Assignment 1

MULTIVARIATE STATISTICS

Team 6

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1. PCA & Biplot of Value Items:

1.1. Standardize the 10 items that measure values of the respondents (see Table 1) and compute a matrix of 34 countries x 10 items that includes in each cell the mean score of respondents in a country on a standardized item. Next apply principal components analysis to the data matrix and make a biplot. Discuss what you can conclude from the PCA and the biplot.

We have created a matrix of dimension 34*10 with the standardized mean score of the respondents in the country. In the correlation plot (Figure 1), we can clearly see a moderate to high correlation between the variables which is an issue of multicollinearity. Hence, conducting a Principal Component Analysis (PCA) on the data will be useful.

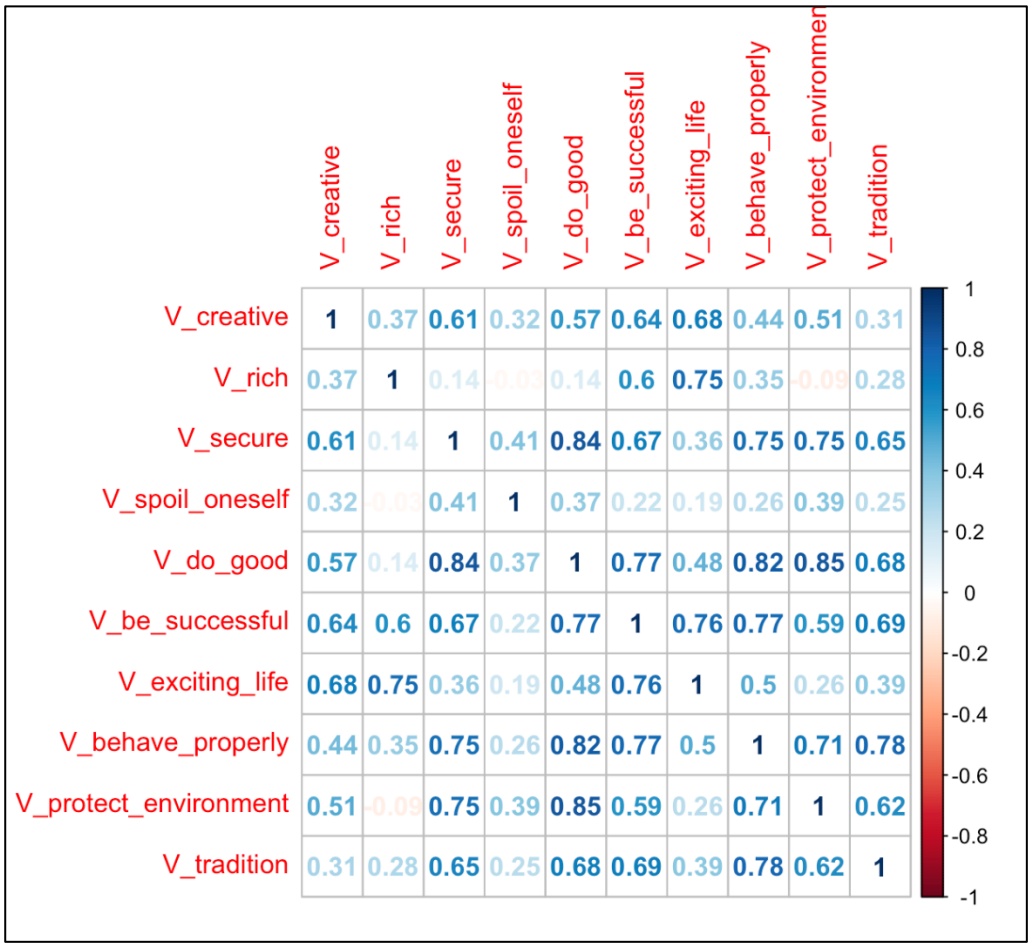


Figure 1: Correlation plot

PCA was conducted on the standardized matrix with 10 items using “prcomp” function of R. As a result, we obtain 10 principal components namely PC1 – PC10. Each component explains the percentage of the total variance in the data. PC1 explains 57% (approx.) of the total variance

whereas PC2 and PC3 explains only 17% and 9% of the variance respectively. A total of 84% of the variation is explained by all the 3 components.

In order to determine the retention of number of components, we have two methods – *Kaiser's Rule* and *Scree Plot*. Using Kaiser's Rule, we should retain only first 2 components as their respective eigenvalues: 5.73 and 1.74 are greater than 1. According to Scree plot *(Figure 2)*, we should retain first three components as there is a slight elbow before fourth component.

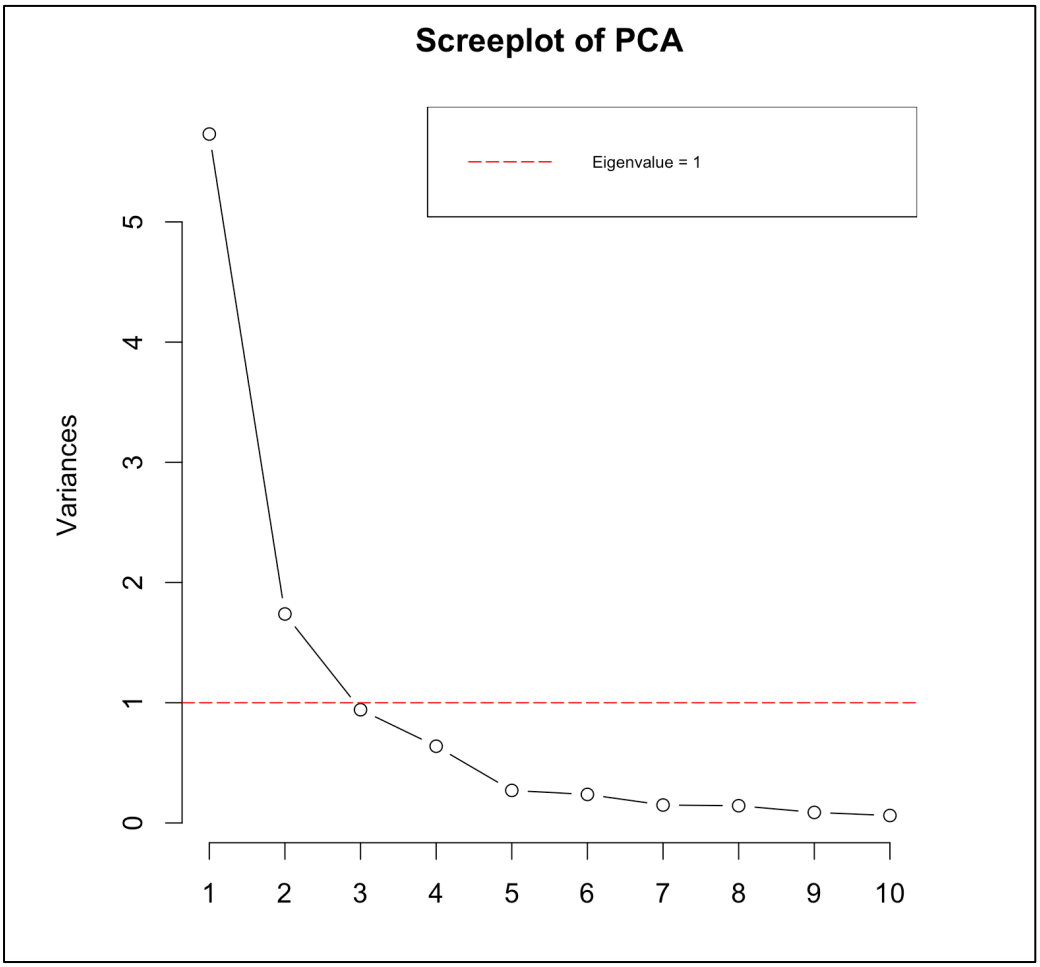


Figure 2: Scree plot of PCA

As we know that Kaiser's rule is criticized by Horn, therefore we have also used Horn's procedure that adjusts the cut-off for the retained components by taking into account the tendency of PCA to capitalize on sampling errors.

Horn's Procedure and its Result:

We have created a sample of bootstrapped data and conducted a Principal Component Analysis on it. By plotting the eigenvalues versus number of components of the real data and bootstrapped data *(Figure 3)*, we can clearly see that the first 2 component's eigenvalues of the real data are

greater than the bootstrapped data's eigenvalues. Hence, we **choose to retain the first two components** as eigenvalues of these components are larger than what can be expected from overfitting.

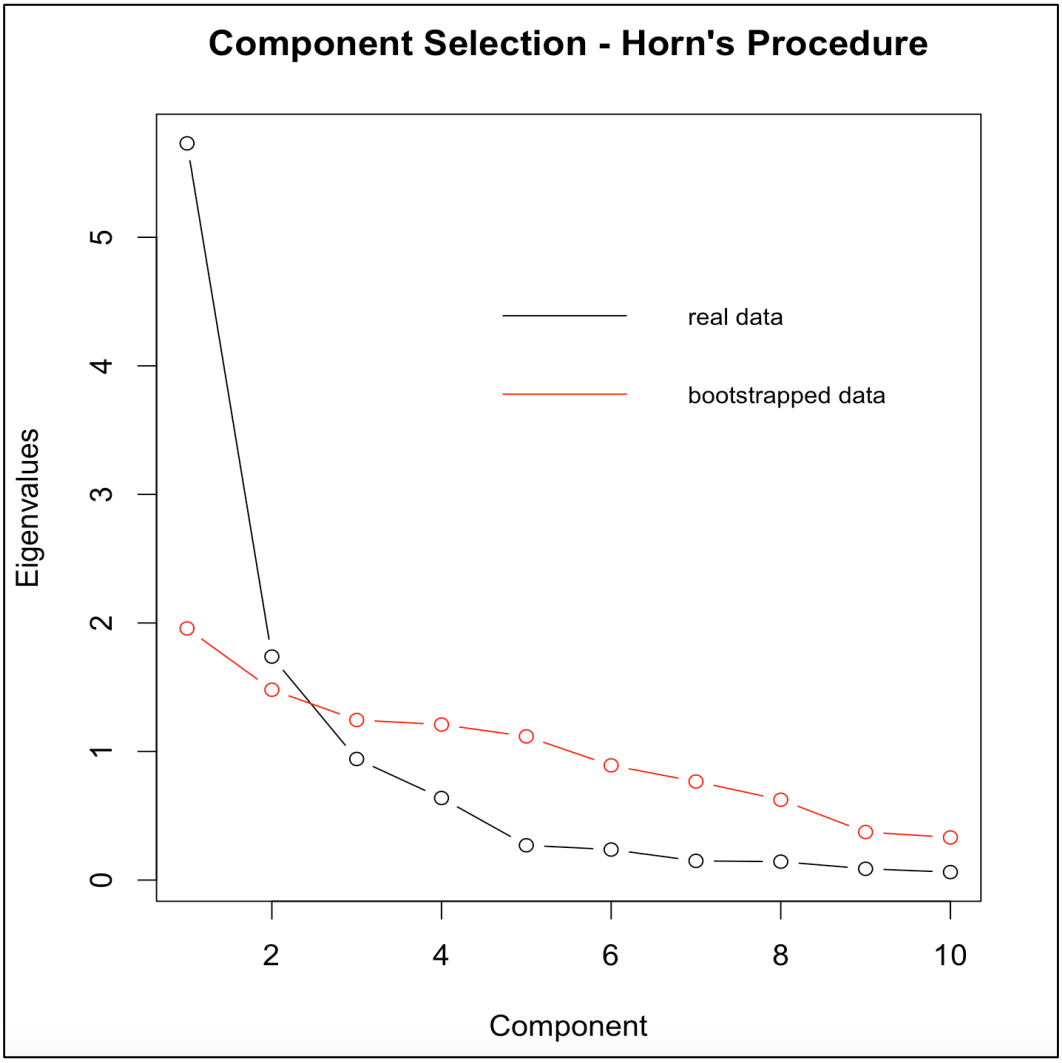


Figure 3: Component selection – Horn's procedure

1.2. Bi-Plot Interpretation:

Each variable in the plot is represented by a vector (here in red) with loadings as coordinates. Each vector has two components: angle between the vector and length of the vector.

The *angle between the vector* explains the predicted correlation between the variables. We know that correlation between "V_rich" and "V_environment" is -0.07 which can be clearly seen through the positions of their vectors. The vectors of "V_be_successful" and "V_creative" is almost coinciding indicating a strong positive relation between the two.(correlation is 0.71).

Moreover, the *length of the vector* indicates the amount of variance that is explained in the vector by two components. The variance explained by "V_spoil_oneself " is only 28% and hence, the length of its vector is shortest. "V_creative" and "V_tradition" explains almost 60% of the variance which can be clearly seen in the length of their vectors. With the remaining vectors 80% (approx..) of the variance is explained which can be seen in the bi-plot figure as well.

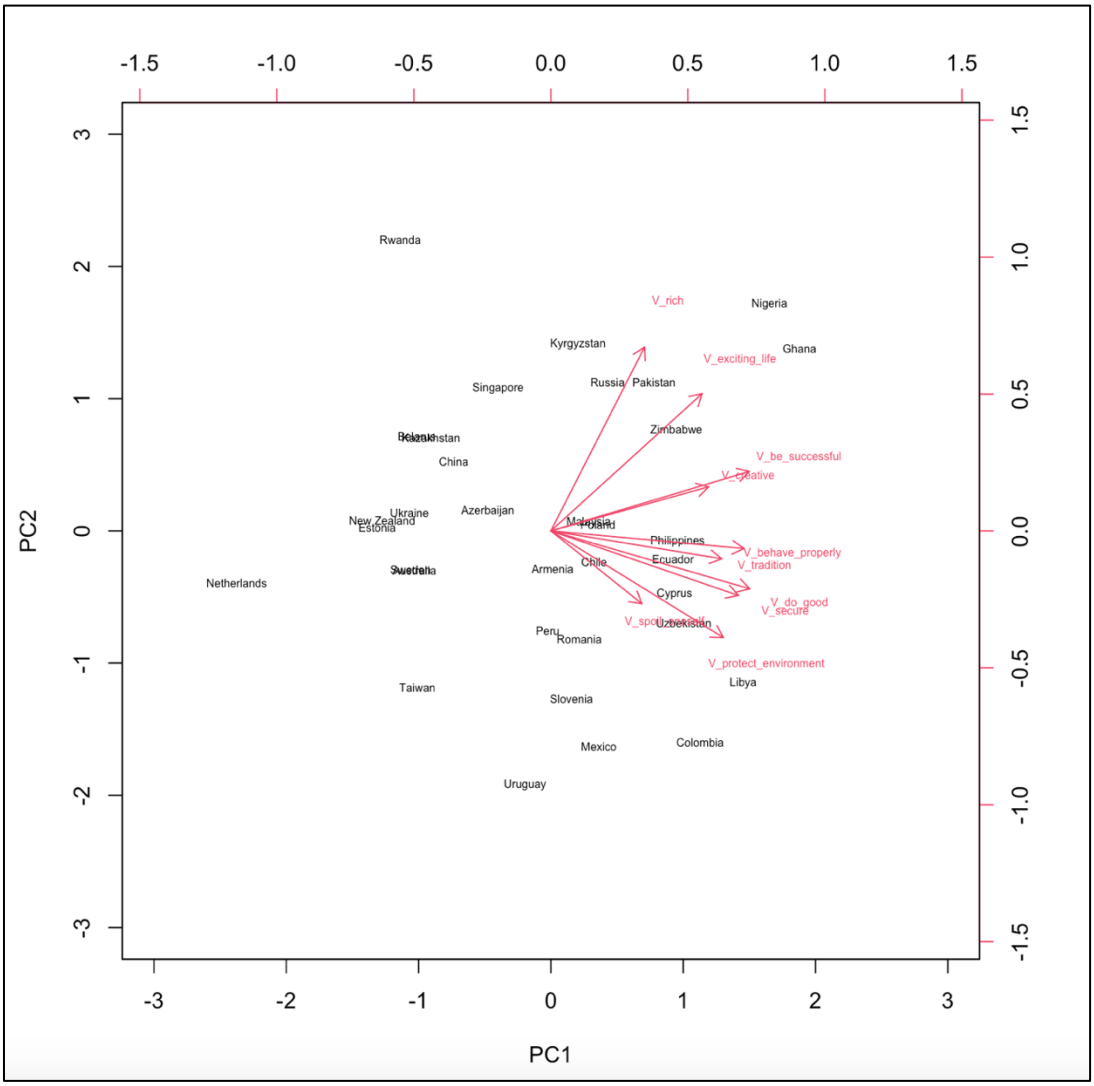


Figure 4: Bi-Plot

A component loading indicates how much each variable contributes to a particular component. All variables have moderate to high loadings on the first component indicating a strong correlation of these variables with the first component. Therefore, **first component** - PC1 is positively related to the measure value of the respondents.

Second component distinguishes between the performance of countries in certain criteria:

- A high Z2 score indicates good rating in "V_rich" criteria.

- A low Z2 score indicates good rating in “V_behave_properly”, “V_tradition” and “V_do_good”.

