Online supporting documentation: Robustness checks

1. Predictions of interaction models

We plot cross-generational differences in life satisfaction based on Models 3, 6, and 9, by fixing other covariates to their mean values, as shown in Figure 1a to Figure 1c in the main text. Predictions based on non-significant interactions are presented and indicated in the legend of each corresponding figure. On the X-axis, we pinpoint commonly used Z-scores – ±1.96 and ±0.68 that define the middle 95% and 50% of a normal distribution, respectively, the point of zero that defines the 50th percentile in the distribution, and the Z-score (3.9) that indicates the 100th percentile of a normal distribution. In Figure 1a through Figure 1c, it is clear that at least up to the 97.5^{th} percentile in the income distribution, 1st-generation immigrants have the highest level of life satisfaction, followed by the 1.5-generation, and lastly by the 2nd-generation. This is consistent with the existing argument about the declining trend in life satisfaction over generations (Bartram, 2011; Knies et al., 2016; Safi, 2010).

What has not yet been discussed in existing literature, however, is that the above generational differences in life satisfaction vary with the selection of the comparison frame. In addition to visualizing the highest degree of relevance of comparison within the mainstream frame for the 2nd generation (Figure 1a) whereas the highest degree of relevance of comparison within the source country frame for the 1st generation (Figure 1c), three figures together show that the relative importance of comparison frames in life satisfaction also varies within each immigrant generation. Patterns across three figures suggest that the 1st-geneation immigrants draw their self-identity partially from their source countries and partially from the host country, and therefore consider income comparisons in all three frames relevant to life satisfaction. By contrast, 1.5 and 2nd generations draw their self-identity completely from host country, and

therefore consider income comparisons in two frames of the host country relevant to life satisfaction. The correspondence between the variation in life satisfaction and the selection of the frame for income comparison, whether within each generation or across all generations, is in line with the theoretical proposition about the shift of self-identification from the source country to the host country, and eventually to the mainstream of the host country among the immigrant population.

2. Well-educated and young subgroups

We check two population subgroups, the well-educated and the young, since they are more likely to self-select to be immigrants (Hunt, 2004, 2006; Mai, 2007). If the variation in life satisfaction were solely the result of self-selection, whom one compares oneself with would not matter and various relative income measures would be similarly correlated with one's life satisfaction. We use two sets of relative income measures. One set is R1 through R3 used in the main analyses. We have rerun interaction models (Models 3, 6, and 9) within respondents with higher-educational degrees (including degrees obtained abroad) and respondents aged between 18 and 30, respectively. On the other hand, we alter the comparison frame. People tend to make comparisons with others similar to themselves (see reviews by Brown et al., 2015; Wolbring et al., 2013). It is highly likely that instead of comparing with the average, well-educated people compare themselves with well-educated others, whereas young people compare themselves with others at similar age. We have therefore constructed new relative income measures in the host country (this strategy cannot be applied to the relative income measure in the host country, due to the lack of individual-level income data in all source countries). Table S3 presents results of interaction models between each relative income measure and one's generational status. One's income status in the mainstream and the co-ethnic group of the host country is reported twice,

with the first column measuring one's income status relative to the average level of each chosen population, and the second measuring that relative to the average level of a subgroup of the chosen population sharing the same focal characteristic with the respondent.

As shown by Table S1, income comparisons with the average level of the chosen population and with the selected subgroup of the chosen population generate similar results. Among the well-educated (with higher-educational degrees), income comparisons with the mainstream (R1), co-ethnic (R2), and source-country (R3) populations are all positively associated with life satisfaction. However, income comparison with the source country is much less relevant, as compared to two comparison frames in the host country (t-test[a] results are both significant between R1 and R3, and between R2 and R3). The difference between R1 and R2 is non-significant (shown by a non-significant t-test). Regarding generational differences, income comparison with the mainstream population is less relevant to life satisfaction of the 1st-generation immigrants, as compared to that of 1.5 and 2nd generations, and that there is no generational difference in terms of the relevance of R2 and R3 to life satisfaction. These findings are consistent with those shown by Models 3, 6, and 9. Namely, there exists a general shift of the relevance of income comparison from the source to host country, whether the population averages or the averages of the well-educated subgroups in the host country used as comparison frames. Consistent with the pattern in Model 3, the lowest degree of the positive association between R1 and the 1st-geneation corresponds to the lowest degree of exposure to the host country within this generation.

