

# Better Jobs Index: An employment conditions index for Latin America

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**BETTER JOBS INDEX:  
AN EMPLOYMENT CONDITIONS INDEX FOR LATIN  
AMERICA.  
METHODOLOGICAL DOCUMENT\***

**TECHNICAL NOTE**  
**INTER-AMERICAN DEVELOPMENT BANK**

September 2017

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## **Abstract**

Employment conditions are central to the wellbeing of families, through the impact of earnings on the resources they have available and through the direct impact on the utility of workers. Recognizing the key role played by employment in the lives of its people, governments view labor market outcomes and employment conditions as a major area for policy, and monitor these conditions regularly with variables such as unemployment rate or labor force participation. In response to the policy importance of employment conditions and recognizing their inherently multifaceted nature, the Labor Markets Division (LMK) of the Inter-American Development Bank (IDB) has created a multidimensional employment conditions index for Latin America called “**Better Jobs Index**”. Its purpose is to allow countries in the region to monitor their employment conditions more effectively, facilitate comparisons across countries, and encourage policies that might lead to more favorable employment conditions. It is expected that the *Better Jobs Index* leads to improved dialogue about labor markets and the quality of employment, leading eventually to the collection of better data for policy decision-making and an improvement in the index itself. This report presents the methodology of the index which includes the data used, the indicators, and the key decomposition properties it satisfies.

## **Key words**

Labor force participation, employment, formal jobs, wages, Latin America

## **JEL codes**

C43, C81, J21, J31, J46, Y20

## 1. Introduction

*Why measure employment conditions?* Employment conditions are central to the wellbeing of families, through the impact of earnings on the resources they have available and through the direct impact on the utility of workers. A **good job** is defined not only by its present conditions but also its capacity of generating a lifelong upward career path, thereby contributing to greater economic and social development (Alaimo et al. 2015). According to the International Labour Organization, decent work means having:

opportunities for work that is productive and delivers a fair income; provides security in the workplace and social protection for workers and their families; offers better prospects for personal development and encourages social integration; gives people the freedom to express their concerns, to organize and to participate in the decisions that affect their lives; and guarantees equal opportunities and equal treatment for all (ILO, 2007).

Recognizing the key role played by employment in the lives of its people, governments view labor market outcomes and employment conditions as a major area for policy, and monitor these conditions regularly along with other macro variables.

*How are employment conditions typically monitored?* The most common indicator of employment conditions is the unemployment rate, which measures the percentage of the population actively engaged in the labor force that are unable to find employment. This gives a clear picture of one aspect of the labor market: the quantity of employment or, more specifically, the extent to which the number of jobs available falls short of the number of persons in the labor force. A second quantity indicator is given by labor force participation, or the extent to which the working age population is actively engaged in the labor market - either searching or employed. An unusually low participation rate suggests that the labor market is failing to make effective use of potential workers, either due to social barriers or the discouraging effects of repeated attempts to find employment.

In addition, aspects related to the *quality* of employment are also important and should be monitored as well. For example, some jobs may have characteristics that are simply inferior. It would be relevant to the description of employment conditions to know whether the jobs people have are good jobs or inferior. Likewise, regardless of the other qualities a job may have, the wage rate conveys tangible information on the job's capacity to support a family under normal circumstances. An unambiguous improvement in employment conditions would arise if more jobs were to offer a wage consistent with an adequate standard of living.

*Purpose of the new index.* In response to the policy importance of employment conditions and recognizing their inherently multifaceted nature, the Labor Markets Division (LMK) of the Inter-American Development Bank (IDB) has created a multidimensional employment conditions index for Latin America called “**Better Jobs Index**”. Its purpose is to allow countries in the region to monitor their employment conditions more effectively, facilitate comparisons across countries, and encourage policies that might lead to more favorable employment conditions. More broadly, it is hoped that the *Better Jobs Index* might lead to improved dialogue about labor markets and the quality of employment, leading eventually to the collection of better data and an improvement in the index itself.

This report presents the methodology of the index which includes the data used, the indicators, and the key decomposition properties it satisfies.

## **2. Setting the Stage**

*Index or dashboard?* To capture the various aspects of employment conditions, an index will likely need to draw on multiple dimensions and indicators. The first question is whether for the present purposes it is enough to report each indicator separately in a “dashboard” or whether indicators should be combined to obtain an overall index. There are advantages and disadvantages to each approach, depending

on one's objective.<sup>2</sup> If the purpose is primarily analytical in nature, or the specific components are totally unrelated, then a dashboard may suffice. However, if the purpose is to monitor overall employment conditions over time or space in such a way as to encourage discussion, an overall "headline" index will help in attaining that objective.<sup>3</sup>

*Desiderata.* Before constructing a multidimensional index, it is useful to consider the qualities that the index should have. One set of desiderata that has been used in other contexts is the following:<sup>4</sup>

- i. It must be understandable and easy to describe
- ii. It must conform to a common-sense notion of what is being measured
- iii. It must fit the purpose for which it is being developed
- iv. It must be technically solid
- v. It must be operationally viable
- vi. It must be easily replicable

i) *Simplicity.* The first criterion is for an index to be simple and understandable by both practitioner and interested citizens. Many indices have terrific properties, but fail to communicate what it is that they are measuring. Sophisticated functional forms can obscure the meaning of an index, while simpler formulas can be more easily understood and communicated. The *Better Jobs Index* strives for transparency and clarity in its definition, both overall and in its indicators, so that it has the greatest chance of being understood and applied.

ii) *Coherence.* The second desideratum requires the index to be reflective of an intuitive concept of what is being measured. To satisfy this requirement, one must first describe the concept and then show that it is the notion that the index is capturing. The standard indicators of employment conditions typically cover the "quantity" dimension. The Index views employment conditions as having two central dimensions: quantity and quality. While other aspects could also be

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<sup>2</sup> See for example Alkire and Foster (2011) or Alkire et al (2015).

<sup>3</sup> And if the headline index can be decomposed into indicators, it will generate an associated "coordinated dashboard" for analysis. See Alkire et al (2015) or Cruz et al (2015).

<sup>4</sup> See Szekely (2006) and Alkire et al (2015).



included, it would make sense to limit consideration to these two basic aspects, both of which are intuitive and complement the other in providing an overall picture of employment conditions.

- iii) *Fulfillment*. The third requires a statement of purpose for the index. The purpose of the Index is to measure employment conditions in Latin America; to monitor progress over time to detect improvement or deterioration within and across countries; to identify best performers and the main challenges in the region in order to motivate change and the implementation of public policies; and to encourage a regional dialogue about the quality of employment and other labor markets topics.
- iv) *Rigor*. The fourth desideratum includes a combination of requirements, such as ensuring that the index satisfies desirable axiomatic properties and conforms to measurement theoretic standards of robustness. The report will identify the properties satisfied by the index, focusing in particular on monotonicity and the decomposition by population subgroups and by indicators.<sup>5</sup>
- v) *and vi) Implementable and replicable*. The fifth and sixth desiderata pay heed to data availability and the ease with which the index can be constructed. Indeed, the Index can be readily calculated given currently available in the Labor Markets and Social Security Information System (or [SIMS](#), for its Spanish acronym) dataset, and recalculated in the future as needed.

*The dataset*. To satisfy desiderata (v) and (vi), the data obtained for different countries must be comparable and regularly available for updates. The dataset must be harmonized across countries and collected frequently. It should include the information on jobs and labor force status needed for the Index as well as the associated gender and demographic characteristics to facilitate analysis by subgroup. One dataset that satisfies all requirements is the SIMS. The SIMS contains harmonized statistics drawn from household surveys for 23 Latin American and Caribbean

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<sup>5</sup> As for the robustness of the index, any composite index requires certain assumptions to be made in order to justify its construction and reduce the extent of arbitrariness of its elements (Alkire and Foster, 2010).

countries since 1990.<sup>6</sup> The SIMS presents a wide range of indicators in six dimensions: population, employment, unemployment, income, social security, and poverty. Consequently, this dataset will be used to construct the Index.

*Orientation of the index.* An index of employment conditions, and each of its indicators, could be oriented in either of two ways: positively or negatively. If the orientation is positive, then an increase in the index or indicator will suggest that employment conditions are improving. A negative orientation - analogous to poverty measures - means that an increase in the index or indicator is associated with worsening employment conditions. For indices designed to gauge progress, it is natural to opt for a positive orientation. Each indicator of employment conditions will be expressed with a positive orientation so that a higher measured level indicates an improvement in employment conditions, and likewise for the overall index.

### **3. Dimensions and Indicators**

*Conceptual framework.* When constructing a multidimensional index, it is important to use a framework that plausibly represents the underlying concept being measured. In practice, this is accomplished by identifying the main dimensions of the index. As described by Atkinson (2003), it is desirable for these dimensions to be seen as equal in importance. This can also be helpful in fixing the weights of the dimensions and their indicators.

*Dimensions.* The *Better Jobs Index* has two key dimensions: quantity and quality. Quantity refers to the extent to which persons are attached to the labor market and the extent to which employment is available. Quality refers to the basic characteristics

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<sup>6</sup> However, the SIMS coverage varies across countries and years, depending on the information included in different countries in different years. For example, Caribbean countries do not ask workers if they contribute or not to social security, which is the key variable used to compute formality/informality rates.

of the jobs people hold. The two dimensions are well-defined as important aspects of employment conditions, and help form the basis of desideratum (ii) above.

