Human need satisfaction enables decoupling of well-being from income

Supplementary Information

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The Supplementary Information reports the detailed results of the confirmatory analysis of the pre-registered study the main article is based on, as well as some exploratory results relevant for the article. The pre-registration can be accessed at the Open Science Framework platform: `https://osf.io/d8uzw/?view_only=396136ced71e417d852cad4eb1144dcb`.

Since the main article presents only a selection of the pre-registered analyses, the naming of models in the main article differs from the pre-registration. In the latter, the names of the models refer to the pre-registered hypotheses that can be tested with them. Model 1, 2, and 3 in the main analysis of the article correspond to models B2, H1-c-f, and H1-k-n in the pre-registered study, with the only difference that for the main paper, we fitted model 1 and 2 on only those data points that are also complete observations for the more complex model 3 (i.e., model H1-k-n) in order to enable a direct comparison of the coefficients. We here report detailed results tables for both versions, the one from the main paper in section 2 and the version following the pre-registration in section 3.1.

Please note: In the main article, we report the units of those variables describing a population share to 10 percentage point steps to improve the readability of the figures. In the Supplementary Information, we keep the units and order of variables from the pre-registration for the sake of consistency.

1 Changes and extensions to pre-registration

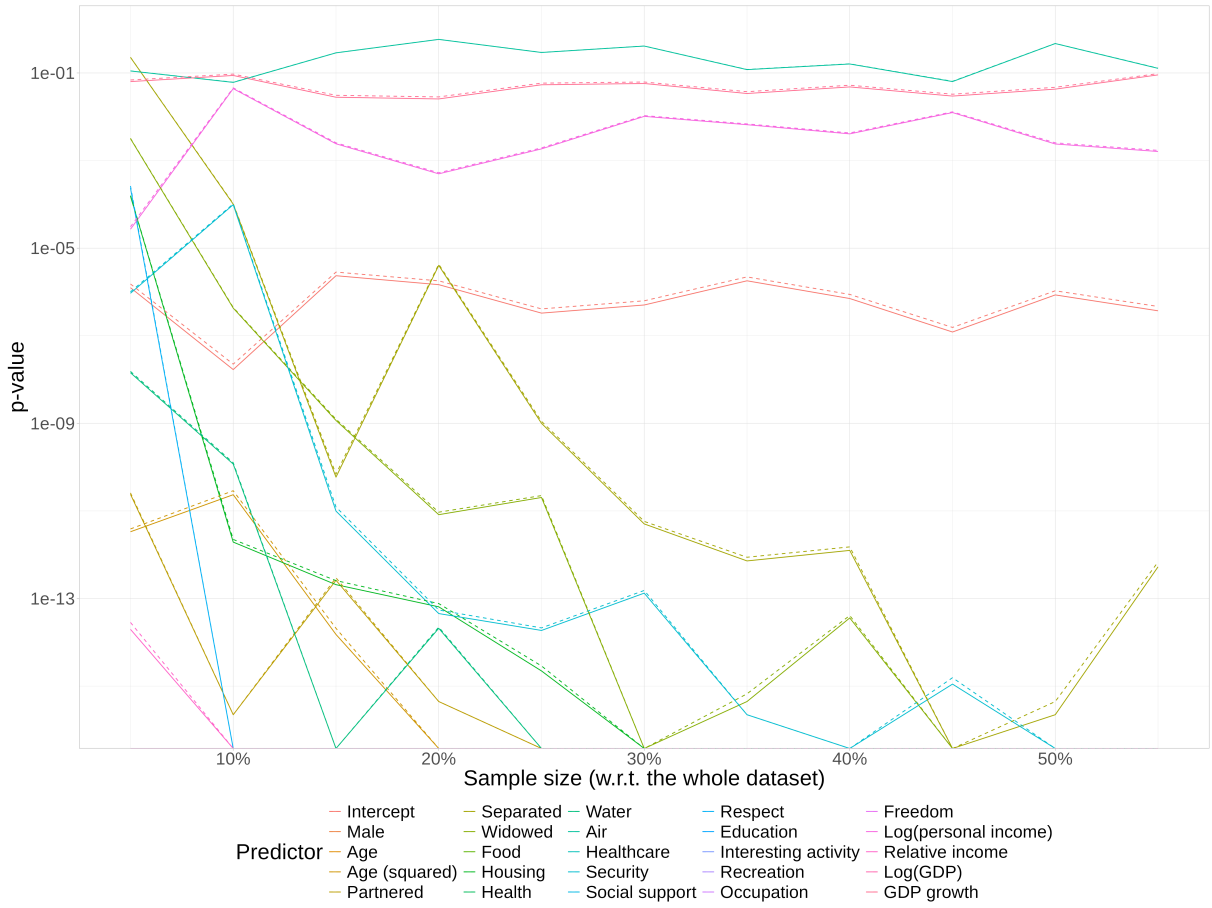
Table 1 documents all changes that me made during the study compared to the pre-registration, as well as our reasons to do so. Some of these changes are discussed in more detail in the following subsections.

1.1 Choice of different optimiser in case of convergence problems

In the case of some the models, there were convergence warnings when using the standard optimiser (NLopt). According to the documentation of the lmer package, this is (contra-intuitively) not uncommon for large datasets due to the way convergence is evaluated. In these cases, following our pre-registration, we used an alternative optimiser (Nelder-Mead) for which no convergence warnings occured – with nearly identical results, indicating that the convergence warnings were a false-positive in the first place. We nevertheless report the results for the Nelder-Mead optimiser.

Change / Extension	**Reason**
Variables	
added age squared to demographic control variables	forgot to include this in pre-registration
changed definition of relative income to income percentile (instead of standardised income with regard to the mean)	due to (a) outliers in the income data distorting the mean and (b) extreme skewness of the standardised income distribution when using the median instead
treated satisfaction with standard of living as continuous variable	not everywhere consistent in pre-registration
binarised education (1 = medium education level or higher) and security (1 = security index of 1)	to facilitate the comparison of different need satisfaction variables
Data cleaning	
removed data points with zero income	data exploration suggested that they are artefacts
removed data for Somalia	PPP conversion factor seems to be wrong (extremely low income values for entire population)
removed data for South Sudan	due to (a) generally low population coverage and (b) large share of respondents with zero income
subsampled data for India to maximal 4900 data points per year	due to oversampling by Gallup, the Indian dataset was so large that a subroutine of the cluster-robust standard errors failed because of memory limits
Models	
added B1 (only demographic control variables) and B2 (only demographic control variables and income variables)	to enable a comparison between the overall income effects and the effects when controlling for need satisfaction
Statistical tests	
changed sample size correction to CR1 instead of CR 2 when calculating cluster robust standard errors	dataset too large for memory heavy CR2, performed a small simulation study showing that this change is irrelevant in our case
based p-values and confidence intervals on t-distribution with Satterthwaite degrees of freedom claculated with package lmerTest	not specified in pre-registration
additionally to F-tests calculated pseudo R squared based on Nakagawa et al. (2017)	extension to improve understanding of goodness-of-fit

Supplementary Table 1: Changes and extensions to pre-registration



Supplementary Fig. 1: p-values of coefficients in model H1-c-f for data subsets of increasing size. *Solid lines*: computed from the bias-reduced cluster-robust covariance estimator (CR1), *Dashed lines*: computed from the generalized bias-reduced cluster-robust covariance estimator (CR2)

1.2 Change of estimator for cluster-robust standard errors

Calculating the p-values for a multilevel regression model involves a proper estimation of the variance-covariance matrix associated to the coefficient estimates. To this aim, we used the R package clubSandwich, which provides several cluster-robust variance-covariance estimators.

