Online Appendix

"The Empirics of Social Progress: The Interplay between Subjective Well-Being and Societal Performance"

This online appendix briefly highlights the broader literature motivating our research question and approach, presents further results regarding the overall relationship between SPI, GDP and social well-being (SWB), and presents our exploratory findings regarding the interaction between SPI and individual characteristics in shaping SWB.

I. Prior Literature

Due to space limitations, we are unable to include a careful literature review in the main text, nor do we attempt a thorough review here. For an extensive and insightful literature review and synthesis of prior work on GDP and social welfare measures, see Fleubaey (2009) and Fleurbaey and Blanchet (2013).

To highlight some of the key work that motivates our approach, we build on a long line of research emphasizing the limitations of GDP as a proxy for social welfare and the development of alternatives. Nordhaus and Tobin (1972) offer one of the earliest analyses of the limitations of GDP and attempts to integrate non-economic dimensions into an overall measure of well-being. As briefly mentioned in the main text, Sen (1985) offered an important turning point in this literature by focusing squarely on the measurement of human capabilities.

For contemporary discussions of the debate over GDP and efforts to move "beyond" GDP, see Coyle (2014) and Fleurbaey and Blanchet (2013). For discussion of the separate evidence on the role of income inequality as an economic metric, see for example Piketty and Saez (2003). As well, there are a number of recent proposals to incorporate information into new aggregate measures of societal performance. Fleurbaey and Gaulier (2009) and Jones and Klenow (2016) offer significant insight by using variation in how particular non-economic amenities vary across countries to infer a "price" for non-economic factors into a national index.

In addition to efforts to move "beyond GDP," a separate literature explores how "direct" measures of SWB can be used for policy analysis. For discussion of the interplay between SWB, social and economic factors, see Deaton (2008) and DiTella, et al (2001). Kahneman and

Krueger (2006) provides a thoughtful account of SWB and its role in policy formulation and evaluation.

II. Social Progress, GDP and Subjective Well-Being Findings

SPI aims to incorporate a broad array of dimensions of societal performance not directly captured by traditional economic metrics such as GDP. Figure A1 summarizes the dimensions and components used to construct the SPI. A major objective is first to offer insights into differences in non-economic societal performance across countries and over time, as well as examine differences within countries in performance across dimensions and components of social progress. In addition to the broad differences across dimensions discussed in the main text, it is useful to emphasize that dimension-level differences can be attributed to differences in the underlying components. For example, whereas the United States and Northern European countries score quite similarly in terms of Water and Sanitation, the Nordic countries tend to realize a high level in terms of measure of health and wellness. As well, it is possible to begin examining changes within country over time (subject to the timeliness of new data releases); for example, whereas overall SPI has been increasing on a global basis, key aspects of Opportunity – most notably, Inclusion, have experienced an absolute decline over the past three years (Porter, Stern, and Green, 2017). The ability to benchmark social performance across and within countries and over time is a major motivation for constructing the SPI.

Beyond these relative comparisons, SPI also offers a novel tool to assessing the interplay between social indicators, traditional economic metrics such as GDP per capita, and more holistic measures of human fulfillment such as SWB. As highlighted in the main text, GDP per capita and SPI are correlated (r = 0.8) but distinct (Figure 1), and there are striking differences in the relationship between each dimension of SPI and GDP per capita (Figure A2). These differences motivate our analysis of how social and economic performance metrics relate to SWB. To do so, we utilize the measure of subjective well-being available through the World Values Survey Wave 6, covering 52 countries between 2012-2014.[1] Table A1 report the

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[1] Our analysis focuses on item V23 from the WVS, which is the most common subjective well-being metric from this survey employed by researchers. Though the broad results we report here are consistent with using alternative measures of subjective well-being (e.g., those available through the Gallup Survey), we focus on the WVS to be

univariate correlation between subjective well-being and the log of GDP per capita, as well as SPI and each of its dimensions: each of these correlations are positive and significant. Both GDP per capita and SPI explain a similar fraction of the total variance (the highest r-squared is actually with the Opportunity dimension), and are associated with similar implied magnitudes.

We can also extend these country-level findings to explore the impact of individual circumstances within countries on subjective well-being. As mentioned briefly in the main text, we take advantage of the individualized data available through the World Values Survey to construct the average subjective well-being within each country for particular categories of individuals. We focus on key differences among individuals that impact the potential role of a stronger social progress environment on their subjective well-being, in particular income, education, and gender.