*Indicators.* The next question is how to identify specific variables or indicators that best represent these dimensions. As noted in Alkire et al (2015), indicators should be salient in that they encapsulate a key component of the dimension being evaluated. It might be helpful for an indicator to have political relevance or have links to one that is being used by countries or in international efforts to represent the dimension. Finally, availability of the indicator for the population in question is a key practical consideration.

- ***The quantity dimension.***

The quantity dimension of the Index has two indicators:

1. *Labor force participation.* The first quantity indicator measures the extent to which a population is engaged in the labor market. More precisely, the labor force participation indicator is defined to be the number of persons in the working age population that are actively engaged in the labor force (either in a job or unemployed and looking for a job) divided by the total working age population<sup>7</sup>. Active engagement in the labor market is clearly a precondition for employment, and there are several reasons why a person might *not* be part of the labor force. Cultural norms and other barriers may dissuade certain subpopulations from engaging. For example, some traditional societies discourage female participation, thus removing from the labor force a significant number of potential workers and dampening GDP growth.<sup>8</sup> Some workers may be unable to engage in the labor market due to severe disability. Other potential workers may have attempted to engage without success, becoming discouraged and electing to disengage from the

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<sup>7</sup> The Index uses a variation of the working age population-WAP. For details see section 3 (subsection “other considerations”) and section 4.

<sup>8</sup> See, for example, Mateo Díaz and Rodríguez-Chamussy (2016) who provide estimates of the impact on GDP of low labor force participation in LAC.

labor market. The labor force participation indicator focuses on the remaining population that is actively engaged.<sup>9</sup>

2. *Employment.* The second quantity indicator goes beyond labor force participation to ask how many are actually employed. It is the number of employed persons divided by the total number of persons in the working age population, representing the extent to which the economy is successfully creating jobs.<sup>10</sup>

- ***The Quality Dimension.***

The quality dimension has the following indicators:

3. *Formality.* In the context of Latin America, there is a particularly salient quality of a job: formality or informality. Despite the low unemployment rates, Latin American countries suffer from high labor instability, low investment in workers' human capital, little protection against unemployment, high informality (defined as those without access to social security benefits), and low productivity (elements that probably fuel one another). This traps millions of workers in a situation marked by poverty, inequity, lack of opportunities, and low economic growth (Alaimo et al., 2015). In Latin America, 53% of workers are in informal jobs; however, informality rates across countries are heterogeneous (from 83% in Bolivia to 23% in Uruguay)<sup>11</sup>, and therefore different solutions are needed.

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<sup>9</sup> Traditional macroeconomists have become more interested in labor force participation as a driver of the macroeconomy. See for example Aaronson et al (2014).

<sup>10</sup> A traditional employment indicator is to express the number employed (or unemployed) as a percentage of labor force. The unemployment rate  $U$  so calculated is perhaps the most commonly cited quantity indicator. It is a negatively oriented indicator, but it would be quite easy to convert into a positively oriented indicator by subtracting it from unity to obtain  $1-U$ . However,  $U$  has been questioned recently as a stand-alone employment indicator. See, for example, Blanchflower and Levin (2015) who critique its use as the only indicator of labor market slackness in the context of the recent US recession and subsequent slow recovery: it can overlook the hidden unemployment outside the labor force (namely persons who are currently not searching but would return to the labor force if conditions were to improve). As noted by Donovan (2015), the potential for confusion arises when  $U$  and the number in the labor force both fall at the same time. She suggests changing the denominator of the employment index to make it independent of the size of the labor force, and this is precisely what the employment rate does.

<sup>11</sup> [Labor Markets and Social Security Information System -SIMS](#), June 2016, IDB.

Informality has economic, social, and fiscal repercussions. It implies enormous difficulties for the design of social insurance mechanisms, with their consequent impact on welfare (Alaimo et al., 2015). It also limits the capacity to accumulate sufficient savings for old age in a context in which the over-65 population will triple in the next 35 years (Bosch, Melguizo, and Pagés, 2013). From a macroeconomic standpoint, a lack of adequate savings can reduce the resources allocated to the financing of productive projects, thus hindering economic growth. Another consequence of informality is the need to create programs to provide some type of coverage for informal workers, which can entail serious fiscal consequences (Bosch, Melguizo, and Pagés, 2013).

Consequently, the number of formal jobs is an important statistic to consider when evaluating employment conditions - especially in Latin America. The most common indicator that conveys this information is the formality rate, or the share of all jobs that are formal, which divides the number of formal jobs by the overall number of jobs. The formality rate is an easy to understand indicator that provides straightforward information on the quality of jobs. Hence according to desideratum (i), its use in the Index would make sense.

When evaluated from the point of view of desideratum (iv), though, an issue arises: the denominator of the formality rate (which is number of persons employed) is the numerator of the employment indicator. As part of an overall index that includes both indicators, there is a real possibility that unambiguous worsening in employment conditions would be seen as an improvement in the overall index. For example, if employment conditions deteriorate so that large numbers of informal workers were thrown out of work, this would clearly decrease the employment indicator. But at the same time the traditional formality rate would increase so that, depending on the aggregation method, the overall index could very well register an increase in employment conditions. Therefore, an alternative denominator is chosen. In the index, the formality indicator divides the number of formal jobs by the size of the working age population; and can be interpreted as the capacity of an economy to provide *formal* jobs.

4. *Living wage jobs.* Rather than identifying other, non-monetary characteristics of a job, the second quality indicator focuses directly on its wage rate. A job that offers a high enough wage is viewed as a higher quality job; one that pays too little is viewed as a lower quality job. A natural way of separating high from low is to set a specific cutoff in wage space.<sup>12</sup> How is such a cutoff to be chosen? To be sure, a cutoff in wage space cannot be linked to a unique living standard for a family, since the latter depends on the characteristics of the family, such as the number of members and the number employed, and the length of the workweek.<sup>13</sup>

Following an approach in the living wage literature, a reasonable wage cutoff can be calibrated with the help of a target living standard where parameters are fixed to certain representative values. Anker (2011) suggests the use of four as the family size, 1.5 as the number of family members who are employed, and 48 hours as the workweek (the maximum workweek allowed by ILO conventions). Given a target living standard of \$5 per person per day (2011 PPP) equivalent, adopted as a poverty cutoff by the World Bank for the Latin America and Caribbean (LAC) region, a living wage can be immediately derived.

The living standard of \$5 per day for each member of a family of four translates to an annual family requirement of \$7300 equivalent.<sup>14</sup> A worker who is employed for 48 hours a week for 52 weeks will work 4396 hours in all, so that 1.5 workers will put in 3744 hours. The resulting *living wage cutoff* would then be \$7300 divided by 3744, or \$1.95 equivalent per hour. A quick examination of the official minimum wages for 17 Latin American countries yields an average of about \$2 (2011 PPP) equivalent per hour, which accords well with this rate.<sup>15</sup> Thus \$1.95

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<sup>12</sup> Of course, any specific cutoff is bound to be arbitrary, in that a cutoff slightly below or above a given cutoff could be equally justifiable. The same is true of the income cutoffs used in measuring poverty.

<sup>13</sup> One alternative would be to focus directly on the living standards of people rather than the quality of jobs, and count the number of workers in poverty. See for example U.S. Bureau of Labor Statistics (2016). It is arguable that this approach would reveal less about the quality of employment and more about the quality of the combined resources of a family.

<sup>14</sup> See Ferreira et al. (2015) for a discussion of the \$5 a day living standard.

<sup>15</sup> This is analogous to the justification used by the World Bank for its extreme poverty line.

equivalent per hour is used as the living wage cutoff in determining the quality of a job.<sup>16</sup> If the wage rate associated with this job is equal to or exceeds \$1.95 equivalent per hour, then we will say that the worker is in a job that pays a living wage.

In the same way as in formality rate, it would make sense to divide the number of living wage jobs by the total number of jobs to obtain an indicator that represents the share of jobs that pay a living wage, which can be easily explained and understood. However, an alternative indicator divides the number of living wage jobs by the size of the working age population. This version would avoid the multiple problems that arise from using the numerator of one indicator in the index as the denominator of another. It would measure the capacity of the economy to generate *living wage* jobs.

- ***Other considerations***

In sum, the Better Jobs Index is constructed using four indicators: a labor force indicator and an employment indicator that make up the quantity dimension, and a formality indicator and a living wage indicator that represent the quality dimension. These two dimensions and four indicators reflect some of the most salient aspects of employment. It should be stressed, though, that they do not cover all elements of employment conditions that might be relevant. Other possibilities include: job security, skills and career development, non-standard forms of employment, hiring rates, and layoffs, to name a few.<sup>17</sup> Unfortunately, data availability restricts the possibility of including additional variables while allowing sufficient coverage across countries.

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<sup>16</sup> One additional issue remains: what if a worker in the data is employed in more than one job? Rather than attempting to aggregate across different jobs with different characteristics, the wage rate of a worker's "main job" is used.

