

RESEARCH ARTICLE SUMMARY

SOCIAL SCIENCE

Relationship of gender differences in preferences to economic development and gender equality

Armin Falk* and Johannes Hermle*

INTRODUCTION: Understanding determinants of gender differences in economic and social domains has been of interest, both in academic and public debates. Previous research has shown that gender differences in fundamental economic preferences are important in explaining gender differences in economic outcomes, such as for occupational choice, financial investment, or educational decisions, among many others. However, gaps remain in understanding the sources of gender differences in preferences and their variation.

RATIONALE: We contrasted and tested two hypotheses that make opposite predictions concerning the cross-country association of gender differences in preferences with economic development and gender equality. On one hand, the attenuation of gender-specific social roles that arises in more developed and gender-egalitarian countries may alleviate differences in preferences between women and men. As a consequence, one would expect gender differences in preferences to be negatively associated with higher levels of economic

development and gender equality (social role hypothesis). On the other hand, greater availability of material and social resources removes the gender-neutral goal of subsistence, which creates the scope for gender-specific ambitions and desires. In addition, more gender-equal access to those resources may allow women and men to express preferences independently from each other. As a consequence, one would expect gender differences in preferences to be positively associated with higher levels of economic development and gender equality (resource hypothesis).

We tested these competing predictions using data on experimentally validated measures of willingness to take risks, patience, altruism, positive and negative reciprocity, and trust for 80,000 individuals in 76 representative country samples. So that the data would be geographically representative, the dataset was chosen so as to include all continents and a broad range of cultures and economic development levels. In total, the data represent about 90% of both the world population and global income.

RESULTS: The data revealed substantial cross-country variation in gender differences in preferences. Gender differences were found to be strongly positively associated with economic development as well as gender equality. These relationships held for each preference separately as well as for a summary index of differences in all preferences jointly. Quantitatively, this

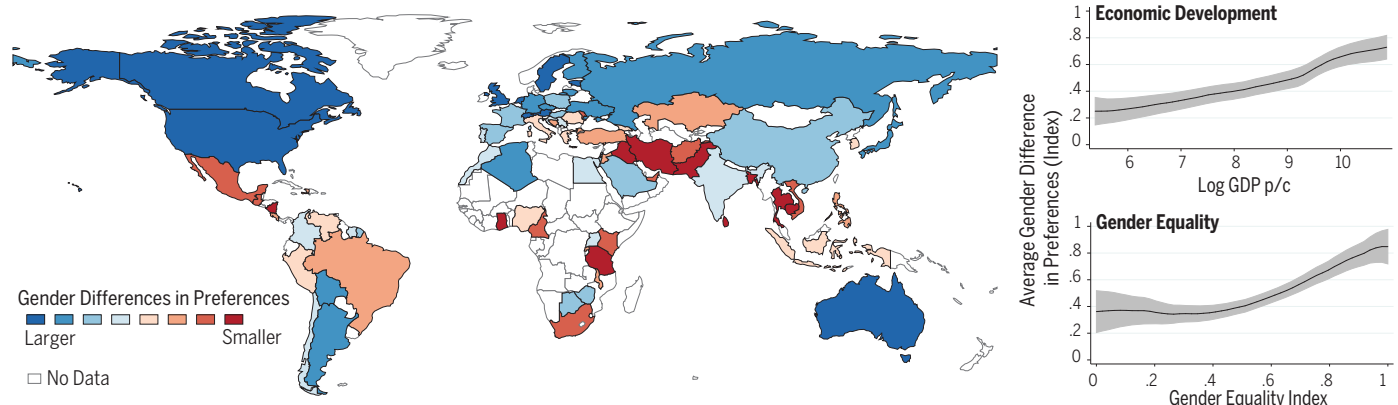
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summary index exhibited correlations of 0.67 ($P < 0.0001$) with log GDP per capita and 0.56 ($P < 0.0001$) with a Gender Equality Index (a joint measure of four indices of gender equality), respectively. To isolate the separate impacts of economic development and gender equality, we conducted a conditional analysis, finding a quantitatively large and statistically significant association between gender differences and log GDP per capita conditional on the Gender Equality Index, and vice versa. These findings remained robust in several validation tests, such as accounting for potential culture-specific survey response behavior, aggregation bias, and nonlinear relationships.

