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The Nexus between Employment and Economic Growth: A Cross-Country Analysis

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Abstract: The main objective of this paper is to examine the relationship between employment and economic growth in developed and developing countries over the period of 1970–2019. As documented in the literature in the past, economic growth in most developing countries has been less job-generating than in developed countries, even though high economic growth is observed in most of the developing world, indicating jobless growth. Based on the Cobb–Douglas production function, we developed an employment demand model to find the employment elasticity with respect to economic growth using working hours and population as explanatory variables. The main findings of the present study reveal that the employment elasticities with respect to GDP are positive and significant in developing and developed countries. But in the developing countries, the employment elasticity is relatively very low (0.11 to 0.15) compared to the developed countries (0.43 to 0.48), which led to the conclusion that a possibility of jobless growth exists in these countries. The findings of the study imply that policymakers should focus more on employment-led growth policies instead of growth-led employment policies, especially in developing countries.

Keywords: employment; economic growth; jobless growth; developed and developing countries; employment demand model

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1. Introduction

The phenomenon of jobless growth has been extensively discussed and analyzed in many developed countries since the early 1990s. So, the word 'jobless growth' gained more interest in examining the relationship between employment and GDP growth after the 1991 global recession when employment recoveries in many countries, especially in the developed countries, were found to be slower than expected. As documented in Altman's [1] paper, jobless growth can be defined in two broad ways. First, "*jobless growth may refer to a situation whereby the overall economy is growing but the absolute employment level is stagnant or falling, rendering near zero or negative employment growth. Secondly, jobless growth may be used to describe a situation whereby the overall economy is growing while the rate of unemployment is rising*" (Haider [2] (pp. 1–2)).

So according to these definitions, if the overall economy is growing, on the one hand, the employment rate is stagnant or falling (low employment elasticity), or the unemployment rate is rising (Okun's Law), then the situation is called jobless growth. The present study discusses and analyzes the first situation (employment elasticity) in developed and developing countries. Estimating the employment elasticity with respect to GDP growth provides a shred of evidence on the presence or absence of jobless growth using the economic framework. So, whenever a country emerges from a recession, people's expectations are that employment will grow when the economy starts to expand—such

as in recent times the COVID-19 pandemic when will completely be over—but if the link between employment and economic growth is weak, then jobs do not grow immediately.

Improving material well-being and the quality of people's lives should be the key objective of any economic policy and it is generally thought that it can be achieved with economic growth which will automatically guarantee that income-generating employment opportunities will increase. This does not seem to be the case in most of the developing economies. Although developing countries' economies have experienced positive real economic growth over the last two decades, they appear to have been unable to create sufficient employment opportunities for its growing population. The result is the unemployment rate is still increasing or the employment rate is still decreasing. A possible reason for this jobless growth is that in many developing countries, growth-led macroeconomic policies often cause a shortfall in stimulating productive employment and a frequent need for policy redirection or target adjustments. So, it is a question of paramount importance that we should look at the relationship between employment and economic growth around the globe, and especially for developed and developing countries, to formulate an employment-oriented growth-oriented policy according to the links found in the analysis.

To the best of our knowledge, none of the studies found in the literature focused mainly on finding the employment elasticity to identify the jobless or job-generating growth. So, in light of the above, the main question for this piece of research is to estimate the employment elasticity with respect to GDP growth in developed and developing countries. In doing so, the present study also investigates whether employment and GDP are cointegrated in the long run. To explore this question, the study applied the Westerlund [3] cointegration test to the data on a sample of developed and developing countries. The present study used the estimated employment elasticity from an employment demand model, formulated as discussed below in Section 3, to evaluate whether the past GDP growth was jobless or job-generating in the full sample of developing countries and developed countries. So, if the link between employment and economic growth is found to be very weak, then this weak link is an indication of jobless growth. If the link between employment and economic growth is found to be moderate or strong, then it is most probably because the past GDP growth was job-generating instead of jobless.

The rest of the paper is organized as follows: Section 2 briefly reviewed past studies that help to identify the research gap, while Section 3 discusses the method of analysis, data, and methodology. Section 4 presents the estimated results and their interpretations while conclusions and policy implications are presented in the Section 5 of the paper.

2. Literature Review

The employment and GDP growth relationship has been extensively analyzed in developed and developing countries in the early 1990s through the employment elasticity, based on Solow [4] aggregate production function and Okun's law [5], and the U-shaped hypothesis [6]. But there is a paucity of studies in the literature that used the labour demand models as most of them used labour supply models, such as Gronau's model [7] and Becker's model [8], focusing on the determinants of labour supply. At the end of the global recession of 1991, investigating the relationship between employment and economic growth gained more interest when employment recoveries in many developed countries were found to be slower than those observed at the end of the last recessions.

After an empirical investigation of the sustainable relationship between employment and economic growth, the study explores a set of indicators that may determine the strength of this relationship in the context of developed and developing countries as many countries around the world are looking for sustainable development to achieve their desired employment targets. Decent work and economic growth is one of the sustainable development goals (SDGs) which highlights the importance of decent employment with sustainable development. While there are two fundamental elements of sustainable development, the first one is development and the other one is sustainability, as pointed out by Klarin [9]. However, Sharpely [10] argued that the terms "Development and Sustainability" could be in

juxtaposition and have counterproductive effects, and according to neoclassical economists (Lele [11]), there is no contradiction between both of them, while others suggest that there is a marriage between both of them and argued that they cannot be divorce from each other as there is no development without sustainability or vice versa.

Two types of studies were found from the earlier literature; one type of literature focused on cross-country analysis, while the other one focused on country-specific analysis. Earlier studies suggest that two strands of literature are found in the context of the employment and economic growth relationship. One strand of the literature suggested that employment and economic growth are positively related while the other suggests that employment and economic growth are negatively related. For example, Padalino and Vivarelli [12] found a positive relationship between employment and GDP for the G-7 countries and determine the jobless growth through estimating the employment elasticities. This study also found that the phenomenon of jobless growth was observed in most of the European countries while, on the other hand, North American economies experienced employment intensive growth. Similar results were found in G-7 countries [13,14] excluding Canada and Sweden. They found that employment elasticity was negative in the case of Italy and Sweden, indicating jobless growth instead of job-generating growth.