<sup>17</sup> For example, the Better Life index of the OECD uses the following four jobs indicators: the employment rate, the long-term unemployment rate, average earnings, and job security (or expected loss of earnings when someone becomes unemployed).

Furthermore, the Index evaluates employment conditions, and thus it is natural to focus on the subset of the population considered to be of working age. However, there is one remaining aspect that concerns the definition of the working age population. For the Index, we define the working age population as all 15-64 years old *excluding* persons who are fully occupied in school and not working or looking for a job. The idea is that if a country is successful in ensuring that its older youth stay in school, it should not be penalized for this, and so, more accurately, reflect the pool of available workers.<sup>18</sup> The traditional labor force participation metric, whose “working age population” denominator includes students, could be seen as having worse employment conditions if school retention and graduation policies are successful.

This decision affects the magnitude of indicators because the denominator would be smaller in size, thus raising the level of the indicator and the overall index. To the extent that different countries have different shares of the population attending school full time, it could also affect the relative rankings of countries with respect to the Index.

#### **4. Index and Properties**

*Aggregation.* The next topic considered is aggregation, or how to combine the four indicators into an overall index of employment conditions. Each of the above indicators is a 0 to 1 variable that measures the prevalence of a particular employment condition among a reference group.<sup>19</sup> There are many possible ways of aggregating the four indicators into an overall index; however, for the Better Jobs Index, Desideratum (i) would suggest using the most intuitive aggregation function

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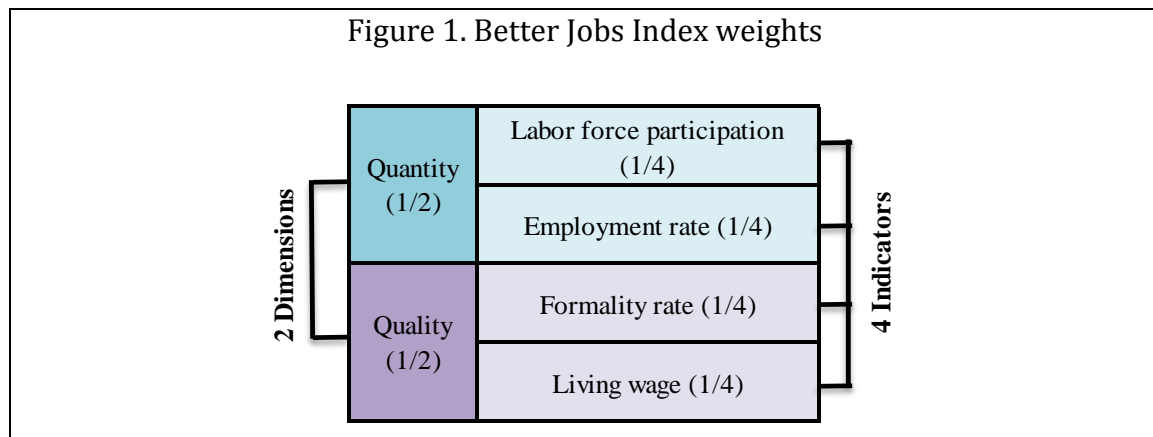
<sup>18</sup> On the other hand, to the extent that this group is in school due to poor market conditions and is merely waiting for conditions to improve before searching, the traditional indicator could more accurately signal the size of the potential universe of workers.

<sup>19</sup> For visualization purposes, the webpage and the country notes present the index in a scale of 0 to 100. This is just the index described here multiplied by 100.



to facilitate communication. A weighted average (as traditionally used by the Human Development Index) is certainly the main option.<sup>20</sup>

*Weights.* On the question of weights, the above discussion on the dimensions of the Index is relevant. In accordance with the suggestion of Atkinson (2003), the two dimensions of quantity and quality are equally important, and so the weight on each dimension is one-half. As for the indicators within a dimension, there being no clear reason for considering different weights it is assumed that each has equal weight. In sum, then, the overall nested weighting scheme implies weights of one-quarter for each of the four indicators (Figure 1).<sup>21</sup>



- ***Formal definition of the index***

In symbols, let  $x = (x_1, x_2, x_3, x_4)$  be the vector containing the four employment conditions indicators, where  $x_1$  is the labor force participation indicator,  $x_2$  is the employment indicator,  $x_3$  is the formality indicator, and  $x_4$  is the living wage indicator.

<sup>20</sup> Another possibility could be the geometric mean used in the new version of the HDI (or more generally a weighted Cobb-Douglas form). The benefit of such a form is that it allows the departures from a target proportional mix of indicators (such as equality) to be punished, if the underlying concept of employment conditions requires it. The cost is in terms of its less intuitive form and the loss of subgroup and dimensional decomposability properties.

<sup>21</sup> The nested weighting structure, which has equal weights across dimensions and equal weights within dimensions, is perhaps the most common weight structure used in multidimensional measurement. For a discussion in the context of multidimensional poverty measurement, see Alkire et al (2015).

An overall employment conditions index will be denoted by  $E = E(x)$ . Then the above discussion suggests that  $E$  take on the form of a weighted average of the indicators:

$$E = w_1x_1 + w_2x_2 + w_3x_3 + w_4x_4 \quad (1)$$

where  $w_j > 0$  is the weight on the  $j^{\text{th}}$  indicator. The above arguments concerning weights suggest that  $w_j = 1/4$  for all  $j = 1, \dots, 4$ , and so  $E$  can be expressed as

$$E = (x_1 + x_2 + x_3 + x_4)/4 \quad (2)$$

or

$$E = \mu(x_1, x_2, x_3, x_4) = \mu(x) \quad (3)$$

where  $\mu$  denotes the arithmetic mean. Clearly  $E$ , like its components, ranges between 0 and 1: the value of  $E$  tends to 0 when each indicator tends to 0, while  $E = 1$  corresponds to a case where all persons in the working age population have formal, living-wage jobs.

- **Properties**

- Property 1: the index should be increasing in each indicator.

*Indicator Monotonicity:* If  $x$  and  $y$  are two vectors of indicators, and  $x > y$  then

$$E(x) > E(y) \quad (4)$$

In other words, indicator monotonicity requires that if any single indicator rises, while the other indicators remain at least as large as before, then  $E$  must rise. No matter how indicators  $x_j$  are defined, or their relationship with employment conditions, this property would trivially hold for the form of  $E$  given in (2). Another, more exacting form of monotonicity will be discussed later on.

- Property 2: the index is decomposable by dimension.

A second property follows immediately from the form given in (2):  $E$  is decomposable by dimension.

*Dimensional Decomposability:* There are functions  $f_1, \dots, f_4$  on the interval  $[0,1]$ , and weights  $v_1, \dots, v_4 > 0$  such that for any possible  $x$  we have

$$E(x) = v_1 f_1(x_1) + v_2 f_2(x_2) + v_3 f_3(x_3) + v_4 f_4(x_4) \quad (5)$$

In other words, dimensional decomposability ensures that  $E$  is a weighted sum of functions  $f_j(x_j)$  that depend only on the information conveyed by dimensional indicator  $j$ . This is clearly implied by formula (2) where the weights are  $1/4$  and the functions are the identity functions. To the extent that each indicator  $x_j$  is salient and linked to policies, this property allows a deeper analysis of the drivers of employment conditions and the policies that are needed to change them. In one country, the issue might be an especially low level of labor force participation that is keeping the overall Index low, but virtually all those who are in the labor force have formal jobs that pay a living wage. In another, the labor force participation may be higher, but the number of jobs is lower. Likewise, when there is a change in the Index over time, the overall change can be decomposed into changes by the indicators. This identifies the indicators that are improving and those that are not, and helps guide policy.

*An implication: quantity and quality indices.* With dimensional decomposability satisfied, the aggregation can also move up one level to between the four indicators and the overall index. The two quantity indicators can be combined to obtain a quantity index  $Q_1$ , while and the two quality variables yield a quality index  $Q_2$ . Index  $E$  defined in (2) has the associated quantity and quality indices  $Q_1 = (x_1 + x_2)/2$  and  $Q_2 = (x_3 + x_4)/2$ ; each can be analyzed separately or combined to obtain  $E = (Q_1 + Q_2)/2$ .

- *Property 3: the index is decomposable by population subgroup.*

One of the most useful properties that an index can exhibit is decomposability by population subgroups. Using this property, the employment conditions can be evaluated separately for different subgroups, to see how they vary for each, and then the subgroup levels can be averaged up to obtain the overall employment conditions for the country as a whole.

*Subgroup Decomposability:* Suppose that an overall population having a working age population of size  $n$  and a vector  $x$  of indicators is broken down into  $k$  many nonempty

subgroups, each having working age populations of size  $n^k$  and vectors  $x^k$  of indicators. Then

$$E(x) = \sum_k (n^k/n) E(x^k) \quad (6)$$

For indices satisfying this property, (6) is a convenient formula linking subgroup employment conditions to overall employment conditions, namely, the population share weighted sum of the subgroup values is equal to the overall value of  $E$ . Using subgroup decomposability, one can measure the employment conditions for each population subgroup and then show how much each subgroup contributes to the country's overall index.<sup>22</sup>

*An implication: subgroup consistency.* One implication of subgroup decomposability is that overall employment conditions must rise if employment conditions rise within subgroup  $k'$  and do not fall in the remaining subgroups, given that subgroup populations sizes are fixed. This is the property of *subgroup consistency*, which ensures that the overall level of  $E$  is consistent with local  $E$  levels. Both subgroup properties are useful when conducting analyses that move between a larger population and its parts, such as between a country and its ethnic subgroups.

