Testing for Measurement Invariance with Many Groups

André Pirralha

2020-10-15

Contents

Chapter 1

Introduction

We have witnessed a surge of cross-national surveys over the past few years. Large international surveys, like the European Social Survey or the World Values Survey, provide researchers with unique opportunities to test their theories and hypothesis in diverse populations around the world. However, this availability of data is only very seldomly accompanied by the realization that the assumption of comparability of the survey instruments should not be given but tested instead. Before attributing any relevant differences between populations to substantial theoretical reasons, methodological and measurement causes should be explicitly ruled out by testing for measurement invariance. This workshop will introduce participants to the basics of measurement invariance testing with many groups. We will start by explaining what is measurement invariance and the major causes for measurement non-equivalence in surveys. Then we will proceed to discuss the three most common approaches to measurement invariance testing and end with a simple tutorial on how to test for measurement invariance with Multi-Group Confirmatory Factor Analysis (MG-CFA) using R environment.

> This workshop is designed to be introductory and therefore I invite readers to follow the cited literature throughout this document and engage in further readings.

Workshop Content

1. Introduction

2. Comparative Survey Research
3. Measurement Invariance
4. Checklist for Measurement Invariance with MG-CFA
5. Testing for measurement invariance with lavaan in R
6. Take-Home Message
7. Further Reading
8. References

1.1   Work in Progress

This document is also a work in progress. New versions with more resources
and information should be completed soon. Check my website to keep up with
the progress www.andrepirralha.com

Chapter 2

Comparative survey research

Cross-national and cross-cultural comparative surveys are a very important resource for the Social Sciences. According to the Overview of Comparative Surveys Worldwide, more than 90 cross-national comparative surveys have been conducted around the world since 1948.

Even though surveys can aim to fulfill different purposes, generally they aim to estimate population means, totals or distributions or relationships between variables. A comparative survey will aim to compare these levels or relationships across groups (national or otherwise).
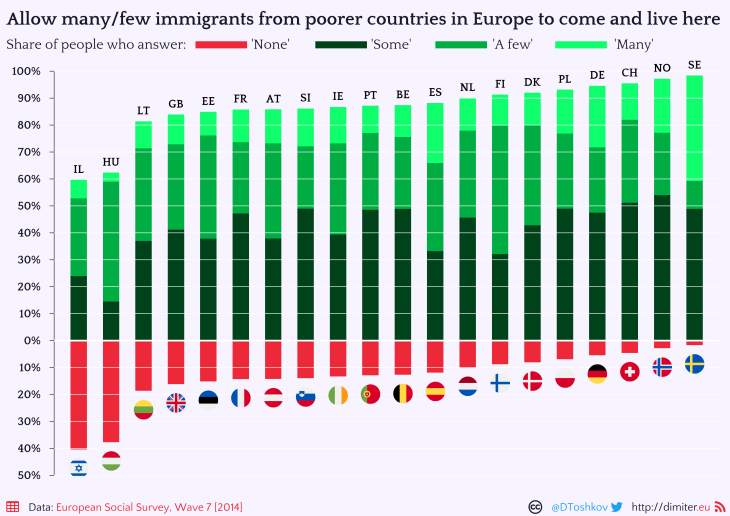
\begin{figure}
\caption{Comparative percentages by country regarding immigration tolerance,

from the European Social Survey Round 7. Source: Dimiter Toshkov 2020}
\end{figure}

Figure 2.1 shows a rather common application of a comparative survey. The groups, in this case European countries, are compared on their percentage shares on the answer to the question about allowing more immigrants.