We begin in Table A2 by evaluating the relationship between subjective well-being, personal income, and the broader economic and non-economic environment. The World Values Survey measures self-reported income by within-country decile, and so we construct a dataset that is composed of ten "bins" per country, with a measure of average subjective well-being for that country-income decile.[2] This structure allows us to perform an analysis exploring the impact of GDP per capita, SPI, and income (and their interaction) on subjective well-being (SWB):

$$SWB_{c,d} = \ln{(GDP)_c} + SPI_c + INC_d + INC_{c,d} * SPI_c + \varepsilon_{c,d} \qquad (2)$$

Similar to earlier research such as Stevenson and Wolfers (2013), (A2-1) highlights that subjective well-being is increasing in both the level of economic performance and the relative personal income decile within a country. At the same time, subjective well-being is increasing in SPI even after controlling for personal income (A2-2), but, we cannot separately disentangle the impact of GDP versus SPI when both are included in the same specification (personal relative income remains strongly positive and significant (A2-3)). However, when we include interactions between SPI and personal relative income (controlling for GDP (as in A2-4) or with country-level fixed effects (as in A2-5)), we find a negative interaction between SPI and relative

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consistent with the next step in our analysis, which incorporates household income and other individual demographics.

[2] Recent studies focusing directly on the impact of absolute and relative income, most notably Stevenson and Wolfers (2013), undertake the careful work of recalibrating these income deciles into absolute income levels for each country. Given that we are focusing here on within-country effects (i.e., we are either controlling for the level of GDP, or including country-specific fixed effects), we use the raw data and weights from the World Values Survey itself.

income. This is seen most sharply in Figure A3, where we estimate a separate impact of SPI for each income decile in a specification with country-level fixed effects. The impact of SPI on subjective well-being is statistically significant for the first seven income deciles (relative to the top decile), and the point estimate is monotonically decreasing by decile. For individuals in the lowest income decile, a standard deviation increase in SPI above the mean level in our sample would be associated with more than a half a standard deviation improvement in average life satisfaction.

We extend these findings in Figure A4, where we examine the interaction between each dimension of SPI and income decile (each of these three specifications includes country-level fixed effects as well as a full set of dummies for income decile). Overall, the pattern for each dimension is similar to the overall results for SPI, with a monotonically declining level of sensitivity of subjective well-being to SPI with relative income. However, there is interesting variation across these dimensions. While the magnitude of variation in the sensitivity to relative income level is relatively low for Basic Human Needs, the slope is steeper for Foundations of Wellbeing or Opportunity. Together, the results suggest that the relationship between SPI and subjective-wellbeing varies by economic circumstance, but that this variation differs for the different dimensions of social progress.

Finally, in Table A3, we consider the role of educational and gender inequalities on subjective well-being. As before, we consider the average level of subjective well-being within particular country-groups (in the context of regressions including country-level fixed effects). In Models A3-1 and A3-2, we focus on the impact of gender, where we find no direct effect of gender nor any interaction between gender and the level of social progress in shaping subjective well-being. We then turn in Models A3-3 and A3-4 to the interplay with educational attainment. We divide education level into three categories, including less than high school, a high school degree, and those with education above a high school degree (i.e., some university). In addition to country-level fixed effects, we include the proportion of individuals with greater than median income within each country-education level group as a control. While there is no direct effect of education level on subjective well-being (the coefficients are small and noisy), individual educational attainment seems to have an important role in moderating the relationship between SPI and life satisfaction. In particular, Model A3-4 shows that SPI has a stronger association with life satisfaction for individuals with lower educational attainment. Together, these results suggest that the role of non-economic social progress on individuals depends on their individual circumstance, and that social and economic inequalities not only influence economic opportunity but may influence the ability to benefit or not from social progress itself.

Appendix References

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Appendix Figures and Tables

Table A1

Determinants of Life Satisfaction

	(1) Life Satisfaction	(2) Life Satisfaction	(3) Life Satisfaction	(4) Life Satisfaction	(5) Life Satisfaction
Logged GDP per Capita	0.284***				
	(0.072)				
SPI		0.028***			
		(0.006)			
Basic Human Needs			0.017*		
			(0.009)		
Foundations of Wellbeing				0.029***	
				(0.011)	
Opportunity					0.025***
					(0.006)
Constant	4.289***	4.862***	5.462***	4.699***	5.437***
	(0.712)	(0.488)	(0.733)	(0.794)	(0.371)
Observations	52	52	52	52	52
R-squared	0.177	0.168	0.068	0.130	0.237

Note: These are linear regression models at the country level. Robust standard errors in parentheses.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A2