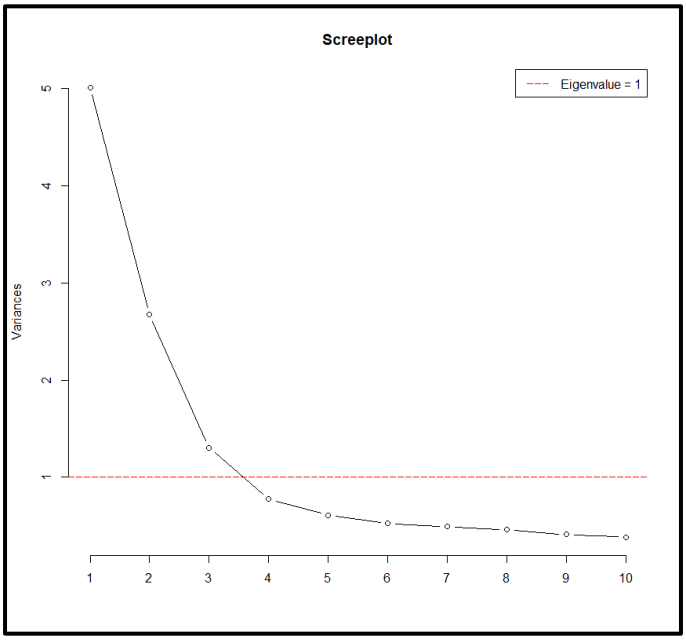
```
> round(cbind(z1 = score[c(1:10,20:25),1], z2 = score[c(1:10,20:25),2], wvs_matrix[c(1:10,20:25),]),2)
              z1    z2 V_creative V_rich V_secure V_spoil_oneself V_do_good V_be_successful V_exciting_life V_behave_properly V_protect_environment V_tradition
Armenia    -0.04 -0.12      -0.19  -0.28     0.20          -0.78      0.14           -0.04          -0.21             0.18                -0.20        0.29
Australia  -0.41 -0.17      -0.15  -0.53    -0.31          -0.41     -0.18           -0.47          -0.23            -0.25                -0.14       -0.66
Azerbaijan -0.19  0.05      -0.36   0.08    -0.28          -0.01     -0.40           -0.27          -0.19             0.03                -0.34        0.48
Belarus    -0.37  0.26      -0.37   0.14    -0.43          -0.30     -0.49           -0.27          -0.19            -0.28                -0.45       -0.04
Chile       0.07 -0.10       0.20  -0.03     0.28           0.55      0.16           -0.13           0.06            -0.14                -0.20        0.02
China      -0.28  0.23      -0.38   0.27    -0.24          -0.40     -0.14           -0.03          -0.25            -0.44                -0.20       -0.22
Colombia    0.34 -0.59       0.23  -0.39     0.42           0.40      0.46            0.25          -0.15             0.18                 0.57        0.36
Cyprus      0.27 -0.20       0.45  -0.36     0.32          -0.46      0.46            0.21           0.06             0.18                 0.22        0.36
Ecuador     0.27 -0.11       0.27  -0.15     0.19           0.53      0.17            0.29           0.32             0.15                 0.17        0.22
Estonia    -0.50 -0.04      -0.29  -0.30    -0.43          -0.23     -0.59           -0.66          -0.26            -0.25                -0.34       -0.33
Pakistan    0.25  0.43       0.27   0.53    -0.13           0.58      0.10            0.39           0.44             0.10                -0.16        0.19
Peru       -0.05 -0.31       0.07  -0.46    -0.01           0.03     -0.09           -0.04          -0.24            -0.01                 0.05        0.11
Philippines 0.28 -0.04       0.10  -0.05     0.28           0.07      0.23            0.20           0.39             0.33                 0.29        0.14
Poland      0.08  0.00       0.06  -0.11     0.03          -0.35      0.19            0.11           0.15            -0.13                 0.16        0.26
Romania     0.03 -0.30       0.07  -0.29     0.12          -0.28     -0.14            0.06          -0.35             0.19                 0.27        0.25
Russia      0.12  0.44       0.03   0.62    -0.03           0.28     -0.09            0.13           0.39             0.02                -0.08        0.08
```

The projection of the country on the vector of the criteria indicates the predicted performance of the country in that particular criteria. Also, the countries that are closer in the bi- plot will have similar performance on the criteria. For instance, Pakistan and Russia are closer in the bi- plot to “V_rich” vector and hence have similar performance in “V_rich” criteria.

2. Exploratory Factor Analysis:

2.1. Standardization and use exploratory factor analysis to summarize the scores on the 14 items using meaningful factors, discussing how well the selected factor model fits the data and interpreting the extracted factors.

The scores on the 14 justifiability items are standardized via a z-score. In order to determine the number of factors for the exploratory factor analysis two different procedures are used, namely the scree plot and the Kaiser's rule. On the basis of the scree plot we can decide to retain three factors because there is a slight elbow at four factors. By using the Kaiser's rule, we can retain three factors because they only have an eigenvalue larger than one. Both procedures suggest retaining three factors. The first factor explains 35.79% of the variance in the 14 items. The second factor explains 19.24% of the variance in the 14 items. The third factor explains 9.32% of the variance in the 14 items. The three factors combined explain in total 64.21% of the variance in the 14 items. The scree plot is shown below.




```
> #Kaiser's rule
> round(ztable3_pca$sdev^2,3)
 [1] 5.010 2.674 1.305 0.776 0.609 0.523 0.493 0.460 0.411 0.384 0.365 0.358 0.335 0.294
> |
```

Figure 1: Scree plot - Kaiser's rule

After determining the number of factors, a matrix of observed correlations is calculated. From this matrix we estimate the exploratory factor analysis with three factors without taking rotation into account. The first factor of this model explains 32.62% of the variance in the 14 variables. The second factor explains 16.10% of the variance in the 14 variables. The third factor explains 5.63% of the variance in the 14 variables. There are a lot of complex variables in this model

(variables that load on more than one factor). All variables have simultaneous a high loading on factor 1 and factor 2, some variables even load high on all three factors. The loading matrix does not have a simple structure therefore it is advised to rotate in order to obtain a loading matrix with a simpler structure.

```
Loadings:
                          Factor1 Factor2 Factor3
J_claiming_benefits         0.382   0.257   0.282
J_avoiding_fare             0.478   0.227   0.303
J_stealing_property         0.625   0.419   0.242
J_cheating_taxes            0.625   0.339   0.286
J_accept_bribe              0.632   0.403   0.211
J_homosexuality             0.572  -0.516   0.073
J_prostitution              0.664  -0.297   0.020
J_abortion                  0.630  -0.470  -0.052
J_divorce                   0.565  -0.559  -0.066
J_sex_before_marriage       0.543  -0.558  -0.031
J_suicide                   0.647  -0.135  -0.104
J_beat_wife                 0.556   0.457  -0.408
J_parents_beating_children  0.325   0.354  -0.425
J_violence                  0.634   0.363  -0.245

               Factor1 Factor2 Factor3
SS loadings      4.567   2.254   0.788
Proportion Var   0.326   0.161   0.056
Cumulative Var   0.326   0.487   0.543
```

Figure 2: EFA with 3 factors

In order to obtain a simple structure, an orthogonal rotation is applied via the Kaiser's varimax rotation The first factor of this model explains 23.36% of the variance in the 14 variables. The second factor explains 18.67% of the variance in the 14 variables. The third factor explains 12.31% of the variance in the 14 variables. Compared to the previous model without rotation taken into account, the explained variance is more equally distributed over the three factors in this model. There are still a lot of complex variables in this model. But if only loadings higher than 0.50 are taken into account, there are no variables that have a high loading on multiple factors and therefore a simple structure appears.

```
Loadings:
                           Factor1 Factor2 Factor3
J_claiming_benefits          0.052   0.533   0.067
J_avoiding_fare              0.138   0.589   0.078
J_stealing_property          0.101   0.733   0.278
J_cheating_taxes             0.157   0.721   0.206
J_accept_bribe               0.120   0.709   0.297
J_homosexuality              0.760   0.131  -0.053
J_prostitution               0.666   0.261   0.130
J_abortion                   0.775   0.110   0.090
J_divorce                    0.797   0.018   0.031
J_sex_before_marriage        0.779   0.027  -0.005
J_suicide                    0.545   0.252   0.294
J_beat_wife                  0.071   0.299   0.767
J_parents_beating_children  -0.009   0.100   0.634
J_violence                   0.182   0.402   0.631

                 Factor1 Factor2 Factor3
SS loadings        3.270   2.614   1.724
Proportion Var     0.234   0.187   0.123
Cumulative Var     0.234   0.420   0.543
```

Figure 3: EFA with 3 factors and orthogonal rotation

After inspection of the loadings the factors have the following interpretation:

- Factor 1 indicates how justifiable sinful behavior is (according to world religions).
- Factor 2 indicates how justifiable financial fraud is.
- Factor 3 indicates how justifiable violence is towards other individuals, including domestic violence.

A model with three factors is sufficient, because the general rule of thumb states that the number of items that load on a factor should be equal to at least the total of factors in the model. In the current model only three items load on factor three, this is just enough for the rule of thumb to be applicable. Therefore, we can conclude adding extra factors is not suitable. The loading matrix of this model has a simple structure if we only take loading into account with a loading higher than 0.50, therefore it is advised to use a model with oblique rotating in order to obtain a loading matrix with an even simpler structure. Another argument for conducting an oblique rotation is that it is more realistic, because the factors can correlate with each other in an oblique rotation.

Therefore, an oblique rotation is applied, and loadings are shown in the table above. The first factor of this model explains 23.21% of the variance in the 14 variables. The second factor explains 18.93% of the variance in the 14 variables. The third factor explains 12.21% of the variance in the 14 variables. Compared to the previous orthogonal rotated model, the explained variance is even more equally distributed over the three factors in this model with oblique rotation. There are only a few complex variables in this model. But if only loadings higher than 0.25 are taken into account, there are no variables that have a high loading on multiple factors and therefore a simple structure appears. The interpretation of the factors stays the same as in the model with an orthogonal rotation. In this model with oblique rotation the factors correlate with each other. Factor 1 and factor 2 have a moderate positive correlation (0.30). This indicates a

moderate positive correlation between justifiability of sinful behavior and justifiability of financial fraud. Factor 1 and factor 3 have a high positive correlation (0.56). This indicates a high positive correlation between justifiability of sinful behavior and justifiability of violence. Factor 2 and factor 3 have a low positive correlation (0.17).

	Factor1	Factor2	Factor3	h2	u2	com
J_claiming_benefits	-0.04	0.60	-0.09	0.29	0.71	1.1
J_avoiding_fare	0.04	0.65	-0.10	0.37	0.63	1.1
J_stealing_property	-0.03	0.75	0.08	0.62	0.38	1.0
J_cheating_taxes	0.03	0.75	0.00	0.59	0.41	1.0
J_accept_bribe	-0.01	0.71	0.11	0.61	0.39	1.1
J_homosexuality	0.77	0.07	-0.12	0.60	0.40	1.1
J_prostitution	0.64	0.17	0.05	0.53	0.47	1.2
J_abortion	0.78	-0.01	0.05	0.62	0.38	1.0
J_divorce	0.82	-0.10	0.01	0.64	0.36	1.0
J_sex_before_marriage	0.80	-0.07	-0.03	0.61	0.39	1.0
J_suicide	0.51	0.12	0.25	0.45	0.55	1.6
J_beat_wife	0.00	0.06	0.79	0.68	0.32	1.0
J_parents_beating_children	-0.05	-0.12	0.70	0.41	0.59	1.1
J_violence	0.10	0.22	0.60	0.59	0.41	1.3

	Factor1	Factor2	Factor3
SS loadings	3.25	2.65	1.71
Proportion Var	0.23	0.19	0.12
Cumulative Var	0.23	0.42	0.54
Proportion Explained	0.43	0.35	0.22
Cumulative Proportion	0.43	0.78	1.00

Figure 4: EFA with 3 factors and oblique rotation

2.2. Saving the factor scores for the selected model and visualizing (for each extracted factor) the distribution of the factor scores for the 34 countries. Discuss what you can conclude from these graphs.

For the factor scores of the oblique rotation model the distribution of every factor for the 34 countries is visualized and interpreted. For Factor 1 we find that the Philippines and Russia have a high average and a large variance on how justifiable they find sinful behavior (according to world religions). All other countries have an average factor score of between -1 and 0. Romania, Libya, Azerbaijan and Armenia have a very low average on this factor. All countries have positive factor score outliers and no negative factor score outliers. This means that all countries have correspondents with an extreme high score on how justifiable they find sinful behavior (according to world religions), but none have correspondents with an extreme low score on this factor.

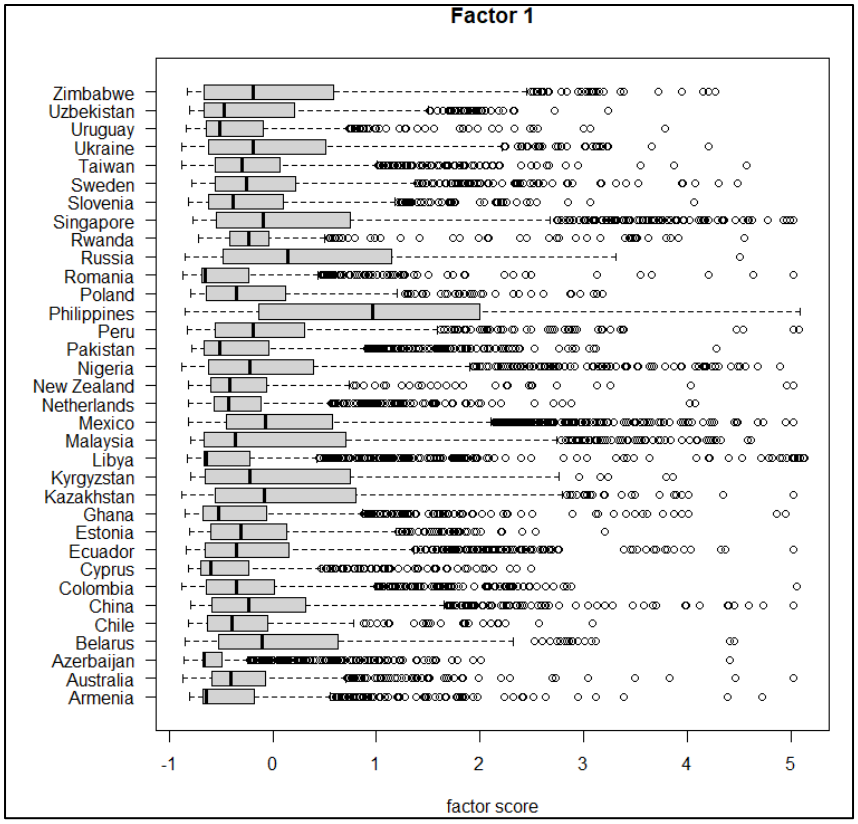


Figure 5: Distribution of Factor 1 for the 34 countries

For factor 2 we find that Uruguay, Sweden, Slovenia, New Zealand, The Netherlands and Australia have a high average on how justifiable they find financial fraud. Zimbabwe, Uzbekistan, Pakistan, Nigeria, Malaysia, Libya, Kyrgyzstan, Ghana, Azerbaijan and Armenia have a low score on this factor. There is a large variance in factor scores between countries. Only Sweden and The Netherlands have negative factor score outliers. This means that both countries have correspondents with an extreme low score on how justifiable they find financial fraud.

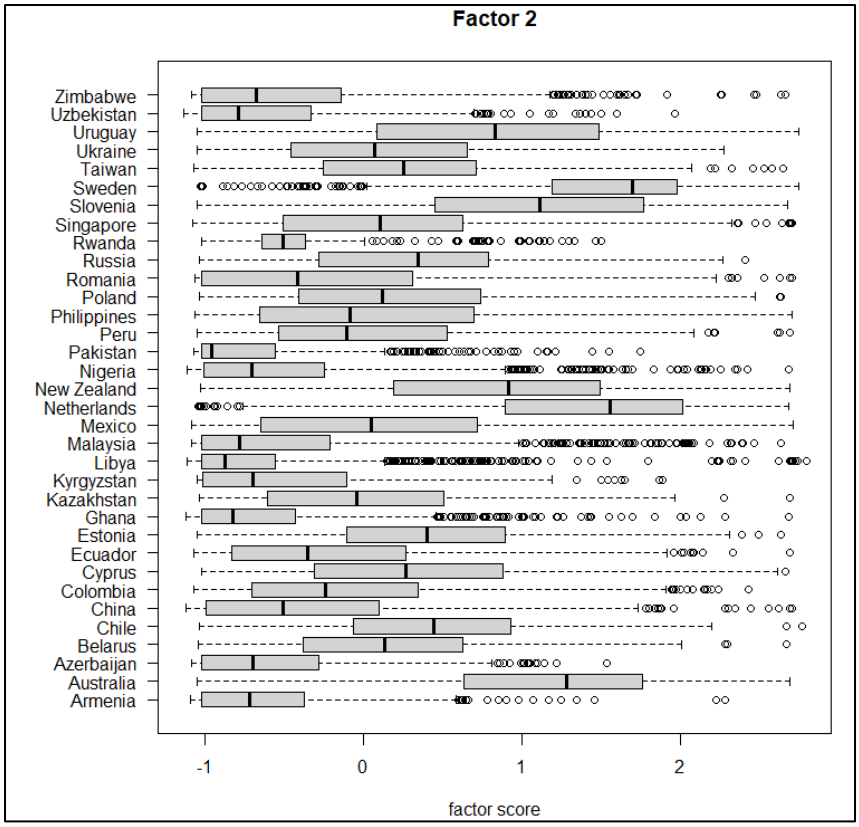


Figure 6: Distribution of Factor 2 for the 34 countries

For factor 3 we find that Zimbabwe, Singapore, Rwanda, Philippines and Nigeria have the highest average on how justifiable they find violence towards other individuals, including domestic violence. Most countries have an average factor score of between -1 and 0, just like Factor 1. Rwanda has the highest average score on this factor. All countries, except Philippines, have positive factor score outliers and most countries have no negative factor score outliers. This means that all countries, except Philippines, have correspondents with an extreme high score on how justifiable they find violence towards other individuals, including domestic violence, but most have no correspondents with an extreme low score on this factor. Only Rwanda has a negative factor score outlier.

