

American Journal of Economics and Business Management

Vol. 9 Issue 11 | **pp.** 667-678 | **ISSN:** 2576-5973
Available online @ https://www.globalresearchnetwork.us/index.php/ajebm

Article

Methodology for the Multidimensional Assessment of Rural Employment: Quantity, Quality, Stability and Logical Bounds

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Abstract: The article refines a method for multidimensional assessment of rural employment through quantity, quality and stability blocks. The blocks are measured for the same population coverage and period, formality is counted once within the quality block, and unobserved blocks are not filled with zeros or averages; instead, logical bounds of the index are computed. Aggregate components show the index rising from 44.5 to 70.0 points in 2016–2025, while with only the quantity block observed in 2020 the full index for the rural population lies between 17.8 and 84.5 points.

Keywords: Rural population, employment, job quality, employment stability, composite index, logical bounds.

Citation: Bukharovich K. A. Methodology for the Multidimensional Assessment of Rural Employment: Quantity, Quality, Stability and Logical Bounds. American Journal of Economics and Business Management 2026, 9(11), 667-678.

Received: 10th Aug 2026
Revised: 11th Sep 2026
Accepted: 11th Oct 2026
Published: 20th Nov 2026

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1. Introduction

Providing employment for the rural population is one of the key priorities of Uzbekistan's policy aimed at raising household incomes and reducing poverty. A substantial share of the country's population lives in rural areas, and these areas also account for a large proportion of the young people entering the labour market each year. The rural labour market differs structurally from its urban counterpart: seasonal agricultural work, activity on household plots and dehqon (smallholder) farms, informal wage labour and labour migration are closely intertwined. Consequently, an increase in the number of employed persons does not necessarily translate into a commensurate improvement in well-being: a worker's wages may be low, income volatile, the employment relationship unregistered and the duration of work dependent on the season. Conversely, even when the number of employed persons remains unchanged over a short period, improvements in wages and legal protection can yield tangible benefits for the population.

Accordingly, an employment regulation strategy should address not only the question "How many people are working?" but also "Under what conditions are they working?" and "How stable is this work?". The legal and institutional basis for such an approach has been established by the laws "On Employment of the Population" and "On Official Statistics" [1; 2], the Labour Code [3], Presidential Resolution No. PP-345 of 21 September 2026 [4] and Cabinet of Ministers Resolution No. 522 on improving the recording of employment and unemployment [5]. These documents set out requirements for improving employment accounting, formalising labour relations and ensuring a safe working environment; in other words, state policy is broadening its focus from the quantity of employment to its quality and stability.

However, this policy shift has not yet been fully reflected in assessment tools. In practice, multidimensional assessment is often reduced to a single composite score, without explicit disclosure of the population coverage, denominator and reference period of each component or of how unobserved parts have been treated. This gives rise to four types of methodological error. First, indicators derived for different age groups or periods are combined into a single index. Second, the employment, economic activity and unemployment rates, although mathematically interrelated, are added together as independent achievements, which assigns excessive weight to the quantity block. Third, formality is counted twice, as an indicator of both quality and stability. Fourth, components for which no data are available are imputed with zeros or mean values. As a result, two regions with identical scores may face substantively different problems: in one, access to employment is limited, whereas in the other, jobs are available but income and social protection are inadequate. Ranking regions or allocating programme funds on the basis of such an index may therefore lead to flawed management decisions.

The aim of the study is to develop a methodology for assessing rural employment across quantity, quality and stability blocks in which each block is measured for the same coverage and period, and the result is reported with no greater precision than the available data permit. To this end, the following objectives were set: to develop a calculation specification (passport) for the blocks and their indicators; to identify the dynamics of the index and the composition of its growth on the basis of aggregate components for 2016–2025; to test the sensitivity of the results to the weights and the aggregation method; and to test the logical bounds of the index for unobserved blocks using 2020 rural data.

The article presents the second scientific novelty of the dissertation: the methodology for the multidimensional assessment of employment has been improved through rules for measuring quantity, quality and stability for the same population coverage and period, avoiding the double counting of formality, and determining logical bounds for unobserved blocks. The scientific contribution lies not in a new name for the index or in the number of formulas, but in the measurement rules themselves: the outcome is not a complete regional index, but a transparent measurement procedure together with interval estimates based on the available data.