*Satisfaction of subgroup consistency depends on choice of indicators.* Unlike the properties of indicator monotonicity and dimensional decomposability, which hold true for all indices of the form (2) regardless of the choice of indicators, subgroup decomposability holds only for certain collections of indicators. The property is thus seen to be a joint restriction on the functional forms of the indicators and the aggregator. Note that the levels of the indicators cannot in general be moved independently. Each is derived from the distribution of employment conditions in the underlying population. When the population is partitioned, the indicators for the groups must be recalculated from the distribution of employment conditions within

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<sup>22</sup> The contribution of a subgroup is the working age population share of the subgroup times its  $E$  value, all over the  $E$  value for the country. For a subgroup decomposable index, the sum of the contributions is always 100%.

each group. To evaluate whether an index satisfies or violates the property requires some additional notation for representing the employment attainments of individuals.

*Employment attainments are the fundamental data of interest.* In the present case, where the four indicators are a labor market indicator, an employment indicator, a formality indicator, and a living wage indicator, the employment status for each person  $i = 1, \dots, n$  can be represented by a vector  $(a_{i1}, a_{i2}, a_{i3}, a_{i4})$  of attainments, where:  $a_{i1} = 0$  means that person  $i$  is not in the labor force, while  $a_{i1} = 1$  means that  $i$  is in the labor force;  $a_{i2} = 0$  means that person  $i$  is not employed, while  $a_{i2} = 1$  means that  $i$  is employed;  $a_{i3} = 0$  means that person  $i$  is not employed in the formal sector, while  $a_{i3} = 1$  means that  $i$  is employed in the formal sector; and  $a_{i4} = 0$  means that person  $i$  is not employed with a living wage, while  $a_{i4} = 1$  means that  $i$  is employed and receives a living wage. Given the definitions of the employment conditions, there are exactly six feasible attainment vectors that a person may have:

$(0,0,0,0)$	outside labor force
$(1,0,0,0)$	in labor force but unemployed
$(1,1,0,0)$	employed in informal, non-living-wage job
$(1,1,1,0)$	employed in formal, non-living-wage job
$(1,1,0,1)$	employed in informal, living-wage job
$(1,1,1,1)$	employed formal, living-wage job

Intuitively, the employment status of a person unambiguously improves when her attainment vector has a “1” where a “0” used to be - in other words, when her new attainment vector dominates the old. The distribution across all persons is captured by the attainment matrix  $a = (a_{ij})$ , where the  $i^{th}$  row is person  $i$ 's attainment vector.

*Finding the numbers in each employment status.* Let WAP be the number of persons in the working age population; let EAP be the number of economically active persons or, equivalently, the size of the labor force; let EMP be the number of persons who are employed; let FOR be the number employed in formal jobs; and let LW be the number employed in living wage jobs. Now denote the  $j^{th}$  column of  $a$  by  $a_j$  and let the sum of the entries in that column be denoted by  $|a_j|$ . To calculate the number in the labor

force one simply adds up the entries in the first column,  $EAP = |a_1|$ ; the number of employed is the sum of the entries in the second column,  $EMP = |a_2|$ ; the number of formal jobs is the sum of entries in the third column,  $FOR = |a_3|$ ; the number of living-wage jobs is the sum of the entries in the fourth,  $LW = |a_4|$ ; and the number of persons in the working age population is  $WAP = n$ .

It is an easy matter to calculate the two sets of indicators described above using the attainment matrix of a population. The traditional indicators will be denoted by  $X_j$  for  $j = 1, \dots, 4$ . They are given as follows:

$$X_1 = EAP/WAP = |a_1|/n \quad \text{labor force participation rate}$$

$$X_2 = EMP/EAP = |a_2|/|a_1| \quad \text{1 - unemployment rate}$$

$$X_3 = FOR/EMP = |a_3|/|a_2| \quad \text{formality rate}$$

$$X_4 = LW/EMP = |a_4|/|a_2| \quad \text{living wage indicator}$$

The indicators used in the Better Jobs Index will be denoted by  $Y_j$  for  $j = 1, \dots, 4$ . They are given as follows:

$$Y_1 = EAP/WAP = |a_1|/n \quad \text{labor force participation rate}$$

$$Y_2 = EMP/WAP = |a_2|/n \quad \text{employment rate}$$

$$Y_3 = FOR/WAP = |a_3|/n \quad \text{alternative formality indicator}$$

$$Y_4 = LW/WAP = |a_4|/n \quad \text{alternative living wage indicator}$$

Denote the index associated with the traditional vector of indicators  $X = (X_1, X_2, X_3, X_4)$  by  $E_X = E_X(a) = \mu(X(a))$ ; similarly, denote the index associated with the Better Jobs indicators  $Y = (Y_1, Y_2, Y_3, Y_4)$  by  $E_Y = E_Y(a) = \mu(Y(a))$

$E_Y$  is subgroup decomposable. It is easily shown that  $E_Y$  can be decomposed by subgroup. For simplicity, suppose that there are only  $k = 2$  subgroups. Let  $a^1$  denote the attainment matrix of the first subgroup, let  $a^2$  denote the attainment matrix of the second subgroup, and let  $a = \begin{bmatrix} a^1 \\ a^2 \end{bmatrix}$  be the attainment matrix of the combined population. Subgroup decomposability of  $E_Y$  would demand that

$$E_Y(a) = \frac{n_1}{n}E_Y(a^1) + \frac{n_2}{n}E_Y(a^2) \quad (7)$$

But this is clearly true since

$$\begin{aligned} \frac{n_k}{n}E_Y(a^k) &= \frac{n_k}{n}[Y_1(a^k) + Y_2(a^k) + Y_3(a^k) + Y_4(a^k)]/4 \\ &= \frac{n_k}{n} \left[ \frac{|a_1^k|}{n_k} + \frac{|a_2^k|}{n_k} + \frac{|a_3^k|}{n_k} + \frac{|a_4^k|}{n_k} \right] /4 \\ &= \left[ \frac{|a_1^k|}{n} + \frac{|a_2^k|}{n} + \frac{|a_3^k|}{n} + \frac{|a_4^k|}{n} \right] /4 \end{aligned} \quad (8)$$

and so

$$\begin{aligned} \frac{n_1}{n}E_Y(a^1) + \frac{n_2}{n}E_Y(a^2) &= \left[ \frac{|a_1^1|+|a_1^2|}{n} + \frac{|a_2^1|+|a_2^2|}{n} + \frac{|a_3^1|+|a_3^2|}{n} + \frac{|a_4^1|+|a_4^2|}{n} \right] /4 \\ &= \left[ \frac{|a_1|}{n} + \frac{|a_2|}{n} + \frac{|a_3|}{n} + \frac{|a_4|}{n} \right] /4 = E_Y(a) \end{aligned} \quad (9)$$

Therefore  $E_Y$  is subgroup decomposable.

$E_X$  is not subgroup decomposable. The same argument does not work for  $E_X$ , and the reason is found in the denominators of the indicators  $X_k$ . Proceeding as before:

$$\begin{aligned} \frac{n_k}{n}E_X(a^k) &= \frac{n_k}{n}[X_1(a^k) + X_2(a^k) + X_3(a^k) + X_4(a^k)]/4 \\ &= \frac{n_k}{n} \left[ \frac{|a_1^k|}{n_k} + \frac{|a_2^k|}{|a_1^k|} + \frac{|a_3^k|}{|a_2^k|} + \frac{|a_4^k|}{|a_3^k|} \right] /4 \\ &= \frac{n_k}{n} \left[ \frac{|a_1^k|}{n_k} + \frac{|a_2^k|}{n_k} \frac{n_k}{|a_1^k|} + \frac{|a_3^k|}{n_k} \frac{n_k}{|a_2^k|} + \frac{|a_4^k|}{n_k} \frac{n_k}{|a_3^k|} \right] /4 \\ &= \left[ \frac{|a_1^k|}{n} + \frac{|a_2^k|}{n} \frac{n_k}{|a_1^k|} + \frac{|a_3^k|}{n} \frac{n_k}{|a_2^k|} + \frac{|a_4^k|}{n} \frac{n_k}{|a_3^k|} \right] /4 \end{aligned} \quad (10)$$

