

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 dimensions 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 preparation 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, dissatisfied, 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

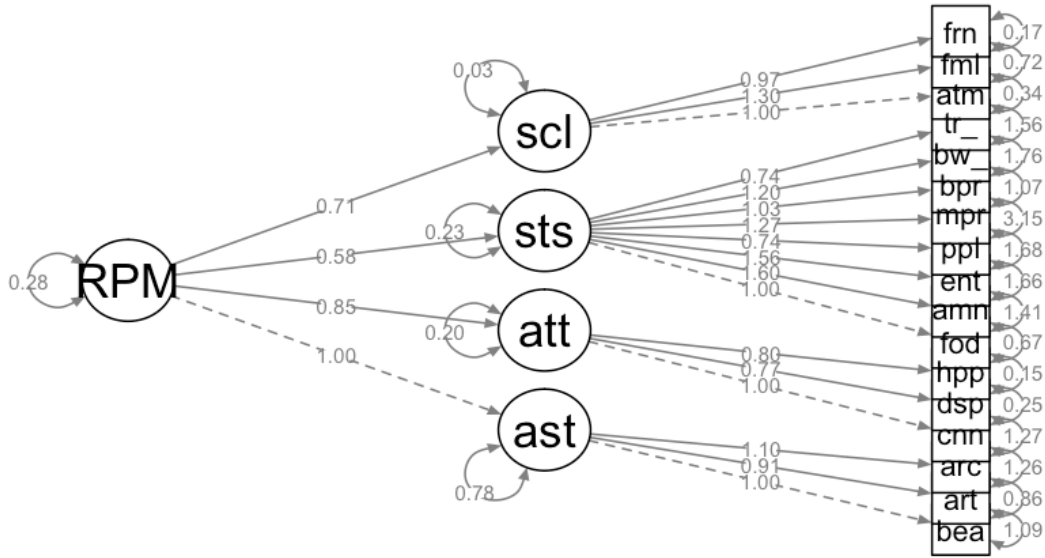


Figure 1: Factor Structure for Rochester Public Market

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.

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

```
## Warning in sem.semmod(model.RPM.sat.gender, data = newds): The following observed variables are in t
## female
```

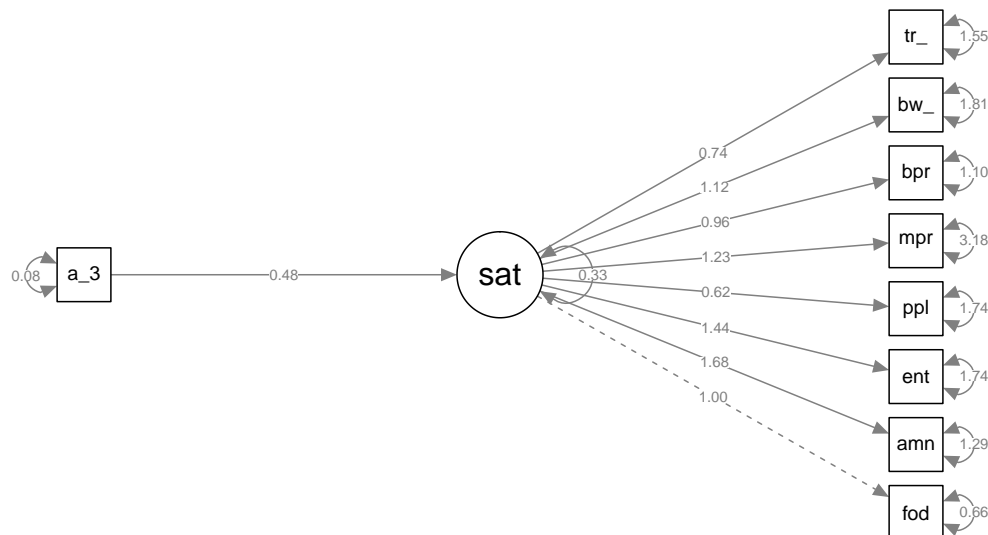


Figure 2: SEM model for RPM with satisfaction and age between 35 to 45

```
##
## Model Chisquare = 52.13204 Df = 27 Pr(>Chisq) = 0.002557811
## AIC = 88.13204
## BIC = -80.10963
##
## Normalized Residuals
##      Min.      1st Qu.      Median      Mean      3rd Qu.      Max.
## -1.6890000 -0.3341000 -0.0000014  0.0548400  0.4454000  2.4310000
##
## R-square for Endogenous Variables
##      sat      food      amn      ent      ppl
## 0.0543 0.3431 0.4289 0.2900 0.0705
## mopark bipark biwalk_access trnst_access
## 0.1404 0.2256 0.1942 0.1085
##
## Parameter Estimates
##      Estimate Std Error z value Pr(>|z|)
## pi2 1.67534130 0.34395885 4.870761 1.111693e-06
## pi3 1.43702745 0.32769152 4.385306 1.158231e-05
## pi4 0.61841842 0.24921042 2.481511 1.308267e-02
## pi5 1.22729575 0.36685558 3.345447 8.215018e-04
```

```

## pi6    0.96484807 0.23987395 4.022313 5.762943e-05
## pi7    1.12419997 0.29551862 3.804160 1.422865e-04
## pi8    0.74104842 0.24682328 3.002344 2.679092e-03
## var1   0.32582369 0.10577708 3.080286 2.068017e-03
## err1   0.65968163 0.10156005 6.495483 8.276732e-11
## err2   1.28779020 0.22306456 5.773173 7.779269e-09
## err3   1.74218749 0.25383388 6.863495 6.719598e-12
## err4   1.73694020 0.21934143 7.918888 2.396445e-15
## err5   3.17693627 0.41557713 7.644637 2.095357e-14
## err6   1.10093889 0.15208503 7.238970 4.521063e-13
## err7   1.80697463 0.24421098 7.399236 1.369703e-13
## err8   1.55381631 0.19984014 7.775296 7.527100e-15
## fi4    0.47716087 0.21524310 2.216846 2.663360e-02
## err22  0.08214566 0.01007335 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
##
## Iterations = 23

```

Satisfaction - How long did the visitor live in rochester

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