

TECHNICAL BRIEFING NOTE 3: SEVEN REASONS FOR EQUAL WEIGHTING OF DIMENSIONS IN CHILD POVERTY MEASUREMENT

Introduction

The UNICEF position on measuring and monitoring child poverty posits that the measurement of child poverty should be based on constitutive rights of poverty. As all rights are equally important, they cannot be ranked. Consequently, there should be *no arbitrary weights across rights*, i.e. all rights/dimensions in the measurement of child poverty should be equally weighted.

Why?

The issue of weighting dimensions in the measurement of poverty has been extensively researched¹. As a result, there are many ways to establish weights. Some of these are based on (subjective) expert opinion while other ones use statistical methods.

However, before discussing how to weight, it is important to establish if weighting is needed at all. The issue of weighting dimensions/rights is introduced both in theoretical debates as well as in applied work at the country level when child poverty measurement is attempted. Often the arguments conflate weighting indicators within a dimension (at the step of determining deprivation) with weighting dimensions (at the aggregation or counting step). While the former is acceptable, the latter is not². In other words, if daily caloric intake, access to micronutrients, and the three anthropometric measures of malnutrition are used to measure realization of the right to nutrition, it need not be the case that all of them are weighted equally³. The point is that the right to nutrition is of equal importance to the right to water. Seven reasons why weighting rights is not acceptable are reviewed below.

¹ Decancq and Lugo (2013) and Greco et al. (2019) provide excellent and informative reviews and classification of many weighting options.

² The equal importance of all human rights has been long established. Also, it was explicitly ratified by the 1986 Declaration on the Right to Development and the 1993 Vienna Declaration and Programme of Action (United Nations, 2006). Specifically for children, in its Guidelines for Initial Reports and Periodic Reports (United Nations, 2005), the Committee on the Rights of the Child says that children's rights "are indivisible and interrelated, and that **equal importance** should be attached to each and every right recognized therein" (emphasis added). Similar language is found in OHCHR (1997) and many other documents.

³ "Most composite indicators rely on equal weighting" according to the review in Joint Research Centre-European Commission (2008). Nevertheless, this report also presents the advantages and disadvantages of weighting

Reason 1: Weights imply ranking rights whereas all rights are equally important

Differential weighting across human rights does not only rank them, which is dubious (and contrary to the most widely accepted Human Rights principles⁴), it sets a specific numerical value measuring **exactly** how much more important a right is compared to another one. For example, when using weights across rights, we not only say that the right to play is more important than the right to health or that education is more important than nutrition. We actually⁵ say that the right to play is twice as important as the right to health, or the right to education is 1.618 times more important than the right to nutrition.

How does this arise from weighting? Let us assume that more weight is given to education than to health. For instance (if there are no other dimensions), the following proportions could be proposed: education is given a weight of 0.7 while health is given a weight of 0.3. This not only means that education is more important than health, it also means that it is more than “double as important”. Actually, it is 2.3333 (= $.7/.3$) as important. This is an extremely difficult position to explain or defend.

Reason 2: Measurement bias

There is another important reason to avoid arbitrary weights. They introduce a bias in measurement. In the following example there are three children (A, B, and C) and four dimensions. Table 1 shows in which dimension each child is deprived (represented by a number 1). Clearly, child A is in the worst situation, as the only child with two deprivations (in dimensions 3 and 4).

Table 1

	Dimension 1	Dimension 2	Dimension 3	Dimension 4
A	0	0	1	1
B	1	0	0	0
C	0	1	0	0

The most sensible way to determine who are poor would be by identifying those who suffer one deprivation. However, in order to compare with a situation in which weights are used, let us assume that the weighted average across the deprivations is used. As way to mimic a cut-off above one dimension to be poor (which would be 0.25), let us assume a cut-off of 0.3 (i.e. the weighted average has to exceed 0.3 to be considered poor).

