A Nonparametric Look at Self-Esteem Development by Gender and Socioeconomic Region

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Introduction

Self-esteem is a measure of one's subjective self-worth.

Question: How does the self-esteem developmental trajectory differ across gender and socioeconomic region?

Participant Characteristics

$n = 45{,}185$ participants from 171 countries ages 10–80 years old

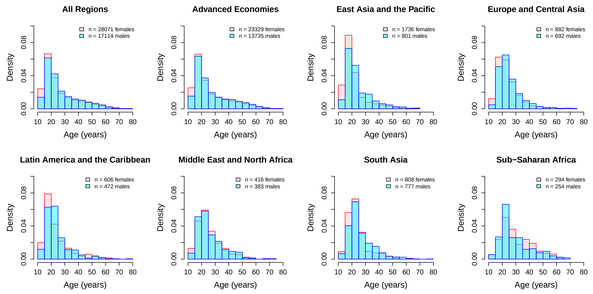

Figure 1: Age/Gender distributions for each socioeconomic region.

Self-Esteem Measure

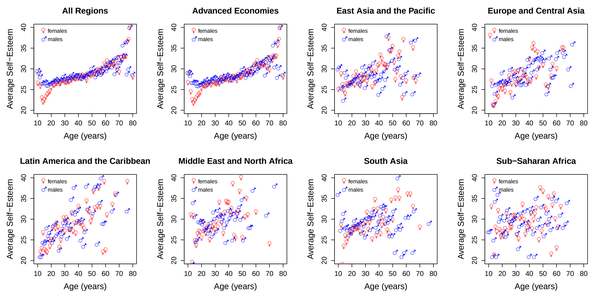

Figure 2: Average score on Rosenberg Self-Esteem Scale (Rosenberg, 1965).

Socioeconomic Region Assignment

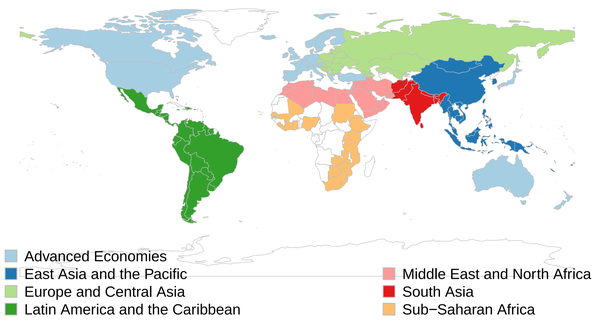

Figure 3: Socioeconomic region assignments based on Barro and Lee (2013).

Age-Gender Model

We use a two-way smoothing spline analysis of variance model:

$$y_i = \eta(a_i, g_i) + \epsilon_i$$

where

- y_i is the self-esteem score for the i-th subject
- a_i and g_i are age and gender of i-th subject
- η is the unknown smooth function that we will estimate
- $\epsilon_i \overset{\text{iid}}{\sim} N(0, \sigma^2)$ is unknown, normally distributed error term

Two possible models that we could consider:

$$\text{Additive:} \quad \eta(a,g) = \eta_0 + \eta_A(a) + \eta_G(g)$$
$$\text{Interaction:} \quad \eta(a,g) = \eta_0 + \eta_A(a) + \eta_G(g) + \eta_{AG}(a,g)$$

where

- η_0 is a baseline (intercept) term
- η_A and η_G are main effects of age and gender (respectively)
- η_{AG} is age-gender interaction effect function

Age-Gender-Region Model

We use a three-way smoothing spline analysis of variance model:

$$y_i = \eta(a_i, g_i, r_i) + \epsilon_i$$

where r_i is socioeconomic region of i-th subject.

Nine possible models that we could consider (see Table 2).

All models were fit with `bigsplines` (Helwig, 2016) package in R software environment (R Core Team, 2016).

Fit Statistics: Age-Gender Model

Table 1: Fit statistics for two-way (age-gender) SSANOVA model.

Model	R^2	Akaike IC	Bayesian IC
1. Additive	0.070	300492.3	300703.5
2. Interaction	0.078	300155.9	300489.1

Note. IC = Information Criterion

Fit Statistics: Age-Gender-Region Model

Table 2: Fit statistics for three-way (age-gender-region) SSANOVA model.