However, what we see in this graph is only the final abstraction of very long process that typically surveys, and most particularly cross-national surveys, must go through. This process is sometimes called survey lifecycle and goes from design to dissemination.
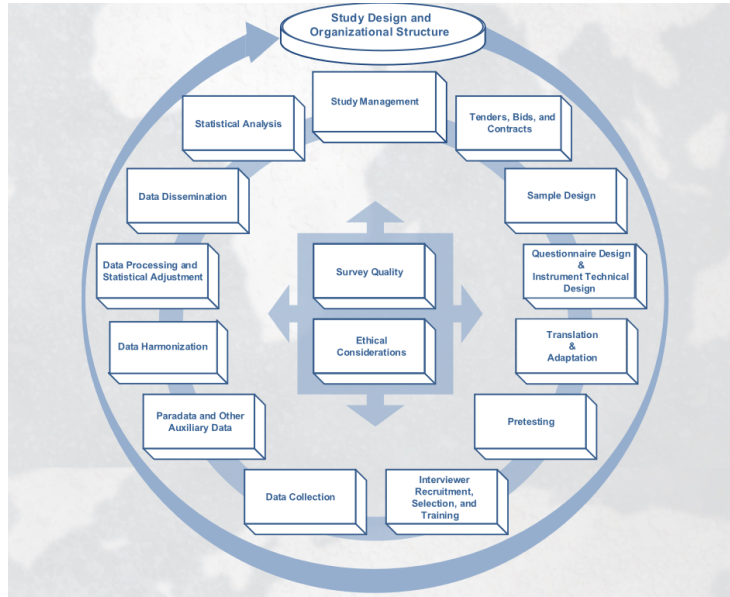
Figure 2.1: Survey Lifecycle.   Source: [Cross Cultural Survey Guidelines](https://ccsg.isr.umich.edu/chapters)

2.1   Survey Error

> *Survey error is any error arising from the survey process that contributed to the deviation of an estimate from its true parameter values.* (**?**)
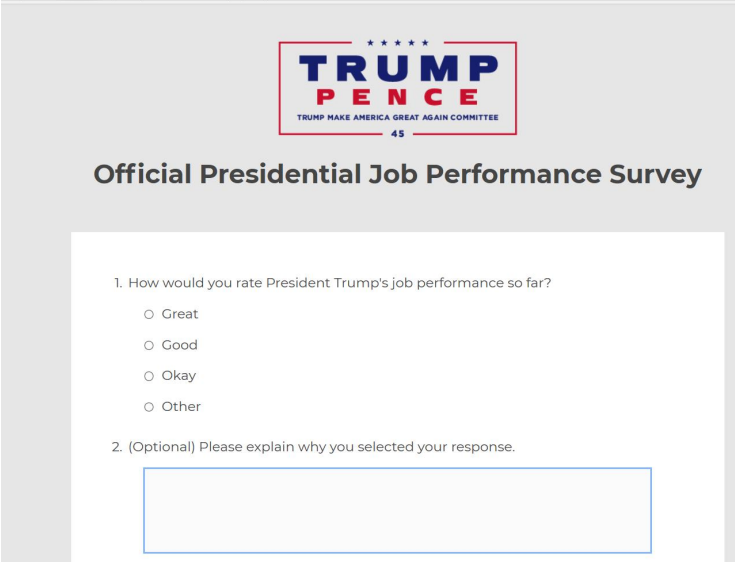
But regardless of how much we can try to prevent it, survey errors in one form or another will always occur. And survey errors might affect the estimates and their comparability.

This applies both to when we compare data from different surveys and comparisons of sub-groups within the same survey.

The comparability of survey measurements is an issue that should be thoughtfully considered before drawing substantive conclusions from comparative surveys.

Figure 2.2: Slighty problematic survey question. Source: [badsurveyq](https://twitter.com/badsurveyq)

Survey error can be classified in two components:

> Random error is caused by any factors that randomly affect measurement of the variable

> Systematic error is caused by any factors that systematically affect measurement of the variable

Survey group comparability problems come from systematic error or "Bias"[1].

What is particular about comparative surveys is that there are at least two different survey statistics. Therefore, each one of these statistics is subject to different sources of error. If the overall statistics are differently affected by the error, this will cause some form of "bias" in the comparison.

> In other words, besides substantive differences between survey statistics, there might be systematic differences caused by survey error.

---

[1]systematic error and "Bias" are terms used interchangeably in the literature and they refer to deviations that are not due to chance alone.