

A Refined Perspective on the Influence of Gender Equality on Gender Differences in Economic Preferences

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Methods

Overview

We replicate the results using the R programming language version 4.2.1 (2022-06-23), and its open-source IDE RStudio. The following packages with respective versions are used:

Package	Version
data.table	1.14.2
bit64	4.0.5
bit	4.0.5
plyr	1.8.7
dplyr	1.1.2
haven	2.5.1
ggplot2	3.4.2
missMDA	1.18
MASS	7.3-58.1

Data Collection, Cleaning, and Standardization

Global Preferences Survey and Gallup World Poll data sets

To download the GPS data set, one can go to the website of the Global Preferences Survey briq - Institute on Behavior & Inequality in the section “downloads”. The data set is not provided in the rawest form: some variables were mixed and already standardized. Some sociodemographic variables (for instance, education level or income quintile) are not part of the Global Preference Survey, but of the Gallup World Poll data set that is not openly available. This data is protected by copyright and can not be given to third parties. Check the website of the briq - Institute on Behavior & Inequality for more information on it.

Log GDP p/c and gender equality indexes

From the website of the World Bank, one can access the data about the GDP per capita on a certain set of years. The data for Log GDP p/c calculated in 2005 US dollars was already archived. We used Log GDP p/c in 2010 US dollars, instead. To build an estimator for Log GDP p/c, we averaged the data from 2003 until 2012 for all the available countries, as done in the original article.

The Gender Equality Index used in the original article was composed of four main data sets as the first principle component of the Principal Component Analysis performed on them:

- **World Economic Forum Global Gender Gap Index:** Taken from the World Economic Forum Global Gender Gap Report 2015. For countries where data was missing, data was added from the World Economic Forum Global Gender Gap Report 2006, as reported in the original article.
- **United Nation Development Programme Gender Inequality Index:** Taken from the Human Development Report 2015. We kept only the table called “Gender Inequality Index”.
- **Ratio of female and male labor force participation:** An average of estimates from 2004 to 2013 provided by the International Labor Organization in World Bank database (<http://data.worldbank.org/indicator/SL.TLF.CACT.FM.ZS>). Values were inverted to create an index of equality. Note that originally the data set was created taking the values between the years 2003 to 2012.
- **Time since women’s suffrage:** This indicator was build based on the data about the year of suffrage in a given country taken from the Inter-Parliamentary Union Website. For several countries more than one date where provided (for example, the right to be elected and the right to vote). We use the last date when both vote and stand for election rights were granted, with no other restrictions commented. Some countries were colonies or within a union of the countries (for instance, Kazakhstan in the Soviet Union). For these countries, the rights to vote and be elected might be technically granted two times within a union and as an independent state. In this case, we kept the first date. It was difficult to decide on South Africa because its history shows the racism part very entangled with women’s rights (Walker 1990). We kept the latest date when also Black women could vote. For Nigeria, considering the distinctions between North and South, we decided to keep only the North data because, again, it was showing the completeness of the country and it was the last date.

In this work we additionally involve the following index:

- **United Nation Development Programme Gender Development Index** taken from Human Development Reports 2020. Note that we have downloaded the two tables of the Human Development Index for males and females, and used the ratio of the two as a GDI index, as described in the report.

Missing Data and Imputation

One of the issues that we faced while trying to reproduce the results of the article has been the missing data.

During the reproduction of the article, we found that the original authors did not describe in detail how they handled missing data in the indicators. They mention on page 14 of the Supplementary Material, that (quoting): “For countries where data were missing, data were added from the World Economic Forum Global Gender Gap Report 2006 (http://www3.weforum.org/docs/WEF_GenderGap_Report_2006.pdf).”

However, regarding the year when women received the right to vote in a specific country, the missing values are the ones coming from the United Arab Emirates and Saudi Arabia, that neither in 2006 (when the WEF Global Gender Gap Report that the authors quote as a reference for the missing values) nor now (in 2022) have guaranteed the right to vote for women yet. There is missing data also in the other sources that the authors quote. So a quick search for the missing countries of the WEF report of 2015, shows us that these countries can’t be found in the report of 2006 either. Missing data and imputation, in general, may not be crucial for the replication of the analysis, although are not desirable. The problem of missing data for a given country often does not influence much the overall trends of found correlations. However, it becomes very relevant for checking the implications of the study concerning a specific country of interest.

