A Multilevel Structural Equation Model on the Social Axioms

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Effects of culture

- Hofstede (1980): culture as “the collective programming of the mind which distinguishes the members of one human group from another”

- People within the same culture share similar languages, beliefs, values and other psychological attributes

- People are nested within cultures in a multilevel perspective

- Key issues:
  - What are cross-cultural differences?
  - Are there universal psychological processes across cultures?
Two approaches

Culture-level analysis: Hofstede (1980)
- Four cultural dimensions on work-related values, namely, individualism, power distance, uncertainty avoidance and masculinity

Individual-level analysis: Schwartz and Bilsky (1987)
- Fifty-six values that could be grouped into ten board clusters (Schwartz value survey)
Availability of cross-cultural data

- Collecting large cross-cultural data sets becomes possible
- For instance,
  - Subjective well-being (Diener & Diener, 1995)
  - Work related values (Hofstede, 1980)
  - Leadership (House et al., 2002)
  - World values survey (Inglehart, Basañez, & Moreno, 1998)
  - Social values and attitudes (International Social Survey Program, 1997)
  - Schwartz value survey (Schwartz, & Sagie, 2000)
  - Social axioms (Leung et al., 2002)

- These large cross-cultural data sets provide much richer information than conventional two-country comparison.
Problems/Opportunities in large cross-cultural data?

**Problems:**
- Data are non-independent (Raudenbush & Bryk, 2002)
- Both individual-level and culture-level analyses are incomplete

**Opportunities:**
- More realistic conceptualization of theories on cultures and people within cultures (Chao, 2000)
- Enable researchers to develop theories capturing the dynamic processes at different levels (Klein, Tosi, & Cannella, 1999)
Two objectives of the present study

1. **Methodology**: Propose to use structural equation modeling (SEM) to investigate cross-cultural differences

2. **Content**: Study the universality of the social axioms.
Structural equivalence of individual-level across cultures

- Structural equivalence: the same construct is measuring the same thing in different cultures (van de Vijver & Leung, 1997)

- If the measurement is equivalent, it has the same meaning and psychometric properties in another culture.

- EFA with procrustes or target rotations (van de Vijver & Leung, 1997)
An SEM approach

Cheung and Chan (2002) proposed a SEM approach, termed meta-analytic structural equation modeling (MASEM), to test the structural equivalence across studies.

- Step 1: Test the homogeneity of correlation matrices with multiple-group SEM
- Step 2: Test the proposed model

It performs better than averaging correlations (Hunter & Schmidt, 1990), averaging Fisher’s z scores (Hedges & Olkin, 1983) and Generalized Least Squares (Becker, 1992).
Functional equivalence across individual- and culture-levels

- Similarity of meaning at both levels as a prerequisite for cross-level comparison (van de Vijver & Poortinga, 2002).

- Functional equivalence: the constructs have similar correlates with other variables at both levels.

- EFA with procrustes or target rotations (van de Vijver & Poortinga, 2002)
**An SEM approach**

- Multilevel SEM (MSEM; Cheung & Au, in press) can be used to assess functional equivalence directly.
  - Separate models for the within- and between-data
  - If the same model fits well at both levels, the measurement is functional equivalent

\[
y_{gi} = y_g + y_w
\]

\[
\Sigma_T = \Sigma_B + \Sigma_W
\]
A study on the Social Axioms

Leung et al. (2002) initiated a project on social axioms or general beliefs.

Social axioms: the basic premises that people endorse and use to guide their behavior in different situations.

Five general factors at the individual level, namely, social cynicism, social complexity, reward for application, religiosity and fate control.
Social cynicism: e.g., “Powerful people tend to exploit others.”
Social complexity: e.g., “People may have opposite behaviors on different occasions.”
Reward for application: e.g., “Knowledge is necessary for success.”
Religiosity: e.g., “Belief in a religion helps one understand the meaning of life.”
Fate control: e.g., “Individual characteristics, such as appearance and birthday, affect one’s fate.”
Research questions

1. **Structural equivalence**: Is the five-factor model universal at the individual-level across cultures?
2. **Functional equivalence**: Is the meaning of the constructs the same at different levels?
Between structure

1\textsuperscript{st} order two-factor model at culture level

Between structure

2\textsuperscript{nd} order two-factor model at culture level
Method

Sample. 7,590 university students from 40 nations (Leung & Bond, 2004).

