Developing a Comprehensive Multidimensional Wellbeing Index Based on What People Value: An Application to a Middle-Income Country

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Abstract

We introduce a comprehensive policy-relevant measure of multidimensional wellbeing conceptually rooted in Amartya Sen's capability approach and applied to a middle-income country: the Multidimensional Wellbeing Index for Peru (MWI-P). We design and collect a specialized survey in Peru in late 2018, which included data on wellbeing achievements across 12 dimensions, on the value that respondents place upon each of these dimensions, and on self-perceived freedom. Then, we utilize this information to set the weighting structure and select a wellbeing sufficiency threshold for the MWI-P, which we estimate using the capability-inspired Alkire–Foster method. Our results show that only 45.9% of the sample population live above the wellbeing threshold, which involves achieving sufficiency in at least seven out of the 12 weighted dimensions of the MWI-P. Subgroup analyses reveal that rural populations, women, and older adults are at a disadvantage compared with urban populations, men, and younger adults, respectively. These subgroups' disparities hold valid if we introduce changes in the weighting structure or in the wellbeing sufficiency threshold. We argue that the MWI-P can inspire other low- and middle-income countries to reorient post-pandemic recovery policies from a focus on economic growth to a human flourishing approach based on what people value.

Keywords Capabilities · Amartya Sen · Multidimensional wellbeing · Alkire–Foster method · Values · Peru

Introduction

Amartya Sen's capability approach has been one of the main contributors to broadening the "space" in which researchers evaluate and measure wellbeing (Robeyns, 2017; White, 2016). Instead of focusing on utility, or resources, Sen

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(1979, 1993) proposed evaluating wellbeing with a focus on human functionings and capabilities. The "space" of functionings and capabilities comprises "doings" and "beings" that "people value" (Alkire, 2016). Then, capability-based wellbeing assessments constitute multidimensional, plural, and people-centered exercises (Alkire, 2002).

The capability approach has also served as the normative basis for the "human development paradigm" introduced by the United Nations Development Programme (UNDP) in 1990 (Fukuda-Parr, 2003). This alternative development approach not only proposed a change of focus from economic growth to "human flourishing" (UNDP, 2010), but also introduced a new multidimensional measure to assess progress at the global level: the human development index (HDI). The HDI emerged as a policy-friendly alternative to GDP and paved the way for an entire family of alternative measures of development, inequality, and poverty.

Although the HDI is subject to some limitations (Klugman et al., 2011), it "has inspired and fostered innovation in the measurement of well-being at the local, national and regional levels" (Dervis & Klugman, 2011; pp. 76) and has influenced other initiatives oriented toward assessing progress "beyond GDP" (Stiglitz et al., 2009; Stiglitz et al., 2018). Some examples at the international level are the Better Life Index (Organisation for Economic Co-operation and Development [OECD], 2020) and the Social Progress Index (Social Progress Imperative, 2020).

Following a similar pathway to the abovementioned international wellbeing indexes, other studies have devised country-level multidimensional wellbeing measures for application to low- and middle-income countries (LMICs) in Latin America (Canaviri, 2016; Férnandez & Gómez, 2019; Mero-Figueroa et al., 2020), Africa (Collomb et al., 2012; Heshmati et al., 2019), and Asia (Haq & Zia, 2013; Senasu et al., 2019; Van Phan & O'Brien, 2019). Nevertheless, the literature on indexes of wellbeing still centers mainly on high-income countries (HICs) (Elliott et al., 2017). Most of these measures, whether developed for HICs or LMICs, tend to rely on data-driven or statistical methods such as principal component analysis (PCA) or multiple correspondence analysis (MCA), among others.

There is, however, another growing body of literature on wellbeing measurement that, instead of relying on data-driven or statistical approaches, chooses to rely on methods that follow the so-called "axiomatic tradition" (Sen, 1976). This kind of measures satisfies a number of explicit principles and properties, some of which are desirable from an ethical and/or policy-relevant perspective (Alkire et al., 2015). One salient example of this kind of measures is the Gross National Happiness (GNH) index. In 2008, Bhutan introduced its GNH index, which encompasses a range of non-income dimensions, as an official measure of national wellbeing (Alkire, 2016). The country adapted it from the Alkire–Foster method (2011) (AF method), whose original form is currently the most used method of estimating multidimensional poverty at both the global and the country levels (UNDP & Oxford Poverty and Human Development Initiative [OPHI], 2019; Zavaleta et al., 2018).

Wellbeing indexes based on the axiomatic tradition have broadened the spectrum of alternative measures of wellbeing to GDP. Yet, most of them are subject to at

least one of the following three limitations: (i) they include a relatively narrow set of wellbeing dimensions, (ii) the weights they assign to each dimension does not explicitly reflect information on what people actually value as components of their own wellbeing or on how valuable they think these components are, and (iii) they exhibit some degree of arbitrariness in setting the criteria used to identify who lives in "wellbeing sufficiency" and who does not.

This study introduces a comprehensive measure of multidimensional wellbeing based on the axiomatic tradition and conceptually rooted in Sen's capability approach: the Multidimensional Wellbeing Index for Peru (MWI-P). We develop the MWI-P in three stages. First, we select 12 wellbeing dimensions based on the "Vision for Peru by 2050," which correspond to a national strategic long-term vision approved by consensus by the Peruvian National Agreement Forum (Acuerdo Nacional & Centro Nacional de Planeamiento Estratégico [CEPLAN], 2019). Second, we design and conduct a nationally representative specialized survey including three modules: (i) sociodemographic characteristics of the respondents, (ii) questions to evaluate respondent's wellbeing achievements in the set of dimensions we selected, and (iii) questions on the value each respondent assigns to each one of the dimensions included in the survey, as well as a question about self-perceived freedom. Third, we use this information to develop and estimate the MWI-P relying on the axiomatic-based counting method developed by Alkire and Foster (2011) inspired by Sen's capability approach.

The MWI-P reflects wellbeing achievements over 12 dimensions, which we operationalize using 30 indicators we design relying on the questions included in our survey. We set the weight of each dimension of the MWI-P based on the information on the value that respondents assign to the 12 dimensions we included in our survey. To select a wellbeing sufficiency threshold, we explore our data to identify respondents who perceived that they are "fairly" or "completely" free to decide how to live their lives, finding that, on average, these respondents achieve sufficiency in seven out of 12 weighted dimensions. In consequence, we choose to identify a person in "wellbeing sufficiency" if she achieves sufficiency in at least seven dimensions of the MWI-P.

We contribute to the literature on axiomatic-based indexes of multidimensional wellbeing in LMICs in three ways. First, our measure includes a broad set of dimensions and indicators that allows us to comprehensively diagnose wellbeing in an LMIC such as Peru. Given that we select these dimensions based on a consensual strategic long-term vision for this country, we argue that this is consistent with Sen (2004) who suggests that public reasoning plays a crucial role in selecting context-relevant sets of wellbeing dimensions. Second, we inform the selection of dimensional weights based on information on the importance survey respondents assign to each of these dimensions. We implement this weighting strategy to be consistent with the capability approach and reflect people's values since "weights might reflect the fundamental importance people place on each indicator [dimension]" (Alkire et al., 2015; pp. 212). Third, we set a multidimensional wellbeing threshold to identify those people who live in a situation of wellbeing sufficiency based on information about how much freedom they consider themselves to have to live their lives. This is also consistent with the capability approach since,

according to Sen (1993; pp. 33), the "freedom to lead different types of life" reflects a "person's capability set."

Overall, the general approach we adopt in this study to develop the MWI-P as a tool for evaluating wellbeing in a LMIC such as Peru has a series of advantages that are linked to the abovementioned contributions. In particular, we develop our measure relying on Amartya Sen's capability approach, which allows as to engage with a broader policy-narrative that have been influential in shaping current development initiatives at the global level, such as the Sustainable Development Goals agenda. Additionally, given that the MWI-P is based on the AF method which, in turn, correspond to the axiomatic tradition, it exhibits a series of properties that are relevant to inform policies aimed at triggering action. For instance, the MWI-P can be broken down by dimensions for policymakers to identify neglected wellbeing aspects that require urgent attention. Similarly, the MWI-P can be decomposed to identify subgroups of the population that have lower levels of wellbeing, and that are at risk of being "left behind". Finally, rooting the design of the MWI-P on "what people value" might strengthen its degree of public legitimacy which, in turn, can marshal political support for policies designed and implemented following the wellbeing diagnosis based on the MWI-P.