Few studies focused on the sustainable relationship between employment and GDP. For example, Dopke [15] estimated the short-run and long-run relationship between employment and economic growth for the 18 OECD countries over the period of 1970–1999 using cointegration and error correction techniques. He found mixed results for cointegration and, in a few countries, the impact of real GDP on employment was surprisingly low. Verme [16] noticed that, even though sustainable growth was observed since 1997 in the seven low-income countries that are included in the Commonwealth of Independent States (CIS), these countries experienced jobless growth. Sengenberger [17] investigated the phenomenon of jobless growth in South-East European (SEE) countries and found that employment elasticity was in the normal range (0.24) for Moldova, Greece, Bulgaria, Albania, and Croatia while negative employment elasticity (−0.19) was found for the overall sample period and to be small in magnitude (0.01) during 1999–2003 for Romania and Turkey. Before Sengenberger [17], some studies on Central and Eastern Europe (CEE) had also shown a low response of employment to economic growth [18,19]. They found that the CEE region exhibited a low and decreasing employment elasticity of economic growth after 1991. Marelli and Signorelli [20] found a negative employment elasticity for the European Union (EU) region. It is concluded from the above-developed countries' studies that, during the early 1990s, many countries around the world, especially countries from the OECD, suffered a profound recession. In most of them, economic recovery was linked to slow job growth (see, for example, OECD, (pp. 53–55, [21])), while Gorg [22] estimated the long-run employment elasticity for average OECD country to be around 0.8. This triggered many economists to examine whether economic recoveries in individual countries were jobless. But only a few studies are available for developing countries, and most studies are conducted on a single country. In this context, the present study reviewed both types of studies that are based on groups of countries and individual country analysis in the case of developing countries.

The study conducted by Fofana [23] in Cote d'Ivoire found a negative relationship between employment and output growth using a production function approach, while Islam [24,25] found a weak relationship between employment and GDP growth in developing countries, mostly from Asia and Africa, during the 1990s compared to the 1980s. However, in some countries, he found the phenomenon of jobless growth where positive output growth is linked with zero or negative employment growth, thus indicating jobless growth in its precise meaning. Haider [2] also estimated employment elasticity with respect to GDP in the case of Pakistan using the ordinary least square method over the time period from 1973 to 2008, and a very weak relationship between employment and GDP growth was found (0.26) while, during the periods of recovery, the magnitude of employment elasticity further declined to 0.12. Another study conducted in a developing country (Botswana) in

Africa, investigated the relationship between employment and GDP growth over the period of 1990 to 2008 and concluded that employment intensity was very weak, and this may lead to the possibility of jobless growth at the sector level [26]. Similar results were found in the study conducted by Leshoro [27], which showed a negative relationship between employment and GDP growth in the case of Botswana. However, he also found a very weak employment elasticity at the sectoral level. The study conducted by Crivelli et al. [28] on the different income levels and regions to find out the employment elasticities found that the employment elasticity for the low-income to middle-income countries varies between 0.02 and 0.10; for the upper-middle-income countries it is 0.18 while, for the high-income countries, the employment elasticity varies between 0.46 and 0.49. A report compiled by the UNCTAD [29] showed that, in most of the least developed countries, the employment elasticity declined over time between 2004 and 2008 compared to 1996–2000. Recently, a similar study conducted by the International Labour Organization (ILO [30]) found that the employment elasticity decreased over time between 2008 and 2018, which indicates that the GDP growth rate has had little impact on employment growth in recent years.

One of the more comprehensive cross-country studies conducted by Kapsos [31] for the International Labour Organization (ILO), using data on 139 countries, identified that global employment intensity of growth declined from 0.39 (1995–1999) to 0.30 (1999–2003). Japan and Western Europe showed a similar trend while Middle East North Africa (MENA) countries found the highest (0.74) employment elasticities in the world; however, a similar decline was observed during the same period. Another study conducted by Crivelli et al. [28] for IMF calculated the employment output elasticities for 167 countries and found employment elasticity in the range of 0 and 1, with the highest in the developed countries. On the other hand, Ball et al. [32] concluded that the unemployment rate is less responsive to GDP growth in developing countries compared to developed countries based on Okun's coefficient using data on 71 countries, and similar results were found by Slimane [33]. A study conducted by the African Development Bank [34] stated that the relationship between unemployment and growth varies in magnitude across countries and time. A similar study conducted by Ghazali and Mouelhi [35] for Tunisia at the aggregate level, found that employment elasticity declined from 0.61 (1980–1989) to 0.48 (2000–2012). A recent study conducted by Bhat et al. [36] found that the employment elasticity of GDP growth in Kazakhstan had declined at an aggregate level based on the rolling regression method using data from 1996 to 2019. In addition, they also identified that population growth was positively related to employment growth, and the coefficient of population growth was very low (0.14), which is in line with the theoretical expectation that as demand for labour increases, more employment is created but at lower wages. On the other hand, Haider [2] estimated the employment demand model using the Cobb–Douglas production function, including population as a control variable to disentangle the effect of GDP from population growth on employment which can affect employment in Pakistan where the high population growth phenomenon is well known and where the population variable has its own effect on employment rather than its effect through GDP per capita. He found a negative relationship between employment and population growth (−0.617) which asserts that the lower productivity growth and more employment-intensive growth were results of a more rapidly expanding labour supply in developing countries like Pakistan. The above short literature review deduced that most of the studies analyzed the employment elasticities in the developed countries, such as for G-7 countries, OECD countries, CEE, and many other developed regions after the 1990s recession, that provide some broad strokes towards an analytical and methodological framework for the analysis of sustainable development, as pointed out by Manioudis and Meramveliotakis [37]. On the other hand, a very limited number of studies were found on developing countries. Most of them analyze a single country, and just a few focus on groups of developed and developing countries. Only a few studies have estimated employment output elasticities using econometrics models and mostly based on the simple point or arc elasticity which are based on the change in employment due to change in the GDP and do not account for any control variables that

may affect the link between the two variables over time that leads to an omitted variable bias in these studies. To fill the identified research gap, the present study analyzes the employment elasticity with respect to GDP and includes the additional control variables, average working hours, capital, and population, because, without the control variables, the estimated elasticity may be overestimated.

