SEM_Exercise

Ashok Sekar

08/11/2016

Introduction

This document is about testing and performing Structural equation modeling with the Sense of Place(SOP) dataset. Earlier, factor analysis model for SOP was built that identified the significant dimentsions and indicators. Building on the factor model we build the SEM.

Datasets

For this analysis we depend on a dataset named *mainFile*. The file contains both the attitudinal responses, travel and socio-demographic characteristics. Note that for factor analysis the attitudinal responses for dimensions were used. For SEM we would be using attitudinal responses, travel and socio-demographic variables.

The mainFile was used to create two different files depending on how the missing values were treated. Numerous responses to SOP attitude questions were NA therefore we decided to convert the NA values to "4" being neutral. Note that NA means responders did not have any attitude towards that question. For the other file no changes were made. However, it is important to note that for our analysis we use the dataset that has NA values converted to 4. The code for the data preperation is not shown here.

Factor Analysis Results

As discussed earlier, we use the results from factor analysis to start building the simple structural equation models. For simplicity, we look at the final factor structure for RPM, which is given in Figure 1. Based on the figure we know of the 6 dimensions dependence and identity does not explain the factor structure. Therefore indicators associated with those dimensions are not necessary. Additionally, many other indicators of each dimensions present in SOP structure are missing, which are also unnecessary. In the *workingFile* generated to do the analysis, the indicators are removed and structures are set based on the factor structure shown in the figure.

The indicators to be included for RPM are:

1. Social: friend, family, atmosphere
2. Satisfaction: food, amenities, entertainment, people, motor vehicle parking, bicycle parking, bike/walking access, transit access.
3. Attachment: happy, dissapointed, connected
4. Aesthetics: architecture, artistic, beau

In addition if any indicators are negatively worded are switched to positive.

Experimental Model:

This is my first experimental model using *SEM* package. I used SEM package because it seemed easy to set arrows with this package. This is followed by using Lavaan based *semPlot* package for visualizing the path
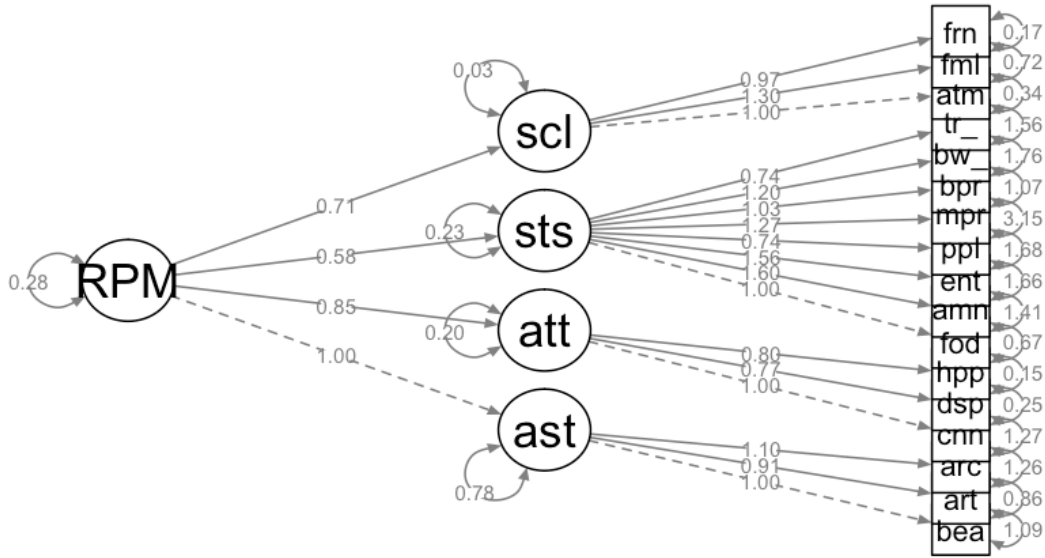
Figure 1: Factor Structure for Rochester Public Market

diagram. In this simple model, a regression model is set up between number of vehicles in a household and the number of drivers with valid driver's license. The estimate is saved as the variable *pi* and the variance are recorded as *var1* and *var2*. Because we are using the *SEM* package the factor structure for RPM is again evaluated using *SEM* package. The same result was identified. To keep the document simple I have not added the results below.

RPM

The following section documents the experiments to find the factor structure for RPM. We test for significance of each demographic variable with one sense of place dimension before moving to the other dimensions. Based on the results from the combination of tests a final model for RPM will be presented.

List of dimensions and the factor structure are already discussed earlier. Check Figure 1.

Satisfaction - AGE

The figure below (Figure 3) shows the only significant model for age in satisfaction structure of RPM. Trail and error method was used to identify the significant variable.

Satisfaction - Gender

Follow the same procedure as above but for gender. However gender was not a significant variable therefore they will not be included.

