Economic growth *is* enough and only economic growth is enough

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Abstract. We show that *any* cross-national measure of human material wellbeing that is (i) *basics* (not luxuries), (ii) *general* (uses indicators from multiple domains), and (iii) *plausible* (uses any defensible choices for weights) will have a statistical relationship with country GDP per capita with four features. First, the relationship will be *strong*, with *nearly all* cross-national variation in basics associated with variation in GDPPC. Second, the relationship will be *non-linear*, with a stronger elasticity of basics to at lower than higher levels of GDPPC. Third, GDPPC is empirically sufficient: *no* country has high levels of GDPPC and low levels of basics. Fourth, GDPPC is empirically necessary: *no* country has high levels of the basics at (very) low levels of GDPPC. These findings extend the existing literature as, while there are large literatures showing a strong connection of GDPPC to money-metric measures of wellbeing (e.g. headcount income/consumption poverty (Pritchett 2020), inequality adjusted incomes (Dollar, Kleineberg, and Kraay 2015)), or, to direct physical measures of specific dimensions of wellbeing like health, nutrition, education, access to sanitation, or indices like multidimensional poverty, our argument is that *all* plausible, general, measures of the basics of human material wellbeing will have a strong, non-linear, empirically sufficient and empirically necessary relationship to GDPPC.

Introduction[1]

In 1988 Robert Lucas said "the consequences for human welfare" of differences in economic growth "are simply staggering," so much so that, once one starts, "it is hard to think about anything else." But something strange has happened in the field of development: the importance of sustained economic growth for human wellbeing is being actively downplayed and development economics seems taken up with "anything but" economic growth.

In a February 2021 blog the executive director and the communication director of J-PAK (Abdul Lateef Jameel Poverty Action Lab) made the (outlandishly and obviously false) claim that: "for millions of people living in poverty, growth is not enough. Specific, targeted social programs based on rigorous empirical evidence are *equally* important to prevent people from being left behind." (emphasis added). When Bill Gates argued that anti-poverty programs providing chickens would be an important avenue for reducing poverty in Africa, Professor Chris Blattman responded not with the corrective that without sustained broad based growth such programs would do little to reduce poverty, but rather that he thought: "the *bes*t investment we could make to fight world poverty" (emphasis added) would be randomized studies comparing the efficacy of programs that transferred livestock assets like chickens versus those that distributed cash. Even development think tanks whose *name* includes "growth" are skeptical: Rohini Pande the director of the Economic *Growth* Center at Yale University in October 2021 has a blog published by the International *Growth* Centre at LSE titled: "not by growth alone" (emphasis added, twice).

Claims that economic growth is not central to poverty reduction are just wrong (Dollar and Kraay 2002, Sala i Martin 2006, Dollar, Kleineberg, and Kraay 2016, Roser 2021). Pritchett (2020) shows that growth in median incomes is strongly empirically sufficient for poverty reduction: growth *is* enough as enough growth alone does (roughly) eliminate extreme poverty. The relative contributions of levels of income and targeted social programs to levels of poverty is not "equal" as J-PAL, with zero evidence, asserts (50:50), it is more like 99:1 in favor of growth. Moreover, it is also well-known that important elements of wellbeing, like child mortality or life expectancy, are strongly associated with GDPPC (Filmer and Pritchett 1999, Pritchett and Viarengo 2010). And, it is also easy to show that *some* cross-national general indicators of the basics of human wellbeing, like the Social Progress Imperative's Basic Human Needs measure, are strongly related to GDPPC (Pritchett 2022).

We up the ante and demonstrate that the skeptics about the benefits from economic growth are not just wrong poverty or about this or that indicator, they are wrong about *everything*, or at least wrong about everything *basic to human material wellbeing*[2] (hereafter rather than use the extended phrase or invent an acronym BHMWB we just say 'basics').

[1] We would like to thank Stephen O'Brien and Vicente Geloso for very helpful comments.

[2] By "material" wellbeing we are bracketing three large and important topics. First, we are not addressing self-reported measures of subjective wellbeing, even though there is a large and interesting literature around self-reported happiness or life satisfaction. Second, we are not broaching the topic of what normatively "ought" to bring people wellbeing or what spiritual or metaphysical stances or beliefs might bring happiness or life satisfaction. Third, as noted below, by "human" wellbeing we acknowledge that we are not incorporating measures of animal wellbeing or of intrinsic, non-instrumental, measures of the natural environment but we are including the natural environment insofar as it impinges on human wellbeing.

At least since Amartya Sen's (1985, 1999) arguments for a "capabilities" approach and the UN's Human Development 1991, many have agreed that normative measures of country development as human wellbeing should go beyond "money metric" measures and include outcomes in health, education, nutrition, access to water and sanitation, the natural environment (and others). The Sustainable Development Goals (UN 2015) include a very wide array of goals and targets. We argue the relationship between *any* general, plausible, measure of the basics of human material wellbeing and GDPPC will have four characteristics:

(i) is *very* tightly correlated with GDPPC. The correlation between a very wide array of measures of basics and their "predicted" value based on GDPPC alone is typically around .9 (equivalently, an R2 around .81). The p-levels for zero on all terms in GDPPC are smaller than 10^{-37}. Even "data undermining" which does specification searchers over the space of possible measures of basics to *minimize* the correlation of basics with GDPPC still produce strong correlations,

(ii) the relationship of basics and GDPPC is strongly non-linear, more non-linear than logarithmic and not constant elasticity. The elasticity of basics wrt to GDPPC is between twice and eight times larger for countries in the second quintile income than for those in fourth quintile,

(iii) the statement "growth is not enough" is demonstrably false for basics. GDPPC is *empirically sufficient*: while at any given level of GDPPC there are countries with higher or lower values, there are no countries with high GDPPC that have low achievement on basics.

(iv) GDPPC is also empirically necessary: there are no countries with low levels of GDPPC with high levels of basics.

After a first section that describes the underlying data sources the next four sections describe various approaches to creating a measure of the basics of human material wellbeing and the relationship of each of those approaches to GDPPC.

I) Data on GDPPC and on human material wellbeing

I.A) GDP per capita

We use a standard source for cross-nationally comparable purchasing power adjusted estimates of GDP per capita, the Penn World Tables, version 10.0 (Feenstra, Inklaar and Timmer 2015). We use the expenditure based ('rgdpe') not output based ('rgdpo') based estimates. GDP for all countries is reported in PPP adjusted 2017 US$ (henceforth "P$"). In most regressions we use 2018, the latest year from which all of our indicators are available, but some basics measures, like World Bank headcount poverty or the multi-dimensional poverty index, are based on micro survey data and only available for different years for different countries hence we match the year of the PWT10.0 GDPPC estimate to the year of the indicator.

I.B) Indicators of human material wellbeing from Legatum Prosperity Index

The Legatum Prosperity Index (LPI) is a large and sophisticated exercise to measure a wide array of aspects of countries' development. The LPI has twelve pillars, with 66 elements, based on 294 distinct indicators. The 12 pillars are: (i) safety and security, (ii) personal freedom, (iii) governance, (iv) social capital, (v) investment environment, (vi) enterprise conditions, (vii) market access and infrastructure, (viii) economic quality, (ix) living conditions, (x) health, (xi) education and (xii) natural environment. Many of these indicators are based on ideas/theories about the deep (governance, social capital) and proximate (enterprise conditions, market access and infrastructure, economic quality) determinants of country productivity and are not intended as direct measures wellbeing.

We use only the data on four LPI pillars that are direct measures of individual/household material well-being: *living conditions, health, education,* and *natural environment*. As shown in Table 1 the aggregate measure for each of the four pillars are built up from 5 or 6 elements each, with the elements built from specific indicators.

The specific indicators are of four types: (i) directly welfare relevant *outcomes*, (ii) *utilization* that (is thought to) improve wellbeing directly and indirectly, (iii) measures of *availability* and (iv) measures of household income or assets. Outcomes, like under-5 child mortality, or prevalence of stunting of children under 5 are directly measures of welfare relevant *outcomes.* These outcomes are affected by a variety of proximate determinants and are influenced by a wide variety of choices that households make subject to the constraints they face. The *utilization* indicators (often called, we believe, misleadingly, "access") measure whether a household has or uses specific goods or services like electricity, cellphone, immunization, schooling, attended births, contraceptive prevalence. These again depend on household choices subject to the constraints of physical availability, cost, efficacy, etc. (which is why we feel "access" is confusing as it is just one element of the choice of utilization). Some of the LPI indicators are whether certain things are *available* perhaps as pure public goods, for which "utilization" cannot be measured at the household level (e.g. methane emissions, freshwater withdrawal, national screening programs) or local public goods like rural roads or publicly provided services like health facilities. The *living conditions* pillar includes the measures of headcount poverty and some direct asset ownership variable, like whether the household owns a refrigerator.

We make only three modifications to the raw LPI data. One, we rescale all elements and each indicator to a common scale of 1 to 100, where 1 is the value for the worst country and 100 is the value for the best country. This is *not* a transformation to an ordinal scale of ranks across countries but rather to a common cardinal scale for all pillars, elements, and indicators where the transformed measure is perfectly correlated with the raw data. The transformation means a one-unit difference for each indicator (e.g. child mortality, access to electricity, primary enrollment rate, etc.) is $1/99^{th}$ of the gap between the worst and best country for that indicator. For instance, in 2018 for under 5 mortality the best outcome is Finland at 2 deaths per 1000 births and the worst outcome is for Somalia at 129.4 so a one unit in a 1 to 100 scale is $1/99^{th}$ of the gap between 129.4 and 2. While there is no perfect way to compare a wide variety of pillars, elements, and indicators and how they are associated with GDPPC, a common cardinal scale at

least has a clear interpretation that a common change in GDPPC moves indicators a certain distance from the worst observed country outcome for that indicator to the best outcome.

Two, we transform every measure so that "up is good" so that, for instance, for under-five mortality where in raw units "up is bad" we simple reverse the 1 to 100 scale. So for "under-5 child mortality" Somalia is 1 and Finland is 100 and the interpretation is therefore child survival (up is good).

Three, there are a number of countries that have LPI data but do not have GDPPC data in the PWT 10.0. For these countries we regress GDPPC on a variety of correlated indicators from the LPI--but not from the four pillars of direct measures of wellbeing which obviously would induce circularity--and use the predicted values of GDPPC from that regression for those few countries with missing GDPPC. We fill in the GDPPC data in part because a commonly cited outlier in some elements of the wellbeing conditional on its GDPPC is Cuba, but which is missing from nearly all empirical analyses because it does not have GDPPC measures from the standard sources.