The relevant scientific literature can be grouped into five strands: international standards for the statistical measurement of employment; employment quality and the concept of decent work; the methodology for constructing composite indices; assessment under incomplete data; and the specific features of the rural labour market, together with national studies. Each strand yields a specific measurement rule for the proposed methodology.

The conceptual foundations of employment measurement are set out in the resolutions of the International Conference of Labour Statisticians. These resolutions distinguish between forms of work, classify the population into employed persons, unemployed persons and persons outside the labour force, and introduce measures of labour underutilisation [10]. The informal economy and informal employment, in turn, are measured on the basis of separate definitions at the level of a person's main job [11]. Statistics on earnings and labour income treat the earnings of employees and the income of the self-employed as distinct concepts [12]. Two implications for the methodology follow from these sources: in the quantity block, the employment share should be separated from labour force participation, while in the quality block, the coverage of the remuneration indicator and the definition of formality should be fixed uniformly in advance.

Approaches to measuring employment quality originate in the ILO concept of decent work. D. Ghai characterised decent work in terms of employment opportunities, rights at work, social protection and social dialogue, and proposed a system of indicators for its measurement [24]; this approach was subsequently developed into a set of statistical and

legal framework indicators in the ILO manual on decent work indicators [25]. The UNECE handbook describes the quality of employment through seven dimensions: safety and ethics of employment; income and benefits from employment; working time and work–life balance; security of employment and social protection; social dialogue; skills development and training; and employment-related relationships and work motivation [26]. The OECD Job Quality Framework, in turn, distinguishes three dimensions: earnings quality, labour market security and the quality of the working environment [27]. Analysing the spread of precarious employment, A. Kalleberg substantiated the need to assess job quality not only in terms of earnings but also in terms of job duration and security [28]. These approaches separate quality and security to varying degrees; however, because formality is linked both to social protection and to employment security, it may enter several dimensions simultaneously. For this reason, in the proposed methodology formality is accounted for only in the quality block, whereas stability is measured through time-related indicators, namely within-year variability and job retention.

With regard to the methodology for constructing composite indices, the handbook prepared by the OECD and the European Commission's Joint Research Centre emphasises that the theoretical framework, selection of indicators, treatment of missing data, normalisation, weighting, aggregation and sensitivity analysis must be harmonised as a single logical chain [16]. A. Saltelli and co-authors systematised methods for testing the sensitivity of results to weights and computational rules [17]. In the Human Development Reports, dimensions are combined by means of the geometric mean in order to limit the extent to which a low score in one dimension can be fully offset by a high score in another [18]. G. Munda and M. Nardo showed that in linear aggregation the weights are not "importance coefficients" but trade-off ratios between components, and on this basis they advocated non-compensatory aggregation methods [29]. It follows that the final score should be published together with the block profile, the sensitivity to weights and the result of an alternative aggregation.

Under incomplete observation, C. Manski proposed computing logical bounds on the outcome without imposing additional assumptions about the unobserved part [19], while E. Tamer generalised this approach in econometrics as the theory of partial identification [30]. R. Little and D. Rubin classified missing-data mechanisms and showed that any imputation method rests on an assumption about the mechanism generating the missingness [20]. Hence, assigning a zero or a mean value to an unobserved block is not a neutral technical operation but an untested assumption. For the job retention indicator in the stability block, the meta-analysis by D. Card, J. Kluve and A. Weber is particularly relevant: the employment effects of active labour market programmes were small in the short run but increased substantially two to three years after programme completion [21]. This suggests that it is more appropriate to evaluate programme outcomes by subsequent employment retention than by the mere fact of job placement.

The specific features of rural employment directly affect the rules for its measurement. F. Ellis demonstrated that rural households diversify their income sources, meaning that a single individual may alternate over the course of a year between agriculture, seasonal wage work and small-scale entrepreneurship [22]. An OECD study stresses the need to assess the opportunities of rural areas not through the same indicators as those used for urban areas, but with a clearly delineated coverage [23]. Under such conditions, the annual average employment rate masks seasonal fluctuations, while the number of employed persons conceals low and unstable incomes. The stability block should therefore be measured separately from the quality block and on the basis of quarterly observations.

