A Multidimensional Approach to Measuring Decent Work in Five Countries using Count Panel Data Models

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Abstract: - This paper proposes a methodology for measuring Decent Work (DW) from a multidimensional perspective using Alkire and Fosters methodology. According to Decent Work Country Programmes (DWCPs), we created a multidimensional index of DW, and takes into account five dimensions, the dimensions include indicators on the availability of employment opportunities, availability of adequate earnings and productive work, availability of stability and security of work, availability of equal opportunity and treatment in employment and availability of social security. Despite the fact that the variables included in this index are not exhaustive due to the aforementioned data constraints, they serve to illustrate to what extent countries are working to provide the greatest number of Decent Work opportunities (DWO) using a data set specifically designed to measure the Decent Work indicator (DWI).Following recommendations made by the existing literature on work quality and the number of DWO provided by countries. In our numerical application, we use count panel data (CPD) models to investigate the impact of some dimensions on the number of DWO for five countries (Bahrain, China, Egypt, Jordan, and Nigeria) that have implemented DW country projects and programmes to construct a synthetic indicator of DW at a country level from 1999 to 2019.The results generated by this indicator show that the methodology used can allow policymakers to identify and focus on the most vulnerable workers in a labour market. The results of this index are then analyzed to highlight the contribution that the indicator can make to the discussion of labour markets in countries , and arranges countries according to the level of DW, through which these countries can measure their level of progress towards DW, The findings degrees different levels of DW among the five countries studied, with Nigeria and Jordan presenting very poor results in terms of the index; Egypt falling into the middle range of achievement; and Bahrain and China achieving better results.

Key-Words: - Conditional Maximum Likelihood Estimation; Count Panel Data Models; Decent Work; Fixed and Random Effects Model; Hausman test; ILO; Labor Regulations; Multidimensional Index.

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1 Introduction

Work dominates most people's lives because it takes so much of their time, effort, and energy. It is one of the most common kinds of social integration and an important factor in the development of self-esteem and identity. Work is also the place in people's lives where economic and social goals interact, and it is the primary source of income and livelihood for the vast majority of them, so the nature of the work they do is a critical determinant of their quality of life, as well as the driving force for society's growth and development, see Poschen [1]. In the context of the continuous development of work standards in various parts of the world and in light of the efforts being made to improve working circumstances and upgrade the conditions of workers, the concept of Decent Work (DW)

emerged to summarize the entirety of the principles and standards of work that must be provided to all workers; as it is every person's right to be able to get a job that enables him to live in dignity. To achieve this goal, a set of basic standards for decent occupations and jobs must be developed. It is suggested that DW is a prerequisite for poverty reduction and fair and inclusive globalization, see ILO [2]. The term DW was first introduced by former ILO Director-General Juan Somavia in his report to the Eighty-Seventh Session of the International Labor Conference in June 1999. Since 2005, the United Nations (UN) has adopted DW as one of the Millennium Development Goals. UN Economic and Social Council resolutions - Resolutions 2007, 2008 - emphasized the importance of adopting a multi-tiered and

multidimensional approach that focuses on productive employment and DW [3]. DW has been included in the sustainable development agenda, where the eighth goal is: enhance sustained and comprehensive economic growth, as well as employment that is both full and productive, and DW for all, UN [4].

The essence of DW is an emphasis on employment quality, in addition to generating the greatest number of jobs possible. Therefore, the DW agenda is particularly pertinent in the developing world, where there is a high rate of underemployment, joblessness, and informal employment is common and often the quality of jobs (such as minimum wage and a healthy and safe work environment) is foregone in order to create jobs for as many people as possible. One of the ILO's goals is to enhance opportunities for people to have DW. DW is a universal aspiration for people everywhere, embodying their aspirations to obtain productive work in conditions of equality, freedom, security, and human dignity. It involves a fair income, freedom for people to express their concerns, participating in the decisions that affect their lives, social integration and better prospects for personal development, social protection for families and security in the workplace, and equal opportunity and treatment in employment.

DW is work that respects basic human rights as well as worker's rights in terms of safety conditions for work and remuneration [5]. It is a multifaceted concept that helps unravel the interconnectedness of the policy measures necessary to ensure the dignity of the human being through his career path [6]. Under DW, employees feel safe and satisfied, as it enhances their dignity through humanizing work and providing them with meaningful job opportunities, as well as ensuring job security, adequate wages, providing safe and healthy working conditions, and giving opportunities to develop human capabilities, and these factors are extremely important to increasing individual productivity [7]. Thus, DW is necessary not only because all human beings deserve the opportunity to live a decent life, but also to ensure that there is sustainable economic growth [8]. DW changes the way the global economy operates so that its benefits reach more and more people. Productive employment and DW are essential for achieving equitable globalization and poverty reduction. The ILO has established an agenda for the community of work that emphasizes job creation, rights at work, social dialogue, and social protection, with gender equality as a cross-cutting goal. Following the 2008 global financial and economic crisis, there has been a greater urge among international policymakers to create high-quality jobs, as well as social protection and respect for worker's rights, in order to enhance sustainable, comprehensive economic development and eradicate poverty. Recent research has focused on the establishment of a Decent Work Indicator (DWI), see Rodgers [9].

ILO constituents have long been concerned about monitoring progress towards DW. However, the DW Agenda's multifaceted nature, which combines social protection with full and productive employment, as well as the promotion of social dialogue and rights at work, means that measurement is a complex task. ILO constituents have debated the complexities of finding a measurement framework that fully accounts for the multidimensional nature of DW on numerous occasions and have provided guidance on the various possible ways and methods for measuring the dimensions of DW to prepare inclusive recommendations for consideration by the ILO's Governing Body. In an effort to reduce the global deficit in DW, the ILO provides support to countries through DW country projects and programmes that are developed in coordination with the organization's tripartite constituencies governments, employers, and worker's organization's and whose priorities and goals are defined within national development frameworks. These projects and programmes provide resources and advice to countries and aim to integrate DW into national policies.

On the other hand, in the econometrics literature, panel data or longitudinal data sets relate to the pooling of observations on a cross-section of families, countries, enterprises, and so on, spanning various time periods. The use of panel data to estimate dynamic econometric models is becoming commonplace. When compared to solely cross-sectional or strictly time-series data, panel data has various advantages, including the ability to compensate for individual heterogeneity, provide more meaningful data, and better investigate adjustment processes. However, when a panel data models response variable is a non-negative integer number, the model is referred to as a count panel data (CPD) model. Additionally, count data analysis has witnessed explosive growth in recent decades in econometrics and in many applied fields. In fact, CPD models are now widely used in a variety of economic applications, including health economics, company productivity, transportation, and education.

The current paper is unique in that, after a comprehensive revision of research on labour

regulations, we were unable to find any Decent Work Composite Index that arranges countries and ranks them according to the level of DW, through which these countries can measure and monitor their level of progress towards DW, as this is a long-standing concern for the ILO's constituents. Actually, the starting point towards eliminating the global deficit of DW is the process of measuring the level of DW within the countries, in order to know the shortcomings that exist in those countries and accurately identify them in order to put the dimensions of DW that need improvement in those countries at the top of the priorities of the DW country programs. To date, all literature has used national averages or microeconomic indicators to measure DW, such as the percentage of young employed [10]. The ability to target populations in vulnerability and observe their behavior based on factors such as industry, age, gender, wage type, and geographical zone is one of the advantages of having a microeconomic indicator. All of this translates into the ability to adopt and implement targeted public policies while saving financial resources. This paper suggests a methodology for measuring DW from a multidimensional perspective in five countries (Bahrain, China, Egypt, Jordan, and Nigeria). Using a dataset designed specifically to assess employment conditions. Building on previous work on multidimensional poverty and employment indicators, the paper used five dimensions and eleven indicators to create a synthetic indicator of the DW for all countries by applying CPD models.

The rest of the paper is organized as follows: After this introduction, Section 2 presents a brief overview of DW in theory and practice, definition and measurement of DW, reducing the DW deficit: a global challenge, Decent Work country programmes (DWCPs), and a literature review to analyze the current DWI. While Section 3 provides panel data modeling, fixed and random effects models. Section 4 discusses the proposed estimators for Poisson and negative binomial models in both fixed and random effects instances. In Section 5, the numerical application of DWI is presented. Section 6 presents the theory behind the multidimensional index and explains the method used for aggregation and estimating the index. The results of the numerical application have been presented in Section 7. Finally, Section 8 offers the concluding remarks.

2 A Brief Overview of Decent Work in Theory and Practice

Holistically, the DW definition extends beyond the ILO's four fundamental labour standards enshrined in the DW agenda; social security, worker's rights, social dialogue, and employment. It is imperative that the concept of DW must include all types of jobs, as well as all individuals and families. To accomplish so, it must acknowledge the multi-dimensional nature of people's lives since these aspects are inextricably linked and indivisible and so must be dealt with in a holistic human rights framework. The mix of dimensions regarding worker's social relations and strictly work-related dimensions under a single framework makes the DW conceptually perfect or ideal for all types of employment and comprehensive of the greatest number of the working population. However, in practice, converting a broad concept like DW into policy instruments that are comparable and quantifiable for a varied world has been a tiresome and never-ending process. That is why the 2008 ILO Declaration on Social Justice for a Fair Globalization recommended the development of appropriate indicators to monitor and evaluate progress in implementing the Decent Work Agenda. The ILO has supported member states through technical assistance and capacity building at the national, sub-regional, and regional levels in this regard.

From a practical point of view, fundamental principles and rights are the prerequisites for DW, while the quality and security of work are its content, and social dialogue is the process by which it can be achieved. The DW Program, through its four main pillars, contributes to promoting human development. By creating job opportunities and developing projects, it is possible to secure income and livelihood resources for individuals, achieve equity, facilitate participation, and deepen the sense of pride and dignity.

2.1 The Concept and Measurement of Decent Work

The ILO established the DW approach to give globalization a social dimension and to begin an intensive and comprehensive human-oriented approach for dealing with the issues and challenges provided by globalization in the workplace. The ILO defines DW as productive work for men and women in conditions of security, freedom, equity, and human dignity. Furthermore, Somavia [11] defines DW as productive labour in which human rights are respected, insurance coverage is available,

and the opportunity to participate in collective decisions is possible. According to Ermida [12], the concept of DW includes the following aspects and characteristics: productive and secure labor; wages are adequate; there is social protection; labour rights are respected; there is social dialog; collective bargaining and participation; and union freedom. In order to achieve the goal of DW, the International Labor Organization created the DW Agenda. The ILO Declaration on Social Equality for an Equitable Globalization is an expression of the DW Agenda's global characteristics; the agenda provides a framework for equitable and sustainable development and advocates for global progress. There are four main pillars of the DW Agenda as follows [13]:

- Creating and providing job opportunities with decent wages.
- Social protection.
- Promote social dialogue between workers and employers and enable workers to have the right to negotiate with employers in order to defend their rights and improve their working conditions.
- The standards, principles, and basic rights at work contained in the declaration of the ILO, which include the elimination of all forms of forced labor, the effective elimination of child labor, and the elimination of discrimination in employment and occupation.