We justify focusing on Peru as a relevant case because it is a LMIC that, before the COVID-19 pandemic, exhibited remarkable macroeconomic performance along with significant levels of deprivation across basic non-income dimensions of wellbeing (Clausen, 2020; Deneulin & Clausen, 2019), some of which we include in our measure. In consequence, we argue that the MWI-P is a tool that can inspire the design of post-pandemic recovery policies in Peru and other LMICSs that go beyond fostering economic growth to focus on promoting human flourishing.

Literature Review

The HDI paved the way for a growing and diverse literature on indexes of multidimensional wellbeing and/or quality of life. Some of the most salient examples of such internationally comparable measures are the Better Life Index (OECD, 2020), the Social Progress Index (Social Progress Imperative, 2020; Stern et al., 2020), the Legatum Prosperity Index (Legatum Institute, 2020), the World Happiness Report (Helliwell et al., 2021), the Humanist Integral Ecology Index (Artavia, 2017), and the Happy Planet Index (Jeffrey et al., 2016).

Incorporating a broad set of dimensions in their construction, these indexes have helped expand the information used to evaluate aggregate wellbeing in different countries. They include not only dimensions of the HDI (health, education, standard of living) but also aspects related to subjective wellbeing, quality of employment, environmental conditions, social connectedness, security, governance, and mental health.

A limitation of most internationally comparable indexes is the difficulty in using large-scale individual-level datasets. On the contrary, this type of information is utilized by the literature on country-level multidimensional wellbeing indexes, which has focused on HICs (Elliott et al., 2017). However, a growing literature on LMICs (Canaviri, 2016; Collomb et al., 2012; Férnandez & Gómez, 2019; Haq & Zia, 2013;

Heshmati et al., 2019; Mero-Figueroa et al., 2020; Van Phan & O'Brien, 2019) has incorporated many of the aforementioned dimensions, used individual-level datasets, and relied on data-driven or statistical methods.

Another group of studies has also used individual-level datasets, but relied on the axiomatic tradition to design multidimensional wellbeing indexes. Notable among this literature focusing on LMICs is Bhutan's GNH index (Centre for Bhutan Studies and GNH Research, 2016), the study by Senasu et al. (2019) on Thailand, as well as the research of Benvin et al. (2016) on four Latin American countries. Another measure that could be included in this group of literature, albeit one applied to a HIC, is the trial Multidimensional Wellbeing Index for the UK proposed by Alkire and Kovesdi (2020). These four measures are based on the AF axiomatic method, which satisfies a series of policy-relevant properties, allowing the use of these metrics to inform the design of wellbeing-enabling public policies.

Developing a multidimensional wellbeing measure using the AF method involves making some decisions, including: (i) selecting the dimensions and indicators that the measure will incorporate, (ii) setting the weight (or relative importance) that each dimension of the measure will have, (iii) and selecting a threshold that reflects the minimum number of dimensions in which a persons should achieve sufficiency to be identified as living in a situation of "wellbeing sufficiency." The four abovementioned measures based on the AF method provide comprehensive justification for the first kind of decision related to the broad sets of dimensions they include. However, none of them inform their decisions related to the structure of dimensional weights or the wellbeing threshold using information on people's values. From a capability-based perspective, this can be considered as a limitation since, according to Sen (1992), the capability approach evaluates wellbeing with focus on the substantive freedom "to accomplish *what we value*" (pp. 31, the emphasis is ours).

To the best of our knowledge, the present study is the first to develop an axiomatic-based multidimensional wellbeing index that simultaneously adopts a method that satisfies policy-relevant properties, uses a broad set of dimensions, and assigns weights and a wellbeing threshold relying on survey-based information about how much people value certain dimensions of their lives and about self-perceived freedom, respectively. All these characteristics constitute the added value of the index we develop in this study.

Selecting Wellbeing Dimensions

The first step in our study involved selecting a set of wellbeing dimensions that are relevant for an LMIC such as Peru. We select a set of 12 dimensions (see Table 1) based on a preliminary version of the "Vision for Peru by 2050," which the National Agreement Forum later approved by consensus (Acuerdo Nacional & CEPLAN, 2019). This document introduced a national strategic long-term vision for Peru with a focus on the key areas the government should prioritize to enhance "human development throughout the entire Peruvian territory" (Acuerdo Nacional & CEPLAN, 2019; pp. 2). The process of reaching such a consensus encompassed a comprehensive and extensive multi-stage consultation conducted throughout

Table 1 Justification of the dimensions included in our dedicated survey on wellbeing in Peru

Dimension	Quotes from "Vision for Peru by 2050" (Acuerdo Nacional and CEPLAN 2019)
Health	"Access to high-quality public healthcare throughout the entire territory is universal, equitable, appropriate, and follows and intercultural approach. Healthy lifestyles and disease preventions are encouraged." (p. 3)
Education	"Public education guarantees equality of opportunities considering cultural, social, territorial and linguistic diversity in the country. Illiteracy has been eradicated. People have free and universal access to public preschool and public basic education." (p. 2)
Employment and social security	"We continue improving the quality of employment, reducing labor informality, and promoting adequate wages, working conditions, and access to social security to preserve people's dignity throughout their lifecycle." (p. 4)
Housing Basic facilities	"More households have access to adequate housing, drinking water, and sanitation." (p. 3)
Social connectedness	"Households' relationships are peaceful and respectful of the dignity and rights of their members." (p. 3) "We participate in the public life in an informed, ethical, responsible, and supportive way." (p. 4)
Living without shame and humiliation	"All forms of discrimination and social inequalities has been significantly reduced." (p. 2)
Environment	"Sustainable exploitation and management of the ecosystem involve stakeholders from each national territory. This guarantees a harmonious social and economic development that is free from contamination […]" (p. 3)
Empowerment	"Citizens are empowered and surveil governmental actions." (p. 5)
Sleep and recreation	"Our urban community life takes place in safe public spaces. These spaces are diverse gathering places for cultural, sport, leisure and recreational activities." (p. 3)
Security	"We live free from fear and violence. Internal order has been significantly strengthened, and public insecurity has been significantly reduced." (p. 4)
Citizenship and governance	"Citizens trust in public and privative institutions" (p. 5) "We are proud of our national identity as well of our national patrimony. We know our rights and duties." (p. 4) "We feel represented by a well-stablished political party system that participate in free and transparent elections that guarantee pluralism and alternance of power." (p. 4)

Source: Acuerdo Nacional and CEPLAN (2019). The translation is ours

the 25 Peruvian administrative regions. Overall, the entire process involved more than 3200 participants, including representatives of civil society, political parties, policymakers, experts, and academics (CEPLAN, 2019).

We argue that the dimensions we identified based on the "Vision for Peru by 2050" reflect enduring consensus on what constitutes key elements of human

wellbeing in Peru. We justify this not only because of the abovementioned extensive consultation process, but also because the National Agreement Forum is considered to be influential given the "moral power that results from the representativeness of [its] members […], from the characteristics of that which is agreed upon, and from the fact that it has been done by consensus" (Iguíñiz, 2015; pp. 12). In addition, this set of dimensions is consistent with the list of dimensions that Clausen (2019) developed based on the Peruvian Constitution, the Sustainable Development Goals agenda, and the multi-annual strategic plans of Peru's various sectorial ministries.

Dataset

Sampling Design

The second step in our research involved designing a specialized survey to collect information on the 12 dimensions we selected in the first step, on the value that respondents assign to each dimension, and on self-perceived freedom. This step was carried out in partnership with the Institute of Public Opinion (Instituto de Opinión Pública, IOP) and the Institute of Human Development of Latina America (Instituto de Desarrollo Humano de América Latina, IDHAL) at the Pontifical Catholic University of Peru (Pontificia Universidad Católica del Perú, PUCP). The survey's sampling framework was based on the 2007 Peruvian National Census by the Peruvian National Institute of Statistics (Instituto Nacional de Estadística e Informática del Perú, INEI). The sampling design for urban areas is as follows. First, we randomly selected 320 blocks from four urban geographic strata. Second, we selected a number of dwellings using a systematic sampling method. Third, we surveyed one individual aged 18 or over from each dwelling based on age and sex quotas. In rural areas, we randomly selected 240 villages, situated close to highways, from three rural geographic strata. Then, we selected individuals aged 18 or over from villages according to age and sex quotas. In total, enumerators interviewed 2800 individuals: 1600 from urban areas and 1200 from rural areas.