3. Model, Method of Analysis and Data

3.1. Employment Demand Model

The previous section presents an overview of past studies that have investigated the relationship between employment and economic growth in developed and developing countries and analyzes the issue of jobless growth by estimating the employment elasticity with respect to GDP in these countries. The present study adopts the econometric model used by Haider [2] and many other studies (e.g., refs. [12,15,38–42]) to find out the employment elasticity with respect to GDP growth based on the Cobb–Douglas production function. A complete derivation of this model can be found in the research work conducted by Haider [2].

$$ln\mathrm{Y_{it}} = \alpha_0 + \alpha_1 \ln L_{it} + \alpha_2 \ln K_{it} + \varepsilon_{it} \quad (1)$$

After disaggregating the labour input (L) into the total number of persons employed (E) and the average working hours (H) which are viewed as a substitute, this indicates that there is a trade-off between employment and average hours worked in the case of many developed and developing countries. After adding the population as a control variable (e.g., refs. [2,39–42]) into Equation (1), it is possible to distinguish the effect of GDP from population growth on employment, which can affect employment in those countries where the high population growth phenomenon is well known and where the population variable has its own effect on employment rather than its effect through GDP per capita. This high population growth phenomenon asserts that the lower productivity growth and more employment-intensive growth are results of a more rapidly expanding labour supply in these countries. After adding the error term, we find the final employment demand model in Equation (2) that is estimated with a suitable econometric method.

$$ln\mathrm{E_{it}} = \beta_0 + \beta_1 \ln Y_{it} + +\beta_2 \ln H_{it} + \beta_3 \ln K_{it} + \beta_4 \ln Pop_{it} + \varepsilon_{it} \quad (2)$$

where 'i' represents cross-sections, which are 44 countries in this case, and t represents the time (1970–2019). The same model is estimated using the data on the full sample of 44 countries and the disaggregated data for the 18 developing and 26 developed countries. The variable E is the employment in total number of persons, Y is the Gross domestic product (GDP) in 2017 USD at constant prices, H is the average hours worked in a year, K is the capital at 2017 USD constant prices, Pop is the total population in each country, and ε is the error term. The logarithmic functional form of the model is used to estimate the elasticities directly. So, β_1, β_2, β_3 *and* β_4 will produce the employment elasticities with respect to the respective variables included in the above model Equation (2). The expected signs for these coefficients are β_1+, β_2-, $\beta_3 \pm$ *and* β_4+. As the sign of the β_3 depends on the countries under analysis, this is expected to be positive for the developed countries and negative for the developing countries.

3.2. Method of Analysis

Next, there are several estimators available in the literature to estimate the model stated above in Equation (2). To choose the appropriate method of analysis, the present study used a suitable econometrics methodology after discussing some econometrics issues (e.g., cross-section dependence, stationarity, heterogeneity, multicollinearity, etc.) that could be faced at the time of estimation. As there are 44 countries and 50 years of data, the present study uses the data in a panel setting to estimate the econometric model presented in Equation (2). Before estimating the econometric model, it is necessary to test all variables used in the model for Cross Section Dependence (CSD) that can arise due to many reasons,

such as spillover effects and common shocks like oil price shock in the 1970s or the global financial crisis in 2007; these were the common recessions that already happened in the world. These extreme events can affect every country around the world at the same time as all countries are connected to each other. So, neglecting the CSD leads to a serious identification problem. So, to test the cross-section dependence, we first employed the CD test proposed by Pesaran [43], which is employed on the individual variable series. For example, because we were interested in analyzing the pre-estimation of the CSD in the individual data series, e.g., investigating the cross-section dependence in the log of employment, we employed this test, and the results are represented below. But the CD test proposed by Pesaran [43] did not provide reliable estimates in the case of mixed results such as some series being diagnosed with CSD, and some not. To overcome this caveat, the proposed CSD test by Pesaran [44] was also applied that is based on the residuals of the estimated models compared to individuals' series. After applying the CSD tests, to test the stationarity of all the data series, the present study applied the first generation panel unit root tests ((e.g., refs. [45–48]) that are frequently used in panel studies) proposed by Maddala and Wu [45] that assumed cross-sectional error independence. All the first generation unit root tests produced inconsistent and sporous results in the presence of the CSD [49,50]. The present study also applied the second-generation unit root test proposed by Pesaran [51] to overcome the caveat identified in the first-generation unit test that is proposed by Maddala and Wu [45] and also for better comparison in the cases where any structural break was found in the data series.

After CSD and stationarity tests, to determine the long-run relationship between variables of the model stated above in Equation (2), and to accommodate the structural breaks in intercept and slope, a second-generation panel cointegration test proposed by Westerlund [3] is also applied in the present study. The panel cointegration test developed by Westerlund [3] also considers serially correlated and heteroskedastic errors along with individual specific time trends and also overcomes the caveats of the first generation cointegration tests. This test assumes that there is no cointegration under the null hypothesis and produces four different tests, out of which two are for the group's tests, and two are for the panel tests. These four test statistics are normally distributed. The two tests (Gt, Pt) are computed with the standard errors estimated in a standard way, while the other statistics (Ga, Pa) are based on Newey and West's [52] standard errors, adjusted for heteroscedasticity and autocorrelations, where G refers to a group level test, and P refers to the panel level test. The criteria to reject the null hypothesis of no cointegration is based on the low probability value, which should be less than 0.05.

After establishing the CSD, unit root, and cointegration, the present study estimates the employment elasticity to determine the jobless or job-generating growth in the economy. As we have different groups of countries, it is most likely that the slope will be heterogeneous, and to address the slope heterogeneity, the present study uses the slope heterogeneity test proposed by Pesaran and Yamagata [53], which is a standardized version of Swamy's [54] test for the slope heterogeneity. This test assumed that all the slope coefficients are identical across cross-sections, and the results are reported below.

In order to account for the CSD and the slope heterogeneity, which are expected in this type of study, the present study uses two more efficient estimators, the Common Correlated Effects Mean Group (CCEMG) and Augmented Mean Group (AMG) proposed by Pesaran [55] and Eberhardt and Teal [56], respectively, which produced more efficient results in the presence of CSD and slope heterogeneity. So, all other estimators, Fixed Effect, Random Effects, Mean Group autoregressive distributive lag, Pool Mean Group ARDL, and Dynamic Fixed Effects ARDL estimator proposed by Pesaran and Shin [57] produced inefficient and inconsistent results, as noted by Eberhardt and Bond [58]; the AMG and CCEMG performed similarly well in terms of bias or Root Mean Squared Error (RMSE) in panels with nonstationary variables (cointegrated or not) and multifactor error terms (cross-section dependence).