Table 1: Pillars, elements and indicators for material living conditions from Legatum Prosperity Index		
Pillar	Elements (22)	Indicators (82)
Living Conditions (6 elements)	Material Resources (MRE):7	Poverty rate at national poverty lines, Poverty rate at $1.90 a day, Poverty rate at $3.20 a day, Poverty rate at $5.50 a day, Households with a refrigerator, Ability to source emergency funds, Ability to live on household income
	Nutrition (NUT): 4	Availability of adequate food, Prevalence of undernourishment, Prevalence of wasting in children under-5. Prevalence of stunting in children under-5
	Basic Services (BSC): 5	Access to electricity, Access to basic water services, Access to piped water, Access to basic sanitation services, Unsafe water, sanitation or hygiene
	Shelter (SHR): 4	Availability of adequate shelter, Housing deprivation, Access to clean fuels and technologies for cooking, Indoor air quality
	Connectedness (CTD): 6	Access to a bank account, Use of digital payments, Access to a cellphone, Rural access to roads, Satisfaction with public transportation, Satisfaction with roads and highways
	Protection from Harm (PHM): 4	Death and injury from road traffic accidents, Death and injury from forces of nature, Unintentional death and injury, Occupational mortality
Health (6 elements)	Behavioral Risk Factors (BRF): 3	Obesity, Smoking, Substance use disorders
	Preventive Interventions (HPI): 6	Diphtheria immunization, Measles immunization, Hepatitis immunization, Contraceptive prevalence, Antenatal care coverage, Existence of national screening programs
	Health Care Services (HCS): 7	Healthcare coverage, Health facilities, Health practitioners and staff, Births attended by skilled health staff, Tuberculosis treatment coverage, Antiretroviral HIV therapy, Satisfaction with healthcare
	Mental Health (MTH): 3	Emotional wellbeing, Depressive disorders, Suicide
	Physical Health (PHH): 5	Physical pain, Health problems, Communicable diseases, Non-communicable diseases, Raised blood pressure
	Life Expectancy (LEX): 5	Maternal mortality, Under 5 mortality, 5-14 mortality, 15-60 mortality Life expectancy at 60
Education (5 elements)	Pre-primary (PPE): 1 (1 Indicator)	Pre-primary enrolment (net)
	Primary (PRI): 3	Primary enrolment, Primary completion, Primary education quality
	Secondary (SEC): 4	Secondary school enrolment, Lower-secondary completion, Access to quality education, Secondary education quality
	Tertiary (TER): 5	Tertiary enrolment, Tertiary completion, Average quality of higher education institutions, Skillset of university graduates, Quality of vocational training
	Adult Skills (ASK): 5	Adult literacy, Education level of adult population, Women's average years in school Education inequality, Digital skills among population
Natural Environment (5 elements)	Emissions (EMS): 5	CO2 emissions, SO2 emissions, NOx emissions, Black carbon emissions, Methane emissions
	Exposure to Air Pollution (EAP): 3	Exposure to fine particulate matter, Health impact of air pollution, Satisfaction with air quality
	Forest, Land, Soil (FLS): 3	Forest area, Flood occurrence, Sustainable nitrogen management
	Freshwater (FWT): 4	Renewable water resources, Wastewater treatment, Freshwater withdrawal, Satisfaction with water quality
	Preservation Efforts (EPE): 6	Terrestrial protected areas, Marine protected areas, Long term management of forest areas, Protection for biodiverse areas, Pesticide regulation, Satisfaction with preservation efforts
Source: Legatum Prosperity Index.		

II) The variety of country indexes of basics

Any national (or regional, sub-national or group) general measure of the basics of human material wellbeing must answer three questions: (i) which measures are included as 'basic'? (ii) what is the summary statistic used from the distribution of the measure of the basic: is there a "deprivation" threshold and the indicator for each household is a binary indicator of whether the household is below/above or a median/average measure of the central tendency of the distribution across households?) (iii) what are the weights for combining indicators?

Equation 1 is the generic formula of a basics index for country k as a linear weighted average of N indicators each with weight α_n where the measure for each indicator n is some mapping from the underlying distribution (f)[3] across households of the indicator B (which in our case all N indicators M^n are re-normed to a 1 to 100 scale).

$$1)\ Index\ of\ BHMWB^k = \sum_{n=1}^{N} \alpha_N * M^n(f_n^k(B^j))$$

Our claim is very strong: for *any* general, plausible cross-national measure of the basics of human material wellbeing there is a strong, non-linear, empirically sufficient and empirically necessary relationship with GDPPC. We support this strong claim by constructing measures of basics using four different approaches, each with many variants, that span the range of measures of basics of human wellbeing that are 'general' and 'plausible.'

The first approach uses the Legatum Prosperity Index (LPI) data to construct two different "correlational" indexes of basics, which use an analytically grounded method to choose which measures and which weights. The Basics Correlational Index-Elements (BCI-E) uses the 22 'elements' of the four wellbeing pillars of LPI while the Basics Correlational Index-Indicators (BCI-I) uses the 82 raw indicators from which those elements are constructed. We use the results from these two as a base case to show the four features, which we can compare to the three other approaches.

Our second approach creates "anchored" indexes. An anchored index uses any indicator widely accepted as a 'basic' as the "anchor." A *general* anchored index adds N-1 other indicators, choosing the N-1 other indicators most strongly correlated with the anchor, and then use principal components for the weights. A wide variety of plausible anchors from different domains of wellbeing (say, under five child mortality, women's years of schooling, prevalence of stunting, access to clean cooking fuels, etc.) lead to measures of basics with similar relationships to GDPPC. Moreover, our "data undermining" shows that even the anchored index with the *weakest* relationship to GDPPC has a relationship with the same four characteristics (strong, non-linear, sufficient, necessary).

Our third approach if 'iterated' indices, starts from seven domains widely regarded as important to human wellbeing from a variety of normative stances (consistent with either a choice/preferences/utility grounding or a capabilities approach or just seat of the pants common

[3] For instance, Foster, Greer, Thorbecke (1984) measure of poverty are partial integrals of the underlying distribution of income/consumption and hence are a non-linear mapping from a variable B to an indicator of well-being.

sense): (i) health, (ii) education, (iii) nutrition, (iv) housing conditions, (v) water and sanitation, (vi) poverty and (vii) natural environment. Within each of these seven domains there are a number of plausible indicators. For example, 'health' can be proxied/measured by life expectancy or under five child mortality or access to health care; education can be measured by completion of various levels (primary or secondary) or measures that incorporate quality. We iterate over the space of *general* and *plausible* measures of basics by (a) randomly choosing a single indicator from each of the seven domains and (ii) randomly assigning the weights to the seven indicators, with weights constrained only such that no one indicator receives more than 3/7 weight. We iterate over this procedure 100,000 times which essentially spans the set of general, plausible, multiple domain indexes. Again, in the spirit of "data undermining" we show the index of basics that emerges from 100,000 iterations with the *weakest* relationship with GDPPC still has a strong, non-linear relationship.

Our fourth approach simply use measures created by other organizations. The World Bank (and others) provide a measure of "poverty" based on thresholds of income/consumption. The Social Progress Initiative has a measure of Basic Human Needs (Pritchett 2022). Sabina Alkire has developed and the Oxford Poverty and Human Development Initiative report a sophisticated multidimensional poverty index (Alkire and Foster 2011, Alkire, Kanagaratnam, Suppa 2021). Each of these is based on choices of indicators, thresholds, and weights that are plausible, but like any other measure are ultimately are social conventions. Not surprisingly, each of these three measures has a very relationship to GDPPC with the same four features as our correlational, anchored, or iterated indexes.

III) Correlational Indexes of Basics from the Legatum Prosperity Index

A good or service "basic" to human could defined as one for which: (i) the income expansion path is steep at low levels of income but which flattens out as income increases and (ii) has low-price elasticities, especially at very low levels of consumption (and at moderate levels of aggregation: the price elasticity of "staples" (e.g. rice, wheat, etc.) is lower than that for any given staple).[4] Clearly it would be circular to define which elements/indicators are basics by their income expansion path and then "find" something about the estimated relationship of that basics index to GDPPC.

We build "correlational" indexes of basics that avoid circularity by using only the correlations *amongst* the elements/indicators (not with GDPPC) to define basics. Our working hypothesis is that, across a wide variety of causal models of basics (including but not only the "income expansion path" from standard microeconomics or "capabilities" approaches), we should expect that the cross-national correlation of basics should be high. If there are N distinct items, each of which "basic" to material wellbeing then most causal models would predict a

[4] The enormous literature on Engel curves (the share of food in consumption wrt to total income/consumption) shows that over time and across countries (i) the budget share of food starts at a very high level and falls as income expands and (ii) Engel curves tend are empirically strikingly similar across time and across countries (see, among the many, Pritchett and Spivack 2013 and references therein).

country who have more of the n*th* basic (e.g. "utilization of sanitation") to have also have more of any other basic (e.g. "adequate nutrition").

III.A) Basic Correlational Index using Elements of LPI (BCI-E)

We compute the bivariate correlation matrix among the 22 elements of the four LPI wellbeing pillars and from that matrix we compute the median correlation of each element with the other 21 elements. We choose a median correlation above .6 as the threshold for an indicator to be 'basic' based on the large gap between the median correlation of the 14th element Health, Preventive Interventions (HPI) at .647 and the 15th (Freshwater (FWT) at .471 (Table 2). The correlation threshold is the only free parameter in this approach and we explore robustness of results to correlation threshold below.

Before discussing the results of this Basics Correlation Index-Elements (BCI-E) understanding *how* the construction of this index works is important for understanding all of the results of the paper. In Table 2 we report the results of the median correlations for each of the 22 LPI elements. For each element we run a simple OLS regression of the element on a quartic in GDPPC. Table 2 shows: (i) the regression predicted gain in moving from the 5th percentile of GDPPC to the 60th percentile, (ii) the same in moving from 60th to 95th percentile, (iii) the difference between those predicted gains, which is assesses the concave non-linearity of the element's income expansion path, and (iv) the R2 of the quartic regression.

The 14 elements chosen as 'basics' by a .6 correlation threshold are very different in their relationship with GDPPC than the 8 elements which are deemed non-basics by this threshold. The basics have (i) a very steep GDPPC expansion path at low levels of income: the median predicted gain in moving from the 5th to 60th percentile is 32 (on a 1 to 100 cardinal scale), (ii) a highly non-linear GDPPC expansion path that flattens out: the gain from the 60th percentile to 95th percentile is only 8.7 and (iii) a high R2: the median is .729. In contrast, the predicted gain for the non-basics is small: the median gain from the 5th to 60th percentile is only .7 and not particularly non-linear and the median R2 for the eight non-basics is only .153.