We considered two different estimators, which only differ in their finite-sample correction: the first one uses bias-reduced linearization (Pustejovsky and Tipton (2016), we will refer to it as CR1), while the second one (Bell and Mccaffrey (2002), here referred to as CR2) is a generalization of the first, dealing with a known issue appearing in some specific models.

While the CR2 estimator is generally more reliable, which is why we chose it in the pre-registration, it is also computationally more demanding. In particular, with the available computational cluster infrastructure, we were not able to calculate the variance-covariance matrix for the models fitted on all data points available in our dataset due to memory problems. Therefore, we decided to use the CR2 estimator instead. We legitimise this replacement for the context of our dataset with a small simulation study, which we describe in the following.

In order to compare the two estimators, we randomly extracted sub-samples of increasing size from our dataset. We were careful in considering the same proportion of data on each country/year category. This means that, for instance, for a sub-sample 20% of the size of the original sample size, the proportion of selected data for a given country and year is also 20% of

what was available for the same country and year in the full sample.

For each of these subsets, we fitted model H1-a and H1-c-f, calculated the variance-covariance matrix using both the CR1 and CR2 estimator, and calculated the p-values of the coefficients based on the two versions of the obtained cluster-robust standard errors.

Fig. 1 shows the p-values of the coefficients in model H1-c-f computed with the CR1 variance estimator (solid lines) and with the CR2 variance estimator (dashed lines) for a selection of random sub-samples of sizes that span from 10% to 55% of the total amount of data. The fact that both computations end up in extremely close results gives us some fair amount of confidence for using the CR1 estimator on the full sample.

Due to the fast convergence below significance borders, we are also confident that the subsampling of the Indian dataset (again due to memory problems with clubSandwich) does not cause any relevant changes to our results.

2 Result tables of main analysis

	Model 1	Model 2	Model 3
2010	-0.057	-0.049	-0.049
2011	-0.064	-0.055	-0.023
2012	-0.161^{**}	-0.122^{*}	-0.055
2013	-0.194^{***}	-0.161^{**}	-0.145^{**}
2014	-0.168^{**}	-0.142^{**}	-0.134^{*}
2015	-0.210^{***}	-0.180^{***}	-0.174^{**}
2016	-0.214^{***}	-0.175^{***}	-0.169^{**}
2017	-0.186^{**}	-0.125^{*}	-0.108^{+}
2018	-0.192^{**}	-0.133^{*}	-0.107^{+}
2019	-0.128^{+}	-0.063	-0.025
2020	0.083	0.041	0.057
2021	-0.046	-0.022	0.044
2022	-0.144^{*}	-0.082	-0.012
Standard deviations			
Country effects	0.5917	0.5057	0.4267
Country-year effects	0.5917	0.5057	0.4267
Residuals	2.074	1.991	1.991
Note:	$+$ p<0.1; * p<0.05; ** p<0.01; *** p<0.001		

Supplementary Table 2: Fixed year and random effect variances of multilevel models for main analysis

	Model 1	Model 2	Model 3
Intercept	-1.828^{***}	-2.174^{***}	-1.087^{+}
Male	-0.165^{***}	-0.194^{***}	-0.194^{***}
Age	-0.047^{***}	-0.030^{***}	-0.030^{***}
Age (squared)	0.0004^{***}	0.0003^{***}	0.0003^{***}
Partnered	0.177^{***}	0.158^{***}	0.159^{***}
Separated	-0.252^{***}	-0.146^{***}	-0.146^{***}
Widowed	-0.275^{***}	-0.160^{***}	-0.160^{***}
Food		0.572^{***}	0.571^{***}
Housing		0.145^{***}	0.145^{***}
Health		0.329^{***}	0.330^{***}
Water		0.101^{***}	0.101^{***}
Air		0.012	0.012^{**}
Healthcare		0.249^{***}	0.248^{***}
Security		0.081^{***}	0.081^{***}
Social support		0.559^{***}	0.558^{***}
Respect		0.186^{***}	0.186^{***}
Education		0.283^{***}	0.283^{***}
Interesting activity		0.321^{***}	0.320^{***}
Recreation		0.300^{***}	0.299^{***}
Occupation		0.332^{***}	0.332^{***}
Freedom		0.301^{***}	0.301^{***}
Food (country average)			0.014^{***}
Housing (country average)			-0.008^{***}
Health (country average)			-0.006^{*}
Water (country average)			0.002
Air (country average)			-0.003
Healthcare (country average)			0.001
Security (country average)			-0.002
Social support (country average)			0.006^{**}
Respect (country average)			-0.0004
Education (country average)			0.002
Interesting activity (country average)			0.010^{***}
Recreation (country average)			0.002
Occupation (country average)			0.011^{**}
Freedom (country average)			0.004^{*}
Government effectiveness			0.113^{*}
Democracy			0.113^{*}
Social protection			-0.002
Log(personal income)	0.103^{***}	0.056^{***}	0.055^{***}
Relative income	0.011^{***}	0.007^{***}	0.007^{***}
Log(GDP per capita)	0.770^{***}	0.528^{***}	0.182^{**}
GDP per capita growth	0.034^{**}	0.025^{**}	0.017^{***}
Residual standard deviation	2.074	1.991	1.991
Marginal Pseudo-R^2	0.1756	0.2421	0.2638
Conditional Pseudo-R^2	0.2571	0.3045	0.3107
Observations	1,369,727	1,369,727	1,369,727

Note: $+$ p<0.1; * p<0.05; ** p<0.01; *** p<0.001

Supplementary Table 3: Multilevel model coefficients for models of the main analysis

3 Detailed results of confirmatory analysis

3.1 Research question 1

	H1-a	H1-b
Intercept	-1.551^{***}	1.616^{***}
Male	-0.165^{***}	-0.192^{***}
Age	-0.023^{***}	-0.028^{***}
Age (squared)	0.0002^{***}	0.0002^{***}
Partnered	0.105^{***}	0.146^{***}
Separated	-0.155^{***}	-0.150^{***}
Widowed	-0.176^{***}	-0.165^{***}
Food	0.660^{***}	0.582^{***}
Housing	0.161^{***}	0.143^{***}
Health	0.348^{***}	0.318^{***}
Water	0.108^{***}	0.103^{***}
Air	-0.016	0.010
Healthcare	0.259^{***}	0.250^{***}
Security	0.075^{***}	0.080^{***}
Social support	0.597^{***}	0.555^{***}
Respect	0.197^{***}	0.180^{***}
Education	0.412^{***}	0.290^{***}
Interesting activity	0.340^{***}	0.321^{***}
Recreation	0.311^{***}	0.302^{***}
Occupation	0.388^{***}	0.331^{***}
Freedom	0.307^{***}	0.303^{***}
Log(personal income)		0.242^{***}
Log(GDP per capita)	0.505^{***}	
Residual standard deviation	2.014	2.004
Marginal Pseudo-R^2	0.2312	0.1715
Conditional Pseudo-R^2	0.2901	0.2553
Observations	1,495,434	1,513,679
Note:	$+$ p<0.1; * p<0.05; ** p<0.01; *** p<0.001	

Supplementary Table 4: Multilevel model coefficients for research question 1, part 1

Table 4, 5, and 6 summarise the multilevel models fitted to test the hypotheses of research question 1. Table 5 shows additionally the coefficients of a model without need satisfaction variables (B2) and one only with the demographic control variables (B1) for comparison, which we fitted on the same datapoints as for H1-a for memory limit reasons. All hypotheses except H1-h ("GDP per capita growth predicts life evaluation beyond the individual and country average satisfaction of basic human needs, GDP per capita, personal income, and relative income.") are accepted based on the chosen alpha level of 0.05.

Table 7 documents the year effects and random effect standard variations of all models for research question 1.

The ANOVA results (table 8) indicate that the inclusion of additional variables improved the fit of the multilevel model in each step.