Pure replication and comparison to the Original Article

In this section, we describe how to reproduce the plots of FH and we compare their results to ours. Since in our extended analysis we used the robust linear regression (RLR), we add here a comparison to the results obtained by this method as well.

Reproducing the Plots of the Main Article

To reproduce the plot of Figure 1A of the original article Falk & Hermle (2018a), we grouped the countries in quartiles based on the logarithm of their average GDP p/c, extracted the mean of each preference from the gender coefficients (the β_i^c) of the countries for each quartile, after standardizing them. The same method was applied to the GEI in correlation to the gender differences for each economic preference, to reproduce the plot in Figure 1C of Falk & Hermle (2018a). Then, we related the magnitude of the summarized gender difference coefficients (the first component of the PCA) with the logarithm of the average GDP per capita to see the effect of the economic development. This reproduced Figure 1B of the original article. We used a linear model to fit the correlation and extract the p-value, and for the plot the variables on the y-axis were additionally transformed as $(y - y_{min}) / (y_{max} - y_{min})$, as it was implemented in the original article. We applied the same method to extract the correlation between the GEI and the summarized gender preference, to see the effect of gender equality in the countries (Figure 1D, of Falk & Hermle (2018a)). Note that here also the GEI is transformed to be on a scale between 0 and 1. It is important to underline that such transformation may be misleading, as $GEI = 1$ does not mean full gender equality (no country achieved this state) as well as $GEI = 0$ does not necessary mean the full absence of it.

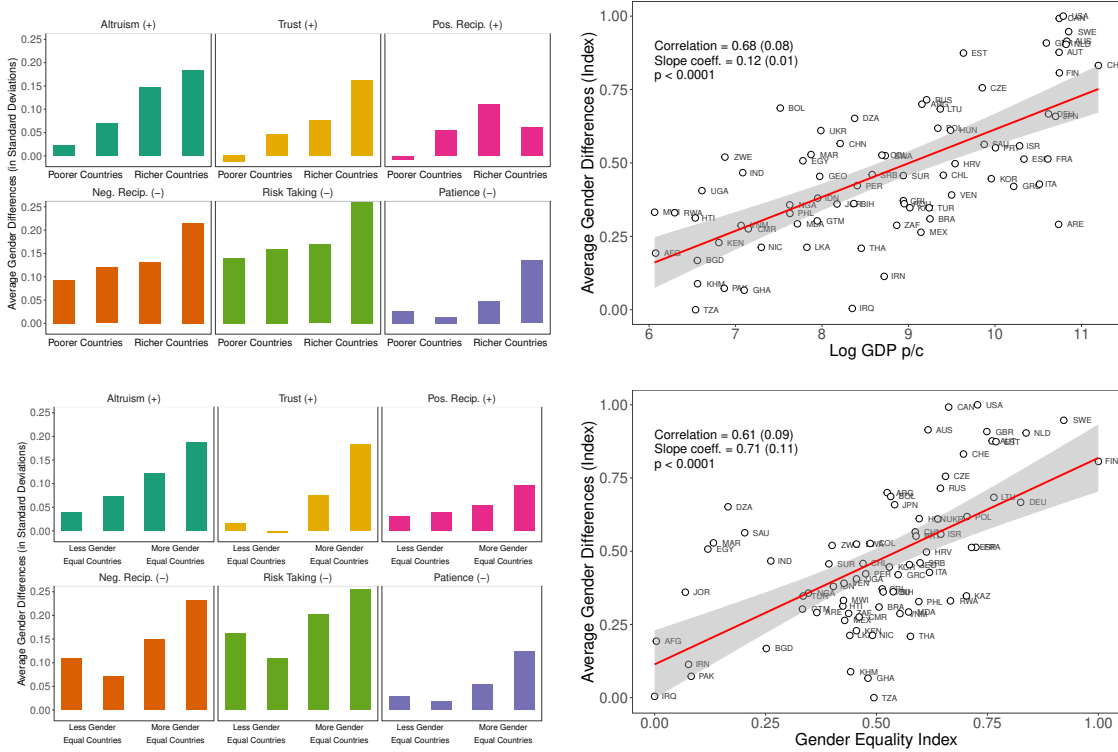


Figure 1: Reproduction of the Fig 1 A-D of FH analysis. On the top left figure, the countries were grouped by quartiles from poorer to richer, and the standardized coefficient for the gender differences is plot for each of the individual economic preferences. Similarly, on bottom left, with less equal to more equal countries. On the right, the correlation between gender differences in economic preferences, summarized into one single coefficient using the PCA, and economic development (on top) and gender equality (bottom).