SPI and Individual Income on Life Satisfaction

	(1) Life Satisfaction	(2) Life Satisfaction	(3) Life Satisfaction	(4) Life Satisfaction	(5) Life Satisfaction
Log GDP	0.203^{***}		0.072	0.072	
	(0.053)		(0.120)	(0.120)	
Income Decile	0.275^{***}	0.275^{***}	0.275^{***}	0.275^{***}	0.430^{***}
	(0.017)	(0.017)	(0.017)	(0.016)	(0.123)
SPI		0.022^{***}	0.015	0.015	
		(0.005)	(0.011)	(0.011)	
Income Decile X SPI				-0.005^{***}	
				(0.001)	
Income Decile X Log GDP					-0.017
					(0.013)
Income Decile X Opportunity					-0.003^{**}
					(0.001)
Constant	7.012^{***}	7.012^{***}	7.012^{***}	7.012^{***}	7.013^{***}
	(0.085)	(0.085)	(0.085)	(0.085)	(0.024)
Observations	516	516	516	516	516
R-squared	0.503	0.507	0.508	0.525	0.797

Note: These regressions are at the country level. For regressions 3-1 through 3-4, the models are cross-sectional linear models at the income-decile level with robust standard errors clustered at the country level. Model 3-4 is a fixed effect regression with robust standard errors * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table A3
Dimensions of SPI and Income with Interactions

	(1) Life Satisfaction	(2) Life Satisfaction	(3) Life Satisfaction	(4) Life Satisfaction
Ffemale	0.035	0.065		
	(0.035)	(0.402)		
Female X SPI		-0.000		
		(0.005)		
Above Median Income			1.413***	1.722***
			(0.529)	(0.521)
Secondary Education			0.175	0.132
			(0.105)	(0.107)
Some Uni. Education			0.247	0.151
			(0.191)	(0.195)
No Secondary Education X SPI				0.014***
				(0.005)
Secondary Education X SPI				0.006*
				(0.004)
Constant	6.843***	6.843***	6.177***	6.108***
	(0.025)	(0.025)	(0.120)	(0.113)
Observations	104	104	156	156
R-square	0.975	0.975	0.918	0.923

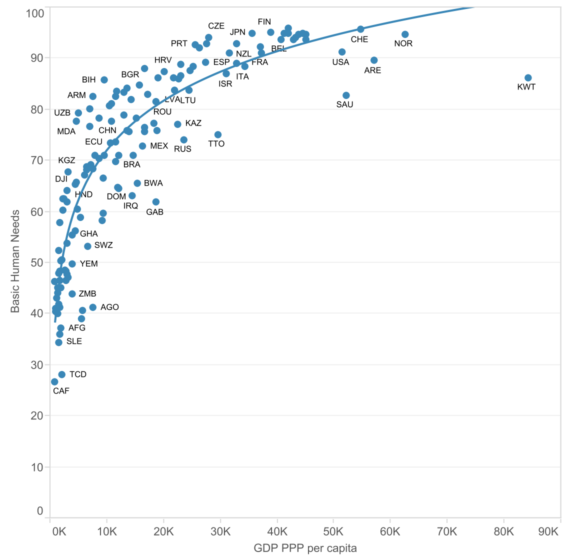
Each of these regressions include country-level fixed effects. Robust standard errors in parentheses.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Figure A1