3.3. Data

All data are taken from the Penn world table (PWT10.01) on the main variables of our model. Employment is taken as the number of persons engaged (in millions), GDP is taken in real GDP at constant national prices (in millions 2017 USD), average hours worked is taken as average annual hours worked by persons engaged, capital stock is taken at constant 2017 national prices (in mil. 2017 USD) while the population is taken in millions for each country included in the sample and a complete list of all countries is provided in Table 1 while the descriptive statistics on all these variables are presented in Table 2.

Table 1. Countries List.

Developing Countries		**Developed Countries**			
1	Bangladesh	1	Greece	19	Denmark
2	Pakistan	2	Portugal	20	Netherlands
3	Myanmar	3	Japan	21	United States
4	India	4	Spain	22	Norway
5	Viet Nam	5	Italy	23	Switzerland
6	Philippines	6	New Zealand	24	Singapore
7	Indonesia	7	Republic of Korea	25	Luxembourg
8	Peru	8	France	26	Ireland
9	Sri Lanka	9	United Kingdom		
10	Colombia	10	Finland		
11	China	11	Belgium		
12	Brazil	12	China, Hong Kong SAR		
13	Thailand	13	Canada		
14	Mexico	14	Germany		
15	Argentina	15	Iceland		
16	Chile	16	Australia		
17	Malaysia	17	Sweden		
18	Turkey	18	Austria		

Table 2. Descriptive Statistics.

Variable	**Obs.**	**Mean**	**SD**	**Min**	**Max**	**Sk.**	**Kur.**
			Full Sample				
Employment	2200	41.9	111.5	0.1	799.3	4.9	28.0
GDP	2200	1171	2439	3.2	20,570	4.9	31.2
Average Hours	2200	1954	307.8	1381	2987	0.5	2.9
Capital	2200	5144	9207	6.2	81,730	4.0	23.4
Population	2200	94.5	227.5	0.2	1434.0	4.3	21.3
GDP per capita	2200	24,835	18,663	533	96,812	0.8	3.4
			Developing Countries				
Employment	900	79.9	164.2	2.7	799.3	3.0	11.4
GDP	900	1055	2254	15	20,600	5.5	39.1
Average Hours	900	2143	219	1609	2987	0.5	3.1
Capital	900	3858	7974	6.2	81,700	5.6	42.6
Population	900	182	330	10	1434	2.6	8.5
GDP per capita	900	8020	6034	533	26,991	0.9	2.9
			Developed Countries				
Employment	1300	15.6	26.4	0.1	158.3	3.2	14.0
GDP	1300	1251	2557	3.2	20,600	4.6	27.4
Average Hours	1300	1823	292	1381	2919	1.3	4.9
Capital	1300	6035	9877	25	69,100	3.4	17.2
Population	1300	33.9	55.7	0.2	329.1	3.2	14.0
GDP per capita	1300	36,476	15,261	2656	96,812	0.9	4.4

Notes: Obs. Refer to observations and full sample includes 44 countries, out of which 18 countries are developing countries and 26 developed countries, for the 50 years from 1970 to 2019. Sk. is a skewness and Kur. is Kurtosis. Some numbers are equal in developed and developing countries due to rounding to one decimal place.

To summarize the data in a significant mode, descriptive statistics is a useful way to present data. Table 2 reports the descriptive statistics for the full sample, the groups of developing (18 countries) and developed (26 countries) countries. The employment statistics show that, on average, 41.9 million people are employed in the full sample, and there is a large variation in the employment data, as the standard deviation is 111.5 for the full sample. A larger variation is found in the group of developing countries as the standard deviation is 164.2 (China and India included in this group) compared to 26.4 for the group of developed countries. A similar pattern exists for the population variables but in terms of GDP (billion USD), the maximum number for the GDP is equal in both groups of countries as China is in the developing countries and the USA in the developed countries list. A similar pattern exists for the average hours worked per person, capital, and per capita GDP in both groups of countries. There is a significant variation in the per capita GDP of developed countries (USD 2656 to USD 96,812) and developing countries (USD 533 to USD 26,991). The standard deviation of the GDP per capita of developed countries (USD 15,261) is higher than that in developing countries (USD 6034). There are 900 observations in developing countries, 1300 in developed countries, and a total of 2200 observations in the full sample.

4. Results and Discussion

Table 3 presents the correlation analysis, and it is found that a positive correlation exists between all the variables when using the full sample of all countries, except for the average hours, which is negatively correlated with the GDP.

Table 3. Correlation Analysis.

Variable	Employment	GDP	Average Hours	Capital	Population
		Full Sample			
Employment	1.0000				
GDP	0.7573 *	1.0000			
Average Hours	0.2381 *	−0.2136 *	1.0000		
Capital	0.6422 *	0.9644 *	−0.2855 *	1.0000	
Population	0.9910*	0.7159 *	0.2774 *	0.5935 *	1.0000
		Developing Countries			
Employment	1.0000				
GDP	0.7435 *	1.0000			
Average Hours	−0.0924 *	−0.469 *	1.0000		
Capital	0.6840 *	0.9785 *	−0.4354 *	1.0000	
Population	0.9834 *	0.7294 *	−0.1210 *	0.6606 *	1.0000
		Developed Countries			
Employment	1.0000				
GDP	0.9472 *	1.0000			
Average Hours	0.0095	−0.1173 *	1.0000		
Capital	0.9554 *	0.9824 *	−0.0950 *	1.0000	
Population	0.9921 *	0.9312 *	0.0306	0.9456 *	1.0000

Note: * refer to significance at 5%.

