BACKGROUND PAPER

Quantifying and Comparing Wellness Across Nations: a Cross Country Empirical Analysis

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DISCLAIMER

QUANTIFYING AND COMPARING WELLNESS ACROSS NATIONS: A CROSS COUNTRY EMPIRICAL ANALYSIS[1]

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Abstract

The lack of a measure of national wellbeing, and the use of gross domestic product (or gross domestic product per capita) as a proxy, has been a cause of concern since the latter's inception. Recently, there has been a renewed effort to understand the weaknesses of growth-led policy and there has been a call for better and more holistic measures of a nation's ability to provide for its citizens; measures that capture the wellbeing of citizens and not just their average level of income. This paper illustrates a new measure of wellness, the Wellness Index which is comprised of four pillars: physical, intellectual, environmental, and social wellness. The Wellness Index is constructed for 153 countries and is used to conduct regional and country level analysis of wellness and its four pillars. The index is used also to highlight areas of policy priority for countries in the region.

JEL Codes

H5, I3

Keywords

wellness, wellbeing, measuring wellbeing, gross domestic product and wellness

[1] The views expressed in this paper are those of the authors alone and do not necessarily reflect the views of the Asian Development Bank (ADB), the ADB Board of Directors, or the countries it represents.

I. INTRODUCTION

In this section, we propose and construct a new index that allows us to measure ordinally a country's ability to cater to the wellness needs of its populace. The Wellness Index presented in this paper uses open data which is mostly readily available to create a cross-country ranking of wellness by extending the Global Wellness Institute's definition of individual wellness to the national level. The index aims to fill an important gap in the literature by providing an estimate of (relative) wellness across countries and serves as an easy-to-use measure of the average level of individual wellness. By updating the Wellness Index over time, policymakers can also use it to benchmark the success of their interventions.

Historically, per capita gross domestic product (GDP) has been used as the de facto measure of a country's success and wellbeing. However, GDP is not a measure of wellness, but rather a simple exercise of national income accounting. Indeed, its own architects warned against its use as a measure of wellbeing (Kuznets 1934). Regardless, over time it came to be a measure of a country's success and a benchmark for policymakers across the world. After the Great Recession, the Stiglitz-Sen-Fitoussi Commission of 2009 highlighted the urgent need to move past growth-focused policy. It laid out not just the shortcomings of GDP as a measure of wellbeing, but also called for policymakers and academics to move towards a more holistic benchmarks of wellbeing and move beyond growth.

A shift towards wellness policy requires measures of wellbeing that can allow policymakers to benchmark their performance. In this section, we propose one such measure; an index that captures the level of wellbeing of the average citizen in a country. We argue that this Wellness Index provides key policy insights and identifies key areas for policy interventions that would allow nations to reap the maximum benefits of their material wealth when used in conjunction with GDP.

In the context of developing Asia, as the region moves towards middle-income status, policymakers have already begun to move beyond growth-focussed policy, with renewed interest in areas of health, education, and individual wellbeing. Therefore, there is a pre-existing need of such an index. The Wellness Index aims to fill this gap in the policy toolbox and is designed to aid

policy makers in identifying areas of strengths and weakness across four dimensions of individual wellness. Further, it is designed not as a replacement to GDP, but rather is intended to be used in conjunction with GDP. As a complement to pre-existing indicators, the index is also in line with the recent recommendations made by the International Monetary Fund that call for new measures or wellbeing to augment those of growth (Reinsdorf 2020).

The Wellness Index takes a bottom-up approach and defines wellness at the individual level that distinguishes it from other aggregate measures of national wellbeing. It uses the Global Wellness Initiative's definition of individual wellness and focuses on four pillars of wellness: physical, intellectual (mental), environmental, and social wellness. Physical wellness captures a nation's ability to cater to the health needs of its populace, while intellectual wellness measures both the quality of and access to education. Social and environmental wellness measure the quality of the social and physical environment. While measures of wellbeing beyond growth have been formulated and put forward, from the Human Development Index (HDI) to the World Happiness Index, none to best of our knowledge model wellness as an individual-level phenomenon aggregated at the country level.

While wellness is not directly observable, we are able to create an ordinal measure of wellness by leveraging the variance in closely related indicators. Cross-country analysis of wellness based on data from the last 5-years allows us to identify areas of strength and weakness for each country in our sample, and allows us to highlight areas that need more targeted policy interventions. We also find a positive correlation between wellness and GDP, though the remarkable variation in wellness between countries at similar levels of economic growth suggests that the relationship is not causal. We argue that policy is needed to link growth to wellness. The results highlight the complementary role of GDP and wellness; the choice between wellness and growth is not either/or, rather policymakers need to give wellness and growth equal footing. Proactive policy is needed to invest the material gains from growth to increase the wellbeing of a country's citizens.

In the sections that follow, we define wellness first and outline the methodology used to create our index. Results from our analysis are discussed, with a special focus on developing Asia and its

performance relative to the rest of the world. Then, the index is compared with pre-existing measures of wellbeing, followed by analysis of the relationship between wellness and growth. Finally, we leverage the Wellness Index to identify areas of policy priorities for countries in the developing Asia region.

II. A NEW INDEX OF WELLNESS

We join a rich literature that seeks to create a comprehensive measure of wellness and the efforts of other multilateral organizations as they aim to better understand and measure the wellbeing of their citizens (for example, Strategy 2030 of the Asian Development Bank [ADB]).[2]

In this section, we detail the Wellness Index's construction and methodology, and present results for the developing Asia region and compare the region's performance with the 153 countries in our sample. Finally, we compare our index to other similar indexes, and highlight both its strengths and weaknesses in relation to pre-existing measures.

A. Building the Index

Our objective is to use available data to build an index that aims to capture the wellbeing of the average citizen in each country. Therefore, we begin our analysis with a well-established definition of individual wellbeing. We utilize the Global Wellness Institute's definition of wellness and focus on the four pillars of wellness they identify; namely, physical, intellectual, environmental, and environmental wellness.

With the push towards more wellness-centric policy, ideally, we would utilize specifically collected micro data, but given current data constraints, we utilize aggregate country level indicators that proxy for individual wellness. When selecting indicators to proxy for wellness, we take an output over input approach. We focus on indicators that reflect the current state of wellness in the country and not policy decisions that may influence future outcomes. For example, we focus on mortality rates as a measure of the physical wellness of citizens in a country, while not using government expenditure on health. While the latter may reflect a

[2] ADB. 2018. *Strategy 2030: Achieving a Prosperous, Inclusive, Resilient, and Sustainable Asia and Pacific*. Manila.

government's policy priority, inefficiencies in implementation may not yield higher levels of wellness, which is what we are interested in measuring.

B. Data Collection Strategy

We utilize available sources of open data to allow easy replication and modifications as needed by policymakers. Therefore, we require, first and foremost, that all indicators used should be easily available to the public. Data used must also be collected in a consistent manner and collated by a single agency.

Availability of data varies across indicators and countries, so we first establish a list of "core countries of interest". The list includes 25 ADB members with a wide variation in size, economic growth, and geography that are known to have good data coverage from previous studies (such as ADB's Inclusive Green Growth Index). These core countries (a list of which is provided in Appendix 1) help guide our data collection and identification strategy.

For an indicator to be selected, it must meet the following requirements for our core countries of interest:

(i) Indicator values must not be older than 2014 (5-year period for data collection).

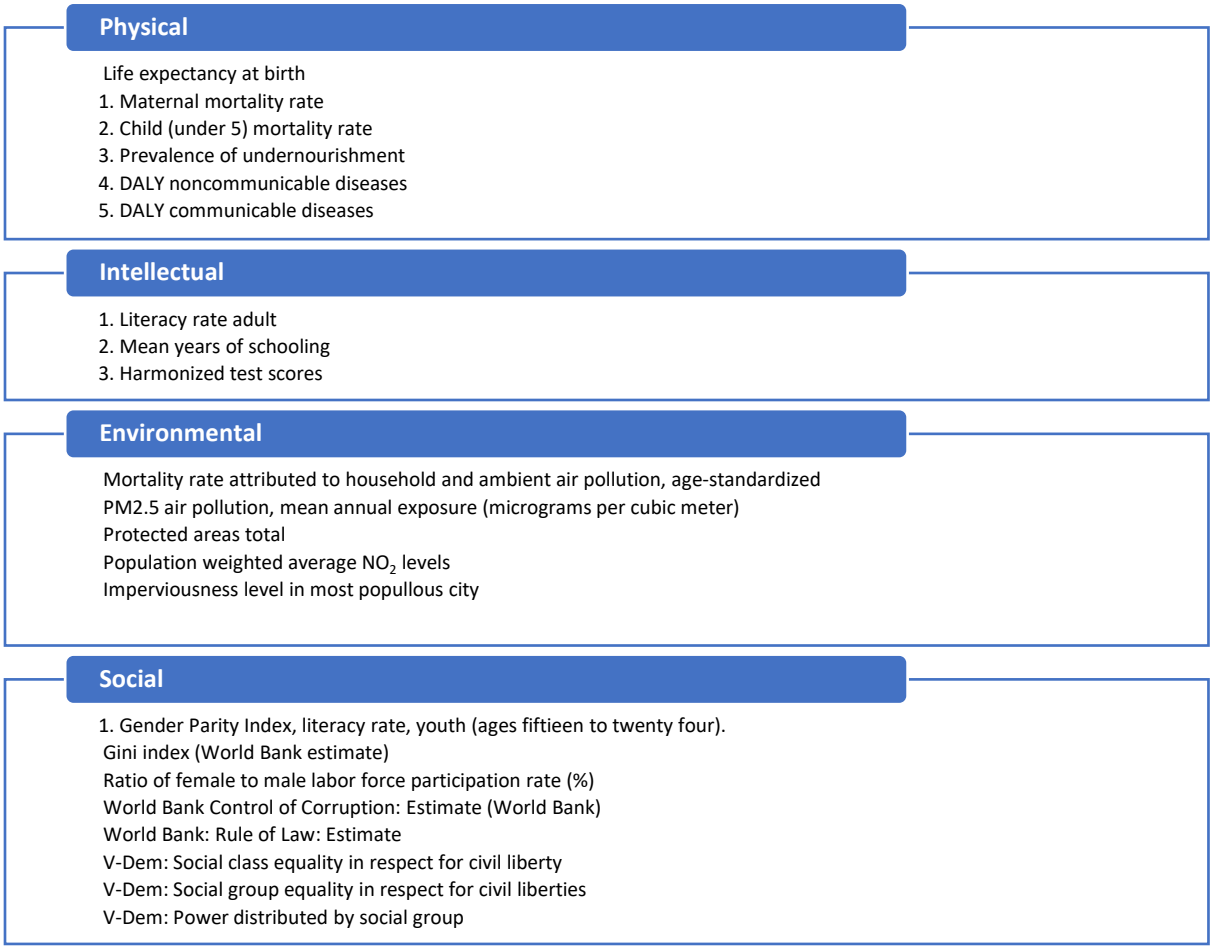
(ii) The latest year for available data is defined as the most recent year (post-2014), where data is available for at least 75% of our core countries of interest.

(iii) Where a country has missing values for the latest year, enough information over past observations must be available to allow time trend imputation.

(iv) For a core country, if a sub-indicator is missing such that time trend imputation is not possible, cross indicator imputation is allowed if no more than 25% of indicators are missing in a pillar.

Following our strategy, we identify 22 unique indicators across our four pillars of wellness (Figure 1) for a total of 153 countries.

Figure 1: List of Indicators by Pillar



DALY = disability-adjusted life year, NO_2 = nitrogen dioxide.
Note: PM2.5 refers to atmospheric particulate matter that has a diameter of less than 2.5 micrometers.
Source: Authors.

Indicators were selected for physical wellness proxy for physical wellbeing of individuals by using data on health outcomes, in particular indicators for mortality rates, undernourishment, and disease burden. Intellectual wellness utilizes objective measures of both the level of educational attainment and the quality of education.