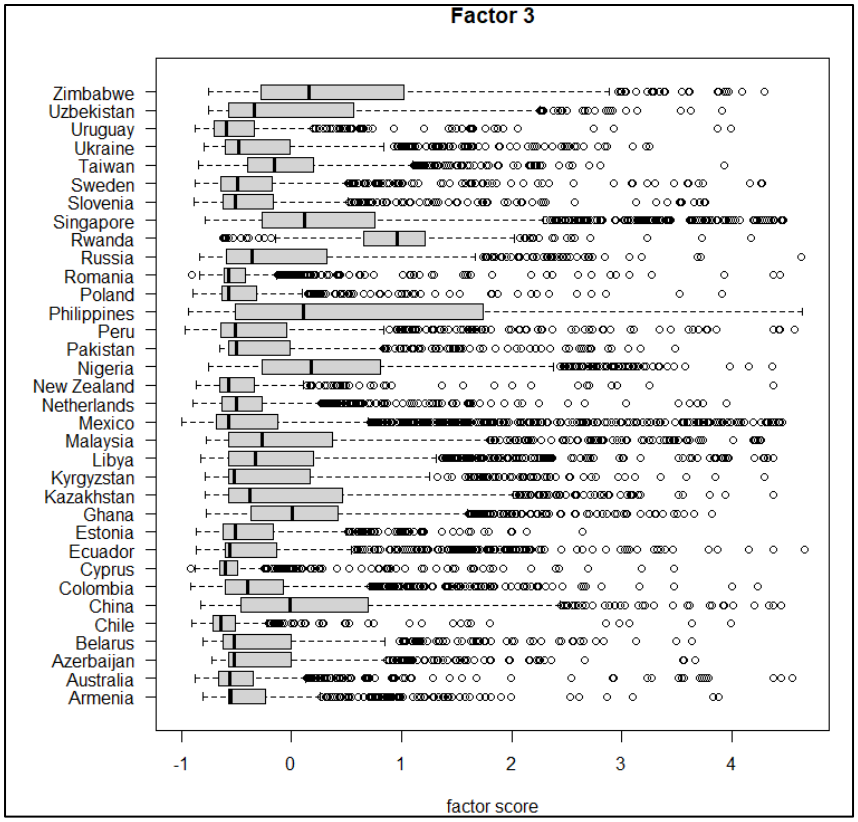


Figure 7: Distribution of Factor 3 for the 34 countries

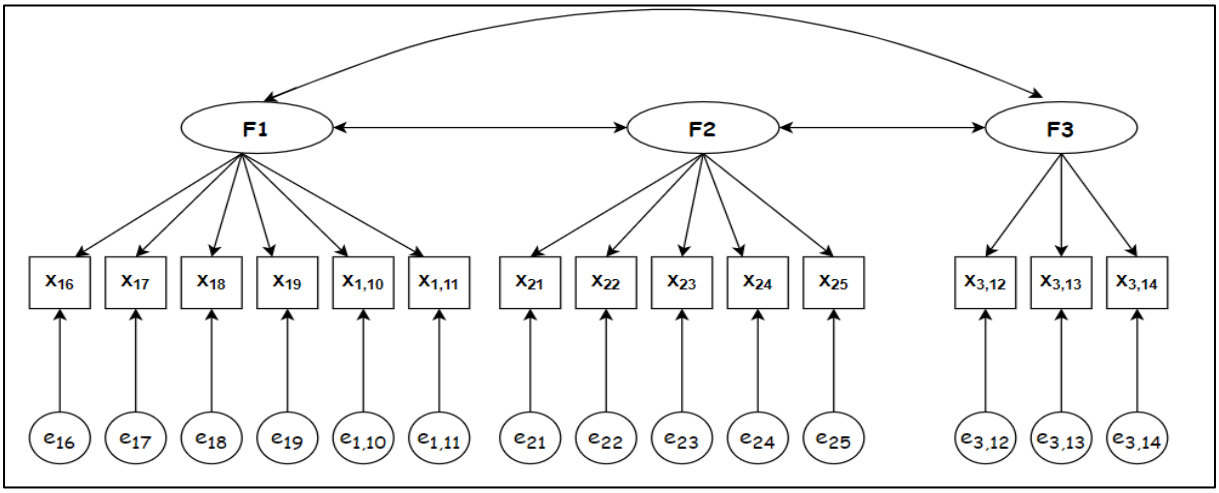
3. Confirmatory Factor Analysis:

3.1. Exploratory factor analysis and formation of the confirmatory model.

As a first step to the confirmatory factor analysis, an exploratory factor analysis is conducted on the data from countries ”Netherlands” and “Malaysia” on the justifiability items. The EFA suggests that 3 factors explain 71% of the variance and these 3 factors are:

a. F1 – factor that indicates justification of various social taboos
b. F2 – factor that indicates justification of financial fraud
c. F3 – factor that indicates justification of violence

Based on the insights from EFA, a CFA model is formed as follows:



Where **X_{16}**- J_homosexuality, **X_{17}**- J_prostitution, **X_{18}**- J_abortion, **X_{19}**- J_divorce, **$X_{1,10}$**-J_sex_before_marriage, **$X_{1,11}$**- J_suicide, **X_{21}**- claiming_benefits, **X_{22}**- J_avoiding_fare, **X_{23}**- J_stealing_property, **X_{24}**- J_cheating_taxes, **X_{25}**- J_accept_bribe, **$X_{3,12}$**- J_beat_wife, **$X_{3,13}$**- J_parents_beating_children, **$X_{3,14}$**- J_violence.

3.2. Modification of the model using modification index after examining the fit of the model.

On examining the fit of the model, from the analysis, it is shown that the model has 31 free parameters and 74 degrees of freedom, all the loadings were positive and significant. The covariances between the factors, F1 and F2 have negative correlation and is non-significant according to the p-value where covariances between F1 and F3 is shown to be very less yet significant and F2 and F3 shows high correlation (0.698) and is significant.

The chi square test that compares the difference between the observed and estimated model shows that the model is significantly different and thus in turn can be perceived that the model doesn’t fit the data. But as we are dealing with a large sample size, other fit measures are also to

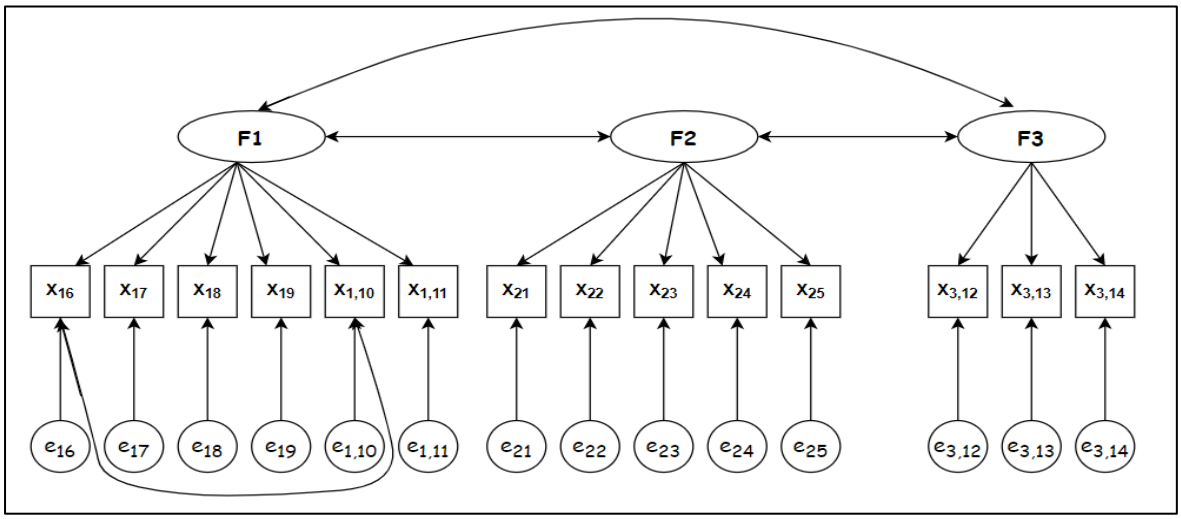
be consulted in order to derive remarks about the present model. Other fit measures of the model is as given:

```
> fitmeasures(fitcfa3,c("chisq","df","cfi","tli","rmsea","srmr"))
chisq       df      cfi      tli    rmsea     srmr
1457.227   74.000    0.950    0.939    0.087    0.070
```

The Tucker-Lewis index (TLI) value and the Root Mean Square Error of Approximation (RMSEA) values doesn't abide to the satisfactory condition as TLI value should be greater than 0.95 and RMSEA less than 0.08 and this shows that the model is not a good fit.

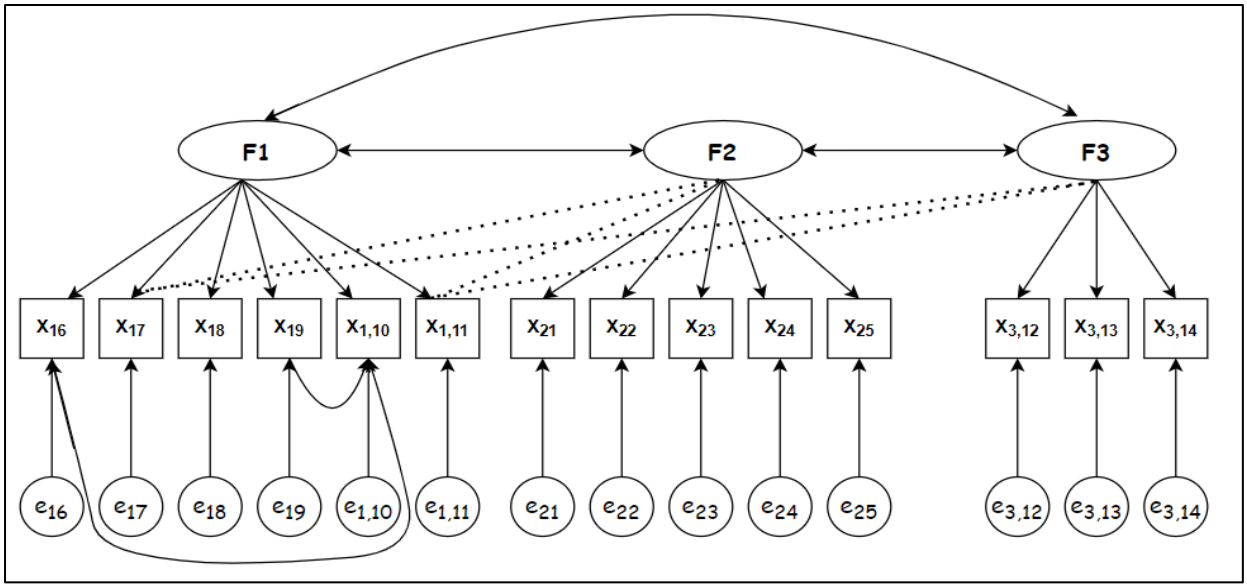
The standardized solutions tables explain the correlation of the factors to the variables are quite strong and similar are the case with their reliabilities. The table also shows the proportion of variance in a variable that is not explained by the factor. It can be seen that the variance in the variable J_suicide is not well explained by F1. As it was inferred that there is a scope for improvement, modification indices are to be checked.

When looked into the modification index values, most of the values are large but instead of just focusing on the 'mi' values, expected parameter change 'epc' values are also considered. From these values in the modification index, as a first step, the correlation between the variables J_homosexuality and J_sex_before_marriage is added to the model. Now the model becomes,




```
> fitmeasures(fitcfa3b,c("chisq","df","cfi","tli","rmsea","srmr"))
   chisq       df      cfi      tli    rmsea     srmr
1335.837   73.000    0.955    0.943    0.084    0.069
```

The fit measures of the improved model given above shows that the fit is not satisfactory and thus have to improve the model. The modification index of the improved model suggests addition of J_prostituition and J_suicide to F2 and F3 along with the addition of correlation between J_divorce and J_sex_before_marriage. So the model is improved again to be,



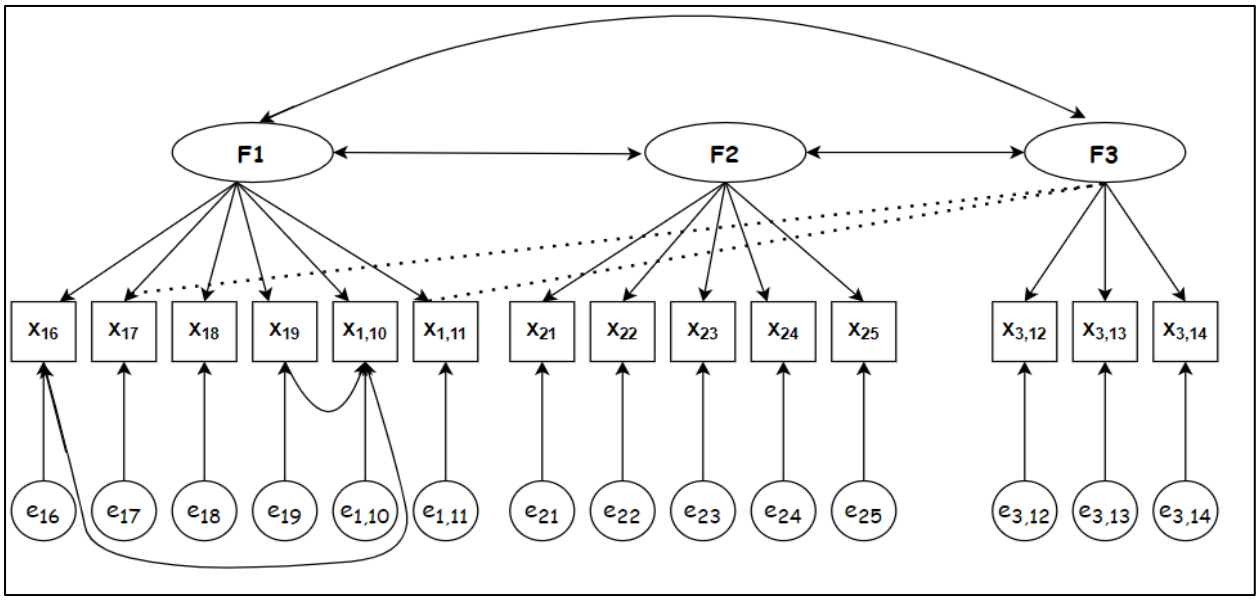

```
> fitmeasures(fitcfa3b1,c("chisq","df","cfi","tli","rmsea","srmr"))
  chisq      df     cfi     tli   rmsea    srmr
957.500  68.000   0.968   0.957   0.073   0.049
```

```
Latent Variables:
                   Estimate  Std.Err  z-value  P(>|z|)
  F1 =~
    J_homosexualty    3.326    0.063   52.850    0.000
    J_prostitution    2.308    0.049   47.089    0.000
    J_abortion        3.143    0.052   60.674    0.000
    J_divorce         3.020    0.053   57.352    0.000
    J_sex_bfr_mrrg    3.392    0.061   55.448    0.000
    J_suicide         2.004    0.049   40.615    0.000
  F2 =~
    J_clamng_bnfts    1.557    0.034   45.936    0.000
    J_avoiding_far    1.508    0.034   44.378    0.000
    J_stlng_prprty    1.553    0.028   56.363    0.000
    J_cheating_txs    1.544    0.035   44.256    0.000
    J_accept_bribe    1.568    0.031   50.301    0.000
    J_prostitution    0.136    0.059    2.314    0.021
    J_suicide         0.089    0.064    1.387    0.165
  F3 =~
    J_beat_wife       1.486    0.027   54.480    0.000
    J_prnts_btng_c    1.441    0.036   40.102    0.000
    J_violence        1.491    0.028   53.427    0.000
    J_prostitution    0.309    0.060    5.188    0.000
    J_suicide         0.550    0.065    8.459    0.000

Covariances:
                   Estimate  Std.Err  z-value  P(>|z|)
  F1 ~~
    F2               -0.027    0.022   -1.247    0.213
    F3                0.078    0.022    3.571    0.000
  F2 ~~
    F3                0.699    0.013   55.848    0.000
 .J_divorce ~~
   .J_sex_bfr_mrrg    0.523    0.071    7.419    0.000
 .J_homosexuality ~~
   .J_sex_bfr_mrrg    1.009    0.092   10.948    0.000
```

On analysis based on the newly improved model, even though all the fit measures except the chi-square test seems to be satisfactory, the loading of J_suicide on F2 seems to be non-significant. Covariances between the factors except F1 and F2 are significant and the covariances between the newly added variables are also significant.