A similar pattern exists in the developed countries except for the average hour's variable, which is also positively correlated with employment but insignificantly. But in developing countries, average hours are also significant and negatively correlated with the population variable, but this is insignificant in terms of the developed countries. Among the independent variables, GDP is highly correlated with the capital in the full sample, both in developed and developing countries. Based on this result, it was concluded that the possibility of collinearity between GDP and capital cannot be rejected but in the regression results, multicollinearity is not an issue, as suggested by Kennedy [59], and cannot alter the interpretation of the estimated results. Correlation does not determine the causal

relationship as it is a simple statistical relationship; a regression analysis is necessary to infer the causal relationship.

Table 4 presented the CD test results proposed by Pesaran [43] which indicate that all series suffer from a cross-section dependence as all estimated *p*-values are less than 0.01. This result leads to the second-generation unit root test proposed by Pesaran [44] that is applied to the residuals estimated from the model instead of the individual series.

Table 4. Cross-sectional dependence test results.

Variable	Full Sample		Developing Countries		Developed Countries	
	Test Stat.	*p*-Value	Test Stat.	*p*-Value	Test Stat.	*p*-Value
lnE	194.38	0.000	85.48	0.000	107.86	0.000
lnY	210.31	0.000	84.87	0.000	124.18	0.000
lnH	80.35	0.000	5.26	0.000	85.51	0.000
lnK	212.15	0.000	84.9	0.000	125.65	0.000
lnPop	205.87	0.000	87.07	0.000	117.59	0.000

Note: No cross-sectional dependence is assumed in the null hypothesis proposed by Pesaran's [43] CD test statistics.

The present study also applied the Pesaran [44] CSD test, and the results are similar to those reported in the individual series (Table 5), especially residuals based on the common correlated effects mean group model. The low *p*-values (less than 0.01) are an indication of the rejection of the null hypothesis "cross-sectional independence" in all the estimated models with and without trend.

Table 5. Cross-sectional dependence test results.

Variable	CSD	*p*-Value	CCEM	*p*-Value
Full Sample (no trend)	1.523	0.128	3.511	0.000
Full Sample (trend)	2.773	0.006	6.806	0.000
Developing Countries (no trend)	−2.116	0.034	−2.822	0.005
Developing Countries (trend)	−2.759	0.006	−3.198	0.001
Developed Countries (no trend)	−0.962	0.336	−3.519	0.000
Developed Countries (trend)	−0.583	0.560	−3.202	0.001

Note: This test is based on Pesaran [44], and the null hypothesis is that the cross-sections are independent.

After determining the cross-sectional dependence based on the Pesaran tests [43,44], the first-generation unit root test did not produce more consistent results. Table 6 presented the second-generation panel unit root test results proposed by Pesaran [51] which indicates different results, such as in the full sample, employment is integrated of order one, i.e., I(1), and all other variables are I(0). But, in developing countries, average hours are also I(1) as well as employment. However, in the developed countries, the results are opposite, and the employment variable is I(0) instead of I(1), while GDP is I(1) instead of I(0). At the same time, the capital and population variables are trend stationary instead of their levels.

Table 6. Panel unit root test results.

Variable	Level		1st Difference		Order of Integration
	No Trend	Trend	No Trend	Trend	
			Full Sample		
lnE	−1.276	1.685	−17.08 *	−18.11 *	I(1)
lnY	−2.762 **	1.177	−19.816 *	−18.7 *	I(0)
lnH	−2.767 **	−0.497	−25.765 *	−25.108 *	I(0)
lnK	−4.452 *	−3.15 *	−2.246	−0.768	I(0)
lnPop	−13.122 *	−22.615 *	2.916	7.576	I(0)

Table 6. *Cont.*

Variable	Level		1st Difference		Order of Integration
	No Trend	Trend	No Trend	Trend	
Developing Countries					
lnE	−0.605	−0.141	−15.423 *	−14.732 *	I(1)
lnY	−3.231 *	−2.174	−13.573 *	−12.923 *	I(0)
lnH	−1.171	1.204	−15.971 *	−15.998 *	I(1)
lnK	−3.851 *	1.254	−1.876	−0.910	I(0)
lnPop	−3.892 *	−12.442*	3.146	3.600	I(0)
Developed Countries					
lnE	−2.782 *	0.851	−10.879 *	−10.422 *	I(0)
lnY	−1.501	−0.103	−17.206 *	−17.061 *	I(1)
lnH	−2.501 **	−0.124	−20.917 *	−20.208 *	I(0)
lnK	−1.272	−5.352 *	−4.080 *	−2.979 *	I(0) TS
lnPop	11.89	−8.741 *	3.892	4.355	I(0) TS

Notes: **, * indicate significant levels at 5, and 1 percent level of significance, respectively. Results are reported for one lag but a maximum of three lags are used for the Pesaran [51] test, while the null hypothesis assumed that the series is homogeneous and non-stationary. Where TS refers to trend stationary while the critical values are −2.25 and 2.76 for without and with trend, respectively, at a 5 percent level of significance.

As discussed above in Section 3, the second-generation unit root tests produced more consistent results in the presence of the cross-sectional dependence, but for better comparison, the present study also applied the first-generation unit root test proposed by Maddala and Wu [45] and the results are presented in Table 7, which indicate that all the series are nonstationary at their levels which is different from the results found in the Pesaran [51]. As there is cross-section dependence in all the countries under analysis, as shown above in Tables 4 and 5, we used the robust *p*-values instead of traditional ones. The results of Westerlund's [3] tests are shown in Table 8 which shows that series are cointegrated in the long run as the null hypothesis "series are not cointegrated" is rejected at a 5% level of significance for two parameters, Gt and Pt. Based on these results, it is expected that all the variables of the models are cointegrated in the long run in the full sample, developing countries, and also for developed countries. From the results, it is also concluded that the cointegrating relationship is robust to the potential level but not at the regime shifts, as the Pt is highly insignificant when used in the model with the trend in all the samples, which indicates that group means tests are more appropriate than panel tests for the data used in this study.

Table 7. First-generation unit root test results.