Indicators used to measure environmental wellness underline our focus on individual wellness and distinguish the Wellness Index from other measures of environmental quality. Unlike most measures, we do not focus on sustainable development, but rather on attributes of the individual's experienced environment. So, we use measures of pollution and proxies for

greenspaces. However, noted that, by not incorporating sustainability, we are not dismissing its importance. We believe that, like growth, sustainability is indeed an important area of policy, but it is essentially beyond the scope of an individual level of individual wellness. Of course, policymakers should prioritize sustainability and employ indicators such as the ADB's Inclusive Green Growth Index (IGGI) to measure it.

Finally, social wellness seeks to measure the level of inclusivity in a society. This is the only pillar where we employ subjective measures (in addition to available objective measures), relying on the World Bank World Governance Indicators (WGI) to measure corruption and rule of law, and the Variety of Democracy Initiative (V-Dem) indicators for equity. Both WGI and V-Dem indicators are widely trusted indicators that are both directly by policymakers, and as inputs in many other indexes (See for example, Fragile State Indicators, and the Social Progress Index). The WGI rely on individual and firm level surveys, while V-Dem uses a panel of country experts to create its indexes.

While, as an exercise in measuring the average wellness of citizens of a country, we began our exercise from the well-established definition of individual wellness, it is interesting to note that the current formulation also lines up well with the recommendations of the Stiglitz-Sen-Fitoussi Commission on Wellness (2009). The Wellness Index while seeking to measure individual wellness independent of material wellness (income, consumption and wealth), covers 5 of the 7 dimensions of nonmaterial well-being identified by the commission.[3]

C. Methodology

While collapsing a complex phenomenon, such as wellness, into a single index has some drawbacks, a single number provides an easy summary statistic of wellness and allows easier digestion by the public at large. This is perhaps one of the reasons for the popularity of GDP as a

[3] The Stiglitz-Sen-Fitoussi Commission identified eight dimensions of wellbeing: (1) material living standards; (2) health; (3) education; (4) personal activities including work; (5) political voice and governance; (6) social connections; (7) environment; and (8) insecurity.

measure of wellness, despite its weaknesses; it takes something as complex and multidimensional as national income accounting and collapses it into one number.

Therefore, to create our index, we must collapse our diverse set of indicators. We utilize principal component analysis (PCA) at the pillar level to create, for each pillar, a pillar score. PCA is a technique that allows us to extract common information from a set of variables. By analysing the correlation between variables, it identifies the orthogonal linear combinations that best capture the variance between variables (Manly and Alberto 2016).[4] This weighted average (typically called a "PCA values") forms the basis of our score for each pillar.

While primarily a dimensionality reduction tool, PCA can be used to proxy for an unobserved variable using variance in related indicators. It is widely used in the development literature to create wealth or standard of living indexes using data on household assets (first proposed by Filmer and Pritchett 2001). The intuition behind the technique is that it leverages the variance in variables that are correlated to our unknown to produce an ordinal ranking in the unobservable dimension of interest. For example, consider physical wellness. While we are unable to measure physical wellness itself, we do have variables that capture information that may be correlated to physical wellbeing. It is reasonable to assume that those with "high" physical wellness, for example, would have lower incidence of disease. PCA uses such related indicators and finds the linear combination that captures the most variance in the sample across countries. This linear sum allows us to create an ordinal ranking that is correlated to physical wellness; the higher the PCA values, the higher the relative position of a country.

The use of PCA imposes some constraints on what is, otherwise, a subjective exercise. An alternative method of creating the index would be to identify our indicators of interest, and then take averages based on subjectively chosen weights. While the selection of any weighing method, including PCA is subjective, PCA chooses weights in a way to capture the most variance in the data and places more weight on indicators that have higher variance in the sample.

[4] Consider the physical pillar. PCA would generate 6 weights (w_i) corresponding to each sub-indicator (i). Then, for a country, its PCA value in the physical dimension will be calculated by taking a weighted average of all demeaned indicator values (v_i), i.e. $\sum w_i v_i$.

D. Pillar Scores and the Wellness Index

The first step in PCA analysis converts the raw data into z-scores, i.e., for any indicator, it converts it into a variable with mean zero and unit variance across the sample. Principal components then use these normalized values to find the linear combinations that capture the most variance in the underlining data. The core idea being that this linear dimension proxies from our pillar, as countries with high wellness in each pillar should consistently be above the mean in their underlining indicators, while those with low wellness would consistently lie below the mean.

To allow comparison across pillars, and to aggregate to a single score of wellness (the Wellness Index), we convert pillar values to pillar scores using the maximum–minimum normalization. The maximum–minimum normalization takes the pillar values for all countries in our sample and subtracts the lowest sample value. It then divides this by the range of scores and multiplies by 100. The transformation gives the country with the highest wellness in a pillar a score of 100 and the country with the lowest score a 0.[5]

Finally, we aggregate all pillar scores by taking a simple average. The average wellness score captures average wellness across our four dimensions of wellness and serves as the Wellness Index. Table 1 reports the Wellness Index for all ADB members in our sample and their global rank. The full list of countries and their scores are reported in Appendix 2. Finally, Figure 2 shows the geographical variation in wellness for the 153 countries in our sample.

As can be seen, there is tremendous variation in the level of wellness across ADB members in our sample. Japan, the Republic of Korea, and Singapore are the top performers among ADB members, while Afghanistan, Pakistan, and India perform poorly relative to the group.

At first glance, there seems to be a correlation between economic development and wellness, but there is significant variance in performance, with middle countries at various levels of economic development filling out the middle tertile of wellness. For example, comparing Bhutan and Thailand, we see that, despite having a GDP per capita (purchasing power parity [PPP]) that

[5] Formally, the pillar score = $100 \times \frac{country\ value - lowest\ value}{highest\ value - lowest\ value}$

is about half that of Thailand, Bhutan outperforms Thailand. The difference is consistent across all pillar, except intellectual wellness where Thailand is higher ranked than Bhutan. These differences highlight the need for policy to focus on wellness in addition to growth, as Bhutan's higher ranking may be because of its focus on wellness above growth and its use of gross national happiness (GNH) to guide policy.

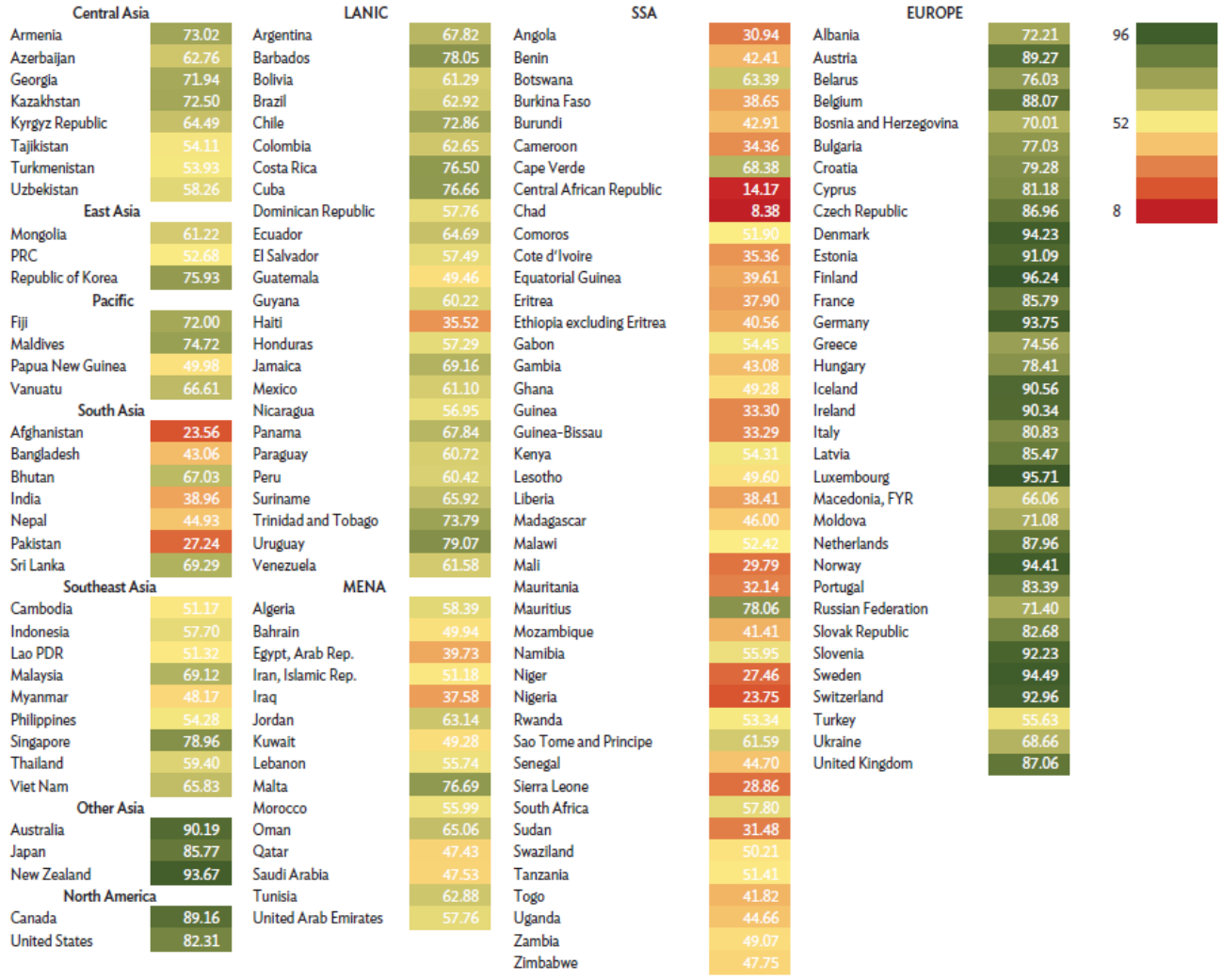
Intuitively, these results suggest that, while there may be a correlation between GDP and wellness, the relationship is not straightforward. Policy may be the missing link between GDP and wellness, and there appears to be space for policy to help achieve higher wellness at all levels of growth. In later sections, we analyze both the relationship between wellness and growth and use our index to identify priority areas for policymakers in developing Asia.

Table 1: Wellness across ADB Members

Country	Physical	Intellectual	Environmental	Social	Wellness Index	Global Rank
Japan	100.00	100.00	58.32	84.76	85.77	21
Singapore	99.68	97.60	52.79	65.77	78.96	30
Republic of Korea	98.41	98.19	34.00	73.12	75.93	39
Maldives	91.03	64.72	95.75	47.37	74.72	40
Armenia	87.16	81.13	61.73	62.05	73.02	43
Kazakhstan	84.75	93.54	66.46	45.26	72.50	45
Fiji	72.96	82.10	86.49	46.43	72.00	47
Georgia	83.72	84.41	60.87	58.75	71.94	48
Sri Lanka	89.28	69.57	82.20	36.09	69.29	52
Malaysia	89.13	77.46	65.74	44.17	69.12	54
Bhutan	76.57	32.72	91.22	67.61	67.03	59
Vanuatu	69.38	48.60	85.70	62.75	66.61	60
Viet Nam	84.23	78.23	55.38	45.48	65.83	63
Kyrgyz Republic	80.37	75.37	60.88	41.34	64.49	66
Azerbaijan	80.35	81.03	59.85	29.78	62.76	71
Mongolia	75.00	74.94	40.54	54.42	61.22	76
Thailand	89.43	65.12	59.31	23.75	59.40	81
Uzbekistan	77.94	77.51	53.76	23.82	58.26	83
Indonesia	75.65	62.64	60.18	32.33	57.70	87
Philippines	72.80	69.38	53.26	21.69	54.28	97
Tajikistan	75.66	77.94	51.63	11.20	54.11	98
Turkmenistan	73.41	70.21	60.11	12.00	53.93	99
People's Republic of China	89.31	69.95	30.89	20.56	52.68	101
Lao People's Democratic Republic	63.90	50.48	70.56	20.34	51.32	105
Cambodia	71.36	53.83	71.98	7.51	51.17	107
Papua New Guinea	50.97	31.50	80.11	37.32	49.98	109
Myanmar	65.45	46.52	57.38	23.31	48.17	116
Nepal	73.46	34.46	22.66	49.14	44.93	121
Bangladesh	73.88	41.05	37.47	19.82	43.06	125
India	69.37	40.78	10.97	34.74	38.96	133
Pakistan	58.17	26.99	20.20	3.58	27.24	149
Afghanistan	40.89	16.74	25.38	11.22	23.56	151

Source: Authors' estimates.