	B1	B2	H1-c-f
Intercept	6.507^{***}	-1.430^{***}	-1.756^{***}
Male	-0.106^{***}	-0.164^{***}	-0.192^{***}
Age	-0.038^{***}	-0.046^{***}	-0.029^{***}
Age (squared)	0.0003^{***}	0.0004^{***}	0.0002^{***}
Partnered	0.071^{**}	0.167^{***}	0.154^{***}
Separated	-0.296^{***}	-0.258^{***}	-0.149^{***}
Widowed	-0.351^{***}	-0.282^{***}	-0.164^{***}
Food			0.568^{***}
Housing			0.140^{***}
Health			0.314^{***}
Water			0.100^{***}
Air			0.014
Healthcare			0.248^{***}
Security			0.079^{***}
Social support			0.555^{***}
Respect			0.179^{***}
Education			0.284^{***}
Interesting activity			0.317^{***}
Recreation			0.299^{***}
Occupation			0.324^{***}
Freedom			0.297^{***}
Log(personal income)		0.094^{***}	0.049^{**}
Relative income		0.011^{***}	0.007^{***}
Log(GDP per capita)		0.731^{***}	0.491^{***}
GDP per capita growth		0.027^{*}	0.018^{*}
Residual standard deviation	2.122	2.082	2
Marginal Pseudo-R^2	0.01263	0.1698	0.2364
Conditional Pseudo-R^2	0.2449	0.2484	0.2965
Observations	1,495,434	1,495,434	1,495,434

Note: $+$ p<0.1; * p<0.05; ** p<0.01; *** p<0.001

Supplementary Table 5: Multilevel model coefficients for research question 1, part 2

	H1-g-j	H1-k-n
Intercept	-1.510^{*}	-1.087
Male	-0.192^{***}	-0.194^{***}
Age	-0.029^{***}	-0.030^{***}
Age (squared)	0.0002^{***}	0.0003^{***}
Partnered	0.154^{***}	0.159^{***}
Separated	-0.149^{***}	-0.146^{***}
Widowed	-0.164^{***}	-0.160^{***}
Food	0.567^{***}	0.571^{***}
Housing	0.141^{***}	0.145^{***}
Health	0.315^{***}	0.330^{***}
Water	0.100^{***}	0.101^{***}
Air	0.014	0.012
Healthcare	0.247^{***}	0.248^{***}
Security	0.079^{***}	0.081^{***}
Social support	0.554^{***}	0.558^{***}
Respect	0.179^{***}	0.186^{***}
Education	0.283^{***}	0.283^{***}
Interesting activity	0.317^{***}	0.320^{***}
Recreation	0.299^{***}	0.299^{***}
Occupation	0.324^{***}	0.332^{***}
Freedom	0.296^{***}	0.301^{***}
Food (country average)	0.014^{***}	0.014^{***}
Housing (country average)	-0.007^{*}	-0.008^{**}
Health (country average)	-0.010^{*}	-0.006
Water (country average)	0.003	0.002
Air (country average)	-0.002	-0.003
Healthcare (country average)	0.002	0.001
Security (country average)	-0.003^{+}	-0.002
Social support (country average)	0.006^{*}	0.006^{*}
Respect (country average)	-0.002	-0.0004
Education (country average)	0.002	0.002
Interesting activity (country average)	0.010^{***}	0.010^{***}
Recreation (country average)	0.003	0.002
Occupation (country average)	0.009^{+}	0.011^{*}
Freedom (country average)	0.004^{*}	0.004
Government effectiveness		0.113^{+}
Democracy		0.113^{*}
Social protection		-0.002
Log(personal income)	0.048^{**}	0.055^{***}
Relative income	0.007^{***}	0.007^{***}
Log(GDP per capita)	0.239^{***}	0.182^{*}
GDP per capita growth	0.010	0.017^{*}
Residual standard deviation	2	1.991
Marginal Pseudo-R^2	0.2574	0.2638
Conditional Pseudo-R^2	0.304	0.3107
Observations	1,495,434	1,369,727
Note:	$+$ p<0.1; * p<0.05; ** p<0.01; *** p<0.001	

Supplementary Table 6: Multilevel model coefficients for research question 1, part 3

	B1	B2	H1-a	H1-b	H1-c-f	H1-g-j	H1-k-n
2010	-0.035	-0.065	-0.062	-0.042	-0.057	-0.056	-0.049
2011	0.004	-0.061	-0.052	-0.032	-0.051	-0.003	-0.023
2012	-0.055	-0.166^{**}	-0.103^{*}	-0.080^{+}	-0.128^{**}	-0.052	-0.055
2013	-0.083	-0.199^{***}	-0.154^{**}	-0.124^{*}	-0.168^{***}	-0.143^{**}	-0.145^{**}
2014	-0.054	-0.184^{**}	-0.146^{**}	-0.106^{*}	-0.157^{**}	-0.140^{*}	-0.134^{*}
2015	-0.046	-0.188^{***}	-0.152^{**}	-0.122^{*}	-0.162^{**}	-0.149^{**}	-0.174^{**}
2016	-0.037	-0.191^{***}	-0.147^{**}	-0.118^{*}	-0.156^{**}	-0.155^{**}	-0.169^{**}
2017	0.050	-0.141^{*}	-0.064	-0.045	-0.083	-0.084	-0.108^{+}
2018	0.080	-0.134^{*}	-0.057	-0.024	-0.078	-0.078	-0.107^{+}
2019	0.141^{*}	-0.085	-0.002	0.058	-0.019	-0.005	-0.025
2020	0.232^{**}	0.103	0.016	0.031	0.057	0.055	0.057
2021	0.164^{*}	-0.004	-0.010	0.045	0.014	0.054	0.044
2022	0.103	-0.097	-0.050	0.012	-0.039	-0.012	-0.012
Standard deviations							
Country effects	1.115	0.5704	0.4791	0.5839	0.485	0.4188	0.4267
Country-year effects	1.115	0.5704	0.4791	0.5839	0.485	0.4188	0.4267
Residuals	2.122	2.082	2.014	2.004	2	2	1.991
Note:							$+$ p<0.1; * p<0.05; ** p<0.01; *** p<0.001

Supplementary Table 7: Fixed year and random effect variances of multilevel models for research question 1

Model	number of parameters	Log-Likelihood	Df	p
B1	23	$-2,972,490.0$		
B2	27	$-2,945,192.0$	4	0
H1-c-f	41	$-2,889,171.0$	14	0
H1-g-j	55	$-2,889,067.0$	14	0
H1-k-n	58	$-2,889,059.0$	3	0.001