In one of the first studies to attempt to quantify the concept of DW, Bescond et al. [14] conducted an international comparison of 40 nations using a single-valued index based on seven decent-work macro indicators. Bonnet et al. [15] provide a more comprehensive and detailed analysis of how to measure DW at meso (firm or enterprise), macro (population aggregate), and micro (individual) levels. They created a composite index at each level using seven work-related securities and their accompanying indicators. The ILO's People's Security Survey (PSS), which was initiated in mid-2000, was based on the seven work-based security theoretical and analytical frameworks; see Kantor et al. [16]. This framework is adaptable to regional/local needs and suitable for obtaining an overview as well as horizontal (dimension-wise) disaggregation of DW at various measurement levels. This theoretical framework for a macro-level analysis is adapted in our study, which horizontally explores and analyses the DW conditions and circumstances for the countries under study.

2.2 Reducing the Decent Work Deficit: A Global Challenge

Despite the importance of DW, the shortcomings of difficulties we see all around us demonstrate how tough it is to make it a reality for all workers in the world. Former ILO Director-General Juan Somavia has expressed deep concern about the massive global DW deficit Somavia [17]; these are evident in the absence of adequate work opportunities, denial of rights at work, insufficient social protection, and deficiencies in social dialogue, see ILO [18]. The organizations current director-general, Guy Ryder, also noted that the DW deficit remains widespread and that additional efforts are needed to improve the job quality for workers and to ensure that growth gains are equitably shared [19]. Some indicators show deficits in providing DW, as follows:

- The number of unemployed people worldwide is estimated at 172 million, and this number is expected to increase by one million people every year [20]. The total under-use of labour is more than twice the size of unemployment, which affects more than 470 million people worldwide. This reflects the mismatch between labour supply and demand. There are also more than 630 million workers around the world who still live in extreme or moderate poverty [21], of whom about 126 million are young people, or 30% of the working youth, see ILO [22].
- Informality is increasing over time in many countries, where the informal economy employs more than 60% of the world's workforce and two billion people live deprived of DW conditions in light of high poverty rates in the informal economy [23].
- Every year, 78 million people die as a work-related illnesses accidents or diseases, and there are approximately 374 million non-fatal work-related injuries each year. The economic burden of poor occupational safety and health practices is estimated at 3.94% of global gross domestic product (GDP) each year [24].
- There are 152 million children globally in child labour [25], of whom 73 million are involved in hazardous work that endangers their health, safety, or growth. The ILO estimates that about 22,000 children die at work every year, and it is not known how many are injured or sick because of their work. Also, there are 25 million adults and children in forced labour [26].
- Contemporary labor markets are still marked by gender discrimination. In 2019, the female labor force participation rate was only 47%, 27

percentage points lower than the male rate of 74%. Women continue to earn 77 percent of what males earn [27], and the gender wage gap is 20% on average worldwide. Moreover, Women make up just 27.1 percent of managers and leaders globally, a figure that has been relatively constant over the last 27 years, see ILO [28].

- Only 45% of the world's population is effectively covered by at least one social protection benefit, while the remaining 55% (up to 4 billion people) are unprotected. The ILO also estimates that only 29% of the world's population is covered by comprehensive social protection systems [29].Recent economic trends in recent decades have increased working hours, and have also led to concerns about workers capacity to manage work and personal life, and family responsibilities [30].

This widespread deficit in DW not only causes economic inefficiencies but also threatens social cohesion within states. In 2019, seven of the world's 11 sub-regions witnessed an increase in protests, indicating that dissatisfaction with the social, economic, or political situation is increasing [31]. While global average incomes are increasing and the global economy has immense potential for innovation and productivity, these gains are accompanied with persisting inequality, expanding exclusion, insecurity induced by economic swings, and a sense that the rules are unjust. Reducing the DW deficit is the road to poverty reduction and to greater legitimacy of the global economy. DW is a goal in its own right but there is also an economic dividend - economic and social efficiency can go together. An integrated approach is essential - each element of DW reinforces the others and all play a part in achieving broad goals such as poverty eradication.

In an effort to reduce the global deficit in DW, the ILO provides support to countries through DW country projects and programmes that are developed in coordination with the organization's tripartite constituencies governments, employers, and worker's organizations and whose priorities and goals are defined within national development frameworks. These projects and programmes provide resources and advice to countries and aim to integrate DW into national policies.

2.3 Decent Work Country Programmes
In 2004, time-bound and resourced country programmes were introduced by the ILO, known as DWCPs. They are based on ILO standards and ethics as well as the priorities and interests of the ILO's constituents (governments, employer's organizations, and labour unions) and national development goals. DWCPs depict the ILO support and help required to achieve measurable progress at the national level in the pursuit of the DW goal for all men and women and reflect the constituent's commitment to achieve this goal and to promote it both individually and in collaboration with one another, especially through development partnerships. All stages of the DWCP are overseen by ILO Country Offices. Policy advice and technical support are provided by Decent Work Technical Support Teams (DWTs) in the various regions, in conjunction with headquarters technical specialists, in DWCPs design and implementation in response to the needs and interests of constituents. Within the teams, technical specialists and experts from the Bureau of Worker's Activities (ACTRAV) and the Bureau of Employer's Activities (ACTEMP) take the lead role in incorporating the perspectives of workers and employer's organizations into DWCPs.

The DWCPs were designed to be harmonized at the country level with other programmes on the advancement of work-life run by the UN and the ILO, to make the most efficient use of limited resources. The DWCPs were designed to highlight the ILO's unique and distinct contribution to United Nations country programmes (UNCP) and form one main tool for better integrating regular budget and extra-budgetary technical cooperation. The outcomes of the ILO biennial programme were created and designed to align well with the goals of sustainable development, enabling the field structures, Centenary Initiatives, flagship programmes, ILO Global Technical Teams, and DWCPs to work together and collaborate within the UN system to help and support the Member States, see ILO [11]. DW aimed to create a more inclusive and sustainable future and to place people at the center of development by advocating for equality, dignity, quality jobs, healthy and safe working conditions and environments, and a fair income, see ILO [32]. With the approval of the 2030 Agenda for Sustainable Development in September 2015, DWCPs preparation and implementation enter a new stage in which action by ILO will have to be a visible part of the inclusive UN efforts.

In the drafting and evolution of the DWCPs, there has been a logical, long-term consistency, as

well as the implementation, coordination, and independent evaluation of the programmes accomplishments. The ILO developed a guideline for national-level actor's support in 2015 to facilitate the DWCPs preparation. The goal of this guideline is to provide a comprehensive, well-informed, but short diagnostic narrative of the DW situation and trends, productive employment, and growth of every country. It also provides the ILO's constituents and other national stakeholders with coherent data on and analysis of the situation and progress associated with DW in every country. At the same time, it acknowledges the major DW challenges that face the country. The country's analytical report provides data for the national development discourse. The country's situation analysis can also be utilized as a base for national training, as well as capacity building and planning for ILO's constituents and other main stakeholders as indicated by Figure 1, see [33].

The process of creating a country programme document has shared features across institutions. As illustrated in Figure 1, the creation of all country programme documents by the UN, including the documents of agency-specific programme, and by multilateral institutions often begin with preliminary discussions with the government and other stakeholders.

The second phase is a country diagnostic process that aids in the establishment of priorities and often entails extensive data collection and analysis. The third phase is the preparation of the main country programme document, which includes a context overview, a declaration of priorities, the identification of the key results and their measurement, and budgetary information. Finally, implementation, monitoring, and evaluation procedures build in the main document, forming an essential component of country programme implementation and the learning of lessons for future programmes.

Moreover, the country diagnostics offer a comprehensive framework for national development, including demographics and statistics related to health, human development and education, the economy's structure and efficiency, aspects related to vulnerability, inequality, and poverty in the country, the labour force, the labour market and employment, fundamental principles and rights at work, the international labour standards implementation, occupational safety and health (OSH) and DW conditions, questions related to social dialogue and social protection, and equal opportunities and treatment in employment, to help recognize and identify the main DW challenges ahead. Figure 2, illustrates the logic of the ILO DWCP process, see ILO [34]

The following are some examples of the DWCP's main contents: Child employment reduction and elimination of its hazard forms; increased and improved employment opportunities for vulnerable groups; and the creation of Decent Work Opportunities (DWO) that help in poverty reduction with a special focus on young women and men. The selected priorities are based on the deficiencies identified in the country's DW diagnosis, see ILO [35].

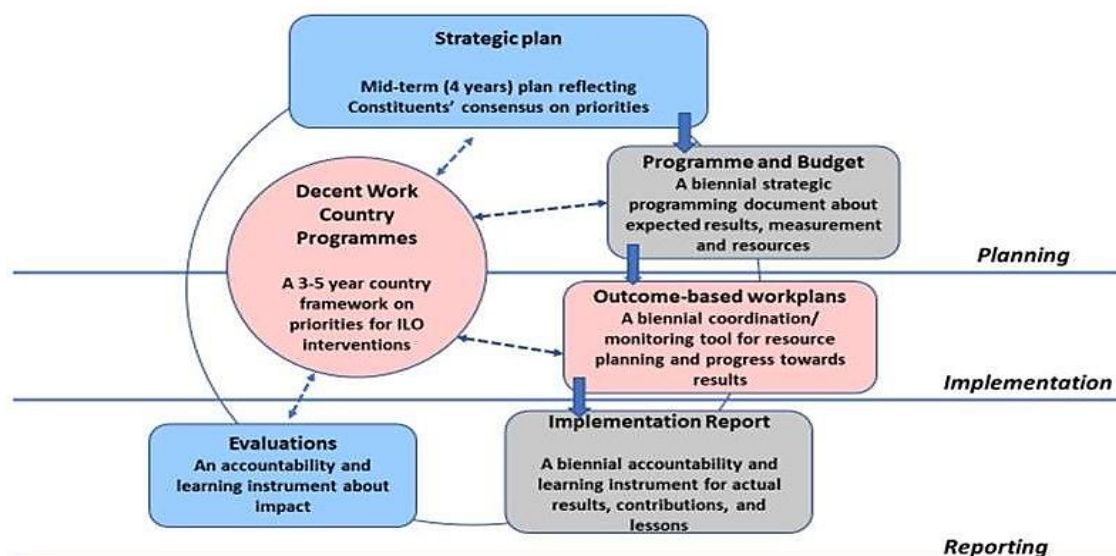Fig. 1: Process of Country Programming, see [34].

Fig. 2: Cycle of ILO Results-based Programming, see [34].

2.4 Literature Review

The ILO's 2008 Declaration on Social Equality for Fair Globalization recommended the development of suitable indicators to track and assess progress in implementing the DW agenda The use of DW indicators enables national-level analyses to monitor changes and trends in the labour market over time, as well as cross-national comparisons, and thus the discussion of indicators is closely related to the goals and meanings of DW in various institutional and structural contexts, see Ghai [36].There is no doubt that indicators for DW are needed. In their absence, governments, workers, and employers are not in a position to know their conditions compared to other countries, and their absence significantly reduces the ILO's ability to communicate its messages and influence public discussions on labour and social issues. For an assessment of DW indicators for countries can assist in reviewing these indicators, and it can also encourage statistical agencies to include additional variables that may be required to study DW more precisely, see Bescond et al. [14].

