
|                | High     | 21 (1.3%)                  | 144 (8.8%)  | 1468 (89.9%) |

### 3.2 Ordinal Regression Analysis

The data gathered from the survey is fitted using R statistical packages to various different models of the form as given in equation (1), with different subsets of potential  $x$  variables in the model. The findings obtained indicated that socio-economic and demographic factors such as locality, family type, educational level and household income are not statistically significant and should be dropped from the full model. Thus, results on the best fitted model, we called here as the final model, involving the important variables are summarised in Table 5 and Table 6.

Table 5: Results on model fitting and goodness of fit test

| Ordinal Regression Model Fitting with Logit Link Function |          |              |      |                       | Goodness of Fit |          |                   |
|---|----------|--------------|------|-----------------------|-----------------|----------|-------------------|
| -2Log Likelihood  |          | Omnibus Test |      | Pseudo R <sup>2</sup> |                 |          |                   |
| Intercept   | Final    | Chi-square   | d.f. | <i>p-value</i>        | McFadden        | AIC      | Residual Deviance |
| 3206.368  | 1564.566 | 1641.802     | 16   | <0.000                | 0.392           | 2579.590 | 2543.588          |

Table 5 presents the assessment of model fitting and goodness-of-fit test for the data. The findings show that the final model fitted reasonably well to the data since there is a large reduction in deviance from the intercept only model to the final model. This is further supported by the computed chi-square value with *p*-values < 0.0001, which is highly significant. Also, the value of McFadden Pseudo R<sup>2</sup> of 0.392 shows that the model fitted excellently to the data. According to McFadden, Tye, and Train (1977), pseudo R<sup>2</sup> values of 0.2 to 0.4 indicate excellent model fitting of the data.

Table 6: Coefficients and standard errors of the Ordinal Regression Model

| Variables              | Ordinal Regression Model |                |            |                        |       |               |
|------------------------|--------------------------|----------------|------------|------------------------|-------|---------------|
|                        | Coefficient              | Standard Error | Odds Ratio | 95% Confident Interval |       | P-Value (Sig) |
|                        |                          |                |            | Lower                  | Upper |               |
| Threshold 1            |                          |                |            |                        |       |               |
| (Low   Moderate, High) | 1.212                    | 0.249          | 3.359      | 2.1                    | 5.5   | -             |
| Threshold 2            |                          |                |            |                        |       |               |
| (Low, Moderate   High) | 4.661                    | 0.286          | 105.784    | 60.4                   | 185.1 | -             |
| Ethnic                 |                          |                |            |                        |       |               |
| Indian (Ref)           |                          |                |            |                        |       |               |
| Chinese                | 0.307                    | 0.185          | 1.359      | 0.9                    | 2.0   | 0.097         |
| Bumiputras             | 0.365                    | 0.171          | 1.440      | 1.0                    | 2.0   | 0.033*        |
| Family Relationship    |                          |                |            |                        |       |               |
| Low (Ref)              |                          |                |            |                        |       |               |
| Moderate               | 1.090                    | 0.235          | 2.975      | 1.9                    | 4.7   | 0.033*        |
| High                   | 2.454                    | 0.241          | 11.637     | 7.3                    | 18.7  | 0.000***      |
| Economic Situation     |                          |                |            |                        |       |               |
| Low (Ref)              |                          |                |            |                        |       |               |
| Moderate               | 0.483                    | 0.157          | 1.621      | 1.2                    | 2.2   | 0.002**       |
| High                   | 1.151                    | 0.170          | 3.160      | 2.3                    | 4.4   | 0.000***      |
| Health                 |                          |                |            |                        |       |               |
| Low (Ref)              |                          |                |            |                        |       |               |
| Moderate               | 0.433                    | 0.200          | 1.541      | 1.0                    | 2.3   | 0.030*        |
| High                   | 0.933                    | 0.214          | 2.543      | 1.7                    | 3.9   | 0.000***      |
| Safety                 |                          |                |            |                        |       |               |
| Low (Ref)              |                          |                |            |                        |       |               |
| Moderate               | 0.010                    | 0.234          | 1.010      | 0.6                    | 1.6   | 0.966         |
| High                   | 0.530                    | 0.247          | 1.699      | 1.0                    | 2.8   | 0.032*        |