Supplementary Table 8: ANOVA results for models in RQ1

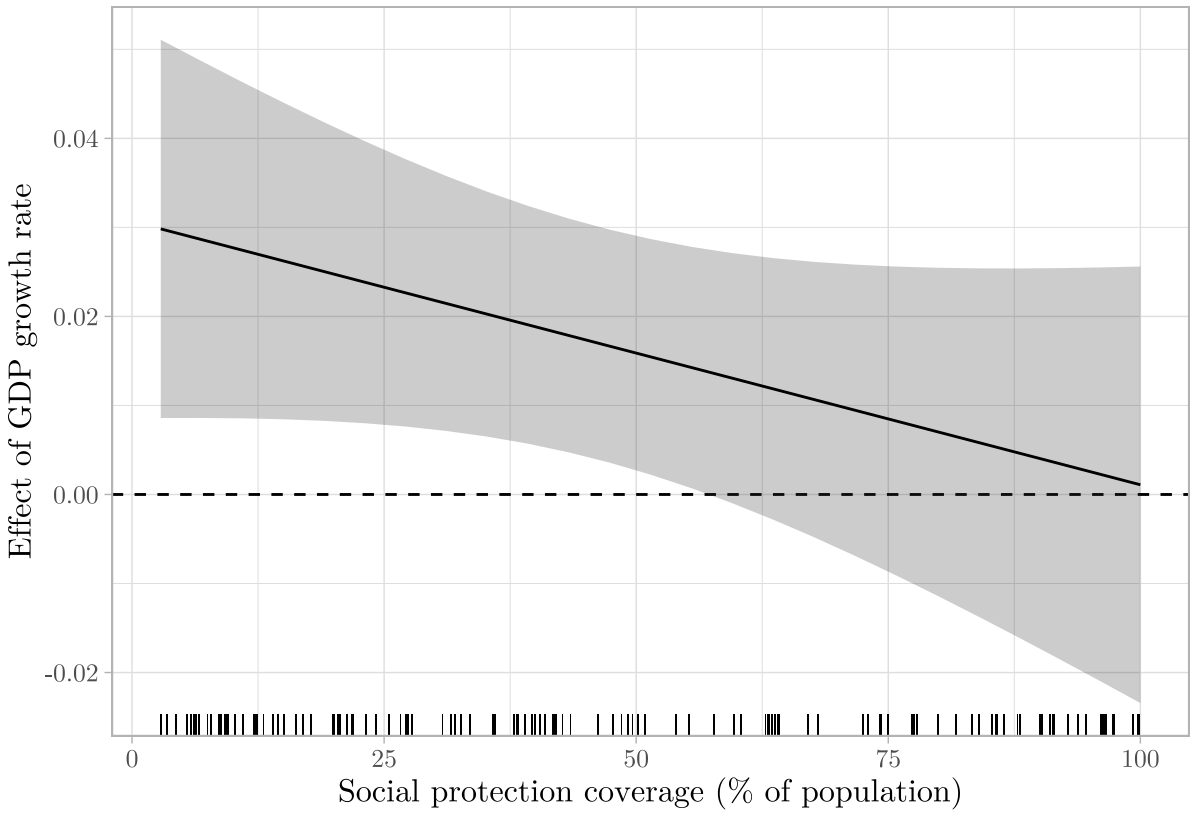
3.2 Research question 2

H2-a The interaction terms between social protection coverage and GDP per capita, GDP per capita growth, personal income, and relative income are all insignificant, i.e., we cannot reject the null hypothesis that they are zero. The marginal effect of personal and relative income is strongly significant and nearly constant over all ranges of social protection coverage. However, in the case of GDP per capita growth, we find that its effect on life evaluation is only significant for a social protection coverage below approximately 60% (see figure 2). According to Brambor et al. (2006), if the significance changes depending on the moderator, this can be seen as an interaction even if the interaction term itself is not significant. This view has been challenged by Berry et al. (2012). They argue that by counting a change of significance as a sign for meaningful interaction, "one is placing too much reliance on an arbitrarily chosen level of statistical significance" (Berry et al. 2012). However, in our case, varying the alpha level in a range from 0.1 to 0.01 only changes the exact percentage at which the effect of GDP per capita growth becomes insignificant and not the fact that there is a change of significance. This result implies that the effect of the GDP per capita growth rate is only evident in countries where most people do not have a public safety net. Although there is also a change of significance for the effect of GDP per capita at alpha = 0.05, it is much more sensitive to the choice of the significance level, which is why we do not consider it to be a meaningful interaction.

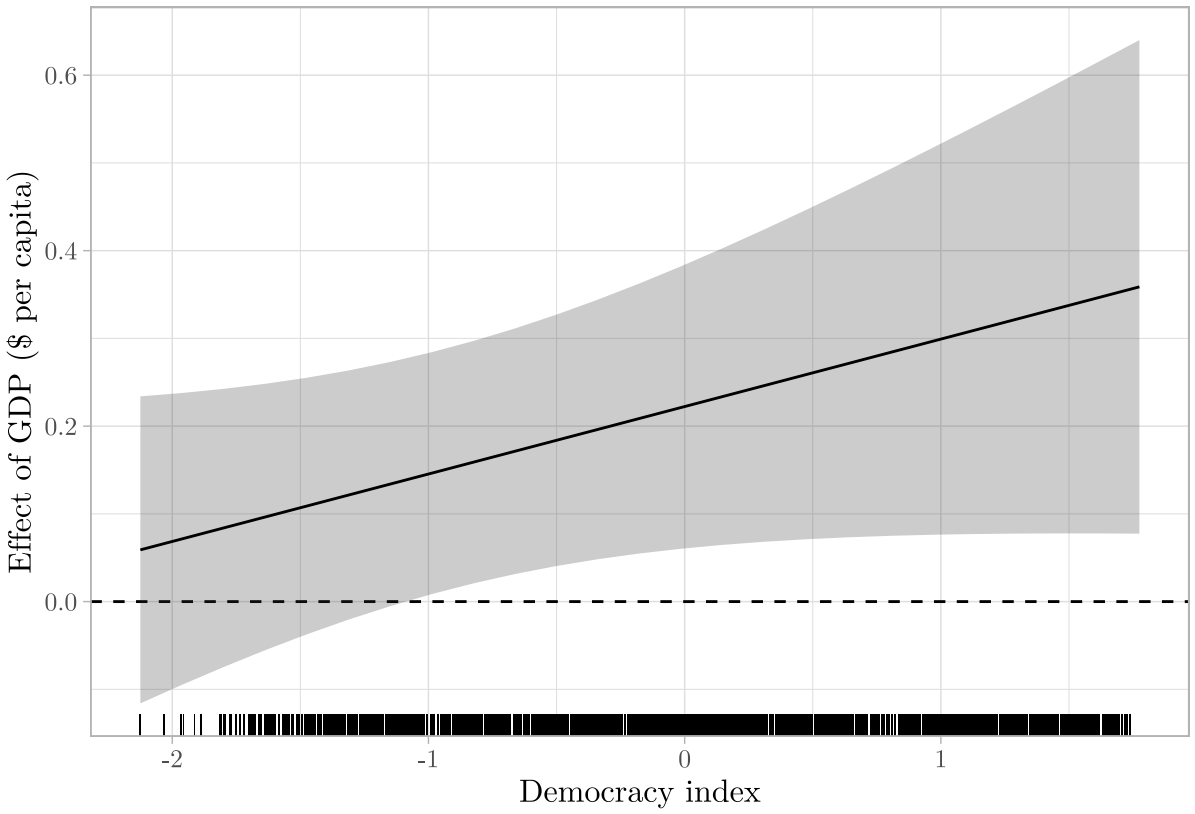
H2-b As for social protection coverage, the interaction terms between government effectiveness and GDP per capita, GDP per capita growth, personal income, and relative income are all insignificant. While personal income and relative income do not show changes in significance, the significance of the effects of GDP per capita and growth seems to depend on the level of government effectiveness. However, the pattern is not stable over a range of alpha values, which is why we do not consider it as evidence for a meaningful interaction.

H2-c All interaction terms are again insignificant. The significance of GDP per capita changes over the range of the democracy index, a result that is qualitatively stable to variations of the alpha level. For alpha = 0.05, the effect of GDP per capita is significant if the democracy index is larger than -1 (see figure 3). The effect of GDP per capita growth rate is only significant at democracy values around 0, however this result is strongly dependent on the chosen alpha level.