		Full Sample				Developing Countries				Developed Countries			
		Constant		Trend		Constant		Trend		Constant		Trend	
Variable	**lags**	**Zt-bar**	***p*-Value**	**Zt-bar**	***p*-Value**	**Zt-bar**	***p*-Value**	**Zt-bar**	***p*-Value**	**Zt-bar**	***p*-Value**	**Zt-bar**	***p*-Value**
lnemp	0	321.3	0.00	40.4	1.00	262.0	0.00	22.5	0.96	59.4	0.23	17.8	1.00
	1	119.3	0.02	110.1	0.06	78.1	0.00	22.2	0.97	41.2	0.86	87.9	0.00
	2	109.7	0.06	66.7	0.96	70.5	0.00	18.3	0.99	39.2	0.91	48.4	0.62
	3	95.7	0.27	80.3	0.71	63.1	0.00	16.3	1.00	32.5	0.98	64.1	0.12
lngdp	0	229.4	0.00	67.2	0.95	45.4	0.14	46.4	0.11	183.9	0.00	20.7	1.00
	1	103.5	0.12	89.9	0.42	19.1	0.99	52.5	0.04	84.4	0.00	37.4	0.94
	2	102.6	0.14	63.7	0.98	16.5	1.00	38.5	0.36	86.1	0.00	25.2	1.00
	3	55.4	1.00	60.5	0.99	10.2	1.00	29.8	0.76	45.3	0.73	30.7	0.99
lnavh	0	206.0	0.00	86.3	0.53	77.1	0.00	37.8	0.39	128.9	0.00	48.5	0.61
	1	148.2	0.00	90.6	0.41	53.0	0.03	36.6	0.44	95.2	0.00	53.9	0.40
	2	135.3	0.00	81.4	0.68	39.2	0.33	33.8	0.57	96.1	0.00	47.6	0.65
	3	124.0	0.01	102.5	0.14	38.6	0.35	48.5	0.08	85.4	0.00	54.0	0.40
lnk	0	1669.9	0.00	547.2	0.00	326.0	0.00	74.8	0.00	1343.9	0.00	472.4	0.00
	1	64.6	0.97	146.1	0.00	21.0	0.98	77.6	0.00	43.6	0.79	68.4	0.06
	2	136.3	0.00	115.4	0.03	31.6	0.68	56.3	0.02	104.7	0.00	59.1	0.23
	3	116.5	0.02	84.5	0.59	28.1	0.82	50.7	0.05	88.3	0.00	33.9	0.98
lnpop	0	1114.2	0.00	272.7	0.00	834.8	0.00	257.7	0.00	279.4	0.00	15.0	1.00
	1	186.8	0.00	670.1	0.00	126.7	0.00	81.2	0.00	60.0	0.21	588.8	0.00
	2	682.1	0.00	114.4	0.03	490.3	0.00	95.8	0.00	191.8	0.00	18.6	1.00
	3	207.4	0.00	278.2	0.00	171.5	0.00	51.3	0.05	36.0	0.96	226.9	0.00

Table 8. Westerlund cointegration test.

	Constant			Constant with Trend		
Statistic	**Value**	**Z-Value**	**Robust *p*-Value**	**Value**	**Z-Value**	**Robust *p*-Value**
			Full Sample			
Gt	**−2.851**	2.815	0.010	**−3.219**	3.437	0.000
Ga	−7.676	4.571	0.860	−10.757	1.218	0.170
Pt	**−11.410**	2.622	0.020	−5.844	3.020	0.270
Pa	−6.558	2.404	0.570	−8.020	0.719	0.350
			Developing Countries			
Gt	**−3.231**	2.683	0.010	**−3.325**	2.156	0.010
Ga	−4.970	9.510	1.000	−4.374	6.375	1.000
Pt	**−14.408**	3.023	0.000	−6.795	4.356	0.360
Pa	−4.932	6.901	1.000	−3.664	5.039	1.000
			Developed Countries			
Gt	**−3.109**	3.544	0.000	**−3.166**	1.696	0.030
Ga	−3.665	6.183	1.000	−4.178	7.778	1.000
Pt	**−14.93**	3.67	0.020	−12.837	0.562	0.390
Pa	−3.548	3.872	0.980	−4.798	5.384	1.000

The null hypothesis of the Westerlund's [3] test assumed "no cointegration" while Akaike's Information Criteria (AIC) is used to determine the optimal lags. The normal distribution is used to determine the one-sided *p*-values. Bold numbers indicate significance at a 5% level of significance.

Tables 9 and 10 present the slope heterogeneity tests results proposed by Pesaran and Yamagata [53] using employment and lag of employment, respectively, as dependent variables. The results of both specifications conclude that slopes are heterogeneous across cross-sections, which determined that AMG and CCEMG estimators are more appropriate estimators to estimate the model stated in Equation (2).

Table 9. Slope heterogeneity test—employment.

	Full Sample		**Developing Countries**		**Developed Countries**	
	Delta	***p*-Value**	**Delta**	***p*-Value**	**Delta**	***p*-Value**
	24.480	0.000	7.968	0.000	17.586	0.000
Adjusted	26.133	0.000	8.506	0.000	18.773	0.000

Note: The null hypothesis of Pesaran and Yamagata [53] tests assumed that slopes are homogeneous and all variables partialled out are constant.

Table 10. Slope heterogeneity test—lag of employment.

	Full Sample		**Developing Countries**		**Developed Countries**	
	Delta	***p***	**Delta**	***p***	**Delta**	***p***
	14.028	0.000	6.095	0.000	8.121	0.000
Adjusted	15.178	0.000	6.595	0.000	8.787	0.000

Note: The null hypothesis of Pesaran and Yamagata [53] tests assumed that slopes are homogeneous and all variables partialled out are constant.

The results of both estimators AMG and CCEMG are reported in Table 11 using without trend specification, while in Table 12 they are reported with trend specification. All the estimated coefficients from both estimators represent average across groups while the cross-section averaged regressors are marked by the suffix_ave when coefficients are estimated by the CCEMG estimator. The GDP coefficient has an expected sign which is the main variable of interest. The GDP and employment growth are positively related which asserts that GDP growth causes employment growth, but the magnitude is very low for the developing countries and only just 0.12, which is an indication of jobless growth in the case of developing countries.

Table 11. Estimation results of (AMGE) and (CCEMG) estimator (no trend specification).