Turning to the young subgroup aged between 18 and 30, we find that income comparison within the mainstream is no longer significantly associated with life satisfaction, though the coefficient is close to be statistically significant when the comparison is made among the

mainstream group aged 18 and 30 (coef.=0.097, p=0.066). Comparison with the co-ethnic group is significantly associated with life satisfaction, either at the average level of the co-ethnic group or among co-ethnic members in the same age range. Income comparison with the source-country population has no significant association with life satisfaction of the 2nd generation, but is positively related to life satisfaction of the 1st-generation immigrants. The positive coefficient of interaction term for the 1.5 generation is close to be statistically significant (coef.=0.015, p=0.091). These findings show that among young immigrants (and immigrant descendants), income comparison with the co-ethnic group in the host country is relevant to life satisfaction, but that with the mainstream is not. While the 1st-generation young immigrants feel satisfied with an income advantage relative to the source country population, their 2nd-generation counterparts no longer consider such income comparison relevant. In short, three comparison frames are not equally relevant to life satisfaction of the young subgroup; and moreover, the relevance tends to vary across generations, at least shown by R3. Whom one compares oneself with indeed matters, not only for one's life satisfaction, but also for differences in life satisfaction across immigrant generations. The findings of these additional analyses indicate that the self-selection explanation, though undoubtedly relevant, would not invalidate our argument about the varying relevance of comparison frames to life satisfaction of the immigrant population.

Note: [a.] Formula for two-sample hypothesis testing is available at http://stattrek.com/hypothesis-test/difference-in-means.aspx?Tutorial=AP (accessed August 5, 2018). See also Lehmann and Romano, 2005.

Lehmann EL and Romano JP (2005) *Testing Statistical hypotheses* (3rd Edition). New York, NY: Springer Science+Business Media, LLC

Table S1.Mixed-effect estimations on life satisfaction by relative income in three comparison frames for the well-educated and young immigrant subpopulations

	Well-educated subgroup					Young subgroup				
	Mainstream	Well-educated subgroup in the mainstream	Co-ethnic	Well-educated subgroup in the co-ethnic group	Source country	Mainstream	Young subgroup in the mainstream	Co-ethnic	Young subgroup in the co-ethnic group	Source country
Relative income status	0.110***	0.121***	0.102***	0.107***	0.019*	0.085	0.097+	0.096*	0.093*	-0.006
	(0.027)	(0.035)	(0.026)	(0.030)	(0.008)	(0.057)	(0.053)	(0.047)	(0.046)	(0.008)
1st-gen*relative income	-0.073*	-0.086*	-0.045	-0.048	0.006	-0.045	-0.071	-0.050	-0.064	0.033*
	(0.032)	(0.041)	(0.032)	(0.037)	(0.011)	(0.060)	(0.054)	(0.053)	(0.051)	(0.014)
1.5-gen*relative income	-0.003	0.011	-0.020	0.007	-0.014	0.024	-0.004	0.010	0.005	0.015+
	(0.041)	(0.052)	(0.039)	(0.049)	(0.009)	(0.070)	(0.063)	(0.066)	(0.069)	(0.009)
Constant	5.206***	5.462***	5.188***	5.450***	5.329***	9.770***	8.996***	9.739***	8.963***	9.598***
	(0.322)	(0.338)	(0.323)	(0.339)	(0.338)	(1.410)	(1.509)	(1.415)	(1.514)	(1.482)
Variance components S.D. for individual variance ($\sigma\_u_{individual}$)	0.686***	0.691***	0.684***	0.690***	0.694***	0.812***	0.815***	0.811***	0.813***	0.817***
	(0.033)	(0.024)	(0.034)	(0.024)	(0.034)	(0.044)	(0.038)	(0.044)	(0.038)	(0.046)
S.D. for within-individual residuals (σ_e)	1.126***	1.112***	1.127***	1.113***	1.113***	1.133***	1.123***	1.134***	1.124***	1.125***
	(0.016)	(0.019)	(0.016)	(0.019)	(0.017)	(0.026)	(0.031)	(0.026)	(0.031)	(0.027)
Number of observations	12,098	12,098	12,098	12,098	12,098	6,109	6,109	6,109	6,109	6,109
Number of individuals	4,493	4,493	4,493	4,493	4,493	3,092	3,092	3,092	3,092	3,092