Among national studies, K.Kh. Abdurakhmanov has examined the theoretical foundations of labour economics and labour market regulation, as well as labour market strategy in the context of human capital, the "green" transformation and artificial intelligence [6–8], while Sh.R. Kholmuminov and co-authors have addressed the

theoretical and practical foundations of providing employment for the rural population [9]. These works recognise employment quality and stability as an important area of inquiry; however, strict rules for their quantitative assessment (identical coverage and denominators across blocks, avoidance of the double counting of formality, the temporal separation of stability, and interval estimation for unobserved components) have not been specifically developed.

2. Research Methodology

The study employed systems analysis, accounting identities, recalculation of the composite index, symmetric component decomposition, comparison of aggregation methods and the method of logical bounds. The data sources were the aggregate components for 2016–2025 validated by the author and the 2020 rural data from the ILO's ILOSTAT database [14; 15]. The structure of the methodology is shown in Figure 1, and the calculation specification is presented in Table 1.

The three blocks are measured for the same coverage; data completeness determines the form of the result

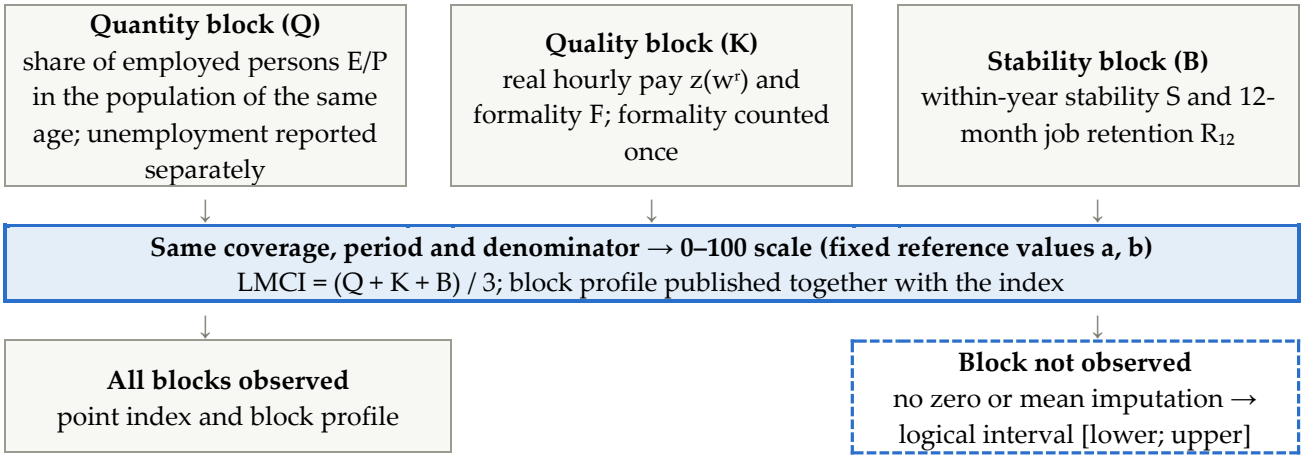


Figure 1. Structure of the methodology for the multidimensional assessment of rural employment

Source: developed by the author.

Table 1. Calculation specification (passport) of the Labour Market Condition Index

Component	Calculation	Direction and condition
Quantity — Q	100 × E/P: share of employed persons in the rural population of the same age	Higher value — higher participation in employment; unemployment reported separately
Real pay — $z(w^r)$	Nominal earnings / hours worked / relevant price index; rescaled to 0–100	Employee earnings and self-employment income treated separately
Formality — F	Share of employed persons whose main job is formal under a uniform definition	Sum of registrations not used
Within-year stability — S	S = 100/(1 + coefficient of variation); employment across four quarters	Four actual observations required
Job retention — R_{12}	Share of the initial cohort of employed persons still employed after 12 months	Attrition from observation calculated separately
Aggregation	$K = (z(w^r) + F)/2$; $B = (S + R_{12})/2$; LMCI = (Q + K + B)/3	Same coverage; computed only when all components are available

Source: calculation procedure refined in the study on the basis of [13; 16]. Weights: transparent baseline rule.