CONCLUSION: The reported evidence indicates that higher levels of economic development and gender equality favor the manifestation of gender differences in preferences across countries. Our results highlight the critical role of availability of material and social resources, as well as gender-equal access to these resources, in facilitating the independent formation and expression of gender-specific preferences. ■

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Gender differences in preferences across countries and their association with economic development and gender equality. (Left) World map visualizing a summary index of gender differences in all six preferences (risk-taking, patience, altruism, trust, and positive and negative reciprocity). (Right) The relationship between the summary index of gender differences in preferences and (top) log GDP per capita and (bottom) a Gender Equality Index comprising measures of material, social, and political gender equality. The relationships are predicted from local polynomial regressions. Shaded areas indicate 95% confidence intervals.

RESEARCH ARTICLE

SOCIAL SCIENCE

Relationship of gender differences in preferences to economic development and gender equality

Armin Falk^{1*} and Johannes Hermle^{2*}

Preferences concerning time, risk, and social interactions systematically shape human behavior and contribute to differential economic and social outcomes between women and men. We present a global investigation of gender differences in six fundamental preferences. Our data consist of measures of willingness to take risks, patience, altruism, positive and negative reciprocity, and trust for 80,000 individuals in 76 representative country samples. Gender differences in preferences were positively related to economic development and gender equality. This finding suggests that greater availability of and gender-equal access to material and social resources favor the manifestation of gender-differentiated preferences across countries.

Fundamental preferences such as altruism, risk-taking, reciprocity, patience, or trust constitute the foundation of choice theories and govern human behavior. A growing literature in economics (1, 2) and psychology (3) documents important gender differences in preferences. These differences provide a key explanation for differential choices and outcomes between women and men in contexts such as occupational choice, financial investment, or educational decisions (4, 5), among many others. The origins of gender differences in preferences, and their variability across countries and cultures, are addressed by an extensive literature that discusses biological and evolutionary determinants (6, 7) and the role of the social environment (8–10).

Hypotheses

We contrast two competing hypotheses that make opposite predictions concerning the cross-country correlational patterns of gender differences in preferences with respect to economic development and gender equality. Following social role theory, one may hypothesize that gender differences in preferences attenuate in more developed, gender-egalitarian countries (social role hypothesis). This hypothesis rests on two premises. First, economic development is a key determinant of societal progression toward gender equality (11, 12), which is critical for the dissolution of traditional gender roles (13, 14). Second, as discussed by a large body of literature (8–10), gender-specific roles instill distinct preferences in women and men and hence constitute a crucial compo-

nent in explaining the gender preference gap. As a consequence, according to the social role hypothesis, higher economic development and gender equality (and the associated dissolution of traditional gender roles) should lead to a narrowing of gender differences in preferences.

In contrast, there is reason to expect that gender differences in preferences expand with economic development and gender equality (resource hypothesis). As suggested by post-materialist theory (15, 16), a critical societal precondition for self-expression is the fulfillment of basic material needs. In line with this, existing research shows that the unrestricted expression of preferences hinges on the availability of sufficient material and social resources (17–20). Therefore, gender differences in preferences should manifest themselves only if both women and men obtain sufficient access to these resources to independently develop and express their intrinsic preferences (21). Specifically, greater availability of material resources eliminates the gender-neutral goal of subsistence. This creates scope for attending to gender-specific ambitions and desires. As a consequence, economic development may facilitate the unfolding of differences between women and men. More developed countries also feature higher levels of gender equality in political, social, and economic domains (11), which is a critical requirement for the acceptance of gender-specific desires and preferences. In particular, as women become less exposed and vulnerable to male influence, gender differentiation may be reinforced through women's greater opportunities for self-expression. In sum, greater availability of material and social resources to both women and men may facilitate the independent development and expression of gender-specific preferences, and hence may lead to an expansion of gender differences in more developed and gender-egalitarian countries.

Data and measures

An empirical test of the two competing hypotheses requires data that meet three critical conditions: (i) reliability of preference measures, (ii) extensive cultural variation as well as comprehensive global coverage, and (iii) representativeness of country samples. Our investigation used the Global Preference Survey (GPS) (22, 23). The GPS was collected as part of the Gallup World Poll 2012 and contains measures of six fundamental preferences with regard to social and nonsocial domains: willingness to take risks; patience, which captures preferences over the intertemporal timing of rewards; altruism; trust (24); and positive and negative reciprocity, which capture the costly willingness to reward kind actions or to punish unkind actions, respectively.