|  |        |       |       |     |     |          |
|--|--------|-------|-------|-----|-----|----------|
| Community Relationship                       |        |       |       |     |     |          |
| Low (Ref)                                    |        |       |       |     |     |          |
| Moderate                                     | 0.405  | 0.209 | 1.500 | 1.0 | 2.3 | 0.052    |
| High   | 0.637  | 0.228 | 1.891 | 1.2 | 3.0 | 0.005**  |
| Religion Practice                            |        |       |       |     |     |          |
| Low (Ref)                                    |        |       |       |     |     |          |
| Moderate                                     | 0.481  | 0.201 | 1.617 | 1.1 | 2.4 | 0.017*   |
| High   | 1.116  | 0.216 | 3.051 | 2.0 | 4.7 | 0.000*** |
| Housing and Environment                      |        |       |       |     |     |          |
| Low (Ref)                                    |        |       |       |     |     |          |
| Moderate                                     | -0.062 | 0.167 | 0.940 | 0.7 | 1.3 | 0.710    |
| High   | 0.629  | 0.184 | 1.876 | 1.3 | 2.7 | 0.000*** |
| *p<0.05, **p<0.01, ***p<0.000                |        |       |       |     |     |          |
| Akaike Information Criteria (AIC) = 2579.590 |        |       |       |     |     |          |
| Deviance Residual = 2543.588                 |        |       |       |     |     |          |

Table 6 provides the estimated coefficients and standard errors of the ordinal regression model. The sign for each particular coefficient indicates the magnitude of the effect of the respective predictor on the response variable given that the other variables remain unchanged. A positive sign of the coefficient indicates a positive relationship between the predictor and outcome, while the negative sign is the converse.

Based on the observed significance level associated with the predictors, we found two significant factors, which are the demography and social factors. Among the demographic variables, only ethnicity is significant; however, all the social factors are significant. Therefore, the estimated cumulative logit model can be given by

$$\begin{aligned}
 \text{Logit}(P(Y \leq j)) = & a_j + 0.307\text{Chinese} + 0.365\text{Bumiputras} + 1.090\text{Family(Moderate)} \\
 & + 2.454\text{Family(High)} + 0.483\text{Economy(Moderate)} + 1.151\text{Economy(High)} \\
 & + 0.433\text{Health(Moderate)} + 0.933 + \text{Health(High)} + 0.010\text{Safety(Moderate)} \\
 & + 0.530\text{Safety(High)} + 0.637\text{Community(High)} + 0.481\text{Religion(Moderate)} \\
 & + 1.116\text{Religion(High)} - 0.062\text{Housing(Moderate)} + 0.629\text{Housing(High)}
 \end{aligned}
 \tag{2}$$

From this ordinal regression model, it is clear that the level of family well-being is related to all the variables given in equation (2). The coefficients for the independent variables in this fitted model can be interpreted based on the odds ratio. With respect to the ethnic group of Bumiputras, it is found that Bumiputras are 1.44 times more likely than Indians to have a higher level of family well-being. However, the Chinese are also more likely to have a higher level of family well-being than the Indians, estimated to be about 1.36 times, but not statistically significant.

A closer inspection of Table 6 shows that the social factor of family relationship stands out more than other social factors in terms of the estimated value of the odds ratio. The odds ratio of family well-being for the respondents who have a moderate level of family relationship is 2.98, indicating that they are three times more likely to have a higher level of family well-being as compared to respondents who have a low level of family relationship. Moreover, the odds of respondents who have a high level of a family relationship on perceiving higher level of family well-being is more than 10 times than those respondents with a low level of family relationship. This finding is supported by some previous works, such as the studies by Desa, Yusoo, Ahmad, Kadir, and Sani (2015), Thomas, Liu, and Umberson (2017) and Tony et al. (2012). Evidence in those studies revealed that a good family relationship, which includes social support, can influence the well-being in many ways, such as psychosocial, behavioural, and physiological pathways.

From the analysis, it is possible to deduce that economic situation and health status of the respondents are both positively related, at about the same extent, to the level of family well-being. The odds ratio for moderate and high levels of both economic situation and health are about 2.0 and 4.0 respectively, indicating that respondents who observed these particular levels of social factors are two and four times more likely to have a higher level of family well-being as compared to those in the reference group respectively. These results are supported by several studies which demonstrated that well-being is associated with economic and health condition. As for the economic situation, one of the indicators which is usually used to measure the economic situation of the family is financial well-being. Hence, the result found here is in line with the study by Ihuoma (2015) that the financial well-being of any family is a key factor by which members of the family are able to maintain themselves and also improve their lives. The study by Ramli et al. (2014) also revealed that the family with a higher level of financial well-being enjoy a higher level of family well-being. With respect to health, possibly, health and physical functioning are strongly correlated to well-being ( Armstrong, Birnie-lefcovitch,

Ungar, & van den Borne, 2005; Diener & Ryan, 2015; Hassan et al., 2012; Thomas et al., 2017).