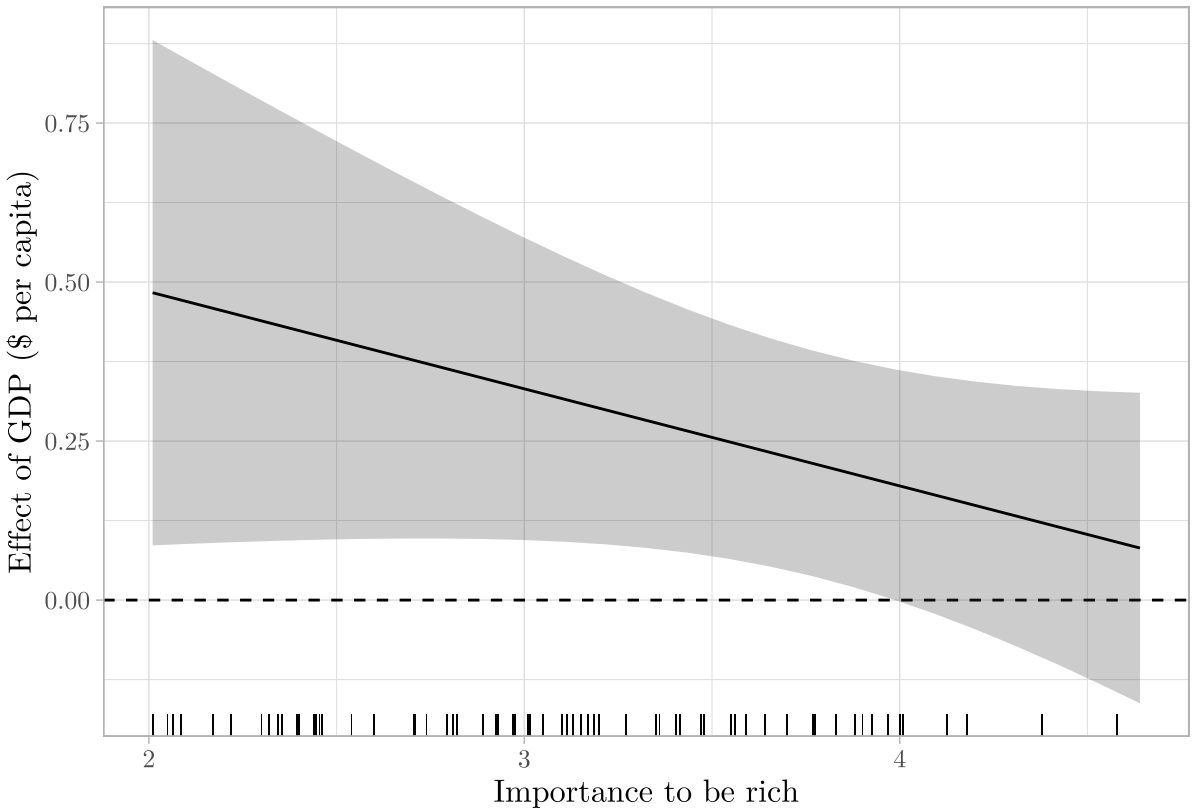
H2-d The results are nearly identical to those of H2-c except that the effect of GDP per capita is significant for *low* levels of importance to be rich.



Supplementary Fig. 2: Effect of GDP per capita growth for different levels of social protection coverage



Supplementary Fig. 3: Effect of GDP per capita for different levels of the democracy index



Supplementary Fig. 4: Effect of GDP per capita for different levels of the average importance to be rich

3.3 Research question 3

Interaction term	Numerator df	Denominator df	p
Log(personal income) × religious	2	7648567	0.760
Log(personal income) × gender	1	44894182	0.158
Log(personal income) × education	1	56796536	0.093+
Log(personal income) × altruistic behaviour	1	30811628	0.085+
Relative income × religious	2	10760536	0.594
Relative income × gender	1	32438038	0.414
Relative income × education	1	59989067	0.016∗
Relative income × altruistic behaviour	1	17437182	0.002∗∗
Log(GDP per capita) × religious	2	9476595	0.430
Log(GDP per capita) × gender	1	60294131	0.159
Log(GDP per capita) × education	1	94508258	0.022∗
Log(GDP per capita) × altruistic behaviour	1	38016081	0.100
GDP per capita growth × religious	2	7634215	0.784
GDP per capita growth × gender	1	77183667	0.199
GDP per capita growth × education	1	52691971	0.001∗∗∗
GDP per capita growth × altruistic behaviour	1	18571769	0.586

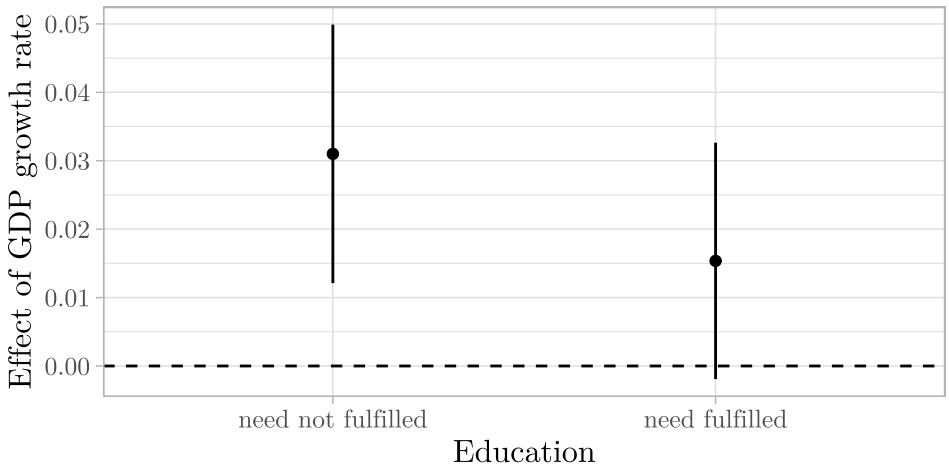
Supplementary Table 9: ANOVA results for interaction terms

Table 9 shows the ANOVA results for the interaction terms and 10 shows the coefficients of the

Religious (formally)	-0.066
Religious (practising)	-0.302
Male	-0.090
Education	-0.093
Altruistic behaviour	0.580^{***}
Log(personal income)	0.062^{+}
Log(personal income) × religious (formally)	-0.017
Log(personal income) × religious (practising)	-0.014
Log(personal income) × male	0.022
Log(personal income) × education	-0.033^{+}
Log(personal income) × altruistic behaviour	0.039^{+}
Relative income	0.006^{***}
Relative income × religious (formally)	0.001
Relative income × religious (practising)	0.001
Relative income × male	-0.0004
Relative income × education	0.002^{*}
Relative income × altruistic behaviour	-0.002^{**}
Log(GDP per capita)	0.143
Log(GDP per capita) × religious (formally)	0.022
Log(GDP per capita) × religious (practising)	0.042
Log(GDP per capita) × male	-0.029
Log(GDP per capita) × education	0.061^{*}
Log(GDP per capita) × altruistic behaviour	-0.047
GDP per capita growth	0.031^{**}
GDP per capita growth × religious (formally)	0.003
GDP per capita growth × religious (practising)	0.004
GDP per capita growth × male	0.005
GDP per capita growth × education	-0.016^{***}
GDP per capita growth × altruistic behaviour	-0.003
Residual standard deviation	1.99
Marginal Pseudo-R^2	0.2676
Conditional Pseudo-R^2	0.3146
Observations	1,237,786

Note: $+$ p<0.1; * p<0.05; ** p<0.01; *** p<0.001
Only interaction variables shown.