If it were the case that

$$\frac{n_1}{|a_1^1|} = \frac{n_2}{|a_1^2|} = \frac{n}{|a_1|} \quad \text{and} \quad \frac{n_1}{|a_2^1|} = \frac{n_2}{|a_2^2|} = \frac{n}{|a_2|} \quad (11)$$

then this would reduce to

$$\begin{aligned}\frac{n_k}{n}E_X(a^k) &= \left[ \frac{|a_1^k|}{n} + \frac{|a_2^k|}{n} \frac{n}{|a_1|} + \frac{|a_3^k|}{n} \frac{n}{|a_2|} + \frac{|a_4^k|}{n} \frac{n}{|a_2|} \right] / 4 \\ &= \left[ \frac{|a_1^k|}{n} + \frac{|a_2^k|}{|a_1|} + \frac{|a_3^k|}{|a_2|} + \frac{|a_4^k|}{|a_2|} \right] / 4\end{aligned}\quad (12)$$

and hence

$$\begin{aligned}\frac{n_1}{n}E_X(a^1) + \frac{n_2}{n}E_X(a^2) &= \left[ \frac{|a_1^1|+|a_1^2|}{n} + \frac{|a_2^1|+|a_2^2|}{|a_1|} + \frac{|a_3^1|+|a_3^2|}{|a_2|} + \frac{|a_4^1|+|a_4^2|}{|a_2|} \right] / 4 \\ &= \left[ \frac{|a_1|}{n} + \frac{|a_2|}{|a_1|} + \frac{|a_3|}{|a_2|} + \frac{|a_4|}{|a_2|} \right] / 4 = E_X(a)\end{aligned}\quad (13)$$

Notice that the ratios given in (11) are the reciprocals, respectively, of the labor force participation rate and the employment rate. Consequently, the key to ensuring that subgroup decomposability holds for  $E_X$  is for the labor force participation rates to be the same across the groups, and the employment rates to be the same across the groups. When the rates are not the same, the departure from subgroup decomposability depends on the differences in the reciprocals of the rates.<sup>23</sup>

- *Property 4: unambiguous improvements in employment status cause the Index to rise.*

Consider the following basic transitions in employment status:

- (0,0,0,0) to (1,0,0,0) outside labor force to inside labor force but unemployed
- (1,0,0,0) to (1,1,0,0) unemployed to employed in informal, not living wage job
- (1,1,0,0) to (1,1,1,0) informal, not living wage job to formal, not living wage job
- (1,1,0,0) to (1,1,0,1) informal, not living wage job to informal, living wage job
- (1,1,1,0) to (1,1,1,1) formal, not living wage job to formal, living wage job
- (1,1,0,1) to (1,1,1,1) informal, living wage job to formal, living wage job

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<sup>23</sup> For the subgroup data evaluated below, the magnitude of the difference between a country's Better Jobs Index and the weighted average of subgroup Indexes is small relative to the values of the Indexes. This suggests that the labor force participation rates and the employment rates are close enough to ensure an approximate decomposition.



We say that a change from  $a$  to  $a'$  represents an *unambiguous improvement in employment conditions* if a person experiences one or more of these basic transitions, while the status of every other person is unchanged. It is natural to require the *Better Jobs Index* to rise whenever there is an unambiguous improvement in employment conditions. This is the requirement expressed in the following property.

*Monotonicity.* If  $a'$  is obtained from  $a$  by an unambiguous improvement in employment conditions then  $E' > E$ .

*The Better Jobs Index satisfies monotonicity.* For the set of indicators given by  $Y_1$  through  $Y_4$ , this clearly holds, as the unambiguous improvement raises at least one of the indicators while none falls. For example, the transition from out of the labor force to unemployed, the labor force (EAP) increases without changing EMP, FOR, and LW, so that  $Y_1$  rises while the remaining indicators are unchanged, thus increasing  $E_Y$ .

*The Index with the traditional indicators violates monotonicity.* Recall that

$$E_X(a) = \left[ \frac{|a_1|}{n} + \frac{|a_2|}{|a_1|} + \frac{|a_3|}{|a_2|} + \frac{|a_4|}{|a_2|} \right] / 4 \quad (14)$$

Note that the final four transitions raise  $|a_3|$  and  $|a_4|$  without affecting  $n$ ,  $|a_1|$ , and  $|a_2|$ , and so they do not conflict with monotonicity. However, the first two transitions can generate conflicts. To see this, suppose that  $a'$  is obtained from  $a$  by the first transition (from outside the labor force to unemployed). Then

$$E_X(a') = \left[ \frac{|a_1|+1}{n} + \frac{|a_2|}{|a_1|+1} + \frac{|a_3|}{|a_2|} + \frac{|a_4|}{|a_2|} \right] / 4 \quad (15)$$

and so the Index rises exactly when

$$\frac{|a_1|+1}{n} + \frac{|a_2|}{|a_1|+1} > \frac{|a_1|}{n} + \frac{|a_2|}{|a_1|} \quad (16)$$

or

$$\begin{aligned} \frac{1}{n} + \frac{|a_2|}{|a_1|+1} &> \frac{|a_2|}{|a_1|} \Leftrightarrow \frac{|a_1|+1}{|a_2|n} + 1 > \frac{|a_1|+1}{|a_1|} \Leftrightarrow \frac{|a_1|+1}{|a_2|n} > \frac{1}{|a_1|} \\ &\Leftrightarrow \frac{|a_1|}{n} + \frac{1}{n} > \frac{|a_2|}{|a_1|} \end{aligned}$$

$$\leftrightarrow X_1 + \frac{1}{WAP} > X_2 \quad (17)$$

In other words, the Index with the traditional indicators will only register an increase if the labor force participation rate plus a very small number exceeds 1 minus the traditional unemployment rate. A quick examination of the data reveals that (17) is always violated for all countries in our sample and hence in each the index  $E_X$  will fall when an unambiguous improvement of this type occurs. This robust violation of monotonicity could substantially compromise the utility of  $E_X$  in monitoring employment conditions and directing policy.

A similar argument applies to a second transition. Suppose  $a''$  is obtained from  $a$  by a transition from being unemployed to being employed in an informal, non-living-wage job, then

$$E_X(a'') = \left[ \frac{|a_1|}{n} + \frac{|a_2|+1}{|a_1|} + \frac{|a_3|}{|a_2|+1} + \frac{|a_4|}{|a_2|+1} \right] / 4 \quad (18)$$

and so the Index rises exactly when

$$\frac{|a_2|+1}{|a_1|} + \frac{|a_3|}{|a_2|+1} + \frac{|a_4|}{|a_2|+1} > \frac{|a_2|}{|a_1|} + \frac{|a_3|}{|a_2|} + \frac{|a_4|}{|a_2|} \quad (19)$$

or

$$\frac{|a_2|+1}{|a_1|} + \frac{|a_3|+|a_4|}{|a_2|+1} > \frac{|a_2|}{|a_1|} + \frac{|a_3|+|a_4|}{|a_2|} \leftrightarrow \frac{1}{|a_1|} + \frac{|a_3|+|a_4|}{|a_2|+1} > \frac{|a_3|+|a_4|}{|a_2|}$$

$$\leftrightarrow \frac{|a_2|+1}{(|a_3|+|a_4|)|a_1|} + 1 > \frac{|a_2|+1}{|a_2|} \leftrightarrow \frac{|a_2|+1}{(|a_3|+|a_4|)|a_1|} > \frac{1}{|a_2|}$$

$$\leftrightarrow \frac{|a_2|}{|a_1|} + \frac{1}{|a_1|} > \frac{|a_3|+|a_4|}{|a_2|}$$

$$\leftrightarrow X_2 + \frac{1}{EAP} > X_3 + X_3 \quad (20)$$

In other words, the Index with the traditional indicators will only register an increase in employment conditions if 1 minus the unemployment rate (plus a very small number) exceeds the formality rate plus the living wage indicator. Once again, an examination of the data reveals that in two thirds of the countries reverse inequality

(20), hence  $E_X$  will fall when an unambiguous improvement of this type occurs. It seems that this sort of non-monotonicity would be rather difficult to rationalize for an index of this type.

*An alternative interpretation of using the same denominator for the Better Jobs Index indicators ( $E_Y$ ).* Composite indices are often made up of unrelated and incommensurate indicators.<sup>24</sup> The index  $E_Y$ , by comparison, combines four related indicators from two equally important dimensions of employment conditions into an intuitive index. All indicators provide information on the prevalence of a specific employment status among the working age population. While each indicator  $Y_j$  is readily viewed as a population statistic, the SIMS data also allows the four components to be viewed and measured at the individual level. In other words, it can be ascertained whether a given person of working age is in the labor market, has a job, and if so then whether it is formal or is associated with a living wage. This allows  $E_Y$  to be reinterpreted as  $1-M_0$  where  $M_0$  is the adjusted headcount ratio of Alkire and Foster (2011) - now applied to evaluate the deprivations in employment conditions of the working age population. The index  $1-M_0$  also has been employed in Bhutan's Gross National Happiness Index and the Women's Empowerment in Agriculture Index.<sup>25</sup>

*Some additional notation.* Additional notation will help explain this alternative representation. As before, let  $i = 1, \dots, n$  denote a working age person where  $n$  is the total number of such persons, and let  $j = 1, \dots, 4$  represent the four components of the index. The *deprivation matrix*  $g^0 = (g_{ij}^0)$  is defined as follows. Define  $g_{i1}^0 = 1$  if person  $i$  is not in the labor force, while  $g_{i1}^0 = 0$  otherwise;  $g_{i2}^0 = 1$  if person  $i$  is unemployed, and  $g_{i2}^0 = 0$  otherwise;  $g_{i3}^0 = 1$  if person  $i$ 's primary employment is in the informal sector, and  $g_{i3}^0 = 0$  otherwise; and  $g_{i4}^0 = 1$  if person  $i$ 's primary employment offers a wage below the living wage rate, and  $g_{i4}^0 = 0$  otherwise.<sup>26</sup> The

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<sup>24</sup> See Ravallion (2012) for a criticism of generic composite indices.