Rule 1: the same object and denominator. The principal indicator of the quantity block is the ratio of the number of employed persons to the population of the same age group; unemployment is reported separately as a supplementary diagnostic indicator:

$$Q = 100 \times \frac{E}{P}, \qquad u = \frac{U}{E+U} \qquad (1)$$

where E is the number of employed persons, P is the population of the given age in the given area, U is the number of unemployed persons, and u is the unemployment rate. Within the same coverage, the employment share, economic activity and unemployment are mathematically interrelated; adding them as three independent achievements would therefore assign excessive weight to the quantity block. Nor is the labour force-to-population ratio used as Q, since its numerator also includes the unemployed.

Rule 2: in the quality block, remuneration and legal status are separated. For the earnings component, hourly pay expressed in constant prices is used:

$$w^r = \frac{W/H}{X/100} \qquad (2)$$

where W is nominal earnings for the period, H is hours worked, and X is a price index with the base period equal to 100. Indicators expressed in different units of measurement are rescaled to a 0–100 scale using predefined lower (a) and upper (b) reference values:

$$z = \min\left\{100; \max\left\{0;\ 100 \times \frac{x-a}{b-a}\right\}\right\} \qquad (3)$$

If the reference values were re-selected each year, the same wage level would receive different scores in different years. For intertemporal comparisons, therefore, the reference values are kept fixed or, if they are changed, the historical series is recalculated. Formality is determined with respect to a person's main job and is counted only once, in the quality block: since the formal and informal shares are complementary, including formality as a positive outcome in the stability block as well would result in the same change being counted twice.

Rule 3: stability is separated from quality along the time dimension. Within-year stability is measured through the coefficient of variation (CV) of employment across four quarters, whereas job retention is determined for the same cohort of individuals:

$$S = \frac{100}{1+CV}, \qquad K = \frac{z(w^r)+F}{2}, \qquad B = \frac{S+R_{12}}{2}, \qquad LMCI = \frac{Q+K+B}{3} \qquad (4)$$

Individuals who drop out of observation are not automatically classified as unemployed. Equal weighting of the blocks serves as a transparent baseline rule, and the effect of changes in the weights on the results is tested separately.

Rule 4: an unobserved block is expressed as an interval. If all blocks are expressed on a 0–100 scale and the weights sum to 1, then for the set of observed blocks O the index lies within the following bounds:

$$\sum_{b\in O} w_b B_b \ \le\ LMCI \ \le\ \sum_{b\in O} w_b B_b + 100 \times \sum_{b\notin O} w_b \qquad (5)$$

When only the quantity block is known, expression (5) takes the form $Q/3 \le LMCI \le (Q + 200)/3$. If the lower bound for one region exceeds the upper bound for another, their ranking is unambiguous; if the intervals overlap, additional observation is required. This interval is not a statistical confidence interval but an informational bound within the chosen scale and aggregation rule.

3. Analysis and Results

Dynamics and Composition of the Aggregate Index

For the aggregate components validated by the author, the equally weighted arithmetic mean defined in formula (4) was computed (Table 2). This series is not an empirical estimate of the refined full index, since the components have not been remeasured on the basis of real hourly pay and job retention indicators. The historical

aggregate series and the proposed measurement methodology are therefore considered separately.

Table 2. Arithmetic consistency of the Labour Market Condition Index components, points

Year	Quantity	Quality	Stability	Recalculated index, points
2016	53.4	38.0	42.0	44.5
2018	55.6	46.0	48.0	49.9
2020	57.1	54.0	54.0	55.0
2022	59.8	62.0	60.0	60.6
2023	61.2	66.0	64.0	63.7
2024	62.7	70.0	68.0	66.9
2025	64.1	74.0	72.0	70.0

Source: aggregate components validated by the author; equal weighting, 0–100 point scale.