Source: Understanding Society, 2009-2015 (waves 1-5), authors' calculations.
Note: 1. The 2nd generation is the baseline group for estimating 1st and 1.5 generations. 2. The following covariates were included into the model: age, age squared, having a religion, gender, marital status, education, physical well-being, status in the labour force, number of children, and 18 countries of origin. 3. Longitudinal weight was included. 4. Robust standard errors in parentheses. *** p<0.001 ** p<0.01 * p<0.05 +<0.1

3. Absolute income

We estimate absolute income (in 1000 British pounds) as shown in Table S2. Model 10 shows that absolute income has almost identical power of explanation to R1 and R2 (σ_u=0.826). Thus, if relative income does not make a substantial contribution to explaining the variation in life satisfaction, neither does absolute income. However, this by no means implies the theoretical unimportance of income in life satisfaction.

In Model 11, the significant coefficient shows that when absolute income increases by about 1300 to 1500 (0.063*(1300~1500)≈0.084~0.093) British pounds, life satisfaction would increase by about 0.084 to 0.093 points. This amount of absolute income increase is rather close to standard deviations of the mainstream and co-ethnic income distributions. In Model 12, the patterns for the main effect of absolute income and its interaction with each generation highly resemble those found in Model 3 focusing on R1. All these findings confirm that our relative income measures successfully capture the variation in absolute income. The other piece of the evidence showing the equivalence between the three relative income and the absolute income measures is that except for changes in coefficients of income measures, coefficients of other control variables and variance estimation remain almost identical across four interaction models (Models 3, 6, 9, and 12). Coefficients of control variables of four interaction models can be seen in Table S3. For this reason, it is neither necessary, nor suitable, to control absolute income when relative income is modelled.

Table S2.

Mixed-effect estimations on life satisfaction by absolute income for the immigrant population

	Model 10	Model 11	Model 12
Absolute income	0.143***	0.063***	0.129***
	(0.004)	(0.015)	(0.024)
1st-gen*absolute income			-0.088**
			(0.028)
1.5-gen*absolute income			-0.051+
			(0.031)
Constant	4.866***	5.320***	5.247***
	(0.007)	(0.262)	(0.264)
Observations	23,012	23,012	23,012
Number of individuals	8,862	8,862	8,862
Variance components			
S.D. for individual variance	0.826***	0.735***	0.735***
	(0.023)	(0.020)	(0.020)
S.D. for within-individual residuals	1.206***	1.198***	1.197***
	(0.013)	(0.015)	(0.015)
Log pseudo-likelihood	-23503	-23504	-23499

Source: Understanding Society, 2009-2015 (waves 1-5), authors' calculations.
Note: 1. The 2nd generation is the baseline group for estimating 1st and 1.5 generations. 2. The following covariates were included into the model: age, age squared, having a religion, gender, marital status, education, physical well-being, status in the labour force, number of children, and 18 countries of origin. 3. Longitudinal weight was included. 4. Robust standard errors in parentheses. *** p<0.001 ** p<0.01 * p<0.05 +<0.1