The 'non-basics' chosen by the correlational method are intuitive. Among the six elements of health pillar, four are classed as basics (Life Expectancy (LEX), Physical Health (PHH), Health Care Services (HCS), and Preventive Interventions (HPI)) whereas two, Mental Health (MTH) (e.g. depressive disorders, suicide) and Behavioral Risk Factors (BRF) (e.g. smoking, obesity) are not 'non-basics' (which is not to say they are unimportant to individual wellbeing, just that they are not basic). Within the five elements of the education pillar, four are 'basic' (pre-primary (PPE), primary (PRI) and secondary (SEC) and adult skills (ASK)) whereas tertiary enrollment (TER) is non-basic. All of the elements of the living condition pillar are basic.

None of the natural environment measures are classed as basic by this method. The natural environment elements have with varying patterns: exposure to air pollution (EAP) has an environmental Kuznets curve (gets worse with GDPPC, then better), whereas preservation efforts only get better at very high levels of GDPPC, and overall emissions (EME), which includes climate change causing emissions CO2 and methane) get consistently worse with respect to GDPC, deteriorating by roughly the same amount from 5th to 60th and 60th to 95th.

Table 2: A correlational test for which elements of the Legatum Prosperity Index are "basics" to material wellbeing									
	Variable		Correlation with all other 21 elements (sorted)	GDPPC expansion path			R2 of quartic in GDPPC	Percent deviation of principal component weight from equality	
	Pillar	Element		From 5th (P$1,520) to 60th (P$16,920) percentile	Predicted gain from 60th (P$16,920) to 95th (P$62,270)	Difference in predicted gain		With all variables	With just basics
Basics	**LC**	**MRE**	**0.805**	**47.0**	**10.6**	**36.3**	**0.797**	**10.7%**	**-0.6%**
	ED	**SEC**	**0.802**	**36.3**	**9.6**	**26.7**	**0.777**	**-4.4%**	**-13.9%**
	LC	**NUT**	**0.794**	**33.8**	**14.7**	**19.1**	**0.732**	**10.7%**	**-0.9%**
	ED	**ASK**	**0.781**	**41.7**	**8.2**	**33.5**	**0.726**	**8.6%**	**-2.7%**
	HL	**LEX**	**0.778**	**32.1**	**3.9**	**28.1**	**0.654**	**20.2%**	**7.1%**
	ED	**PRI**	**0.776**	**27.9**	**-0.6**	**28.5**	**0.555**	**25.2%**	**11.3%**
	LC	**SHR**	**0.774**	**56.4**	**9.1**	**47.3**	**0.838**	**19.2%**	**7.0%**
	HL	**HCS**	**0.767**	**28.8**	**15.7**	**13.1**	**0.774**	**-1.5%**	**-11.7%**
	LC	**BSC**	**0.753**	**53.7**	**3.7**	**50.0**	**0.779**	**30.4%**	**16.6%**
	LC	**CTD**	**0.726**	**20.9**	**19.3**	**1.6**	**0.752**	**2.1%**	**-9.0%**
	ED	**PPE**	**0.718**	**32.0**	**5.5**	**26.4**	**0.581**	**-5.3%**	**-14.9%**
	HL	**PHH**	**0.697**	**29.6**	**5.7**	**23.9**	**0.563**	**18.1%**	**4.8%**
	LC	**PHM**	**0.648**	**15.5**	**14.7**	**0.8**	**0.504**	**6.8%**	**-5.5%**
	HL	**HPI**	**0.647**	**12.3**	**3.3**	**8.9**	**0.336**	**27.1%**	**12.4%**
Median			**0.771**	**32.0**	**8.7**	**26.6**	**0.729**	**10.7%**	
Not basics	NE	FWT	0.471	4.9	-4.3	9.2	0.284	-14.4%	
	NE	EPE	0.444	0.8	11.9	-11.1	0.311	-26.7%	
	HL	MTH	0.271	13.3	-6.5	19.9	0.107	8.8%	
	NE	FLS	0.269	6.5	17.7	-11.2	0.200	-37.1%	
	NE	EAP	0.149	-8.0	1.4	-9.5	0.089	11.4%	
	NE	EMS	-0.056	-13.5	-13.5	0.0	0.072	-1.2%	
	ED	TER	-0.071	0.6	-0.6	1.1	0.009	-97.3%	
	HL	BRF	-0.532	-34.8	-17.8	-17.1	0.457	-11.3%	
Median			0.209	0.7	-2.5	-4.7	0.153	-12.8%	

The simple analysis in Table 2 reveals that there are a substantial number of measures of the basics of material wellbeing that are both (a) quite highly correlated amongst themselves and (b) quite highly associated (non-linearly) with GDPPC. As we will see, these facts are going to imply that (roughly) no matter how you choose measures across multiple domains to form an overall index of basics and (roughly) no matter how you choose weights for those indicators you are going to end up with any general, plausible, index of basics with (roughly) the same relationship to GDPPC.

Once it is chosen which measures are 'basics', an index needs weights. Equal weights are often used as a "focal point" default. This is often not because equal weights has any good justification, but rather that no particular set of weights (including equal weights) has a good justification, which forces reliance on one arbitrary "focal point," equality. Our first preference is to use weights derived from the principal component of the set of measures. The final two columns of Table 2 show that if one chooses basics based on a correlational threshold the difference between principal component weights and average weights is quite small (intuitively, as all the elements are highly correlated) such that the correlation of indexes with principal components weights and equal weights is over .99. In contrast, if one uses all 22 elements, the principal components procedure produces quite different weights.

III,B) Basics Correlational Index with LPI Indicators (BCI-I)

We implement the same procedure as above for the 22 elements for the 82 indicators from the four wellbeing pillars. We compute the 82 by 82 bivariate correlation matrix and from that the median correlation for each indicator. Using the 82 indicators we chose a median correlation threshold of .65 to distinguish between non-basic and basic indicators. This relatively high threshold produces 10 indicators of the 82 that are 'basic' with 6 of those 10 indicators are from the education pillar.

As with the elements of LPI, there are no natural environment indicators that make the correlation threshold, which remains true even if the threshold is made quite low, the highest correlation of any natural environment indicator is "Long term management of forest areas" with a median correlation of only 0.445.

III.C) Results for the relationship of GDPPC and basics (BCI-E and BCI-I)

Figure 1 illustrates the relationship between GDPPC and the two correlational indexes of basics (BCI-LE and BCI-LI) in four distinct ways (which will be used for other indicators below).

We show the 17-country rolling median of BCI-E and BCI-I by GDPPC[5]. This statistic is both non-parametric—other than the width of the window nothing about the functional form

[5] This is a special case of a a large variety of smoothed statistics, which pick a weighting function and a window, in this case we calculated the median using a rectangular window, with a window width of 17, roughly 10 percent of the sample.

between basics and GDPPC has to be imposed—and robust as it uses the median which is not sensitive to outlying observations.

Figure 1 also shows the predicted value of BCI-LE and BCI-LI from a regression on a quartic in GDPPC. This flexible functional form trades off the costs imposing some structure on the relationship (versus the rolling median) but with the (modest) analytical gain of allowing more traditional summary statistics like the R-Squared and exact formulas for slope and elasticity (equations 2 and 3 below).

Three, we show an "envelope" of the range of country experiences with basics and GDPPC with a lower and upper bound on basics for any given level of GDPPC[6].

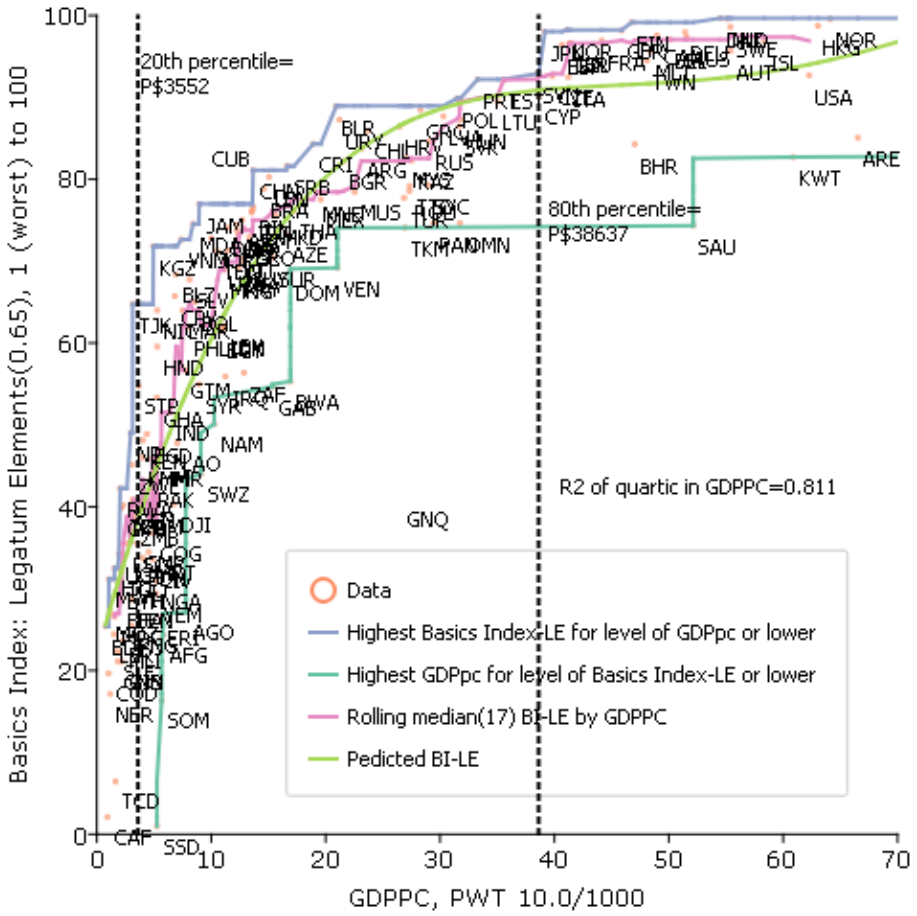
The lower line of the envelope shows the *worst* outcome for basics for any country with a given level of GDPPC or *higher*. This lower limit illustrates empirical sufficiency as the lower-right or "southeast" of the graph shows the combinations of high GDPPC and low basics that never happen.

The upper line of the envelope shows the *best* outcome for basics for any given level of GDPPC or *lower*. This is, in some sense the "production possibility frontier" of producing basics from GDPPC. The upper limit illustrates empirical necessity as the upper-left or "northwest" of the graph shows the combinations of high achievement on basics and low GDPPC that do not happen.