The loading of variable J_prostitution on F2 is very less and in the standardized solutions, it is shown that the reliability of this variable on F2 is very less. Because of this, it is decided to remove the addition of J_prostitution and J_suicide on F2. The new model becomes:




```
> fitmeasures(fitcfa3b2,c("chisq","df","cfi","tli","rmsea","srmr"))
  chisq      df     cfi     tli   rmsea    srmr
964.088  70.000   0.968   0.958   0.072   0.049
```

The model has 35 free parameters and 70 degrees of freedom. Fit measures in the model are satisfactory except the chi-square which is not always reliable as we are dealing with a large sample size. The loadings of the variables on their latent variables are positive and significant. Covariances between the factors except F1 and F2 are also positive and significant.

The standardized solutions table below shows high correlations between the variables and their factors and thus implies the good reliability scores. The reliability scores for F1, F2 and F3 are 0.921, 0.867 and 0.734 respectively. This indicates that factors that justify different social taboos and financial fraud are highly reliable as they are having high scores and the factor that justifies violence specify comparatively poor reliability.

```
> standardizedSolution(fitcfa3b2)
                          lhs op                       rhs est.std    se       z pvalue ci.lower ci.upper
1                          F1 =~            J_homosexuality   0.859 0.006 142.037  0.000    0.847    0.871
2                          F1 =~             J_prostitution   0.785 0.008  93.413  0.000    0.768    0.801
3                          F1 =~                 J_abortion   0.932 0.004 247.276  0.000    0.925    0.940
4                          F1 =~                  J_divorce   0.902 0.005 191.930  0.000    0.893    0.911
5                          F1 =~       J_sex_before_marriage   0.887 0.005 165.711  0.000    0.876    0.897
6                          F1 =~                  J_suicide   0.697 0.011  64.690  0.000    0.676    0.719
7                          F2 =~          J_claiming_benefits   0.789 0.009  91.598  0.000    0.772    0.806
8                          F2 =~              J_avoiding_fare   0.771 0.009  84.115  0.000    0.753    0.789
9                          F2 =~         J_stealing_property   0.899 0.005 168.406  0.000    0.888    0.909
10                         F2 =~             J_cheating_taxes   0.769 0.009  83.524  0.000    0.751    0.787
11                         F2 =~              J_accept_bribe   0.838 0.007 117.621  0.000    0.824    0.852
12                         F3 =~                 J_beat_wife   0.893 0.007 136.966  0.000    0.881    0.906
13                         F3 =~ J_parents_beating_children   0.722 0.011  66.329  0.000    0.700    0.743
14                         F3 =~                 J_violence   0.883 0.007 131.018  0.000    0.870    0.896
15                         F3 =~             J_prostitution   0.142 0.013  10.646  0.000    0.116    0.168
16                         F3 =~                  J_suicide   0.216 0.015  14.747  0.000    0.188    0.245
17                         F1 ~~                         F1   1.000 0.000      NA     NA    1.000    1.000
18                         F2 ~~                         F2   1.000 0.000      NA     NA    1.000    1.000
19                         F3 ~~                         F3   1.000 0.000      NA     NA    1.000    1.000
20                         F1 ~~                         F2  -0.023 0.022  -1.061  0.289   -0.065    0.019
21                         F1 ~~                         F3   0.078 0.022   3.559  0.000    0.035    0.120
22                         F2 ~~                         F3   0.700 0.012  56.285  0.000    0.676    0.725
23                J_divorce ~~       J_sex_before_marriage   0.209 0.024   8.755  0.000    0.162    0.255
24            J_homosexuality ~~       J_sex_before_marriage   0.288 0.021  13.541  0.000    0.246    0.329
25            J_homosexuality ~~            J_homosexuality   0.262 0.010  25.162  0.000    0.241    0.282
26             J_prostitution ~~             J_prostitution   0.347 0.012  28.180  0.000    0.323    0.371
27                 J_abortion ~~                 J_abortion   0.131 0.007  18.575  0.000    0.117    0.144
28                  J_divorce ~~                  J_divorce   0.186 0.008  21.933  0.000    0.169    0.203
29      J_sex_before_marriage ~~       J_sex_before_marriage   0.214 0.009  22.522  0.000    0.195    0.232
30                 J_suicide ~~                  J_suicide   0.443 0.014  31.172  0.000    0.415    0.471
31       J_claiming_benefits ~~          J_claiming_benefits   0.377 0.014  27.766  0.000    0.351    0.404
32           J_avoiding_fare ~~              J_avoiding_fare   0.406 0.014  28.751  0.000    0.378    0.434
33        J_stealing_property ~~         J_stealing_property   0.192 0.010  19.995  0.000    0.173    0.211
34           J_cheating_taxes ~~             J_cheating_taxes   0.408 0.014  28.834  0.000    0.381    0.436
35            J_accept_bribe ~~              J_accept_bribe   0.298 0.012  24.925  0.000    0.274    0.321
36               J_beat_wife ~~                 J_beat_wife   0.202 0.012  17.336  0.000    0.179    0.225
37 J_parents_beating_children ~~ J_parents_beating_children   0.479 0.016  30.528  0.000    0.449    0.510
38               J_violence ~~                 J_violence   0.221 0.012  18.551  0.000    0.197    0.244
```

3.3 Multi-group Analysis:

The data we are looking into right now comes from the responses of people from two different countries. On considering this difference in the source of responses, we can also assume the difference in the culture, tradition and financial status of these two countries might influence their approach towards certain variables. Multi-group analysis helps us to check if there is any measurement invariance in the model due to this difference.

A likelihood test is conducted to check if there is difference in loadings (and intercepts) across the countries. From the ANOVA results, it is concluded that both the strong and metric measurement invariance model is rejected by the LR test. (H_0: the loadings (and intercepts) are equal across the countries).

```
> anova(config,metric)
Chi-Squared Difference Test

       Df    AIC    BIC  Chisq Chisq diff Df diff Pr(>Chisq)
config 146 124205 124739 2709.2
metric 159 124979 125438 3509.4     800.21      13  < 2.2e-16 ***
> anova(config,strong)
Chi-Squared Difference Test

       Df    AIC    BIC  Chisq Chisq diff Df diff Pr(>Chisq)
config 146 124205 124739 2709.2
strong 170 126544 126940 5097.0     2387.8      24  < 2.2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

On summarizing the fit measures, it can be seen that the configural model itself is not a good fit and this suggests that there happens to be a regional discrepancy in the model as presumed.

	chisq	df	cfi	tli	rmsea	srmr	bic	aic	chidf
configural	2709.190	146	0.890	0.862	0.119	0.218	124739.4	124204.6	18.556
metric	3509.398	159	0.856	0.835	0.131	0.342	125438.0	124978.8	22.072
strong	5097.000	170	0.788	0.773	0.153	0.347	126939.7	126544.4	29.982

Further looking into the loadings of the variables on their latent factors by 2 countries in the configural model, it is seen that the loadings are all positive and significant except for the variable J_prostitution on F3 in Malaysia.

Covariances:

	Estimate	Std.Err	z-value	P(>|z|)
F1 ~~				
F2	-0.015	0.034	-0.449	0.653
F3	-0.033	0.034	-0.974	0.330
F2 ~~				
F3	0.736	0.019	38.774	0.000
.J_divorce ~~				
.J_sex_bfr_mrrg	0.280	0.096	2.916	0.004
.J_homosexuality ~~				
.J_sex_bfr_mrrg	1.506	0.139	10.861	0.000

Covariances:

	Estimate	Std.Err	z-value	P(>|z|)
F1 ~~				
F2	0.506	0.024	21.463	0.000
F3	0.721	0.018	40.617	0.000
F2 ~~				
F3	0.576	0.022	26.363	0.000
.J_divorce ~~				
.J_sex_bfr_mrrg	0.638	0.068	9.401	0.000
.J_homosexuality ~~				
.J_sex_bfr_mrrg	0.043	0.056	0.779	0.436

Covariances of the latent factors and variables of Netherlands and Malaysia are shown in the two boxes above and this shows that in Netherlands, the correlation between F1 and F2 and F1 and F3 are non-significant while in Malaysia, they are both significant and high. There happens to be major differences in the covariances of the variables across two countries also.

From the contrasts that are discussed above, it can be concluded that the difference in the religious, cultural and financial status across Netherlands and Malaysia may have contributed to this measurement invariance in the model.

4. Structural Equation Models:

4.1. Structural equation model (SEM) Continue working on the data of the countries "Netherlands" and "Malaysia". Estimate a structural equation model to investigate how the importance of religion affects the justifiability of behaviors for respondents. Does the result of the analysis differ for respondents of the two countries?

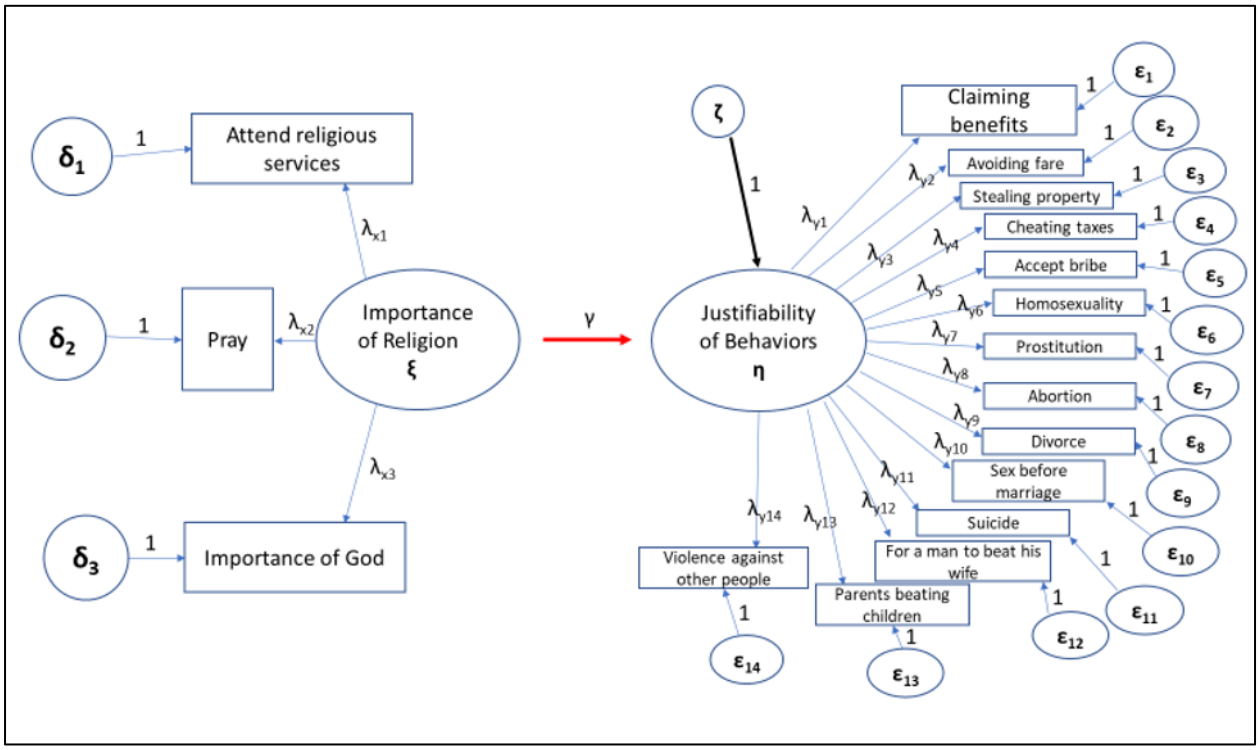


Figure 1: This is the framework of the Structural Equation Model which we have used.

We were asked to estimate a structural equation model to investigate how the importance of religion affects the justifiability of behaviors for respondents of Malaysia and the Netherlands. We were also asked to analyze, whether the result of the analysis differs for the respondents of the two countries. We have achieved this using a Structural Equation Model whose framework we have indicated above in the picture, and whom we explain through words and formulae later.

'Importance of Religion', is our explanatory or exogenous variable, **ξ.** There are three different indicators, 'Religious Services', 'Pray' and 'Importance of God' feeding into 'Importance of Religion', our ξ value. There are three different loadings $\lambda_{X1}, \lambda_{X2}, \lambda_{X3}$, and three different error terms $\delta_{1,2,3}$ going into the three indicators 'Religious Services'(X_1), 'Pray'(X_2) and 'Importance of God'(X_3), which build up the 'explanatory variable', ξ.

'Justifiability of Behaviors' is our explained or endogenous variable **η.** Our explanatory/exogenous variable 'Importance of Religion **ξ'** is connected through the 'regression coefficient **γ**' to 'Justifiability of Behaviors' **η**. There is one error term ζ going into **η**, ζ is the

error term of the regression γ between ξ and η. There are also 14 different indicators ($Y_{1\text{-}14}$) of η, each with their own loadings $\lambda_{Y1\text{-}Y14}$, and disturbance variables $\varepsilon_{1\text{-}14}$, feeding into the endogenous variable 'Justifiability of Behaviors η'. λ_{Y1} and $\varepsilon_{1\text{-}14}$ are all fixed to 1. We estimate the indicator 'Pray' freely. $\delta_{1,2,3}$ are all fixed to 1.

To identify the model, we set the loading λ_{Y1} 'Claiming Benefits' to be equal to 1. We also set the covariance of ξ to be 1. Due to the structural relations, the covariance structure of η is more complex, because of this, we do not set the variance of η to be 1.

The **measurement model** is:

for X, where n = 1, 2, 3 $$X_n = \lambda_{xn}\,\xi + \delta_n$$

for Y, where n = 1, 2, …, 14 $$Y_n = \lambda_{yn}\,\eta + \varepsilon_n$$

The **structural model** is:

$$\eta = \gamma\,\xi + \zeta$$

The covariance of η can be derived as:

$$\text{var}(\eta) = E[(\gamma\xi + \zeta)'(\gamma\xi + \zeta)] = \gamma\text{^}2 + \psi$$

Interpreting the results for Malaysia:

The test statistic is 5397.818 with 118 Degrees of Freedom, and a significant P-value : 0.000. The P value is close to zero, which means the model deviates significantly from the perfectly fitting model and can be rejected by the absolute goodness of fitness test. However, this test is very sensitive due to the large sample size.

'Importance of Religion' has a negative significant effect on 'Justifiability of behaviors'. The estimated correlation between ξ and η equals γ**:** -0.298. Hence, when the 'Importance of Religion' goes up by 1%, the 'Justifiability of Behaviors' is likely to decrease by 0.298%. The estimated variance of η is 2.104. The estimated variance of ξ was set to 1. Using the equation where we have defined the variance of η**,** we can estimate the variance of the error term of η, var(ζ)**,** which is equal to ψ:

$$\psi = \eta - \gamma\text{^}2$$

$$\psi = 2.104 - (-0.298)\text{^}2 = 2.015$$

We calculate the reliabilities of the indicators (of both the exogenous and endogenous variables), in order to inspect how big a part of the variance is explained by a certain indicator. Reliabilities

above 0.70 are desirable (or 0.50 at the very least). The squared standardized loadings ((λ_{Xn})^2) give the reliabilities for X_1, X_2 and X_3:

```
relig =~ R_pray                        => 0.75^2   = 0.56
relig =~ R_importance_God              => 0.426^2 = 0.18
relig =~ R_attend_religious_services   => 0.652^2 = 0.425
```

Figure 2: The reliabilities of the loadings λ_{X1}, λ_{X2} and λ_{X3} for Malaysia

Hence, only a small part of the variance is due to the latent factor of the X variable indicators 'Importance of God' and 'Attend religious services'. While a moderate part of the variance can be explained by the latent factor of the indicator 'Pray'.

The reliabilities are stronger for some of the Y variable indicators, ((λ_{Yn})^2):