Figure 2: Global Distribution of Wellness



Central Asia	
Armenia	73.02
Azerbaijan	62.76
Georgia	71.94
Kazakhstan	72.50
Kyrgyz Republic	64.49
Tajikistan	54.11
Turkmenistan	53.93
Uzbekistan	58.26
East Asia	
Mongolia	61.22
PRC	52.68
Republic of Korea	75.93
Pacific	
Fiji	72.00
Maldives	74.72
Papua New Guinea	49.98
Vanuatu	66.61
South Asia	
Afghanistan	23.56
Bangladesh	43.06
Bhutan	67.03
India	38.96
Nepal	44.93
Pakistan	27.24
Sri Lanka	69.29
Southeast Asia	
Cambodia	51.17
Indonesia	57.70
Lao PDR	51.32
Malaysia	69.12
Myanmar	48.17
Philippines	54.28
Singapore	78.96
Thailand	59.40
Viet Nam	65.83
Other Asia	
Australia	90.19
Japan	85.77
New Zealand	93.67
North America	
Canada	89.16
United States	82.31

LANIC	
Argentina	67.82
Barbados	78.05
Bolivia	61.29
Brazil	62.92
Chile	72.86
Colombia	62.65
Costa Rica	76.50
Cuba	76.66
Dominican Republic	57.76
Ecuador	64.69
El Salvador	57.49
Guatemala	49.46
Guyana	60.22
Haiti	35.52
Honduras	57.29
Jamaica	69.16
Mexico	61.10
Nicaragua	56.95
Panama	67.84
Paraguay	60.72
Peru	60.42
Suriname	65.92
Trinidad and Tobago	73.79
Uruguay	79.07
Venezuela	61.58
MENA	
Algeria	58.39
Bahrain	49.94
Egypt, Arab Rep.	39.73
Iran, Islamic Rep.	51.18
Iraq	37.58
Jordan	63.14
Kuwait	49.28
Lebanon	55.74
Malta	76.69
Morocco	55.99
Oman	65.06
Qatar	47.43
Saudi Arabia	47.53
Tunisia	62.88
United Arab Emirates	57.76

SSA	
Angola	30.94
Benin	42.41
Botswana	63.39
Burkina Faso	38.65
Burundi	42.91
Cameroon	34.36
Cape Verde	68.38
Central African Republic	14.17
Chad	8.38
Comoros	51.90
Cote d'Ivoire	35.36
Equatorial Guinea	39.61
Eritrea	37.90
Ethiopia excluding Eritrea	40.56
Gabon	54.45
Gambia	43.08
Ghana	49.28
Guinea	33.30
Guinea-Bissau	33.29
Kenya	54.31
Lesotho	49.60
Liberia	38.41
Madagascar	46.00
Malawi	52.42
Mali	29.79
Mauritania	32.14
Mauritius	78.06
Mozambique	41.41
Namibia	55.95
Niger	27.46
Nigeria	23.75
Rwanda	53.34
Sao Tome and Principe	61.59
Senegal	44.70
Sierra Leone	28.86
South Africa	57.80
Sudan	31.48
Swaziland	50.21
Tanzania	51.41
Togo	41.82
Uganda	44.66
Zambia	49.07
Zimbabwe	47.75

EUROPE	
Albania	72.21
Austria	89.27
Belarus	76.03
Belgium	88.07
Bosnia and Herzegovina	70.01
Bulgaria	77.03
Croatia	79.28
Cyprus	81.18
Czech Republic	86.96
Denmark	94.23
Estonia	91.09
Finland	96.24
France	85.79
Germany	93.75
Greece	74.56
Hungary	78.41
Iceland	90.56
Ireland	90.34
Italy	80.83
Latvia	85.47
Luxembourg	95.71
Macedonia, FYR	66.06
Moldova	71.08
Netherlands	87.96
Norway	94.41
Portugal	83.39
Russian Federation	71.40
Slovak Republic	82.68
Slovenia	92.23
Sweden	94.49
Switzerland	92.96
Turkey	55.63
Ukraine	68.66
United Kingdom	87.06

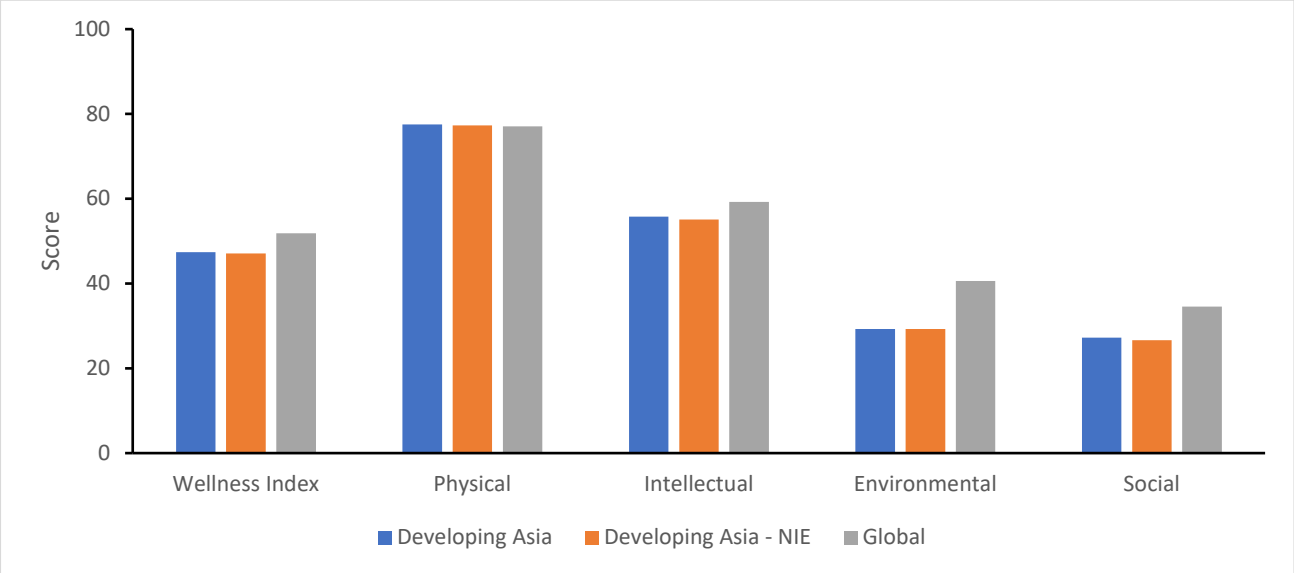
FYR = former Yugoslav republic, LANIC = Latin America and the Caribbean, Lao PDR = Lao People's Democratic Republic, MENA = Middle East and North Africa, PRC = People's Republic of China, SSA = Sub-Saharan Africa.

Note: Full tables are available in the Appendix.
Source: Authors' estimates.

E. Wellness across Developing Asia

Focussing on wellness in developing Asia, Figure 3 compares the average wellness score as captured by the Wellness Index and its four pillars between developing Asia (ADB members in our sample, minus Japan), developing Asia excluding newly industrialized economies (Republic of Korea; Singapore; and Hong Kong, China) and the global average.

Figure 3: Comparing Average Wellness

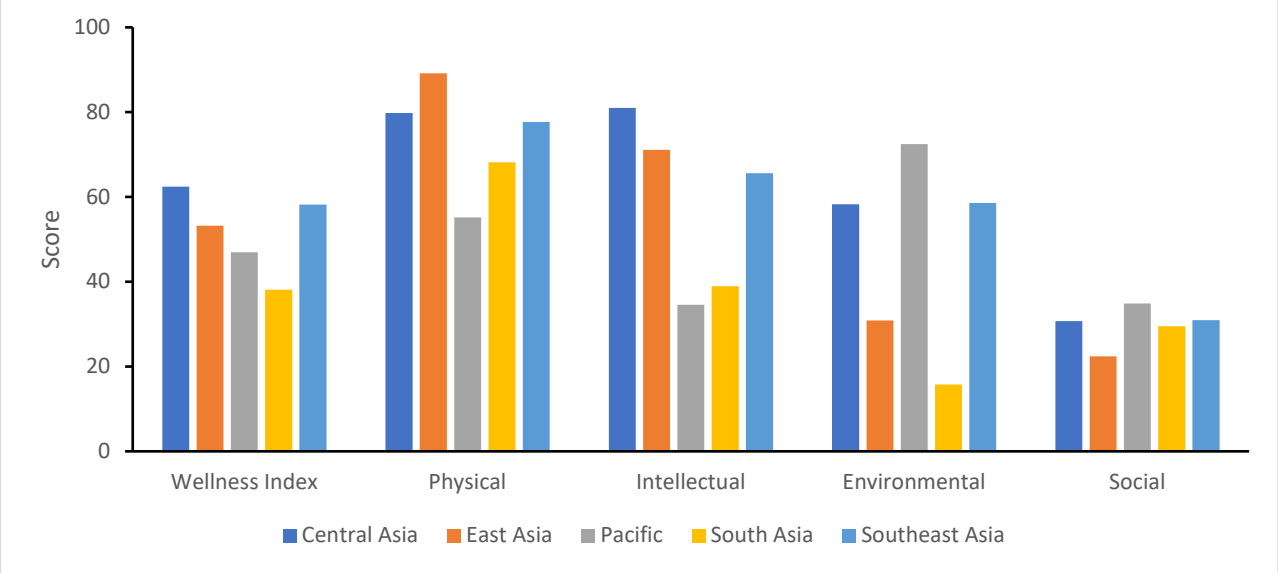


NIE = newly industrialized economy.
Note: Regional averages are population weighted of country scores.
Source: Authors' estimates.

Data shows that developing Asia, on average, performs close to the global average. This is in line with country level scores in Table 1; countries in the region are spread evenly across the global ranking, with nations placing across the tertiles of the global rankings. The dimensions where developing Asia performs relatively poorly are social and environmental wellness. This seems to be driven primarily by its weak performance on social indicators and those relating to equal opportunities across gender, as well as the high levels of pollution and imperviousness in its largest urban areas.

When we remove from our analysis the newly industrialized economies, the average performance dips slightly across all pillars except environmental wellness, though the differences are minimal. To further analyze differences within developing Asia, Figure 4 breaks down the average scores by subregion.

Figure 4: Wellness across Developing Asia Subregions[a]



[a] Subregion definitions and coverage are listed in Appendix 5.
Source: Authors' estimates.

There is however significant heterogeneity across subregions, with no single region consistently performing higher than others. East Asia ranks highest on physical wellness, Central Asia on intellectual wellness, and the Pacific on environmental and social wellness.

The result hints at a positive relationship between GDP and at least two pillars of wellness; namely, physical and intellectual. This makes intuitive sense as regions that perform well have higher GDP and therefore more resources available to allocate to health and education.

We build on these insights in later sections when we study the relationship between material wellbeing (as measured by GDP), and Wellness Index and its pillars. We also dive deeper into the distribution of wellness in ADB members, as we use the Wellness Index to highlight areas of weakness and strength.

F. Comparison with Other Measures of Wellbeing

There is a wide variety of measures designed to capture various aspects of wellbeing. Some incorporate material wellbeing (as captured by GDP), while others, like our Wellness Index, do not. As aforementioned the current default measure for wellbeing is GDP. GDP (and its predecessor gross national product) were not designed to measure wellbeing, but rather

were simple calculations of a nation's "income". GDP measures the total production in a country (or any geographical area) over a certain period, and aggregates it using the prices of each product. Even though those who formulated it warned against its use as a measure of wellbeing (Kuznets 1934), it has become the yardstick by which a nation's success is measured.