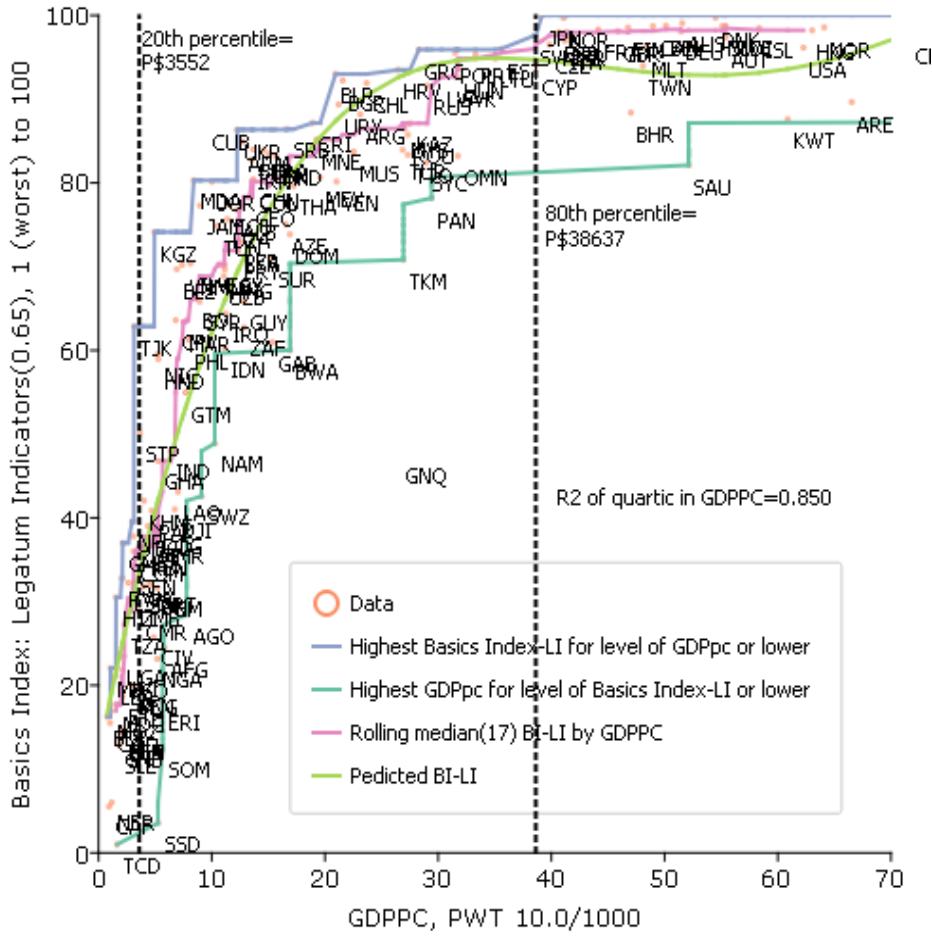
[6] As we discuss below, the regressions include but the envelope calculations shown exclude Cuba and Equatorial Guinea, which we discuss as interesting outliers below.

Figure 1: Relationship between an index of Basics and GDPPC: strong, non-linear, sufficient, necessary

Panel A: Using 22 'elements' from Legatum Prosperity Index



Panel B: Using 82 'indicators' from Legatum Prosperity Index



Source: Authors' calculations.

Table 3 shows summary statistics from the regressions of these indexes of basics on a quartic in GDPPC. (Table 3 also reports the exact same calculations for all other indexes, which is a preview of coming attractions as the construction of the left hand side variable has not yet been described). The regression coefficient estimates and other summary statistics are presented in Table A.R.1 (for BCI-LE, BCI-LI and three other measures) and Appendix Table AR.2 for the anchored indexes.

The first column of Table 3 shows the regression R2, which is .811 for the BCI-LE(.6) and .850 for the BCI-LI(.65). With a bivariate linear regression the R2 is the square of the correlation coefficient, the correlation equivalent for a bivariate non-linear function is .90 and .92[7]. The appendix tables report the p-levels of the F-tests for excluding all terms in GDPPC. In this era of "replication crisis" and concern about relying on p-levels (like .01), it is worth pointing out that the p-level of the test for inclusion of all terms in GDPPC is 10^{-54} and 10^{-60} (Table A.R.1) are literally astronomically low p-levels[8].

The next four columns of Table 3 show the elasticity of the basics index wrt to GDPPC at the mean GDPPC of the first four quintiles: P$2,050, P$6,450, P$13,240 and P$27,1000. With the quartic functional form in GDPPC the elasticity (equation 2) varies across levels of GDPPC as the slope is a cubic in GDPPC (by simple differentiation, equation 3). This allows, unlike more commonly imposed functional forms like a linear, log-linear, or log-log functional form, the elasticity to vary flexibly across levels of GDPPC.

$$2)\ \epsilon_{BI,GDPPC} = \frac{dBI}{dGDPPC} * \frac{GDPPC}{BI}$$

$$3)\ \frac{dBI}{dGDPPC} = \beta_1 + 2 * \beta_2 * y + 3 * \beta_3 * y^2 + 4 * \beta_4 * y^3$$

The results show that the elasticity tends to start at a moderate level, then rises with GDPPC, reaching a peak in Quintile II, fall modestly but remains high in Quintile III, and then falls to a much lower level by the average GDPPC in Quintile IV, P$27,100. The mean income of quintile IV of P$27,100 is about the upper limit for "developing" countries, as Turkey is around P$26,900, Malaysia P$27,100 and Greece P$28,300.

The population weighted average of GDPPC of those countries below the 80th percentile (roughly the "developing" countries) is P$10,044 (naturally, this lies in between the population giants of India at P$6366 and China at P$13,664). This implies the typical developing country person lives in a country near the peak of the elasticity of basics wrt to GDPPC.

[7] The naïve use of the bivariate correlation as a measure of strength of association, which (incorrectly) imposes linearity in the relationship is only .73 and .71. There is no reason that the relationship should be linear and basic microeconomic theory suggests it should not. This point might seem too trivial to even mention but prominent authors often show scatter plots of measures of basics against GDPPC which are obviously non-linear but nevertheless only show a linear relationship (e.g. Figure 7 of Porter, Stern, and Artavia Loria 2013).

[8] "Astronomical" because astronomy produces very large numbers: $3*10^{52}$ is the estimated mass of the universe in kg, 10^{24} a rough estimate of number of stars in the universe.

Table 3: Summary of the regression results of the relationship between GDPPC and the basics of material human wellbeing for the four different classes of basics indexes

Measure of country basics of material wellbeing	N	R-Squared of quartic	Non-linear: Elasticity of index wrt GDPPC at				Empirically necessary		Empirically sufficient	
			μ_{QI} $2,030	μ_{QII} $6,450	μ_{QIII} $13,240	μ_{QIV} $27,100	Pred at μ_{QI}	Max at μ_{QI}	Pred at μ_{QIV}	Minimum at μ_{QIV}
BCI-LE(.6)	167	0.811	0.293	0.458	0.430	0.200	31.6	42.2	87.0	74.3
BCI-LI(.65)	167	0.850	0.497	0.613	0.503	0.162	24.5	32.8	93.0	78.2
Anchored Basics Indexes (N=10, anchor plus 9 most highly correlated other indicators), PC weights, 15 different anchors										
Median of 15 Anchored Indices	167	0.821	0.468	0.579	0.452	0.090	30.2	33.2	100.1	85.9
Contraceptive Prevalence Rate (lowest R2 of any of the 15 anchors)	167	0.703	0.272	0.429	0.388	0.126	35.1	47.9	88.1	68.8
Seven Domain Basics Indexes, randomly chosen indicators and random weights, 100,000 iterations										
Lowest R2 over with randomly chosen indicators, equal weights: wasting, primary enrollment, maternal mortality, headcount poverty (extreme), indoor air quality, exposure to fine particulates	167	0.625	0.165	0.290	0.262	0.019	50.5		91.3	
Lowest R2 with randomly chosen indicators and weights: Wasting (.394), mortality rate age 15-60 (.009), education of adult population (.047), safe water (.185), extreme poverty (.012), housing deprivation (.001), exposure to fine particulates (.353)	167	0.327	0.071	0.146	0.155	0.048	45.7		62.9	
Other commonly used indicators of basics of human wellbeing										
Basic Human Needs (SPI)	153	0.833	0.290	0.424	0.342	0.051	37.9	40.6	90.2	79.1
Multidimensional poverty index (OPHI)	100	0.725	0.516	0.339	-0.02		49.9	70.5	104.1	99.6
Poverty (P$5.50/day)	143	0.865	1.329	0.880	0.588	0.112	11.6	13.9	89.7	87.8
Source: Authors' calculations										

The final four columns of Table 3 show the calculations of the predicted value of the measures of basics at the mean value of GDPPC of the first quintile (P$2,030) and at the average of the fourth quintile (P$27,010).

Also shown are the results of the "envelope" calculations showing the highest basics of any country at the mean of quintile I or below (which is an indicator of the "empirically necessary" aspect of GDPPC) and the lowest basics for any country at the mean of quintile IV or above (which is an indicator of the "empirically sufficient").