Assuming a cut-off of 0.3 to be considered poor and equal weighting across the four dimensions, child A is identified as deprived while children B and C are not identified as poor. In Table 2, each number 1 has

schemes (which could be used within each of the child poverty dimensions). Moreover, their main message is clear: “Indicators should be aggregated and weighted according to the underlying theoretical framework”, which unequivocally supports the principle that there should only be equal weights across child rights constitutive of child poverty.

⁴ Besides the UN documents mentioned above, Donnelly (2003) and Quane (2012) offer good pedagogical/academic introductions to this concept.

⁵ Even if it is implicit and not always obvious to all readers.

been multiplied by 0.25 (the same weight for each dimension, written in the second row). For each child, the sum of the weighted deprivations⁶ is represented in the last column. Only child A exceeds 0.3.

Table 2

	Dimension 1	Dimension 2	Dimension 3	Dimension 4	Weighted sum
	0.25	0.25	0.25	0.25	
A	0	0	0.25	0.25	0.5 (poor)
B	0.25	0	0	0	0.25
C	0	0.25	0	0	0.25

A slight variation in the weights (again, they are shown in the second row) results in a very different group of children being identified as poor in Table 3

Table 3

	Dimension 1	Dimension 2	Dimension 3	Dimension 4	Weighted sum
	0.35	0.35	0.15	0.15	
A	0	0	0.15	0.15	0.3
B	0.35	0	0	0	0.35 (poor)
C	0	0.35	0	0	0.35 (poor)

In Table 4 another variation provides drastically different identification and aggregation of poor children.

Table 4

	Dimension 1	Dimension 2	Dimension 3	Dimension 4	Weighted sum
	0.3	0.4	0.15	0.15	
A	0	0	0.15	0.15	0.3
B	0.3	0	0	0	0.3
C	0	0.4	0	0	0.4 (poor)

Interestingly, in the latter two cases, child A (who suffers the most deprivations) is not identified as poor. The weighted average is 0.3, not exceeding it, so child A is not counted as poor.

The difference between Tables 3 and 4 is what happens to children B and C. In the former both children (B and C) suffering a deprivation are counted as poor while in the latter only one of them (C) is counted as poor.

These odd results happen due to the arbitrary weights assigned to different rights. Even if the weights were the result of a consultation with experts or focus groups with “poor people”, they would still be arbitrary⁷. Also, it should be remembered that rights are inalienable. Thus, people cannot vote to “give up rights” (or to trade a right off against another one) even if a group of people in a focus group agree on this

⁶ I.e. the weighted average of deprivations.

⁷ A good review of some the problematic nature of this type of “participation” is provided by Cooke and Kothari (2001).

or referendum were to be held. In other words, even if in a participatory process people did not mention a right (or say that one right is more important than another one), it does not mean it should not be measured (or ranked less than other rights)⁸.

Reason 3: Decision Theory and the principle of insufficient reason

A common problem in Decision Theory (similar to many ones in Game Theory and related fields) is a situation when an action needs to be chosen but the final outcome depends on the chosen course of action as well as some external event (which could be completely exogenous or the action of other persons). In some settings, probabilities can be assigned to the various possible external events. However, in many cases, no such probabilities exist, nor can they be estimated. In the absence of knowledge about the relative likelihood of different events, it is common to assign equal probabilities to these events. This approach avoids introducing any spurious or subjective valuation and is known as the principle of “insufficient reason”⁹.

This principle could be applied in the case of dimensions of child poverty. In this case, under the impossibility of establishing with any proper, scientific rationale a set of weights, it is better to leave them all equally valued¹⁰. In other words, arbitrary or differential weights across dimensions should not be used.

Reason 4: Statistical efficiency

In addition, statistical advice against weights has been collected for years in the construction of indices. Hagerty and Land (2007) found the best approach in the construction of composites indexes is to avoid weighting dimensions. There is no gain in efficiency or information when applying weights.

Gordon et al (2012), following Ghiselli et al (1981), make similar arguments based on empirical evidence. They show that when weights across items are similar, there are many variables, and they are correlated (as it is the case in multi-dimensional poverty analysis¹¹) weighting does not improve estimates¹².