GDP's weakness as a measure of wellbeing should be obvious; it only measures a nation's income and nothing else. Even as a measure of income, it is an aggregate measure and does not account for inequality within the country. The Wellness Index seeks to measure wellness beyond growth with the aim to complement GDP. Therefore, it incorporates aspects of wellness that are missing in the GDP, and explicitly disregards measures of wealth. This is not to argue that wealth is not important, but rather that the Wellness Index seeks to become a tool used by policymakers in conjunction with GDP; it is not a substitute then, rather a complement. Given the importance of GDP in policy and academic discourse, we also analyze the relationship between the Wellness Index and GDP in later sections.

Given the historic focus on GDP, attempts have been made to propose alternatives to GDP that seek to better capture wellbeing. Before we discuss these alternatives, note that, when comparing them to the Wellness Index, we anchor the conversation around the Wellness Index. Note that some of the indexes, given their different approaches, also incorporate concepts that are beyond the scope of the Wellness Index.

One of the earliest measures of wellbeing is the HDI proposed by Amartya Sen and Mahbub Ul Haq and curated yearly by the United Nations Development Programme. HDI measures wellbeing in the dimensions of health, education, and material wealth by incorporating measures of life expectancy, literacy, and GDP, respectively. While it is a more comprehensive measure of wellness when compared with GDP, HDI is incomplete as it does not incorporate multiple dimensions of wellbeing, and even in those that it does measure, it uses a very limited number of indicators.

Like HDI, the Happy Planet Index relies on pre-existing indicators and data from the Gallup World Poll to incorporate satisfaction, life expectancy, inequality, and ecological footprint. It relies on subjective surveys on wellbeing conducted by Gallup and other pre-existing data to create a measure of wellbeing and sustainability. While more comprehensive than HDI, the

Happy Planet Index is still lacking in coverage of all aspects of wellbeing. Not surprisingly, given its name however, it does capture some aspects of emotional wellbeing that are not included in the Wellness Index because of the underlying data being proprietary.

Other indexes that capture more specific aspects of wellness include the Indigo Wellness Index and the World Happiness Report. The former utilizes measures of health and consumption across countries to capture some aspects of physical wellness. The World Happiness Report measures, as the name implies, happiness by utilizing subjective survey data on happiness. Both indexes are limited in their approach when compared with the Wellness Index but do contain some indicators distinct from those used in the current exercise.

More recently, three indexes have been proposed that take a more comprehensive view of wellbeing. The Organisation for Economic Co-operation and Development Better Life Index takes direct inspiration from the Stiglitz-Sen-Fitoussi commission and creates 11 indexes capturing various aspects of wellness for a sample of 50 countries. Compared with the Wellness Index, their use of indicators is limited, as is their coverage of countries.

The IGGI is another recent addition to indicators that seek to augment GDP. As IGGI's focus is on sustainable and equitable growth, it incorporates social inclusion, environmental wellbeing, and growth to provide policy makers with an easy to understand index. Like the Wellness Index, it relies on pre-existing and open data. However, given its primary focus on green growth, the IGGI's methodology and coverage of indicators is understandably significantly different.

Finally, the Social Progress Index (SPI) is perhaps the closest in both motivation and methodology to the current exercise. The SPI identifies three basic foundations of social progress, each with four subcategories, covering various aspects of societal wellbeing; from access to necessities to personal freedoms. It utilizes 52 indicators and, like the Wellness Index, uses subcategory factor analysis to create an aggregate index. Like the Wellness Index, SPI aims to measure wellbeing. However, the approaches are significantly different. As its starting point, SPI defines three areas of social progress at the national level and uses them to create what can be viewed as a top–down measure of social progress. In contrast, the Wellness Index uses personal wellbeing as its starting point and focusses on the current and

lived experience of the average citizen with regard to wellness. While SPI utilizes both inputs and outputs (e.g., access to necessities), the Wellness Index only uses outcomes. These differences in motivation result in significantly different approaches.

Table 2 provides a summary of the coverage provided by each index, relative to the pillars of wellness identified by the Wellness Index.

Table 2: Coverage of wellness across different indicators relative to the Wellness Index

Index Name	Methodology	Physical	Intellectual	Environmental[a]	Social	Independent of Growth
Human Development Index (HDI)	Composite indicator which was created by using gross national product, life expectancy, and literacy and enrollment rates	🟡	🟡	🔴	🔴	🔴
OECD Better Life Index	11 sub indicators that captured different dimensions of wellness	🟡	🟡	🟡	🔴	🔴
Happy Planet Index (HPI)	Index that combines four components to measure the efficient use of environmental resources	🟡	🔴	🟡	🟡	🟢
Indigo Wellness Index	Based on primarily physical health data and consumer spending	🟢	🔴	🔴	🔴	🔴
Social Progress Index (SPI)	Composite of 51 measures of social progress, divided into three categories: basic human needs, foundations of wellbeing, and opportunity	🟢	🟡	🟡	🟢	🟢
Inclusive Green Growth Index (IGGI)	Composite indicator that was created to measure inclusion, growth, and environmental sustainability	🟡	🟡	🟡	🟡	🔴

OECD = Organisation for Economic Co-operation and Development.
Note: Traffic lights system. 🟢 = yes, 🔴 = no, 🟡 = partial.
[a] Other indexes take a country level approach to environmental wellness, while the Wellness Index uses an individualistic approach.
Source: Index definitions and collation.

In addition to cross-country indexes, many countries have their own internal measures of wellbeing. While beyond the scope of this cross-country exercise, two that deserve mention are the GNH index used by Bhutan and the Canadian Index of Wellbeing. The GNH was one of the first wellness indexes proposed and one that is used heavily to inform policy in the country. Both indexes rely on surveys that are unique to each country and include both subjective and objective measures of wellbeing. While not comparable with a cross-country

exercise, they suggest promising directions for future global data collection exercises, especially if wellbeing is to become an integral part of policy.

G. Caveats

As formulated, the Wellness Index leverages data that are available over the past half-decade to rank countries ordinally. The use of PCA analysis relies on the assumption that each pillar represents a unique dimension of wellness that, while unobservable directly, affects the sub-indicators in a consistent manner. The resulting index must be understood for what it is, ordinal and sample dependent. Its purpose is to allow us to compare countries across dimensions of wellness, not to assign a definitive value on wellness itself.

The ordinal ranking we achieve is sample dependent, that is, the weights generated by principal components are a result of the underlining variation in country level indicators that may change with time. We have attempted to clearly lay out the methodology of the index to allow easy replication in the future by using newer data. However, with newer data, the weights may change, and care must be taken when comparing rankings across different time periods.

Further, the sample dependence may also be a strength of the current methodology. While it only allows comparisons across years with respect to changes in ranking, the weights in principal components reflect underlining variance in indicators. As countries focus to improve their wellness, lower variance in improved indicators would result in higher weights assigned to other dimensions, updating the policy priority automatically.[6]

Replication is also one of the core reasons for using open access and nonproprietary data. Given their needs, policymakers and researchers can and should add or remove variables to the analysis, if certain proprietary variables are more suitable for their purposes. The Wellness Index is an attempt to create a "general" ranking of wellbeing across nations and should be interpreted as such.

[6] However, note that this effect can work both ways. In the unlikely event that all countries get *worse* in a dimension and reduce the variance with a race to the bottom, the weight of that indicator would also decrease.

III. GROSS DOMESTIC PRODUCT AND WELLNESS

By leaving out from the composition of Wellness Index-based measures of growth and GDP, we can study the relationship between the two indexes. In this section, we try to understand the relationship between wellness and GDP, both at the aggregate and pillar level. The analysis highlights the remarkable variance in wellness at each GDP level, both at the aggregate and pillar level.

A. Gross Domestic Product and Wellness Index: A Positive Relationship Overall

Figure 5 illustrates the relationship between Wellness Index and natural log of GDP per capita at PPP (based on the latest available figures from 2018).[7] Each point on the plot represents a different nation in our sample, differentiating ADB members using blue dots.

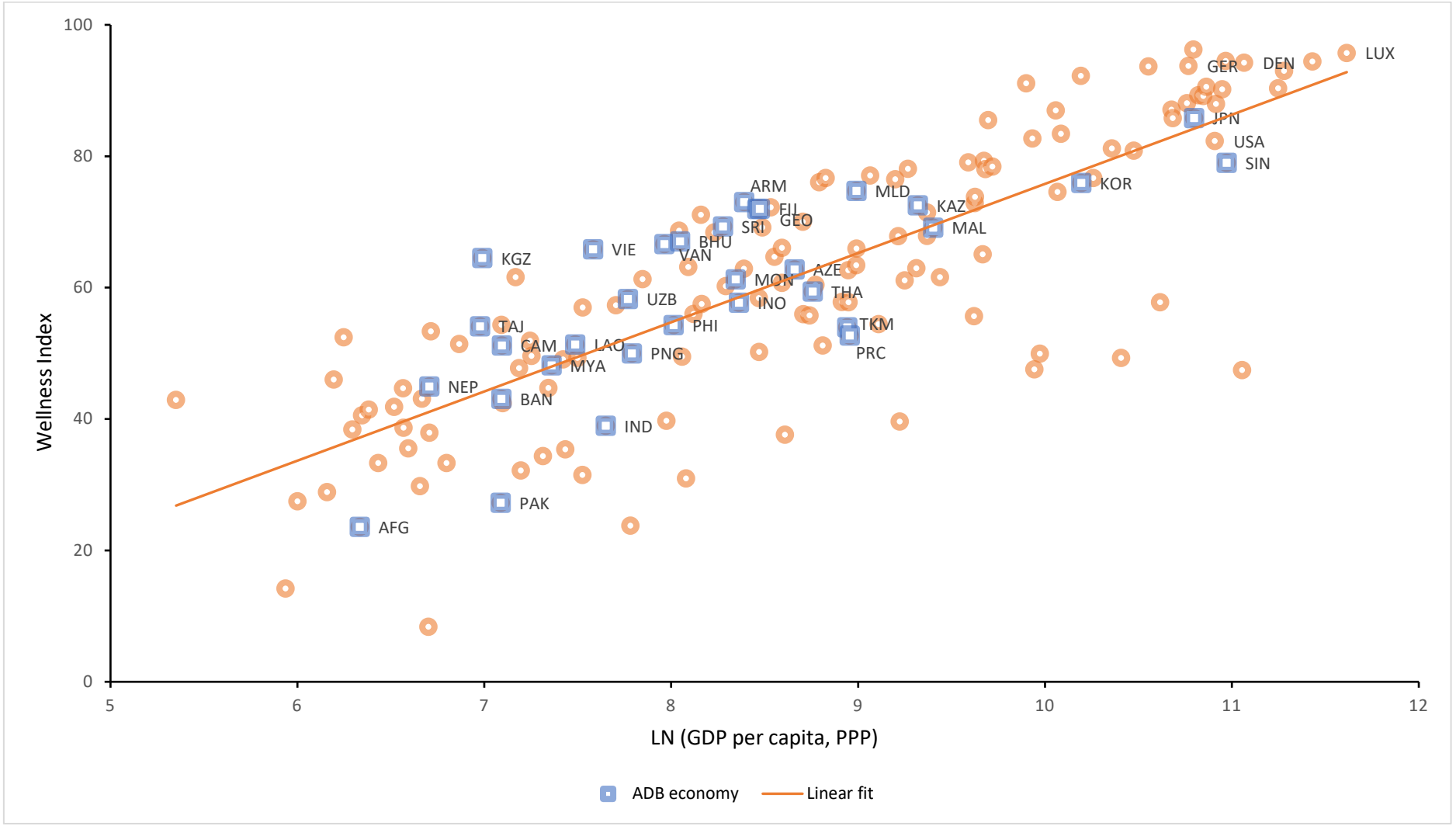
As can be seen, the data suggests that there is a positive relationship between the Wellness Index and GDP, with countries with higher GDP performing better on the Wellness Index. The correlation perhaps then justifies the historic focus on GDP, which is further supported by intuition. Countries with higher GDP per capita may intuitively have access to more resources to provide their citizens with more services and better cater to their wellness needs.

However, this intuitive result ignores that the bridge between GDP and wellness is policy. The wide dispersion in wellness at all GDP levels highlights that, to utilize material resources, you need proactive policy to focus on wellness. The link between GDP and wellness is not direct, and countries need wellness -focussed policies to gain the maximum benefits of their material resources.