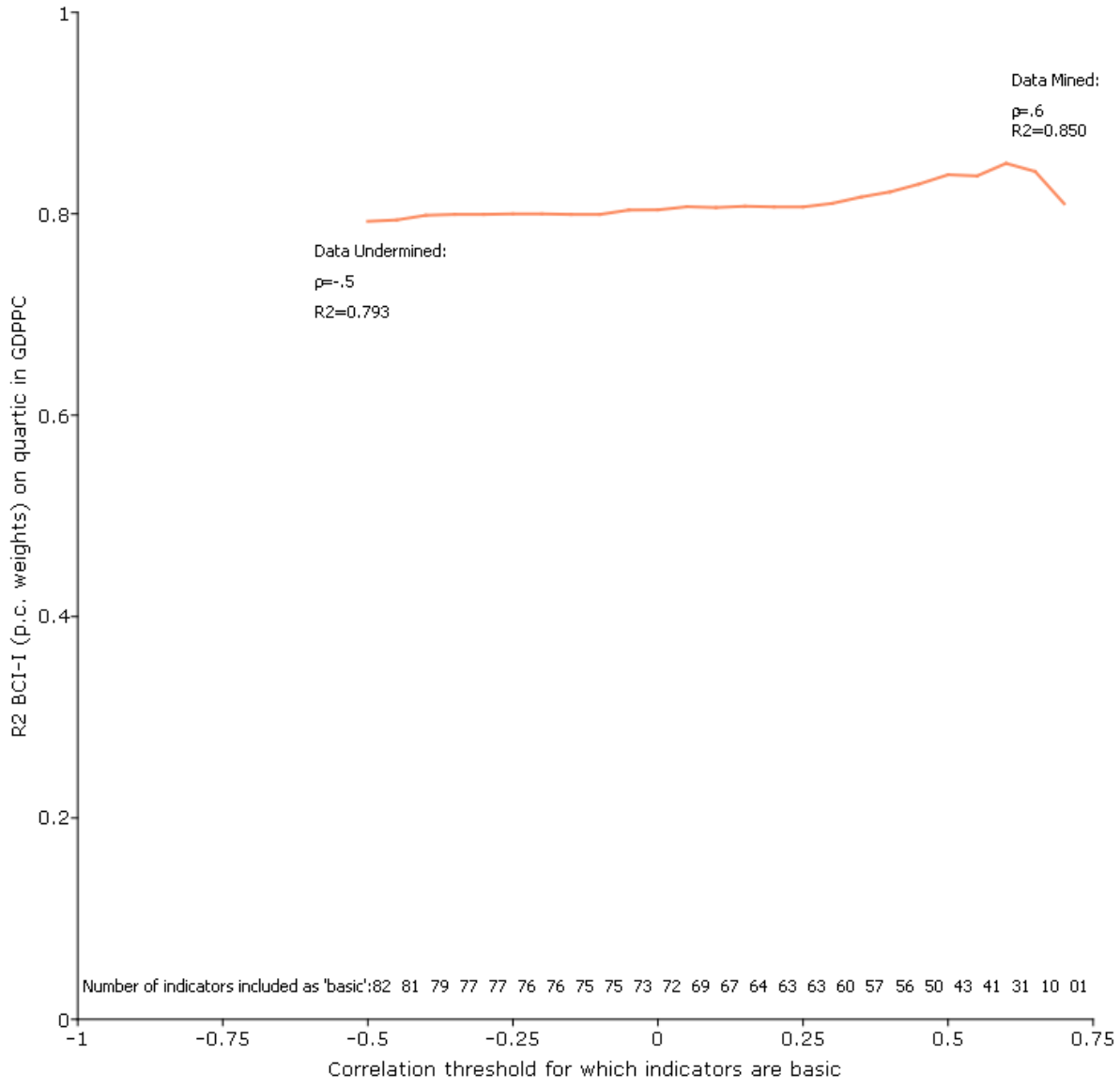
These results for these two correlational indexes of basics are presented as a "baseline" of non-data-mined results from just one plausible analytic, non-circular, process for creating a measure of basics.

The main point of this paper is that there is no amount of (plausible) "data *under*mining" that changes these four basic factual findings about the relationship of basics and GDPPC. "Data mining" is a directed search over the many, many, degrees of freedom in any empirical research to find the strongest result for what the point the authors are making. Data *undermining* (or, more commonly, robustness analysis) is the opposite, a search across the various ways of defining basics, measuring basics with indicators, and weighting those indicators into a general index to see if *any* plausible procedure fails to produce the same four facts about the relationship with GDPPC[9].

Figure 2 illustrates the data undermining versus data mining approach for the BCI-LI by iterating over all possible choices of the correlation threshold that defines which LPI indicators are to be included as "basics" which is the only free parameter of the method. Even if one takes at the threshold the smallest possible correlation threshold (-.5) and hence includes all 82 indicators as 'basic' *and* uses equal weights for those indicators--the R2 is still .79, not very much different from the highest possible R2 of .85 when the correlation threshold is .6 and 31 indicators are included. A finding is robust if the data undermined results are similar to the data mined (best) or typical result.

[9] This paper has been heavily influenced by Leamer's classic "Taking the con out of econometrics" (Leamer 1983) and his more general work on specification searches (Leamer 1978) and how they invalidate the use of standard statistics.

Figure 2: Data mining and data undermining with the correlation threshold for BCI-I



IV) A collection of anchored indexes of the basics of material wellbeing

Across the wide array of dimensions of human wellbeing--health, education, roads and transport, electricity, nutrition, reproductive health, early childhood development, drinking water, gender, sanitation, indoor air pollution, outdoor air pollution, gender, etc.--one cannot expect easy consensus about what is a "basic", either across or within development domains. The comprehensive agenda of the Sustainable Development Goals includes 169 distinct targets. A second method for building an index of basics is to avoid any attempt to create a consensus as a starting point and instead start from any single indicator that any group argues is "basic" to material wellbeing and use that indicator as an "anchor." An N-indicator anchored basics index then adds N-1 other indicators to the anchor by choosing the N-1 indicators most highly correlated with the anchor.

The steps for the construction an anchored indexes of basics:

(i) Choose any single indicator likely to generate significant agreement as a "basic" of human material wellbeing (e.g. under 5 mortality, access to safe drinking water, primary schooling completion, child malnutrition (stunting), indoor air pollution, head count poverty rate (and one emphasize gender by choosing any of these indicators for just females)).
(ii) Compute the correlation of that anchor indicator with all other potential indicators of wellbeing.
(iii) Choose the N-1 mostly highly correlated indicators with the "anchor" indicator.
(iv) Use principal components to create the weights for an N-indicator anchored index of basics.

The two free parameters of this method are the anchor and the total number of indicators. For a "base case" we chose N=10 indicators. Ten is somewhat arbitrary but is similar to other existing indicators: the multidimensional poverty index (MPI) examined below has 10 elements, the Social Progress Initiative (SPI) Basic Human Needs index has 16 indicators, the BCI-LI index using a threshold correlation of .65 results in 10 indicators (Figure 2). In the next section we argue there are commonly at least seven conceptually distinct major domains of wellbeing that are included in nearly every discussion of basics and 10 indicators allows, in principle, for at least one indicator from each domain.

Table 3 shows the median of the regression results across all 15 anchors (and Appendix Table AR.3 shows the summary results for all 15 anchors that we explore) and these results are very similar to the BCI-LI(.65) results.

Our primary use of the anchor indexes is data *under*mining to explore robustness. Table 3 shows the results for the anchor with the *weakest* R2 of any of the 15 anchors, which happened to be the contraceptive prevalence rate. Many consider the contraceptive prevalence rate to be a basic as a key to reproductive health and also an important indicator of women's freedom to make choices and empowerment. Even for the weakest anchor all four facts are true. The R2 was .703 so the association is strong. The elasticity falls from .43 at quintile II to .13 at quintile IV and so the relationship is strongly non-linear. On the 1 to 100 scale the highest at mean of Quintile I is 47.9 and the lowest at mean of quintile IV is 68.8 and so GDPPC is empirically necessary and (weakly) sufficient.

Even if we search over other free parameters of anchored indexes, say, reduce the number of indicators to a total of 6 (the anchor and five others) the *smallest* R2 of any of the 15 anchors falls only from .703 to .676. Conversely, if we increase the number of included indicators included the R2 of the weakest increases (and the variance across anchors decreases), which is intuitive, as eventually the anchor becomes irrelevant and the R2 reaches the R2 of including all 82 indicators.

V) Indexes of basics with randomly chosen indicators and weights

A third way to demonstrate that *any* general plausible index of basics will have (roughly) the same relationship with GDPPC is to start from seven domains of basics included in nearly everyone's proposed of list basics: (i) health, (ii) education, (iii) nutrition, (iv) water and sanitation, (v) housing conditions, (vi) income/consumption headcount poverty and (vii) natural environment. In each of those seven domains we choose from the LPI indicators those that are plausibly "basic" (e.g. within "health" we do not include "obesity" and within "education" we do not include "average quality of higher education").

Table 4: Seven domains of basics of human material wellbeing	
Domain (number of LPI indicators)	Eligible indicators from LPI
Health (7)	Healthcare coverage, Births attended by skilled health staff, Maternal mortality, Under 5 mortality, 5-14 mortality, 15-60 mortality, Life expectancy at 60
Education (10)	Pre-primary enrolment (net), Primary enrolment, Primary completion, Secondary school enrolment, Lower-secondary completion, Access to quality education, Adult literacy, Education level of adult population, Women's average years in school, Education inequality
Nutrition (4)	Availability of adequate food, Prevalence of undernourishment, Prevalence of wasting in children under-5. Prevalence of stunting in children under-5
Water and Sanitation (4)	Access to basic water services, Access to piped water, Access to basic sanitation services, Unsafe water, sanitation or hygiene
Housing (4)	Availability of adequate shelter, Housing deprivation, Access to clean fuels and technologies for cooking, Indoor air quality
Poverty (3)	Headcount poverty rate at extreme, low, and medium poverty lines (P$1.9/day, P$3.2/day, P$5.5/day).
Natural Environment (4)	Exposure to particulate matter, Health impact of air pollution, SO_2 emissions, NO_x emissions.

We create an instance of a "seven domain index of basics" by randomly choosing one indicator from each of the seven domains. For any set of indicators there are two choices for weights. One us just to use average weights. The other chooses the weight for each of the seven indicators as a draw from a random uniform distribution, but in order that the weights be "plausible" no single indicator can have a weight higher than 3/7 (.428) of the total.

Our data undermining exercise asks first: "Across 100,000 iterations of choosing indicators from seven domains building an equal weights index of the basics, how bad could it be?" Table 3 shows: "not so bad." The R2 would be .625. The elasticities in quintiles I, II and III are still substantial (.165, .290, .262) and non-linear (the elasticity falls to only .019 for Quintile IV), and the predicted value of basics rises from 50.1 to 91.3 between quintile I and quintile IV.

Our data undermining exercise then asks: "Across 100,000 iterations of both random indicators and also random weights for those indicators across, how bad can it be?" By putting large weight on some indicators the results can be weakened. The worst case drives the R2 to

only .327, while still rejects zero association with GDPPC at astronomically small p-levels, on the order of 10^{-13}. The elasticities are still non-linear (rising to .15, declining to .05) and countries are predicted to gain from 45.7 to 62.9.

This is a true "torture test" of robustness as, to our view the indicators and weights that produce are wildly implausible as normative evaluations: to adopt these as weights for a normative index of basics of material wellbeing one would have to believe that exposure to particulate matter was 40 times more important to an index of basics than adult mortality (.353/.009), 29 times more important than extreme poverty (.353/.012) and 7.5 times more important than adult education levels (.353/.047). We believe that nearly everyone would agree that putting over a third of the weight in a seven domain index of basics on just exposure to particulate matter is implausible but we the point of the exercise is to show just how implausible one has to be—and this still generates a quite strong relationship in the *worst* case.

VI) Other indicators of basics

In addition to the results of our three methods for creating a general multi-dimensional index of basics (correlational, anchored, and random) we compare three widely used indicators: Basic Human Needs from the Social Progress Initiative, the Multidimensional Poverty Index from OPHI, and income/consumption poverty.