The survey was collected in late 2018 and covered 21 out of the 25 Peruvian administrative regions. The group of provinces included in the sample accounts for 76.5% of the Peruvian population aged 18 and over. It was not possible to include the country's remaining provinces in the survey because of logistical and budget constraints. This might represent a limitation of the dataset since some of these areas are among the most disadvantaged and least vehicle-accessible Andean or Amazonian territories in Peru (INEI, 2020). This survey is representative of the population aged 18 and over in the provinces that comprise the 21 regions included in our survey. All our estimates used survey weights to reflect the structure of this population.

On a scale of 1 to 12, where 1 means "not important at all" and 12 means "absolutely important", how important are the following aspects to you?
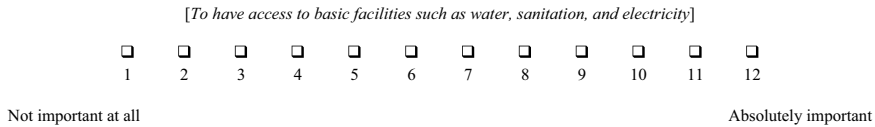
[*To have access to basic facilities such as water, sanitation, and electricity*]

❏	❏	❏	❏	❏	❏	❏	❏	❏	❏	❏	❏
1	2	3	4	5	6	7	8	9	10	11	12

Not important at all   Absolutely important

Fig. 1 Survey question on the value each respondent assigns to the dimension of "basic facilities". Source: 2018 IOP and IDHAL's survey

Survey Modules

To develop our survey questionnaire[1] we used a range of questions included in the INEI's 2017 Peruvian National Household Survey (INEI, 2018) as well as questions systematized by the Oxford Poverty and Human Development Initiative as part of its project on the Missing Dimensions of Poverty Data (Diprose, 2007; Ibrahim & Alkire, 2007; Lugo, 2007; Samman, 2007; Zavaleta, 2007; Zavaleta et al., 2014). We also included other questions from the Latin America Public Opinion Project (Cohen et al., 2017), the National Statistics Institute's 2015 Chilean Socioeconomic Characterization Survey (Instituto Nacional de Estadística de Chile [INE], 2016), the National Administrative Department of Statistics' 2008 Colombian Quality of Life Survey (Departamento Administrativo Nacional de Estadística de Colombia [DANE], 2009), and the INEI's 2010 Peruvian National Time Use Survey (INEI, 2011).

Our survey also included a module to capture the importance people assign to each of the 12 dimensions of wellbeing included in the survey. This module followed an ordinal scale valuation approach (Esposito & Chiappero-Martinetti, 2019). Specifically, the enumerators asked respondents to indicate how important each dimension was to them by way of a 12-step ladder scale, whose first step indicated that a dimension was "not important at all" and whose 12th step corresponded to an "absolutely important" dimension (see Fig. 1 for an example applied to the dimension of basic facilities). Each respondent provided information using a different 12-step ladder scale for each dimension. Hence, respondents were not forced to rank one dimension as more important than the others, allowing them to place equal importance on all the dimensions if they opted to do so.

Finally, we also added a question on self-perceived freedom that we later used to set the multidimensional wellbeing threshold of the MWI-P. This corresponds to one of the questions of the basic psychological needs short-form scales based on Ryan and Deci's (2000) self-determination theory which was included in the review of measures of psychological and subjective wellbeing by Samman (2007) (see Fig. 2).

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[1] We include a shortened version of the questionnaire translated from Spanish to English which only contains the 101 questions that we used to develop the 30 indicators of the MWI-P in Online Resource 1. The full survey questionnaire in Spanish as well as the dataset are available upon request.

How true is the following statement for you? "I feel free to decide for myself how to lead my life"

❏	❏	❏	❏
Not at all true	Somewhat true	Fairly true	Completely true

Fig. 2 Survey question on self-perceived freedom. Source: Samman (2007; pp. 465) based on Ryan and Deci (2000)

The Alkire Foster Method Applied to Wellbeing Measurement

In this study, we follow previous applications of the AF method used to calculate multidimensional wellbeing indexes (Alkire & Kovesdi, 2020; Centre for Bhutan Studies and GNH Research, 2016). First, we define a set of $d = 30$ indicators of wellbeing grouped into the 12 dimensions of the MWI-P. For each of these indicators, $I_{ij} = 1$ if individual i satisfies a criterion of sufficiency we set (see third column in Table 2 in section Design of the MWI-P, below) and $I_{ij} = 0$ otherwise, where $i = 1, \ldots, n$ and $j = 1, \ldots, 30$. Then, we define a set of weights for each of the indicators, w_j. In this way, we calculate a "sufficiency score" for individual i, defined as the weighted sum of the sufficiency indicators: $c_i = \sum_{j=1}^{30} w_j * I_{ij}$. In addition, we establish a "wellbeing threshold," k, that allows us to identify whether an individual is in a situation of wellbeing sufficiency ($c_i \geq k$) or wellbeing insufficiency ($c_i < k$).

The AF method allows us to aggregate this individual information into a set of wellbeing measures. The first is the "wellbeing headcount ratio," H, which is the proportion of people in a situation of wellbeing sufficiency. The second is the "average sufficiency" of people in wellbeing insufficiency, A, which is the average value of c_i of those individuals i for which $c_i < k$. Finally, $MWI\text{-}P = H + (1 - H) * A$, where the MWI-P takes values between 0 and 1; here, a higher value reflects greater wellbeing in society. By including $(1 - H) * A$ as part of the MWI-P, this index satisfies the axiom of "dimensional monotonicity" (Alkire & Foster, 2011). This means that, unlike H, the MWI-P increases not only when there is a larger number of people in a situation of wellbeing sufficiency, but also when people who live in wellbeing insufficiency improve their situation by getting closer to the wellbeing threshold (k). We present the estimates of H, A, and the MWI-P at the national level and disaggregated by area of residence (urban/rural), sex (male/female), and age group (young people aged 18 to 29/adults aged 30 to 59/older adults aged 60 or over).

In addition, as the MWI-P satisfies the subgroup decomposition property, we present the contribution of the abovementioned subgroups to the index to explore potential patterns in wellbeing disparity in the population. We also take advantage of the dimensional breakdown property to explore the contribution of sufficiency in each dimension to the MWI-P for the entire sample and for each of the subgroups. Complimentarily, we estimate the measure M_0 (Alkire, 2016), which we interpret in the context of this research as a "multidimensional illbeing index." This measure corresponds to the percentage of people who do not meet the multidimensional wellbeing threshold multiplied by the average multidimensional insufficiency of these people. We also present the contribution of insufficiency in each dimension to M_0.

Table 2 Dimensions, indicators, and sufficiency criteria of the Multidimensional Wellbeing Index for Peru (MWI-P)

Dimension	Indicator	Sufficiency criteria
Health	Medical attention	The person did not have a health problem (symptoms or discomfort, illness, relapse of chronic illness, accident) in the last four weeks and reports that she would be able to access healthcare if she became ill; or she did have a health problem and received medical attention at a health center operated by the Ministry of Health, a health center operated by a Local Health Administration Committee, a health center or polyclinic pertaining to the social health system (EsSalud), a hospital operated by the Ministry of Health, an EsSalud hospital, a hospital pertaining to the armed forces and/or national police force, a private surgery, or a private clinic
	Health insurance	The person is affiliated with some form of health insurance (other than the non-contributory Comprehensive Health Insurance [SIS])
Education	Educational attainment	The person is at least 18 years old and has completed secondary school
	School attendance	In the household, there are no children or adolescents aged between 6 and 17 who have not yet completed school but do not currently attend school
Employment and social security	Employment	The person works, is not time-related underemployed (works fewer than 35 h per week, but wants to work more hours and is available to do so), receives payment and works in good conditions (she has adequate protection for the type of work she does, she does not work on public roads, she has access to drinking water, she has access to adequate toilet facilities); or the person does not work but did not want to work, or she did want to work but was not available to do so, and she is not an unpaid domestic worker
	Social security	The person is between 18 and 64, is affiliated with a pension system, and makes regular contributions; or the person is 65 or older and, over the last six months, she received a pension, or reports that she would receive a pension if she were to retire

Table 2 (continued)