As the Wellness Index is the average of wellness scores across four dimensions, Figure 6 shows the relationship between growth and the pillars of the Wellness Index. We find that all four pillars display a positive relationship, though once again there is wide dispersion at every level of GDP.

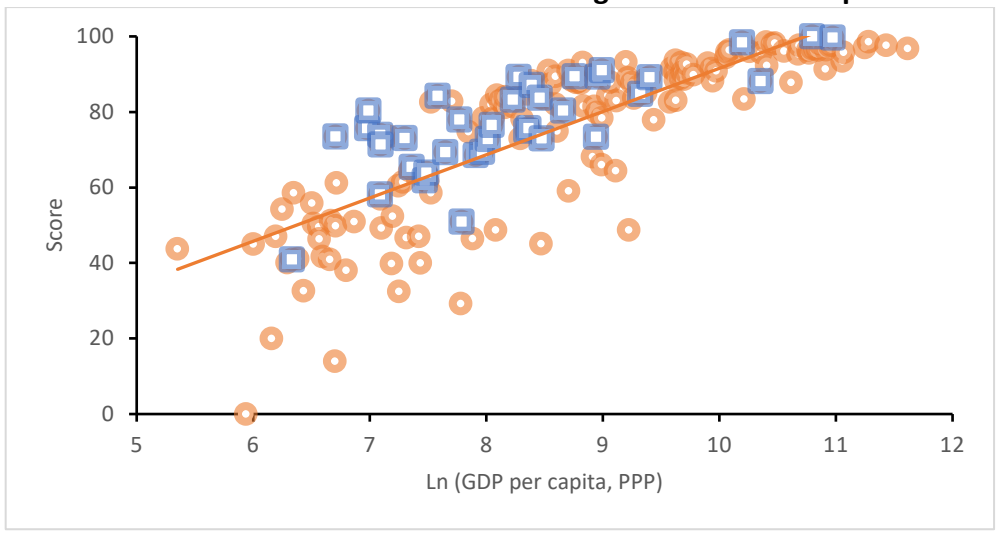
[7] Throughout this paper, we use GDP per capita at PPP, using constant US$2010. The underlining distribution of GDP per capita has a lot of "clustering" at the bottom. Taking a concave transformation, such natural log allows cleaner exposition. If a transformation is made, note that the relationship is not "linear" as may be assumed from the graph, but rather log linear.

Figure 5: Wellness and Gross Domestic Product

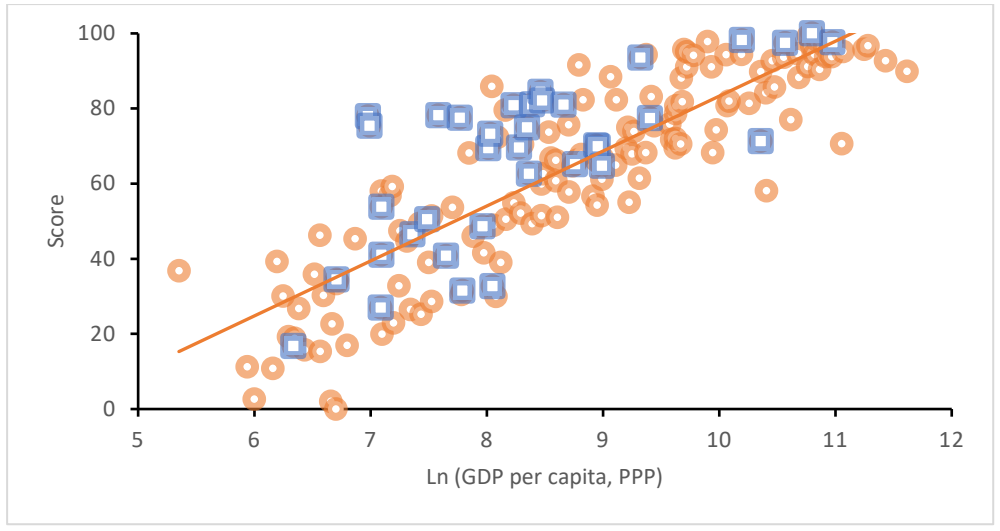


AFG = Afghanistan, ARM = Armenia, AZE = Azerbaijan, BAN = Bangladesh, BHU = Bhutan, CAM = Cambodia, DEN = Denmark, FIJ = Fiji, GEO = Georgia, GER = Germany, INO = Indonesia, IND = India, JPN = Japan, KAZ = Kazakhstan, KGZ = Kyrgyz Republic, KOR = Republic of Korea, LAO = Lao People's Democratic Republic, LUX = Luxembourg, MAL = Malaysia, MLD = Maldives, MON = Mongolia, MYA = Myanmar, NEP = Nepal, PAK = Pakistan, PHI = Philippines, PNG = Papua New Guinea, PRC = People's Republic of China, SIN = Singapore, SRI = Sri Lanka, THA = Thailand, TAJ = Tajikistan, TKM = Turkmenistan, USA = United States, UZB = Uzbekistan, VIE = Viet Nam, VAN = Vanuatu.
Note: ADB members in blue.
Source: Authors' estimates.

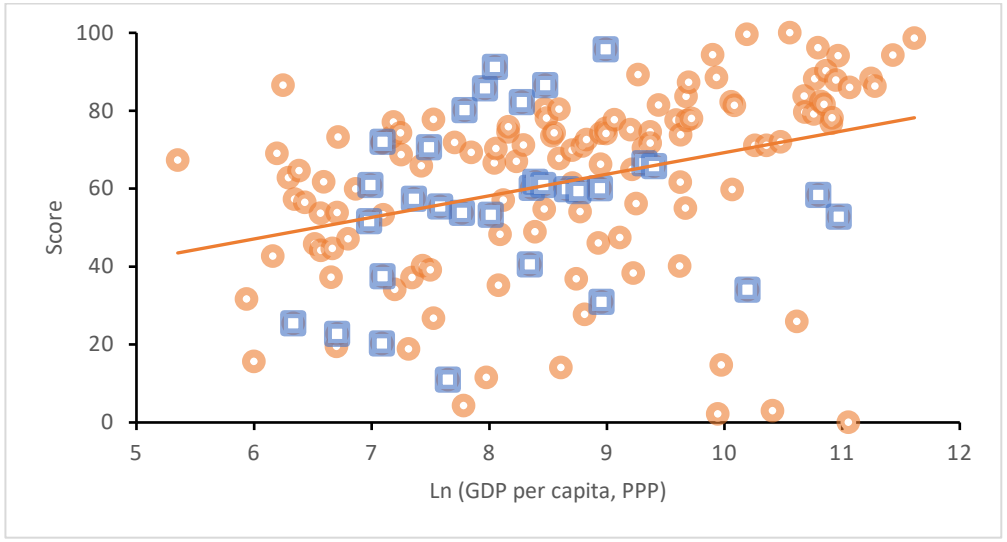
Figure 6: Relationship between Growth and the Pillars of Wellness



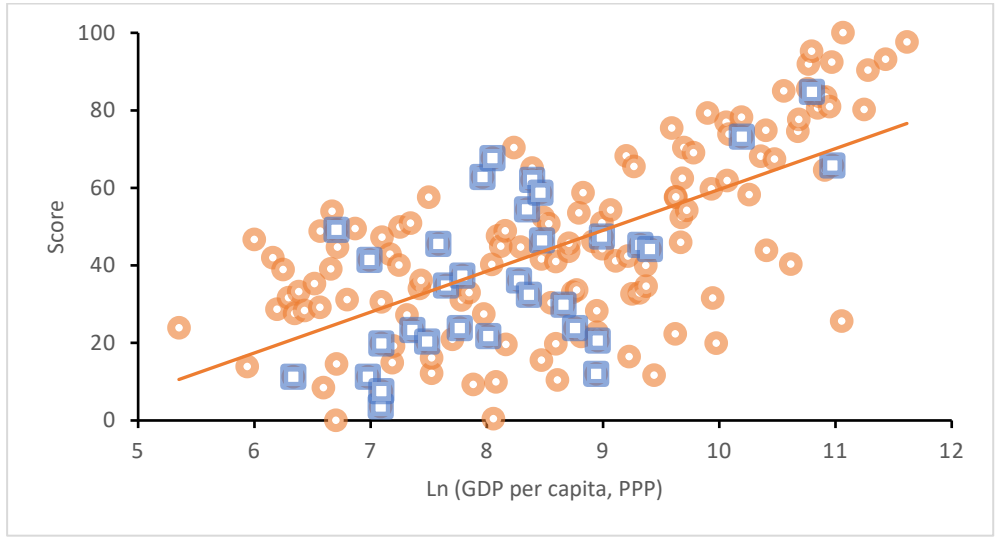
(a) Physical Wellness



(b) Intellectual Wellness



(c) Environmental Wellness



(d) Social Wellness

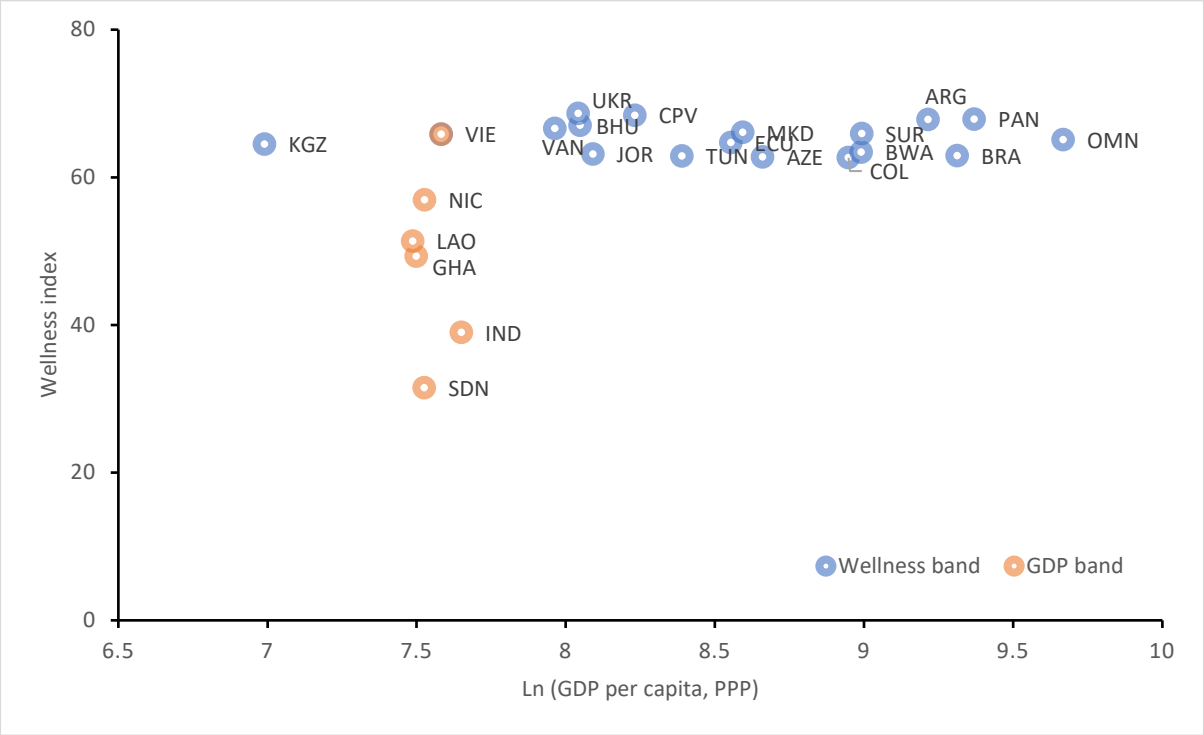
Note: As before ln(gross domestic product per capita purchasing power parity) is on the X-axis, with each pillar score on the Y-axis. Blue dots represent ADB members.
Source: Authors' estimates.

B. Need for Policy to Prioritize Wellness

While there is a positive relationship between wellness and GDP, the dispersion at all GDP per capita levels suggests that there is need for policy that focusses on wellness, beyond simply material well-being (as captured by GDP).