VI.A) Basic Human Needs from Social Progress Initiative

As part of the general push back against economic growth there are a number of groups proposing alternatives to GDP as a measure of economic activity or, for that matter, any economic or "money metric" measures. One such group proposing non-money metric indicators as the normative goals of development is the Social Progress Imperative, whose mission statement is:

> *We dream of a world in which people come first. A world where families are safe, healthy and free. Economic development is important, but strong economies alone do not guarantee strong societies. If people lack the most basic human necessities, the building blocks to improve their quality of life, a healthy environment and the opportunity to reach their full potential, a society is failing no matter what the economic numbers say. The Social Progress Index is a new way to define the success of our societies. It is a comprehensive measure of real quality of life, independent of economic indicators.*

One of the three components of their Social Progress Index is called Basic Human Needs. Basic Human Needs is an equally weighted average of four sub-indices for Nutrition and Basic Medical Care, Water and Sanitation, Shelter, and Personal Safety and each of those is, in turn, based on indicators either in physical units (e.g. maternal mortality rate) or (rarely) subjective indicators like "perceived criminality" (Table 5).

Table 5: The sub-components and indicators in the Social Progress Imperative's Basic Human Needs index	
Sub-component (and number of indicators)	Indicators in each sub-component
Nutrition and Basic Medical Care (NB): 5	Undernourishment (% of pop.), Deaths from infectious diseases (deaths/100,000), Child stunting (% of children), Maternal mortality rate (deaths/100,000 live births), Child mortality rate (deaths/1,000 live births)
Water and Sanitation (WS): 4	Unsafe water, sanitation and hygiene attributable deaths (per 100,000 pop'l), Populations using unsafe or unimproved water sources (%), Populations using unsafe or unimproved sanitation (%)
Shelter (HS): 3	Usage of clean fuels and technology for cooking (% of pop.), Access to electricity (% of pop.), Household air pollution attributable deaths (deaths/100,000)
Personal Safety (SF): 4	Traffic deaths (deaths/100,000), Political killings and torture (0=low freedom; 1=high freedom), Perceived criminality (1=low; 5=high), Homicide rate (deaths/100,000)
Source: *Social Progress Imperative*.	

Table 3 shows the results of regressing an index of Basic Human Needs constructed by an organization whose stated goal is to de-emphasize economic indicators. The relationship of SPI Basic Human Needs with GDPPC is strong, non-linear, necessary and sufficient. The R2 is .833 (with 153 countries) which in the range for the BCI-LE(.60) of .811 and BCI-LI(.65) of .850. The elasticities wrt GDPPC have the same non-linear pattern of increasing, reaching a peak at Quintile II at .424 then falling for a low elasticity of .051 by Quintile IV. The highest of any country at or below the mean of Quintile I (P$2,050) is 40.6 and the *lowest* of any country at or below the mean of Quintile IV is 79.1 so growth in GDPPC over the range of developing countries is empirically necessary and sufficient for SPI Basic Human Needs.

VI.B) Income/consumption poverty and GDPPC

While "development" (in some sense) has always been about the reduction of "poverty" (in some sense) the World Bank's World Development Report of 1990 on poverty brought to wide use the Foster, Greer, Thorbecke (FGT) 1984 class of poverty measures[10]. Primarily for advocacy purposes the WDR 1990 emphasized a very low poverty line for measurement of global poverty, the famous "dollar a day" poverty line, based on the poverty lines chosen by the poorest countries in the world (Ravallion, Datt, and van de Walle 1991). While there are a variety of ways of choosing national poverty lines, some of which are based on the idea a

[10] A person or household is said to be in poverty if their income or consumption is below a threshold called the poverty line. Formulated with a continuous distribution of income/consumption, f(y), the FGT poverty measures are the weighted partial integrals of the distribution of income/consumption up to a poverty line.

$$(FGT)\ Poverty(\alpha) = \int_{-\infty}^{PL} (PL - y)^{\alpha} f(y) dy$$

When α=0 this produces the headcount, α=1 is the poverty gap measure, and α=2 is the squared gap measure. Although the original FGT 1984 paper emphasized the squared gap measure, in practice the headcount ratio is far and away the most widely used measure of poverty.

household should be able to afford a nutritionally adequate diet[11], fundamentally all poverty lines, national or global, are a social convention about a threshold of wellbeing. We use the data on headcount poverty ratios produced by the World Bank's PovCalNet[12] for the P$5.5/day poverty line, as a compromise between the advocates for "low bar" ("extreme") and "high bar" poverty lines (Pritchett 2006), but all of our reported empirical results are robust to using any of the commonly used poverty lines.

Table 3 shows the R2 of poverty on a quartic in GDPPC is .863 which is higher than any of the other basics indexes. The elasticity of poverty reduction wrt GDPPC is massively non-linear falling from 1.33 for Quintile I to .11 in Quintile IV[13]. The *best* poverty rate (on the 1 to 100 'out of poverty' scale) is 13.9 at the median of Quintile I and the *worst* poverty rate is 87.8 at the mean of Quintile IV so higher GDPPC is an empirically necessary and sufficient condition for improvements in poverty. This section can be very brief as the empirically very tight connection between cross-national levels (or long-term changes) in poverty and economic growth, including GDP per capita is widely known and accepted (Dollar and Kraay 2002, Adams 2003, Dollar, Kleineberg, Kraay 2016, Pritchett 2020, McKenzie 2020) and well understood analytically (Bergstrom 2022).

VI.C) Multidimensional poverty index

The Multidimensional Poverty Index combines the features of a poverty measure (with deprivation thresholds) and non-money metric measures using physical outcome measures, like health, schooling, access to water and sanitation, housing conditions, etc. Perhaps the most widely used and cited multidimensional poverty measure is that developed, implemented, refined and maintained by Sabine Alkire (Alkire and Foster 2011, Alkire, Alkire, Kanagaratnam, Suppa 2021) and the Oxford Poverty and Human Development Initiative. Table 6 (which is Table 1 from Alkire, Kanagaratnam and Suppa 2021) presents the indicators, thresholds for deprivation, and weights (along with the corresponding element of the Sustainable Development Goals (SDG) for the current versions of the multidimensional poverty index. We use the Multidimensional Poverty Index which combines the headcount measure and the intensity of deprivation measure. We rescale and invert the raw data so that it measures fraction of the population *not* in poverty, with 1 being the worst country and 100 the best.

The main drawback of this indicator is that it relies on collections of household survey data that are carried out only in developing countries, such as the Demographic and Health Survey (DHS), so the upper range of GDPPC is missing entirely. The highest GDPPC in the MPI sample is Trinidad and Tobago with GDPPC of P$35,800 (about the 80th percentile).

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[11] Even poverty lines which are based on being able to afford food consumption that produces adequate calories has to decide what basket of foods at which caloric adequacy is reached and, since the "cost per calorie" tends to increase sharply with income as people choose higher quality foods (e.g. more meats, eggs, diary) the poverty line depends heavily in the "reference group" consumption that establishes the food basket (e.g. Pradhan, Suryahadi, Sumarto and Pritchett 2001), which is obviously itself a social convention.

[12] PovcalNet: the on-line tool for poverty measurement developed by the Development Research Group of the World Bank.

[13] This empirical result for the pattern of elasticities is kind of baked into the definition of FGT poverty as, once the poverty line is below the mode of the distribution the slope with respect to a distribution neutral shift in f(y) necessarily falls.

Table 6. MPI (Multi-dimensional poverty index): Dimensions, Indicators, Deprivation Cutoffs, and Weights

Dimensions of poverty	Indicator	Deprived if...	SDG area	Weight
Health	Nutrition	Any person under 70 years of age for whom there is nutritional information is **undernourished**.	SDG 2	1/6
	Child mortality	A child **under 18** has **died** in the household in the five-year period preceding the survey.	SDG 3	1/6
Education	Years of schooling	**No** eligible household member has completed **six years** of **schooling**.	SDG 4	1/6
	School attendance	Any school-aged child is **not attending** school **up to** the age at which he/she would complete **class 8**.	SDG 4	1/6
Living Standards	Cooking fuel	A household cooks using **solid fuel**, such as dung, agricultural crop, shrubs, wood, charcoal, or coal.	SDG 7	1/18
	Sanitation	The household has **unimproved** or **no** sanitation **facility** or it is improved but **shared** with other households.	SDG 6	1/18
	Drinking water	The household's source of **drinking water** is **not safe** or safe drinking water is a **30-minute** or **longer walk** from home, roundtrip.	SDG 6	1/18
	Electricity	The household has **no electricity**.	SDG 7	1/18
	Housing	The household has **inadequate** housing materials in **any** of the three components: **floor**, **roof**, or **walls**.	SDG 11	1/18
	Assets	The household does **not own more than one** of these **assets**: radio, TV, telephone, computer, animal cart, bicycle, motorbike, or refrigerator, and does not own a car or truck.	SDG 1	1/18

Source: Table 1 of Alkire, S., Kanagaratnam, U. and Suppa, N. (2020). 'The Global Multidimensional Poverty Index (MPI) 2020', OPHI MPI Methodological Notes 49, Oxford Poverty and Human Development Initiative, University of Oxford.

The results in Table 3 show the MPI has a strong, non-linear, necessary and sufficient relationship with GDPPC. The RQ is "only" .723, but that is to be expected from excluding the high-income countries and the p-level of the F-statistic for excluding GDPPC is on the order of 10^{-27}. As with income/consumption poverty, as a "deprivation" index the elasticity is higher at lower levels of income and falls faster—reaching essentially zero by Quintile III since by GDPPC of about P$20,000 the MPI has reached its maximum with (nearly) everyone of out multi-dimensional poverty. Growth is clearly sufficient. Again, given that the MPI has such a steep relationship wrt to GDPPC at low levels even at the mean of Quintile I the predicted score is 50--and the highest is 70.8--but nevertheless growth is still necessary to reach high levels of population out of MPI.

Conclusions and Caveats

Back to Robert Lucas. For poor countries he was exactly right. The welfare consequences of increased GDPPC, measured here not as improvements income but as improvements in non-money metric indexes of the basics of material wellbeing, are indeed so large it makes it hard to think about anything else. Famously, Ghana and South Korea had similar GDPPC in 1960 but their different growth rates over the last (nearly) 60 years has produced GDPPC near P$41,000 in Korea and Korea's basics index (BCI-LI) is 99.7. In contrast, Ghana, while it does relative well conditional on GDPPC of only P$5,300, has a basics index of 46, more than 50 points behind Korea. This implies Ghanaians enjoy less of nearly every important element of material wellbeing than Koreans.

This paper is about facts, not counterfactuals, and uses simple statistical procedures to establish those facts (and while most of the attention is to the OLS results we remind the reader that the graphs show that more non-parametric and robust statistical approaches produce nearly identical results). We make no claim our results are structural parameters or causal or support this or that theory. However, facts are facts and the existence of a strongly robust association between GDPPC and the basics of human wellbeing is a fact that should not just be ignored—but often is with completely unfounded claims that "growth is not enough." Of course slow growth or growth over a short time brings only limited benefits and may not be "enough" relative to some objective for progress, that is a definitional banality not an interesting claim, but growth is empirically sufficient—growth is enough—and necessary—only growth is enough--for high levels of the basics of human wellbeing.