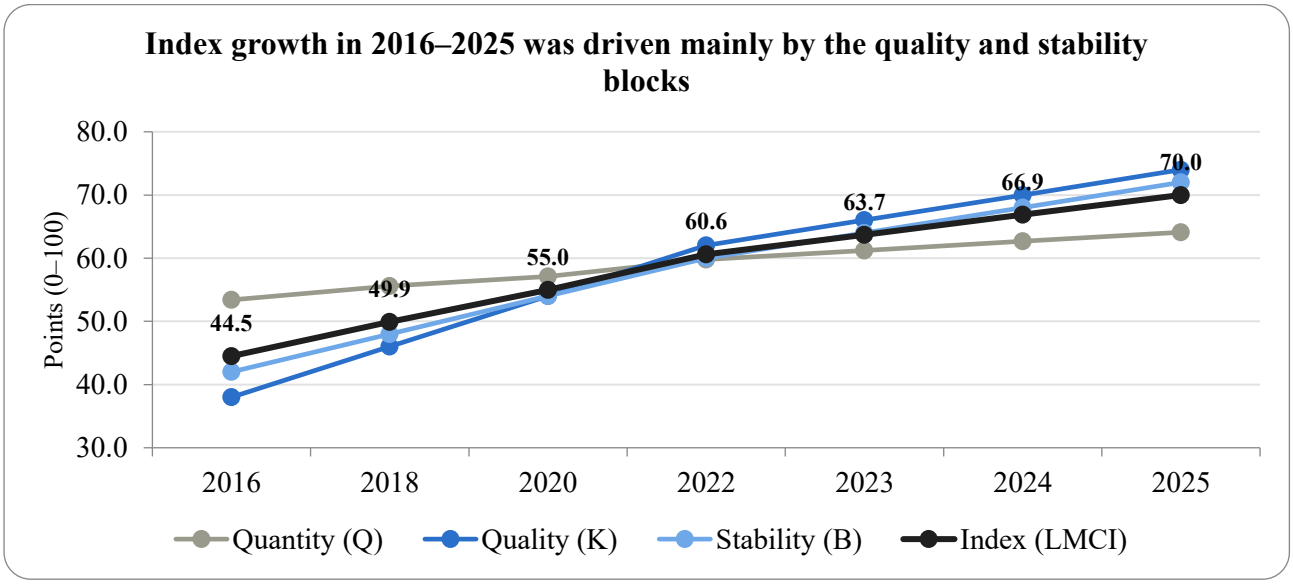


Figure 2. The Labour Market Condition Index and its blocks, 2016–2025

Source: Table 2. Note: for 2016–2020, observations are given at two-year intervals.

In 2016 the index stood at (53.4 + 38.0 + 42.0)/3 ≈ 44.5 points, and in 2025 at (64.1 + 74.0 + 72.0)/3 ≈ 70.0 points. The table contains two-year intervals between 2016, 2018 and 2020 and one-year intervals thereafter; hence, the difference between adjacent rows does not always represent "annual growth". A distinction should also be drawn between a change in index points and relative growth: an increase of 10.0 index points is not equivalent to growth of 10.0 per cent. Under equal weights, the change in the index is decomposed into contributions equal to one third of the change in each component (Table 3).

Table 3. Decomposition of aggregate index growth by component, 2016–2025

Component	Change in component, points	Contribution to index, points	Share of growth, %
Quantity	10.7	3.6	14.0
Quality	36.0	12.0	46.9
Stability	30.0	10.0	39.1
Total	**76.7**	**25.6**	**100.0**

Source: 2016 and 2025 values from Table 2; equally weighted arithmetic decomposition.

Of the total growth, 14.0 per cent is attributable to the quantity component, 46.9 per cent to quality and 39.1 per cent to stability. These shares represent an arithmetic decomposition within the chosen formula and do not constitute a causal attribution of policy effects: the components have not been decomposed into underlying factors and may

also be influenced by common factors. The practical implication is that the improvement in the overall score cannot be explained solely by growth in the number of employed persons, since it is precisely the quantity block that made the smallest contribution.

The sensitivity of this conclusion to the weights was also tested: three alternative specifications, each assigning a weight of 0.50 to one block and 0.25 to each of the remaining two, were compared with the equally weighted calculation (Table 4).

Table 4. Sensitivity of the change in the aggregate index to the weights, points

Weighting scheme (Q; K; B)	2016	2025	Change, points
Equal weights (1/3; 1/3; 1/3)	44.5	70.0	25.6
Quantity priority (0.50; 0.25; 0.25)	46.7	68.5	21.8
Quality priority (0.25; 0.50; 0.25)	42.9	71.0	28.2
Stability priority (0.25; 0.25; 0.50)	43.9	70.5	26.7

Source: author's calculations based on the components in Table 2.