Dimension	Indicator	Sufficiency criteria
Housing	Housing materials	The walls (brick or cement block, stone or ashlar with lime or cement, wood), floors (parquet or polished wood, asphalt sheet, vinyl or similar, tiles, terrazzo or similar, wooden boards, cement), and roof (reinforced concrete, wood, tiles, corrugated iron, cement fiber, Eternit or similar) comprise suitable materials
	Housing tenure	The person rents or owns the house she lives in and has title deeds duly registered with SUNARP, the Peruvian public registry
	Overcrowding	There are fewer than three household members per room (not counting the bathroom, kitchen, hallway, or garage)
Basic facilities	Water and sanitation	The house has connections to the public water network and has 24-h access to water every day, and the toilet has connections to the public sewerage network
	Energy	The house has an electricity supply every day at all hours. In addition, it uses no polluting fuel (kerosene, charcoal or coal, firewood, dung or manure, agricultural waste, reeds, shrubs, or other unidentified types of fuel) for cooking
	Communication technology	The household has access to a telephone of some kind (landline, basic mobile phone, or mobile phone with Internet/smartphone) and Internet
Social connectedness	Financial support	The person has relatives or friends who can support her, for example, through financial assistance
	Care support	The person has trusted individuals to whom she can entrust the care of her children, elderly parents, or a sick relative if needed
	Emotional support	The person has someone she can talk to about personal matters
Living without shame and humiliation	Freedom from discrimination	The person feels that no other person has discriminated against her in the last three months
	Freedom from shame	The person rarely or never feels shamed, ridiculed, repressed/afraid to speak out or act, humiliated, stupid, that people treat her like a child, or that people make fun of her
	Fair and respectful treatment	The person feels that other people always treat her with respect and fairly

Table 2 (continued)

Dimension	Indicator	Sufficiency criteria
Environment	Pollution-free environment	In the last 12 months, the person has not experienced or witnessed frequently any of the following: air pollution or bad smells; the contamination of rivers, canals, or lakes; water contamination from the public sewerage network; or the accumulation of garbage on the streets, roads, pavements, or public spaces
	Protection from environmental shocks	In the last 12 months, droughts, torrential rain, pests, floods, *huaycos* (mudslides and flash floods), frosts, and earthquakes have not significantly affected the person, any member of her household, or any of her belongings
Empowerment	Power to improve personal situation	The person feels that she could make important changes to improve her personal situation if she wanted to, whether very easily, easily, or with difficulty. (1)
	Power to improve family's situation	The person feels that she could make important changes to improve her family's situation if she wanted to, whether very easily, easily, or with difficulty. (2)
	Power to improve community's situation	The person feels that she could make important changes to improve her community's situation if she wanted to, whether very easily, easily, or with difficulty. (3)
Sleep and recreation	Sleep	The person slept for at least seven hours every day over the last week
	Free time and recreational activity	Over the last week, the person had at least one hour of free time every day or spent at least one hour every day doing recreational activities

Table 2 (continued)

Dimension	Indicator	Sufficiency criteria
Security	Freedom from victimization	In the last 12 months, the person and any members of her household were not victims of any of the following situations: i) someone entered their house or room without permission and stole or tried to steal something; ii) someone stole something from them, such as a mobile phone, animals, crops, a vehicle or parts of a vehicle, a motorcycle, and machinery; iii) someone assaulted, hit, pushed, kicked, or inflicted any other form of physical violence on them inside or outside their home without a weapon; iv) someone assaulted, hit, injured, burned, or inflicted any other form of physical violence on them inside or outside their home with a weapon other than a firearm (e.g. bottle, glass, knife, brass knuckles, liquid, or rope); v) someone assaulted, injured, or inflicted any other form of physical violence inside or outside the home with a firearm
	Community safety	In the last 12 months, none of the following situations have occurred in the person's neighborhood, village, or community: i) someone entered a neighbor's house or room without permission and stole or tried to steal something; ii) someone stole something from you one of your neighbors such as a smartphone, animals, crops, a vehicle or parts of a vehicle, a motorcycle, and machinery; iii) someone assaulted, hit, injured, burned, or inflicted any other form of physical violence on a neighbor within the neighborhood/village/community; iv) there have been shootings or fights that have resulted in serious injuries or damage to neighbors' property
	Freedom from the fear of crime	In the last 12 months, the person has not experienced any of the following situations for fear of being a victim of crime: i) avoided going out at night alone; ii) avoided leaving the house empty at night, iii) avoided buying things such as a mobile phone, footwear, watch, jacket, or cap because they might be stolen; iv) stopped the children in her household from playing in the street; v) stopped her young children from going to school out of fear for their safety; vi) felt the need to change neighborhood/village/settlement because of the fear of crime; vii) changed her job or place of study because of the fear of crime

Table 2 (continued)

Dimension	Indicator	Sufficiency criteria
Citizenship and governance	Trust in institutions	The person has a lot of or some trust in the district municipality, the provincial municipality, the regional government, the national police force, the armed forces, the judiciary, Congress, and the presidency. (4)
	Perception of civil liberties	The person believes that there is sufficient freedom of press, freedom of speech, freedom to express political opinions without fear, and protection of human rights

Notes:

(1) We consider that a person does not satisfy the sufficiency criterion in this indicator if (i) she feels that she could make important changes to improve her personal situation with great difficulty or (ii) she feels she could not make any important change at all

(2) We consider that a person does not satisfy the sufficiency criterion in this indicator if (i) she feels that she could make important changes to improve her family's situation with great difficulty or (ii) she feels she could not make any important change at all

(3) We consider that a person does not satisfy the sufficiency criterion in this indicator if (i) she feels that she could make important changes to improve her community's situation with great difficulty or (ii) she feels she could not make any important change at all

(4) We consider that a person does not satisfy the sufficiency criterion in this indicator if she has little or no trust in the district municipality, the provincial municipality, the regional government, the national police force, the armed forces, the judiciary, Congress, or the presidency

Design of the MWI-P

Indicators of Wellbeing Achievement

The third step of our research involved using the information from our specialized survey to design and estimate a multidimensional wellbeing index for Peru (MWI-P) relying on the AF method. The MWI-P has 30 indicators grouped into 12 dimensions: (i) "health" (two indicators), (ii) "education" (two indicators), (iii) "employment and social security" (two indicators), (vi) "housing" (three indicators), (v) "basic facilities" (three indicators), (vi) "social connectedness" (three indicators), (vii) "living without shame and humiliation" (three indicators), (viii) "environment" (two indicators), (ix) "empowerment" (three indicators), (x) "sleep and recreation" (two indicators), (xi) "security" (three indicators), and (xii) "citizenship and governance" (two indicators).

Additionally, we corroborated that the dimensions we selected and included in our survey are, indeed, valued by the respondents. Specifically, we found that more than 60% of respondents placed the 12 dimensions in the 11th or 12th steps of importance. Table 2 presents the dimensions and indicators as well as describes the sufficiency criteria we set for each indicator of the MWI-P.[2]

To test for potential redundancy between the 30 indicators, we follow Santos and Villatoro (2018) and Hwang and Nam (2020) and estimate Cramér's V correlation coefficients. Our results suggest a low association between indicators (most values are below 0.25; see Appendix 1).

Dimensional Weights

Setting dimensional weights for wellbeing indexes remains an open field of research (Alkire, 2018). According to Decancq and Lugo (2013), weights can be set based on three approaches: (i) data-driven, (ii) normative, and (iii) hybrid weighting. Recent research has shown that some data-driven approaches based on endogenous weights might violate important axioms such as dimensional monotonicity (Dutta et al., 2021). In turn, Greco (2018) developed a capability-based multidimensional wellbeing measure for women in a rural district of Malawi (Women's Capability Index for Malawi) using different weighting schemes: data-driven (based on principal component analysis), normative (based on focus-group consensuses on the values of the dimensions), hybrid (based on individual-level survey information on dimensional importance rankings), and equal weights. Another significant recent contribution to this field is the study by Esposito and Chiappero-Martinetti (2019), who used the budget allocation technique to set weights based on information from a non-statistically representative sample administered in the Dominican Republic.

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[2] We acknowledge that some of the questions included in the MWI-P rely on different recall periods. However, we decided to keep the original form of these questions since they correspond to instruments included in survey modules that have already been validated in such form (see first paragraph in Survey Modules subsection).

To set the weights for the MWI-P, we rely on one specific kind of hybrid weighting approach: the ordinal scale valuation approach. We acknowledge that this might be subject to certain limitations such as individual and cultural biases in the ordinal scales, independence of the valuation of each dimension, and potential inaccuracy in the reported scores (Esposito & Chiappero-Martinetti, 2019; pp. S208). Nonetheless, we argue that it constitutes a meaningful contribution given that, unlike most previous research, our information on the 30 indicators of wellbeing achievement and the self-stated values people assign to each of the 12 dimensions of the MWI-P comes from the same dataset. This allows us to account for respondents' wellbeing achievement in each dimension (that we evaluate using the 30 indicators and the sufficiency criteria we set in Table 2 in subsection Indicators of Wellbeing Achievement) alongside the importance they assign to each of said dimensions.