To better understand this point, consider more closely the case of Viet Nam. Like the majority of developing Asia, Viet Nam is a middle-income country with a nominal GDP per capita in 2018 of US$2,566.60 (US$1,964 at PPP using constant 2010 United States dollar). Analyzing the subset of countries (Figure 7) that have similar GDP per capita (PPP) to Viet Nam, we find it outperforms all countries that have GDP similar to it (we allow for GDP to vary by ±10%). Not only this, we find that Viet Nam is able to compete on wellness with countries with significantly higher GDP per capita (PPP). For example, it outperforms Brazil, which has a GDP per capita (PPP) that is nearly five times larger.

Figure 7: Gross Domestic Product and Wellness for Countries within 10% bands of Viet Nam

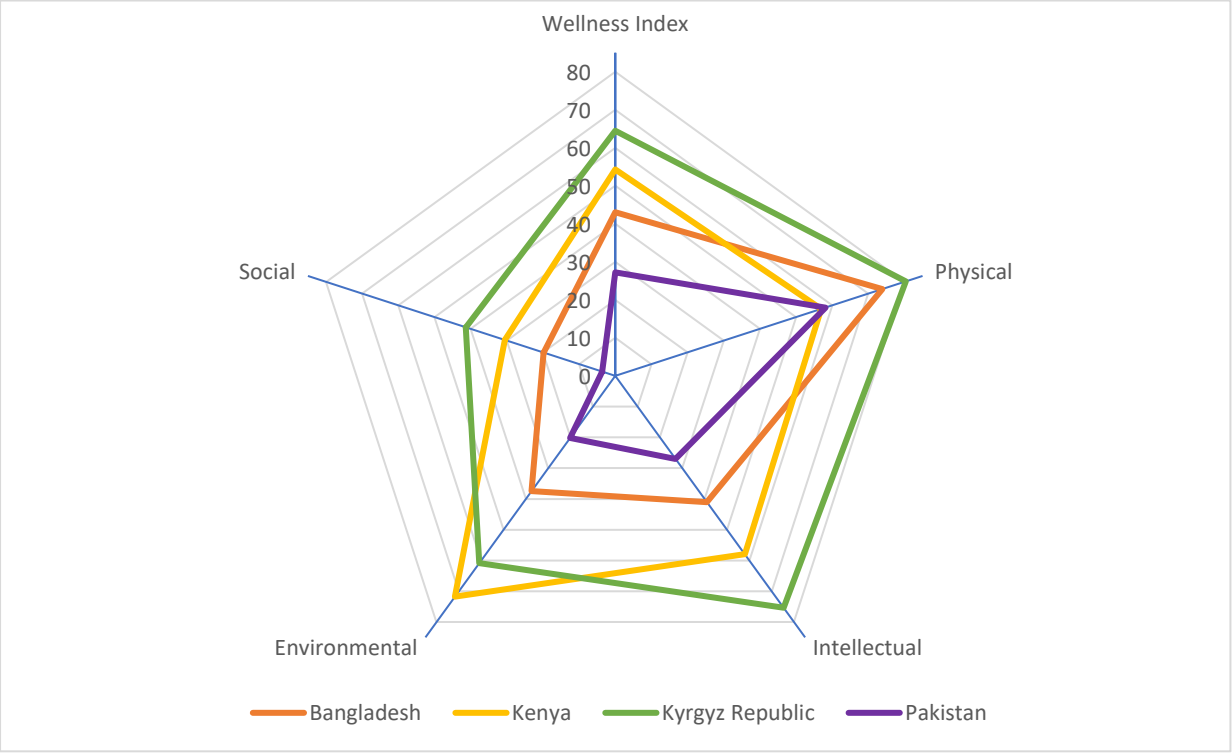


ARG = Argentina, AZE = Azerbaijan, BRA = Brazil, BHU = Bhutan, BWA = Botswana, COL = Colombia, CPV = Cabo Verde, ECU = Ecuador, GHA = Ghana, IND = India, JOR = Jordan, KGZ = Kyrgyz Republic, LAO = Lao People's Democratic Republic, MKD = Republic of North Macedonia, NIC = Nicaragua, OMN = Oman, PAN = Panama, SDN = Sudan, SUR = Suriname, TUN = Tunisia, UKR = Ukraine, VIE = Viet Nam, VAN = Vanuatu

Source: Authors' estimates.

Similarly, on the pillar level, we find major variation is performance. Consider the subset of countries that have GDP per capita (PPP) between US$1,085 and US$1,205. We find variance in each country's level of wellness, both overall and for each pillar. Interestingly, the Kyrgyz Republic, which has the lowest GDP outperforms all its GDP peers. Of course, each nation will have different dynamics and historical contexts, but the comparison shows that, by only comparing and focussing on GDP, in fact, policymakers may be ignoring wellness. It also highlights how the index can be used to identify areas of priority.

Figure 8: Variation in Performance of Countries with Similar Levels of Gross Domestic Product



Source: Authors' estimates.

IV. POLICY PRIORITIES FOR DEVELOPING ASIA

In this section, we use the Wellness Index, in particular the scores of each pillar, to highlight dimensions that need special attention from policy makers. In previous sections, we compared the performance of developing Asia on average to the rest of the world and found that it needs to focus on social wellness as a region. In this section, we conduct a similar exercise, but at the country level.

Table 3 summarizes the country level priorities identified using the Wellness Index. The traffic light system indicates the global tertile each country lies in for each pillar, assigning countries to low, middle, and high levels of wellness. Finally, for each country, the highlighted cell indicates the lowest score across the four pillars of wellness.

Table 3: Priority Areas for Developing Asia

Country	Physical	Intellectual	Environmental	Social	Wellness
Afghanistan	🔴	🔴	🔴	🔴	🔴
Armenia	🟡	🟢	🟡	🟢	🟢
Azerbaijan	🟡	🟢	🟡	🔴	🟡
Bangladesh	🟡	🔴	🔴	🔴	🔴
Bhutan	🟡	🔴	🟢	🟢	🟡
Cambodia	🔴	🔴	🟡	🔴	🔴
China, People's Republic of	🟢	🟡	🔴	🔴	🟡
Fiji	🔴	🟢	🟢	🟡	🟢
Georgia	🟡	🟢	🟡	🟢	🟢
India	🔴	🔴	🔴	🟡	🔴
Indonesia	🟡	🟡	🟡	🔴	🟡
Kazakhstan	🟡	🟢	🟡	🟡	🟢
Korea, Republic of	🟢	🟢	🔴	🟢	🟢
Kyrgyz Republic	🟡	🟡	🟡	🟡	🟡
Lao People's Democratic Republic	🔴	🔴	🟡	🔴	🔴
Malaysia	🟢	🟡	🟡	🟡	🟡
Maldives	🟢	🟡	🟢	🟡	🟢
Mongolia	🟡	🟡	🔴	🟢	🟡
Myanmar	🔴	🔴	🟡	🔴	🔴
Nepal	🟡	🔴	🔴	🟡	🔴
Pakistan	🔴	🔴	🔴	🔴	🔴
Papua New Guinea	🔴	🔴	🟢	🟡	🔴
Philippines	🔴	🟡	🔴	🔴	🟡
Singapore	🟢	🟢	🔴	🟢	🟢
Sri Lanka	🟢	🟡	🟢	🟡	🟡

Tajikistan					
Thailand					
Turkmenistan					
Uzbekistan					
Vanuatu					
Viet Nam					
Number of low-wellness nations in region	10	11	12	14	9

Note: Traffic light system for areas of concern relative to the rest of the world in each category (red = lowest global tertile, yellow = middle tertile, and green = top global tertile). Highlighted cell shows the area with lowest for each country.
Source: Authors' estimates.

Consistent with the regional analysis, for most countries in the region, social wellness is the most common country priority area, indicating the need for perhaps not just country level policy interventions, but the opportunity for regional policy collaboration.

Countries, where social wellness does not have the lowest score, show weak performance in either environmental or intellectual wellness. The former is not surprising given that those with (relatively) low environmental scores are, by and large, either newly industrialized, fast-growing economies, or oil-producing nations.

Finally, the physical pillar not being identified as a priority area perhaps speaks of the decades of policy work and interventions in this space. However, it is important to note that this does not mean that work is not needed in the area, as quite a few countries in developing Asia lie in the bottom tertile globally for physical wellness, indicating a need to continue work in this domain.

V. CONCLUDING REMARKS

The Wellness Index takes a grassroots approach to measure the average level of wellness of citizens in each country. It joins a growing list of measures that seek to enrich policy and allow it to grow beyond its focus on growth. It is the first measure that takes an “individual” level approach and builds a country level index through the use of multiple proxies for each of the four pillars of wellness.

The Wellness Index provides policymakers with an easy-to-use benchmark of their performance on each of four dimensions of wellness. The methodology employed allows us the leverage currently available data and use it to identify areas of strength and weakness. Its reliance on open data also allows for easy replication and allows for users to easily add and subtract indicators to best suit their needs. Finally, it joins the growing chorus of work aimed at highlighting the need for measures of wellness, and the indexes weakness, that is its reliance on pre-existing indicators, highlights the need for regional level cooperation to realign data-collection activities to more wellness-centric instruments.

In summation, given current data limitations, the Wellness Index provides the first step towards a comprehensive measure of individual wellness. It can in its current form already be used to benchmark country performance and highlights exciting new areas for future research in wellness, in particular the need for more wellness focussed data collection.

APPENDIXES

Appendix 1: List of Core Asian Countries

1. Armenia
2. Azerbaijan
3. Bangladesh
4. Cambodia
5. Fiji
6. Georgia
7. India
8. Indonesia
9. Japan
10. Kazakhstan
11. Kyrgyz Republic
12. Malaysia
13. Nepal
14. Pakistan
15. Papua New Guinea
16. People's Republic of China
17. Philippines
18. Republic of Korea
19. Singapore
20. Sri Lanka
21. Tajikistan
22. Thailand
23. Turkmenistan
24. Uzbekistan
25. Viet Nam

Appendix 2: Full Wellness Index

Table A2 presents the results of the Wellness Index for all countries, where data was available, to calculate values for at least one pillar. The complete index has coverage for 153 countries, based on which we provide a global ranking. For countries with incomplete coverage, we only report scores for pillars where data is available, leaving the remaining cells blank.