```
justif =~ J_claiming_benefits        => 0.633^2   = 0.4
justif =~ J_avoiding_fare            => 0.63^2    = 0.3969
justif =~ J_stealing_property        => 0.705^2   = 0.497
justif =~ J_cheating_taxes           => 0.671^2   = 0.45
justif =~ J_accept_bribe             => 0.718^2   = 0.5155
justif =~ J_homosexuality            => 0.754^2   = 0.5685
justif =~ J_prostitution             => 0.849^2   = 0.72
justif =~ J_abortion                 => 0.885^2   = 0.78
justif =~ J_divorce                  => 0.731^2   = 0.534
justif =~ J_sex_before_marriage      => 0.778^2   = 0.605
justif =~ J_suicide                  => 0.910^2   = 0.828
justif =~ J_beat_wife                => 0.851^2   = 0.72
justif =~ J_parents_beating_children => 0.625^2   = 0.39
justif =~ J_violence                 => 0.874^2   = 0.76
```

Figure 3: The reliabilities of the loadings $\lambda_{Y1\text{-}14}$ for Malaysia

Hence, a large part of the variance is due to the latent factor of the Y variable indicators. The most reliable loadings are "Suicide", "Violence" and "Abortion" respectively.

When we run modificationIndices(fit1), we can see that model fit can be substantially improved by adding residual variances and covariances between certain indicators as well as by further defining latent relationships between certain indicators. Some of the biggest improvements can be achieved by adding residual variances between J_stealing_property ~~ J_accept_bribe, J_stealing_property ~~J_cheating_taxes and J_avoiding_fare ~~J_stealing_property for a few examples.

Interpreting the results for the Netherlands:

The test statistic is 4495.227 with 118 Degrees of Freedom, and a significant P-value: 0.000. The P value is close to zero, which means the model deviates significantly from the perfectly fitting model. However, this test is very sensitive due to the large sample size.

'Importance of Religion' has a non-negative non-significant (P: 0.979) effect on 'Justifiability of behaviors'. The estimated correlation between **ξ** and **η** is **γ:** 0.000. Hence, when the 'Importance of Religion' goes up by 1%, the 'Justifiability of Behaviors' is likely to increase by 0.000%. So the **ξ** is likely to have (very close to) no effect on the **η**. The estimated variance of **η** is 0.272. The estimated variance of **ξ** was set to 1. Using the equation where we have defined the variance of **η,** we can estimate the variance of **ζ,** which is equal to **ψ**:

$$\psi = \eta - \gamma^2$$

$$\psi = 0.272 - (0.000)^2 = 0.272$$

The squared standardized loadings $((\lambda_{Xn})^2)$ give the reliabilities for $\mathbf{X_1}$, $\mathbf{X_2}$ and $\mathbf{X_3}$, which are moderately to strongly reliable:

```
relig =~ R_pray                    => 0.918^2 = 0.84
relig =~ R_importance_God          => 0.855^2 = 0.73
relig =~ R_attend_religious_services => 0.812^2 = 0.659
```

Figure 4: The reliabilities of the loadings λ_{X1}, λ_{X2} and λ_{X3} for the Netherlands

Hence a large enough part of the variance is due to the latent factor of the X variable indicators.

The reliabilities for the Y variable indicators are very weak ((λ_{Yn})^2):

justif =~ J_claiming_benefits	=> 0.457^2 = 0.2088
justif =~ J_avoiding_fare	=> 0.449^2 = 0.20
justif =~ J_stealing_property	=> 0.684^2 = 0.467
justif =~ J_cheating_taxes	=> 0.531^2 = 0.281
justif =~ J_accept_bribe	=> 0.554^2 = 0.306
justif =~ J_homosexuality	=> -0.116^2 = 0.013
justif =~ J_prostitution	=> 0.057^2 = 0.003
justif =~ J_abortion	=> -0.013^2 = 0.0001
justif =~ J_divorce	=> -0.056^2 = 0.003
justif =~ J_sex_before_marriage	=> -0.086^2 = 0.007
justif =~ J_suicide	=> 0.041^2 = 0.0016
justif =~ J_beat_wife	=> 0.662^2 = 0.438
justif =~ J_parents_beating_children	=> 0.581^2 = 0.337
justif =~ J_violence	=> 0.659^2 = 0.434

Figure 5: The reliabilities of the loadings $\lambda_{Y1\text{-}14}$ for the Netherlands

Hence only a small part of the variance is due to the latent factor of the Y variable indicators. In other words, only a small part of the variance can be explained by the latent factor of the Y variable indicators.

When we run modificationIndices(fit2)**,** we can see that model fit can be substantially improved by adding residual variances and covariances between certain indicators as well as by further defining latent relationships between certain indicators. Some of the biggest improvements can be achieved by adding residual covariances between J_homosexuality ~~ J_sex_before_marriage and J_prostitution ~~ J_abortion, or defining relig =~ J_abortion as a latent variable for a few examples.

Comparing the results for the two countries:

As we can see, the analysis results in large differences between Malaysia and the Netherlands.

Due to the large sample size, the model deviates significantly from fitting the data well enough regarding either country's given data. This is a similarity.

The effect of 'Importance of Religion' on 'Justifiability of behaviors' has a negative significant estimated correlation **γ** of -0.298 for Malaysia and a non-negative non-significant estimated correlation of 0.000 for the Netherlands. Hence, 'Importance of Religion' is likely to have a substantial negative effect on 'Justifiability of Behaviors' for Malaysia: when the 'Importance of Religion' goes up by 1%, the 'Justifiability of Behaviors' is likely to decrease by 0.298%. For the Netherlands 'Importance of Religion' is likely to have (very close) to no effect on

'Justifiability of Behaviors': when the 'Importance of Religion' goes up by 1%, the 'Justifiability of Behaviors' is likely to increase by 0.000%.

The estimated covariance for **η** 'Justifiability of Behaviors' for Malaysia is 2.104, while for the Netherlands it is 0.272.

The estimated covariance for **ξ,** 'Importance of Religion' was fixed to 1 for both Malaysia and the Netherlands.

The estimated variance for the error term of the regression, between ξ and **η, ζ,** which is equal to **ψ**, is equal to 2.015 for Malaysia and to 0.272 for the Netherlands.

The reliability of the loadings for the Explanatory and the Endogenous variables are reversed for each country. The loadings for the Exogenous variables are strong for the Netherlands and weak for Malaysia, while the loadings for the Endogenous variables are strong for Malaysia, while weak for the Netherlands. This means that for Malaysia the latent factors for the X variable cannot be reliably measured, while they can be moderately measured for the Y variable. The reverse is true for the Netherlands, thus the latent factors for X can be measured reliably, while the evidence for the latent factors of Y is weak.

Although it is not extensively explained here, running modificationIndices(fit1) and modificationIndices(fit2), we can see that the fits of the two countries' models' can be improved in different measures. What would improve one country's fit, might not have a substantial impact on the other's fit, and vice-versa. For example, adding a residual variance in J_homosexuality ~~J_divorce for the Netherlands would substantially improve its fit, but would barely improve the fit of Malaysia. Adding a residual variance between J_stealing_property ~~ J_accept_bribe would impact Malaysia's fit in a major way but would not have nearly as big an effect on the Netherlands.

Using a Structural Equation Model, we have investigated how the importance of religion affects the justifiability of behaviors for respondents of Malaysia and the Netherlands. We have explained the framework of the model we have used in this analysis. We have talked about the significance of the reliabilities of the loadings of the explanatory and endogenous variables. We have also explained how a better fit to the perfectly fitting model is achievable from our models. We have highlighted some key differences between the results of the countries based on the responses from the two countries.

5. Canonical Correlation Analysis:

5.1. Conduct a canonical correlation analysis to investigate the relations between the following two sets of variables: Set of X variables: 3 items about importance of religion (see Table 4) and 5 items about occurrence of crimes in the neighborhood (see Table 2) Set of Y variables: 14 items about the justifiability of behaviors (see Table 3) Conduct the analysis on standardized items using the data of the countries "Netherlands" and "Malaysia".

The first canonical correlation R(u1,t1) equals 0.77798. The canonical variate u1 explains 60.52% of the variance in canonical variate t1. The second canonical correlation R(u2,t2) equals 0.21617. The canonical variate u2 explains 4.67% of the variance in canonical variate t2. The third canonical correlation R(u3,t3) equals 0.17196. The canonical variate u3 explains 2.96% of the variance in canonical variate t3. The fourth canonical correlation R(u4,t4) equals 0.14828. The canonical variate u4 explains 2.2% of the variance in canonical variate t4. The fifth canonical correlation R(u5,t5) equals 0.11756. The canonical variate u5 explains 1.4% of the variance in canonical variate t5. All other remaining canonical correlations are rather small.

5.2. How many canonical correlations are significant?

The first five canonical covariates are significant as the p-value of all these variates is less than 0.05 significance level. All the other canonical covariates from sixth to eighth are not significant.

```
Test of H0: The canonical correlations in the
current row and all that follow are zero

     CanR LR test stat approx F numDF   denDF   Pr(> F)
1 0.77798      0.34671  25.0400   112 17199.5 < 2.2e-16 ***
2 0.21617      0.87831   3.5350    91 15293.5 < 2.2e-16 ***
3 0.17196      0.92136   2.8127    72 13351.6 3.337e-14 ***
4 0.14828      0.94944   2.3288    55 11362.6 1.042e-07 ***
5 0.11756      0.97078   1.8275    40  9310.9  0.001117 **
6 0.09546      0.98438   1.4356    27  7173.4  0.067110 .
7 0.06618      0.99344   1.0127    16  4914.0  0.439093
8 0.04683      0.99781   0.7717     7  2458.0  0.611133
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Figure 1: Significance of Canonical Covariates

<u>*Significance test:*</u>

The null hypothesis (all the correlations are zero) is rejected as p-value < 0.001 ($\Lambda = 0.347$, F = 25.04, df1 = 112, df2 = 17199.5).

Sequential test:

1. H0: ρ(u2, t2) = ρ(u3, t3) = ρ(u4, t4) = ρ(u5, t5) = ρ(u6, t6) = ρ(u7, t7) =ρ(u8, t8) =0 is rejected as p-value < 0.001 (Λ = 0.878, F = 3.535, df1 = 91, df2 = 15293.5).
2. H0: ρ(u3, t3) = ρ(u4, t4) = ρ(u5, t5) = ρ(u6, t6) = ρ(u7, t7) =ρ(u8, t8) = 0 is rejected as p-value < 0.05 (Λ = 0.921, F = 2.813, df1 = 72, df2 = 13351.6).
3. H0: ρ(u4, t4) = ρ(u5, t5) = ρ(u6, t6) = ρ(u7, t7) =ρ(u8, t8) = 0 is rejected as p-value < 0.05 (Λ = 0.949, F = 2.329, df1 = 55, df2 = 11362.6).
4. H0: ρ(u5, t5) = ρ(u6, t6) = ρ(u7, t7) =ρ(u8, t8) = 0 is rejected as p-value < 0.05 (Λ = 0.931, F = 1.828, df1 = 40, df2 = 9310.9).
5. H0: ρ(u6, t6) = ρ(u7, t7) = ρ(u8, t8) = 0 cannot be rejected as p-value = 0.067 > 0.05 (Λ = 0.984, F = 1.435, df1 = 27, df2 = 7173.4).
6. H0: ρ(u7, t7) = ρ(u8, t8) = 0 cannot be rejected as p-value > 0.05 (Λ = 0.993, F = 1.0127, df1 = 16, df2 = 4914.0).
7. H0: ρ(u8, t8) = 0 cannot be rejected as p-value = 0.617 > 0.05 (Λ = 0.997, F = 0.772, df1 = 7, df2 = 2458.0).

We can clearly see that last three pairs of canonical variates are not significant and hence, we should only take the first five canonical variates.

5.3. How much of the variance in the Y variable is explained by the variable X?

The measure of redundancy tells us about the amount of variance in Y that can be explained by X. The reported redundancies show that u1 accounts for 18.88% of the variance in Y. But the reported redundancies of u2, u3, u4 and u5 only accounts for a rather small portion of the variance in Y, 0.3%, 0.6%, 0.1% and 0.1% respectively. However, all the remaining covariates are insignificant as they have p-value above significance level of 0.05 and account for no variance in Y.

```
> round(cbind(R2tu,VAFYbyt,redund,total=cumsum(redund)),3)
       R2tu VAFYbyt redund total
Ycan1 0.605   0.310  0.188 0.188
Ycan2 0.047   0.070  0.003 0.191
Ycan3 0.030   0.217  0.006 0.198
Ycan4 0.022   0.059  0.001 0.199
Ycan5 0.014   0.046  0.001 0.200
Ycan6 0.009   0.037  0.000 0.200
Ycan7 0.004   0.057  0.000 0.200
Ycan8 0.002   0.034  0.000 0.200
```

Figure 2: Redundancies

Using the first five canonical variates (the ones that are significant, with a p-value less than 0.05), we see that variable X accounts for a total of 20% of the variance in the Y variables. The

remaining canonical correlations are rather small and insignificant; therefore, we will only interpret the first five canonical variates.

5.4. How can you interpret canonical variates?

A high score on u1 indicate a low importance of religion and a low occurrence of robberies in the neighborhood. The canonical loadings on u1 and t1 suggest that a low importance of religion and a low occurrence of robberies generally have a high justifiability of sinful behavior and a low justifiability of claiming benefits from government, stealing properties and domestic violence.

Overall Malaysia has a low score on u1 and t1, The Netherlands has a high score on u1 and t1. Because there is a clear distinction in score between both countries a separate analysis for both Malaysia and Netherlands is conducted.

```
> cancor.out$structure$X.xscores[,1]
R_attend_religious_services                  R_pray          R_importance_God             CR_robberies                CR_alcohol
                -0.837678025            -0.893892098            -0.956960437            -0.301549319            -0.004408362
        CR_police_military         CR_racist_behavior                CR_drug_sale
                -0.099042445            -0.087594178            -0.096097321
> cancor.out$structure$Y.yscores[,1]
      J_claiming_benefits          J_avoiding_fare       J_stealing_property          J_cheating_taxes          J_accept_bribe
                -0.30250992             -0.08642101             -0.23459004             -0.05574635             -0.16505054
          J_homosexuality           J_prostitution               J_abortion                J_divorce J_sex_before_marriage
                 0.85718236              0.70589203              0.89327296              0.85041193              0.94944816
                J_suicide              J_beat_wife J_parents_beating_children               J_violence
                 0.63984576             -0.22216358             -0.20728502             -0.06929150
```

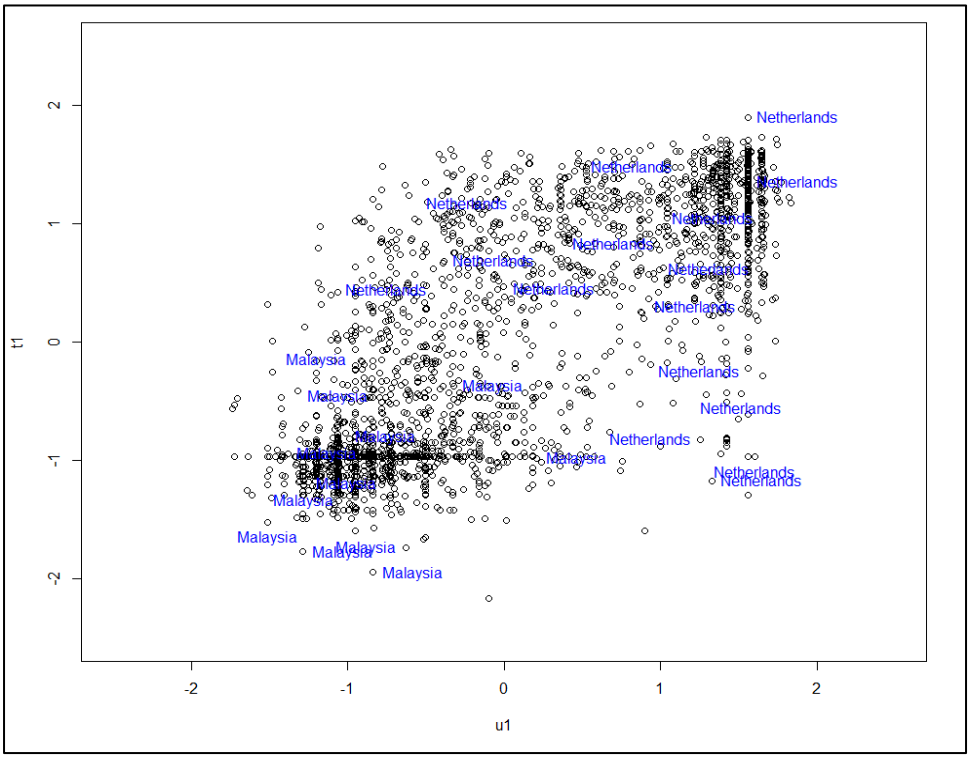


Figure 3: First canonical variate

A high score on u2 indicates a high attendance of religious services and a low occurrence of overall crimes in the neighborhood like robberies, alcohol consumption, racist behavior and interference of police/military. The canonical loadings on u2 and t2 suggest that a high attendance of religious services and a low occurrence of crimes in neighborhoods have a low justifiability of financial fraud, prostitution, divorce and violence.