Table S3. Estimations of covariates in interaction models

	Model 3	Model 6	Model 9	Model 12
1st-gen	0.275***	0.293***	0.268***	0.401***
	(0.044)	(0.045)	(0.045)	(0.061)
1.5-gen	0.199***	0.210***	0.192***	0.271***
	(0.050)	(0.051)	(0.051)	(0.069)
Age	-0.091***	-0.091***	-0.089***	-0.091***
	(0.011)	(0.011)	(0.011)	(0.011)
Age squared	0.001***	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
Having a religion	-0.004	-0.004	0.008	-0.002
	(0.040)	(0.040)	(0.040)	(0.040)
Male	-0.112***	-0.109***	-0.114***	-0.112***
	(0.033)	(0.033)	(0.033)	(0.033)
Marital status (ref.=living with a partner)				
Never married	-0.192***	-0.193***	-0.202***	-0.193***
	(0.053)	(0.053)	(0.053)	(0.053)
Divorced/widowed	-0.345***	-0.344***	-0.352***	-0.346***
	(0.057)	(0.057)	(0.057)	(0.057)
Educational qualification (ref.=no qual.)				
Degree	0.242***	0.231***	0.275***	0.245***
	(0.066)	(0.067)	(0.066)	(0.066)
Other degrees	0.145+	0.140+	0.157*	0.146+
	(0.075)	(0.075)	(0.076)	(0.075)
A-level	0.129+	0.123+	0.131+	0.129+
	(0.073)	(0.073)	(0.073)	(0.073)
GCSE	0.051	0.044	0.045	0.050
	(0.077)	(0.077)	(0.077)	(0.077)
Other qualifications	0.055	0.052	0.055	0.055
	(0.085)	(0.085)	(0.085)	(0.085)
Physical well-being	0.021***	0.021***	0.022***	0.021***
	(0.002)	(0.002)	(0.002)	(0.002)
Labour force status (ref.= paid-employed)				
Self-employed	0.077	0.078	0.079	0.077
	(0.052)	(0.052)	(0.052)	(0.052)
Unemployed	-0.376***	-0.370***	-0.417***	-0.380***
	(0.056)	(0.056)	(0.056)	(0.056)
Retired	0.222*	0.222*	0.180+	0.217*
	(0.098)	(0.098)	(0.097)	(0.098)
Inactive	-0.074+	-0.068	-0.096*	-0.077+
	(0.043)	(0.043)	(0.043)	(0.043)
Number of children	0.064***	0.068***	0.047**	0.062***
	(0.016)	(0.016)	(0.016)	(0.016)
Countries of origin	Included	Included	Included	Included

Source: Understanding Society, 2009-2015 (waves 1-5), authors' calculations.
Note: 1. The 2nd generation is the baseline group for estimating 1st and 1.5 generations. 2. Longitudinal weight was included. 3. Robust standard errors in parentheses. *** p<0.001 ** p<0.01 * p<0.05 +<0.1

4. Alternative relative income measures

We consider two alternative relative income measures, rank of income and one's income status in the Local Authority (LA) area one resides in. Boyce et al. (2010) find rank of income as the stronger predictor of life satisfaction than income itself. However, rank of income describes relative income positions only by sequence, and it loses information about the gap between positions. By contrast, a Z-score captures not only the rank of an absolute income value, but also how widely apart any two income values are from each other. Thus, a standardized Z-score is a more sensitive measure that indicates a possible association between relative income and life satisfaction more closely

To demonstrate this point, we have constructed rank of income, by ranking an immigrant in income distributions of the mainstream and co-ethnic populations in the host country, following Boyce et al.'s (2010) method. Again, this approach cannot be applied to the source-country population, due to the restrictions of accessing individual-level income data from all source countries. By converting absolute income distributions of the mainstream and co-ethnic groups into sequences ranging between 0 and 1, the rank of an immigrant's absolute income can be formulated as:

$$Rnkm_{ij} = \frac{inc_{ij} - inc_{jmin_m}}{inc_{jmax_m} - inc_{jmin_m}}, \text{ and}$$

$$Rnke_{ij} = \frac{inc_{ij} - inc_{jmin_e}}{inc_{jmax_e} - inc_{jmin_e}},$$

where $Rnkm$ refers to rank of income situated in the income distribution of the mainstream group; $Rnke$ refers to rank of income situated in the income distribution of the co-ethnic group; i refers to individual 1, 2, 3,…, i; j refers to wave 1, 2,…, 5; Inc_{ij} indicates an individual i's absolute income in wave j; inc_{jmin_m} and inc_{jmax_m} are the minimal and maximal values in the

income distribution of the mainstream group in the host country; likewise, inc_{jmax_e} and inc_{jmin_e} are the minimal and maximal values in the income distribution of the co-ethnic group in the host country.