The DW assessment was initiated with the aim of developing a wide range of employment indicators that enable cross-country comparisons along with an assessment of individual labor markets, see Sehnbruch et al. [37]. The study of Standing [38] identified several dimensions of DW: income security, security for skill reproduction, job security, work security, employment security, and security for representation and expression. The study of Bescond et al. [14] focused on six dimensions of DW: job opportunities, work in an atmosphere of

freedom, productive work, justice at work, job security, and dignity at work. The Council of the European Union adopted its policies on measuring DW, which focused on five main dimensions of DW: quality of work and employment; ensuring job security; maintaining the health and safety of workers; developing skills and competencies; and balancing work and personal life [39].

The study by Banerjee and Kundu [40] sought to recognize the achievements of DW for informal workers in rural and urban areas in the Hooghly region in India. The study used the theoretical framework for seven dimensions of DW: labour market security, employment security, job security, work security, skill reproduction security, income security, and representation security. These are the same dimensions that were used in the study of Standing [38]. The study then constructed seven sub-indicators and one composite indicator for DW at the individual level, using the primary survey data. The study by Mackett [41] attempted to provide a systematic starting point for measuring DW using a national labour force survey and the available variables for such a scale. The study understood the scarcity of variables by merging some indicators and saw that some indicators could be swapped against some of them, while the directional nature of other variables (for example, the gender wage gap) posed a challenge to the composite indicator's design.

From the above, it is noted that despite the use of many scales in an attempt to assess DW based on a set of indicators, there is no consensus among researchers on a single scale. In addition, each of these attempts failed to provide a comprehensive scale that fully reflects the basic pillars of DW and

its various dimensions; where there was a focus on certain dimensions of DW and ignoring the rest of the dimensions. There were also restrictions due to lack of data; as there were some indicators for which data were not available for some countries, which made it difficult for international comparison, and this prompted some researchers to report the difficulty of measuring DW such as Burchell et al. [42] and Sehnbruch et al. [37], or to conduct a study of DW at the micro-level in a particular industry so that there is an ease in collecting data, or evaluating DW at the national level without making an international comparison.

However, understanding the dynamics of DW requires measuring it across several local, national, regional, and global levels, and this requires indicators that evaluate several levels of analysis, and this will make the pursuit of DW more effective and sustainable according to the study of Ferraro et al. [43, 44]. Realizing this, this study attempted to find a set of indicators for DW that can capture all its dimensions to give an integrated understanding and paint a comprehensive picture of it. These indicators were evaluated for the five countries under study, and the extent to which the population of the countries under study feels about the improvement in DW levels within their countries achieved by DW country projects and programs. Moreover, this study not relied on the questionnaire, which is the method that was used in most of the previous literature to measure and evaluate DW, but this study relied on the method of panel data analysis.

3 Panel Data Modeling

The connection between variables and the error term in linear regression causes inconsistencies in the estimated parameters. In the case of longitudinal data, Hsiao [45] presents a review. The count data regression suffers from the same issue, resulting in skewed parameter estimates. As Winkelmann [46] points out, if standard estimating processes are corrected, consistent estimates can be found. However, fixed effects (FE) model and random effects (RE) model are perhaps the most widely estimated models in panel data modelling. Boucher and Denuit [47] compared FE model and RE model. They demonstrated that on a joint distribution with RE model, typical estimate methods such as classical maximum likelihood can still be applied. Indeed, the resulting parameter estimates, while biassed, indicate the apparent effect on claim frequency, which is exactly what is of interest when linked omitted variables cannot be employed in

classification, for more details of panel data models; see e.g. [48, 49].

Even though all slopes are the same, the FE model allows for a separate intercept term for each cross-sectional (i) unit. In its most basic form, the FE model can be written as;

$$y_{it} = \alpha_i + x'_{it}\beta + \varepsilon_{it}, \qquad i = 1,2,\dots,N$$
$$; t = 1,2,\dots,T, \qquad (1)$$

where y_{it} is the dependent variable for individual i at time t, α_i is the intercept, x_{it} is the it^{th} observation on dependent variables, β is the regression coefficients vector, and ε_{it} is the model's error term.

The error term now has new assumptions, whereas the RE model shoulders that there is a single constant term (α) for all across units and that the changes in the intercept term may be reproduced in the error term. The RE model is justified by the supposition that, different the FE model, variation across entities is random and that the unit's error term is uncorrelated with the forecasters. The RE model is defined as follows:

$$y_{it} = \alpha + x'_{it}\beta + \varepsilon_{it}, \qquad (2)$$

where $\varepsilon_{it} = \delta_i + \mu_{it}$; this signifies that the models error term is made up of two components, while δ_i denotes the unobservable impacts that are unique to each individual, and μ_{it} represents the variations in disturbances as a function of units and time.

Both the fixed and random effects estimators would be in agreement if the RE model was accurately defined. A Hausman test [50] can be based on the difference between the two estimators. Cameron and Trivedi [51] propose the following representation of the test:

$$T_H = (\hat{\beta}_{FE} - \hat{\beta}_{RE})'[\hat{V}(\hat{\beta}_{FE} - \hat{\beta}_{RE})]^{-1}(\hat{\beta}_{FE} - \hat{\beta}_{RE}), (3)$$

where T_H is the Hausman test statistic, $\hat{\beta}_{FE}$ are the estimated parameters obtained from the FE model and $\hat{\beta}_{RE}$ are the estimated parameters obtained from the RE model. To estimate the variance term $\hat{V}(\hat{\beta}_{FE} - \hat{\beta}_{RE})$, we can use a panel bootstrap method as;

$$\hat{V}(\hat{\beta}_{FE} - \hat{\beta}_{RE}) = \frac{1}{B-1}\Sigma_{b=1}^{B}\left(\hat{\beta}_{FE}^{(b)} - \hat{\beta}_{RE}^{(b)}\right)\left(\hat{\beta}_{FE}^{(b)} - \hat{\beta}_{RE}^{(b)}\right),$$

where $\hat{\beta}_{FE}^{(b)}$ and $\hat{\beta}_{RE}^{(b)}$ are the estimates obtained from the bth bootstrap replication.

4 Count Panel Data Distributions

In panel data models, if the response (dependent) variable is not normally distributed; especially, if the response variable has non-negative integer values (count data). For example, the number of occupations, accidents in various places, days off for many people over time, protests in various countries over time, medical visits, and the number of occurrences of a certain health event for each of many patients over time. In the econometrics literature, however, Poisson and negative binomial models are frequently used to fit this data.

4.1 Poisson Distribution

The Poisson model shoulders that the dependent variable (y_{it}) requires a Poisson distribution by a probability density function (PDF);

$$f(y_{it}; \theta_{it}) = \frac{[exp(-\theta_{it})](\theta_{it})^{y_{it}}}{y_{it}!}, \qquad (4)$$

where θ_{it} is the mean predicted or expected of y_{it}. The mean and variance of y_{it} it must be equal, i.e. $E(y_{it}) = var(y_{it}) = \theta_{it}$, in this model.

The individuals heterogeneity term α_i in the fixed effects Poisson (FEP) model captures all non-time-varying traits. The regressors x_{it} are missing an intercept since the intercept is incorporated into α_i. The conditional probability function (CPF) for the FEP model is as follows:

$$f(y_{it}|x_{it}, \alpha_i, \beta) = \frac{[exp(-\alpha_i\theta_{it})](\alpha_i\theta_{it})^{y_{it}}}{y_{it}!}, \qquad (5)$$

where $\theta_{it} = exp(x'_{it}\beta)$. The conditional maximum likelihood estimation (CMLE) proposed by Hausman et al. [52] can be used to estimate the parameters of this model. Since y_{it} and $\sum_{t=1}^{T} y_{it}$ are shadow the Poisson distribution, then the conditional joint PDF for the ith observation be situated;

$$f(y_{i1}, \ldots, y_{iT}|\sum_{t=1}^{T} y_{it}) = \frac{(\sum_{t=1}^{T} y_{it})!}{(\sum_{t=1}^{T} y_{it})^{\sum_{t=1}^{T} y_{it}}} \prod_{t=1}^{T} \frac{(\theta_{it})^{y_{it}}}{y_{it}!},$$

The conditional log-likelihood is calculated by captivating the logarithm of conditional joint PDF and summing ended all individuals as follow;

$$\ln L = \sum_{i=1}^{N} \{\ln(\sum_{t=1}^{T} y_{it})! - \sum_{t=1}^{T} \ln y_{it}! +$$
$$\sum_{t=1}^{T} y_{it} [y_{it}x'_{it}\beta - y_{it}\ln \sum_{t=1}^{T} y_{it} exp(x'_{it}\beta)]\}, (6)$$

it can get the FEP model estimated parameters by solving;

$$\sum_{i=1}^{N} \sum_{t=1}^{T} x'_{it} \left(y_{it} - \frac{\sum_{t=1}^{T} y_{it}}{\sum_{t=1}^{T} \theta_{it}} \theta_{it} \right) = 0.$$

On the other hand, to estimate the parameters of the random effects Poisson (REP) model, the individual-specific impact δ_i necessity must a given distribution. In this model, we expected that the individual-specific influence requires a gamma distribution by parameters (γ, γ). The parameters of this model were estimated using the maximum likelihood estimation (MLE) approach. For the it^{th} observation, the MLE function is:

$$f(y_{it}|\delta_i, x_{it}) =$$
$$\prod_{t=1}^{T} \left[\frac{(\theta_{it})^{y_{it}}}{y_{it}!} \right] \left[\frac{\gamma}{\gamma + \sum_{t=1}^{T} \theta_{it}} \right]^{\gamma} \left[\frac{\Gamma(\sum_{t=1}^{T} y_{it} + \gamma)}{\Gamma(\gamma)} \right]^{\gamma}$$

$$[\gamma + \sum_{t=1}^{T} \theta_{it}]^{-\sum_{t=1}^{T} y_{it}},$$

This model includes the intercept, which has been incorporated into x_{it}. The log-maximum likelihood function is defined as follows:

$$\ln L = \sum_{i=1}^{N} \{\sum_{t=1}^{T} y_{it}(y_{it}x'_{it}\beta - \ln y_{it}!) + \gamma \ln \gamma -$$
$$\gamma \ln[\gamma + \sum_{t=1}^{T} exp(x'_{it}\beta)] + \ln[\Gamma(\sum_{t=1}^{T} y_{it} + \gamma)] -$$
$$\ln[\Gamma(\gamma)] - \sum_{t=1}^{T} y_{it} \ln[\gamma +] \qquad (7)$$

It is possible to acquire of this model estimated parameters by solving;

$$\sum_{i=1}^{N} \sum_{t=1}^{T} x'_{it} \left(y_{it} - \theta_{it} \left(\frac{\bar{y}_i + \gamma/T}{\bar{\theta}_i + \gamma/T} \right) \right) = 0.$$

4.2 Negative Binomial Distribution

Classically, when the data set has an excessive dispersion problem, the negative binomial (NB) distribution is a useful another to the Poisson model; this problem arises once $var(y_{it}) > E(y_{it})$. Because the NB model needs a dispersion parameter φ_i, it permits the variance to be bigger than the nasty because the dispersion parameter gives the count distribution a wider shape than the Poisson distribution model.