The increase in the index persists under all specifications, although its magnitude ranges from 21.8 to 28.2 points: growth is smallest when the quantity block receives the highest weight and largest when the quality block does. Thus, the conclusion that "the index has increased" does not depend on the choice of weights, whereas the magnitude of the increase depends on the chosen computational rule and should therefore be published together with that rule.

Aggregation Method and Hidden Compensation

In a composite score, a high value on one component may offset a low value on another. To examine this, two hypothetical profiles were compared: in the first, quantity, quality and stability score 90.0, 40.0 and 50.0 points, respectively, whereas in the second each block scores 60.0 points (Figure 3). These figures are not an assessment of any particular region but an illustration of a property of aggregation.

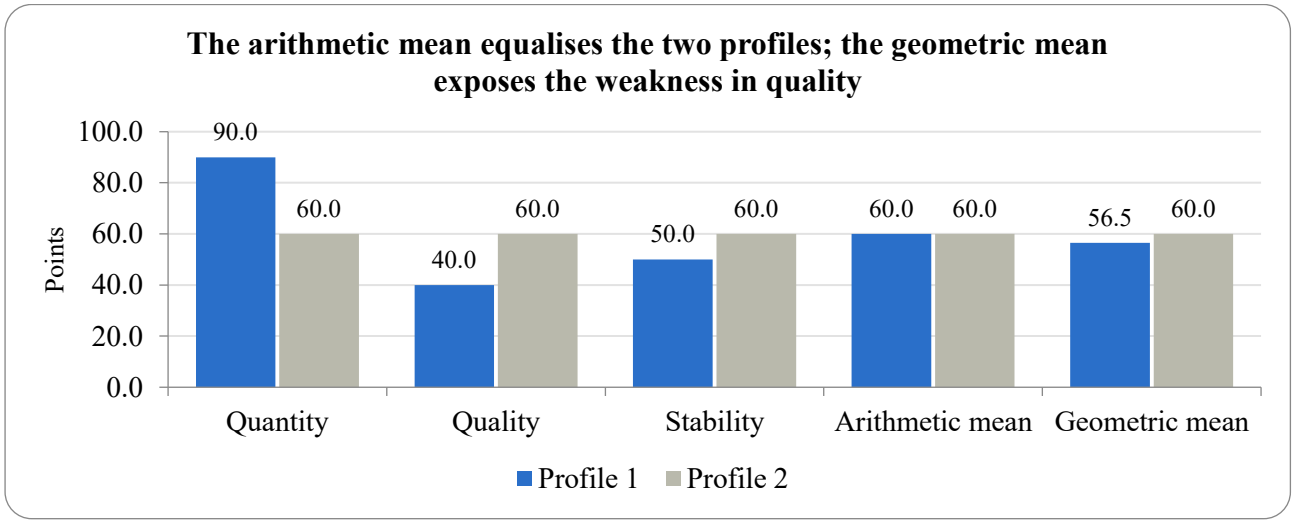


Figure 3. Block scores and aggregation results for two profiles with an identical arithmetic index

Source: hypothetical example constructed by the author; not observed regional data.

The equally weighted arithmetic index equals 60.0 points for both profiles; however, in the first case the quality block is weak, whereas in the second the blocks are balanced. When the geometric mean is applied, the score of the first profile falls to approximately 56.5 points, while that of the second remains at 60.0 points. Nevertheless, the geometric mean is not in itself the "correct" method: the meaning of a zero value, the normalisation reference values and the degree of substitutability between components must be justified. Accordingly, the arithmetic method is retained for the main calculation, with the blocks reported separately, while the alternative method is used to detect hidden compensation. Offsetting serious violations of workplace safety with a high quantitative indicator would

be substantively inappropriate; mandatory statutory requirements are therefore assessed independently of the composite score [4].

The choice of normalisation reference values also affects the conclusions. If each year the highest wage is set at 100 and the lowest at 0, the index will remain unchanged when wages grow at the same rate in all regions; conversely, even if wages in a given region remain unchanged, a deterioration in other regions may raise its relative score. Hence, fixed reference values are used to assess dynamics over time, while a relative scale is used to determine the relative position of regions, and the two are not combined within a single time series.