On the contrary, weights can distort the underlying situation. This is illustrated in Table 5 and Figure 1. First, in Table 5, two situations with three variables each (first from a to c, and then from d to f) are shown. For variables a, b, and c, all the values, ranging between 1.8 and 2.2 are similar. However, for variables d,

⁸ Further analysis and recommendations on human rights measurement and monitoring (including difficulties in translating concepts and measuring what is relevant for various groups) can be found in OCHRH (2012) and Merry and Wood (2015)

⁹ The principle harks back to work by Bayes, Bernoulli, and Laplace during the XVIIth and XVIIIth Centuries. (Luce and Raiffa, 1957).

¹⁰ While this is similar to the strict application of the insufficient reason principle, other classical models (such as the Maximin or Minimax criteria) exist. However, they also avoid assigning differential probabilities to the various events.

¹¹ As child poverty is not a collection of disparate bad things that may happen to children but grounded on the notion of rights constitutive of poverty (i.e. those closely associated with lack of resources), there is an expected high correlation of deprivation among the various dimensions/rights.

¹² United Nations Economic Commission for Europe (2020) clearly says (Recommendation 28.d): “A deprivation or poverty index should only ever be weighted if this results in a reduction in measurement error, i.e. if the differential weights improve the validity and/or reliability of the index.”

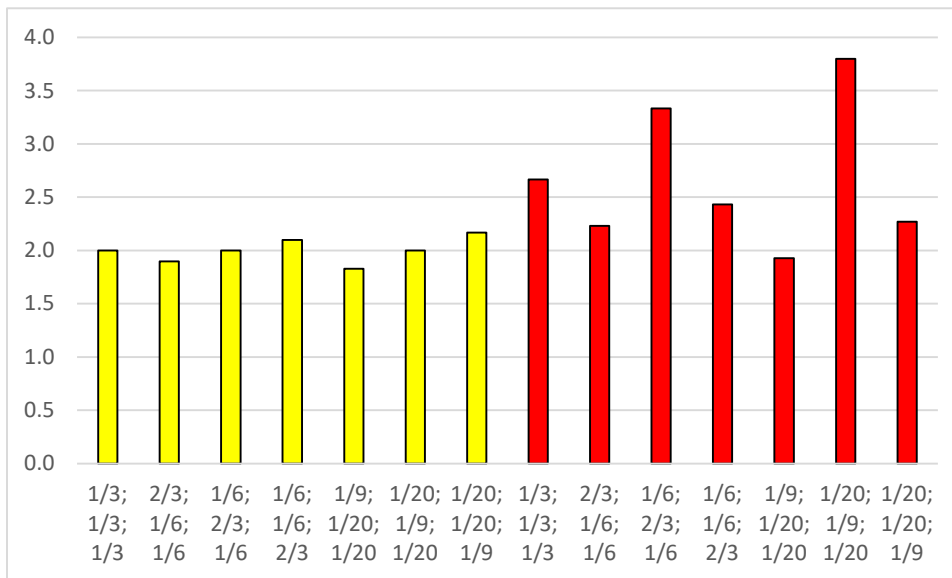
e, and f, the range is between 1.8 to 4. The different rows show various possible weighting schemes applying respectively to each variable¹³.

When applying these weights, different weighted averages are obtained. They are shown in Figure 1. It can be seen that for variables a, b, and c (in yellow) the weighted averages do not vary much. However, for variables d, e, and f (in red) the weighted averages gyrate depending on the weighting scheme. These wide variations are not due to the underlying data but the different weights given to each variable. Thus, differential weights result in different results, without a proper or clear justification.