In the fixed effects negative binomial (FENB) model, Hausman et al [52] proved that the conditional joint PDF for the ith observation be situated;

$$f(y_{i1}, \ldots, y_{iT}|\sum_{t=1}^{T} y_{it}) = \frac{\Gamma(\sum_{t=1}^{T} \theta_{it}) \Gamma(\sum_{t=1}^{T} y_{it} + 1)}{\Gamma(\sum_{t=1}^{T} \theta_{it} + \sum_{t=1}^{T} y_{it})} \times$$
$$\left[\prod_{t=1}^{T} \frac{\Gamma(\theta_{it} + y_{it})}{\Gamma(\theta_{it}) \Gamma(y_{it} + 1)} \right], \qquad (8)$$

whe $\sum_{t=1}^{T} y_{it} \sim NB\left[Y_i \sum_{t=1}^{T} \theta_{it}, (Y_i \sum_{t=1}^{T} \theta_{it})(1 + Y_i)\right]$; $Y_i = \Psi_i/\varphi_i$, and $\Gamma(\cdot)$ is the gamma function. The CMLE of the FENB model can be got by maximizing the next log-conditional maximum likelihood function:

$$ln L = \sum_{i=1}^{N}\{\ln \Gamma(\sum_{t=1}^{T} \theta_{it}) + \ln \Gamma(\sum_{t=1}^{T} y_{it} + 1) -$$
$$ln \Gamma(\sum_{t=1}^{T} \theta_{it} + \sum_{t=1}^{T} y_{it}) + \sum_{t=1}^{T}[ln\Gamma(\theta_{it} + y_{it}) -$$
$$ln\Gamma(\theta_{it}) - ln\Gamma(y_{it} + 1)]\}, \quad (9)$$

In the random effects negative binomial (RENB) model, Hausman et al [52] expected y_{it} to be independent and identically distributed NB, and $1/(1 + \Omega_i)$ where $\Omega_i = \delta_i/\varphi_i$, is distributed as beta with parameters (a, b). The expected and the variance of y_{it} are $\theta_{it}\Omega_i$ and $\theta_{it}\Omega_i(1 + \Omega_i)$, respectively. Then for the ith observation in the RENB model the conditional joint PDF is;

$$f(y_{it}|x_{it}) = \frac{\Gamma(a+b)\,\Gamma(a+\sum_{t=1}^{T}\theta_{it})\Gamma(b+\sum_{t=1}^{T}y_{it})}{\Gamma(a)\,\Gamma(b)\,\Gamma(a+\sum_{t=1}^{T}\theta_{it})\Gamma(b+\sum_{t=1}^{T}y_{it})} \times$$
$$\left[\prod_{t=1}^{T}\frac{\Gamma(\theta_{it}+y_{it})}{\Gamma(\theta_{it})\,\Gamma(y_{it}+1)}\right].$$

The next log-maximum likelihood function is maximized, yields the MLE of the RENB model;

$$ln L = \sum_{i=1}^{N}\{ln \Gamma(a + b) + ln \Gamma(a + \sum_{t=1}^{T}\theta_{it}) +$$
$$ln \Gamma(b + \sum_{t=1}^{T}y_{it}) - ln \Gamma(a) - ln \Gamma(b) -$$
$$ln \Gamma(a + b + \sum_{t=1}^{T}\theta_{it} + \sum_{t=1}^{T}y_{it}) +$$
$$\sum_{t=1}^{T}[ln \Gamma(\theta_{it} + y_{it})] - ln \Gamma(\theta_{it}) - ln \Gamma(y_{it} + 1)\}$$
$$(10)$$

5 Numerical Application

In order to measure the DW, the author relied on descriptive and analytical statistics to evaluate DW indicators for the countries under study using CPD analysis. The sample of the study was selected based on available data on the number of Decent Work Opportunities (DWO) in the countries under study and the data set has been obtained through the ILO and the World Bank (WB) website; the study population consists of countries that have implemented DW country projects and programmes from 1999 to 2019. The study sample consists of five countries (Bahrain, China, Egypt, Jordan, and Nigeria). These five countries represent various regions, cultures, and economic and social development levels. This enriches the study and gives an opportunity to evaluate DW indicators in

various environments. Moreover, the reasons for choosing these countries are:

- **Bahrain:** was among the first eight countries selected in the world to implement the DW Pilot Program in October 2000, and Bahrain is one of the countries with the most advanced labor laws in the Gulf region. The unemployment insurance program was also recently introduced, which is setting an example in the region. The Kingdom of Bahrain also won the original membership of the ILO's board of directors in the elections that took place during the 106th session of the International Labor Conference in June 2017.

- **China:** is the second-largest economy in the world and a major global trading partner. China has the largest population in the world and nearly a quarter of the global workforce, and has the largest volume of employment of 650,207,177 workers, see WB [53].It has been able to benefit from human resources and translate it into an amazing annual GDP growth of 9.5% on average, and China has also developed a large-scale social safety net that has lifted 800 million Chinese out of poverty over the past 40 years and has emerged in it a strong middle class, ILO [54].

- **In Egypt:** a set of DW projects were implemented as part of a roadmap for recovery after the events of the 25 January 2011 revolution [55]. Egypt adopted reforms and major structural economic programs aimed at accelerating its path towards comprehensive growth. The minimum wage was raised periodically, and the Egyptian government launched the National Action Plan to combat the worst forms of child labor in Egypt and support the family [56], and Egypt also launched the Takaful and Karama Cash Transfer Program, which included 2.4 million families or 10 million people in 2019.

- **Jordan:** is at the forefront of the Arab countries that signed the DW Country Program in 2006 and was chosen from among the nine countries globally and the only one from the Arab States region to test the Global Jobs Pact that was adopted during the International Labor Conference in June 2009 [57]. Jordan provides an

international public benefit by hosting the second largest percentage of refugees in the world, and Jordan was also the first Middle Eastern country to sign the Social Security (Minimum Standards) Convention (No. 102 of 1952).

- **Nigeria:** is the largest economy in Africa, with a GDP of 448.12 billion USD [58], and constituting 17% of the continents GDP. Nigeria was one of the three African countries selected to receive ILO assistance to implement the Global Jobs Pact in response to the global financial crisis the Government of the Federal Republic of Nigeria [59]. Nigeria has half the population of West Africa with nearly 202 million people, has one of the largest proportions of youth in the world, and is abundant in natural resources, and is the largest oil exporter in Africa, see WB [60].

6 Dimensions and Indicators

As discussed above, the DWI presented here uses available information from the framework presented by labour statistics experts at the tripartite international meeting held by the ILO in September 2008, which included ten axes for DW: employment opportunities, adequate earnings and productive work, decent working time and combining work with family and personal life, work that should be abolished, stability and security of work, equal opportunity and treatment in employment, safe work environment, social security, social dialogue, and worker's and employer's representation, see ILO [61]. Resulting in a composite index for DW composed of five dimensions and eleven indicators. By following the recommendations offered by the available literature on quality of work and the number of DWO provided by countries, the dimensions of DWI include indicators on the availability of employment opportunities, the availability of adequate earnings and productive work, the availability of stability and security at work, the availability of equal opportunity and treatment in employment and the availability of social security. Ferraro et al [43]. The variables included in this index serve to illustrate to what extent countries are working to provide the largest possible number of DWO. The dimensions and indicators together are summarized in Table 1 below. The DW indicators adopted by the study to measure and evaluate DW in the countries under study can be reviewed as follows:

6.1 Availability of Employment Opportunities

Employment refers to all forms of paid and unpaid work, self-employment, formal and informal work, full-time work, and part-time work. The priority of job creation is not exaggerated, as getting to work is the surest way out of poverty, just as getting people into productive activities is the way to create wealth that enables the achievement of social policy goals. There should be enough work for everyone to have complete access to opportunities for generating income, see Tipple [62]. The creation of employment opportunities is the political mandate of the ILO, the one that comes from the streets, the one that comes from the individuals, the mandate to the foundation of more and better jobs. With full employment as a goal, there is a specific focus on three critical determinants of employment: macroeconomic policies, transformations of production systems and enterprise strategy, and equal access to employment and labor markets. In all cases, the goal will be to integrate employment objectives into national policies. The availability of employment opportunities in the countries under study will be measured based on the following two indicators:

6.1.1 Employment to the working-age population ratio

The employment-to-working-age population ratio (EPR) is a fundamental measure for determining the economy's total demand for employment and provides information about the economy's ability to create jobs. The EPR is defined as the percentage of people in the working-age population who are employed. When the EPR rises over time, it usually means that there is an increased demand for workers within the economy [3]. It is noted that the relationship between the EPR indicator and the DW is a positive relationship, meaning that the greater the value of this indicator, the better the level of DW within the country, which means that the impact of this indicator will be positive on the DW in the country. The EPR indicator can be measured by:

$$EPR = \frac{\text{Number of people that are employed in the workforce} - \text{age population}}{\text{Total number of people in the workplace} - \text{age population}} \times 100$$

6.1.2 Unemployment Rate

The unemployment rate (UR) shows the economy's inability to provide employment opportunities for individuals who want to work, are available for work, and are actively seeking work. As a result, it's

seen as a barometer of the economy's efficiency and efficacy in absorbing its workforce, as well as the labour market's performance. The UR is defined as the proportion of unemployed individuals in the labour force. The labour force is composed of the number of individuals who are employed and those who are unemployed, see ILO [63]. It is noticed that the relationship between the UR indicator and the DW is an inverse relationship, meaning that the greater the value of this indicator, the worse the level of DW within the country, which means that the impact of this indicator will be negative on DW in the country. The following formula is used to calculate this indicator:

$$UR = \frac{\begin{array}{c}\text{Number of unemployed individuals in}\\ \text{the workforce} - \text{age population}\end{array}}{\begin{array}{c}\text{Total number of Individuals}\\ \text{in the labour force as a whole}\end{array}} \times 100$$

6.2 Availability of Adequate Earnings and Productive Work

Adequate earnings and productive work indicate that there will be remuneration for the work performed by the individual that helps him lead a decent life, and this income must be sufficient and commensurate with the high prices of goods and services that the individual needs. The work should result in a wage (cash or in-kind) that meets the basic needs of the worker and his family members. One study confirmed that the minimum wage can achieve positive results in alleviating poverty by improving the living conditions of workers and their families, and it also helps boost productivity, see Saget [64]. Productive work is crucial for workers to have decent living conditions for themselves and their families, as well as to achieve long-term growth. The availability of adequate earnings and productive work in the countries under study will be measured based on the following three indicators:

6.2.1 Labour Productivity Growth Rate

Labour productivity growth rate (LPR) is a key indicator closely related to economic development, competitiveness, and living standards. Labor productivity indicates the total volume of output expressed in terms of GDP output per unit of labour-measured by the number of employed individuals-during a given reference period. It is noticed that the relationship between the LPR indicator and the DW is a positive one, meaning that the higher the value of this indicator, the better the level of DW within the country, meaning that the effect here will be positive on the DW in the

country. The LPR indicator is calculated as follows, see ILO [65]:

$$\text{Labour productivity} = \frac{\text{GDP at constant prices}}{\begin{array}{c}\text{Total number of}\\ \text{people employed}\end{array}}$$