Overall the scores on u2 and t2 for Malaysia and the Netherlands are diffused (no distinct difference between both countries.)

```
> cancor.out$structure$X.xscores[,2]
R_attend_religious_services                  R_pray          R_importance_God             CR_robberies              CR_alcohol
                 0.39244273              0.06990438             -0.14948212             -0.23851702             -0.25302355
        CR_police_military        CR_racist_behavior             CR_drug_sale
                -0.47132147             -0.34172229              0.11681084
> cancor.out$structure$Y.yscores[,2]
      J_claiming_benefits           J_avoiding_fare       J_stealing_property          J_cheating_taxes           J_accept_bribe
                -0.55630989             -0.12008617             -0.32684111             -0.48314854             -0.22654381
          J_homosexuality           J_prostitution               J_abortion                J_divorce      J_sex_before_marriage
                 0.08302622             -0.20434622             -0.10326587             -0.21900370             -0.12453378
                J_suicide              J_beat_wife J_parents_beating_children               J_violence
                 0.14479515             -0.28807590              0.02140467             -0.19651999
```

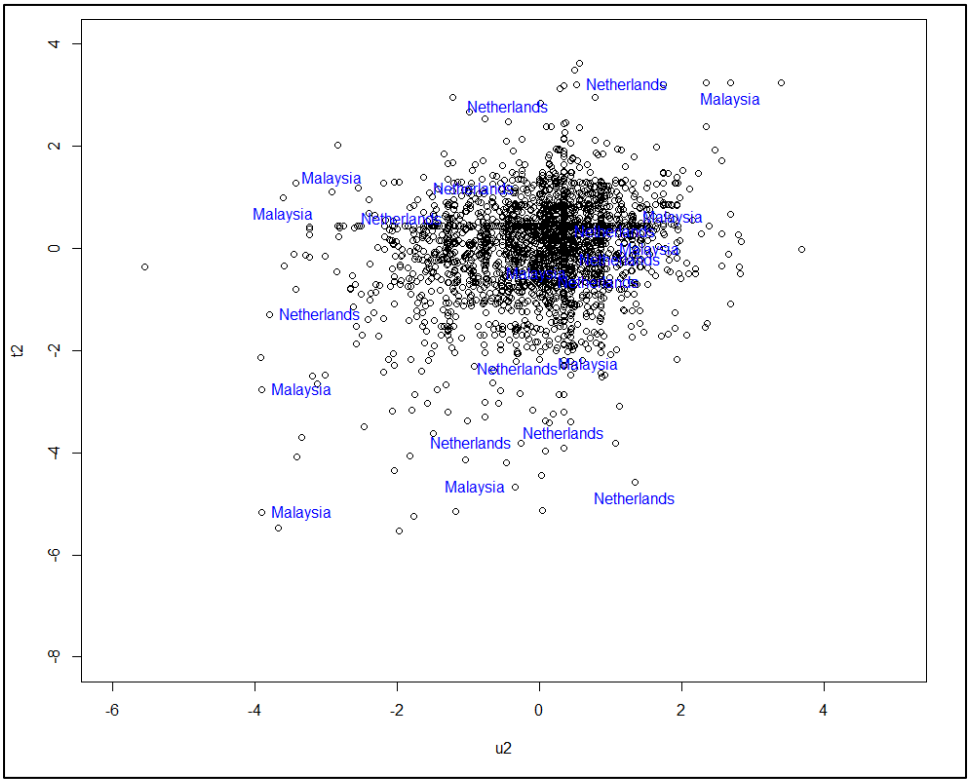


Figure 4: Second canonical variate

A high score on u3 indicates low importance of religion and a low occurrence of crimes in the neighborhood. The canonical loadings on u3 and t3 suggest that a low importance of religion and a low occurrence of crimes in the neighborhood have a low justifiability of financial fraud, suicide and violence.

Overall the scores on u3 and t3 for Malaysia and the Netherlands are diffused (no distinct difference between both countries.)

```
> cancor.out$structure$X.xscores[,3]
R_attend_religious_services                     R_pray          R_importance_God              CR_robberies                CR_alcohol
                 -0.2198784                 -0.2767061                  0.2008114                 -0.1982066                 -0.2357649
        CR_police_military          CR_racist_behavior               CR_drug_sale
                 -0.5281251                 -0.4592527                 -0.1737184
> cancor.out$structure$Y.yscores[,3]
      J_claiming_benefits            J_avoiding_fare       J_stealing_property          J_cheating_taxes            J_accept_bribe
                -0.47769135                -0.56465025                -0.64666986                -0.57069037                -0.68745041
          J_homosexuality              J_prostitution                J_abortion                  J_divorce      J_sex_before_marriage
                -0.12966543                -0.20849001                -0.15155805                 0.03919483                -0.10310248
               J_suicide                  J_beat_wife J_parents_beating_children                  J_violence
                -0.37751361                -0.51994734                -0.33475508                -0.81138162
```

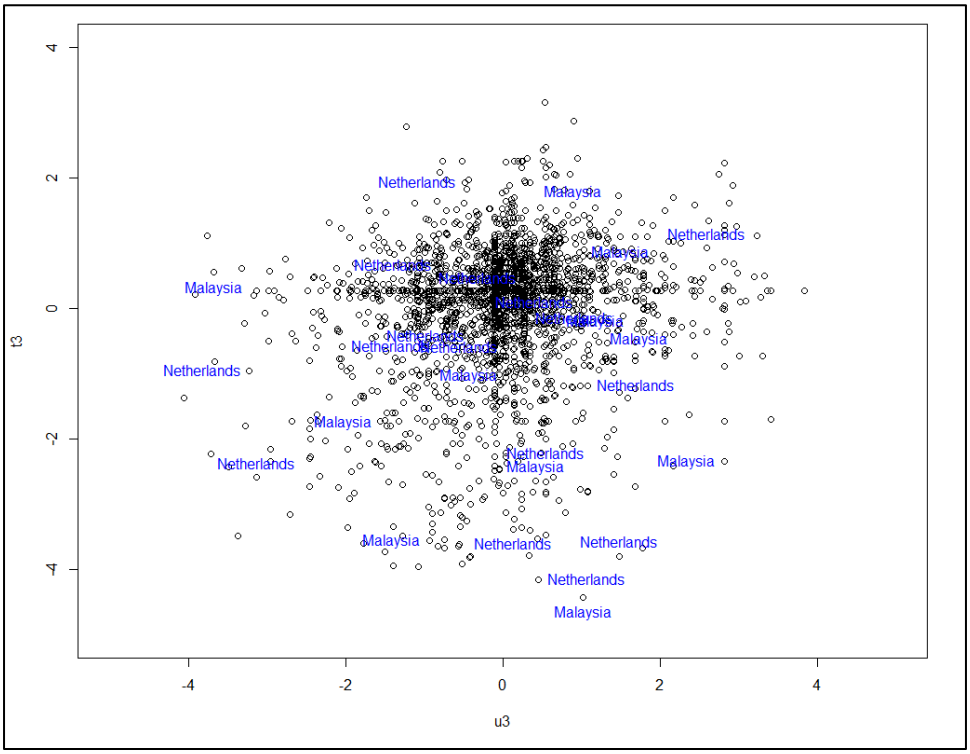


Figure 5: Third canonical variate

A high score on u4 indicates a high attendance of religious services and a low occurrence of overall crimes in the neighborhood like robberies, racist behavior and drug sales. The canonical loadings on u4 and t4 suggest that a high attendance of religious services and a low occurrence of crimes in the neighborhood have a low justifiability of financial fraud, prostitution, suicide and parents beating children.

Overall the scores on u4 and t4 for Malaysia and the Netherlands are diffused (no distinct difference between both countries.)

```
> cancor.out$structure$X.xscores[,4]
R_attend_religious_services                  R_pray          R_importance_God             CR_robberies                CR_alcohol
               0.238214886              -0.100302032               0.007448663             -0.298351366               0.121997421
        CR_police_military       CR_racist_behavior             CR_drug_sale
               0.169811937              -0.389503964              -0.412023435
> cancor.out$structure$Y.yscores[,4]
      J_claiming_benefits             J_avoiding_fare       J_stealing_property          J_cheating_taxes             J_accept_bribe
               -0.23308230              -0.25484160              -0.21491842              -0.37178579              -0.12453904
          J_homosexuality             J_prostitution                J_abortion                 J_divorce      J_sex_before_marriage
                0.01707226              -0.15900838              -0.01777673              -0.11405208              -0.09426760
                J_suicide                J_beat_wife J_parents_beating_children                J_violence
               -0.19961207              -0.06621403              -0.63857611              -0.06721154
```

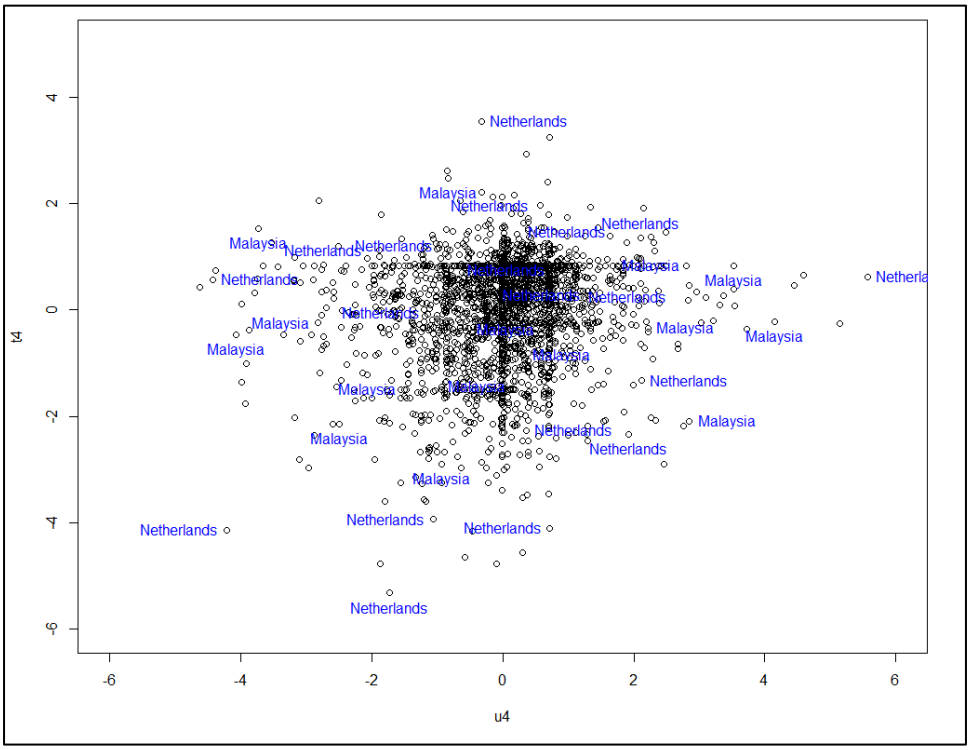


Figure 6: Fourth canonical variate

A high score on u5 indicates a high occurrence of crimes in the neighborhood like alcohol abuse, police/military inference, racist behavior and drug sale. The canonical loadings on u5 and t5 suggest that a high occurrence of crimes in the neighborhood have a high justifiability for avoiding fares on public transports, interference of police/military and domestic violence, and a low justifiability of cheating on taxes.

Overall the scores on u5 and t5 for Malaysia and the Netherlands are diffused (no distinct difference between both countries.)

```
> cancor.out$structure$X.xscores[,5]
R_attend_religious_services                  R_pray          R_importance_God             CR_robberies                CR_alcohol
               -0.0977773328            0.0628346493             0.0785016247            -0.0004284647             0.4903361316
        CR_police_military       CR_racist_behavior                CR_drug_sale
                0.4347360530            0.1843915863             0.7281073300
> cancor.out$structure$Y.yscores[,5]
      J_claiming_benefits          J_avoiding_fare       J_stealing_property          J_cheating_taxes            J_accept_bribe
                0.08591390            0.48416826             0.20623613            -0.17027203             0.04547273
         J_homosexuality           J_prostitution               J_abortion               J_divorce     J_sex_before_marriage
                0.08019758            0.29737790             0.01991495             0.11897419             0.05126834
              J_suicide             J_beat_wife J_parents_beating_children              J_violence
               -0.06738286            0.34287008             0.22100767             0.21392322
```

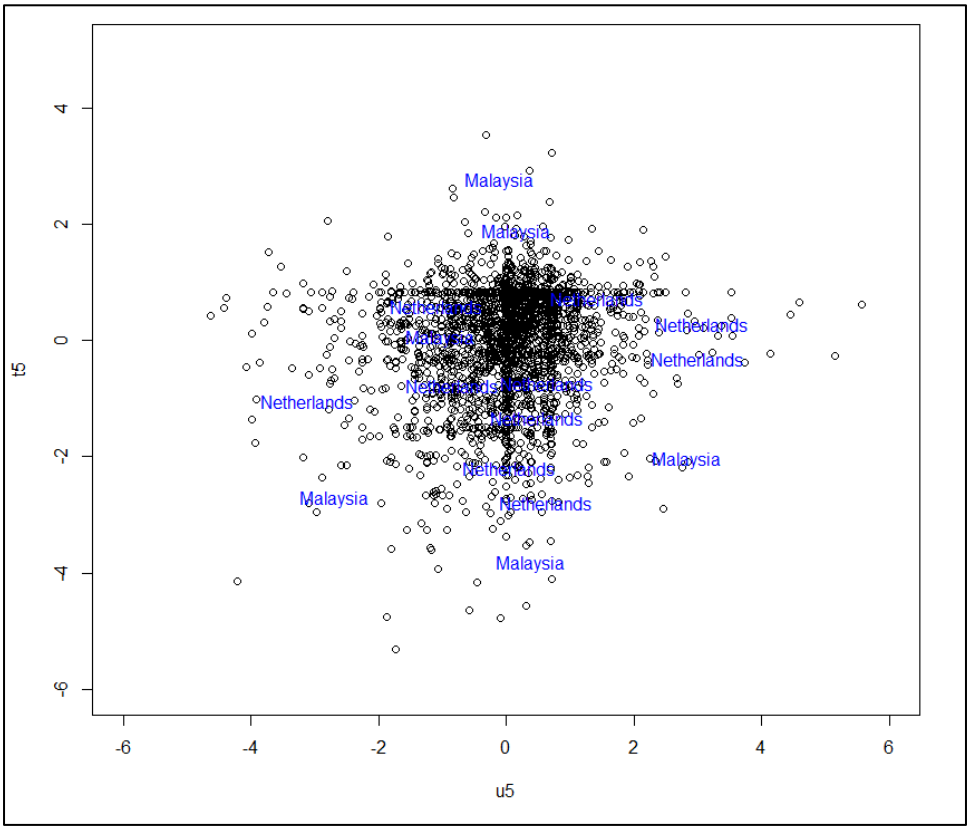


Figure 7: Fifth canonical variates

Differences between Malaysia and the Netherlands for the first canonical variate:

A high score for Malaysia on u_1 indicates a high importance of religion and a low occurrence of crimes in the neighborhood. The canonical loadings for Malaysia on u_1 and t_1 suggest that a high importance of religion and a low occurrence of crimes in the neighborhood have a low justifiability of financial fraud, sinful behavior and violence.

```
cancor.out.MY$structure$X.xscores[,1]
R_attend_religious_services                  R_pray          R_importance_God             CR_robberies                CR_alcohol
                 0.51064319              0.49054428              0.81998134              -0.05470109              -0.27198498
        CR_police_military       CR_racist_behavior             CR_drug_sale
                -0.39729302             -0.26120259              0.04884917
> cancor.out.MY$structure$Y.yscores[,1]
      J_claiming_benefits          J_avoiding_fare       J_stealing_property          J_cheating_taxes           J_accept_bribe
                -0.4725841              -0.4306319              -0.5441979              -0.5957924              -0.4490419
         J_homosexuality           J_prostitution               J_abortion               J_divorce     J_sex_before_marriage
                -0.7676113              -0.7364668              -0.6808088              -0.6446509              -0.8736122
               J_suicide             J_beat_wife J_parents_beating_children              J_violence
                -0.6272308              -0.4625345              -0.1431410              -0.5516939
```