<sup>25</sup> See Ura et al (2015) and Alkire et al (2013).

<sup>26</sup> In other words  $g^0 = \mathbf{1} - a$ , where  $\mathbf{1}$  is the  $n \times 4$  matrix of 1's. See the discussion in Alkire and Foster (2016).

adjusted headcount ratio  $M_0$  can then be defined as  $M_0 = \mu(g^0) = \left(\frac{1}{4n}\right) \sum_i \sum_j g_{ij}^0$ , or the average value in the deprivation matrix.<sup>27</sup> Notice that each alternative indicator can be written as  $Y_j = \left(\frac{1}{n}\right) \sum_i (1 - g_{ij}^0)$  so that  $E_Y = \left(\frac{1}{4}\right) \sum_j Y_j = 1 - M_0$ . In other words,  $E_Y$  has the structure of  $1 - M_0$ , the positively oriented version of the adjusted headcount ratio. The properties of  $E_Y$  - including subgroup decomposability and dimensional decomposability - are inherited from the properties of  $M_0$ .

*Why this matters.* The fact that  $E_Y$  has an alternative interpretation provides an additional pathway for potential users to connect with the index.  $M_0$  is the structure underlying virtually all of the official multidimensional poverty measures both in LAC and the rest of the world. It is also linked to many measures of social exclusion used in Europe.<sup>28</sup>  $1 - M_0$  is the structure underlying the Gross National Happiness Index and the Women's Empowerment in Agriculture Index supported by USAID. It also demonstrates that  $E_Y$  goes beyond the typical composite index. This additional information was considered along with other points raised above in selecting the form of the Index.

## 5. Final remarks

- *The general methodology.*

The headline measure and its associated indices and indicators provide a useful toolkit with which to monitor and analyze employment conditions. The absence of other variables in the data has helped impose a parsimonious and intuitive structure that is an improvement on standard measures but does not overextend itself. It can surely be applied to the purpose for which it was developed and it is easy to explain

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<sup>27</sup> The interpretation uses a "union" based identification, which means that all deprivations are considered by the index.

<sup>28</sup> See for example Chakravarty and D'Ambrosio (2006)

to potential users. Besides, given the SIMS data, it will be able to be computed regularly.

- ***Discussion: indicators.***

The decision of using the same denominator for all the indicators is reduced to a discussion of desideratum (i) on the simplicity of the index, of desideratum (iv) on rigor, as well as their relative importance in the present context. Index  $E_X$  based on the traditional indicators is about as simple as it gets, with indicators that should be generally understood and accepted. Index  $E_Y$  based on the chosen indicators for the Better Jobs Index is close behind in this respect, but with a number of qualifications. Its formality indicator,  $Y_3$ , would require somewhat more explanation as it is a variant of the traditional version.<sup>29</sup> Finally, the link that  $E_Y$  has to the  $M_0$  form of multidimensional measure - a form that is well known in the LAC region by now - represents a communication advantage. With respect to desideratum (iv) on rigor, the advantage clearly goes to  $E_Y$ . The traditional version's failure to satisfy subgroup decomposability would ordinarily be enough to drop it from consideration. More important is its violation of monotonicity: basic improvements in employment conditions can lead to a decrease in  $E_X$ . Violating a fundamental axiom is a problem and it could be especially detrimental to policy applications. In contrast, there are no hidden problems with  $E_Y$  as the underlying measure  $M_0$  has no such difficulties and has been used in many different contexts for several years now.

- ***Discussion: working age population.***

The question regarding the denominator of all four indicators hinges on desiderata (i) and (iv). The traditional working age population definition - ages 15 to 64 - is generally accepted and used by many countries; it is simple and easy to communicate.<sup>30</sup> On the other hand, the retention of students and their completion of

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<sup>29</sup> The final indicator on living wage jobs is new, and hence the traditional version does not have a communication advantage arising from familiarity. The labor force participation indicator is the same across the two indices.

<sup>30</sup> To be sure, other definitions are in common use. The lower bound is sometimes altered to 14 or 16, while the upper bound is sometimes removed altogether.

secondary school are clearly central policy challenges for countries in the LAC region, and are important prerequisites for improving the quality of employment.<sup>31</sup> Consequently, it makes sense to explore how improvements in policies designed to improve retention might impact the Index: the index should not fall if school retention policies are working.

*School retention property:* If a school retention policy leads a youth to stay in school rather than enter the labor force as an unemployed person, then the index should not fall as a result.

Consider first the index  $E_Y$  under the traditional definition of the working age population. Suppose that a 16-year-old youth decides to stay in school rather than enter the labor force as an unemployed person. Using the traditional definition, the youth stays in the working age population in either case, and hence the number in this group is unchanged. However, the number of economically active persons falls when the youth chooses school over unemployment; thus,  $Y_1$  falls while  $Y_2$ ,  $Y_3$ , and  $Y_4$  are unchanged, implying that  $E_Y$  falls and violating the school retention property. Now, consider what happens under the alternative definition of the working age population that excludes full time students. Assume that at least half the working age population is employed, a plausible assumption considering the SIMS data for LAC.<sup>32</sup> It will be shown that  $E_Y$  does not fall when a youth selects school over unemployment. Denote the number in the working age population by WAP, the number in the labor force by EAP, the number employed by EMP, the number working in the formal sector by FOR, the number earning a living wage by LW, and denote  $K = EAP + EMP + FOR + LW$ . When a youth decides to stay in school full time rather than enter the labor force as an unemployed person, this means that both WAP and EAP will be lower by 1 while EMP, FOR and LW are unchanged. Let  $E_Y$  denote the Index level when the youth is

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<sup>31</sup> See for example UNESCO (2014).

<sup>32</sup> Note that the far weaker assumption  $WAP \leq EAP + EMP + FOR + LW$  is sufficient to ensure that the school retention property is satisfied by  $E_Y$ .

unemployed in the labor force, and let  $E_Y'$  be the Index level the youth stays in school full time. Then

$$E_Y = \frac{1}{4} \frac{K}{WAP}$$

and

$$E_Y' = \frac{1}{4} \frac{K-1}{WAP-1}$$

Consequently,  $E_Y \leq E_Y' \Leftrightarrow \frac{K}{WAP} \leq \frac{K-1}{WAP-1} \Leftrightarrow K WAP - K \leq K WAP - WAP \Leftrightarrow WAP \leq K$ . But by assumption  $WAP \leq 2 EMP$  and by definition  $2 EMP \leq EAP + EMP \leq K$ . Thus,  $E_Y \leq E_Y'$ , which shows that the index does not fall.

Therefore, given the importance of these policies in the LAC region, it makes sense to select the WAP alternative definition (excluding full time students).

- ***Discussion: index versus dashboard***

One important concern is whether the proposed index adds relevant information to that already contained in its four components. This is the “index vs dashboard” discussion. There are two extreme situations that might limit the usefulness of such index. One is when all four components are highly correlated. In such case the index adds little to the information already contained in any of the variables; i.e., any variable can play the role of the index in tracking regional, temporal and subgroup information. The other extreme scenario arises when all variables are conceptually relevant but uncorrelated, hence the index (understood as an average) is, by definition, an inappropriate unidimensional summary of a truly four-dimensional reality.

Paradoxically, indexes are relevant in the intermediate situation where the underlying dimensionality is neither one nor that of the original space: there must be something not trivial to summarize but the summary must be representative of a complex reality.

This issue can be explored using a principal components analysis on the four variables used to construct the index, based on information available on the SIMS for (circa) 2014.<sup>33</sup>

Figure 1 presents a simple boxplot for each index. Results suggest that the “quality” components of the index (formality -for- and living wage -lw-) present lower values but also much higher variability than their “quantitative” counterparts (labor force participation -eap- and employment -emp-). This is relevant since it is a first indication that the information contained in both aspects (qualitative and quantitative) is not redundant. Also, it suggests that care must be taken when weights are considered, considering the differences in scales of the variables (which is relevant for both index construction and principal components).

Table 1 presents the correlation matrix for the original variables. As expected, the correlation between the quantitative components (eap and emp) is quite high. Interestingly, all other correlations (among qualitative components and between quantitative and qualitative components) is low. This suggests that components might contain information not trivially included in all other variables, and that the underlying space of attributes is truly multidimensional.

Table 2 presents the loadings of a standard principal components analysis, where variables were previously re-scaled, a standard practice in this type of technique. Results are striking. The first principal component weighs all variables positively and with almost equal importance. Consequently, the first principal component can be safely seen as a simple average of all components, which is exactly the weighting scheme proposed for the Index based on purely conceptual concerns. That is, from this perspective the Index is the best way to reproduce the total variability in the four original indicators; the average arises as a solution to the problem of choosing the

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<sup>33</sup> For details on this approach to measure multidimensionality see Caruso, G., Sosa Escudero, W. and Svarc, M. (2013), Poverty and the dimensionality of welfare, Chapter 3 in Betti, G and Lemmi, A. (eds), Poverty and Social Exclusion: New Methods of Analysis, Routledge, New York, and Caruso, G., Sosa Escudero, W. and Svarc, M., (2015), Deprivation and the Dimensionality of Welfare: A Variable-Selection Cluster-Analysis Approach, 2015, Review of Income and Wealth, 61, 4, pp. 702-722.



best way to combine the original variables linearly, so that the resulting index reproduces the original multidimensional variability as accurately as possible.