Before the launch of the international survey, multiple survey items were selected for these preferences through an ex ante experimental validation (25). For each preference, subjects responded to a large set of survey items and participated in incentivized choice experiments. The subset of survey items that maximized adjusted R^2 in predicting incentivized behavior in the corresponding experiment was selected for the international survey. The selected items, described below, comprise a combination of qualitative self-assessments and quantitative items that involve economic trade-off decisions. The qualitative items elicit participants' subjective assessment of their willingness to act in a certain way, such as whether participants are generally willing to take risks. Complementarily, the quantitative items provide revealed preference measures by using participants' choices in monetary trade-off decisions. As an example, the quantitative item for risk-taking provides the participants with a sequence of five interdependent choices between a fixed and a risky payment (lottery). This allows one to progressively approach the point of indifference between the fixed payment and the lottery, which serves as a revealed preference measure for risk-taking behavior. The presence of both qualitative and quantitative items allows for robustness tests with respect to potential culture-specific response behavior. So that survey items were comparable across cultures, all items were translated back and forth by professionals, and monetary values mentioned in the survey questions were adjusted along median household income across countries. The survey items were pretested in 22 countries of varied cultural heritage as part of the Gallup World Poll 2012 pretest, conducted in late 2011, to guarantee cross-cultural validity.

After the ex ante experimental validation and pretests, the international survey was implemented in a total of 76 countries, representing about 90% of the global population and global GDP. To provide geographic representativeness as well as developmental and cultural variation, we selected the countries to include all continents and a very broad range of economic development levels. For each country, the data contain samples representative of the resident population aged 15 and older, with a median sample size

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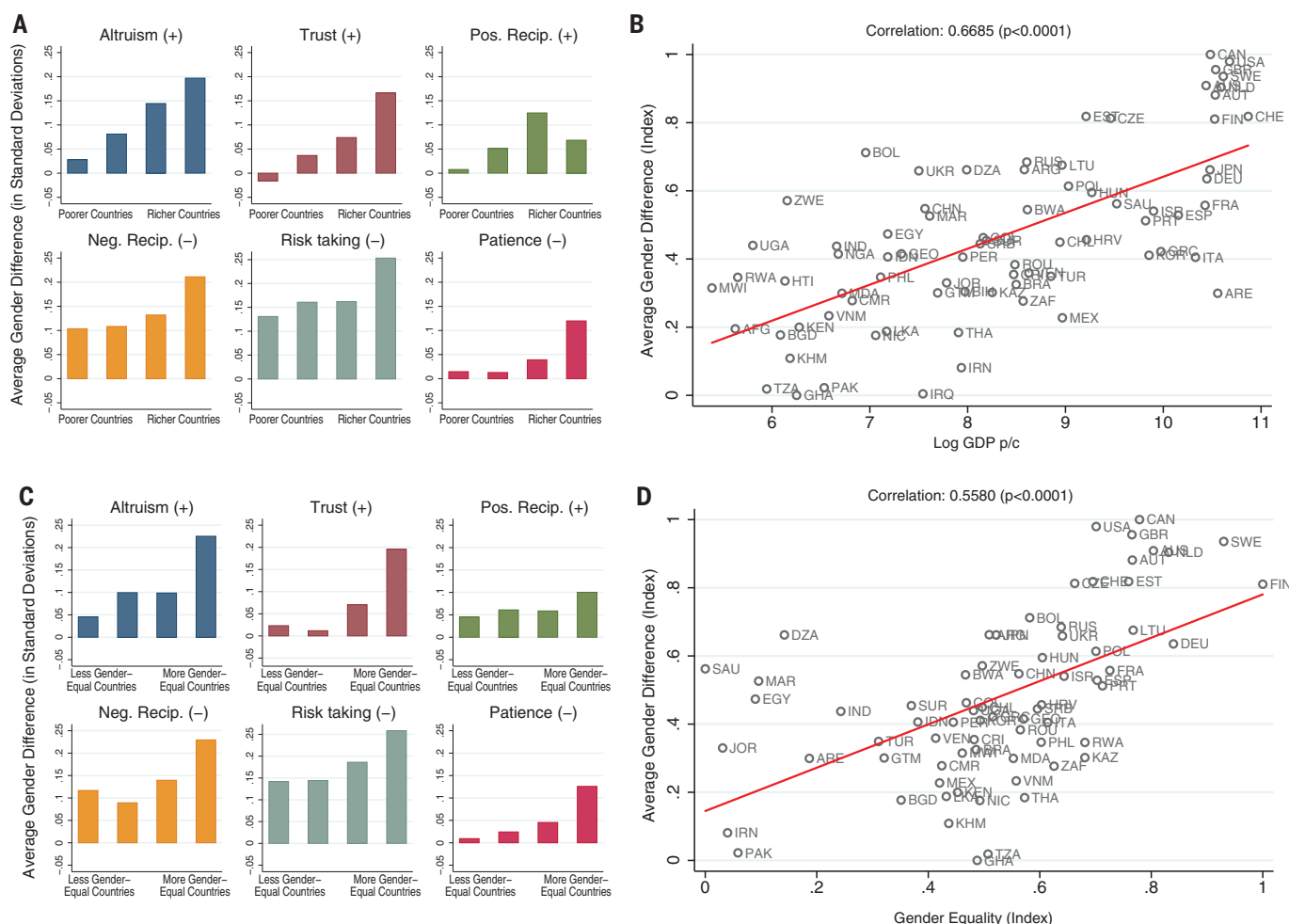