Logical Bounds for Unobserved Blocks

When data are insufficient to compute the full index, imputing zeros or mean values for unobserved components, or implicitly redistributing their weights to the remaining components, alters the meaning of the index. Rule (5) was applied to the ILO 2020 rural data: among the rural population aged 15 and over, the employment-to-population ratio was 53.4 per cent overall, 70.0 per cent for men and 37.2 per cent for women [15]. For the same coverage, the labour force participation rate was 56.3 per cent, i.e. 2.9 percentage points higher than the employment-to-population ratio; this gap arises because the unemployed are also included in the numerator. If the participation rate were used as Q, the quantity block would be overstated for women, whose unemployment rate is higher (7.5 per cent); it is precisely this error that Rule 1 prevents. Values of the quality and stability blocks for this coverage were not observed (Table 5).

Table 5. Logical bounds of the full index when only the quantity block is observed, 2020

Coverage	Labour force participation, %	Unemployment rate, %	Employment-to-population ratio = Q	Lower bound	Upper bound
Total rural population	56.3	5.2	53.4	17.8	84.5
Men	72.8	3.9	70.0	23.3	90.0
Women	40.2	7.5	37.2	12.4	79.1

Source: author's calculations based on ILOSTAT, Uzbekistan, 2020, rural population aged 15+ [15]; 0–100 point scale.

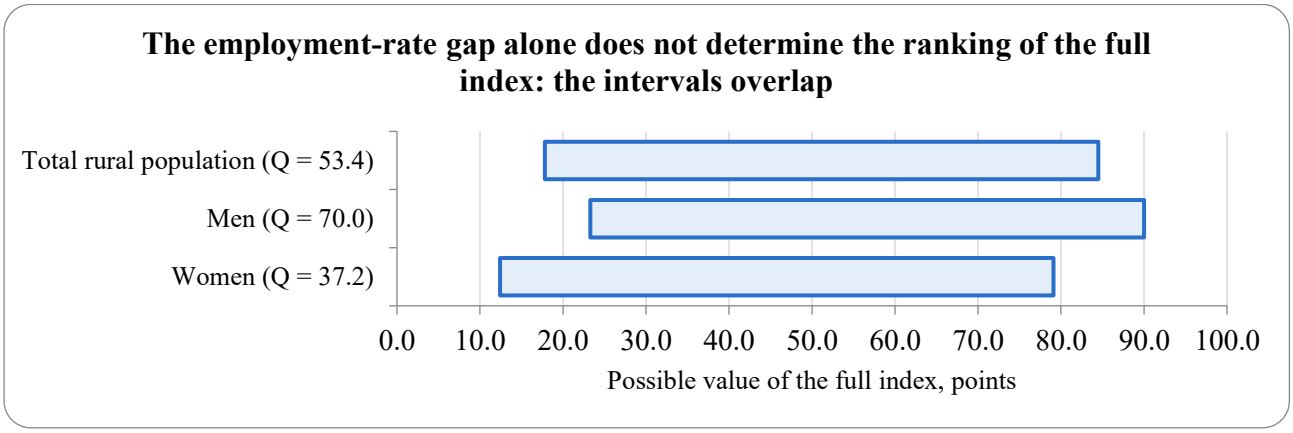


Figure 4. Logical intervals of the full index when only the quantity block is observed, 2020

Source: Table 5. Interval: from Q/3 to (Q + 200)/3.

Although the observed quantity block for the rural population amounts to 53.4 points, the full index lies within the range of 17.8–84.5 points. For men, this interval is 23.3–90.0 points and for women 12.4–79.1 points, and the two intervals overlap. Thus, although the 32.8 percentage point gap in the employment-to-population ratio persists, these data do not allow a definitive overall ranking that also takes quality and stability into account.

When two blocks are known, the interval narrows: for example, if quantity is 60.0 and quality 50.0 points while stability is unobserved, the index lies between 36.7 and 70.0 points. If this interval contains the score of the region being compared, there are insufficient grounds for a definitive ranking, and it must first be established which block's measurement would affect the decision.

Data Availability by Component

Before the methodology is applied at the regional level, the availability of observations with the same coverage is verified for each component. Open official statistics provide employment and unemployment indicators for the rural population, but the quality and stability components are not observed for this coverage (Table 6).