	(1)	(2)	(3)	(4)	(5)	(6)
	Full Sample		Developing Countries		Developed Countries	
VARIABLES	**AMG**	**CCEMG**	**AMG**	**CCEMG**	**AMG**	**CCEMG**
lnY	0.309 ***	0.332 ***	0.119 *	0.128 ***	0.437 ***	0.465 ***
	(0.0481)	(0.0484)	(0.0632)	(0.0485)	(0.0496)	(0.0478)
lnH	−0.200 *	−0.0537	−0.606 ***	−0.634 ***	0.00929	−0.000950
	(0.119)	(0.0958)	(0.213)	(0.213)	(0.139)	(0.0862)
lnK	−0.108 **	−0.0394	−0.0268	−0.00780	−0.0469	0.136
	(0.0516)	(0.0576)	(0.0426)	(0.0491)	(0.0926)	(0.118)
lnPop	1.032 ***	0.803 ***	0.903 ***	−0.00642	0.666 **	0.155
	(0.162)	(0.151)	(0.194)	(0.490)	(0.264)	(0.276)
lnE_avg		0.764 ***		1.118 ***		0.927 ***
		(0.166)		(0.263)		(0.118)
lnY_avg		−0.346 ***		−0.162 **		−0.518 ***
		(0.0860)		(0.0776)		(0.115)
lnH_avg		−0.0297		0.0360		−0.229
		(0.338)		(0.317)		(0.341)
lnK_avg		0.0821		0.0634		0.0262
		(0.160)		(0.0908)		(0.186)
lnPop_avg		−0.657		−0.0968		−0.514
		(0.607)		(0.621)		(0.431)
c_d_p	0.638 ***		0.830 ***		0.555 ***	
	(0.208)		(0.277)		(0.213)	
Constant	−1.365	−0.860	2.872	2.545	−3.668 ***	0.597
	(0.909)	(3.042)	(1.901)	(4.932)	(1.329)	(3.500)
Observations	2200	2200	900	900	1300	1300
Number of cross-sections	44	44	18	18	26	26

Note: ***, **, * indicate significant levels at 1, 5, and 10 percent level of significance, respectively, while standard errors are presented in parentheses and c_d_p refers to the common dynamic process in the AMG estimator.

This result is in line with the study of Crivelli et al. [28], who found the employment elasticity for the low-income to middle-income countries to be around 0.02 to 0.10; similar results were found by Haider [2], 0.12 for Pakistan in recovery periods, and 0.18 for the upper-middle-income countries (as pointed out by references [19,20] for Indonesia), indicating a low elasticity of employment which shows economic growth in developing countries largely focused on projects that did not generate employment over the period and led to the conclusion that most of the developing countries face jobless growth (as pointed out by Haider [2]).

A moderate employment elasticity was found (0.437) for the developed countries and, as pointed out by reference [38], the employment elasticity (0.46 to 0.49) for high-income countries was similar to the results found by Wolnicki et al. [40] for the European countries. The model results are robust in terms of employment elasticity with respect to GDP (as the functional form of the model is logarithmic, the estimated coefficients provide the elasticities), but there is a large difference in the magnitudes of the employment elasticity between developed and developing countries. In the full sample, the GDP coefficient is 0.309, which is positive and highly significant; it indicates that, in response to a 1 percent increase in the GDP, employment will increase by 0.309 percent when using the AMG estimator 0.332 percent when using the CCEMG estimator. The capital coefficient is negative and significant only in the AMG estimator in the full sample while it is insignificant in all other specifications. The average hours worked per person has a significant negative effect on employment in the AMG estimator in the case of developing countries and full sample countries. A 1 percentage point decrease in the average working hours will increase employment by 0.606 percentage points in the developing countries, while increasing by 0.20 percentage points in the full sample countries, which is expected and is in line with

the theory as discussed by Caballero and Hammour [60]. They also found that, to generate employment opportunities in France, the average weekly working hours were reduced to 40 between 1960 and late 1970s and further decreased to 39 h in 1981. In the present study, it is also found that there is a trade-off between employment and working hours (negative elasticity with respect to working hours), and both employment and working hours are viewed as substitutes for each other in the case of developing countries and the full sample countries. Similar results were found by Erbas and Sayers [61] and they also indicate that to increase employment in G-7, policymakers must adhere to the hour reduction and employment subsidy policy to increase employment opportunities in these countries during the period of 1970–2000. But the average hours worked is positively correlated but insignificant in the case of developed countries in both estimators. This indicates that the average hours worked in the developing countries have dominant effects, as shown in the full sample. So, these results indicate that the developed countries have already reduced the number of working hours to boost employment in the past. But in the case of developing countries, average hours are much higher (2143 average working hours) than the developed countries (1823 average working hours) which significantly affects employment creation. If developing countries want to increase employment opportunities in the country, they should adopt the policy of reduced working hours as adopted by the developed countries in the past as pointed out by Erbas and Sayers [61].

Table 12. Estimation results of (AMGE) and (CCEMG) estimator (trend specification).

	(1)	(2)	(3)	(4)	(5)	(6)
	Full Sample		Developing Countries		Developed Countries	
VARIABLES	**AMG**	**CCEMG**	**AMG**	**CCEMG**	**AMG**	**CCEMG**
lnY	0.315 ***	0.331 ***	0.125 *	0.150 ***	0.437 ***	0.483 ***
	(0.0455)	(0.0449)	(0.0648)	(0.0510)	(0.0473)	(0.0453)
lnH	−0.180 *	0.0229	−0.409 ***	−0.650 ***	−0.0492	0.0510
	(0.108)	(0.0804)	(0.111)	(0.222)	(0.136)	(0.0676)
lnK	−0.0783	−0.00575	−0.0609	0.0340	0.0233	0.314 ***
	(0.0547)	(0.0564)	(0.0493)	(0.0695)	(0.0883)	(0.110)
lnPop	0.917 ***	0.735 ***	0.667 ***	−0.257	0.881 ***	−0.113
	(0.151)	(0.134)	(0.239)	(0.582)	(0.166)	(0.272)
trend	−0.00214	0.00385	0.000506	0.00963	−0.00411 **	0.00110
	(0.00212)	(0.00333)	(0.00441)	(0.00794)	(0.00205)	(0.00496)
lnE_avg		0.764 ***		1.039 ***		0.860 ***
		(0.149)		(0.288)		(0.129)
lnY_avg		−0.371 ***		−0.139		−0.490 ***
		(0.0803)		(0.0939)		(0.105)
lnH_avg		0.113		0.355		0.0740
		(0.330)		(0.339)		(0.423)
lnK_avg		0.0251		−0.0461		−0.204
		(0.141)		(0.104)		(0.185)
lnPop_avg		−1.006		0.202		−0.183
		(0.751)		(0.831)		(0.589)
c_d_p	0.720 ***		1.027 ***		0.641 ***	
	(0.209)		(0.271)		(0.200)	
Constant	−2.055 **	−1.720	4.398 **	3.507	−4.118 ***	−1.179
	(0.996)	(2.316)	(2.053)	(4.449)	(1.586)	(3.849)
Observations	2200	2200	900	900	1300	1300
Number of cross-section	44	44	18	18	26	26

Note: Note: ***, **, * indicate significant levels at 1, 5, and 10 percent level of significance, respectively, while standard errors are presented in parentheses and c_d_p refers to the common dynamic process in the AMG estimator.