We conclude the conclusion with five clarifications/caveats of important issues, four substantive, one technical, we do not address here.

First, this is precisely *not* about a normative preference for "income" over other measures of wellbeing, or a "utility" approach over a "capabilities" approach, or a "deprivation" approach versus "average" approach. Given that no matter how one chooses indicators of basics and weights the association of country basics of human wellbeing with GDPPC is very robust and so, for this purpose in any case these debates are not central.

Second, we just examine the association of basics and GDPPC and do not adjust for inequality or whether the path of economic growth by which the level of GDPPC was achieved was "inclusive growth" or not. This is not an oversight but a deliberate decision to focus on just the level of GDPPC and nothing else. We are engaged in research to examine how much the "inclusiveness" of the growth process matters to the impact of growth on wellbeing indicators and the preliminary indications, consistent with the results here, are that for the poorer countries the association of growth is quite similar over a range of patterns of growth incidence. Moreover, these simple strong associations with levels are inconsistent with strong claims like that economic growth brings benefits "only if" that growth is inclusive. That said, in the graphs there is an outlier, Equatorial Guinea (GNQ) which is the obvious exception that proves the rule and shows that one can have (relatively) high levels of GDPPC driven by mineral (oil) exports that is sufficiently "exclusive" that it does not lead to gains in basics.

Third, we make no naïve generalizations about the "policy" implications of these results, in two important regards. One, just because GDPPC and basics have a strong association does not mean that any policy that raises GDPPC is welfare beneficial, much less "optimal" (again, Equatorial Guinea as a case in point). We are not making some silly claim like "it is worth doing anything to promote growth" but rather "analysis of which actions to take in which circumstances that would effectively (or efficiently) promote higher levels of economic output are complex and granular—and important for wellbeing." Two, we are not arguing that there are not, at any given level of GDPPC specific interventions that are not cost-effective in improving wellbeing, either by redistributing purchasing power or by selectively raising the productivity of the poor or by lowering the cost of achieving the basics through effective collective or public sector provision or production. But neither should the argument that there are actions that raise wellbeing conditional on GDPPC nor that some actions which would raise GDPPC would not raise wellbeing should lead economists or development actors to ignore that, in general, economic growth in developing countries has a very strong association with improvements in all measures of the basics of human material wellbeing.

Fourth, we also have made no explicit reference to the other favorite adjective for growth, "sustainable." Three brief points here. One, in our analysis we never decided not to include indicators about the condition of the natural environment and its impact on human wellbeing but rather chose processes for defining basics from which the particular indicators included as basics emerged endogenously. We did not "ignore" or "exclude" environmental indicators. Two, if the level of GDPPC is "unsustainable" in the sense that it cannot be sustained and falls in the future on the current (expected) path then the dynamics of GDPPC and basics would get complicated. But nothing we say should be or could be, we hope, interpreted as encouraging countries pursue "unsustainable" paths of GDPPC. Third, the discussion of climate change and the sustainability of GDPPC due to the impacts of climate change is very complicated because for most poor countries there is an almost complete disconnect between the "sustainability" of their particular emissions of greenhouse gases and the impact on their economy of climate change. Precisely because the externality is global what the Maldives does as an emitter of GHG has nothing to do with its "sustainability" due to ocean levels rising as that is determined by total global emissions, of which they are an inconsequentially small part.

Fifth, we often encounter quite misguided objections to the use of associations of levels versus changes or growth rates. Four short points. One, while our focus is mainly on recent data from developing countries, there are similar studies of historical data making the connection between multi-dimensional physical measures of living standards and economic growth (e.g. Gallardo-Albarran and de Jong 2020 on England 1750-1850, Prados de la Escosura 2021 globally since 1870). Two, we are fundamentally limited by long-period data availability of the raw data from Legatum Prosperity Index and the Social Progress Index (which cover less than two decades). Three, the debate between whether level on level or changes on changes best reveals the long-run dynamics of an association is complex and there is no general presumption that changes on changes with short periods will be more accurate or reliable or precise about long run relationships (and there are many pitfalls to the use of short period data that authors fall into leading them to a misleading finding of "no association"). Four, even if one did produce results on short period changes the level on level associations are still a hard fact to be encompassed into our understanding.

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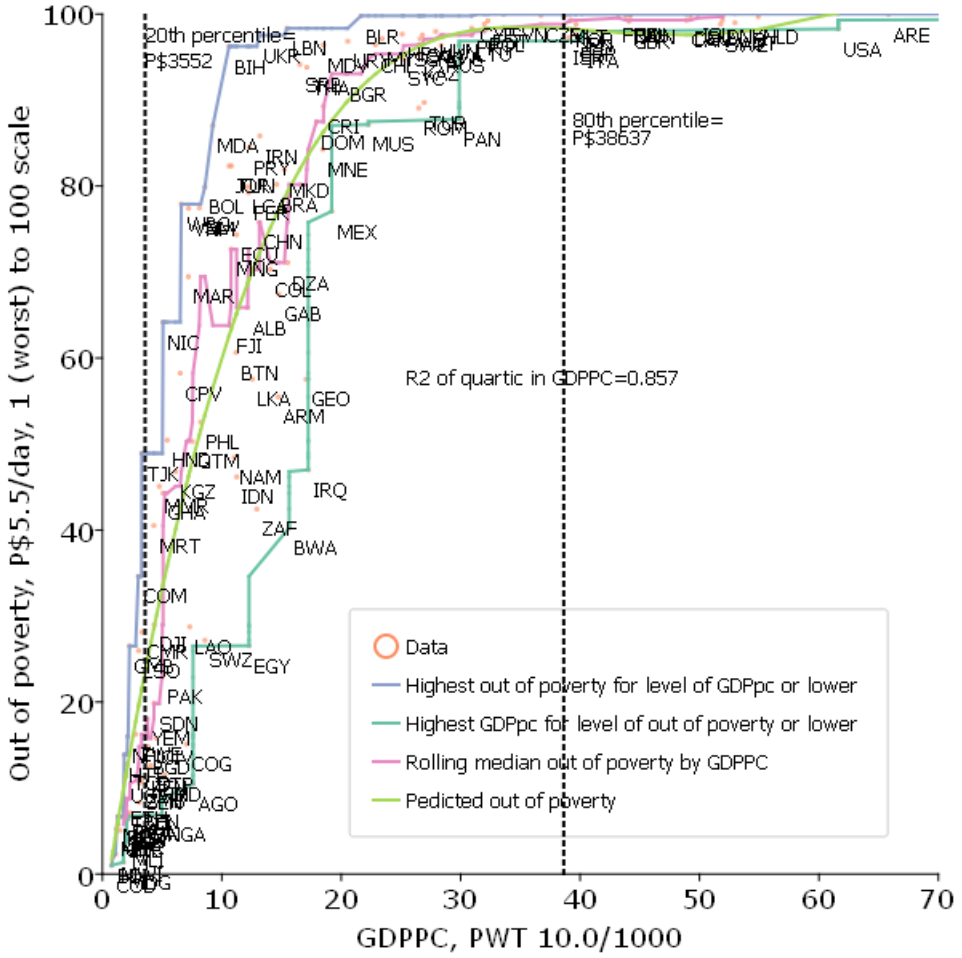
Appendix Table R1: Summary of regression results for Basics Correlational Indexes (Elements and Indicators), Social Progress Initiative Basic Human Needs, World Bank out of headcount poverty (P$5.5/day), Multidimensional Poverty Index (OPHI)						
		Basics Correlation Index-Legatum Elements (.6)	Basics Index-Legatum Indicators (.65)	Basic Human Needs (SPI)	Out of income poverty, P$5.5	Multidimensional poverty index
Constant	Est.	21.79	11.57	26.08	4.4	18.7
	Std. err.	2.34	2.38	2.23	4.58	5.47
GDPPC	Est.	5.090	6.773	6.276	8.67	18.24
	Std. err.	0.430	0.438	0.474	0.704	2.573
GDPPC^2	Est.	-0.138	-0.195	-0.219	-0.281	-1.523
	Std. err.	0.020	0.020	0.027	0.040	0.330
GDPPC^3	Est.	0.00162	0.00231	0.00321	0.00379	0.05313
	Std. err.	0.00032	0.00033	0.00052	0.00079	0.01530
GDPPC^4	Est.	-6.65E-06	-9.44E-06	-1.62E-05	-1.80E-05	-6.45E-04
	Std. err.	1.60E-06	1.63E-06	3.16E-06	4.86E-06	2.27E-04
Number of countries		167	167	153	143	100
R-Squared		0.811	0.850	0.833	0.865	0.725
F-test of YPC and powers		173.9	229.6	184.1	206.0	62.7
p-level of F-test		2.95E-58	1.57E-66	3.37E-57	4.73E-58	2.70E-26

Appendix Table R2: Summary of results for all "anchored" basic indexes										
Measure of country basics of material wellbeing	N	R2 of quartic (sorted)	Non-linear: Elasticity of index wrt GDPPC at				Empirically necessary		Empirically sufficient	
			$\mu_{QI`}$	μ_{QII}	μ_{QIII}	μ_{QIV}	Pred at μ_{QI}	Max at μ_{QI}	Pred at μ_{QIV}	Minimum at μ_{QIV}
Anchored Basics Indexes (anchor plus 9 most highly correlated other indicators, PC weights)										
Nutrition, stunting (LCNUTPST)	167	0.862	0.827	0.768	0.574	0.158	17.1	27.8	94.8	81.0
Health care coverage (HLHCSHCV)	167	0.859	0.675	0.704	0.540	0.139	20.6	32.5	96.4	77.9
Own refrigerator (LCMRERFG)	167	0.851	0.624	0.675	0.516	0.107	23.1	28.5	99.4	86.1
Rural roads (LCCTDRAR)	167	0.849	0.473	0.597	0.492	0.149	25.7	33.3	93.5	79.6
Clear fuels for cooking (LCSHRCFC)	167	0.840	0.661	0.690	0.517	0.090	22.6	24.7	100.1	85.8
Headcount poverty, P$5.5/day (LCMREPRM)	167	0.838	0.689	0.707	0.534	0.120	20.8	30.7	97.1	80.3
Women's years of schooling (EDASKWYR)	167	0.831	0.549	0.641	0.511	0.141	23.4	31.0	94.0	79.0
Access to piped water (LCBSCABW)	167	0.821	0.424	0.550	0.437	0.056	32.2	36.1	101.6	87.6
Access to electricity (LCBSCELA)	167	0.815	0.468	0.579	0.452	0.054	30.2	33.2	101.5	86.7
Access to Sanitation (LCBSCABS)	167	0.815	0.468	0.579	0.452	0.054	30.2	33.2	101.5	86.7
Indoor Air Quality (LCSHRIAQ)	167	0.801	0.399	0.529	0.422	0.042	34.2	38.9	102.6	90.2
Births attended by Skilled health Staff (HLHCSBRA)	167	0.765	0.265	0.413	0.359	0.058	42.5	57.6	100.4	90.5
Under-5 mortality (HLLEXUFM)	167	0.758	0.280	0.425	0.357	0.030	42.6	53.4	101.8	89.4
Primary Completion Rate (EDPRIPRC)	167	0.756	0.295	0.440	0.367	0.033	40.5	49.6	100.1	85.9
Contraceptive Prevalence (HLHPICPV)	167	0.703	0.272	0.429	0.388	0.126	35.1	47.9	88.1	68.8
Median	167	0.821	0.468	0.579	0.452	0.090	30.2	33.2	100.1	85.9
Source: Authors' calculations.										