6.2.2 Labour Income Rate

The labour income rate (LIR) is the amount that workers earn by working. This concept is used to distinguish it from capital income, as asset owners obtain capital income due to their property. The LIR includes employee wages and a portion of the self-employed income, as self-employed workers earn from their work and capital ownership. LIR's share of GDP is total employee compensation given as a percentage of GDP. It is noted that the relationship between the LIR indicator and the DW is a positive one, meaning that the higher the value of this indicator, the better the level of DW within the country, meaning that the effect here will be positive on the DW in the country. This indicator can be calculated as follows:

$$LIR = \frac{\text{Total employee compensation}}{\text{GDP}} \times 100$$

6.2.3 Inflation and Consumer Prices Indices

Inflation measured by the consumer price index (CPI) can be defined as the change in the prices levels of a basket of goods and services that are frequently bought by certain categories of households. The CPI is one of the most commonly used indicators for detecting periods of inflation or deflation. It is noticed that the relationship between the CPI indicator and the DW is an inverse relationship, meaning that the greater the value of this indicator, the worse the level of DW within the country, which means that the impact of this indicator will be negative on DW in the country. The CPI indicator is calculated as follows:

$$CPI = \frac{\text{Cost of Market Basket in Given Year}}{\text{Cost of Market Basket in Base Year}} \times 100$$

6.3 Availability of Stability and Security of Work

Stability and security of work include employment-related concerns such as employment security or protection from unfair dismissal, and employment stability consistent with economic dynamics. For most people, losing a job or work is a dangerous event, and there is no doubt that job security is viewed by most individuals as a significant aspect of DW. The availability of stability and security of

work in the countries under study will be measured based on the following two indicators:

6.3.1 Formal Employment Rate

The regular or formal employment rate (FER) is the total number of salaried workers as a proportion of the total employees, and they are workers who work in the jobs specified as "paid employment jobs", where the incumbents have explicit (written or oral) or implicit employment contracts that provide them with a basic salary that is not directly dependent upon the income of the unit for which they work, see WB [66]. The relationship between the FER indicator and the DW is a positive one, meaning that the higher the value of this indicator, the better the level of DW within the country, which means that the impact will be positive on the DW in the country.

6.3.2 Vulnerable Employment Rate

The vulnerable employment rate (VER) indicates the percentage of workers whose jobs put them at a higher risk of losing their jobs than other workers. The VER is defined as the percentage of the total number of self-employed workers or contributing family members. High levels of this indicator may indicate poor working conditions and a lack of job creation in the formal sector [3]. Vulnerable employment is frequently characterized by insufficient revenues, low productivity, and tough working conditions that jeopardize worker's basic rights. The lifting of restrictions and regulatory controls, market liberalization, privatization, and the desire for a flexible labour market has led to the spread of informal employment [5]. Most of the people who are poor in the developing world already have a job, but it is mostly in the informal economy. Contributing family workers and self-employed workers are most at risk and therefore the most vulnerable to falling into poverty, and they are the least likely to have safety nets to protect against economic shocks [60]. It is noted that the relationship between the VER indicator and the DW is an inverse relationship in the sense that the greater the value of this indicator, the deterioration of the level of DW within the country, meaning that the effect here will be negative on the DW in the country. This indicator can be calculated as follows:

$$\text{VER} = \frac{\text{Own} - \text{account workers or family members who contribute to the family's income}}{\text{Total number of Employed}} \times 100$$

6.4 Availability of Equal Opportunity and Treatment in Employment

The availability of equal opportunity and treatment in employment provides information on the employment of men and women. The word "employment" means a group of jobs whose tasks and duties are broadly similar. This dimension highlights the extent to which men and women benefit from different chances and treatment in the workplace. Equality is at the core of the DW concept, and ILO Convention No. 111 continues to provide the basis for positive policies to promote equality, see Hepple [67]. DW implies work without any kind of discrimination. Investing in gender equality and DW for women and empowering them is vital to achieving economic and social equity and can translate into tangible and sustainable improvements in women's position at work, see Charlesworth [68]. This dimension will be measured in the countries under study based on the following two indicators:

6.4.1 Ratio of Females to Males in Employment to the Working-age Population Rate

It is noted that the relationship between the ratio of females to males in employment to the working-age population (FMER) and the DW is a positive relationship in the sense that the greater the value of this indicator, the better the level of DWI within the country, meaning that the effect here will be positive on the DW in the country. This indicator can be calculated as follows:

$$\text{FMER} = \frac{\text{Ratio of employed females to the total number of females of working} - \text{age}}{\text{Ratio of employed males to the total number of males of working} - \text{age}} \times 100$$

6.4.2 Share of Women in the Wage Employment Rate

The Share of women in the wage employment rate (FPER) indicator displays the share of females in wage employment as a proportion of total wage employment. The extent of women's access to wage employment could indicate their incorporation into the monetary economy while providing a far more consistent and monetary income, and this, in turn, is likely to have a favorable influence on women's independence and their decision-making abilities. It is noted that the relationship between the FPER indicator and the DW is a positive one, meaning that the higher the value of this indicator, the better the level of DW within the country, meaning that the effect here will be positive on the DW in the country. The following formula can be used to determine this indicator:

$$FPER = \frac{\text{Number of women in paid employment}}{\text{Total number of individuals in paid employment}} \times 100$$

6.5 Availability of Social Security

Social security refers to the general actions taken in response to levels of vulnerability, risk, and deprivation that are deemed socially unacceptable within a particular system or society. These measures include labour market interventions, social safety nets, and pensions, along with interventions to enhance conditions of normality and deal with regular and often persistent deprivation. Social protection is important during the privatization process and as trade liberalization progresses. National experiences show that coordinated action of social security policies can contribute to ease the transition from informal to formal economies. The availability of social security will be measured in the countries under study based on the following two indicators:

6.5.1 Dependency Ratio

A dependency ratio (DR) shows the number of individuals in the dependent age groups children under the age of 15 and people over the age of 64 to the number of individuals in the working-age group between 15 and 64 years. Thus, it shows the number of people in dependent age groups for every 100 persons of working age [69]. A higher DR means a greater demand for social security expenditures for this vulnerable group, which is unable to work and secure their living expenses. When the dependency ratio is high, it makes financing social security plans difficult, as there are few people of working age, of whom a few are productively employed, and the direct financial revenues (through income tax) and indirect (through consumption tax) will be low, and this means lower financial revenues, and thus the governments will not be able to finance social security plans, see Harasty and Ostermeier [70]. Hence, an increase in the dependency ratio means a decrease in social security. It is noted that the relationship between the DR indicator and the DW is an inverse relationship in the sense that the greater the value of this indicator, the deterioration in the level of DW within the country, meaning that the effect here will be negative on the DW in the country.

6.5.2 Working Poverty Rate

The concept of "poor employment" aims to measure the number of workers who live in poverty despite the fact that they are employed. Consequently, the working poverty rate (WPR) shows the percentage of the working population living in families classified as poor that is, having levels of consumption or income levels below the national or international poverty line specified. The WPR is illustrated by the number of working poor as a percentage of the employed population, see ILO [71]. Poverty is a concept that applies to families, not individuals, and is based on the assumption that families pool their income to lift the entire family out of poverty. Social security is one of the most important tools that reduce poverty risks, see Cantillon [72]. An increase in the WPR means a decrease in social security. DW and empowerment reinforce each other in a powerful cycle of making economic growth more pro-poor, as they will have more access to good-quality jobs. Productive work is the best way out of poverty. Reducing the DW deficit is also a way to reduce poverty. Full and productive employment and DW for all are essential to achieving the Millennium Development Goals and eradicating poverty [5]. Employment should be a means of lifting people out of poverty, but this is only true if the quality of the job is adequate, including adequate earnings, job security, and safe work environments. The regions with the highest working poverty rates are also those with the highest rates of informal employment, see Gammarano [73]. The relationship between the WPR indicator and the DW is an inverse relationship in the sense that the greater the value of this indicator, the worse the level of DW within the country, meaning that the effect here will be negative on the DW in the country. This indicator can be calculated as follows:

$$WPR = \frac{\text{Number of employed people living in low} - \text{income families}}{\text{Employed total number}} \times 100$$

7 Results

As a numerical application, this paper is concerned with studying the significant impact of five dimensions on the number of DWO using data set for five countries (Bahrain, China, Egypt, Jordan and Nigeria) during period from 1999 to 2019. The data set is limited by the amount of information available for each state involved. This paper follows the methodology by Youssef et al. [74] for applying CPD models.

In order to perform of the CPD models for this application, we used softwares in our research are "STATA version 15" and "R version 4.1.1" with (*pglm* package). Table 2 summarizes the descriptive

statistics for the variables (dependent and independent variables). Since the p-value of Jarque and Bera [75] test is greater than 0.05 for all variables, we may conclude that the data are not having large variation and are distributed normally.

Table 1. Dimensions and Indicators for Decent Work

Dimensions	Indicators	Indicators symbols	Measuring Unit
Dependent variable	Decent Work opportunities	DWO	Count
Availability of employment opportunities	Employment to the working-age population ratio	EPR	%
	Unemployment rate	UR	%
Availability of adequate earnings and productive work	Labour productivity growth rate	LPR	%
	Labour income rate	LIR	%
	Inflation and consumer prices Indices	CPI	%
Availability of stability and security of work	Formal employment rate	FER	%
	Vulnerable employment rate	VER	%
Availability of equal opportunity and treatment in employment	Ratio of females to males in employment to the working-age population	FMER	%
	Share of women in the wage employment rate	FPER	%
Availability of social security	Dependency ratio	DR	%
	Working poverty rate	WPR	%

Table 2. Descriptive Statistics of the Variables

Variables	Mean	Max.	Min.	Std. Dev.	JB. Test	P-value
DWO	18600,749	95800	11268	28800,872	5.073	0.094
EPR	54.085	75.200	32.830	14.138	1.757	0.462
UR	7.003	16.850	0.950	4.813	0.611	0.089
LPR	2.705	13.632	-5.842	4.284	3.313	0.191
LIR	42.816	67.000	25.800	13.115	0.595	0.069
CPI	5.728	29.507	-1.401	5.599	0.703	0.392
FER	61.101	97.350	10.480	29.056	1.879	0.495
VER	34.243	89.220	8.183	30.545	1.475	0.367
FMER	51.161	86.072	15.305	28.541	3.416	0.079
FPER	26.497	48.124	14.157	11.069	2.640	0.259
DR	59.051	88.592	26.964	20.181	4.266	0.108
WPR	59.051	88.592	26.964	20.181	2.387	0.523