We summarized the results of Figure 1B and 1D in Table 1. Moreover, we add in the same Table the results obtained using the robust linear regression instead of the simple linear regression model.

Table 2: Correlation between PCA-summarized gender differences in economic preferences vs Log GDP p/c and joint Gender Equality Index. Significance ≤ 0.001 (***), ≤ 0.01 (**), ≤ 0.05 (*)

	Original	Replication (OLS)	Replication (RLR)
Log GDP p/c	0.6685***	0.68 (0.08)***	0.67 (0.09)***
Gender Equality Index	0.5580***	0.61 (0.09)***	0.59 (0.09)***

We reproduced the plots in Figure 2A-F in Falk & Hermle (2018a) using the variable conditioning analysis. This has been done for the economic development, for the GEI, and each of the four indicators building the GEI. The variable used on the y-axis is the first Principal Component of the PCA made on the gender differences on the six preferences. All the variables used have been standardized to have a mean at 0 and a standard deviation of 1 before performing the conditional analysis. Using the residuals, we performed a linear regression on the data points and extracted correlation coefficients and p-values.

Correlation between Economic Development and Gender Equality

As mentioned in our article, the fact that there is a correlation between economic development and gender equality is revealed (Duflo 2012) and reported in the World Economic Forum (2015). We checked the correlation between Log GDP p/c and GEI, reported here in Figure 3. In addition, we checked the correlation of Log GDP p/c with the three indexes used in our extended analysis for the measure of gender equality: the WEF GGGI from the World Economic Forum Global Gender Gap Report 2015, the UNDP GII Human Development Report 2015, and the UNDP Gender Development Index (GDI) The correlation between economic development expressed in Log GDP p/c and gender equality indexes is very strong (see also Figure 3).

Reproducing the results in FH Supplementary Material

For the comparison of the results from Figure S4 in Falk & Hermle (2018b), we refer to Table 3, showing the correlation between the average gender differences to the single-gender equality indicators. In parenthesis, we put the standard deviation for the relative correlation coefficient to have an overview on the level of agreement between the original and the replication study. We report the replication results using both the OLS and the RLR.

Table 3: Individual indicators for the gender equality correlated with gender differences in economic preferences. Significance ≤ 0.001 (***), ≤ 0.01 (**), ≤ 0.05 (*)

	Original	Replication (OLS)	Replication (RLR)
WEF GGGI	0.4097***	0.41 (0.11)***	0.39 (0.11)**
UNDP GII	0.6482***	0.67 (0.09)***	0.66 (0.09)***
F/M LFP	0.2661*	0.29 (0.11)*	0.26 (0.11)*
TSWS	0.5139***	0.45 (0.10)***	0.45 (0.10)***

For the comparison of the results of the Figure S5 and S6 of Falk & Hermle (2018b) to ours, refer to Table 4 and Table 5.