In addition, respondents with a high level of perception on safety, community relationship, and housing and environment are found to have significant positive coefficient, with the odds ratios of about 1.7 to 1.9. Therefore, it can be inferred that safety, community relationship and housing and environment also have positive contributions to the level of family well-being, particularly when the level of perception on the social factors is high. With respect to religious practise, respondents who have a high level of religious practice are three times more likely to have a high level of family well-being as compared to respondents who have a low level of religious practice. This result is supportive of the idea of Yoon and Lee (2014) which states that there is a positive relationship between the level of religiosity and life satisfaction.

#### **4.0 CONCLUSION**

The main purpose of the present study is to apply an ordinal regression modelling technique in modelling the level of family well-being of Malaysian families. Ordinal regression modelling could describe a set of relationships between independent variables and response variables, where the response variable is in ordered rank (Agresti, 2010; Fullerton, 2009). This technique is the only analysis that could be used to do a complete analysis and consider the ordinal nature of response variables (Agresti, 2010). The analysis in the present study is implemented under R, a flexible statistical package which allows one to examine the relationship involving continuous, ordered categorical, and dichotomous variable (Christensen, 2019) .

In the area of well-being research, the demand for ordinal response data analysis is increasing tremendously (Arvidsson, 2019; Kryš et al., 2019; Schmidt, Clouth, Haggemüller, Naber, & Reitberger, 2006; Winkelmann, 2005), and therefore, it is crucial for researchers to understand the principle for analysing ordinal response variables. There are a limited number of studies on the application of ordinal regression for modelling the level of family well-being, particularly with covariates involving the demographic and social characteristics of the respondents (Arvidsson, 2019; Pratiwi & Kismiantini, 2019; Soukiazis & Ramos, 2016; Winkelmann, 2005). The demographic factors considered are ethnicity, locality, family type, education level and household income. In contrast, social factors are family relationship, economic situation, health, safety, community relationship, religious practice and housing and environment. All these social factors in the study are measured based on the perception of the

respondents which were given in three ordered Likert type scales, which are low, moderate, and high.

With respect to the aim of this study, the ordinal regression model provides several key findings. Firstly, the analysis shows that demographic factors, such as ethnicity, is significant in contributing to the level of family well-being. Surprisingly, Bumiputras regardless of whether they live in urban or rural, are more likely to have a significantly higher level of family well-being as compared to Indians, and when the Chinese are compared to the Indians, the odds ratios are slightly higher but not significant. The Bumiputras predominantly consist of the Malays who are Islamic in faith and do believe in the concept of grateful (Rachmadi, Safitri, & Aini, 2019). People who exhibit the characteristic of being grateful is believed to have a greater tendency of accepting that whatever they have is a blessing from God. Thus, they need to be thankful. This kind of attitude inspires positive thinking in a person whereby positive thinking, as explained by Khodayarifard et al. (2016), could lead to improving the quality of life, in which the family well-being is a part of.

Secondly, the results show that a high level of perception on family relationship, economic situation, health, safety, community relationship, religious practice and housing and environment has a greater value of odds ratio, from 1.5 up to 11.7, as compared to the reference category. Based on the findings, it can be seen that high level of perception on every social factor considered in this research significantly contribute to improving the status of family well-being.

Finally, it is anticipated that the ordinal regression model provides useful information for policymakers to enhance the status of family well-being in Malaysia via various policy initiatives. This model is particularly pertinent for this study since the family well-being was measured in ordinal scales. For instance, each respondent has to respond to a statement such as “Overall, to what extent are you satisfied with your family well-being?” using categories such as not satisfied at all, satisfied, moderately satisfied, satisfied, and satisfied at all. The response on level of well-being by a particular subgroup in the population can be easily compared to other subgroups under the ordinal regression model. Furthermore, the attainment of a high-ranking level of each particular social factor which is significant in the study, could lead to improvement of family well-being, and this is particularly clear when the family relationship is considered. Those who have a strong bond in family relationships are more likely to have a high level of family well-being. Other social factors such as health and safety are also important in relation to family well-being, however, to a lesser degree as compared to family relationship as rated by the respondents.

It is surprising to see that the level of income is not a significant variable for explaining the level of family well-being, different from those reported by many authors such as Hajdu and Hadju (2014), Clark, Frijters, and Shields (2006), and Comanor and Phillips (2002). However, the economic situation is significant in the fitted ordinal model, indicating that the contribution of income level on family well-being has been masked by the perception on the level of the economic situation. It remains to be investigated further as to why the level of economic situation is significant but not the level of income. Perhaps respondents were contented with what they have. Thus, they tend to have a positive impression on their economic situation. Or, on the other hand, other factors such as the size of family and the place of living are implicitly taken into consideration by the respondents in addition to their monthly earnings as they decide on their economic situation. This makes the economic situation as a fair reflection on the economic status of each particular respondent. Accordingly, these are still many unsolved issues regarding family well-being, particularly its measurement from various schools of thought, and of course, more efforts are required to investigate them.

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