Table 3. Correlation Matrix and VIF values

| Variables	DWO	EPR	UR	LPR	LIR	CPI	FER	VER	FMER	FPER	DR	WPR
DWO	1											
EPR	0.623 (0.000)	1										
UR	0.299 (0.201)	0.451 (0.046)	1									
LPR	0.493 (0.027)	0.650 (0.024)	0.321 (0.167)	1								
LIR	0.714 (0.001)	0.574 (0.008)	0.268 (0.254)	0.798 (0.004)	1							
CPI	0.495 (0.027)	0.446 (0.049)	0.053 (0.826)	0.439 (0.053)	0.491 (0.051)	1						
FER	-0.025 (0.916)	0.216 (0.360)	0.598 (0.005)	-0.097 (0.684)	-0.255 (0.277)	-0.037 (0.877)	1					
VER	-0.282 (0.228)	0.685 (0.061)	-0.723 (0.030)	0.574 (0.028)	0.495 (0.038)	-0.392 (0.002)	-0.679 (0.001)	1				
FMER	0.870 (0.060)	-0.037 (0.877)	0.439 (0.053)	-0.679 (0.005)	0.525 (0.017)	-0.016 (0.969)	0.484 (0.017)	0.629 (0.036)	1			
FPER	-0.494 (0.019)	-0.457 (0.025)	-05.229 (0.330)	0.657 (0.003)	-0.502 (0.061)	0.671 (0.093)	0.639 (0.007)	0.574 (0.006)	0.439 (0.053)	1		
DR	0.590 (0.013)	0.650 (0.001)	-0.271 (0.310)	0.345 (0.247)	-0.781 (0.017)	0.692 (0.012)	-0.532 (0.019)	0.704 (0.028)	0.198 (0.094)	0.195 (0.190)	1	
WPR	0.423 (0.025)	0.419 (0.036)	0.064 (0.805)	0.490 (0.061)	0.693 (0.057)	0.601 (0.069)	-0.505 (0.039)	0.492 (0.008)	-0.086 (0.074)	0.434 (0.059)	-0.348 (0.010)	1
VIF	------	**2.482**	**5.182**	**3.169**	**6.392**	**2.906**	**3.092**	**1.582**	**6.173**	**4.182**	**8.091**	**3.396**
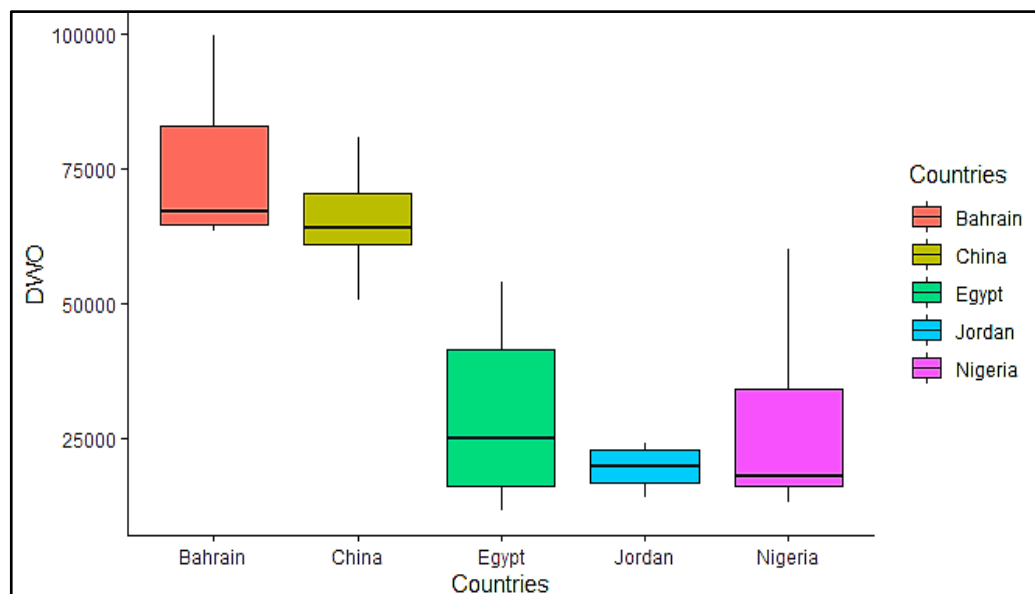
Fig. 3: Boxplots of the Number of DWO for Each Country studied

7.1 Testing the Multicollinearity and Outliers for Dataset

The first stage in data processing is to make sure that two or more explanatory variables do not have a high linear association. When there is multicollinearity, statistical inferences are unreliable because it causes estimates of regression coefficients to be erroneous, inflates their standard errors, deflates partial t-tests for them, generates false non-significant p-values, and decreases the model predictability. To find multicollinearity, we employ the most widely used methods: (i) the Pearson correlation matrix between each pair of predictor variables, and (ii) the Variance Inflation Factor (VIF), see [76,77]. Table 3 presents the pairwise correlation coefficients between all variables associated with two-tailed significant t-test in parentheses. It is worth noting that the correlation between DWO and EPR is larger, whilst the

correlation between CPI and FMER is the least. Also, because all of the VIF values are less than 10, Table 3 shows that the data set does not have an issue with multicollinearity.

On the other hand, Figure 3 displays the boxplots of the number of DWO for the countries studied. The disparity in the number of DWO between countries is depicted in this graph, however the distribution of DWO within each country is essentially symmetrical and without outlier values.
Moreover, the classical (non-robust) estimator is ineffective when the data contains outlier values, and the regression parameters must be estimated using a robust estimator. Many publications in several regression models discuss a variety of robust estimators; see e.g. [78 79, 80, 81].

7.2 Selecting the Appropriate CPD Model
In order to choose the appropriate CPD model for this data, we will during in analysis do the following steps:
1. The four CPD (FEP, REP, FENB and RENB) models will be estimating.
2. Testing the Hypothesis;

    H_0: The random effects model is appropriate.
    H_1: The fixed effects model is appropriate.

3. Conducting the Hausman [50] test to compare the fixed and random effects models.
4. In the final step, the selection criteria (goodness-of-fit measures) will be used to select the appropriate CPD model.

The findings of the FEP and REP models are presented in Table 4. The CMLE approach was used to estimate the parameters in fixed effects models, whereas the MLE method was used to estimate the parameters in random effects models. Because the Wald test P-value is less than 0.05, the two models (FEP and REP) are statistically significant. Based on the results of Hausman test, the P-value of chi-squared is less than 0.05, then we can reject the null hypothesis, this means that FEP model is more appropriate.

However, the findings of CML estimates of the FENB model and MLE estimates of the RENB model are presented in Table 5. Because the Wald test P-value is less than 0.05, the two models (FENB and RENB) are statistically significant. The FENB model is more appropriate because the P-value of the Hausman test is less than 0.05.

Moreover, the values of the Hausman test statistic, T_H values, are shown in Figure 4 based on the number of bootstrap replications (for the bootstrap variance matrix estimated in the Hausman test). As the P-value of the Hausman test is less than 0.05 or any lower level of significance after 1000 replications, then we reject the null hypothesis (H_0), implying that the fixed effects model is more appropriate.

Based on the results in Tables 4 and 5, we concluded that FEP and FENB models are preferable to REP and RENB models. The Akaikes information criterion (AIC) and the Bayesian information criterion (BIC) should then be used to select the appropriate model (FEP or FENB). On the other hand, the good model, correlates to reduce AIC and BIC criteria and largest values of P-value. The formulae that are utilized to determine these approaches are as follows.

$$AIC = 2k - 2L, \qquad (11)$$

$$BIC = k \log(n) - 2L, \qquad (12)$$

where L is the log-likelihood function value for the estimated model, k is the number of parameters, and n is the sample size. Table 6 indicates that the FENB model has the lowest AIC and a BIC value, as well as higher R-Squared values, implying that it is the best model for fitting the data set.

The national DWI is obtained by adding up the indexes for the five dimensions and normalizing the result used the Alkire/Foster (AF) method [82]. This can be done for five countries, i.e. those for which all five of the dimensions indexes could be estimated with the data available. As can be seen in Figure 5, the highest scores on the DWI are Bahrain, followed by China, Egypt, Jordan, finally Nigeria.

Table 4. Poisson Panel Models Estimates

Variables	FEP Model			REP Model		
	Estimate	T-value	P-value	Estimate	T-value	P-value
Intercept	--------	--------	--------	-5.523	-3.980	0.002
EPR	0.452	4.664	0.003	0.312	0.664	0.713
UR	-0.153	-1.096	0.276	-0.782	-6.096	<0.001
LPR	0.676	16.541	<0.001	0.983	8.541	<0.001
LIR	0.835	0.563	0.527	-0.529	-0.903	0.492
CPI	-0.947	-2.547	0.013	0.498	2.547	0.039
FER	0.765	10.209	<0.001	0.929	13.209	<0.001
VER	-0.896	-7.547	<0.001	-0.107	-0.147	0.195
FMER	-0.418	-3.696	0.004	-0.582	-3.953	0.003
FPER	0.906	1.680	0.056	0.790	18.691	<0.001
DR	-0.649	-1.507	0.113	-0.369	-4.206	<0.001
WPR	-0.952	-11.462	<0.001	-0.112	-0.256	0.809
Wald Test	$\chi^2 = 1058.926, df = 11;$ $P-value\,(\chi^2) < 0.001$			$\chi^2 = 3296.285, df = 11;$ $P-value\,(\chi^2) < 0.001$		
Hausman Test	$\chi^2 = 894.372\; ; P-value\,(\chi^2) < 0.001$					

Table 5. Negative Binomial Panel Models Estimates

Variables	FENB Model			RENB Model		
	Estimate	T-value	P-value	Estimate	T-value	P-value
Intercept	-12.586	-21.638	<0.001	-19.169	-30.892	<0.001
EPR	0.937	7.835	<0.001	0.019	2.349	0.023
UR	-0.492	-1.284	0.316	-0.685	-4.096	<0.001
LPR	1.890	0.495	0.090	3.693	2.541	<0.001
LIR	0.720	0.836	0.005	0.284	0.539	0.574
CPI	-0.793	-2.904	0.017	-0.962	-1.947	0.019
FER	3.848	14.209	<0.001	0.091	2.609	0.007
VER	-0.569	-2.170	0.005	2.837	0.547	0.041
FMER	2.721	16.696	<0.001	-0.284	-0.562	0.569
FPER	0.839	18.778	<0.001	8.128	17.061	<0.001
DR	-0.419	-6.572	<0.001	-0.197	-1.521	0.209
WPR	-0.0915	-3.694	0.002	-6.830	-3.092	0.002
Wald Test	$\chi^2 = 2489.063, df = 11;$ $P-value\,(\chi^2) < 0.001$			$\chi^2 = 4820.729, df = 11;$ $P-value\,(\chi^2) < 0.001$		
Hausman Test	$\chi^2 = 286.904\; ; P-value\,(\chi^2) < 0.001$					