Fig. 1. Analysis of gender differences in preferences in relation to economic development and gender equality. (A) Mean country-level gender difference in altruism, trust, positive reciprocity, negative reciprocity, risk-taking, and patience by development level. Countries were sorted into four bins according to their GDP per capita quartile. The symbols + and – in the panel titles indicate the sign of the difference for each preference; + indicates that positive differences

correspond to women exhibiting higher levels of the respective preference, whereas – indicates that positive differences correspond to women exhibiting lower levels of the respective preference. (B) Relationship between the aggregate index of gender differences in all six preferences and log GDP per capita. (C and D) Same relationships as in (A) and (B) for the Gender Equality Index. See supplementary materials for country abbreviation key.

of 1000 participants per country; this made generalizable inferences possible. In total, the data include preference measures for about 80,000 participants.

After implementation of the worldwide survey, the measures for the six preferences were generated according to the following procedure. First, each of the survey items was standardized using the mean and variance of the entire worldwide sample. Then, to obtain the preference measures, the relevant z -scores were averaged using weights developed in the experimental validation. Further details on the data collection and construction of our measures are given below and in the supplementary materials.

The data allow assessment of the existence and quantitative relevance of gender differences in preferences at the global level (22). For this purpose, global gender differences were calculated as follows: Each preference measure was standardized at the global level to exhibit a mean

of 0 and a standard deviation of 1. Then, for each preference, an ordinary least-squares (OLS) regression was performed on the worldwide sample, using as the independent variable a gender indicator in which male is the reference category, controlling for age, age squared, cognitive skills (as proxied by subjective math skills), education level, household income quintile, and country fixed effects. Standard errors were clustered at the country level. The estimated coefficient on the gender indicator served as the gender difference in the respective preference. On the global level, all six preferences featured significant gender differences (fig. S1): Women tended to be more prosocial and less negatively reciprocal than men, with differences in standard deviations of 0.106 for altruism ($P < 0.0001$), 0.064 for trust ($P < 0.0001$), 0.055 for positive reciprocity ($P < 0.0001$), and 0.129 for negative reciprocity ($P < 0.0001$). Turning to nonsocial preferences, women were less risk-taking by 0.168 standard deviations ($P < 0.0001$)

and less patient by 0.050 standard deviations ($P < 0.0001$) (26). The observed differences in preferences set the stage for our analysis.

Analysis of gender differences in preferences in relation to economic development and gender equality

To test the competing hypotheses, we computed country-level gender differences for each preference. For this purpose, we standardized each preference measure at the country level to exhibit a mean of 0 and a standard deviation of 1. We then performed for each preference and country a separate OLS regression using as independent variable a gender indicator in which male is the reference category. We also included several controls to isolate the gender effect from potentially confounding factors that might differ between women and men. These controls are age, age squared, subjective math skills, education level, and household income quintile. The obtained

coefficient on the gender indicator served as a measure of the gender difference in the respective preference and country.

Using the country-level estimates of gender differences in preferences, we examined variation along levels of economic development and gender equality. As the measure of economic development, we used GDP per capita. To assess the role of gender equality, we created a Gender Equality Index as a joint measure of four indices of gender equality: (i) the Global Gender Gap Index of the World Economic Forum (WEF), (ii) the Gender Equality Index of the United Nations (UN), (iii) the ratio of female to male labor force participation rates, and (iv) the number of years since women's suffrage. The Gender Equality Index was constructed as the predicted main component from a principal components analysis of the four indices.

To study the effect of economic development, we first sorted the 76 countries into four bins according to their level of development, measured by GDP per capita. We then computed for each bin the average country-level gender difference in each preference. Gender differences in all six preferences increased with a country's level of development (Fig. 1A). The positive correlations between log GDP per capita and country-level gender differences were large and statistically significant for all six preferences: 0.58 for altruism ($P < 0.0001$), 0.59 for trust ($P < 0.0001$), 0.31 for positive reciprocity ($P = 0.0067$), 0.35 for negative reciprocity ($P = 0.0017$), 0.37 for risk-taking ($P = 0.0011$), and 0.38 for patience ($P = 0.0006$) (fig. S2). We also analyzed a summary index of gender differences for all preferences jointly. For this purpose, we first performed a principal components analysis of the country-level gender differences in the six preferences. We then created an index of gender differences in preferences as the predicted main component. This index exhibited a correlation of 0.67 ($P < 0.0001$) with log GDP per capita (Fig. 1B) (27).