Table 5

Weighting Scheme	a	b	c	Weighting Scheme	d	e	f
	1.8	2	2.2		1.8	4	2.2
1/3; 1/3; 1/3	0.33	0.33	0.33	1/3; 1/3; 1/3	0.33	0.33	0.33
2/3; 1/6; 1/6	0.67	0.17	0.17	2/3; 1/6; 1/6	0.67	0.17	0.17
1/6; 2/3; 1/6	0.17	0.67	0.17	1/6; 2/3; 1/6	0.17	0.67	0.17
1/6; 1/6; 2/3	0.17	0.17	0.67	1/6; 1/6; 2/3	0.17	0.17	0.67
1/9; 1/20; 1/20	0.90	0.05	0.05	1/9; 1/20; 1/20	0.90	0.05	0.05
1/20; 1/9; 1/20	0.05	0.90	0.05	1/20; 1/9; 1/20	0.05	0.90	0.05
1/20; 1/20; 1/9	0.05	0.05	0.90	1/20; 1/20; 1/9	0.05	0.05	0.90

Figure 1 Weighted averages for different weighting schemes for variables a, b, and c (in yellow) and for d, e, and f (in red)



¹³ In each row the weighting schemes are the same. They are repeated to show the first weight applies to the first variable the second weight to the second variable, and the third weight to the third variable.

Reason 5: Communication conundrum

Ease of communication is also something to consider. If no weights are applied, explaining how child poverty is measured is very simple: “a child who is deprived of any right constitutive of poverty” (or “a child who is deprived of two or more rights constitutive of poverty”). The rights constitutive of child poverty can easily be listed.

This phrase ought to be compared with: “a child is poor when a weighted average (based on arbitrary weights) of x-number of dimensions is below an arbitrarily established parameter”. Even a simplified statement such as “poor children are those deprived in 2.3 dimensions” is very hard to interpret given the difficulty of understanding the decimal associated with deprivation (either you are deprived or you are not). The alternative is to explain it glossing over the details. However, this hinders transparency and leaves the audience with the false impression of having understood but actually have not been told how the estimates are carried out in practice.

Reason 6: Capabilities cannot and should not be traded-off

The Capabilities Approach can also be used to avoid arbitrary weights. It is quite well established that capabilities cannot be traded off (i.e. that if a person has no political voice, this cannot be compensated by giving them more food)¹⁴. Thus, all capabilities should be equally weighted.

A good example is the Human Development Index in which there are equal weights across “domains”. Within each domain there are different elements. However, the calculation is done across domains, which is quite similar to the proposed principle of equal weights across rights.

Reason 7: Parsimony principle

Finally, Ockham’s razor (principle of parsimony) can also be applied. Confronted with two possible explanations, it is better to go for the simplest one.

Weighting should not be done just because it is possible or because it looks good. Thus, the onus is on proving WHY weighted dimensions would be better than the simple version without arbitrary weights¹⁵.

How can equal weights across rights/dimensions be applied in practice?

Although the indicators used to establish the deprivation in or fulfillment of any individual rights could be weighted (or combined in various ways), all rights should be equally valued. There are at least three ways of doing this.

¹⁴ “A Capabilities Approach is generally committed to the equal protection of rights for all up to a certain threshold. Any trade-off that leaves some people below this threshold will thus be a clear failure of basic justice under a Capabilities Approach”, Dixon and Nussbaum (2012), page 554.

¹⁵ This is related to the point made in footnote 12, when proposing weights, the burden of proof is on why using them (and how), not on explaining why equal weights is the preferred option.

EXAMPLE 1: For each dimension, there are various indicators. However, aggregation takes place along the dimensions (equally weighted). The approach, used in Mexico by CONEVAL, is a good real-world case.