Model	R^2	Akaike IC	Bayesian IC
1. $\eta_\bullet + \eta_{AG} + \eta_{AR} + \eta_{GR} + \eta_{AGR}$	0.087	299778.9	300530.0
2. $\eta_\bullet + \eta_{AG} + \eta_{AR} + \eta_{GR}$	0.087	299761.8	300349.8
3. $\eta_\bullet + \eta_{AG} + \eta_{AR}$	0.086	299787.4	300352.9
4. $\eta_\bullet + \eta_{AG} + \eta_{GR}$	0.085	299787.2	300192.0
5. $\eta_\bullet + \eta_{AR} + \eta_{GR}$	0.079	300130.2	300561.7
6. $\eta_\bullet + \eta_{AG}$	0.085	299824.0	300360.8
7. $\eta_\bullet + \eta_{AR}$	0.078	300157.0	300564.6
8. $\eta_\bullet + \eta_{GR}$	0.078	300158.7	300526.1
9. $\eta_\bullet$	0.077	300184.3	300467.0

Note. IC = Information Criterion and $\eta_\bullet = \eta_0 + \eta_A + \eta_G + \eta_R$

AIC selects Model 2, and BIC selects Model 4. We prefer Model 2.

Results: Age-Gender Model

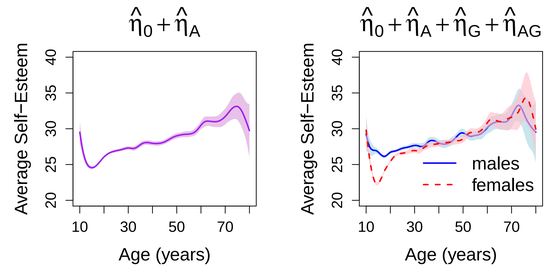

Figure 4: Predicted self-esteem developmental trajectory ignoring gender (left) and including gender (right).

Results: Age-Gender-Region Model

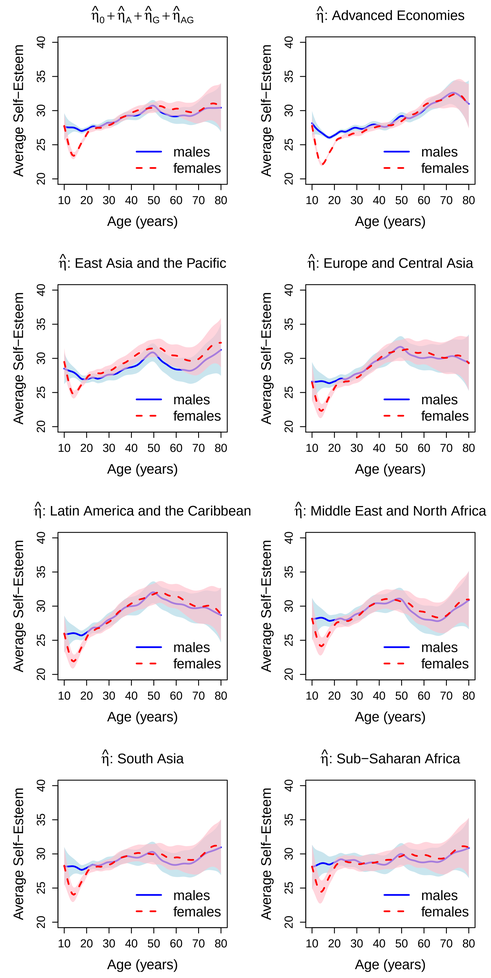

Figure 5: Model predicted self-esteem developmental trajectory by gender and socioeconomic region.

Self-Esteem Gender Gap by Socioeconomic Region

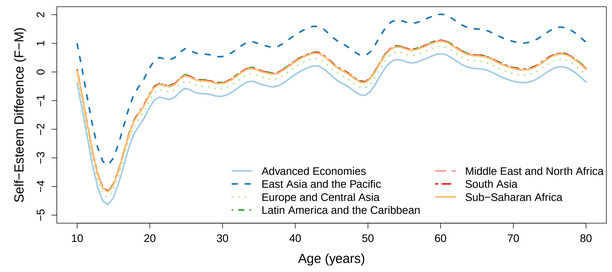

Figure 6: Model predicted gender differences in the self-esteem developmental trajectory for each socioeconomic region.

Conclusions

(1) There are significant age and gender differences in the self-esteem developmental trajectory.

(2) There is a common mechanism negatively effecting female self-esteem entering adolescence.

- The adolescent gender gap is robust to socioeconomic region
- Female self-esteem lowest at age 14 across all regions

(3) There exist socioeconomic influences that serve to moderate the self-esteem developmental trajectory.

- Females in East Asia and the Pacific have significantly higher levels of self-esteem during adolescence
- There are region-specific age and gender differences in the self-esteem developmental trajectory

(4) Further studies should aim to identify the regional influences specific to East Asia and the Pacific driving the higher female self-esteem in that region.

References

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