We calculate dimensional weights using information on the abovementioned 12-step ladder scales included in the survey. We define s_{ij} as the number assigned to the position (step) individual i assigns to dimension j on the 12-step ladder scale. Then, we calculate the relative value of dimension j for individual i as $\omega_{ij} = \frac{s_{ij}}{\sum_{j=1}^{12} s_{ij}}$, which implies that $\sum_{j=1}^{12} \omega_{ij} = 1$ (or 100%). This kind of normalization allows us to interpret ω_{ij} as the relative weight of dimension j for individual i (Hsieh, 2004), thereby overcoming the problem of "individual scale bias" (Esposito & Chiappero-Martinetti, 2019; pp. S210). Finally, we compute the dimensional weights of the MWI-P as the average value of the individual relative values for all respondents, $w_j = \frac{1}{n}\sum_{j=1}^{n} \omega_{ij}$, which implies that $\sum_{j=1}^{12} w_j = 1$ (or 100%). We call this group of weights "Set I."[3] In addition, to check for robustness we show results using two alternative sets of weights: equal weights for each dimension (Set II) and different sets of weights for each respondent i in which the weight of dimension j is directly equal to ω_{ij} (Set III). Table 3 shows the weights of each dimension according to Sets I and II as well as the standard deviations and the minimum and maximum values for Set III. For all three sets, we distribute the weight assigned to each dimension equally among the indicators utilized to operationalize these dimensions.

Multidimensional Wellbeing Threshold

The AF method (sometimes called "dual cutoff" method) also involves selecting a multidimensional wellbeing threshold (k) that, in this application, corresponds to the minimum number of weighted dimensions in which an individual must meet sufficiency (according to the criteria we set in Table 2, above) to be considered in a situation of sufficient wellbeing. Specifically, using Set I, the MWI-P identifies a person as living in wellbeing sufficiency if $c_i \geq 57.6\%$ (see Table 3), which is approximately equivalent to experiencing sufficiency in at least seven weighted dimensions. To set this parameter, we rely on a similar approach to that of Angulo et al. (2011), who

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[3] We also use this formula to calculate different sets of weights for different subgroups of our survey such as men, women, urban and rural populations, and different age-groups. However, we did not find considerable differences between the weights calculated for each of these subgroups (see Appendix 2).

Table 3 Dimensional weights and wellbeing thresholds of the Multidimensional Wellbeing Index for Peru (MWI-P); Sets I, II, and III

Dimension	Set I	Set II	Set III
Health	8.5%	8.3%	Std. Dev.: 0.7% Min: 1.1% Max: 16.7%
Education	8.3%	8.3%	Std. Dev.: 0.9% Min: 0.8% Max: 14.1%
Employment and social security	8.4%	8.3%	Std. Dev.: 0.8% Min: 0.8% Max: 14.0%
Housing	8.3%	8.3%	Std. Dev.: 1.1% Min: 0.8% Max: 47.8%
Basic facilities	8.4%	8.3%	Std. Dev.: 0.8% Min: 0.9% Max: 27.8%
Social connectedness	8.1%	8.3%	Std. Dev.: 1.0% Min: 0.8% Max: 29.0%
Living without shame and humiliation	8.3%	8.3%	Std. Dev.: 0.9% Min: 0.8% Max: 13.3%
Environment	8.4%	8.3%	Std. Dev.: 0.7% Min: 2.1% Max: 14.3%
Empowerment	8.3%	8.3%	Std. Dev.: 0.8% Min: 0.9% Max: 21.9%
Sleep and recreation	8.1%	8.3%	Std. Dev.: 1.1% Min: 0.8% Max: 25.8%
Security	8.4%	8.3%	Std. Dev.: 0.7% Min: 1.3% Max 13.5%
Citizenship and governance	8.4%	8.3%	Std. Dev.: 0.7% Min: 1.7% Max: 14.3%
Wellbeing threshold (k)	57.6%	57.8%	57.6%

Source: Authors' calculations based on 2018 IOP and IDHAL's survey

used information on self-perceived poverty to inform their selection of a multidimensional poverty threshold for the official national multidimensional poverty index for Colombia. We set k based on the average value of the sufficiency score (c_i) of respondents who answered that it was "fairly or completely true" that they "feel like [they are] free to decide for [themselves] how to live [their] lives" (Samman, 2007; pp. 465). This question reflects one aspect of human autonomy, and it is part of the basic psychological needs short-form scales based on the self-determination theory
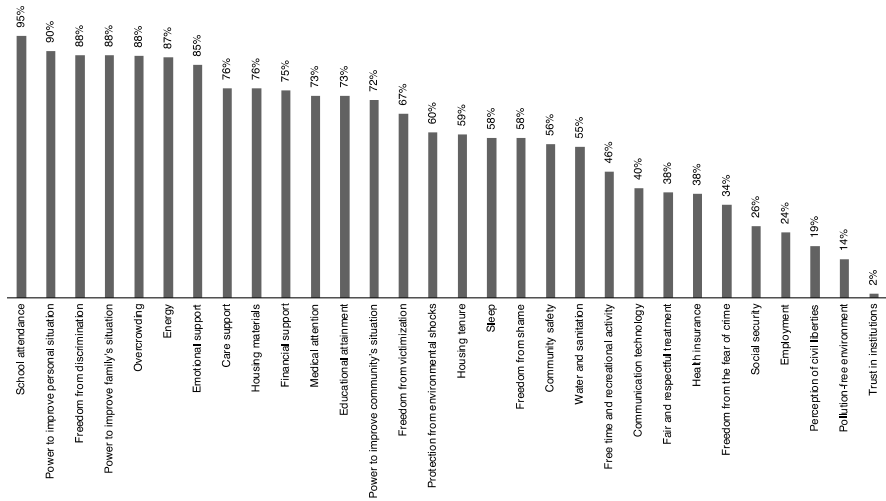
Fig. 3 Uncensored headcount ratios by indicator for the entire sample. Source: Authors' calculations based on 2018 IOP and IDHAL's survey

(Ryan & Deci, 2000). We argue that this way of setting a wellbeing threshold is consistent with the capability approach since it considers information on the "freedom to live different types of life" that reflects a "person's capability set" (Sen, 1993; pp. 33). Table 3 also shows the results for Set II ($k = 57.8\%$) and Set III ($k = 57.6\%$).

Results

The uncensored headcount ratios show low levels of sufficiency (see Fig. 3). For instance, 16 out of the 30 indicators of the MWI-P present an incidence of sufficiency below 60%. Moreover, all the indicators corresponding to the dimensions of "citizenship and governance," "environment," "employment and social security," and "sleep and recreation" are in this group. Appendix 3 shows that the distributions of the incidences of wellbeing sufficiency by indicator differ between groups by area of residence, sex, and age. Individuals who live in urban areas present higher incidences of sufficiency than their rural peers in 21 indicators. Men exhibit advantages in 10 indicators over women, who, in turn, prove better off only in the "sleep" indicator. In addition, young people (aged 18–29 years) have a higher incidence of sufficiency in 10 indicators compared with adults (aged 30–59 years) and in 12 indicators compared with older adults (60 years and over).