In the case of developing countries, average hours worked have a significant negative effect, but in the case of developed countries, the average hours worked have a positive but insignificant effect. Similar results were found by Werner [62] in the case of European

countries, but not in the US where employment and hours move in the same direction. Meanwhile, for capital, similar results are found (negative and significant) when estimating both estimators (AMG and the CCEMG) for the full sample countries, which is expected and in accordance with the theory that as long as the countries move towards capital-intensive technologies, the employment shifts away from the manufacturing to the labour absorbing sectors. This sectoral reallocation is one of the main reasons for the jobless growth found in some countries (Aaronson et al. [63]). The coefficient of capital becomes insignificant when estimating the employment model for the developed and developing countries separately.

The population has a significant positive effect on employment which is a striking result in the case of the developing countries and contrasts with Haider's [2] findings in the case of Pakistan but is still in line with the theory which suggests that a rapid growth in population results in a rapidly growing young population entering the labour force, which is true in the case of the developed countries as indicated by [40,42]. Similar results were found by Crivelli et al. [28] which reveals that the urban population has a positive effect on the employment in the developed and developing countries. And the variable (c_d_p) refers to the common dynamic process in the AMG estimator, which is positive and significant, while the magnitude is less than one in all the sample specifications indicating that the coefficients are stable over time. The results are also estimated with the trend specification which is presented in Table 12.

Table 12 shows the trend specification results, which are similar to the results from the specifications without the trend, and different in terms of the magnitude in the employment elasticity with respect to our main variable of interest, GDP, which is fractionally larger in the trend specification. The trend term is insignificant in all the estimated models except for the AMG estimator for the developed countries. The other difference when using the trend specification is that the capital coefficient is insignificant in all the models except for the CCEMG estimator for the developed countries, which is positive and significant at a 1% level of significance. The magnitude of the capital coefficient is 0.314 which asserts that a 1 percent increase in capital will increase employment by 0.314 percent which leads to the conclusion that the developed countries are in the third stage of development (post-industrialization). So, this means that labour and capital are complementary in terms of magnitude. This reflects the technical progress that has been employment-intensive in developed countries but not in developing countries. As pointed out by Robert [64], the impact of capital formation on employment can be rather negligible, and he also found that investment has a negligible effect on employment creation in the long run for many developing countries. He also indicates that, for policy purposes, job creation is predominantly an issue of encouraging more employment whatever investment exists at that time.

5. Conclusions and Policy Implications

One of the main findings of the present study is that the employment elasticities with respect to GDP are positive and significant for the full sample of both developing and developed countries. The magnitude of the employment elasticity for the developing countries is very low (0.11 to 0.15 compared to the developed countries' 0.43 to 0.48), which leads us to conclude that a possibility of jobless growth exists in these countries. This asserts that the past growth in the developing countries may be viewed as jobless, and the GDP growth did not fully contribute to generating new jobs in these countries. But for the developed countries, a moderate employment elasticity is found, which asserts that there is relatively less chance that these countries faced the jobless growth phenomenon in the period of the present study. The employment elasticity, which is in the range of 0.30 to 0.33, is also lower for the full sample compared to the developed countries. The average working hours have negative and significant effects on employment in developing countries and no effects in the case of developed countries. The main result found in terms of capital elasticity, which is positive and significant for the developed countries, indicates that technical progress has been employment-intensive in the developed countries but not

in the developing countries. The main striking result found in the case of population in developing countries shows that population has a significant positive effect on employment which is not in line with the theory. The theory suggests that a rapid growth in population leads to a rapid growth in labour force as more young people enter into the labour market which can lead to more employment-intensive and lower productivity growth, which is true in the case of developed countries but not for developing countries. So, the present study's results should be interpreted with caution. It may not be possible to generalize them for the rest of the countries, especially for the African continent, as no countries were taken from Africa due to the unavailability of employment and average working hours data that are not available for these countries over the study period of analysis.

The policy implications of the present analysis, especially for developing countries, are that the policymakers in those countries should focus on the employment-led growth policy instead of the growth-led employment in addressing the unemployment problem. This is in line with the results concluded in many developing Sub-Saharan African countries by Adegboye [65], where growth-led policies often present a shortfall in stimulating productive employment; this leads us to conclude that developing countries should focus on sustainable employment and careers for human well-being in the new norms instead of sustainable growth. This will help to generate employment opportunities that are sustainable and productive which will promote sustainable growth in developing countries. The policies of reduced working hours, similar to those adopted by some developed countries, may be more effective in generating employment opportunities with sustainable growth but those policies will help in developed countries like France, etc., that have already achieved the industrial revolution. This, again, indicates that policymakers in developing countries should target the generation of sustainable employment, the ultimate objective of which is to improve the material well-being and quality of human lives in new norms that will automatically lead to sustainable growth, instead of targeting the growth that will harm employment in the rapid advancements in digital technologies and artificial intelligence.

The present study suffers from some limitations that provide some directions for future research. The analysis conducted in the present study is based on 44 countries for which data are available from 1970 in the Penn World Table. To the best of our knowledge, we used the most recent available data from the respective sources. The analysis can be extended to different regions or continents if more data are available. The present study does not control the other determinants of employment, such as structural changes in employment which are viewed as one of the main reasons for jobless growth in the literature. However, notwithstanding the present study suffering some limitations, the quantitative analysis conducted in the present study provides some useful information for policymakers on the role of sustainable growth in improving the material well-being and standard of people's lives in developing countries.

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