Table 6. Measures of Goodness-of-fit for FE Models

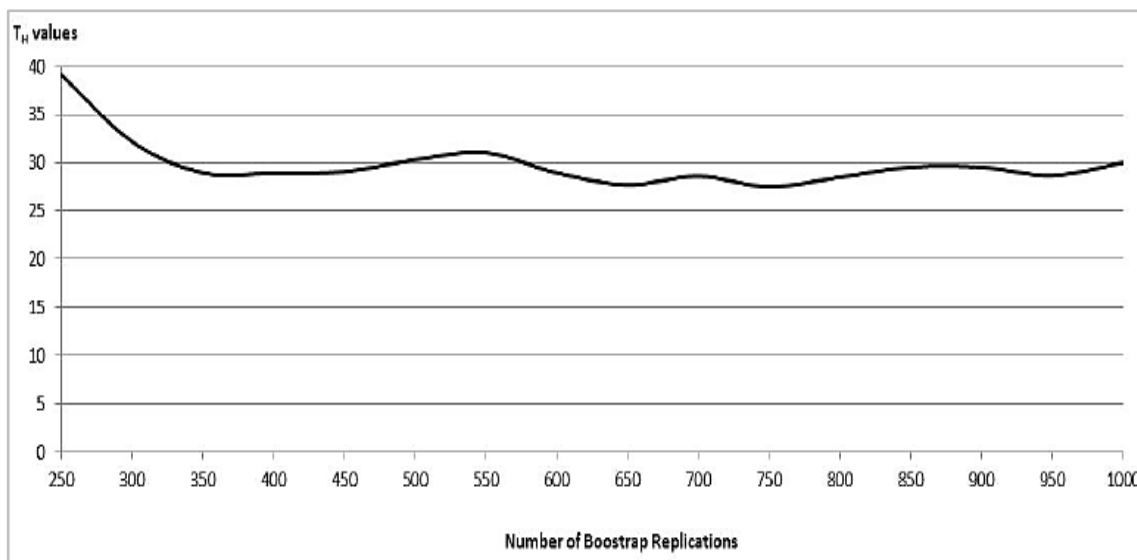| Measure	FEP Model	FENB Model
AIC	7182.962	4746.501
BIC	7190.846	4751.385
Log likelihood	-5629.841	-3162.012
R-Squared	0.7187	0.8490

Fig. 4: The Hausman test T_H values are determined by the number of bootstrap replications
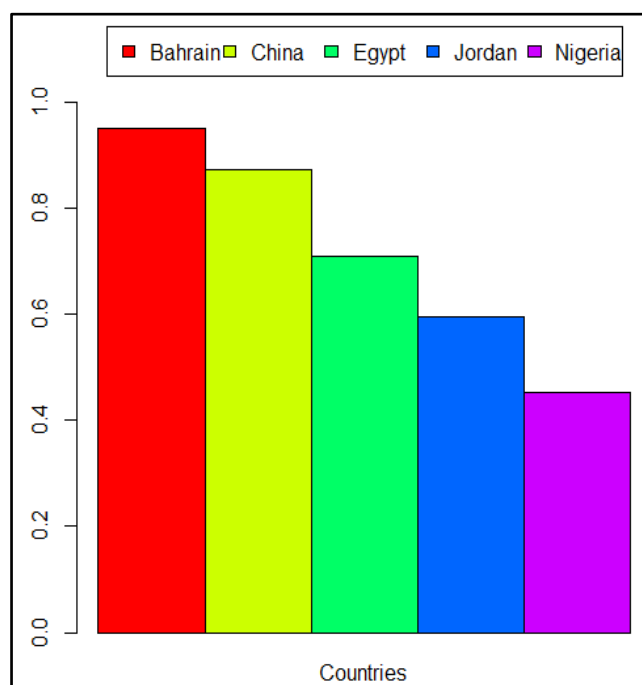

Fig. 5: Decent Work index for Each Country

Based on previous research results, we recommend the following:

- Strong political will is required among countries to integrate DW goals into national economic and social policy priorities, as well as to provide the economic, administrative, and infrastructure requirements for proper implementation of DWCPs.
- Governments should take a set of measures and procedures to improve compliance with labour standards. Chief among them is strengthening the capacity of labour inspectors, providing additional supervisory personnel, and applying deterrent penalties until employers comply with occupational safety and health requirements. A greater focus should also be placed on workers in the informal economy, and a preventive national culture of safety and health must be instilled within society.
- The need for coordination between education outputs and the labour market to maximize the benefit from human resources so that it does not turn into an unemployment problem that disturbs countries, see [83]. Information systems and labour market analysis must be strengthened, and employment-related training

opportunities should also be expanded with an emphasis on enabling people with disabilities to acquire the skills necessary to secure employment. Convergence and consistency between economic, social, and environmental policies must also be ensured to create more green jobs. It is important to increase the effectiveness of growth by being more inclusive so that disadvantaged groups can benefit on a large scale from comprehensive improvements in living standards and working conditions. Growth must be labor-intensive enough to create more jobs for a larger workforce.

- It is necessary to hasten the transition from the informal to the formal economy, see [84]. While deterrence measures such as the imposition of sanctions and denial of privileges are necessary and important, the components of compliance strategies are most effective when combined with awareness-raising and providing information and guidance. It is noted that websites, apps, social media, and the media can be used to raise awareness and improve compliance.

- Preparing special programmes to provide women with the skills required in their work according to market needs, while striving to provide job opportunities for women in various sectors of the national economy, removing barriers that limit their active participation in the labour market, and eliminating social and cultural prejudices, as women are an important partner in development.

- Donors should provide more funding for DW country projects and programs, as a lack of funding can be an obstacle that leads to stalled implementation and the failure of the project or program. Donors must also ensure that these grants are managed in an efficient and effective manner in the recipient countries.

- Achieving a perfect balance among both work and family life is essential through establishing family-oriented policies in the work environment, such as the use of a flexible work time policy and a telework policy so that employees can work from their homes.

- For social dialogue to succeed the state is responsible for creating a stable political and civil climate in which employers and workers organizations can operate freely and without fear, and to include the voice of the various segments of workers who are not currently represented.

- The minimum wage must be reviewed regularly, based on accurate and up-to-date information, and accompanied by tax measures and other benefits to effectively combat poverty. Equity and social cohesion must also be strengthened by expanding social security systems. Social security should be seen as an investment in human capital, not a cost, because it helps contain inequality, and has an important impact on ensuring sustainable and inclusive growth and moving out of poverty, which will also help eliminate child labor.

8 Concluding Remarks

This paper shows that the Alkire Foster (AF) method for calculating multi-dimensional indices can be usefully applied to the measurement of DW. In this paper, we examined the effect of five dimensions and eleven indicators on the number of DWO in five countries over the period from 1999 to 2019 by applying four CPD models, For more details about CPD models, see e.g. [85] The Hausman test has been conducted to compare fixed and random effects models; the results of the Hausman test indicate that FE models are better than RE models. Using selection criteria (AIC, BIC and R-Squared), we find that the FENB model is the appropriate for this data, because it has the lowest AIC, BIC values and higher values of R-Squared. We found that the FENB model results indicated that the EPR,FER, FMER and FPER indicators have a positive significant result on the number of DWO, implying that the greater the value of this indicator, the better the level of DW within the country. However, the UR, VER, DR, WPR indicators have a negative significant effect on the number of DWO. While the LPR, LIR, CPI indicators have little bearing on the number of DWO. The results show that the five countries analyzed have varying levels of DW, with Nigeria and Jordan scoring very low on the index, Egypt obtaining a median level of achievement, and Bahrain and China scoring higher. It is worth noting that these findings are reliable. The aggregated measures of the DWI allow for the construction of a countries ranking and produces internationally comparable results across a range of countries with differing levels of development.

References:

[1] Poschen, P. (2009). Decent Work for All: From ILO Initiative to a Global Goal. In *International Handbook of Education for the Changing World of Work* (pp. 111-128). Springer, Dordrecht.

[2] International Labour Organization. (2019). Time to act for SDG 8: Integrating Decent Work, sustained growth and environmental integrity. ILO. https://www.ilo.org/wcmsp5/groups/public/---dgreports/---inst/documents/publication/wcms_712685.pdf

[3] International Labour Organization. (2015). *National employment policies: A guide for workers organizations.* . ILO.https://www.ilo.org/wcmsp5/groups/public/@ed_emp/@emp_policy/documents/publication/wcms_334920.pdf

[4] United Nations. Secretary-General proposes Global Compact on Human Rights, Labour, Environment In Proceedings of the Secretary-General Kofi Annan to the World Economic Forum, Davos, Switzerland, 31 January 1999; Available online: https://www.un.org/press/en/1999/19990201.sgsm6881.html (accessed on 30 July 2019).

[5] MacNaughton, G., & Frey, D. F. (2010). Decent Work for all: a holistic human rights approach. *American University International Law Review*, 26(2), 441-483.

[6] Bisom-Rapp, S., Frazer, A., & Sargeant, M. (2011). Decent Work, older workers and vulnerability in the economic recession: a comparative study of Australia, the United Kingdom, and the United States. *Employee Rights and Employment Policy Journal,* 15(43), 43-121.

[7] Adhikari, D. R., Hirasawa, K., Takakubo, Y., & Pandey, D. L. (2012). Decent Work and work life quality in Nepal: an observation. *Employee relations,* 34*(1)*, 61-79.

[8] Siron, L. (2014). *Benchmarking social upgrading and Decent Work indicators in a South African sustainable cotton textile and apparel supply chain* (Doctoral dissertation, University of Delaware).

[9] Rodgers, G. (2002). Decent Work as a goal for the global economy. *unpublished mimeograph*.

[10] Anker, R., Chernyshev, I., Egger, P., Mehran, F., & Ritter, J. A. (2003). La medición del trabajo decente con indicadores estadísticos. *Revista Internacional del trabajo*, *122*(2), 161-195.

[11] Somavia, J. (2000).Introduction, en Globalizing Europe. Decent Work in the information economy. Reporte del Director General, Sexta Reunion Regional Europea, OIT, Ginebra, vol. 1.

[12] Ermida, O. (2000). Trabajo decente y formacion profesional, en Boletin Cinterfor No. 151 Montevideo, Cinterfor.

[13] International Labour Organization. (2019). Address by Mr. Juan Somavia, Director General of the International Labour Organization. Proceedings of the 87th Session, International Labour Conference, Geneva, Switzerland, 1 June 1999; Available online: https://www.ilo.org/public/english/standards/relm/ilc/ilc87/rep-i.htm (accessed on 30 July 2019).

[14] Bescond, D., Chataignier, A., & Mehran, F. (2003). Seven indicators to measure Decent Work: An international comparison. *International Labour Review*, 142(2), 179–211.

[15] Bonnet, F, Figueiredo, J., & Standing, G. (2003). A family of Decent Work indexes. *International Labour Review*, 142(2), 213–238.

[16] Kantor, P., Rani, U., & Unni, J. (2006). Decent Work deficits in informal economy case of Surat. *Economic and Political Weekly*, *41*(21), 2089–2097.

[17] Somavia, J. (2001). *Report of the Director-General: Reducing the Decent Work deficit - a global challenge*. International Labour Conference, 89th Session, Geneva: ILO.

[18] International Labour Organization. (2004). *Reducing the Decent Work Deficit in the Infrastructure and Construction Sectors: The Experience and Proposals of ILO'S Employment-Intensive Investment Programme*. International Labour Office.

[19] International Labour Organization. (2018c). *World Employment and Social Outlook – Trends 2018*. International Labour Office.

[20] International Labour Organization. (2019e). *World Employment and Social Outlook – Trends 2019*. International Labour Office.

[21] International Labour Organization. (2020b). *World Employment and Social Outlook – Trends 2020*. International Labour Office.

[22] International Labour Organization. (2020a). *Global Employment Trends for Youth 2020: Technology and the future of jobs*. International Labour Office.

[23] International Labour Organization. (2018b). *Women and men in the informal economy: a statistical picture*. International Labour Office.

[24] Wadsworth, E., & Walters, D. (2019). *Safety and health at the heart of the future of work: building on 100 years of experience*. International Labour Office.