Supplementary Table 10: Multilevel model coefficients for research question 3



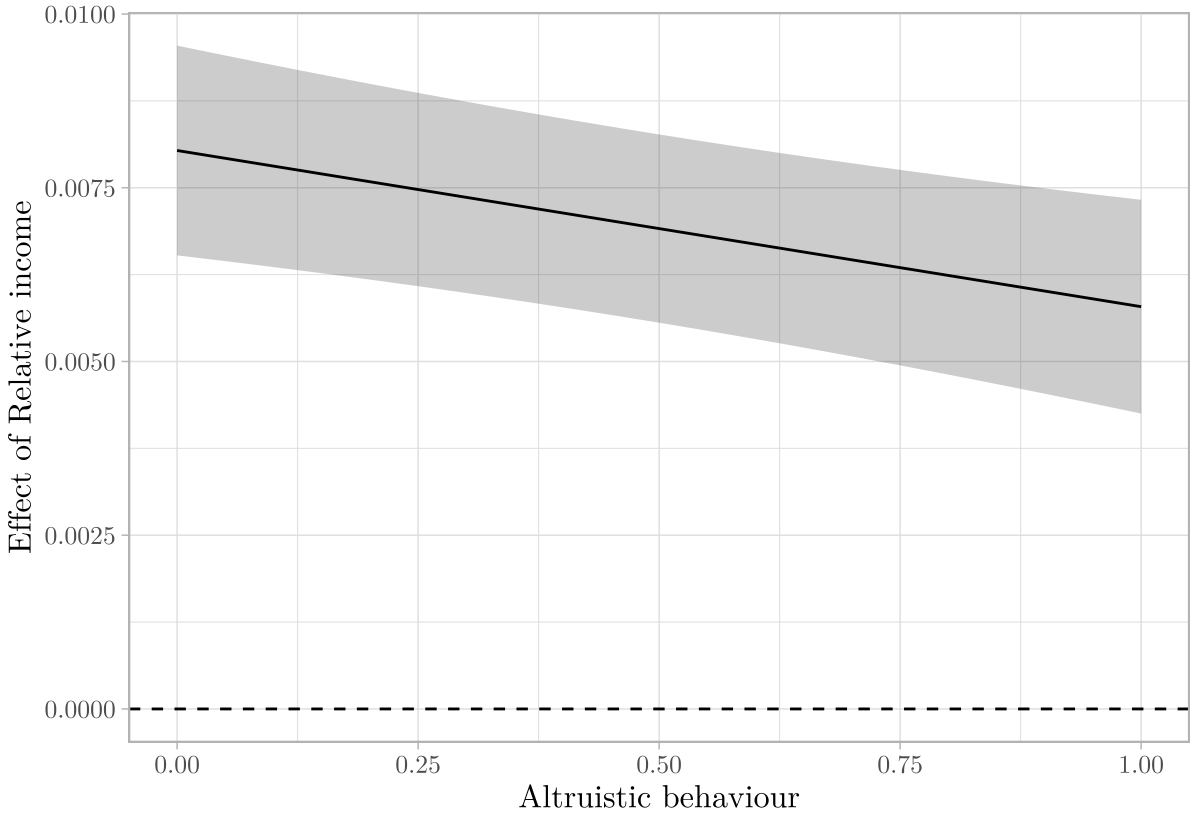
Supplementary Fig. 5: Conditional effect of GDP per capita growth depending on fulfillment of need for education. Effects for non-religious woman with altruistic behavior index of 0.

interaction and base terms of the model fitted for research question 3.

As can be seen in table 9, we did not find evidence for a significant interaction of religiosity (H3-a) or gender (H3-b) with any income variable.

H3-c Education interacts significantly with relative income, GDP per capita, and GDP per capita growth. People with a fulfilled need for education have a stronger effect of GDP per capita and relative income but a lower effect of GDP per capita growth. The effect of GDP per capita growth on life evaluation is in fact insignificant for individuals with a fulfilled need for education (see figure 5).

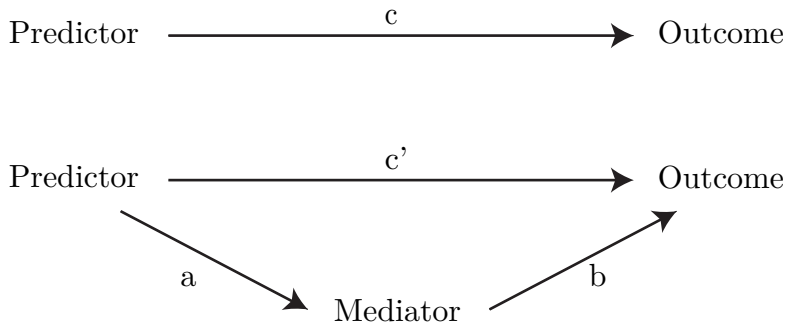
H3-d The only significant interaction term for altruistic behaviour is the one with relative income. According to the model, the more altruistic a person behaves, the less important is their relative income for their life evaluation. Nevertheless, the effect of relative income remains positive and significant for the whole range of altruistic behaviour scores and all combinations of gender, education, and religiosity (see figure 6 for the case of a formally religious and educated man).



Supplementary Fig. 6: Effect of relative income for different values of altruistic behaviour (formally religious, male, educated)

3.4 Research question 4

As can be seen in table 11, only hypothesis H4-b and -d can be accepted based on the Sobel test. While the inclusion of the variable "expected economic conditions" does let the effect of GDP per capita growth drop to insignificant levels, the effect of relative income remains nearly unchanged when standard of living is included as a predictor, despite the latter being a significant mediator.



Supplementary Fig. 7: Measured effects for mediator analysis

Hyp.	Predictor	Mediator	c	a	b	c'	p_{Sobel}
H4-a1	Log(GDP per capita)	Econ. conditions	0.182*	0.031	0.373***	0.101	0.16
H4-a2	Log(GDP per capita)	Confid. institutions	0.182*	-0.004	0.286***	0.177*	0.61
H4-b	GDP per capita growth	Exp. econ. conditions	0.017*	0.042***	0.221***	0.009	0
H4-c	Log(pers. income)	Standard of living	0.055***	-0.015***	1.03***	0.071***	1.00
H4-d	Relative income	Standard of living	0.007***	0.002***	1.03***	0.005***	0

Supplementary Table 11: Results of mediation analysis for research question 4. A visual representation of the coefficients a, b, c, and c' and their causal meaning can be found in Supplementary Fig. 7. While c is the original total effect, a is the effect of the predictor on the mediator, b the effect of the mediator on the outcome variable, and c' is the remaining, "direct" effect of the predictor on the outcome.

4 Selected results of exploratory analysis

4.1 Relationship between income variables and need satisfaction

	Food	Housing	Health	Water
Intercept	2.114^{***}	2.457^{***}	2.996^{***}	1.542^{***}
Male	0.032^{***}	-0.044^{***}	0.186^{***}	0.014^{***}
Age	-0.040^{***}	-0.028^{***}	-0.046^{***}	-0.026^{***}
Age (squared)	0.0004^{***}	0.0003^{***}	-0.00000	0.0003^{***}
Partnered	0.045^{***}	-0.025^{***}	0.152^{***}	-0.013^{*}
Separated	-0.386^{***}	-0.284^{***}	-0.061^{***}	-0.076^{***}
Widowed	-0.316^{***}	-0.187^{***}	-0.177^{***}	0.016
Log(personal income)	0.010	-0.004	0.077^{***}	0.042^{***}
Relative income	0.533^{***}	0.316^{***}	0.218^{***}	0.022^{***}
Log(GDP per capita)	0.927^{***}	0.718^{***}	0.383^{***}	0.529^{***}
GDP per capita growth	0.078^{***}	0.044^{**}	0.010	-0.009

Note: $+$ p<0.1; * p<0.05; ** p<0.01; *** p<0.001

Supplementary Table 12: Multilevel logistic regression coefficients for needs, part 1. Coefficients of income variables are standardised.