Table 4 presents the results of the wellbeing headcount ratio (H), the average sufficiency of people in wellbeing insufficiency (A), and values for the MWI-P. We estimate these three measures using Sets I, II, and III for both the entire sample and all the subgroups analyzed. Nationwide, the values of H range between 45.7% (Set III) and 45.9% (Sets I and II); those of A, between 45.9% (Set III) and 46.1% (Set II); and those of the MWI-P, between 0.707 (Set III) and 0.708 (Sets I and II). The

Table 4 Wellbeing headcount ratio (H), average sufficiency for people in wellbeing insufficiency (A), and the Multidimensional Wellbeing Index for Peru (MWI-P); Sets I, II, and III; entire sample and subgroups

		H			A			MWI-P			Population size
		Set I	Set II	Set III	Set I	Set II	Set III	Set I	Set II	Set III	
All		45.9% (1.86%)	45.9% (1.86%)	45.7% (1.86%)	46.0% (0.31%)	46.1% (0.31%)	45.9% (0.31%)	0.708 (0.010)	0.708 (0.010)	0.707 (0.010)	2,796
Area	Urban (1)	51.0% (2.13%)	51.0% (2.13%)	50.8% (2.14%)	47.1% (0.37%)	47.2% (0.37%)	47.0% (0.37%)	0.740 (0.012)	0.741 (0.012)	0.739 (0.012)	2,422
	Rural (2)	12.9% (1.31%)	12.9% (1.31%)	12.5% (1.26%)	42.1% (0.54%)	42.3% (0.54%)	42.2% (0.53%)	0.496 (0.010)	0.497 (0.010)	0.494 (0.010)	374
	Difference (1)—(2)	38.02***	38.02***	38.31***	4.96***	4.92***	4.81***	0.24***	0.24***	0.25***	
Gender	Men (1)	48.9% (2.09%)	48.9% (2.09%)	48.3% (2.08%)	46.4% (0.38%)	46.5% (0.38%)	46.4% (0.37%)	0.726 (0.011)	0.727 (0.011)	0.723 (0.011)	1,352
	Women (2)	43.0% (2.25%)	43.0% (2.25%)	43.3% (2.23%)	45.7% (0.37%)	45.8% (0.37%)	45.5% (0.38%)	0.691 (0.012)	0.691 (0.012)	0.691 (0.012)	1,444
	Difference (1)—(2)	5.83**	5.83**	4.96**	0.73*	0.73*	0.86**	0.04***	0.04***	0.03***	
Age group	18–29 (1)	53.5% (2.30%)	53.5% (2.30%)	53.3% (2.37%)	47.2% (0.47%)	47.4% (0.47%)	47.1% (0.49%)	0.755 (0.012)	0.756 (0.012)	0.753 (0.013)	816
	30–59 (2)	42.9% (2.29%)	42.9% (2.29%)	42.7% (2.28%)	46.2% (0.37%)	46.4% (0.37%)	46.2% (0.37%)	0.693 (0.012)	0.694 (0.012)	0.692 (0.012)	1,505
	60 + (3)	42.1% (3.59%)	42.1% (3.59%)	42.3% (3.63%)	43.6% (0.69%)	43.7% (0.70%)	43.4% (0.70%)	0.673 (0.021)	0.674 (0.021)	0.673 (0.021)	475
	Difference (1)—(2)	10.63***	10.63***	10.53***	0.97*	1.02*	0.87	0.06***	0.06***	0.06***	
	Difference (1)—(3)	11.40***	11.40***	10.99***	3.65***	3.72***	3.67***	0.08***	0.08***	0.08***	
	Difference (2)—(3)	0.78	0.78	0.46	2.68***	2.70***	2.80***	0.02	0.02	0.02	

(i) *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. (ii) Standard errors in parentheses

Source: Authors' calculations based on 2018 IOP and IDHAL's survey

Table 5 Contribution of each subgroup to the Multidimensional Wellbeing Index for Peru (MWI-P); Set I

Subgroup		Share of the population	Subgroup contribution to MWI-P
Area	Urban	86.6%	90.6%
	Rural	13.4%	9.4%
Gender	Men	48.3%	49.6%
	Women	51.7%	50.4%
Age group	18–29	29.2%	31.1%
	30–59	53.8%	52.7%
	60+	17.0%	16.2%

Source: Authors' calculations based on 2018 IOP and IDHAL's survey

analysis of the three metrics for Sets I, II, and III consistently suggests that the urban population, men, and young people enjoy greater levels of wellbeing than rural populations, women, and adults or older adults, respectively.

Using the subgroup decomposition property of the MWI-P (Set I), Table 5 shows patterns of disparity in the wellbeing distribution that are similar to those described above. The contributions to the MWI-P of the urban population, men, and young people are greater than their respective population shares, leaving these subgroups overrepresented among those living in wellbeing sufficiency. The results hold if we utilize Sets II and III (see Appendix 4).

Table 6 presents the contribution of the 12 dimensions to the MWI-P (wellbeing measure) and M_0 (illbeing measure) estimated using the Set I specification, with data for the entire sample and for all the subgroups analyzed. Sufficiency in the dimensions of "education" (10.2%), "empowerment" (10.2%), "housing" (9.5%), and "social connectedness" (9.4%) contribute the most to the MWI-P across the sample, whereas insufficiency in "citizenship and governance" (14.6%), "employment and social security" (13.9%), "environment" (11.4%), and "health" (9.6%) contribute the most to M_0.

The dimensional breakdown by subgroup shows the existence of major heterogeneities in the dimensional composition of both wellbeing and illbeing by area of residence and age. Specifically, while the four dimensions that contribute the most to the MWI-P for the urban population are the same as those for the entire sample, the four most important dimensions for the MWI-P in rural areas are "empowerment" (12.3%), "security" (11.8%), "education" (11.6%), and "social connectedness" (11.6%). Another difference is that the "security" dimension makes a greater contribution to M_0 for the urban population (9.8%) than it does for the overall population (8.7%), whereas the contribution to M_0 of the "basic facilities" dimension is greater for the rural population (12.5%) than for the total population (8.5%).

When it comes to the dimensional breakdown by age, no marked distinctions are apparent. However, although the four dimensions that contribute the most to the MWI-P for young people, adults, and older adults are the

Table 6 Dimensional breakdown of the Multidimensional Wellbeing Index for Peru (MWI-P) and of the Multidimensional Illbeing Index (M_0); Set I; entire sample and subgroups

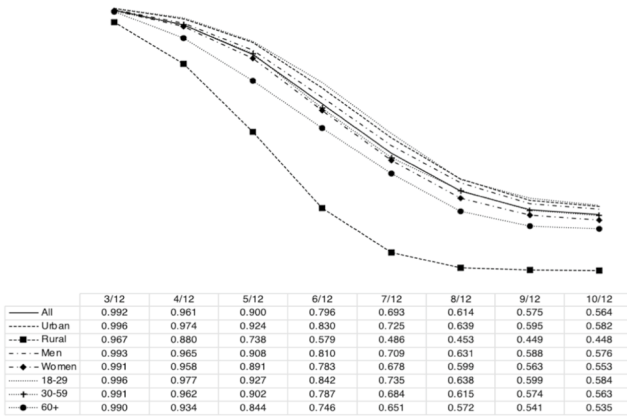| Dimension	All		Area				Gender				Age group					
			Urban		Rural		Men		Women		18–29		30–59		60+	
	MWI-P	M_0	MWI-P	M_0	MWI-P	M_0	MWI-P	M_0	MWI-P	M_0	MWI-P	M_0	MWI-P	M_0	MWI-P	M_0
Health	8.1%	9.6%	8.1%	9.7%	7.8%	9.2%	8.0%	9.9%	8.2%	9.2%	8.0%	10.2%	8.1%	9.5%	8.4%	8.8%
Education	10.2%	3.7%	10.1%	3.3%	11.6%	5.1%	10.3%	3.0%	10.1%	4.3%	10.4%	2.0%	10.5%	3.5%	9.3%	6.4%
Employment and social security	6.1%	13.9%	6.4%	14.2%	3.7%	13.0%	6.4%	13.6%	5.8%	14.1%	6.4%	14.5%	5.9%	14.0%	6.2%	12.8%
Housing	9.5%	5.4%	9.6%	4.5%	8.2%	8.4%	9.3%	5.5%	9.6%	5.3%	9.1%	5.9%	9.6%	5.3%	9.9%	5.1%
Basic facilities	8.4%	8.5%	8.8%	7.3%	4.3%	12.5%	8.4%	8.6%	8.5%	8.4%	8.4%	8.5%	8.5%	8.4%	8.2%	8.8%
Social connectedness	9.4%	4.9%	9.2%	5.0%	11.6%	4.7%	9.4%	4.8%	9.5%	5.0%	9.6%	3.4%	9.4%	5.3%	9.3%	5.8%
Living without shame and humiliation	8.7%	7.3%	8.5%	7.5%	10.2%	6.3%	8.6%	7.3%	8.7%	7.2%	8.3%	8.1%	8.8%	6.9%	8.8%	7.1%
Environment	7.2%	11.4%	7.3%	11.5%	5.6%	11.1%	7.2%	11.7%	7.2%	11.2%	7.3%	11.7%	7.0%	11.5%	7.2%	10.8%
Empowerment	10.2%	3.6%	10.0%	3.4%	12.3%	4.4%	10.1%	3.6%	10.4%	3.7%	9.9%	3.4%	10.6%	3.0%	9.5%	5.8%
Sleep and recreation	8.0%	8.3%	7.8%	8.9%	9.8%	6.4%	7.9%	8.6%	8.1%	8.0%	8.3%	7.5%	7.7%	8.9%	8.3%	7.5%
Security	8.3%	8.7%	8.0%	9.8%	11.8%	5.2%	8.4%	8.6%	8.3%	8.9%	8.1%	9.6%	8.2%	9.0%	9.1%	7.1%
Citizenship and governance	5.9%	14.6%	6.2%	14.9%	3.1%	13.7%	6.1%	14.7%	5.7%	14.6%	6.3%	15.1%	5.7%	14.7%	5.8%	13.9%