Table 6: Simplified version of the CONEVAL dimensions and indicators

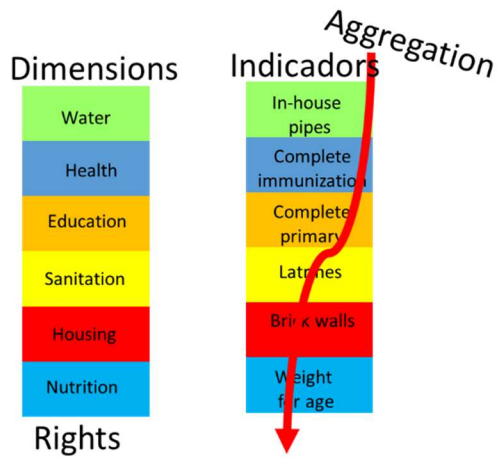
Dimensions/ Rights	Indicators (only some are listed as there are many indicators, some of which only apply for certain subsets of the population)
Education	Lack mandatory basic education and are not attending a formal educational center
Health	Not enrolled in nor entitled to receive medical services from any public institution offering them or from private medical services
Social Security	That the salaried economically active population is missing benefits such as: <ul style="list-style-type: none"> • Medical services. • Retirement Savings System. • Disability benefits. That the non-waged or independent working population is missing benefits such as: <ul style="list-style-type: none"> • Medical services. • Retirement Savings System.
Lodging	If the dwelling has dirt floor. The ratio of the number of members of the household per room is greater than 2.5 (overcrowding)
Housing amenities	Water is obtained from a well, river, lake, stream, or truck; or when piped water is carried from another dwelling or gotten at a public faucet or hydrant. There is no drainage service.
Access to food	Had a diet based on a very small variety of foods. Stopped having breakfast, lunch or dinner. Ate less than what he/she thinks should eat. Were left without any food.

Source: CONEVAL (2009)

In this example, clearly, there is no need to have equal number of indicators for each right nor is it needed that all indicators (across all dimensions or within each one of them) have the same weight. The important element is that the identification/aggregation is made across the equally weighted rights.

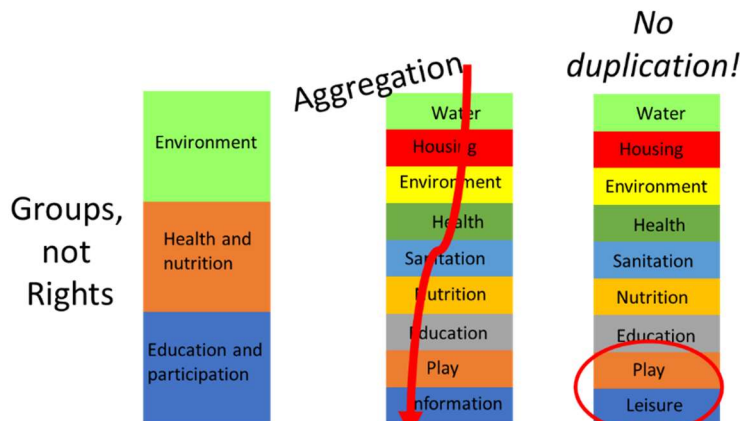
EXAMPLE 2: In this hypothetical case, there is only one indicator for each dimension. Thus, in a way, it does not matter if the aggregation is done across dimensions or indicators. As long as the dimensions/indicators have the same weight, the principle that rights are equally weighted is retained.

Figure 2: One indicator per right/dimension



EXAMPLE 3: In this case, rights are combined into groups. Within each group, there are several rights (each right has its own, single indicator). As long as there are an equal number of rights in each group and as long as both groups and the rights within them are equally weighted, then the principle holds. However, special care is needed to avoid a situation where rights are duplicated. This would implicitly give more importance to one right compared to the other ones (as, for instance, in Figure 2 where play and leisure appear as separate rights).

Figure 3: One indicator per right/dimension, rights grouped but aggregation/identification is carried out across rights.



There could be 4 GROUPS, with either 2 or 3 rights, or 2 GROUPS with 4 rights, etc (depending on data availability and sensitivity analysis)

Conclusions

The question is not which weights to apply but why to apply weights at all. It is hard to provide arguments for weighting in child poverty measurement.

It can be seen that there are several reasons to avoid weighting of rights/dimensions when estimating child poverty. The fundamental reason is that all rights have equal importance.

However, many other disciplines and perspectives (such as Decision Theory, the Capability Approach, etc) establish the same conclusion. Moreover, it is easy to apply the principle of equal weights across rights with various alternatives in terms of combining indicators to assess deprivation in each right.

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