**Educational Psychology 960**

**Problem Set 4**

**Multiple Group Factor Analysis and MIMC Modeling**

“Motivation and engagement can be regarded as the driving forces behind learning. Given the importance of mathematics for students’ future lives, school systems need to ensure that students have not only the knowledge that is necessary to continue learning mathematics beyond formal schooling, but also the interest and motivation that will make them want to do so. PISA distinguishes two forms of motivation to learn mathematics: students may learn mathematics because they enjoy it and find it interesting and/or because they perceive learning mathematics as useful. These two constructs are central in self-determination theory (Ryan and Deci, 2009) and expectancy-value theory (Wigfield, Tonks and Klauda, 2009).”

OECD (2013), “Students’ Derive and Motivation”, in PISA 2013 Results: Ready to Laern (Volume III): Students’ Engagement, Drive and Self Befliefs, OECD Publishing.

Q29 Thinking about your views on mathematics: to what extent do you agree with the following statements? (Please tick only one box in each row.)

Strongly agree (1)/ Agree (2)/ Disagree (3)/ Strongly disagree (4)

a) I enjoy reading about mathematics.

b) Making an effort in mathematics is worth it because it will help me in the work that I want to do later on.

c) I look forward to my mathematics lessons.

d) I do mathematics because I enjoy it.

e) Learning mathematics is worthwhile for me because it will improve my career.

f) I am interested in the things I learn in mathematics.

g) Mathematics is an important subject for me because I need it for what I want to study later on.

h) I will learn many things in mathematics that will help me get a job.

In the data set, CNT is country coded 1/0. This is to make the interpretation of the MIMIC model easier. Remember that CNT = 1 will be the reference group (the first group) in the multiple group models.

For this assignment, please do the following steps.

1. Conduct and EFA (using PA and promax rotation) and CFA (using lavaan) for each country separately and report the results. Missing is coded as 999. Please use listwise deletion for the EFA, and for the CFA please use FIML and MLR. To run these analyses separately, you can split the sample in R using the subset command and run the analyses on the separate samples. For example

pisaCNT1 <- subset(pisa, pisa$CNT == “1”)

pisaCNT0 <- subset(pisa, pisa$CNT == “0”)

2. Based on the number of factors chosen in step 2, conduct multiple group factor analysis including mean structure analysis in lavaan. This includes configural, metric, and scalar invariance tests. Report on changes in goodness-of-fit and discuss conclusions regarding measurement invariance for Country 1 and the Country 0. Be sure to discuss the factor mean differences between Country 1 and the Country 0.

3. Based on the number of factors chosen in step 2, estimate a MIMC model relating the factors to the country dummy variable. Discuss findings. Check modification indices for any direct effect of country on individual items, free paths if necessary and discuss the results with respect to changes from the initial MIMIC model. In particular, consider an explanation for any direct path you estimate.