Source: Authors' calculations based on 2018 IOP and IDHAL's survey

same, "education" (10.4%) makes the largest contribution for the first group, "empowerment" (10.6%) for the second, and "housing" (9.9%) for the third. We find no significant differences in the dimensional compositions of the MWI-P or in M_0 between men and women. All these results prove similar when we use Set II (see Appendix 5). We cannot present the dimensional contributions using Set III because the dimensional breakdown property requires an assumption that the weights are equal for all the individuals in the sample.
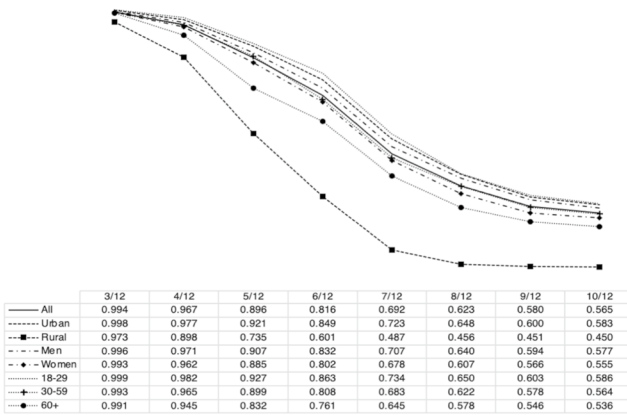
To analyze the degree of robustness of the MWI-P, in Fig. 4 we follow Santos et al. (2015), to illustrates to what extent our main results hold valid if we change the value of k for the weights of Sets I (Panel 1), II (Panel 2), and III (Panel 3). This figure presents the results for a relevant range of values of k from 3/12 to 10/12. In general, in line with the results presented above, the urban population, men, and young people sustain the highest levels of wellbeing in comparison with the rural population, women, adults, and older adults. The gaps between the urban and rural populations, between young people and adults, and between young people and older adults are statistically significant at conventional levels for the entire range of values of k presented, regardless of the set of weights used. The gaps between men and women are statistically significant at conventional levels from $k = 5/12$ to $k = 10/12$ for all the sets of weights used. We identify the statistical significance of the gaps using t-tests.

In addition, also following Santos and Villatoro (2018), we explore the identification robustness of the MWI-P (Table 7). This shows, for the entire sample and the subgroups, the percentage of people consistently identified as living in wellbeing sufficiency in the three sets simultaneously ("consistent") as well as the percentage of people identified as living in wellbeing sufficiency in just one of the three sets ("inconsistent"). The proportion of inconsistent cases is 1.4% for the total sample and no more than 2.1% for the subgroups analyzed, which shows that the estimates are robust to the three specifications presented. Moreover, we explore the identification robustness for each pair of sets (Sets I and II, Sets I and III, and Sets II and III). Table 7 also shows, for each pair of sets, the percentage of people identified as living in wellbeing sufficiency by both sets simultaneously ("consistent") and the percentage of people identified as living in wellbeing sufficiency by just one of the two sets ("inconsistent"). Sets I and II identify the same population as living in a situation of wellbeing sufficiency. Inconsistent cases in both Sets I and III and Sets II and III are 1.4% for the total sample and no more than 2.1% for the subgroups analyzed. Overall, these results show that the MWI-P is a highly robust measure.

1 MWI-P; Set I; from $k = 3/12$ to $k = 10/12$

	3/12	4/12	5/12	6/12	7/12	8/12	9/12	10/12
All	0.992	0.961	0.900	0.796	0.693	0.614	0.575	0.564
Urban	0.996	0.974	0.924	0.830	0.725	0.639	0.595	0.582
Rural	0.967	0.880	0.738	0.579	0.486	0.453	0.449	0.448
Men	0.993	0.965	0.908	0.810	0.709	0.631	0.588	0.576
Women	0.991	0.958	0.891	0.783	0.678	0.599	0.563	0.553
18-29	0.996	0.977	0.927	0.842	0.735	0.638	0.599	0.584
30-59	0.991	0.962	0.902	0.787	0.684	0.615	0.574	0.563
60+	0.990	0.934	0.844	0.746	0.651	0.572	0.541	0.535

2 MWI-P; Set II; from $k = 3/12$ to $k = 10/12$

	3/12	4/12	5/12	6/12	7/12	8/12	9/12	10/12
All	0.994	0.967	0.896	0.816	0.692	0.623	0.580	0.565
Urban	0.998	0.977	0.921	0.849	0.723	0.648	0.600	0.583
Rural	0.973	0.898	0.735	0.601	0.487	0.456	0.451	0.450
Men	0.996	0.971	0.907	0.832	0.707	0.640	0.594	0.577
Women	0.993	0.962	0.885	0.802	0.678	0.607	0.566	0.555
18-29	0.999	0.982	0.927	0.863	0.734	0.650	0.603	0.586
30-59	0.993	0.965	0.899	0.808	0.683	0.622	0.578	0.564
60+	0.991	0.945	0.832	0.761	0.645	0.578	0.546	0.536

3 MWI-P; Set III; from $k = 3/12$ to $k = 10/12$

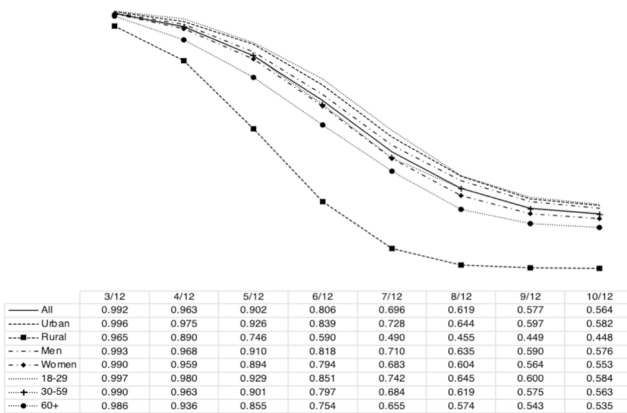|	3/12	4/12	5/12	6/12	7/12	8/12	9/12	10/12
All	0.992	0.963	0.902	0.806	0.696	0.619	0.577	0.564
Urban	0.996	0.975	0.926	0.839	0.728	0.644	0.597	0.582
Rural	0.965	0.890	0.746	0.590	0.490	0.455	0.449	0.448
Men	0.993	0.968	0.910	0.818	0.710	0.635	0.590	0.576
Women	0.990	0.959	0.894	0.794	0.683	0.604	0.564	0.553
18-29	0.997	0.980	0.929	0.851	0.742	0.645	0.600	0.584
30-59	0.990	0.963	0.901	0.797	0.684	0.619	0.575	0.563
60+	0.986	0.936	0.855	0.754	0.655	0.574	0.543	0.535

Fig. 4 Multidimensional Wellbeing Index for Peru (MWI-P) for different wellbeing thresholds (k); entire sample and subgroups. Source: Authors' calculations based on 2018 IOP and IDHAL's survey

Table 7 Identification robustness of the MWI-P using Sets I, II, and III; entire sample and subgroups

		H Set I	H Set II	H Set III	All sets		Sets I-II		Sets I-III		Sets II-III	
					Consistent	Inconsistent	Consistent	Inconsistent	Consistent	Inconsistent	Consistent	Inconsistent
All		45.9%	45.9%	45.7%	45.1%	1.4%	45.9%	0.0%	45.1%	1.4%	45.1%	1.4%
Area	Urban	51.0%	51.0%	50.8%	50.2%	1.4%	51.0%	0.0%	50.2%	1.4%	50.2%	1.4%
	Rural	12.9%	12.9%	12.5%	11.9%	1.7%	12.9%	0.0%	11.9%	1.7%	11.9%	1.7%
Gender	Men	48.9%	48.9%	48.3%	47.7%	1.7%	48.9%	0.0%	47.7%	1.7%	47.7%	1.7%
	Women	43.0%	43.0%	43.3%	42.6%	1.2%	43.0%	0.0%	42.6%	1.2%	42.6%	1.2%
Age group	18–29	53.5%	53.5%	53.3%	52.3%	2.1%	53.5%	0.0%	52.3%	2.1%	52.3%	2.1%
	30–59	42.9%	42.9%	42.7%	42.3%	1.0%	42.9%	0.0%	42.3%	1.0%	42.3%	1.0%
	60+	42.1%	42.1%	42.3%	41.4%	1.7%	42.1%	0.0%	41.4%	1.7%	41.4%	1.7%

