**Measuring gender gap from a POSET perspective**

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**Background:** In the last decades the attention on gender gap has grown up significantly; from the UN International Year of Women, in 1975 to the UN Millennium Declaration, in 2000, the relevance of statistics on gender disparities has become increasingly noticeable (UNECE, 2010, UNFPA, 2011, UN WOMEN, 2011).

For a long time, many studies investigating the gender gap adopted data collected without a gender sensitive perspective. Even now, many official statistics gathered at national level, with respect to several issues like the professional career, the political participation, the child care to mention a few, are not gender sensitive (Mecatti et al, 2012).

However, this attitude changes from the 80s. In 1984, in particular, the Demographic and Health Surveys (DHS) program started with the purpose of reaching a “global understanding of health and population trends in developing countries”. Those surveys provided representative data at national level regarding various issues, including the gender disparities.

**Objectives:** We collected a DHS dataset concerning the women’s status and the gender disparities, on sixteen African states; all the surveys were carried out between 2007 and 2012.

Using the information provided from the DHS dataset, this contribute aims to quantify the severity of the perceived gender gap among women in many African states, with the innovative adoption in this field of a POSET approach.
We focused our attention on the battery of questions that have been administered only to the subgroup of women living with their partner. Each question asks about a decision process and the interviewee can answer if she has the final say, if her partner has the final say or both she and her partner have the final say in the decision process.

A careful analysis of the battery of questions has allowed the identification of three variables: 1) final say on woman's health care 2) final say on visits to family or relatives and 3) final say on making large household purchases. Those three variables of interest enabled to explore the perceived gender gap with respect to three different dimensions, namely the woman’s health care dimension, the dimension of social inclusion and the economic dimension.

**Methods:** Dealing with ordinal variables, as those we selected, achieving the goal of quantifies the severity of gender gap involves a methodological challenge.

Studies on gender gap have widely adopted statistical measures such as simple and complex indicators. Those methods, nevertheless, are based on a marginal analysis, variable by variable and only at a second stage a multi-dimensional synthesis is performed based on some method of aggregation. On the contrary, the POSET approach is truly multi-dimensional because it allows directly a conjoint analysis on the whole set of variables related to a specific latent dimension.

The mathematical theory of partial order or POSET, formalized in the 19th century, may be, then, an optimal means to answer this challenge. Moreover, the POSET enables to respect the ordinal nature of the data (Fattore and Arcagni, 2014), avoiding any aggregation or scaling procedures, and to quantify easily the gender gap as a function of the resulting complete ordering.

Let us consider a set of ordinal variables: a partial ordering between subjects is immediately available, but we need to sort them unambiguously. Given a set of $k$ ordinal variables, each one with $j_i$ levels, first we have to construct the set of all possible profiles: a profile is a collection of $k$ numbers, each one equal to the level of the corresponding variable. So the number of all possible profiles is the product of the number of levels of the $k$ variables.

A partially ordered set is a finite set $X$ of profiles that has a partial order relation, namely that respects the properties of reflexivity, anti-symmetry and transitivity.

In order to classify the profiles with respect to a gap dimension, it is worth to define a threshold, that simply is a profile or a list of profiles that, because of its mathematical properties, generates a down set $D$.

All profiles belonging to the down-set $D$ are certainly under the threshold but some other profiles cannot be ordered with respect to the chosen threshold: a solution can be found, then, in the computation of the evaluation function that is a function from the finite space of all possible profiles to the $[0,1]$ interval.

By means of a theorem by Neggers and Kim, that guarantees that the set of all linear extensions of a poset uniquely identifies it, the profiles that do not belong to $D$ are ranked above the threshold in some linear extensions and below them in others. Then simply we count how many times a profile is below $D$, in the set of all linear extensions; the resulting function assumes value 0 if a profile is certainly under the threshold, value 1 if the profile is certainly upper the threshold and values in the real interval 0-1 for profiles that are not certainly ordered with respect to the chosen threshold.

With the evaluation function, then, a complete an unique order between the profiles is achieved.
Finally all the information contained in the POSET can be synthesized by a gap measure that quantifies the severity of gender gap: basically it determines the fraction of people a women must overtake to exit her deprivation status.

**Results and conclusions**: We are expecting to observe a gender gap against women with respect to the dimensions considered; we will provide a ranking of the African countries with respect to the gap measures obtained with the POSET approach and we will compare this ranking with the official ones on gender inequalities.

**Main references**


UN WOMEN (2011), Global Gender Gap Report reveals slow progress on economic equality and political participation.