Table A2: Countries sorted in alphabetical order

Country	Physical	Intellectual	Environmental	Social	Wellness Index	Rank
Afghanistan	40.89	16.74	25.38	11.22	23.56	151
Albania	90.92	73.70	73.54	50.67	72.21	46
Algeria	85.70	51.45	54.76	41.66	58.39	82
Angola	48.73	29.95	35.18	9.91	30.94	145
Antigua and Barbuda	*88.48*	*71.94*				
Argentina	89.01	74.99	64.91	42.38	67.82	58
Armenia	87.16	81.13	61.73	62.05	73.02	43
Australia	97.47	94.55	87.85	80.89	90.19	13
Austria	96.70	94.38	82.31	83.68	89.27	14
Azerbaijan	80.35	81.03	59.85	29.78	62.76	71
Bahamas, The	*83.42*					
Bahrain	90.83	74.27	14.75	19.92	49.94	110
Bangladesh	73.88	41.05	37.47	19.82	43.06	125
Barbados	90.54	81.77	77.48	62.40	78.05	33
Belarus	88.06	91.59	70.95	53.52	76.03	38
Belgium	96.37	91.17	79.15	85.58	88.07	16
Belize	*84.76*					
Benin	49.23	19.93	53.27	47.20	42.41	127
Bhutan	76.57	32.72	91.22	67.61	67.03	59

Bolivia	74.75	68.16	69.27	32.97	61.29	75
Bosnia and Herzegovina	90.95	75.67	69.82	43.60	70.01	51
Botswana	66.03	61.13	75.40	50.99	63.39	67
Brazil	86.97	61.44	70.40	32.88	62.92	69
Brunei Darussalam	*88.15*	*71.27*				
Bulgaria	87.86	88.39	77.63	54.25	77.03	34
Burkina Faso	46.32	15.34	44.10	48.84	38.65	134
Burundi	43.75	36.77	67.28	23.84	42.91	126
Cambodia	71.36	53.83	71.98	7.51	51.17	107
Cameroon	46.73	44.74	18.81	27.18	34.36	140
Canada	96.34	98.08	81.59	80.62	89.16	15
Cape Verde	81.39	54.83	66.95	70.37	68.38	56
Central African Republic	0.00	11.18	31.67	13.84	14.17	152
Chad	14.00	0.00	19.51	0.00	8.38	153
Chile	93.68	78.62	61.61	57.53	72.86	44
China, People's Republic of	89.31	69.95	30.89	20.56	52.68	101
Colombia	90.15	66.03	66.21	28.23	62.65	72
Comoros	60.40	32.80	74.32	40.07	51.90	103
Congo, Republic of	*46.40*	*45.95*		*9.28*		
Costa Rica	93.24	69.46	75.11	68.19	76.50	37
Cote d'Ivoire	40.02	25.18	40.19	36.06	35.36	139
Croatia	93.07	88.11	83.61	52.34	79.28	28
Cuba	93.06	82.26	72.59	58.72	76.66	36
Cyprus	95.70	89.83	71.05	68.16	81.18	26
Czech Republic	94.39	94.28	82.26	76.89	86.96	19
Denmark	95.80	95.17	85.95	100.00	94.23	5
Djibouti	*61.41*					
Dominican Republic	79.87	54.22	74.19	22.75	57.76	85
Ecuador	87.37	66.77	74.27	30.34	64.69	65
Egypt, Arab Republic	78.36	41.56	11.56	27.44	39.73	131
El Salvador	84.03	50.47	75.88	19.57	57.49	88
Equatorial Guinea	48.72	55.01	38.31	16.42	39.61	132
Eritrea	49.86	33.34	53.84	14.55	37.90	136
Estonia	92.91	97.83	94.36	79.28	91.09	10
Ethiopia (excluding Eritrea)	58.54	18.79	57.31	27.60	40.56	130
Fiji	72.96	82.10	86.49	46.43	72.00	47
Finland	96.79	96.81	96.18	95.20	96.24	1
France	97.67	88.24	79.61	77.64	85.79	20
Gabon	64.38	64.87	47.41	41.13	54.45	95
Gambia, The	51.14	22.60	44.65	53.90	43.08	124
Georgia	83.72	84.41	60.87	58.75	71.94	48
Germany	95.60	99.30	88.15	91.94	93.75	6
Ghana	61.49	38.96	39.14	57.52	49.28	113
Greece	95.88	80.75	59.75	61.86	74.56	41
Grenada	*82.97*	*82.30*				
Guatemala	78.31	48.90	70.23	0.40	49.46	112
Guinea	38.08	16.96	47.06	31.12	33.30	141

Guinea-Bissau	32.58	15.76	56.48	28.31	33.29	142
Guyana	72.94	52.09	71.15	44.71	60.22	80
Haiti	41.66	30.26	61.75	8.41	35.52	138
Honduras	82.77	53.65	71.80	20.93	57.29	89
Hong Kong, China		*97.45*				
Hungary	90.37	91.07	78.00	54.20	78.41	31
Iceland	98.02	90.37	90.22	83.60	90.56	11
India	69.37	40.78	10.97	34.74	38.96	133
Indonesia	75.65	62.64	60.18	32.33	57.70	87
Iran, Islamic Republic	87.65	67.73	27.73	21.60	51.18	106
Iraq	74.88	51.00	14.06	10.39	37.58	137
Ireland	97.04	95.79	88.28	80.22	90.34	12
Israel	*97.97*	*92.68*				
Italy	98.25	85.67	71.99	67.42	80.83	27
Jamaica	83.56	62.60	78.08	52.39	69.16	53
Japan	100.00	100.00	58.32	84.76	85.77	21
Jordan	84.41	72.31	48.26	47.56	63.14	68
Kazakhstan	84.75	93.54	66.46	45.26	72.50	45
Kenya	56.97	57.99	71.76	30.52	54.31	96
Kiribati	*61.90*					
Korea, Democratic Republic	*67.81*					
Korea, Republic of	98.41	98.19	34.00	73.12	75.93	39
Kuwait	92.26	58.09	2.94	43.82	49.28	114
Kyrgyz Republic	80.37	75.37	60.88	41.34	64.49	66
Lao People's Democratic Republic	63.90	50.48	70.56	20.34	51.32	105
Latvia	88.64	95.64	87.26	70.33	85.47	22
Lebanon	88.35	64.71	36.86	33.05	55.74	93
Lesotho	32.41	47.42	68.72	49.84	49.60	111
Liberia	40.04	19.20	62.75	31.64	38.41	135
Libya	*81.47*		*46.02*			
Lithuania	*89.85*	*94.13*		*68.99*		
Luxembourg	96.76	89.86	98.62	97.61	95.71	2
Macedonia, former Yugoslav Republic of	89.43	66.20	67.68	40.92	66.06	61
Madagascar	47.04	39.26	69.01	28.67	46.00	120
Malawi	54.25	30.02	86.56	38.86	52.42	102
Malaysia	89.13	77.46	65.74	44.17	69.12	54
Maldives	91.03	64.72	95.75	47.37	74.72	40
Mali	40.91	1.97	37.23	39.03	29.79	146
Malta	96.04	81.39	71.09	58.23	76.69	35
Marshall Islands		*73.28*				
Mauritania	52.41	22.87	34.11	19.16	32.14	143
Mauritius	83.61	73.88	89.27	65.49	78.06	32
Mexico	87.75	67.87	56.17	32.60	61.10	77
Micronesia, Federated States of	*68.53*					
Moldova	81.23	79.60	74.57	48.91	71.08	50

Mongolia	75.00	74.94	40.54	54.42	61.22	76
Morocco	82.98	39.02	57.07	44.91	55.99	91
Mozambique	41.08	26.75	64.61	33.19	41.41	129
Myanmar	65.45	46.52	57.38	23.31	48.17	116
Namibia	59.07	57.71	61.36	45.67	55.95	92
Nepal	73.46	34.46	22.66	49.14	44.93	121
Netherlands	96.41	93.83	78.16	83.44	87.96	17
New Zealand	96.11	93.62	100.00	84.94	93.67	7
Nicaragua	82.60	51.34	77.77	16.08	56.95	90
Niger	45.00	2.58	15.62	46.64	27.46	148
Nigeria	29.24	30.44	4.29	31.03	23.75	150
Norway	97.60	92.66	94.26	93.12	94.41	4
Oman	88.87	70.54	54.94	45.90	65.06	64
Pakistan	58.17	26.99	20.20	3.58	27.24	149
Palau		*83.13*				
Panama	88.69	68.23	74.51	39.93	67.84	57
Papua New Guinea	50.97	31.50	80.11	37.32	49.98	109
Paraguay	82.02	60.76	80.36	19.75	60.72	78
Peru	87.81	66.15	54.09	33.62	60.42	79
Philippines	72.80	69.38	53.26	21.69	54.28	97
Poland	*92.67*	*95.05*				
Portugal	96.40	81.97	81.36	73.85	83.39	23
Qatar	93.48	70.63	0.00	25.61	47.43	119
Russian Federation	85.02	94.28	71.66	34.64	71.40	49
Rwanda	61.17	34.23	73.26	44.70	53.34	100
Samoa	*83.26*	*80.80*				
Sao Tome and Principe	73.50	56.81	73.17	42.87	61.59	73
Saudi Arabia	88.23	68.21	2.12	31.58	47.53	118
Senegal	64.37	26.44	37.14	50.84	44.70	122
Seychelles	82.61	75.81				
Sierra Leone	20.02	10.78	42.68	41.97	28.86	147
Singapore	99.68	97.60	52.79	65.77	78.96	30
Slovak Republic	91.46	91.07	88.46	59.74	82.68	24
Slovenia	96.73	94.39	99.57	78.21	92.23	9
Solomon Islands	*73.05*					
Somalia	*25.79*					
South Africa	68.12	56.60	60.31	46.15	57.80	84
Spain	98.50	84.17		74.84		
Sri Lanka	89.28	69.57	82.20	36.09	69.29	52
St. Lucia	84.42					
St. Vincent and the Grenadines	*81.53*					
Sudan	58.54	28.56	26.71	12.11	31.48	144
Suriname	78.38	66.87	74.15	44.27	65.92	62
Swaziland	45.05	59.86	80.41	15.52	50.21	108
Sweden	97.68	93.77	94.12	92.40	94.49	3
Switzerland	98.53	96.66	86.32	90.33	92.96	8
Syrian Arab Republic	*82.96*					

Tajikistan	75.66	77.94	51.63	11.20	54.11	98
Tanzania	50.91	45.32	59.94	49.48	51.41	104
Thailand	89.43	65.12	59.31	23.75	59.40	81
Togo	50.40	35.84	45.82	35.24	41.82	128
Tonga	*78.15*	*70.46*				
Trinidad and Tobago	83.05	80.69	73.80	57.63	73.79	42
Tunisia	88.23	49.33	48.87	65.07	62.88	70
Turkey	90.65	69.48	40.08	22.32	55.63	94
Turkmenistan	73.41	70.21	60.11	12.00	53.93	99
Uganda	49.56	46.23	53.68	29.17	44.66	123
Ukraine	81.98	85.83	66.60	40.22	68.66	55
United Arab Emirates	87.82	76.98	25.93	40.29	57.76	86
United Kingdom	95.35	94.53	83.77	74.58	87.06	18
United States	91.39	96.53	76.77	64.56	82.31	25
Uruguay	91.57	71.74	77.61	75.36	79.07	29
Uzbekistan	77.94	77.51	53.76	23.82	58.26	83
Vanuatu	69.38	48.60	85.70	62.75	66.61	60
Venezuela	77.91	75.38	81.40	11.65	61.58	74
Viet Nam	84.23	78.23	55.38	45.48	65.83	63
Yemen, Republic of	*55.86*					
Zambia	47.00	49.38	65.86	34.04	49.07	115
Zimbabwe	39.84	59.18	77.10	14.88	47.75	117

Source: Authors' estimates.

Appendix 3: Principal Component Analysis Weights

The following table provides the weights obtained from our principal component analysis at the pillar level. Note that there are some minor differences between statistical software. The weights used in our analysis were obtained using the "pca <variable>" command in Stata 15.

Indicator (year)	**Weight**	**Indicator** (year)	**Weight**
Physical wellness		**Environmental wellness**	
Life expectancy at birth (2018)	0.4493	Mortality rate attributed to household and ambient air pollution (2017)	0.4062
Maternal mortality Rate (2017)	0.4232	PM2.5 air pollution, mean annual exposure (micrograms per cubic meter) (2017)	0.6553
Child (under 5) mortality rate (2018)	0.4448	Protected areas total (2018)	0.2103
Prevalence of undernourishment (2017)	0.361	Population weighted average NO_2 levels (2019)	0.3094
DALY noncommunicable diseases (2017)	0.3068	Imperviousness of most populous city (2015)	0.5154

DALY communicable diseases (2017)	0.4436		
Intellectual wellness		**Social wellness**	
Literacy rate adult (2018)	0.573	Literacy rate, youth (ages 15-24), gender parity index (GPI) (2018)	0.1346
Mean years of schooling (2018)	0.5996	GINI index (World Bank estimate) (2018)	0.2043
Harmonized test scores (2017)	0.5586	Ratio of female to male labor force participation rate (%) (2018)	0.1453
		Control of corruption: Estimate (2018)	0.4452
		Rule of law: Estimate (2018)	0.4442
		Social class equality in respect for civil liberty	0.4587
		Social group equality in respect for civil liberties	0.4047
		Power distributed by social group	0.3865

DALY = disability-adjusted life year, NO_2 = nitrogen dioxide.
Note: PM2.5 refers to atmospheric particulate matter that has a diameter of less than 2.5 micrometers.
Source: Authors' estimates.

Appendix 4: Data Definitions and Sources

Appendix 4 defines all indicators used in our analysis. Definitions are reproduced from their original sources, which are also listed. The process is described also where multiple indicators were collated to create a new indicator.