Source: Authors' calculations based on 2018 IOP and IDHAL's survey

Discussion

Through the MWI-P we propose in this study, we make a threefold contribution to the literature on axiomatic-based multidimensional wellbeing indexes in LMICs. First, we propose wellbeing measure that we estimate using data from a specialized survey which incorporates a broad set of dimensions and indicators selected based on enduring consensus about the strategic long-term vision for Peru, an LMIC. Second, we set the dimensional weights of our measure based on information on the importance that respondents of our specialized survey assign to each of the 12 dimensions we included in the MWI-P. In line with the capability approach, this information allowed us to propose a structure of dimensional weights that reflect people's values Third, we set the multidimensional wellbeing threshold of the MWI-P based on data on how free people consider themselves to be to decide how to live their lives, information that is also included in our specialized survey. This is consistent with the capability approach, which conceptualizes capabilities as "opportunity or option freedoms" (Robeyns, 2017; pp. 105) or "freedom to achieve valuable human functionings" (Sen, 1990; pp. 460). To the best of our knowledge, this is the first study to have incorporated these three elements simultaneously into an axiomatic-based measure of multidimensional wellbeing for application to an LMIC.

Our main results show that in the entire sample, the proportion of people in a situation of wellbeing sufficiency (H) ranges from 45.7% (Set III) to 45.9% (Sets I and II), while the MWI-P values range from 0.707 (Set III) to 0.708 (Sets I and II). The subgroups with the highest levels of multidimensional wellbeing are the urban population, men, and young people compared with the rural population, women, adults, and older adults, respectively. Our results on these gaps between subgroups remain valid if we change the wellbeing threshold (k), and the proportion of the population identified as living in wellbeing sufficiency is robust to all three specifications (Sets I, II, and III).

One of the key findings in our estimates is that the dimensions that go beyond health, education, and standard of living account for a sizable proportion of the composition of the MWI-P and its counterpart, the Multidimensional Illbeing Index, M_0. For instance, the two dimensions that contribute the most to the MWI-P are "empowerment" and "social connectedness." Moreover, the dimensions that contribute the most to M_0 are "citizenship and governance" and "environment." So long as most datasets in LMICs do not include information on these dimensions, it would be worthwhile promoting large-sample household surveys that include short modules aimed at capturing information on less commonly explored wellbeing dimensions.

The subgroup decomposition and dimensional breakdown properties that the AF method satisfies allow us to identify which dimensions contribute the most to the MWI-P and M_0 for each of the subgroups. The results show that the dimensional compositions of wellbeing and illbeing are heterogeneous between urban and rural populations as well as between age groups. These findings highlight the policy-relevant character of our measure, providing evidence in favor of adopting more context-specific sets of interlinked wellbeing-enhancing policy interventions that prioritize different subsets of dimensions for different subgroups of the population.

In keeping with the capability approach, we define the weights based on information on how people value the 12 dimensions of the MWI-P and the wellbeing threshold based on information about how free people feel they are to decide their own lives. We show that there is a range of at least three possible options for weights and threshold specifications (Sets I, II, and III) for which our results do not vary significantly. For the three sets, the values of H and the MWI-P for the entire sample are similar, displaying the same patterns of disparities between subgroups. Moreover, under the two specifications with which it is methodologically possible to perform dimensional breakdowns (Sets I and II), we estimate that the dimensional composition of the MWI-P is similar for both the entire sample and the subgroups. These results show that even when it might not be possible to reach full consensus on the relative importance of wellbeing dimensions, it is possible to achieve reasonably consistent results at the aggregate level. This result is consistent with some of the findings of Greco (2018), who showed that the estimations of the Women's Capability Index for Malawi are similar among the equal weights, the normative, and the hybrid weighting schemes.

We explicitly acknowledge that our study is subject to some limitations. First, we draw on a dedicated survey with a relatively small sample ($n = 2800$) in comparison with the national surveys administered by government agencies. Moreover, this sample is representative of a group of provinces in which 76.5% of the Peruvian adult population lives but does not include information about people younger than 18 years old, nor about all rural populations situated furthest from the highways and cities, which tend to present lower levels of wellbeing. This involves that our results might overestimate Peru's wellbeing situation, since the areas that our sample does not include could exhibit lower wellbeing achievements in some of the dimensions included in the MWI-P. Second, although our measure includes a broad set of wellbeing dimensions, due to data limitations we were not able to include additional dimensions such as "mental health", "subjective wellbeing", and "freedom from domestic violence". Third, some of the indicators we use might not reflect all the relevant aspects of wellbeing in the dimensions they seek to operationalize. For example, the indicators in the "education" dimension do not measure educational quality, and the "water source" indicator does not measure chlorine in the water to determine drinkability. Additionally, some indicators such as "school attendance," "protection from environmental shocks," or "freedom from victimization" reflect information that survey respondents provided not only about themselves but also about other members of their households, which might be subject to some degree of "informant bias." Fourth, we follow an ordinal scale valuation approach to define the weights in Sets II and III, but this has some shortcomings. Researchers could overcome such limitations by applying different approaches such as the budget allocation technique used by Esposito and Chiappero‑Martinetti (2019). Fifth, our analysis does not explore the interaction between the non-monetary dimensions we included in the MWI-P and information on income or consumption. Future research could conduct said analysis by collecting an expanded version of our specialized survey including a module on monetary information.

Conclusion

In this research we showed how despite having an outstanding macroeconomic performance (Clausen, 2020; Deneulin & Clausen, 2019), an LMIC such as Peru has not been able to guarantee that at least 50% of its population aged 18 or older enjoy a "sufficient" level of non-income wellbeing. Overall, our results contribute to illustrate a scenario in which evaluating the situation of an LMIC might drastically vary depending on whether such evaluation is conducted using a conventional economic growth-centered approach or a broader multidimensional lens focused on non-income human wellbeing that goes "beyond GDP."

Our findings might also partially explain why, despite its apparently exceptional performance, Peru has been one of the countries most severely affected by COVID-19 at the global level.[4] One example of the mismatch between Peruvian macroeconomic performance and the availability of wellbeing-enhancing conditions is that "there were approximately 0.2 ICU beds per 100,000 inhabitants before the pandemic" (Díaz-Vélez et al., 2021; pp. 12). In fact, based on 2018 data, our results are consistent with the abovementioned mismatch: the dimensional contribution of insufficiency in "health" to multidimensional illbeing (9.6%) was higher than its dimensional weight (8.33%). This means that people living in wellbeing insufficiency were more likely to face limitations in "health" (including lack of access to medical attention) than in other dimensions.

We argue that the general approach we have followed in this research to develop and estimate the MWI-P has at least three advantages that are relevant for evaluating multidimensional wellbeing in a LMIC such as Peru. First, it is based in the capability approach which represents an influential framework in international development initiatives, allowing our research to engage with global policy efforts under the overarching agenda of the Sustainable Development Goals. Second, the axiomatic properties that our measure exhibits can provide policymakers with information to tailor wellbeing enabling initiatives focused on dimensions that require particular attention as well as on subgroups of the population that might be "left behind". Third, we developed our MWI-P relying on information on "what people value" to inform key normative decisions related to the design of this measure. This might increase the legitimacy of the MWI-P design and gather public support for policies that could be developed based on the priorities that emerge from wellbeing evaluations based on this measure.

The recovery from the multidimensional crisis caused by the global pandemic is an opportunity for the post-COVID-19 reconstruction process in LMICs to go beyond the promotion of economic growth and enable the emergence of systems and institutions that strengthen wellbeing in its multiple dimensions. Policy-relevant axiomatic-based multidimensional measures of wellbeing applied to LMICs, such as the MWI-P we developed and estimated in this paper, can inspire, and inform post-pandemic recovery policies that are consistent with a broader multidimensional human flourishing perspective that reflect what people value.

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[4] Cumulative confirmed COVID-19 deaths per million people according to the COVID-19 Data Repository provided by the Center for Systems Science and Engineering at Johns Hopkins University; see https://github.com/CSSEGISandData/COVID-19.

Declarations

Conflict of Interest No potential conflict of interest was reported by the authors.

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