	Air	Healthcare	Security	Social support
Intercept	1.423^{***}	1.190^{***}	-0.394^{***}	3.314^{***}
Male	0.115^{***}	-0.055^{***}	0.440^{***}	-0.073^{***}
Age	-0.019^{***}	-0.036^{***}	0.017^{***}	-0.059^{***}
Age (squared)	0.0002^{***}	0.0004^{***}	-0.0002^{***}	0.0005^{***}
Partnered	0.118^{***}	0.032^{***}	0.065^{***}	0.005
Separated	-0.029^{**}	-0.058^{***}	-0.109^{***}	-0.330^{***}
Widowed	0.149^{***}	0.014	0.026^{**}	-0.089^{***}
Log(personal income)	0.010	-0.008	-0.066^{***}	0.129^{***}
Relative income	-0.101^{***}	0.092^{***}	0.058^{***}	0.241^{***}
Log(GDP per capita)	0.034	0.627^{***}	0.448^{***}	0.579^{***}
GDP per capita growth	-0.0004	0.017	0.068^{***}	0.028^{**}

Note: $+$ p<0.1; * p<0.05; ** p<0.01; *** p<0.001

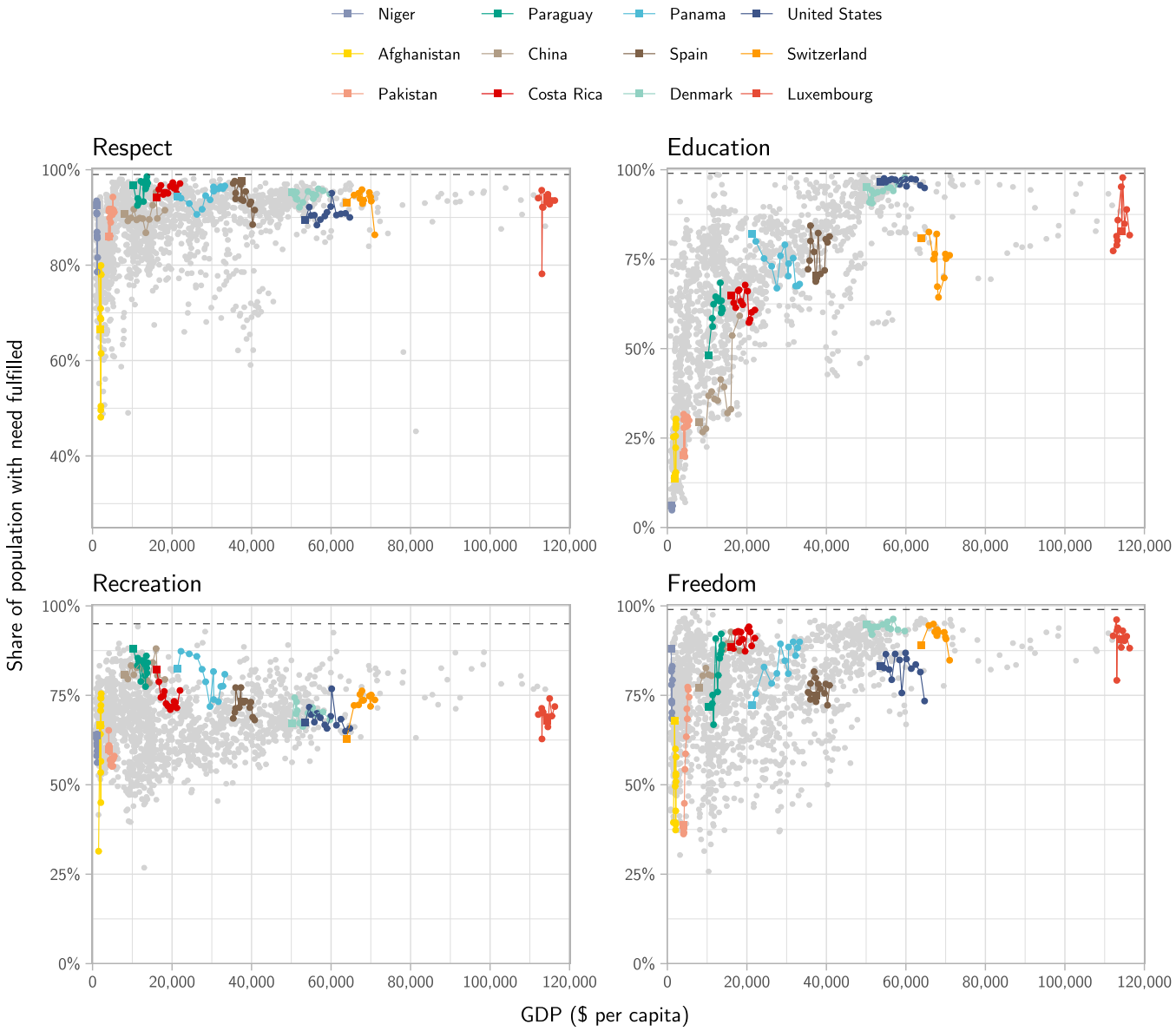
Supplementary Table 13: Multilevel logistic regression coefficients for needs, part 2

	Respect	Education	Interesting activity	Recreation
Intercept	2.271^{***}	1.852^{***}	0.644^{***}	1.918^{***}
Male	-0.044^{***}	0.222^{***}	0.090^{***}	0.066^{***}
Age	-0.010^{***}	0.017^{***}	-0.010^{***}	-0.054^{***}
Age (squared)	0.0001^{***}	-0.001^{***}	-0.00003^{***}	0.001^{***}
Partnered	0.115^{***}	-0.366^{***}	-0.075^{***}	-0.068^{***}
Separated	-0.230^{***}	-0.354^{***}	-0.159^{***}	-0.190^{***}
Widowed	-0.054^{***}	-0.802^{***}	-0.305^{***}	-0.214^{***}
Log(personal income)	0.023^{*}	0.228^{***}	0.024^{***}	-0.007
Relative income	0.194^{***}	0.524^{***}	0.160^{***}	0.142^{***}
Log(GDP per capita)	0.326^{***}	0.917^{***}	0.160^{***}	0.111^{***}
GDP per capita growth	-0.005	0.019	0.011	0.032^{***}
Note:				$+$ p<0.1; * p<0.05; ** p<0.01; *** p<0.001

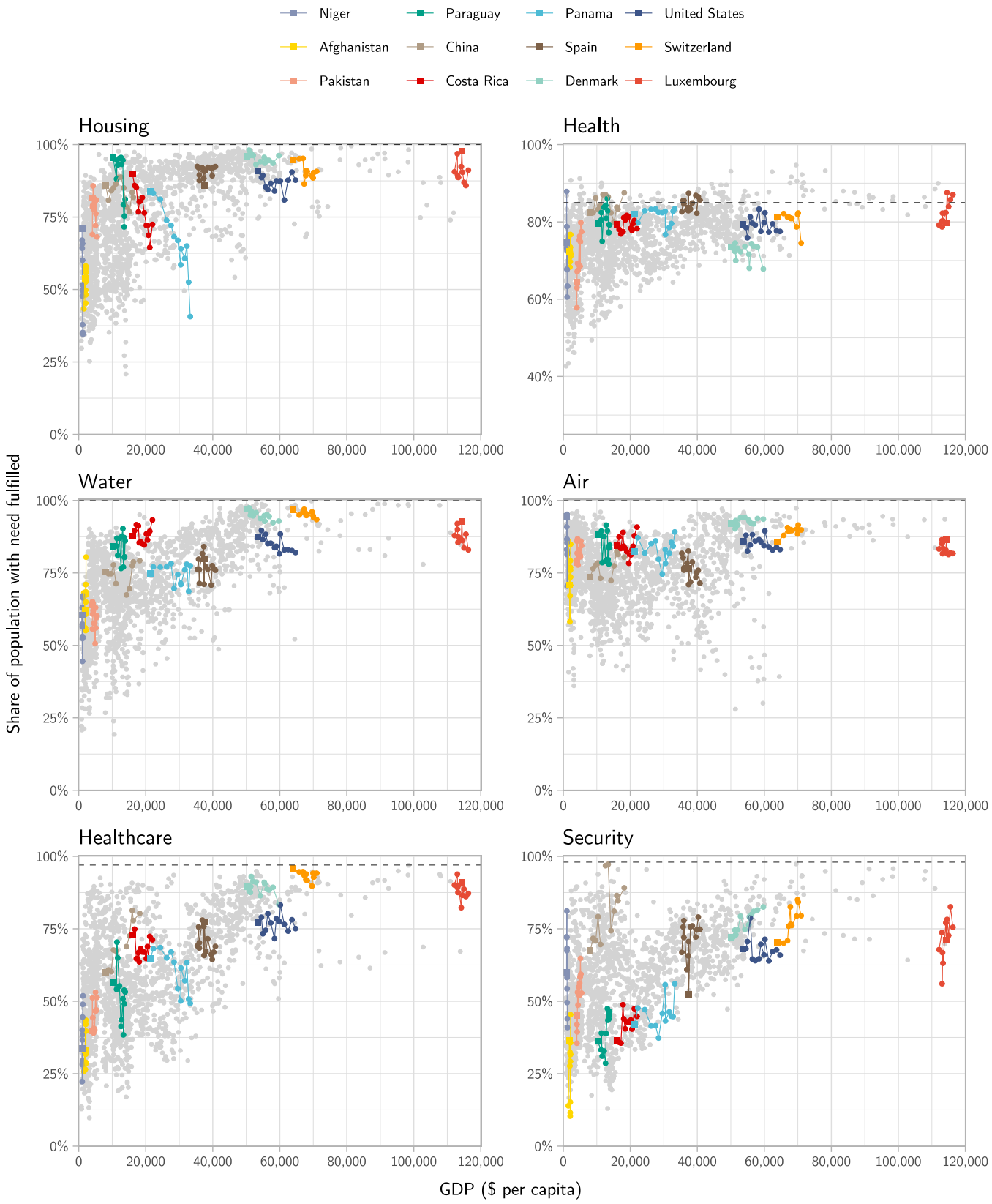
Supplementary Table 14: Multilevel logistic regression coefficients for needs, part 3