To study the effect of gender equality, we ran the same analysis as for economic development, using the Gender Equality Index as the explanatory variable. Gender differences in preferences were found to increase with gender equality for each preference separately (Fig. 1C) as well as for the index of gender differences in preferences (Fig. 1D). For the individual preferences, the correlation coefficients were 0.51 for altruism ($P < 0.0001$), 0.41 for trust ($P = 0.0005$), 0.13 for positive reciprocity ($P = 0.2875$), 0.40 for negative reciprocity ($P = 0.0005$), 0.34 for risk-taking ($P = 0.0036$), and 0.43 for patience ($P = 0.0002$) (fig. S3). The summary index of gender differences in preferences exhibited a correlation of 0.56 ($P < 0.0001$) with the Gender Equality Index. Reassuringly, the positive relationship between the index of gender differences in preferences and gender equality was also found for the four individual indicators of gender equality (fig. S4).

Economic development and gender equality are strongly intertwined (17). To isolate the separate impacts of economic development and gender equality on gender differences in preferences,

we conducted a conditional analysis. We constructed partial regression plots illustrating the relationship between the index of gender differences in preferences and log GDP per capita conditional on the Gender Equality Index (Fig. 2A) and vice versa (Fig. 2B). The dependent and independent variables were standardized to exhibit a mean of 0 and a standard deviation of 1. Hence, the slope coefficients can be interpreted as the standard deviation change in the dependent variable in response to a change of one standard deviation in the independent variable.

There was a quantitatively large and statistically significant association of gender differences with log GDP per capita conditional on the Gender Equality Index. The estimated slope coefficient was 0.53 ($P < 0.0001$). Likewise, gender differences were strongly associated with the Gender Equality Index conditional on log GDP per capita, with a somewhat smaller slope coefficient of 0.32 ($P = 0.0033$) (see also table S4, column 7). When conducting an *F*-test for equality of both coefficients, we failed to reject at $P = 0.2537$, indicating that the strength of the relationships between the index of gender differences in preferences and log GDP per capita and the Gender Equality Index were not statistically different. These findings imply that both economic development and gender equality exhibited an independent and significant association with gender differences in preferences (28). Conditional on log GDP per capita, differences in preferences were also significantly and positively associated with the four individual measures of gender equality (Fig. 2, C to F). Slope coefficients were 0.23 ($P = 0.0084$) for the WEF Global Gender Gap Index, 0.29 ($P = 0.0515$) for the UN Gender Equality Index, 0.25 ($P = 0.0123$) for ratio of female to male labor force participation, and 0.30 ($P = 0.0023$) for years since women's suffrage.

In sum, these findings provide evidence in favor of the resource hypothesis that higher levels of economic development and gender equality are associated with stronger gender differentiation in preferences.

A potential concern regarding the reported results involves bias due to culture-specific survey response behavior (29–32). Note that our data contain two types of items: qualitative self-assessments and quantitative choice measures. Qualitative self-assessments might be affected by response biases such as scaling effects, which might vary across cultures, thereby introducing systematic measurement error (33). In contrast, the quantitative items present trade-offs that are well-defined in terms of stakes and probabilities, yielding revealed preference measures that facilitate a culturally fair comparison. To test for robustness with regard to the elicitation method, we constructed two separate indices of gender differences using either qualitative or quantitative items only (analogous to how we constructed the main index). The correlations of the indices with log GDP per capita were found to be very similar, with values of 0.551 ($P < 0.0001$) for qualitative items and 0.516 ($P < 0.0001$) for

quantitative items (fig. S7, A and B). A test of the null hypothesis of equality of the correlation coefficients failed to reject at conventional significance levels ($P = 0.744$). Likewise, correlations with the Gender Equality Index were 0.480 ($P < 0.0001$) for qualitative items and 0.479 ($P < 0.0001$) for quantitative items (fig. S7, C and D). Testing equality of the coefficients failed to reject ($P = 0.991$), thus providing no support that culture-specific response behavior contaminated the results.