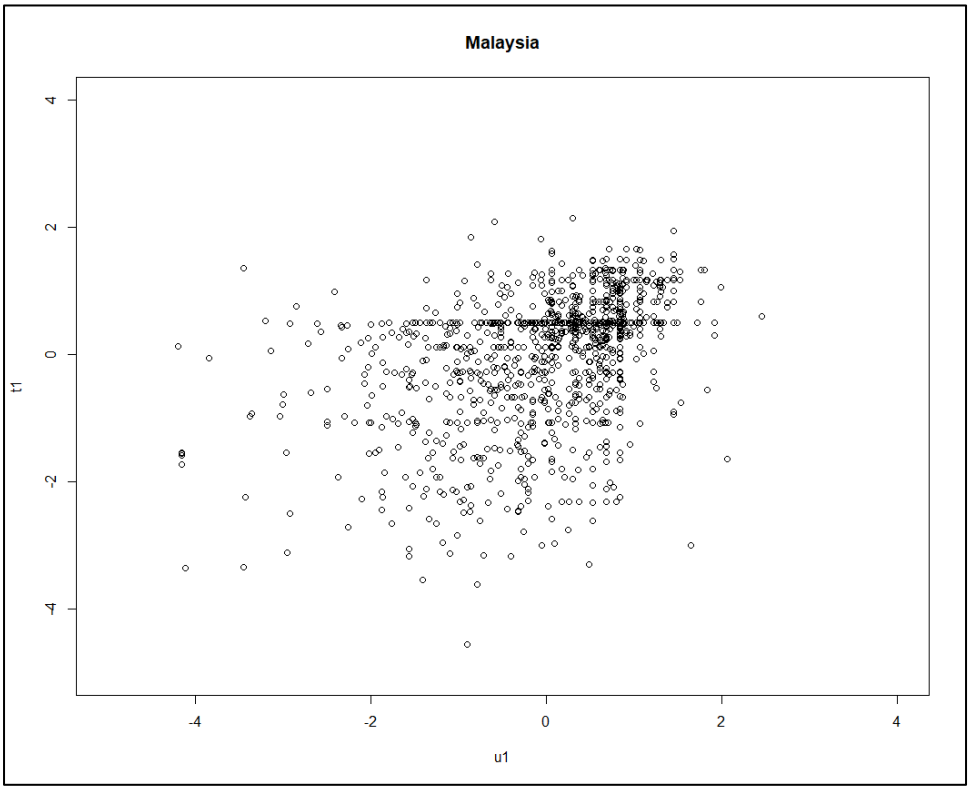


Figure 8: First canonical variate for Malaysia

A high score for The Netherlands on u1 indicates a low importance of religion and a low inference of police/military and robberies in the neighborhood. The canonical loadings for The Netherlands on u1 and t1 suggest that a low importance of religion and a low inference of police/military in the neighborhood have a high justifiability of sinful behavior.

```
cancor.out.NL$structure$X.xscores[,1]
R_attend_religious_services                  R_pray          R_importance_God             CR_robberies                CR_alcohol
                -0.93023094             -0.84679726             -0.85690975              -0.12949342               0.02041444
        CR_police_military       CR_racist_behavior             CR_drug_sale
                -0.21567692             -0.11631245             -0.09512180
> cancor.out.NL$structure$Y.yscores[,1]
      J_claiming_benefits          J_avoiding_fare       J_stealing_property          J_cheating_taxes           J_accept_bribe
              -0.068721920             0.123744170             -0.045292413             0.104058978              0.024226202
         J_homosexuality           J_prostitution               J_abortion               J_divorce     J_sex_before_marriage
                0.547370868             0.574661872             0.850269459              0.709175345              0.859925173
               J_suicide             J_beat_wife J_parents_beating_children              J_violence
                0.540463708            -0.060248751            -0.130547277             -0.003629368
```

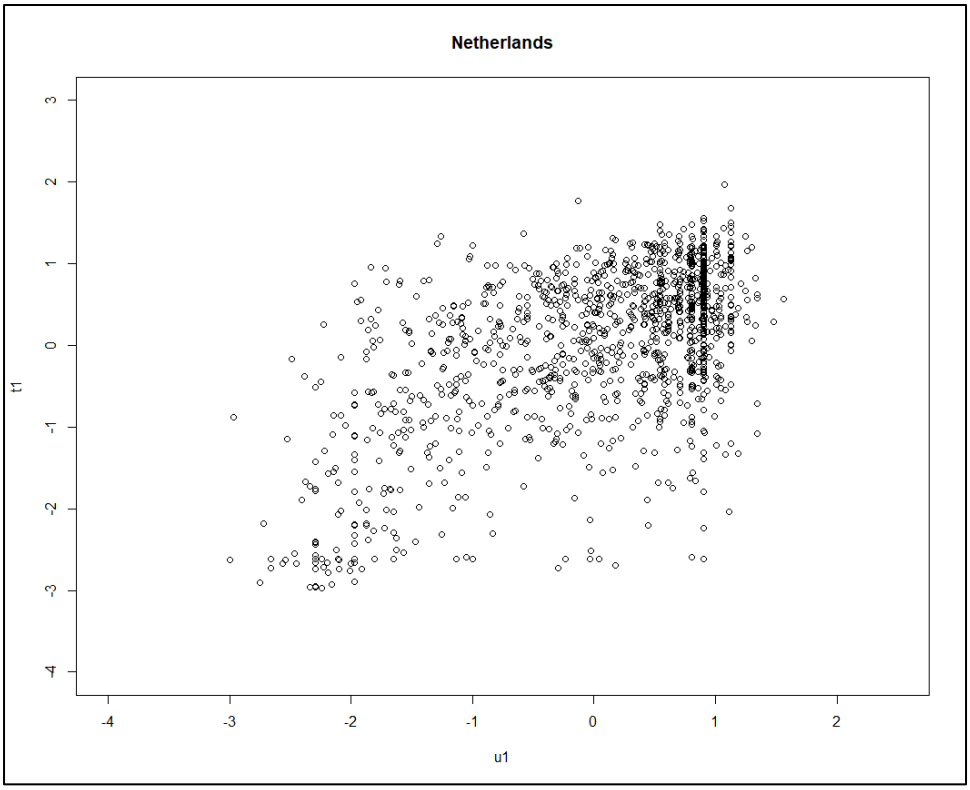


Figure 9: Firsts canonical variate for The Netherlands

For the other factors there is no distinct difference between both countries.

5.5. Validity of Solution:

As CCA is sensitive to overfitting, we did validity of solution by spitting the data into calibration and validation set using split-half approach and conducted a CCA on both sets individually.

Results:

The estimated reliabilities of T1 to T5 are 0.976, 0.296, 0.043, 0.08 and 0.078. Clearly, it is only sufficient for T1. The diagonal elements of T2 and T3 are negative because the orientation of these variates have been flipped. We can see some of the off-diagonal correlations (in absolute terms) are rather smaller than the diagonal elements except correlation between T3, T5 and T5, T4.

```
> # Compute u* = Xa* and t* = Yb* - cononical variates of training set and coefficients of the validation set
> train.X2<-as.matrix(train_data[,1:8])%*%cancor.valid$coef$X
> train.Y2<-as.matrix(train_data[,9:22])%*%cancor.valid$coef$Y
> #R(T,T*) and R(U,U*)
> round(cor(train.Y1,train.Y2)[1:5,1:5],3)
       Ycan1  Ycan2  Ycan3  Ycan4  Ycan5
Ycan1  0.988  0.051 -0.056  0.050  0.014
Ycan2  0.042 -0.544 -0.213  0.202  0.143
Ycan3 -0.034 -0.199 -0.208  0.110 -0.725
Ycan4 -0.052  0.230 -0.084  0.283  0.241
Ycan5  0.002 -0.219 -0.383 -0.674  0.280
```

Figure 10: R (T, T*)

The estimated reliabilities of U1 to U5 is 0.990, 0.583, 0.297, 0.242 and 0.052. Hence, only sufficient for U1. As the orientation has been flipped for U2 and U3, therefore their correlations are negative. Off-diagonal elements' correlation is small than the diagonal elements except for U3, U5 and U5, U4 (in absolute terms).

```
> round(cor(train.X1,train.X2)[1:5,1:5],3)
       Xcan1  Xcan2  Xcan3  Xcan4  Xcan5
Xcan1  0.995  0.016 -0.055  0.013 -0.095
Xcan2  0.032 -0.764 -0.209  0.112 -0.121
Xcan3 -0.061 -0.011 -0.545  0.269 -0.671
Xcan4  0.008  0.093  0.111  0.492  0.200
Xcan5 -0.020 -0.211 -0.347 -0.625  0.229
```

Figure 11: R (U, U*)

The diagonal elements of R (U*, T*) is lower than R (U, T) indicating some amount of capitalization when estimating canonical correlations. Also, the off-diagonal elements are smaller than the diagonal elements in absolute terms.

```
> round(cor(train.X1,train.Y1)[1:5,1:5],3)
      Ycan1 Ycan2 Ycan3 Ycan4 Ycan5
Xcan1 0.773 0.000 0.000 0.000 0.000
Xcan2 0.000 0.227 0.000 0.000 0.000
Xcan3 0.000 0.000 0.213 0.000 0.000
Xcan4 0.000 0.000 0.000 0.163 0.000
Xcan5 0.000 0.000 0.000 0.000 0.147
> round(cor(train.X2,train.Y2)[1:5,1:5],3)
       Ycan1 Ycan2  Ycan3  Ycan4  Ycan5
Xcan1  0.761 0.039 -0.040  0.041  0.021
Xcan2  0.004 0.109  0.045 -0.009 -0.037
Xcan3 -0.038 0.079  0.058  0.017  0.068
Xcan4  0.003 0.009  0.002  0.093 -0.042
Xcan5 -0.073 0.022  0.019 -0.042  0.121
```

Figure 12: R (U*, T*) and R (U, T)

The off-diagonal elements of both R (U*, U*) and R (T*, T*) are close to 0 in absolute terms, hence the canonical variates are independent.

```
> #R(T*,T*) and R(U*,U*)
> round(cor(train.Y2,train.Y2)[1:5,1:5],3)
       Ycan1  Ycan2  Ycan3  Ycan4  Ycan5
Ycan1  1.000 -0.002  0.006  0.033  0.035
Ycan2 -0.002  1.000 -0.133 -0.082 -0.044
Ycan3  0.006 -0.133  1.000 -0.002 -0.023
Ycan4  0.033 -0.082 -0.002  1.000 -0.018
Ycan5  0.035 -0.044 -0.023 -0.018  1.000
> round(cor(train.X2,train.X2)[1:5,1:5],3)
       Xcan1  Xcan2  Xcan3  Xcan4  Xcan5
Xcan1  1.000 -0.042  0.019  0.014 -0.073
Xcan2 -0.042  1.000  0.012 -0.002  0.031
Xcan3  0.019  0.012  1.000 -0.057 -0.031
Xcan4  0.014 -0.002 -0.057  1.000  0.041
Xcan5 -0.073  0.031 -0.031  0.041  1.000
```

Figure 13 : R (T*, T*) and R (U*, U*)

Appendix 1

Question 4 : Structural Equation Models (SEM)

Malaysia

Summary

```
lavaan 0.6-7 ended normally after 43 iterations

  Estimator                                         ML
  Optimization method                           NLMINB
  Number of free parameters                         35

  Number of observations                          1213

Model Test User Model:

  Test statistic                              5397.818
  Degrees of freedom                               118
  P-value (Chi-square)                           0.000

Parameter Estimates:

  Standard errors                             Standard
  Information                                 Expected
  Information saturated (h1) model          Structured

Latent Variables:
                   Estimate  Std.Err  z-value  P(>|z|)
  relig =~
    R_pray            1.416    0.077   18.489    0.000
    R_importanc_Gd    0.700    0.055   12.644    0.000
    R_ttnd_rlgs_sr    1.261    0.074   17.117    0.000
  justif =~
    J_clamng_bnfts    1.000
    J_avoiding_far    0.972    0.049   19.662    0.000
    J_stlng_prprty    1.025    0.048   21.547    0.000
    J_cheating_txs    1.043    0.050   20.709    0.000
    J_accept_bribe    1.091    0.050   21.868    0.000
    J_homosexualty    1.079    0.047   22.731    0.000
    J_prostitution    1.193    0.048   24.860    0.000
    J_abortion        1.224    0.048   25.633    0.000
    J_divorce         1.174    0.053   22.185    0.000
    J_sex_bfr_mrrg    1.244    0.053   23.286    0.000
    J_suicide         1.210    0.046   26.130    0.000
    J_beat_wife       1.152    0.046   24.908    0.000
    J_prnts_btng_c    0.955    0.049   19.532    0.000
    J_violence        1.188    0.047   25.390    0.000

 Regressions:
                   Estimate  Std.Err  z-value  P(>|z|)
   justif ~
     relig           -0.298    0.053   -5.662    0.000

 Variances:
                   Estimate  Std.Err  z-value  P(>|z|)
     relig            1.000
    .justif           2.104    0.174   12.084    0.000
    .R_pray           1.557    0.185    8.427    0.000
    .R_importanc_Gd   2.217    0.101   22.019    0.000
    .R_ttnd_rlgs_sr   2.146    0.163   13.140    0.000
    .J_clamng_bnfts   3.278    0.137   23.986    0.000
    .J_avoiding_far   3.148    0.131   23.996    0.000
    .J_stlng_prprty   2.339    0.099   23.681    0.000
    .J_cheating_txs   2.913    0.122   23.842    0.000
    .J_accept_bribe   2.454    0.104   23.607    0.000
    .J_homosexualty   1.937    0.083   23.362    0.000
    .J_prostitution   1.211    0.055   22.145    0.000
    .J_abortion       0.906    0.043   21.122    0.000
    .J_divorce        2.633    0.112   23.526    0.000
    .J_sex_bfr_mrrg   2.215    0.096   23.154    0.000
    .J_suicide        0.668    0.033   19.983    0.000
    .J_beat_wife      1.109    0.050   22.097    0.000
    .J_prnts_btng_c   3.119    0.130   24.013    0.000
    .J_violence       0.959    0.045   21.513    0.000
```

Netherlands

Summary

```
lavaan 0.6-7 ended normally after 66 iterations

  Estimator                                         ML
  Optimization method                           NLMINB
  Number of free parameters                         35

  Number of observations                          1260

Model Test User Model:

  Test statistic                              4495.227
  Degrees of freedom                               118
  P-value (Chi-square)                           0.000

Parameter Estimates:

  Standard errors                             Standard
  Information                                 Expected
  Information saturated (h1) model          Structured

Latent Variables:
                   Estimate  Std.Err  z-value  P(>|z|)
  relig =~
    R_pray            2.485    0.062   40.322    0.000
    R_importanc_Gd    2.713    0.075   36.258    0.000
    R_ttnd_rlgs_sr    1.490    0.044   33.730    0.000
  justif =~
    J_clamng_bnfts    1.000
    J_avoiding_far    1.283    0.113   11.351    0.000
    J_stlng_prprty    1.136    0.081   14.080    0.000
    J_cheating_txs    1.637    0.131   12.507    0.000
    J_accept_bribe    1.340    0.105   12.789    0.000
    J_homosexualty   -0.672    0.185   -3.638    0.000
    J_prostitution    0.314    0.172    1.823    0.068
    J_abortion       -0.070    0.172   -0.406    0.685
    J_divorce        -0.271    0.152   -1.781    0.075
    J_sex_bfr_mrrg   -0.393    0.144   -2.729    0.006
    J_suicide         0.240    0.184    1.305    0.192
    J_beat_wife       1.316    0.095   13.898    0.000
    J_prnts_btng_c    1.753    0.134   13.102    0.000
    J_violence        1.583    0.114   13.874    0.000

Regressions:
                   Estimate  Std.Err  z-value  P(>|z|)
  justif ~
    relig             0.000    0.017    0.027    0.979

  Variances:
                   Estimate  Std.Err  z-value  P(>|z|)
     relig            1.000
    .justif           0.272    0.035    7.744    0.000
    .R_pray           1.147    0.113   10.113    0.000
    .R_importanc_Gd   2.719    0.165   16.527    0.000
    .R_ttnd_rlgs_sr   1.151    0.059   19.462    0.000
    .J_clamng_bnfts   1.028    0.044   23.554    0.000
    .J_avoiding_far   1.772    0.075   23.624    0.000
    .J_stlng_prprty   0.399    0.020   19.904    0.000
    .J_cheating_txs   1.858    0.081   22.802    0.000
    .J_accept_bribe   1.105    0.049   22.506    0.000
    .J_homosexualty   9.005    0.360   25.020    0.000
    .J_prostitution   8.166    0.326   25.081    0.000
    .J_abortion       8.250    0.329   25.099    0.000
    .J_divorce        6.360    0.254   25.082    0.000
    .J_sex_bfr_mrrg   5.605    0.224   25.056    0.000
    .J_suicide        9.344    0.372   25.090    0.000
    .J_beat_wife      0.603    0.029   20.490    0.000
    .J_prnts_btng_c   1.640    0.074   22.107    0.000
    .J_violence       0.886    0.043   20.560    0.000
```