Table 2 presents the eigenvalues of the principal components decomposition, in decreasing order. A standard practice is to retain components whose eigenvalues are greater than one in absolute value. Consequently, results suggest that the total variability in the four indicators can be appropriately summarized by the first two components. The first principal component can reproduce 56.1% of the total variability in all indexes jointly, which is quite high considering that the pairwise correlations of the four variables are in general low.

The second principal component assigns small and negative importance to the quantitative components and positive and high to the qualitative one. Even though it reproduces only 37% of the total variability, it suggests that the difference between quantitative and qualitative dimensions are an important factor.

Figure 2 presents the previous results graphically. It basically reproduces the information in Table 2, that is, each line corresponds to each of its columns. The thickest solid line shows loadings of the first principal component. The thick dashed line shows loadings of the second principal component. Non-relevant principal components are presented in the other two thinner lines, for completeness. The loadings of the first principal component (thick solid line) are the coefficients used to produce the best unidimensional linear summary of the four variables. All are positive and take very similar values. As a matter of fact, they can be reasonably represented by the average (the solid horizontal line), suggesting that the simple unweighted average (as in the Better Jobs Index) is not only conceptually relevant but also statistically coherent with the idea of being representative of the underlying variables used to construct the index.

The fact that more than one principal component is relevant and necessary to reproduce the information in the four original variables suggest that the original space is truly multidimensional, so the index is indeed a relevant summary of a complex reality. The fact that the first principal component accounts for more than

50% of the original variability suggests that the index is a proper summary of a multidimensional space.

Interestingly, the principal component results suggest that separate “quantity” and “quality” indexes are informative as well, in particular their differences.

- **Summary.**

The Better Jobs Index is:

$$E_Y = \mu(Y_1, Y_2, Y_3, Y_4)$$

where

$$\begin{aligned} Y_1 &= \text{EAP/WAP} && \text{(labor force participation)} \\ Y_2 &= \text{EMP/WAP} && \text{(employment)} \\ Y_3 &= \text{FOR/WAP} && \text{(formal employment)} \\ Y_4 &= \text{LW/WAP} && \text{(living wage employment)} \end{aligned}$$

and WAP excludes full time students. It can also be expressed as

$$E_Y = \mu(Q_1, Q_2)$$

where

$$\begin{aligned} Q_1 &= \mu(Y_1, Y_2) && \text{(quantity index)} \\ Q_2 &= \mu(Y_3, Y_4) && \text{(quality index).} \end{aligned}$$

Alternatively, using the notation of Alkire and Foster (2011), the measure can be constructed as follows. Let  $g^0 = (g_{ij}^0)$  be the  $n \times 4$  deprivation matrix with entries defined as

$$\begin{aligned} g_{i1}^0 &= 1 \text{ if person } i \text{ is not in the labor force, and } 0 \text{ otherwise} \\ g_{i2}^0 &= 1 \text{ if person } i \text{ is not employed, and } 0 \text{ otherwise} \\ g_{i3}^0 &= 1 \text{ if person } i \text{ does not have a formal job, and } 0 \text{ otherwise} \\ g_{i4}^0 &= 1 \text{ if person } i \text{ does not have a living wage job, } 0 \text{ otherwise.} \end{aligned}$$

Then

$$E_Y = 1 - M_0 = 1 - \mu(g^0).$$

Equivalently, defining the  $n \times 4$  attainment matrix  $a = (a_{ij})$  by  $a = \mathbf{1} - g^0$ , so that

$a_{i1} = 1$  if person  $i$  is in the labor force, and 0 otherwise

$a_{i2} = 1$  if person  $i$  is employed, and 0 otherwise

$a_{i3} = 1$  if person  $i$  does has a formal job, and 0 otherwise

$a_{i4} = 1$  if person  $i$  has a living wage job, and 0 otherwise.

Then

$$E_Y = \mu(a).$$

The subgroup decomposition formula can be stated as follows: Where  $a^1$  denotes the attainment matrix of a first population subgroup with (WAP) population size  $n_1$ , and  $a^2$  denotes the attainment matrix of a second subgroup with population size  $n_2$ , and  $a = \begin{bmatrix} a^1 \\ a^2 \end{bmatrix}$  is the attainment matrix of the combined population size  $n$ , then

$$E_Y = \frac{n_1}{n} E_Y^1 + \frac{n_2}{n} E_Y^2 \quad \text{where } E_Y^1 = \mu(a^1) \text{ and } E_Y^2 = \mu(a^2).$$

In other words, the overall Index is a population weighted average of employment conditions subgroup. This formula can be generalized to any number of population subgroups. Likewise, the dimensional decomposition of  $E_Y$  can be defined with the help of the four column vectors  $(a_1, a_2, a_3, a_4)$  of  $a$  as follows:

$$E_Y = \mu(Y_1, Y_2, Y_3, Y_4) \quad \text{where } Y_j = \mu(a_j) \text{ for all } j.$$

$Y_j$  can be interpreted as the  $j^{\text{th}}$  attainment headcount ratio, or the share of working age persons attaining the  $j^{\text{th}}$  employment condition. Consequently, the overall Index is an average of the four attainment headcount ratios. The first decomposition allows the Index to be analyzed by ethnic group, by subnational region, or by other relevant partition of the population. The second identifies the dimensions that are responsible for the magnitude of the overall Index.

*New insights: decompositions by employment groups.* The employment attainments underlying the Index can be “nested” in that one must attain one in order to attain the other. For example, being employed requires being in the labor force, so attainment 2 requires having attainment 1. Likewise, each of the quality attainments requires both of the quantity attainments. As a consequence, the number of possible attainment configurations is reduced from 16 to the following six attainment vectors:

- $v_1 = (0,0,0,0)$  outside labor force
- $v_2 = (1,0,0,0)$  in labor force but unemployed
- $v_3 = (1,1,0,0)$  employed in informal, non-living-wage job
- $v_4 = (1,1,1,0)$  employed in formal, non-living-wage job
- $v_5 = (1,1,0,1)$  employed in informal, living-wage job
- $v_6 = (1,1,1,1)$  employed formal, living-wage job

Consider the six population subgroups defined by the configurations, and let the share of the population having configuration  $v_t$  be denoted by  $s_t$ , for  $t = 1, \dots, 6$ . Then subgroup decomposability implies that

$$E_Y = s_1\mu(v_1) + \dots + s_6\mu(v_6).$$

The quantity  $\mu(v_t)$  can be viewed as the “value” associated with an individual of type  $t$ , found by adding up the entries in  $v_t$  and dividing by 4. The overall Index is then the weighted average of these values, where the weights are the population shares given in the population share vector  $s = (s_1, \dots, s_6)$ . In order to calculate  $E_Y$  for a country or a region, one need only have its population share vector  $s$ , which indicates the prevalence of each type in the population. This alternative representation  $E_Y$ , which is facilitated by the nested structure of employment attainments, may prove to be a useful tool for analysis.

## **Appendix. Measuring Horizontal Equity**

Employment conditions may well be different across population subgroups within a country, generating what might be called horizontal inequity in employment

conditions.<sup>34</sup> The population subgroups evaluated can be defined by geography, ethnicity, or some other characteristic, but of particular interest are the cases of gender and age. The Better Jobs Index can be used to measure horizontal inequity (or equity) in employment conditions given the partition of the population into subgroups. For instance, a simple parity index that compares subgroup Index based on a “gap” measure from poverty analysis can be used when the partition of the population creates two subgroups, such as with gender or youth/adult comparisons.

- *Gender Disparity.* Let  $E_f$  and  $E_m$  denote the Indexes for the female and male working age populations, respectively. This approach relies on concepts from poverty analysis to compare  $E_f$  and  $E_m$  and thereby obtain a measure of gender disparity in employment conditions. The *poverty gap* is defined for a poverty standard  $z$  and an income level  $y$  as  $(z - y^*)/z$ , where  $y^*$  is the income level censored at the poverty standard.<sup>35</sup> To evaluate the disparity of female employment conditions relative to male conditions, for example, one can replace achievement  $y$  with female employment conditions  $E_f$ , and standard  $z$  with male employment conditions  $E_m$ , to obtain the *female disparity* index  $D_f = (E_m - E_f^*)/E_m$ , where  $E_f^*$  is  $E_f$  censored at  $E_m$ . Whenever the female Index exceeds the male level the value is  $D_f = 0$ , which indicates that there is no female disparity; otherwise,  $D_f$  evaluates the extent to which the  $E_f$  falls below the  $E_m$ , using  $E_m$  as the standard. Symmetrically, the *male disparity* index, defined as  $D_m = (E_f - E_m^*)/E_f$ , uses the female Index as the standard against which the male Index is evaluated. Both take on values in the interval  $[0,1]$  and one of the two must have the value 0.