Figure GA.1: Population out of income/consumption poverty and GDP per capita

Panel A: All countries with GDPPC<P$70,000



Panel B: Countries with GDPPC<P$40,000

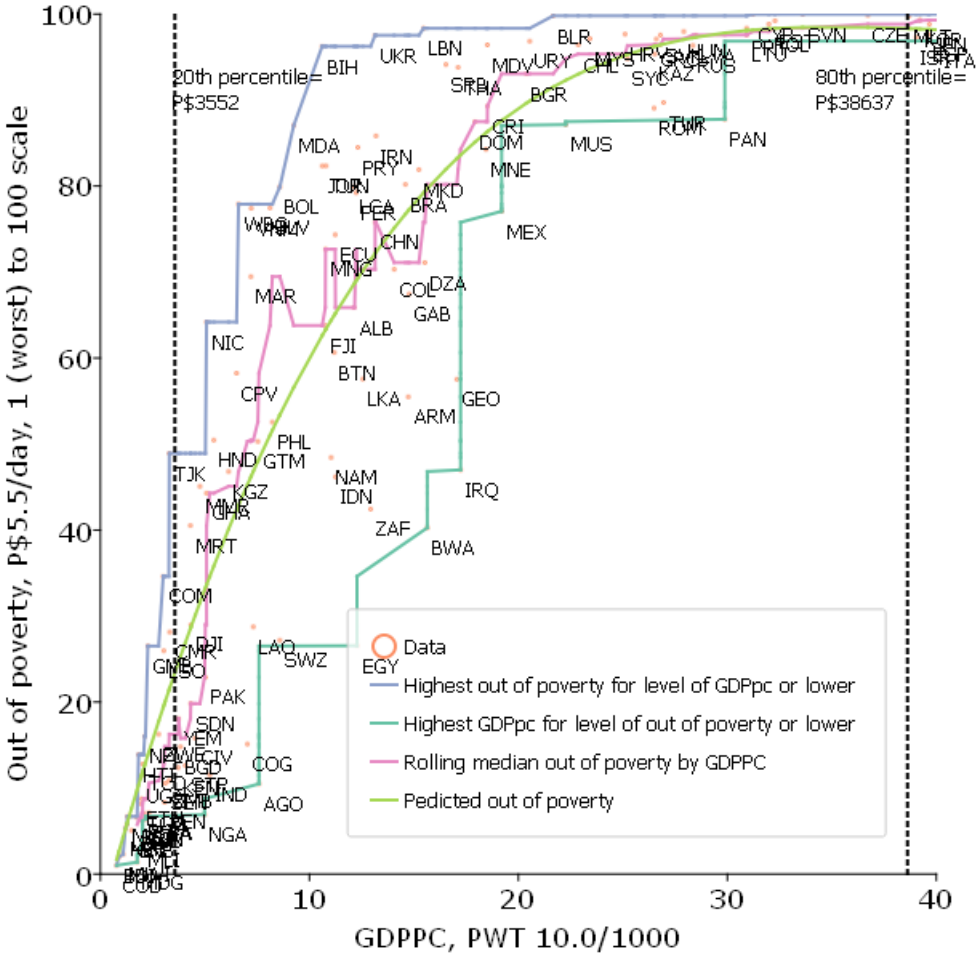
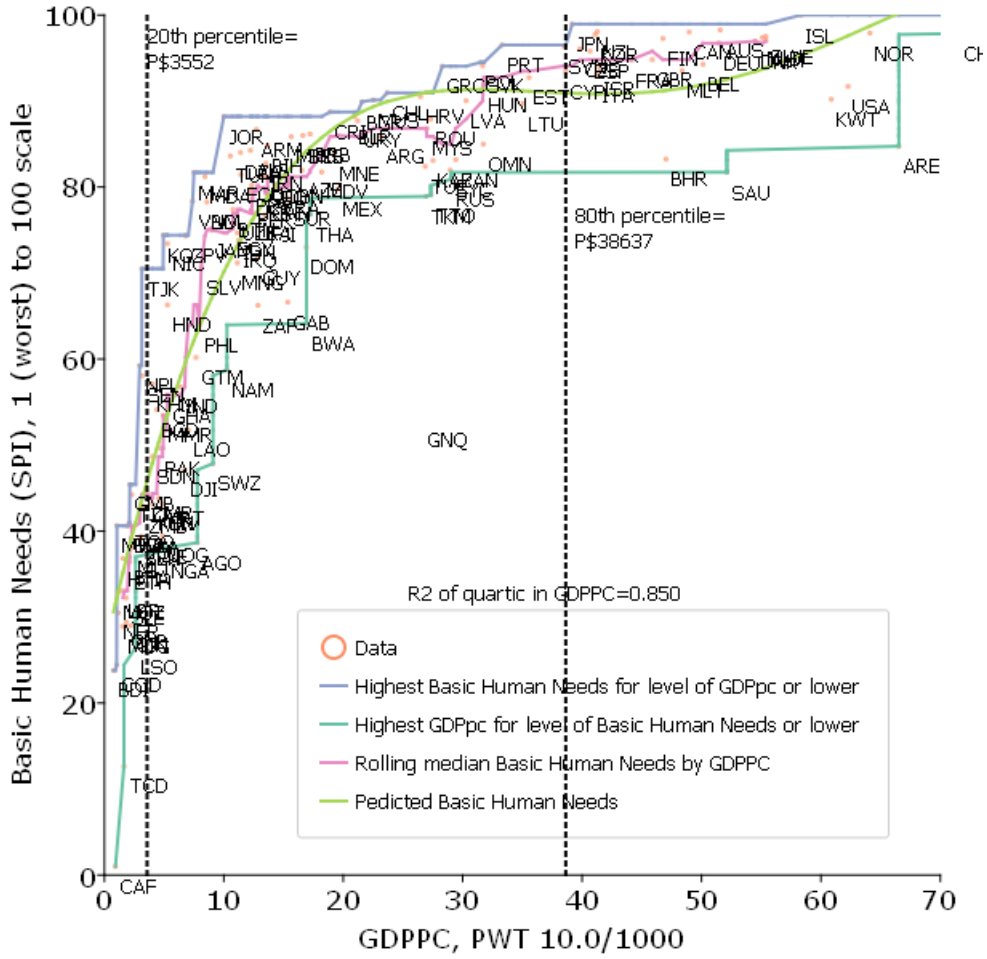


Figure GA.2: Basic Human Needs (from Social Progress Imperative) and GDP per capita



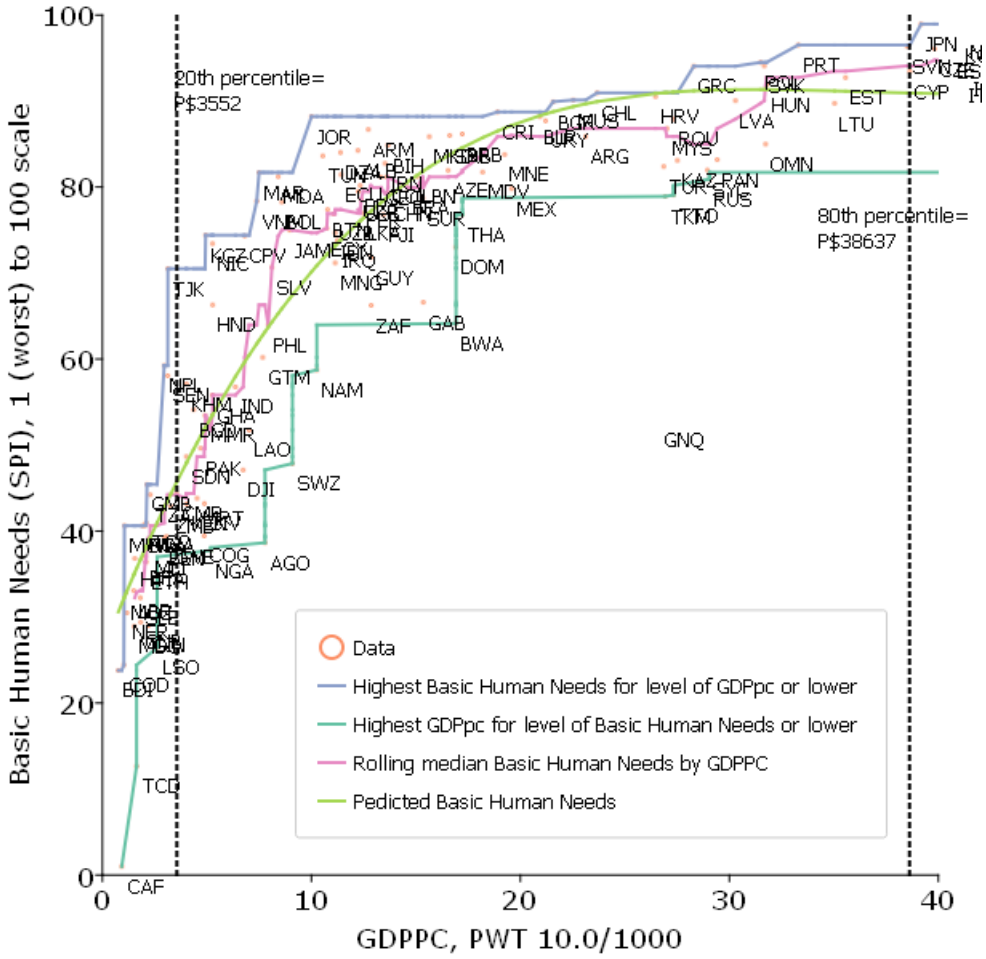


Figure GA.3: (Out of) Multidimensional Poverty Index (headcount and intensity), rescaled to 1 (worst) to 100 (best) scale and GDP per capita