A. Physical Wellness

Life expectancy at birth (2018). Life expectancy at birth indicates the number of years a new-born infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life.
Source: World Bank. 2019. *Wold Development Indicators.* Washington, DC.

Maternal mortality rate (2017). Maternal mortality ratio is the number of women who die from pregnancy-related causes while pregnant or within 42 days of pregnancy termination per 100,000 live births. The data are estimated with a regression model using information on the proportion of maternal deaths among non-AIDS deaths in women aged 15-49, fertility, birth attendants, and gross domestic product measured using purchasing power parities.
Source: World Bank. 2019. *Wold Development Indicators.* Washington, DC.

Child (under 5) mortality rate (2018). Under-5 mortality rate is the probability per 1,000 that a new-born baby will die before reaching age 5, if subject to age-specific mortality rates of the specified year.
Source: World Bank. 2019. *Wold Development Indicators.* Washington, DC.

Prevalence of Undernourishment (2017). Population below the minimum level of dietary energy consumption (also referred to as the prevalence of undernourishment) shows the percentage of the population whose food intake is insufficient to meet dietary energy requirements continuously. Data showing as 5 may signify a prevalence of undernourishment below 5%.
Source: World Bank. 2019. *Wold Development Indicators.* Washington, DC.

DALY noncommunicable diseases (2017). Age-standardized disability-adjusted life year (DALY) rates per 100,000 individuals from noncommunicable diseases. DALYs are used to measure total burden of disease, both from years of life lost and years lived with a disability. One DALY equals one lost year of healthy life.
Source: Global Burden of Disease Collaborative Network. . (2018). *Global Burden of Disease Study 2017 (GBD 2017).* Seattle, United States: Institute for Health Metrics and Evaluation (IHME).

DALY communicable diseases (2017). Age-standardized DALY rates per 100,000 individuals from noncommunicable diseases. DALYs are used to measure total burden of disease, both from years of life lost and years lived with a disability. One DALY equals one lost year of healthy life.
Source: Global Burden of Disease Collaborative Network. . (2018). *Global Burden of Disease Study 2017 (GBD 2017).* Seattle, United States: IHME.

B. Intellectual Wellness

Literacy rate adult (2018). Adult literacy rate is the percentage of people ages 15 and above, who can both read and write with understanding a short simple statement about their everyday life.
Source: World Bank. 2019. *Wold Development Indicators.* Washington, DC.

Mean years of schooling (2018). Average number of years of education received by people ages 25 and older, converted from education attainment levels using official durations of each level.
Source: United Nations Development Programme, Human Development Report (2018 Statistical Update).

Harmonized test scores (2017). Harmonized test scores from major international student achievement testing programs. They are measured in Trends in International Mathematics and Science Study (TIMSS)-equivalent units, where 300 is minimal attainment and 625 is advanced attainment. Most recent estimates are used. For more information, consult the Global Database on Education Quality (Patrinos and Angrist 2018)
Source: World Bank. 2019. *Wold Development Indicators.* Washington, DC.

C. Environmental Wellness

Mortality rate attributed to household and ambient air pollution, age-standardized (2017). Mortality rate attributed to household and ambient air pollution is the number of deaths attributable to the joint effects of household and ambient air pollution in a year per 100,000 population. The rates are age standardized.
Source: World Bank. 2019. *Wold Development Indicators.* Washington, DC.

PM2.5 air pollution, mean annual exposure (micrograms per cubic meter) (2017). Population-weighted exposure to ambient PM2.5 pollution is defined as the average level of exposure of a nation's population to concentrations of suspended particles measuring less than 2.5 microns in aerodynamic diameter, which are capable of penetrating deep into the respiratory tract and causing severe health damage. Exposure is calculated by weighting mean annual concentrations of PM2.5 by population in both urban and rural areas.
Note: PM2.5 refers to atmospheric particulate matter that has a diameter of less than 2.5 micrometers.
Source: World Bank. 2019. *Wold Development Indicators.* Washington, DC.

Protected areas total (2018). Terrestrial-protected areas are totally or partially protected areas of at least 1,000 hectares that are designated by national authorities as scientific reserves with limited public access, national parks, natural monuments, nature reserves or wildlife sanctuaries, protected landscapes, and areas managed mainly for sustainable use. Marine-protected areas are areas of intertidal or subtidal terrain—and overlying water and associated flora and fauna and historical and cultural features—that have been reserved by law or other effective means to protect part or all of the enclosed environment. Sites protected under local or provincial law are excluded.
Source: World Bank. 2019. *Wold Development Indicators.* Washington, DC.

Population weighted average NO_2 levels (2019). The data used for the processing were 2016 LandScan grid population data (about 1 kilometers (km) spatial resolution) and 2019 Sentinel-5P nitrogen dioxide (NO_2) concentration temporal median (about 1.1 km spatial resolution) and both were in EPSG:4326 projection. To make each pixel match, the LandScan population data was resampled to the spatial resolution of NO_2 concentration data. After having the datasets in both resolutions, the raster files were multiplied, and the pixel of the resulting raster image has a value of population XNO_2 concentration. The Database of Global Administrative Areas (GADM) country boundary was used to get the

summation of population XNO_2 concentration pixels as well as the total grid population per country. The country level population weighted average was then computed using the formula:
country average = summation (population*NO_2 exposure)/total grid population.
Sources: Multiple sources (see description) and in-house calculations.

Imperviousness of largest city. The data used for the processing were 2016 LandScan grid population data (about 1 km spatial resolution) and 2015 WSF imperviousness data (30 meters resolution pixel in EPSG:3857 web-mercator projection) for the 156 cities of interest. The WSF imperviousness datasets were projected to EPSG:4326 projection to make it consistent with the population data. To make each pixel match, the imperviousness data was resampled to the spatial resolution of the population data. Averaging resampling method was used for this process. The population data was clipped within the boundary of each city squares. After having both population and imperviousness data in the same scope, projection, and resolution, the raster files were multiplied, and the pixel of the resulting raster image has a value of populationXimperviousness. The summation of populationXimperviousness pixels as well as the total grid population per city were the identified. The city/country level population weighted average was then computed using the formula:
Population-weighted average = sum (population*imperviousness)/total grid population.
Source: Multiple sources (see description) and in-house calculations.

D. Social Wellness

Literacy rate, youth (ages 15–24), gender parity index (2018). Gender parity index for youth literacy rate is the ratio of females to males aged 15–24 who can both read and write with understanding a short simple statement about their everyday life.
Source: World Bank. 2019. *Wold Development Indicators.* Washington, DC.

Gini index (World Bank estimate) (2018). Gini index measures the extent to which the distribution of income (or, in some cases, consumption expenditure) among individuals or households within an economy deviates from a perfectly equal distribution. A Lorenz curve plots the cumulative percentages of total income received against the cumulative number of recipients, starting with the poorest individual or household. The Gini index measures the area between the Lorenz curve and a hypothetical line of absolute equality, expressed as a percentage of the maximum area under the line. Thus, a Gini index of 0 represents perfect equality, while an index of 100 implies perfect inequality.
Source: World Development Indicators.

Ratio of female to male labor force participation rate (%) (2018). Labor force participation rate is the proportion of the population aged 15 and older that is economically active: all people who supply labor for the production of goods and services during a specified period. Ratio of female to male labor force participation rate is calculated by dividing female labor force participation rate by male labor force participation rate and multiplying by 100.
Source: World Bank. 2019. *Wold Development Indicators.* Washington, DC.

Control of corruption: Estimate (2018). Control of corruption captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests. Estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e. ranging from about -2.5 to 2.5.
Source: World Bank. 2019. *Wold Development Indicators.* Washington, DC.

Rule of law: Estimate (2018). Rule of law captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. Estimate gives the country's score on the aggregate indicator, in units of a standard normal distribution, i.e. ranging from about -2.5 to 2.5.
Source: World Bank. 2019. *Wold Development Indicators.* Washington, DC.

Social class equality in respect for civil liberty (2020). Answer to the question: Do poor people enjoy the same level of civil liberties as rich people do?
Source: Coppedge, M., J. Gerring, C. H. Knutsen, S. L. Lindberg, J. Teorell, D. Altman, and D. Ziblatt. 2020. V-Dem [Country–Year/Country–Date] Dataset v10. Varieties.

Social group equality in respect for civil liberties (2020). Answer to the question: Do all social groups, as distinguished by language, ethnicity, religion, race, region, or caste, enjoy the same level of civil liberties, or are some groups generally in a more favorable position?
Source: Coppedge, M., J. Gerring, C. H. Knutsen, S. L. Lindberg, J. Teorell, D. Altman, and D. Ziblatt. 2020. V-Dem [Country–Year/Country–Date] Dataset v10. Varieties.

Power distributed by social group (2020). Answer to the question: Is political power distributed according to social group?
Source: Coppedge, M., J. Gerring, C. H. Knutsen, S. L. Lindberg, J. Teorell, D. Altman, and D. Ziblatt. 2020. V-Dem [Country–Year/Country–Date] Dataset v10. Varieties.
Notes: Indicators used for each pillar of wellness. Definitions are taken from the source listed in the source column. Source refers to the database used to collect data; indicators may be collected by different agencies.

Appendix 5: Developing Asia Coverage

The following table lists countries in developing Asia, divided by the relevant subregions, and highlights data coverage for countries and divides accordingly. Countries with full coverage are part of the full wellness index; those with partial coverage have data available to allow at least one pillar score to be calculated; and, finally, those with such limited data that no score could be calculated are designated as having no coverage.

Central Asia	East Asia	South Asia	Southeast Asia	The Pacific
		Full coverage		
Armenia	Mongolia	Afghanistan	Cambodia	Fiji
Azerbaijan	People's Republic of China	Bangladesh	Indonesia	Papua New Guinea
Georgia	Republic of Korea	Bhutan	Lao People's Democratic Republic	Vanuatu
Kazakhstan		India	Malaysia	
Kyrgyz Republic		Maldives	Myanmar	
Tajikistan		Nepal	Philippines	
Turkmenistan		Pakistan	Singapore	
Uzbekistan		Sri Lanka	Thailand	
			Viet Nam	
		Partial coverage		
	Hong Kong, China		Brunei Darussalam	Samoa
				Solomon Islands
				Tonga
				Federated States of Micronesia
				Kiribati
				Marshall Islands
				Palau
		No coverage		
	Taipei,China		Timor-Leste	Cook Islands
				Nauru
				Niue
				Tuvalu

Source: Authors.

REFERENCES

Canadian Index of Wellbeing. 2016. *How are Canadians Really Doing: THE 2016 CIW National Report.* Waterloo: Canadian Index of Wellbeing and University of Waterloo.

Coppedge, M., Gerring, J., Knutsen, C. H., Lindberg, S. I., Teorell, J., Altman, D., . . . Ziblatt, D. 2020. V-Dem [Country–Year/Country–Date] Dataset v10. Varieties.

Filmer, D., & Pritchett, L. H. 2001. India., Estimating wealth effects without expenditure data—or tears: an application to educational enrollments in states of. *Demography*, 115-132.

Global Burden of Disease Collaborative Network. 2018. *Global Burden of Disease Study 2017 (GBD 2017).* Seattle, United States: Institute for Health Metrics and Evaluation (IHME).

Kuznets, S. 1934. National Income, 1929-1931. *Senate Document*. United States of America: 73rd US Congress.

Manly, B. F., & Alberto, J. A. 2016. *Multivariate Statistical Methods, A Primer.* CRC Press.

OECD. 2011. *How's Life? Measuring well-being.* OECD Publishing.

Patrinos, H. A., & Angrist, N. 2018. *Global Dataset on Education Quality: A Review and Update (2000–2017).* The World Bank.

Reinsdorf, M. B. 2020. Measuring Economic Welfare: What and How? *Internation Monetary Fund Policy Paper*.

Stiglitz, J., Sen, A., & Fitoussi, J. 2009. *Report by the Commission on the Measurement.*

United Nations Development Programme. 1991. *Human Development Report.* New York.

World Bank. 2019. *Wold Development Indicators.* Washington, DC: World Bank.