To further test for the robustness of our results, we conducted several additional analyses. First, because trust reflects a composite trait that captures beliefs about others' behavior, prosocial preferences, and preferences for risk-taking, we repeated our analysis excluding the trust dimension. To do so, we constructed an alternative index of gender differences in preferences in a procedure parallel to the main index but using only the five remaining preferences. Similar to our main results, this alternative index exhibited a quantitatively large association with economic development and measures of gender equality (tables S5 and S6). Second, we tested whether the level of standardization affected our results. We repeated our analysis using preference measures standardized at the global rather than the country level. The results using preferences standardized at the global level were similar to our main results (fig. S8 and tables S7 and S8). Third, we repeated our analysis without using individual-level controls when calculating gender differences, yielding similar results (fig. S9 and tables S9 and S10). Fourth, a common concern in cross-country analysis involves measurement error. Because the experimental validation was conducted in Germany, more linguistically similar countries might exhibit smaller measurement error. To test for robustness against this potential confound, we additionally controlled for linguistic distance to German, which left the results qualitatively unchanged (tables S11 and S12). Fifth, to address concerns of aggregation bias, we tested for the relationship between household income and gender differences in preferences in individual-level regressions, finding a significant relationship for each preference (table S13). Finally, we tested for a nonlinear relationship with economic development. A closer inspection of Fig. 1B suggested a nonlinear, convex relationship, which is confirmed by regression analysis (table S14, column 2). This pattern originated from the fact that richer countries are overproportionally more gender-equal. Therefore, when we investigated the relationship between the index of gender differences in preferences and log GDP per capita after residualizing both variables with respect to the Gender Equality Index, the relationship was found to be linear (table S14). See supplementary text for details of the robustness tests.

Concluding remarks

The reported evidence indicates that higher levels of economic development and gender equality are associated with stronger gender differentiation

in preferences. These findings may also relate to other personality traits, such as the Big Five (34, 35) or value priorities (36). Our findings do not rule out an influence of gender-specific roles that drive gender differences in preferences. They

also do not preclude a role for biological or evolutionary determinants of gender differences (37). Our results highlight, however, that theories not attributing a significant role to the social environment are incomplete (38).

In this regard, our findings point toward the critical role of availability of and equal access to material and social resources for both women and men in facilitating the independent formation and expression of gender-specific preferences