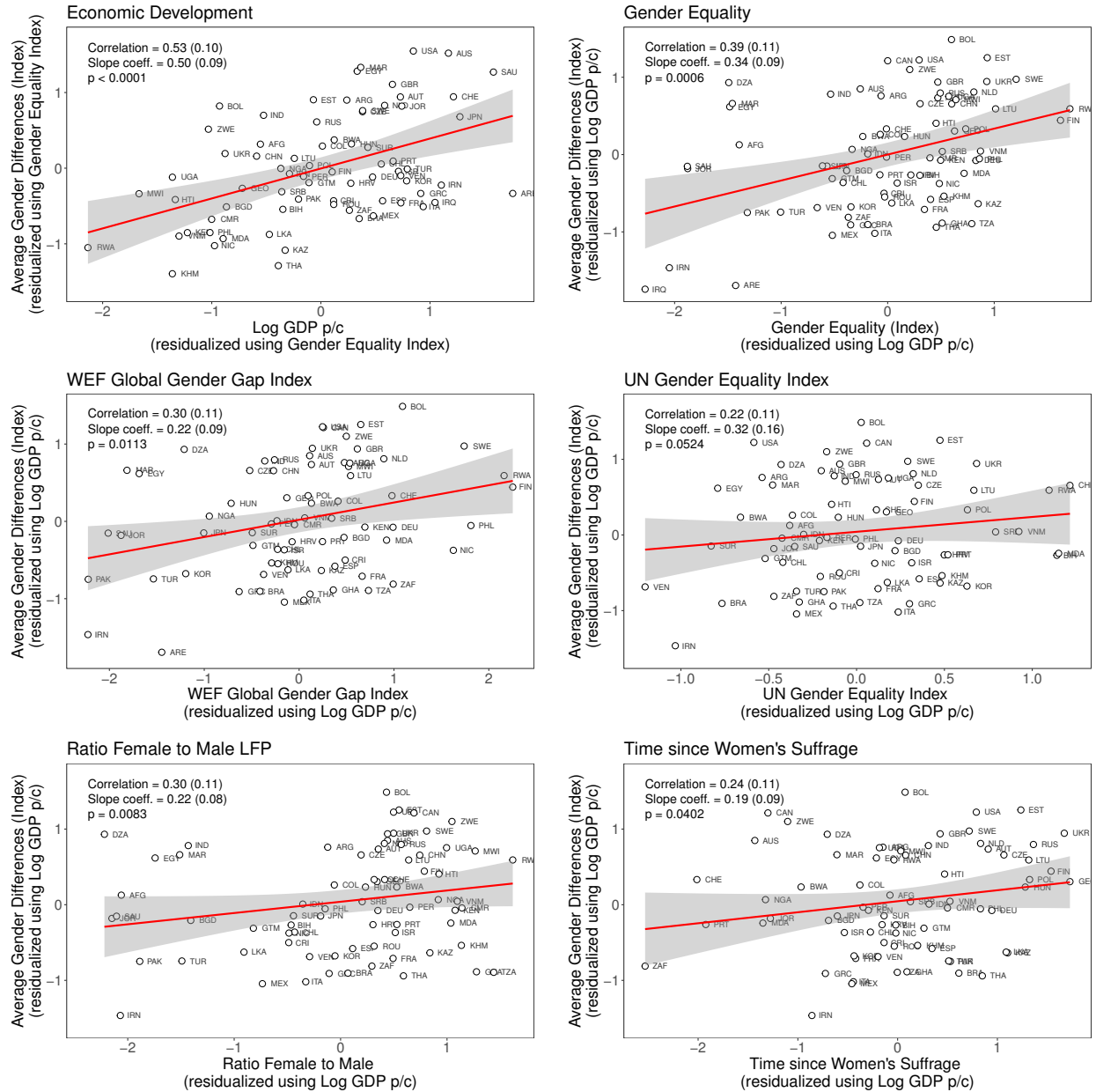


Figure 2: Relationship between summarized gender differences in economic preferences and economic development conditional on gender equality (Fig. 2A), and between summarized gender differences in economic preferences and gender equality conditional on economic development, with gender equality being represented by GEI (Fig. 2B), by WEF GGGI (Fig. 2C), by UNDP GII (Fig. 2D), by F/M LFP (Fig. 2E), and by TSWS (Fig. 2F).