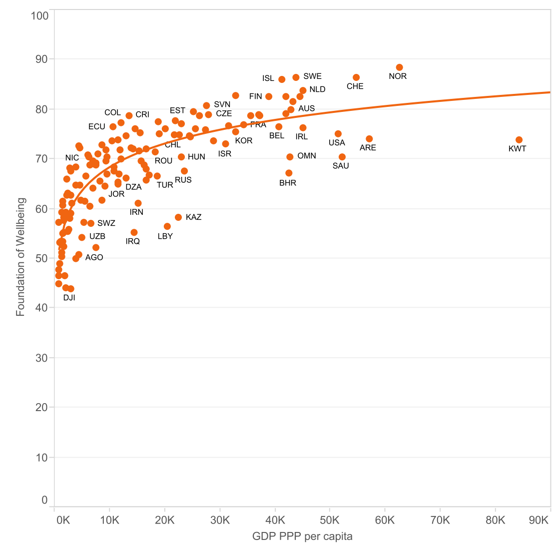
Social Progress Index Framework

Figure A2

GDP Per Capita and
Basic Human Needs



GDP Per Capita and
Foundations of Wellbeing



GDP Per Capita and
Opportunity

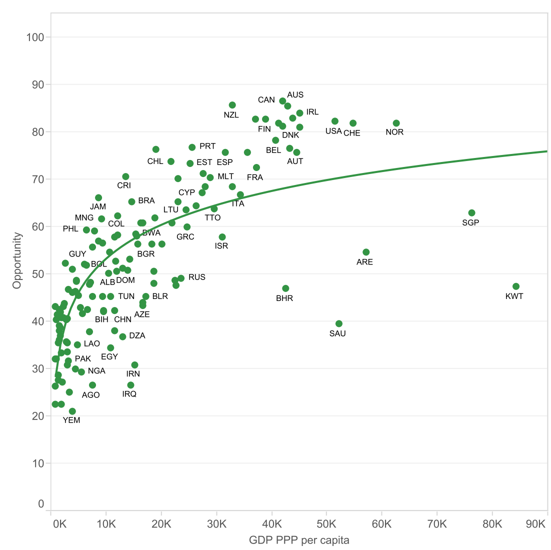
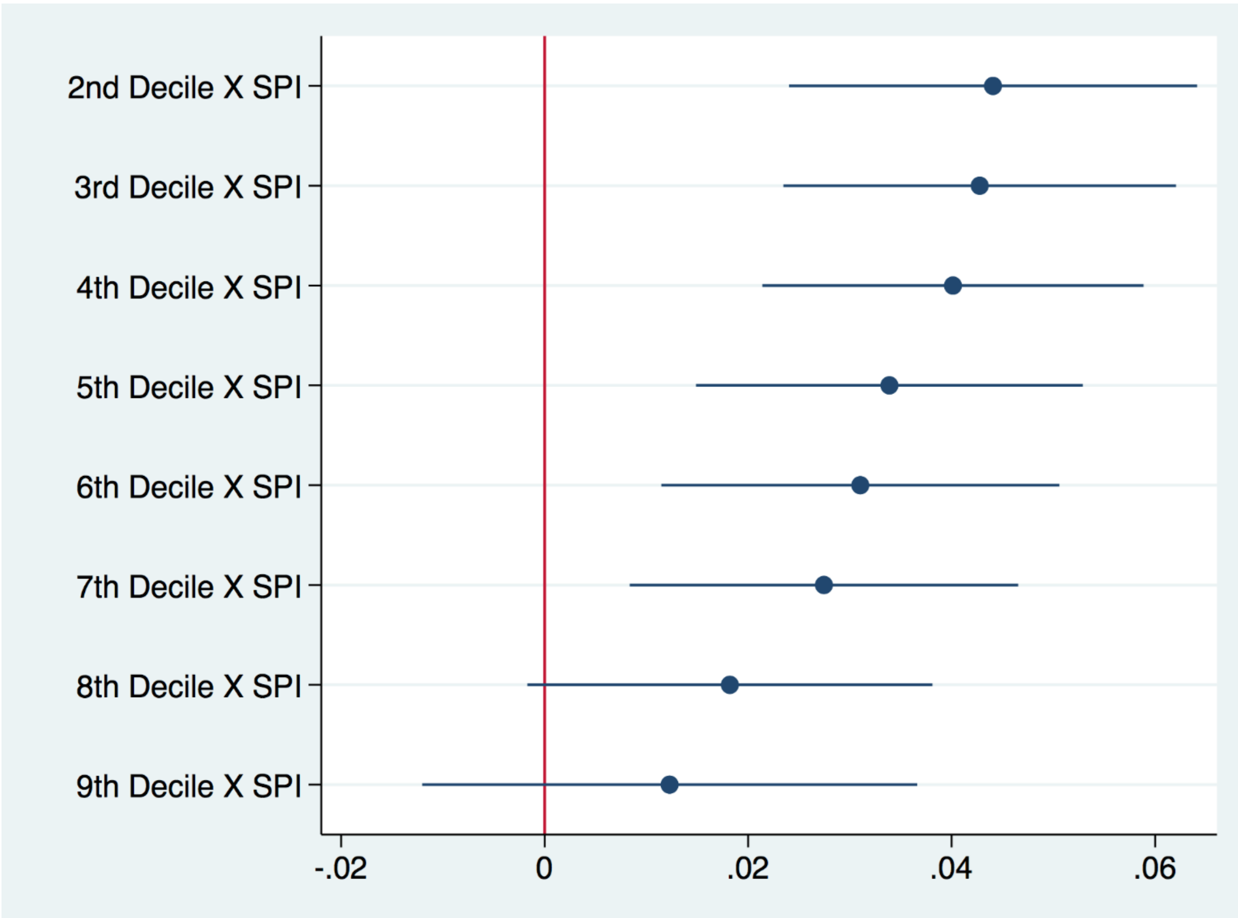