Table 6. Data availability and form of the result by component

Component	Required observation	Current status	Form of the result
Quantity — Q	Rural population aged 15+; employed and unemployed persons	Available (ILO rural data, 2020; labour balance)	Point value
Real pay — $z(w^r)$	Hourly pay, hours worked, relevant price index	Not available for rural coverage	Interval; data collection required
Formality — F	Formality of the main job under a uniform definition	Not available for the same coverage	Interval; data collection required
Within-year stability — S	Employment across four quarters	Cannot be derived from annual series	Interval
Job retention — R_{12}	12-month follow-up of the same individuals	No panel observation available	Interval; collection among programme participants

Source: author's analysis based on [13–15].

As the table shows, a full point index cannot be computed for regions on the basis of currently available open data: the available result consists of the quantity block and the interval given by rule (5). This is not a shortcoming of the methodology but rather one of its strengths, since it indicates in advance which observations are missing and to what extent they affect the decision. The priority for collecting the four missing components is determined by the block whose observation would narrow the interval the most: under equal weights, observing either the quality or the stability block reduces the interval width from 66.7 to 33.3 points.

Index Validation Framework

Three types of uncertainty are distinguished in the assessment: primary observational uncertainty (sampling and measurement errors), methodological uncertainty (the choice of weights and normalisation) and coverage uncertainty. The range obtained by varying the weights is not a statistical confidence interval; estimating sampling error requires individual-level microdata and information on the sample design [16; 17; 20]. The checks are performed independently of one another (Table 7).

Table 7. Types and limitations of index checks

Check	Varied condition	What it shows
Arithmetic control	Formula and published components	Consistency of totals and rounding
Weight sensitivity	Weights; components held constant	Dependence of rankings on the computational rule
Aggregation comparison	Arithmetic or geometric mean	Compensation property
Sampling uncertainty	Sample design and individual observations	Standard error; cannot be computed from aggregates
Coverage comparison	Age, place of residence and time	Comparability of indices

Check	Varied condition	What it shows
External outcome	Subsequent independent observation	Predictive or practical value; separate check

Source: validation framework developed in the study.

For external validation, outcomes that are not included in the index or that relate to a subsequent independent period are selected, since a high correlation with the wage or job retention indicators already contained in the index does not, in itself, demonstrate its validity [21]. Whenever the index is updated, its version is recorded: if real hourly pay is added or the definition of job retention is changed, the difference between the new and old indices is not interpreted as a genuine improvement in the labour market.

4. Conclusions and Recommendations

The study has refined the measurement rules for the multidimensional assessment of rural employment. The main conclusions are as follows:

- the quantity, quality and stability blocks are measured on the basis of the same age group, place of residence, period and observational definition; adding the employment share, economic activity and unemployment as independent achievements assigns excessive weight to the quantity block;

- formality is counted only once, in the quality block, while the informal share serves as a substantive cross-check. Stability is separated from quality through indicators of within-year variability and 12-month job retention;

- on the basis of the aggregate components, the index increased from 44.5 to 70.0 points over 2016–2025; 46.9 per cent of this growth is attributable to the quality block, 39.1 per cent to the stability block and only 14.0 per cent to the quantity block;

- profiles with an identical arithmetic score diverge to 56.5 and 60.0 points under geometric aggregation; the block profile should therefore be published together with the index, and mandatory requirements should be assessed independently of the score;

- unobserved blocks are not imputed with zeros or mean values. In the 2020 rural data, when only the quantity block is known, the full-index intervals for men and women overlap, which means that additional observations are required for a definitive overall ranking.

Recommendations: to include the quantity, quality and stability blocks as separate mandatory indicators in the passports of regional employment programmes, recording the coverage, denominator and source date for each of them; to collect data on hourly pay, the formality of the main job and quarterly employment for the rural population within the Labour Force Survey; to introduce a 12-month job retention indicator based on the individual-level follow-up of employment programme participants; and, when rankings are published on the basis of incomplete data, to report logical intervals instead of point scores. A limitation of the study is that the historical series is based on aggregate components and does not imply that the full index has been measured for all regions under the new methodology; full measurement remains a direction for future research.

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