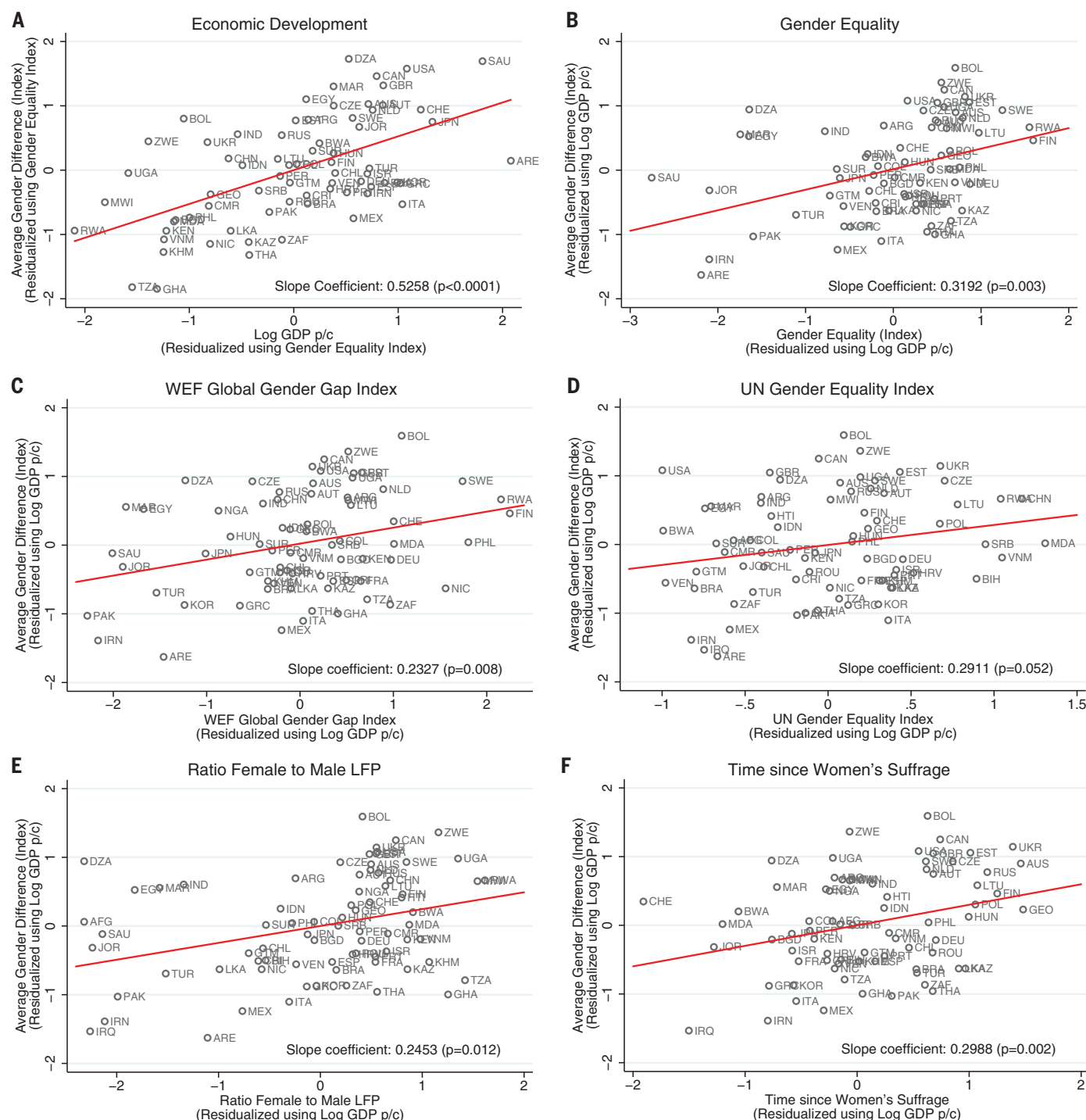


Fig. 2. Analysis of gender differences in preferences in relation to economic development conditional on gender equality, and vice versa. Each panel depicts a partial regression plot. (A) Relationship between the aggregate index of gender differences in preferences and log GDP per capita after residualizing both variables with respect to the Gender Equality Index. (B to F) Relationship between the aggregate index

of gender differences in preferences and five indices of gender equality after residualizing all variables with respect to log GDP per capita. Indices of gender equality are (B) the Gender Equality Index, (C) WEF Global Gender Gap Index, (D) UN Gender Equality Index, (E) ratio of female to male labor force participation, and (F) years since women's suffrage. For corresponding regression evidence, see table S4.

across countries. As suggested by the resource hypothesis, greater availability of material resources removes the human need of subsistence, and hence provides the scope for attending to gender-specific preferences. A more egalitarian distribution of material and social resources enables women and men to independently express gender-specific preferences.

Materials and methods

See the supplementary materials for further details, including a list of the 76 countries included in the survey.

Experimental selection of survey items and construction of preference measures

Survey items included in the GPS data were selected in an ex ante experimental validation procedure at the Laboratory for Experimental Economics of the University of Bonn in winter 2010–2011. In this procedure, 402 subjects participated in incentivized-choice experiments and responded to a large set of survey items, which were either newly developed or taken from existing surveys (25).

Incentivized-choice experiments were conducted to obtain an incentivized behavioral measure for each preference. Risk-taking was measured as the average response to two multiple price lists in which subjects chose between a lottery and varying safe options. Patience was measured as the average response to two multiple price lists in which subjects chose between receiving a payment on the day of the experiment or a larger payment 12 months later. Trust was measured as the average amount sent as a first mover in two investment games. Altruism was measured as first-mover behavior in a dictator game with a charitable organization as recipient. Positive reciprocity was measured as the average amount sent back as a second mover in two investment games. Negative reciprocity was measured as the average amount invested into punishment after unilateral defection of the opponent in a prisoner's dilemma and the minimum acceptable offer in an ultimatum game.

For each preference, we selected those survey items for constructing the GPS that exhibited the highest predictive power for the corresponding incentivized behavioral measure (25). Formally, for each preference the behavioral measure was regressed on different combinations of the survey items. The combination that maximized the adjusted R^2 was then selected for the respective preference.

Twelve survey questions were selected for the GPS; these comprised a mixture of qualitative items, measured on an 11-point Likert scale (0 to 10), and quantitative items involving economic trade-off decisions. Risk-taking was elicited by (i) an item determining the indifference point between a lottery with 50% chance of winning and receiving a fixed certain payment, and (ii) the response to the item “Please tell me, in general, how willing or unwilling you are to take risks.” Patience was elicited by (i) an item determining