Malaysia **Standardized Solution**

	lhs	op	rhs	est.std	se	z	pvalue	ci.lower	ci.upper
1	relig	=~	R_pray	0.750	0.035	21.553	0	0.682	0.819
2	relig	=~	R_importance_God	0.426	0.031	13.910	0	0.366	0.486
3	relig	=~	R_attend_religious_services	0.652	0.033	19.892	0	0.588	0.717
4	justif	=~	J_claiming_benefits	0.633	0.018	35.621	0	0.598	0.668
5	justif	=~	J_avoiding_fare	0.630	0.018	35.220	0	0.595	0.665
6	justif	=~	J_stealing_property	0.705	0.015	46.852	0	0.675	0.734
7	justif	=~	J_cheating_taxes	0.671	0.016	40.991	0	0.639	0.703
8	justif	=~	J_accept_bribe	0.718	0.015	49.498	0	0.689	0.746
9	justif	=~	J_homosexuality	0.754	0.013	58.090	0	0.729	0.779
10	justif	=~	J_prostitution	0.849	0.009	97.987	0	0.832	0.866
11	justif	=~	J_abortion	0.885	0.007	128.800	0	0.872	0.899
12	justif	=~	J_divorce	0.731	0.014	52.370	0	0.704	0.758
13	justif	=~	J_sex_before_marriage	0.778	0.012	65.185	0	0.755	0.801
14	justif	=~	J_suicide	0.910	0.006	160.558	0	0.899	0.921
15	justif	=~	J_beat_wife	0.851	0.009	99.480	0	0.834	0.868
16	justif	=~	J_parents_beating_children	0.625	0.018	34.594	0	0.590	0.660
17	justif	=~	J_violence	0.874	0.007	117.298	0	0.859	0.888
18	justif	~	relig	-0.201	0.034	-5.902	0	-0.268	-0.135
19	relig	~~	relig	1.000	0.000	NA	NA	1.000	1.000
20	justif	~~	justif	0.959	0.014	69.773	0	0.932	0.986
21	R_pray	~~	R_pray	0.437	0.052	8.365	0	0.335	0.539
22	R_importance_God	~~	R_importance_God	0.819	0.026	31.451	0	0.768	0.870
23	R_attend_religious_services	~~	R_attend_religious_services	0.574	0.043	13.428	0	0.491	0.658
24	J_claiming_benefits	~~	J_claiming_benefits	0.599	0.023	26.619	0	0.555	0.643
25	J_avoiding_fare	~~	J_avoiding_fare	0.603	0.023	26.758	0	0.559	0.647
26	J_stealing_property	~~	J_stealing_property	0.504	0.021	23.759	0	0.462	0.545
27	J_cheating_taxes	~~	J_cheating_taxes	0.550	0.022	25.043	0	0.507	0.593
28	J_accept_bribe	~~	J_accept_bribe	0.485	0.021	23.283	0	0.444	0.526
29	J_homosexuality	~~	J_homosexuality	0.431	0.020	22.042	0	0.393	0.470
30	J_prostitution	~~	J_prostitution	0.280	0.015	19.014	0	0.251	0.308
31	J_abortion	~~	J_abortion	0.216	0.012	17.739	0	0.192	0.240
32	J_divorce	~~	J_divorce	0.466	0.020	22.822	0	0.426	0.506
33	J_sex_before_marriage	~~	J_sex_before_marriage	0.395	0.019	21.261	0	0.358	0.431
34	J_suicide	~~	J_suicide	0.172	0.010	16.701	0	0.152	0.192
35	J_beat_wife	~~	J_beat_wife	0.276	0.015	18.941	0	0.247	0.304
36	J_parents_beating_children	~~	J_parents_beating_children	0.609	0.023	26.981	0	0.565	0.654
37	J_violence	~~	J_violence	0.237	0.013	18.168	0	0.211	0.262

Netherlands **Standardized Solution**

	lhs	op	rhs	est.std	se	z	pvalue	ci.lower	ci.upper
1	relig	=~	R_pray	0.918	0.009	103.231	0.000	0.901	0.936
2	relig	=~	R_importance_God	0.855	0.010	81.707	0.000	0.834	0.875
3	relig	=~	R_attend_religious_services	0.812	0.012	68.813	0.000	0.788	0.835
4	justif	=~	J_claiming_benefits	0.457	0.026	17.835	0.000	0.407	0.508
5	justif	=~	J_avoiding_fare	0.449	0.026	17.378	0.000	0.398	0.500
6	justif	=~	J_stealing_property	0.684	0.019	35.724	0.000	0.646	0.722
7	justif	=~	J_cheating_taxes	0.531	0.024	22.348	0.000	0.484	0.577
8	justif	=~	J_accept_bribe	0.554	0.023	23.962	0.000	0.508	0.599
9	justif	=~	J_homosexuality	-0.116	0.031	-3.754	0.000	-0.177	-0.055
10	justif	=~	J_prostitution	0.057	0.031	1.837	0.066	-0.004	0.118
11	justif	=~	J_abortion	-0.013	0.031	-0.406	0.685	-0.074	0.049
12	justif	=~	J_divorce	-0.056	0.031	-1.794	0.073	-0.117	0.005
13	justif	=~	J_sex_before_marriage	-0.086	0.031	-2.777	0.005	-0.147	-0.025
14	justif	=~	J_suicide	0.041	0.031	1.310	0.190	-0.020	0.102
15	justif	=~	J_beat_wife	0.662	0.020	33.382	0.000	0.623	0.701
16	justif	=~	J_parents_beating_children	0.581	0.022	26.031	0.000	0.537	0.625
17	justif	=~	J_violence	0.659	0.020	33.096	0.000	0.620	0.698
18	justif	~	relig	0.001	0.033	0.027	0.979	-0.063	0.065
19	relig	~~	relig	1.000	0.000	NA	NA	1.000	1.000
20	justif	~~	justif	1.000	0.000	17493.679	0.000	1.000	1.000
21	R_pray	~~	R_pray	0.157	0.016	9.592	0.000	0.125	0.189
22	R_importance_God	~~	R_importance_God	0.270	0.018	15.089	0.000	0.235	0.305
23	R_attend_religious_services	~~	R_attend_religious_services	0.341	0.019	17.836	0.000	0.304	0.379
24	J_claiming_benefits	~~	J_claiming_benefits	0.791	0.023	33.729	0.000	0.745	0.837
25	J_avoiding_fare	~~	J_avoiding_fare	0.798	0.023	34.409	0.000	0.753	0.844
26	J_stealing_property	~~	J_stealing_property	0.532	0.026	20.319	0.000	0.481	0.584
27	J_cheating_taxes	~~	J_cheating_taxes	0.718	0.025	28.515	0.000	0.669	0.768
28	J_accept_bribe	~~	J_accept_bribe	0.694	0.026	27.120	0.000	0.643	0.744
29	J_homosexuality	~~	J_homosexuality	0.987	0.007	137.636	0.000	0.972	1.001
30	J_prostitution	~~	J_prostitution	0.997	0.004	279.190	0.000	0.990	1.004
31	J_abortion	~~	J_abortion	1.000	0.001	1261.007	0.000	0.998	1.001
32	J_divorce	~~	J_divorce	0.997	0.003	285.730	0.000	0.990	1.004
33	J_sex_before_marriage	~~	J_sex_before_marriage	0.993	0.005	185.237	0.000	0.982	1.003
34	J_suicide	~~	J_suicide	0.998	0.003	390.989	0.000	0.993	1.003
35	J_beat_wife	~~	J_beat_wife	0.562	0.026	21.388	0.000	0.510	0.613
36	J_parents_beating_children	~~	J_parents_beating_children	0.663	0.026	25.567	0.000	0.612	0.713
37	J_violence	~~	J_violence	0.565	0.026	21.525	0.000	0.514	0.617

Malaysia Fitmeasures

chisq	df	pvalue	cfi	tli	rmsea	srmr
5397.818	118.000	0.000	0.707	0.662	0.192	0.110

Netherlands Fitmeasures

chisq	df	pvalue	cfi	tli	rmsea	srmr
4495.227	118.000	0.000	0.504	0.428	0.172	0.210

Malaysia

Some of the Modification Indices

lhs	op	rhs	mi	epc	sepc.lv	sepc.all	sepc.nox
relig	=~	J_claiming_benefits	0.027	-0.011	-0.011	-0.005	-0.005
relig	=~	J_avoiding_fare	2.888	0.108	0.108	0.047	0.047
relig	=~	J_stealing_property	0.162	0.022	0.022	0.010	0.010
relig	=~	J_cheating_taxes	2.876	-0.104	-0.104	-0.045	-0.045
relig	=~	J_accept_bribe	10.061	0.180	0.180	0.080	0.080
relig	=~	J_homosexuality	15.432	-0.199	-0.199	-0.094	-0.094
relig	=~	J_prostitution	9.839	-0.129	-0.129	-0.062	-0.062
relig	=~	J_abortion	3.298	-0.066	-0.066	-0.032	-0.032
relig	=~	J_divorce	34.141	-0.344	-0.344	-0.145	-0.145
relig	=~	J_sex_before_marriage	51.057	-0.389	-0.389	-0.164	-0.164
relig	=~	J_suicide	8.004	0.091	0.091	0.046	0.046
relig	=~	J_beat_wife	15.427	0.155	0.155	0.077	0.077
relig	=~	J_parents_beating_children	13.508	0.233	0.233	0.103	0.103
relig	=~	J_violence	30.189	0.204	0.204	0.101	0.101
justif	=~	R_pray	49.403	0.295	0.436	0.231	0.231
justif	=~	R_importance_God	61.127	-0.251	-0.372	-0.226	-0.226
justif	=~	R_attend_religious_services	4.287	-0.080	-0.119	-0.062	-0.062
R_pray	~~	R_importance_God	4.287	0.446	0.446	0.240	0.240
R_pray	~~	R_attend_religious_services	61.133	4.521	4.521	2.474	2.474
R_pray	~~	J_claiming_benefits	0.540	-0.062	-0.062	-0.027	-0.027
R_pray	~~	J_avoiding_fare	1.477	0.100	0.100	0.045	0.045
R_pray	~~	J_stealing_property	0.669	0.059	0.059	0.031	0.031
R_pray	~~	J_cheating_taxes	0.064	0.020	0.020	0.009	0.009
R_pray	~~	J_accept_bribe	1.598	0.093	0.093	0.048	0.048
R_pray	~~	J_homosexuality	10.077	-0.208	-0.208	-0.120	-0.120
R_pray	~~	J_prostitution	0.826	-0.048	-0.048	-0.035	-0.035
R_pray	~~	J_abortion	1.469	-0.057	-0.057	-0.048	-0.048
R_pray	~~	J_divorce	7.583	-0.210	-0.210	-0.104	-0.104
R_pray	~~	J_sex_before_marriage	10.941	-0.233	-0.233	-0.125	-0.125
R_pray	~~	J_suicide	4.136	0.084	0.084	0.083	0.083
R_pray	~~	J_beat_wife	5.143	0.116	0.116	0.088	0.088
R_pray	~~	J_parents_beating_children	13.799	0.305	0.305	0.138	0.138
R_pray	~~	J_violence	13.684	0.178	0.178	0.145	0.145
R_importance_God	~~	R_attend_religious_services	49.404	-1.295	-1.295	-0.594	-0.594
R_importance_God	~~	J_claiming_benefits	3.740	0.157	0.157	0.058	0.058
R_importance_God	~~	J_avoiding_fare	1.233	-0.088	-0.088	-0.033	-0.033
R_importance_God	~~	J_stealing_property	2.496	-0.109	-0.109	-0.048	-0.048
R_importance_God	~~	J_cheating_taxes	0.801	-0.069	-0.069	-0.027	-0.027
R_importance_God	~~	J_accept_bribe	0.425	-0.046	-0.046	-0.020	-0.020
R_importance_God	~~	J_homosexuality	28.882	-0.340	-0.340	-0.164	-0.164
R_importance_God	~~	J_prostitution	2.020	-0.073	-0.073	-0.044	-0.044
R_importance_God	~~	J_abortion	5.402	0.105	0.105	0.074	0.074
R_importance_God	~~	J_divorce	8.601	0.215	0.215	0.089	0.089
R_importance_God	~~	J_sex_before_marriage	8.221	-0.195	-0.195	-0.088	-0.088
R_importance_God	~~	J_suicide	1.568	-0.050	-0.050	-0.041	-0.041
R_importance_God	~~	J_beat_wife	2.516	0.078	0.078	0.050	0.050
R_importance_God	~~	J_parents_beating_children	3.431	0.147	0.147	0.056	0.056
R_importance_God	~~	J_violence	1.757	-0.061	-0.061	-0.042	-0.042
R_attend_religious_services	~~	J_claiming_benefits	0.233	-0.042	-0.042	-0.016	-0.016
R_attend_religious_services	~~	J_avoiding_fare	1.292	0.098	0.098	0.038	0.038
R_attend_religious_services	~~	J_stealing_property	0.193	0.033	0.033	0.015	0.015

Netherlands

Some of the Modification Indices

lhs	op	rhs	mi	epc	sepc.lv	sepc.all	sepc.nox
relig	=~	J_claiming_benefits	0.313	0.017	0.017	0.015	0.015
relig	=~	J_avoiding_fare	15.917	-0.162	-0.162	-0.109	-0.109
relig	=~	J_stealing_property	0.249	-0.010	-0.010	-0.012	-0.012
relig	=~	J_cheating_taxes	10.171	-0.135	-0.135	-0.084	-0.084
relig	=~	J_accept_bribe	2.823	-0.055	-0.055	-0.044	-0.044
relig	=~	J_homosexuality	107.175	-0.919	-0.919	-0.304	-0.304
relig	=~	J_prostitution	130.445	-0.965	-0.965	-0.337	-0.337
relig	=~	J_abortion	288.367	-1.441	-1.441	-0.502	-0.502
relig	=~	J_divorce	190.365	-1.028	-1.028	-0.407	-0.407
relig	=~	J_sex_before_marriage	282.981	-1.178	-1.178	-0.496	-0.496
relig	=~	J_suicide	123.765	-1.005	-1.005	-0.328	-0.328
relig	=~	J_beat_wife	1.299	0.029	0.029	0.028	0.028
relig	=~	J_parents_beating_children	8.526	0.118	0.118	0.075	0.075
relig	=~	J_violence	0.208	-0.014	-0.014	-0.011	-0.011
justif	=~	R_pray	0.093	-0.029	-0.015	-0.006	-0.006
justif	=~	R_importance_God	1.025	-0.117	-0.061	-0.019	-0.019
justif	=~	R_attend_religious_services	2.330	0.109	0.057	0.031	0.031
R_pray	~~	R_importance_God	2.256	290.994	290.994	164.742	164.742
R_pray	~~	R_attend_religious_services	1.121	-100.057	-100.057	-87.061	-87.061
R_pray	~~	J_claiming_benefits	0.002	0.002	0.002	0.002	0.002
R_pray	~~	J_avoiding_fare	2.027	-0.082	-0.082	-0.057	-0.057
R_pray	~~	J_stealing_property	0.425	-0.019	-0.019	-0.028	-0.028
R_pray	~~	J_cheating_taxes	0.149	0.023	0.023	0.016	0.016
R_pray	~~	J_accept_bribe	0.256	-0.023	-0.023	-0.021	-0.021
R_pray	~~	J_homosexuality	0.016	-0.016	-0.016	-0.005	-0.005
R_pray	~~	J_prostitution	0.854	-0.111	-0.111	-0.036	-0.036
R_pray	~~	J_abortion	2.179	-0.179	-0.179	-0.058	-0.058
R_pray	~~	J_divorce	0.844	-0.098	-0.098	-0.036	-0.036
R_pray	~~	J_sex_before_marriage	1.116	-0.106	-0.106	-0.042	-0.042
R_pray	~~	J_suicide	0.151	-0.050	-0.050	-0.015	-0.015
R_pray	~~	J_beat_wife	0.000	-0.001	-0.001	-0.001	-0.001
R_pray	~~	J_parents_beating_children	0.917	0.054	0.054	0.040	0.040
R_pray	~~	J_violence	0.155	0.017	0.017	0.017	0.017
R_importance_God	~~	R_attend_religious_services	0.056	-21.703	-21.703	-12.267	-12.267
R_importance_God	~~	J_claiming_benefits	0.860	0.052	0.052	0.031	0.031
R_importance_God	~~	J_avoiding_fare	0.479	-0.051	-0.051	-0.023	-0.023
R_importance_God	~~	J_stealing_property	0.003	0.002	0.002	0.002	0.002
R_importance_God	~~	J_cheating_taxes	1.100	-0.079	-0.079	-0.035	-0.035
R_importance_God	~~	J_accept_bribe	0.179	-0.025	-0.025	-0.014	-0.014
R_importance_God	~~	J_homosexuality	5.611	-0.381	-0.381	-0.077	-0.077
R_importance_God	~~	J_prostitution	2.503	-0.242	-0.242	-0.051	-0.051
R_importance_God	~~	J_abortion	18.033	-0.652	-0.652	-0.138	-0.138
R_importance_God	~~	J_divorce	7.840	-0.378	-0.378	-0.091	-0.091
R_importance_God	~~	J_sex_before_marriage	8.885	-0.378	-0.378	-0.097	-0.097
R_importance_God	~~	J_suicide	28.755	-0.877	-0.877	-0.174	-0.174
R_importance_God	~~	J_beat_wife	1.717	0.059	0.059	0.046	0.046
R_importance_God	~~	J_parents_beating_children	0.411	-0.046	-0.046	-0.022	-0.022
R_importance_God	~~	J_violence	2.331	-0.083	-0.083	-0.054	-0.054
R_attend_religious_services	~~	J_claiming_benefits	0.475	-0.024	-0.024	-0.022	-0.022
R_attend_religious_services	~~	J_avoiding_fare	0.118	-0.016	-0.016	-0.011	-0.011
R_attend_religious_services	~~	J_stealing_property	0.181	0.010	0.010	0.014	0.014