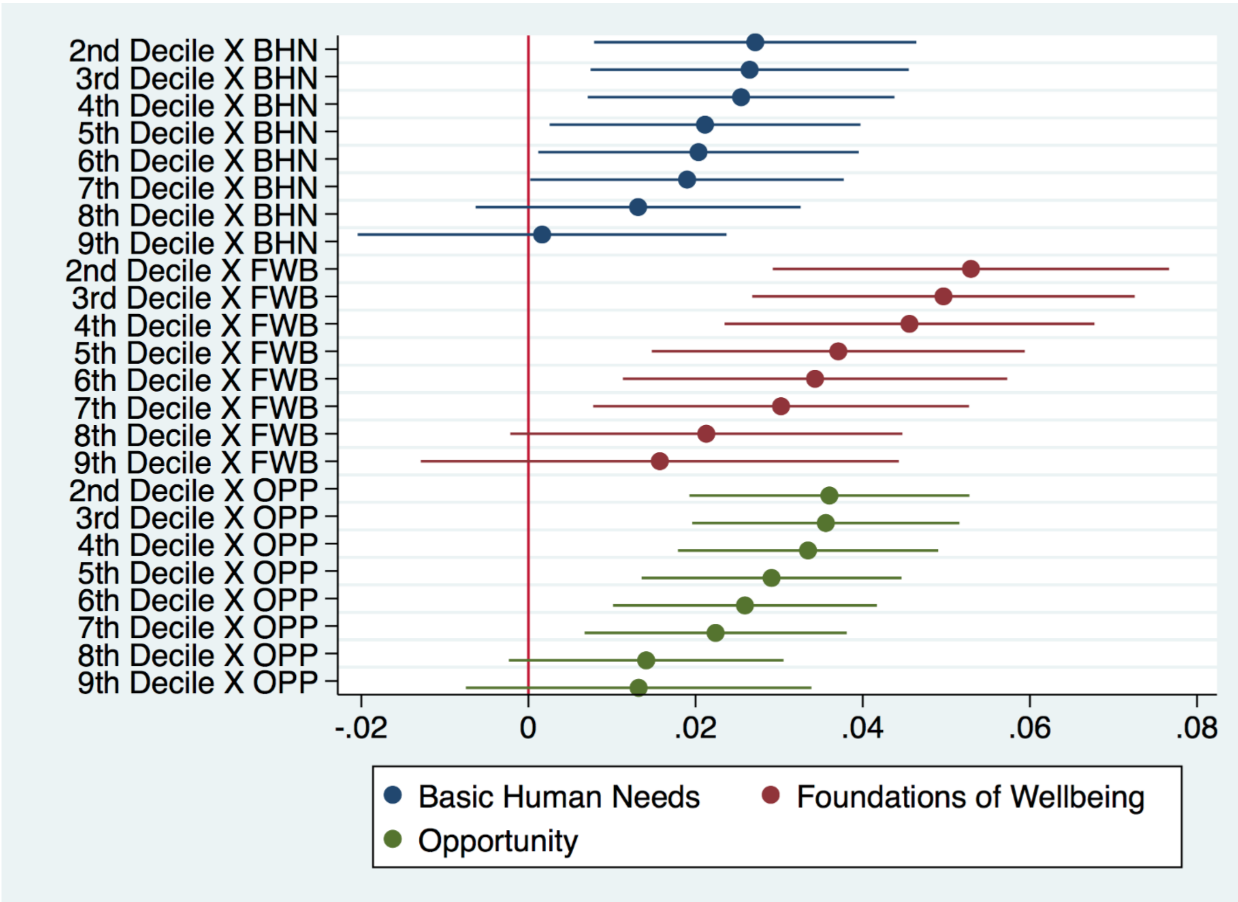
Figure A3
Variation in SPI's relationship to Life Satisfaction by Income Decile



Note: This figure provides a plot of the regression coefficients and standard errors for the interaction terms from a fixed effects regression. The interaction term with first decile and SPI drops out because of data sparseness.

Figure A4

Variation in SPI Dimensions' relationship to Life Satisfaction by Income Decile



Note: This figure provides a plot of the regression coefficients and standard errors for the interaction terms from a fixed effects regression. The interaction term with first decile and SPI drops out because of data sparseness.