the indifference point between receiving a fixed monetary amount on the day of the survey and a larger amount 12 months later, and (ii) the response to the question “How willing are you to give up something that is beneficial for you today in order to benefit more from that in the future?” Positive reciprocity was elicited by (i) an item asking for the value of a thank-you gift the respondent is willing to give in return for help by a stranger and (ii) the response to the item “When someone does me a favor I am willing to return it.” Negative reciprocity was elicited by responses to the items (i) “If I am treated very unjustly, I will take revenge at the first occasion, even if there is a cost to do so,” (ii) “How willing are you to punish someone who treats you unfairly, even if there may be costs for you?”, and (iii) “How willing are you to punish someone who treats others unfairly, even if there may be costs for you?” Altruism was elicited by (i) the quantitative value in response to the question “Imagine the following situation: Today you unexpectedly received 1000 euros. How much of this amount would you donate to a good cause?” and (ii) the response to the question “How willing are you to give to good causes without expecting anything in return?” Trust was elicited by the response to the item “I assume that people have only the best intentions.” For each preference, the final survey measure was given as the weighted average of the z -scores of the corresponding survey items. The weights were calculated as the coefficients in OLS regressions of the incentivized behavioral measures on the respective survey items.

Selection of countries, translation of survey items, and pretest

For the GPS, 76 countries were selected with the goal of providing representative coverage of the global population. As a key criterion, the selected countries covered all development levels and geographic regions, including 24 in Europe, 22 in Asia, 1 in Oceania, 14 in Africa, and 15 in the Americas. Further, the selection process aimed at maximizing variation along country characteristics (such as language and historical, political, and ecological conditions) and favored culturally distinct and non-neighboring countries.

For each country, the selected survey items were translated into the country's major languages by at least three translators for each language. A first translator suggested, depending on the region of the target language, an English, French, or Spanish version of the item. A second translator conducted the translation into the target language. A third translator conducted a translation back to the original language. If a discrepancy occurred, the process was iterated until all translators agreed. Furthermore, monetary amounts used in the survey questions were adjusted to correspond to the same share in the median income of the target countries.

The survey items were pretested as part of the Gallup World Poll 2012 pretest, conducted at the end of 2011 in 22 countries with a sample size of 10 to 15 respondents per country. No respondent

indicated problems in understanding the wording or the quantitative content of the survey items. Some respondents suggested rewording, which was incorporated through minor adjustments of some survey items.

Sampling and selection of respondents

We included the GPS as part of the Gallup World Poll 2012 through the infrastructure of Gallup (23). Respondents were sampled to achieve national representativeness of the resident population aged 15 and older. Telephone interviews were conducted in regions where at least 80% of the country's population is covered by telephone or where it is the customary survey methodology. Otherwise, face-to-face interviews were conducted.

The selection of households in countries with telephone interviews used either a random-digit-dialing method or nationally representative lists of phone numbers. In countries with face-to-face interviews, primary sampling units were stratified by population size and/or geography. To select sampled households, we used a random-route procedure. Respondents were selected randomly by either the latest-birthday or Kish grid method.

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24. We note that trust is not a preference but a composite trait, including beliefs about others' behavior, prosocial preferences, and preferences for risk-taking. Given its importance, however, we decided to include it in our analysis. The results remained unchanged when excluding trust from the analysis; see supplementary materials.
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27. This relationship remained robust when controlling for country-specific differences such as geographic, demographic, and historical factors (table S2). A complementary analysis further showed that gender differentiation in preferences was driven by those components of economic development that disproportionately benefit females relative to males (table S3).
28. We also investigated, separately for each preference, the relationship between gender differences and economic development conditional on gender equality, and vice versa. For each preference, gender differences were found to be strongly associated with log GDP per capita conditional on the Gender Equality Index (fig. S5). Likewise, gender differences were found to be highly associated with the Gender Equality Index conditional on log GDP per capita (fig. S6).
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33. A specific concern involves cross-cultural differences in gender-specific social comparison (29–32): Survey respondents in less developed, less gender-egalitarian countries may be inclined to define themselves relative to people of the same gender (intragroup social comparison). In contrast, those in more developed and gender-egalitarian countries may be likely to compare themselves to both women and men (intergroup social comparison). As a consequence, gender differences estimated through self-assessments may be understated in less developed countries.
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37. An example for the biological role in shaping human preferences comes from twin studies (39–42).
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SUPPLEMENTARY MATERIALS

www.sciencemag.org/content/362/6412/eaas9899/suppl/DC1
Materials and Methods
Supplementary Text
Figs. S1 to S9
Tables S1 to S14
References (44–52)

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Relationship of gender differences in preferences to economic development and gender equality

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Assessing gender differences

What contributes to gender-associated differences in preferences such as the willingness to take risks, patience, altruism, positive and negative reciprocity, and trust? Falk and Hermle studied 80,000 individuals in 76 countries who participated in a Global Preference Survey and compared the data with country-level variables such as gross domestic product and indices of gender inequality. They observed that the more that women have equal opportunities, the more they differ from men in their preferences.

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