Items:
- Social cynicism: 11 items
- Social complexity: 6 items
- Reward for application: 9 items
- Religiosity: 7 items
- Fate control: 6 items
Statistical analyses

☑ Software
  - LISREL 8.54 (Jöreskog & Sörbom, 2003): implement the MASEM procedures proposed by Cheung and Chan (2002)
  - Mplus 3.01 (Muthén & Muthén, 2004): conduct MSEM

☑ Criteria to evaluate the models (Hu & Bentler, 1998)
  - TLI and CFI ≈ .95
  - RMSEA ≈ .06 and SRMR ≈ .08
Results: Structural equivalence

- *Meta-analytic SEM.*
  - **First stage:** Homogeneity of correlation matrices
    - $\chi^2(28,899, \ N=7,590) = 41,132, \ p < .0001$
    - RMSEA = 0.047
    - TLI = 0.79, CFI = 0.79
  - **Second stage:** Fitting a five-factor model
    - $\chi^2(692, \ N=7,590) = 6,653, \ p < .0001$
    - RMSEA = 0.034, SRMR = 0.046,
    - TLI = 0.68, CFI = 0.70.

- Contradicting findings between RMSEA and SRMR vs. TLI and CFI
Which ones to rely on?

Rigdon (1996):  
RMSEA (less sensitive to sample size and estimation methods) may be more appropriate sometimes

Browne et al. (2002):  
CFI and TLI may indicate a poor fit model but indeed not

RMSEA and SRMR are more appropriate in evaluating the models
Factor correlations

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- Our results show that the five-factor model fits at the individual-level across cultures.
- Most factors are uncorrelated.
Results: Functional equivalence

ICC

- Average intra-class correlation (ICC) for the variables is 0.12.
- People are more similar in the belief of social complexity (ICC=.07)
- People are more dissimilar in the belief of religiosity (ICC=.20)
Multilevel SEM

- **1st** order five-factor model:
  - Nonconvergence problem (no solution)

- **1st** order two-factor model:
  - RMSEA = 0.026, SRMR (between structure) = 0.152,
    SRMR (within structure) = 0.042
  - CFI = 0.77, TLI = 0.75
  - AIC = 780,372 and BIC = 781,800

- **2nd** order two-factor model:
  - RMSEA = 0.026, SRMR (between structure) = 0.148
    SRMR (within structure) = 0.042,
  - CFI = 0.77, TLI = 0.75
  - AIC = 780,292 and BIC = 781,749
The 2\textsuperscript{nd} order two-factor model fits a little bit better than the 1\textsuperscript{st} order two-factor model.

- Within model is better than the between model
Factor structure at culture level

- **Societal cynicism**: social cynicism
- **Dynamic externality**: social complexity, reward for application, religiosity and fate control
Conclusion on Social Axioms

- **Structural equivalence:**
  - Social axioms are structurally equivalent across 40 cultures

- **Functional equivalence:**
  - Cynicism shows strong functional equivalence at both levels
  - Other four factors are highly correlated at the country level while they are only slightly correlated at the individual level
Why not just EFA?

- *Exploratory vs. confirmatory research*
  - EFA for exploratory only
  - SEM can be used for both exploratory and confirmatory research, e.g., modification indexes and specification search

- *Measurement model vs. more sophisticated model*
  - EFA is only for measurement model
  - SEM can be used to test more sophisticated models, e.g., the 2nd order factor analysis model, binary and categorical variables
Conclusion

- The level issue is critical in building cross-cultural theory

- Structural and functional equivalence is essential in understanding how the psychological process operates at both levels

- SEM is a flexible modeling tool which is very useful in cross-cultural research
Selected References


Thank you!