Satisfaction - How long did the visitor live in rochester

In this experiment all the variables were found insignificant **unfortunately**.

Satisfaction - Income

None of the income variables were significant. Although some of the income groups were close to significance with $zvalue = 1.4$.

Satisfaction - number of household members

Notes: there seems to be an interactio nbetween *hhmem_1* and *hhmem_2*. When running the model seperately with *hhmem_1* we get a significant value for *hhmem_1*. When I run *hhmem_1* and*hhmem_2* together *hhmem_1* becomes insignificant, while *hhmem_2* is significant. when i run *hhmem_2* seperately, *hhmem_2* is significant. In addition to these two values *hhmem_5ormore* was also significant. When i ran a model with *hhmem_2 and hhmem_5* together *hhmem_5ormore* became insignificant. Therefore from this point forward variable *hhmem_2* will be included while the other two that were significant independently will be given further inspection later.

Satisfaction - number of household members employed full time employed

In this experiment people with 1 fulltime employed household member seemed to be a signifcant indicator of satisfaction.

Satisfaction - number of children in household

In this experiment no significant variables were found.

Satisfaction - realtionship with household members

In this experiment people who were living immedialtely with family were significant in explaining satisfaction.

```
## NOTE: it is generally simpler to use specifyEquations() or cfa()
##       see ?specifyEquations


##
##  Model Chisquare =  86.53709   Df =  54 Pr(>Chisq) = 0.003257584
##  AIC =  134.5371
##  BIC =  -177.9463
##
##  Normalized Residuals
##     Min.  1st Qu.  Median    Mean 3rd Qu.    Max.
## -2.14700 -0.69620 -0.04682 -0.04268  0.38680  2.91900
##
##  R-square for Endogenous Variables
##          sat          food          amn          ent          ppl
##       0.1760        0.3318        0.4280        0.3057        0.0780
##       mopark        bipark biwalk_access  trnst_access
##       0.1421        0.2268        0.1999        0.1077
```

```
## 
##   Parameter Estimates
##        Estimate   Std Error  z value   Pr(>|z|)
## pi2    1.70309726 0.34491471  4.937734 7.903536e-07
## pi3    1.50007975 0.33333915  4.500161 6.790212e-06
## pi4    0.66014417 0.25217103  2.617843 8.848749e-03
## pi5    1.25396195 0.37002403  3.388866 7.018223e-04
## pi6    0.98309488 0.24196175  4.063018 4.844234e-05
## pi7    1.15880222 0.29889969  3.876893 1.057987e-04
## pi8    0.74957604 0.24846746  3.016798 2.554604e-03
## var1   0.27578562 0.09108802  3.027683 2.464367e-03
## err1   0.67412536 0.10081071  6.687041 2.277275e-11
## err2   1.29737918 0.21831118  5.942798 2.801983e-09
## err3   1.71088586 0.24955238  6.855819 7.090527e-12
## err4   1.72485361 0.21809353  7.908780 2.599244e-15
## err5   3.17685272 0.41412254  7.671287 1.702794e-14
## err6   1.10265309 0.15117128  7.294065 3.007408e-13
## err7   1.79915359 0.24236984  7.423174 1.143460e-13
## err8   1.55755277 0.19960838  7.803043 6.043189e-15
## fi4    0.59833856 0.20936941  2.857813 4.265720e-03
## err22  0.08214566 0.01007335  8.154753 3.498936e-16
## fi28   0.17292975 0.11274997  1.533746 1.250923e-01
## err44  0.25047699 0.03071546  8.154753 3.498936e-16
## fi34  -0.22927826 0.12502493 -1.833860 6.667472e-02
## err50  0.20788911 0.02549300  8.154753 3.498936e-16
## fi49   0.22481080 0.12171644  1.847004 6.474651e-02
## err65  0.21956010 0.02692419  8.154753 3.498936e-16
##
## pi2   amn <--- sat
## pi3   ent <--- sat
## pi4   ppl <--- sat
## pi5   mopark <--- sat
## pi6   bipark <--- sat
## pi7   biwalk_access <--- sat
## pi8   trnst_access <--- sat
## var1  sat <--> sat
## err1  food <--> food
## err2  amn <--> amn
## err3  ent <--> ent
## err4  ppl <--> ppl
## err5  mopark <--> mopark
## err6  bipark <--> bipark
## err7  biwalk_access <--> biwalk_access
## err8  trnst_access <--> trnst_access
## fi4   sat <--- age_35to45
## err22 age_35to45 <--> age_35to45
## fi28  sat <--- hhmem_2
## err44 hhmem_2 <--> hhmem_2
## fi34  sat <--- emp_ft_1
## err50 emp_ft_1 <--> emp_ft_1
## fi49  sat <--- rltnHHmem_family
## err65 rltnHHmem_family <--> rltnHHmem_family
##
##   Iterations =  28
```