- *Parity.* Corresponding indices of gender *parity* can be obtained by subtracting the disparity indices from their highest value:  $P_f = 1 - D_f = E_f^*/E_m$  and  $P_m = 1 - D_m = E_m^*/E_f$ . A gender parity index measures the censored Index level for one gender as a share of the Index level of the other. The values of  $P_f$  and  $P_m$  always lie in the interval  $[0,1]$  and one must have the value 1. This is the standard way of measuring

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<sup>34</sup> See Stewart (2002) for a discussion of horizontal inequalities.

<sup>35</sup> In other words  $y^* = y$  if  $y < z$  while  $y^* = z$  if  $y \geq z$ .

gender parity and is found in both the Global Gender Gap Index (World Economic Forum, 2015) and the Gender Parity Index of the Womens' Empowerment in Agriculture Index (Alkire et al, 2013).

*A horizontal inequality measure for the many subgroup case.* Now suppose that the overall population is divided into  $k$  subgroups having respective Better Jobs Index levels  $E_1, E_2, \dots, E_k$ . Recall that by construction each Index level is also the average individual employment condition level within a subgroup. The literature on inequality decompositions can be used to create a measure of horizontal inequality as follows. Let  $e_i = \mu(a_i)$  denote the  $i^{\text{th}}$  person's employment condition value calculated by averaging the entries of the attainment vector  $a_i$ , and let  $e = (e_1, \dots, e_n)$  be the population distribution of employment conditions. Create the *smoothed distribution*, denoted  $\bar{e}$ , by replacing each person's entry  $e_i$  with the mean level of the subgroup that person  $i$  is in. So, for example, if person  $i$  is in subgroup 2 then  $e_i$  is replaced with  $E_2$ . Now apply an inequality measure  $I$  to the smoothed distribution to obtain a *horizontal inequality measure*  $H_I(e) = I(\bar{e})$ .<sup>36</sup> For example, let  $I$  be Atkinson's inequality measure defined as  $I = (\mu - g)/\mu$ , where  $g$  is the geometric mean. Then the horizontal inequality measure becomes  $H_I(e) = (\mu(\bar{e}) - g(\bar{e}))/\mu(\bar{e})$ . Notice that  $\mu(\bar{e}) = \mu(e) = E_Y$ , or the population Index. It has a value of 0 whenever  $E_1, E_2, \dots, E_k$  are identical across all groups and rises as the employment conditions become more unequal across the subgroups.

*Horizontal equality.* Now  $I(\bar{e})$  is of course a negatively oriented measure. For measures like the Atkinson measure that range between 0 and 1, it is easy to obtain a positively oriented measure. Simply subtract  $H_I(e)$  from 1 to obtain the *horizontal equity measure*  $H_E(e) = g(\bar{e})/\mu(\bar{e})$ . It has a value of 1 whenever  $E_1, E_2, \dots, E_k$  are identical across all groups and falls as the conditions become more unequal across the subgroups.

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<sup>36</sup> If the inequality measure is decomposable, then this corresponds to the *between group inequality* term of its decomposition.

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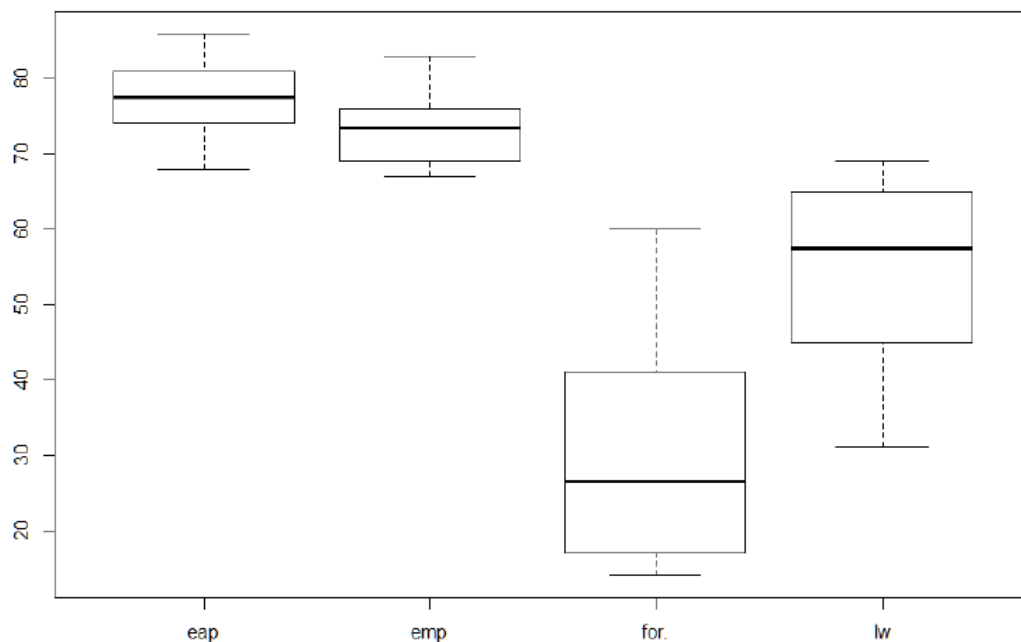
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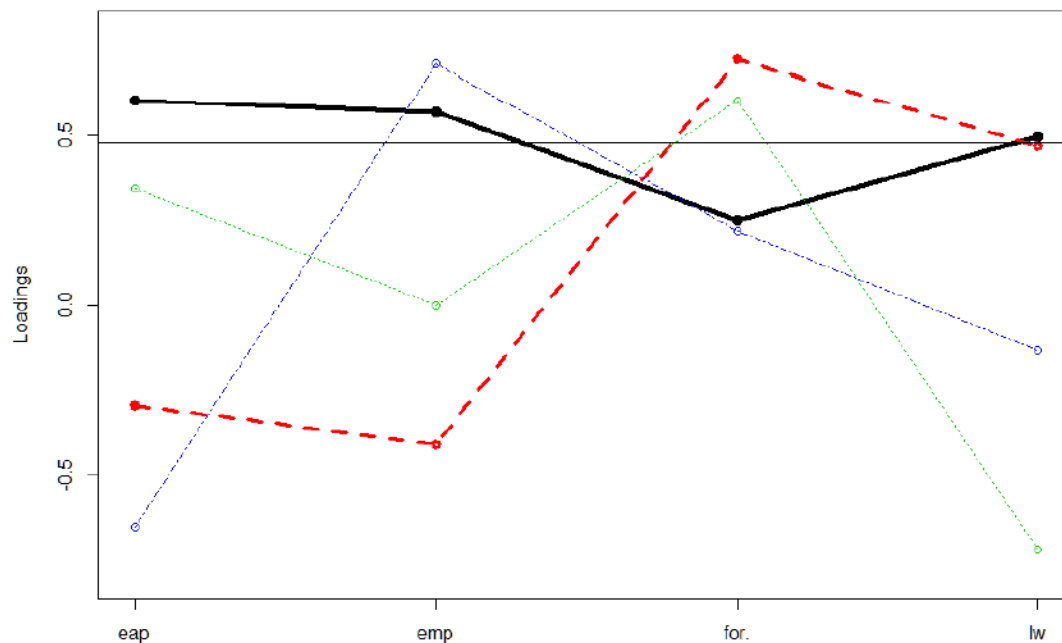


**Figure 1. Cross section variability of index components**



Notes: eap: labor force participation; emp: employment; for: formal employment; lw: living wage  
Source: Sosa-Escudero report on Foster's report. Calculated using information available at SIMS platform circa 2014.

**Figure 2. Loadings of principal components**



Notes: eap: labor force participation; emp: employment; for: formal employment; lw: living wage.  
thickest solid line shows loadings of the first principal component. Thick dashed line shows loadings of the second principal components. Non-relevant principal components are presented in the other two thinner lines, for completeness.

Source: Sosa-Escudero report on Foster's report. Calculated using information available at SIMS platform circa 2014.

**Table 1: Pairwise correlations of index components**

	eap	emp	for	lw
eap	1	0.929	0.062	0.418
emp	0.929	1	-0.111	0.351
for	0.062	-0.111	1	0.673
lw	0.418	0.351	0.673	1

Notes: eap: labor force participation; emp: employment; for: formal employment; lw: living wage.

Source: Sosa-Escudero report on Foster's report. Calculated using information available at SIMS platform circa 2014.

**Table 2: Loadings of principal components**

	PC1	PC2	PC3	PC4
eap	0.6047	-0.2973	0.3452	-0.6533
emp	0.5696	-0.4093	-0.0013	0.7128
for.	0.2485	0.7252	0.6037	0.2189
lw	0.4982	0.4671	-0.7186	-0.1312

Notes: eap: labor force participation; emp: employment; for: formal employment; lw: living wage. PC: principal component

Source: Sosa-Escudero report on Foster's report. Calculated using information available at SIMS platform circa 2014.

**Table 3: Variance decomposition**

Component	Eigenvalue	Proportion	Cummulative
1	22.445	0.5611	0.5611
2	14.709	0.3677	0.9289
3	0.2345	0.0586	0.9875
4	0.050	0.0125	1.0000

Source: Sosa-Escudero report on Foster's report. Calculated using information available at SIMS platform circa 2014.