[25] International Labour Organization. (2021a). https://endchildlabour2021.org/what-is-child-labour/ Accessed on 26/2/2021.

[26] International Labour Organization. (2019b). Ending child labour, forced labour and human trafficking in

global supply chains. *ILO, OECD, IOM and UNICEF*.

[27] International Labour Organization. (2018a). *ILO Action Plan for Gender Equality 2018–21*. International Labour Office.

[28] International Labour Organization. (2019a). *A quantum leap for gender equality: for a better future of work for all*. International Labour Office.

[29] International Labour Organization. (2017). *World Social Protection Report 2017–19: Universal social protection to achieve the Sustainable Development Goals*. Executive summary.

[30] International Labour Organization. (2019c). *Guide to developing balanced working time arrangements*. International Labour Office.

[31] International Labour Organization. (2019). Decent Work Country Programmes; International Labour Office: Geneva, Switzerland, 1999; Available online: https://www.ilo.org/global/about-the-ilo-how-the-ilo-works/departments-and-o_ces/program/dwcp/lang--en/index.htm (accessed on 30 July 2019).

[32] International Labour Organization. (2019). ILO Implementation Plan 2030 Agenda for Sustainable Development 2016. CABIN-160421-2-EN.docx. Available online: https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---webdev/documents/publication/wcms_510122.pdf (accessed on 30 July 2019).

[33] International Labour Organization. (2015). Decent Work Country Diagnostics. Technical Guidelines to Drafting Diagnostic Report; International Labour Office: Geneva, Switzerland, 2015; Available online: https://www.ilo.org/wcmsp5/groups/public/---ed_mas/---program/documents/genericdocument/wcms_561044.pdf (accessed on 31 July 2019).

[34] International Labour Organization. (2016a). ILO Decent Work Country Programme. Practical Guidebook;Version 4; First Published; 2005; International Labour O_ce: Geneva, Switzerland, 2016; Available online: https://www.ilo.org/wcmsp5/groups/public/---ed_mas/---program/documents/genericdocument/wcms_561025.pdf (accessed on 28 August 2019).

[35] International Labour Organization. (2016b). What is Decent Work? 2016. Available online: https://www.youtube.com/watch?time_continue=110&v=mZpyJwevPqc (accessed on 30 July 2019).

[36] Ghai, D. (2002). *Decent Work: Concepts, models and indicators*. International Institute for Labour Studies, Geneva, ILO. Rev., 142, 113.

[37] Sehnbruch, K., Burchell, B., Agloni, N., & Piasna, A. (2015). Human development and Decent Work: why some concepts succeed and others fail to make an impact. *Development and Change*, 46(2), 197-224.

[38] Standing, G. (2002). From peoples security surveys to a Decent Work index. *International Labour Review*, 141(4), 441-454.

[39] Bamber, G. J., & Russell, B. (2008). Realising Decent Work in a Globalising World: Dignity of Work and Dignity at Work. *Available at SSRN 1358286*.

[40] Banerjee, B., & Kundu, A. (2020). Evaluation of Decent Work Index for Informal Workers: An Empirical Study from Hooghly District, West Bengal, India. *Indian Journal of Human Development*, *14*(1), 76-98.

[41] Mackett, O. (2020). The measurement of Decent Work in South Africa: A new attempt at studying quality of work. *African Review of Economics and Finance*, 12(1), 203-247.

[42] Burchell, B., Sehnbruch, K., Piasna, A., & Agloni, N. (2014). The quality of employment and Decent Work: definitions, methodologies, and ongoing debates. *Cambridge journal of economics*, 38(2), 459-477.

[43] Ferraro, T., Pais, L., & Dos Santos, N. R. (2015). Decent Work: An aim for all made by all. *International Journal of Social Sciences*, 4(3), 30-42.

[44] Ferraro, T., Pais, L., Rebelo Dos Santos, N., & Moreira, J. M. (2018). The Decent Work Questionnaire: Development and validation in two samples of knowledge workers. *International Labour Review*, *157*(2), 243-265.

[45] Hsiao, C. (2014). *Analysis of Panel Data*, Cambridge, Cambridge University Press, 2nd ed.

[46] Winkelmann, R. (2008). *Econometric Analysis of Count Data*, Springer Science & Business Media. Berlin, 5th ed.

[47] Boucher, J. P., & Denuit, M. (2006). Fixed versus random effects in Poisson regression models for claim counts: A case study with motor insurance. *ASTIN Bulletin: The Journal of the IAA*, *36*(1), 285-301.

[48] Abonazel, M. R. (2018). Different estimators for stochastic parameter panel data models with serially correlated errors. *Journal of Statistics Applications and Probability*, 7(3), 423-434.

[49] Abonazel, M. R. (2019). Generalized estimators of stationary random-coefficients panel data models: Asymptotic and small sample properties. *Revstat Statistical Journal*, *17*(4), 493-521.

[50] Hausman, J. A. (1978). Specification tests in econometrics. *Econometrica: Journal of the econometric society*, 1251-1271.

[51] Cameron, A. C., & Trivedi, P. K. (2013). *Regression analysis of count data* (Vol. 53). Second Edition, Cambridge university press.

[52] Hausman, J. A., Hall, B. H., & Griliches, Z. (1984). Econometric models for count data with an application to the patents-R&D relationship.

[53] World Bank. (2021b). https://data.worldbank.org/indicator/SL.EMP.TOTL.SP.ZS?view=chart Accessed on 19/3/2021.

[54] International Labour Organization. (2019d). *The ILO in China*. ILO Country Office for China and Mongolia.

[55] International Labour Organization. (2014). *Independent evaluation of the ILO's Decent Work Country Programmer Strategies and Activities in North-Africa: 2010-2013*. Evaluation office.

[56] International Labour Organization. (2021b).https://www.ilo.org/africa/mediacentre/articles/WCMS_749347/lang--en/index.htm Accessed on 10/2/2021.

[57] International Labour Organization. (2012). *Decent Work Country Programme (2012 - 2015) The Hashemite Kingdom of Jordan*. International Labour Organization Regional Office for the Arab States.

[58] World Bank. (2021a). https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?locations=NG Accessed on 20/1/2021

[59] The Government of the Federal Republic of Nigeria. (2020). *Nigeria integration of the SDGs into national development planning – A second voluntary national review*. The Office of the Senior Special Assistant to the President on SDGs.

[60] World Bank. (2021c). https://www.worldbank.org/en/country/nigeria/overview Accessed on 22/1/2021.

[61] International Labour Organization. (2012). *Decent Work Indicators: Concepts and Definitions*. International Labor Office.

[62] Tipple, G. (2006). Employment and work conditions in home-based enterprises in four developing countries: do they constitute Decent Work?. *Work, employment and society*, *20*(1), 167-179.

[63] International Labour Organization. (2021a). https://ILO's tat.ilo.org/topics/labour-income/ Accessed on 17/2/2021.

[64] Saget, C. (2001). Poverty reduction and Decent Work in developing countries: Do minimum wages help. *Int'l Lab. Rev.*, *140*, 237.

[65] International Labour Organization. (2021b). https://ILO's tat.ilo.org/glossary/working-poverty-rate/ Accessed on 9/1/2021.

[66] World Bank. (2021). https://data.worldbank.org/indicator/SL.EMP.WORK.ZS Accessed on 11/1/2021.

[67] Hepple, B. (2001). Equality and empowerment for Decent Work. *International Labour Review*, 140(1), 5-18.

[68] Charlesworth, S. (2010). *The Sex Discrimination Act: Advancing Gender Equality and Decent Work?*. Canberra: ANU E Press.

[69] Rantanen, J., Muchiri, F., & Lehtinen, S. (2020). Decent Work, ILO's response to the globalization of working life: Basic concepts and global implementation with special reference to occupational health. *International journal of environmental research and public health*, *17*(10), 3351.

[70] Harasty, C., & Ostermeier, M. (2020). Population Ageing: Alternative measures of dependency and implications for the future of work. *ILO Working Paper*, *5*.

[71] International Labour Organization. (2021c). https://ILO's tat.ilo.org/resources/methods/description-unemployment-rate/ Accessed on 8/2/2021.

[72] Cantillon, B. (2018). Social Security and Poverty Reduction in Rich Welfare States: Cracks in the Post War Policy Paradigm, Avenues for the Future. *Antwerpen: Herman Deleeck Centre for Social Policy*.

[73] Gammarano, R. (2019). Labour market access: a persistent challenge for youth around the world. *International Labour Organization, Geneva*.

[74] Youssef, A. H., Abonazel, M. R., & Ahmed, E. G. (2021). The performance of count panel data estimators: a simulation study and application to patents in Arab countries. *J. Math. Comput. Sci.*, *11*(6), 8173-8196.

[75] Jarque, C. M., & Bera, A. K. (1980). Efficient tests for normality, homoscedasticity and serial independence of regression residuals. *Economics letters*, *6*(3), 255-259.

[76] Kamel, A. R. & Alqarni, A.A. (2020). A New Characterization of Exponential Distribution through Minimum Chi-Squared Divergence Principle. *Journal of Advanced Research in Applied Mathematics and Statistics*, 5(1&2), 14-26.

[77] Studenmund, A. H. (2016). *Using econometrics a practical guide*. 7th Edition, Pearson.

[78] Abonazel, M., & Rabie, A. (2019). The impact of using robust estimations in regression models: An application on the Egyptian economy. *Journal of Advanced Research in Applied Mathematics and Statistics*, 4(2), 8-16.

[79] Abonazel, M., & Gad, A. A. E. (2020). Robust partial residuals estimation in semiparametric partially linear model. *Communications in Statistics-Simulation and Computation*, 49(5), 1223-1236.

[80] Youssef, A. H., Kamel, A.R. & Abonazel, M. R (2021). Robust SURE estimates of profitability in the Egyptian insurance market, Statistical journal of the IAOS, (Preprint), 1-13 (2021). DOI:10.3233/SJI-200734.

[81] Kamel, A.R. (2021). *Handling outliers in seemingly unrelated regression equations model*, MSc thesis, Faculty of graduate studies for statistical research (FGSSR), Cairo University, Egypt.

[82] Alkire, S., & Fang, Y. (2019). Dynamics of multidimensional poverty and uni-dimensional income poverty: An evidence of stability analysis from China. *Social Indicators Research*. https:// doi. org/ 10.1007/ s11205- 018- 1895-2.

[83] Couto, G., Pimentel, P., Batista, M. D. G., Sousa, Á., Carvalho, C., & Castanho, R. A. (2021). The Potential of Rural Tourism Development in the Azores Islands from the Perspective of Public Administration and Decision-Makers. *WSEAS Transactions on Environment and Development*, 17, 713-721.

[84] Iaroslav, P., Khmarska, I., Tkachenko, T., Koptieva, H., & Komandrovska, V. (2021). The Importance of Small and Medium Enterprises in the Economic Development of Eastern Europe. *WSEAS Transactions on Environment and Development*, 17, 898-910.

[85] Abonazel, M. R., & Shalaby, O. (2021) On Labor Productivity in OECD Countries: Panel Data Modeling. *WSEAS Transactions on Business and Economics*. vol. 18, pp. 1474-1488.

Conflicts of Interest:
The author declares that he has no conflicts of interest regarding the publication of this paper.