As shown in the first two columns of Table S4, an immigrant's rank in the mainstream income distribution is less relevant to the 1st-generation's life satisfaction, as compared to the 2nd-generation, whereas the rank in the co-ethnic income distribution seems to be equally important to all immigrant generations. These findings, on the one hand, do not contradict patterns found in the main analyses; on the other hand, they show that rank of income is indeed less sensitive than relative income measures generated through standardization, and is thus unable to completely show nuanced differences across immigrant generations.

The literature has also pointed out the importance of the surrounding environment in the formation of one's comparison frame (Wolbring et al., 2013; see also Brown et al.'s 2015 review: 48). Geographic proximity is a key factor in this respect. We compute a new measure, R4 that indicates one's status in the income distribution of the LA one resides in: $R4_{ikj} = \frac{Inc_{ikj} - E[Inc]_{kj}}{\sigma(Inc)_{kj}}$, where i refers to individual 1, 2, 3,…, i; k refers to LA area 1, 2, 3,…, k; j refers to wave 1, 2,…, 5; Inc indicates individual absolute income; $E[Inc]_{kj}$ and $\sigma(Inc)_{kj}$ are the mean and standard deviation values, respectively, of the income distribution of the population in LA area k and in wave j. To estimate the interaction between R4 and one's generational status, multilevel modelling is adopted, with individuals nested within LAs. The same set of covariates used in the main analyses is included.

The last column of Table S4 presents that one's position in the income distribution of the LA area one resides in is positively associated with life satisfaction. There is no significant difference across generations. Namely, when the comparison frame is narrowed down to the local area,

obtaining a high status in the local income distribution is equally important to all immigrant generations. Rather than contradicting our argument in the main analyses, results of the relative income measure at the LA-level, once again, show that life satisfaction of the immigrant population varies with the selection of the comparison frame where one's income is situated.

Table S4. Mixed-effect and multilevel estimations on life satisfaction of the immigrant population by using rank of income and Local Authority (LA) areas as comparison frames

	Rank of income		LA frame
	Mainstream	Co-ethnic	
Income measures	2.800***	0.766**	0.095***
	(0.107)	(0.292)	(0.024)
1st-generation*income measures	-1.780**	-0.312	-0.007
	(0.630)	(0.332)	(0.028)
1.5-generation*income measures	-1.148+	-0.251	0.014
	(0.601)	(0.315)	(0.032)
Variance components			
Level 3 S.D. (σ_u_{LA})	-	-	0.015***
	-	-	(0.005)
Level 2 S.D. ($\sigma\_u_{individual}$)	0.741***	0.741***	0.607***
	(0.043)	(0.043)	(0.020)
Level 1 residual S.D. (σ_e)	1.210***	1.210***	1.508***
	(0.022)	(0.022)	(0.018)
Constant	4.987***	5.022***	5.336***
	(0.184)	(0.196)	(0.187)
Observations	23,012	23,012	23,000
Number of individuals	8,862	8,862	8,858
Number of LAs	-	-	393

Source: Understanding Society, 2009-2015 (waves 1-5), authors' calculations.
Note: 1. Rnkm refers to the rank in the mainstream group of the host country; Rnke refers to the rank in the co-ethnic group of the host country; R4 – relative to the income distribution in the LA area one resides in. 2. The following covariates were additionally included into the model: age, age squared, having a religion, gender, marital status, education, physical well-being, status in the labour force, number of children, and 23 countries of origin. 3. Longitudinal weight was included. 4. Robust standard errors in parentheses. *** $p<0.001$ ** $p<0.01$ * $p<0.05$ + $p<0.1$