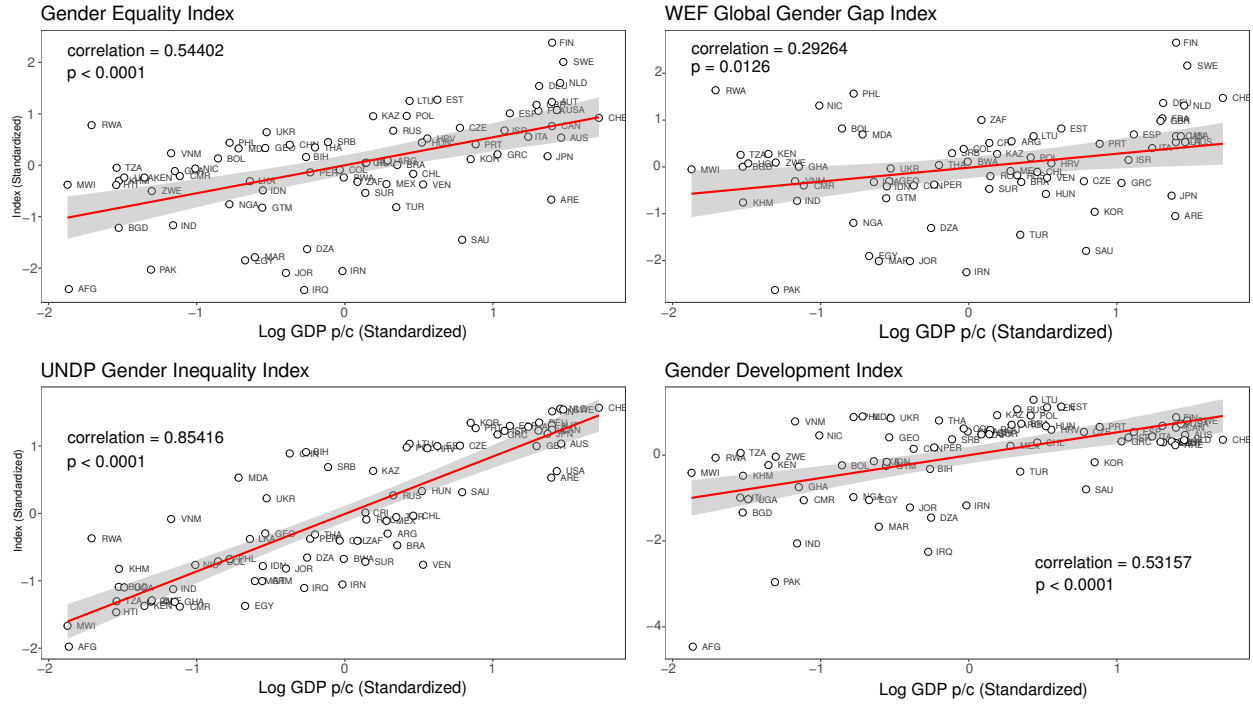


Figure 3: Correlation between gender equality indicators and economic development by country. Note that only the countries participating in the original study are included.

Table 4: Gender differences in single economic preferences regressed on Log GDP p/c conditional on Gender Equality Index. Significance levels: ≤ 0.001 (***), ≤ 0.01 (**), ≤ 0.05 (*).

	Original	Replication (OLS)	Replication (RLR)
Trust	0.4574***	0.43 (0.11)***	0.45 (0.10)***
Altruism	0.4751***	0.43 (0.10)***	0.40 (0.11)***
Pos. Rec.	0.2771*	0.25 (0.11)*	0.25 (0.11)
Neg. Rec.	0.2444*	0.21 (0.11)	0.25 (0.11)*
Risk Tak.	0.2868*	0.23 (0.11)	0.22 (0.11)*
Patience	0.2621*	0.23 (0.11)*	0.24 (0.11)*

Table 5: Gender differences in single economic preferences regressed on Gender Equality Index, conditional on Log GDP p/c. Significance levels: ≤ 0.001 (***), ≤ 0.01 (**), ≤ 0.05 (*).

	Original	Replication (OLS)	Replication (RLR)
Trust	0.2050	0.25 (0.11)*	0.25 (0.11)*
Altruism	0.3304**	0.27 (0.11)*	0.24 (0.11)
Pos. Rec.	-0.0115	0.05 (0.12)	0.05 (0.12)
Neg. Rec.	0.2788*	0.22 (0.11)	0.20 (0.11)*
Risk Tak.	0.1973	0.19 (0.11)	0.19 (0.11)*
Patience	0.2967*	0.28 (0.11)*	0.28 (0.11)*

Lastly, we have reproduced the results from Figures S8 and S9 of Falk & Hermle (2018b) in Tables 6 and 7.

Table 6: Gender differences and economic development by preference using preferences standardized at the global level. Economic preferences were standardized at the global level, instead of using country level. Significance levels: ≤ 0.001 (***), ≤ 0.01 (**), ≤ 0.05 (*).

	Original	Replication (OLS)
Trust	0.5787***	0.58 (0.10)***
Altruism	0.5505***	0.59 (0.09)***
Pos. Rec.	0.2819*	0.32 (0.11)**
Neg. Rec.	0.2980**	0.37 (0.11)**
Risk Tak.	0.2974**	0.36 (0.11)**
Patience	0.4391***	0.41 (0.11)***

Table 7: Gender differences and economic development by preference without controls (OLS being performed using only gender as a independent variable). Significance levels: ≤ 0.001 (***), ≤ 0.01 (**), ≤ 0.05 (*).

	Original	Replication (OLS)
Trust	0.5434***	0.55 (0.10)***
Altruism	0.5808***	0.59 (0.09)***
Pos. Rec.	0.2748*	0.28 (0.11)*
Neg. Rec.	0.4038***	0.39 (0.11)***
Risk Tak.	0.3860***	0.39 (0.11)***
Patience	0.4830***	0.48 (0.10)***

Further notes on the replication

The Figure S7 of Falk & Hermle (2018b) could not be replicated because there is no access to raw data. For the replication of several tables in the supplementary material, the description of the data sets and the analysis approach was not sufficient for replication.

References

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