	Occupation	Freedom
Intercept	3.088^{***}	1.341^{***}
Male	0.099^{***}	-0.018^{***}
Age	-0.037^{***}	-0.023^{***}
Age (squared)	0.001^{***}	0.0003^{***}
Partnered	0.493^{***}	0.145^{***}
Separated	0.104^{***}	-0.078^{***}
Widowed	0.511^{***}	0.022^{*}
Log(personal income)	-0.144^{***}	-0.080^{***}
Relative income	0.413^{***}	0.156^{***}
Log(GDP per capita)	0.290^{***}	0.493^{***}
GDP per capita growth	0.083^{***}	0.061^{***}
Note:	$+$ p<0.1; * p<0.05; ** p<0.01; *** p<0.001	

Supplementary Table 15: Multilevel logistic regression coefficients for needs, part 4



Supplementary Fig. 8: Average need satisfaction versus GDP for needs not shown in the main part of the article, part 1. The dashed line indicates the chosen level in the "ideal" scenario of Figure 3, Setting 3 (main paper). Every data point corresponds to a country year combination. Coloured countries are an arbitrary selection to illustrate different time series shapes, with the rectangle indicating the first year in the dataset and the connecting lines showing the chronological order.



Supplementary Fig. 9: Average need satisfaction versus GDP for needs not shown in the main part of the article, part 2.

4.2 Life satisfaction instead of life evaluation

Data points covering life satisfaction and the need satisfaction variables are only available for 11 countries, each of them surveyed either in 2009 or in 2010. To check whether life satisfaction and life evaluation behave differently, we fitted both the B2 and the H1-c-f model on those data points with complete data coverage for both outcome variables.

As can be seen in table 16 and 17, the regression results are very similar for the two different measures of subjective well-being. Housing and security are the only variables that are significant in only one of the models. The coefficients of the income variables are close to each other while differing strongly from those in the life evaluation model fitted to the whole dataset.

Most likely, the small number of different countries makes it impossible to separate the effects of the different income variables (since only 11 different values for GDP per capita and growth are available, as well as only 11 different income distributions).

	Dependent variable:	
	Life evaluation	Life satisfaction
	(1)	(2)
Intercept	1.547	2.775
Male	-0.097^{+}	-0.040
Age	-0.043^{***}	-0.049^{***}
Age (squared)	0.0004^{**}	0.0005^{***}
Partnered	0.102	0.083
Separated	-0.522^{***}	-0.650^{***}
Widowed	-0.343^{***}	-0.468^{***}
Log(personal income)	0.406^{***}	0.442^{***}
Relative income	0.005^{+}	0.005
Log(GDP per capita)	0.162	0.062
GDP per capita growth	-0.042	-0.034
Residual standard deviation	1.766	1.835
Marginal Pseudo-R^2	0.1899	0.1649
Conditional Pseudo-R^2	0.3269	0.3302
Observations	13,445	13,445
Note:	$+$ p<0.1; * p<0.05; ** p<0.01; *** p<0.001	

Supplementary Table 16: Comparison of multilevel coefficients for life evaluation and life satisfaction, B2

	Dependent variable:	
	Life evaluation	Life satisfaction
	(1)	(2)
Intercept	1.817	3.081
Male	-0.083^{*}	-0.028
Age	-0.034^{***}	-0.032^{***}
Age (squared)	0.0003^{**}	0.0003^{***}
Partnered	0.121	0.126
Separated	-0.391^{**}	-0.559^{***}
Widowed	-0.123	-0.236^{***}
Food	0.601^{***}	0.555^{***}
Housing	0.175	0.307^{**}
Health	0.318^{***}	0.274^{***}
Water	0.054	0.145^{+}
Air	0.087	0.052
Healthcare	0.122^{***}	0.164^{***}
Security	0.091^{**}	0.029
Social support	0.419^{***}	0.421^{***}
Respect	0.220^{*}	0.340^{***}
Education	0.215^{***}	0.232^{***}
Interesting activity	0.301^{***}	0.281^{***}
Recreation	0.212^{***}	0.255^{***}
Occupation	0.420^{**}	0.480^{**}
Freedom	0.288^{**}	0.500^{***}
Log(personal income)	0.339^{***}	0.338^{**}
Relative income	0.003	0.003
Log(GDP per capita)	-0.079	-0.210
GDP per capita growth	-0.106	-0.124
Residual standard deviation	1.718	1.783
Marginal Pseudo-R^2	0.2647	0.2442
Conditional Pseudo-R^2	0.3737	0.3672
Observations	9,881	9,881
Note:	$^{+}$ p<0.1; * p<0.05; ** p<0.01; *** p<0.001	
	Fixed year effects not shown for space reasons.	

Supplementary Table 17: Comparison of multilevel coefficients for life evaluation and life satisfaction, H1c-f

4.3 Objective need satisfaction variables

For this exploratory analysis, we run the same regressions as for the confirmatory analysis but we restricted the need satisfaction variables to food, housing, health, security, social support, education, and employment status. For security, we used an alternative version of the security index in which we excluded the question whether one feels safe walking alone at night. All other excluded variables (i.e., water, air, healthcare, recreation, and freedom) included notions of feelings or satisfaction. We fitted each model on the same data points as for the corresponding model with all needs included.

The results for these alternative version of the analysis are overall very similar to those of the original confirmatory analysis. The coefficient values for the income predictors are slightly higher in all regressions (except personal income, for which they are slightly smaller). Additionally, the effects of government effectiveness, democracy, and social protection coverage are significant in H1-k-n. Surprisingly, the effect of social protection coverage is negative.

For the moderator analysis, results are similar. The only difference for the country level moderators is that for those cases where we found changes of significance but insignificant multiplicative terms in the full model, the multiplicative terms all had a p-value below 0.1 in the model only including "objective" need satisfaction variables. In the case of the individual level moderators, the only difference is that we obtain a significant negative interaction between altruistic behaviour and GDP per capita, i.e., the more altruistic a person behaves, the less relevant is GDP per capita for their life evaluation.

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