Analyzing the *Non-equivalen Group with Anchor Test Design* from a Partial Identification Perspective

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Equating is use to ensure that test scores can be comparable and used interchangeably. Different equating designs have been proposed each leading to different data structures. One of the designs is the *non-equivalent groups with anchor test design (NEAT)*, also called CINEG (common items non-equivalent groups designs). In this design, two random samples of test takers are taken from two different populations $\mathcal{P}$ and $\mathcal{Q}$. Each sample is administered only one of two test forms $\mathcal{X}$ and $\mathcal{Y}$ plus a common test called the anchor test $\mathcal{A}$. This portion of common items can be internal, in which case, the scores obtained do count for the total final score obtained, or external, where the total anchor score is not considered for the final score to be reported. The equating procedure is based on the distributions $P(X, A)$ and $P(Y, A)$, where X, Y and A correspond to the scores obtained in the respective forms.

Because groups of test takers only observe one of the two test forms, there are parts of the *common* distribution that cannot be directly estimated from data, namely the distribution of the X-scores of examinees who take the form $\mathcal{Y}$, and the distribution of the Y-scores of examinees who take the form $\mathcal{Y}$. This *identification problem* is typically solved by introducing a strong ignorability condition, namely that (X, Y) are independent of the test assignment conditionally on the anchor test.

What happens if we are not willing to believe to such a strong condition? Is it possible to solve the equating problem without assuming restrictions on the unidentified components of the problem? Using the concept of *partial identification*, we will answer these questions in a positive way, showing how *incredible* is the current solution and to what extend some of the current solutions are non-admissible.

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