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The Role of Economic Uncertainty, Economic Growth, and Globalization in Affecting Unemployment in E-7 Countries

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Abstract

Employment creation is one of the sustainable development goals' top priorities to be achieved by 2030, and economic uncertainty poses a major threat to this goal. Using data from 1990 to 2017, our study examines the impact of economic uncertainty (EUI), economic growth (EG), and globalization on unemployment in E7 countries. Our study employs the second generation panel tests and the Cross-Section Augmented Autoregressive Distributed lag CS-ARDL and the Pooled Mean Group (PMG) estimation techniques. The findings of the CS-ARDL and PMG indicate that a decrease in EUI reduces unemployment in the long-run. In addition to decreasing unemployment, economic growth exhibits the Okun's law. The PMG results indicate that globalization has a positive and significant relationship with unemployment, while the CS-ARDL results indicate that globalization has a negative but insignificant effect on unemployment. The Juodis, Karavias, and Sarafidis (JKS) Granger-causality test demonstrates a unidirectional causal effect from EUI, EG, and globalization to unemployment. The policy implication is that the government and policymakers should adopt measures to reduce economic uncertainty. Moreover, unemployment, SDGs, and the Paris Agreement are interlinked, with the SDGs offering sustainable development that involves decent work and economic growth (SDG-8), whereas the Paris Agreement addresses climate change, which can affect employment and economic growth.

Keywords: Economic uncertainty, Economic growth, Globalization, Unemployment, CS-ARDL & PMG, E7 economies

JEL: E30, E60, O40, J60, F10

1. Introduction

Most contemporary economies face many challenges, including unemployment (UE), industrial transformations, economic development, and others, with UE being one of the most severe and pervasive,

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particularly for developing economies. Therefore, the forecasting of UE is a crucial task for researchers, policymakers, and other forecasters of economic issues (Mulero & García-Hiernaux, 2021; Semra, 2020). UE exacerbates both social and economic problems (Spisakova & Barbora, 2023) and therefore, remains the biggest problem that every country must address (Iftitah & Kusumawardani, 2022). In addition, achieving sustainable EG along with stable and lower UE rates is one of the major goals of macroeconomic policy in all nations. Lower UE can contribute to the development of a sustainable social and economic framework (Simionescu, Streimikiene, & Strielkowski, 2020). For this reason, the UE rate is a key indicator for the Sustainable Development Goals, as it is directly targeted in SDG-8 to promote inclusive and sustained economic growth, and full employment (Davidescu, Apostu, & Stoica, 2021). UE continues to be of great concern in some E7 economies. In 2024, Brazil's UE rate was 6.6%, China's was 5.1%, India's, was 4.9%, Indonesia's was 4.91%, Mexico's was 2.6%, it was 2.3% in Russia, and 8.7% in Turkey (WDI, 2024). Thus, the current UE rates of economies have persistently persuaded researchers to investigate the contemporary determinants of UE.

Among the several factors contributing to the rise in UE, economic uncertainty (i.e., economic risk), which refers to instability in the economy, is outstanding. Economic uncertainty is the potential for adverse fluctuations in economic conditions that can inversely affect economies, industries, and businesses (Hye, Ul-Haq, Visas, & Rehan, 2023). Numerous factors including inflation, recessions, political instability, and fluctuations in the exchange rate, natural disasters, regulatory changes, and trade disputes, can contribute to economic uncertainty. As these factors contribute to economic instability, economic uncertainty increases, causing a rise in UE. The economic uncertainty index (EUI) is comprised of GDP per capita, real GDP growth, annual inflation rate, budget balance as a % of GDP, current account as a % of GDP, and the risk points which are assigned based on a scale (for more detail see (Howell, 2011)). The EUI scale ranges from 0-50, with 0 indicating higher risk and 50, lower risk. Overall, economic uncertainty affects individuals, investors, governments, and businesses, and plays an important role in investment decision-making, financial planning, and policy formulation (Hye et al., 2023).

Reducing UE and simultaneously achieving high growth rate is a top priority of every nation, particularly the developing nations. EG is one of the fundamental factors that influence UE rate. The relationship between UE and EG as described by Okun’s law, reveals a negative association between UE and EG. While UE decrease by 1%, GDP (real) must increase by 2% (Porras-Arena & Martín-Román, 2023). Okun’s law illustrates the continuous rise in labor quantity and productivity, which emphasizes the production of more goods and services which increases employment opportunities and reduces the UE rate. Numerous studies have shown that as EG rises, UE reduces (Amor, 2023; Gómez & Irewole, 2023; Danlami Mujitapha, Othman, Hewage, Pyeman, & Samah, 2023).

The impact of globalization (GLB) on employment opportunities especially in developing economies, has been widely discussed in recent years (Hye et al., 2023). Whether the effect of GLB on UE rate is positive or not, is still a controversial debate.

In emerging economies, GLB can ease the integration of the economic development into the global markets and institutions, promote cultural exchange and diffusion, establish good governance, increases cross-border capital flows, and serves as a source of technology, information, and expertise (Bacchetta & Bustamante, 2009). The viewpoint is that the major indicators of GLB such as trade liberalization, technology transfer, and FDI enhance EG, consequently creating new opportunities for employment. GLB has the potential to promote EG and development (Daly, Ullah, Rauf, & Khan, 2017). However, many existing studies have demonstrated that such effect is not always consistent with actual economic conditions. FDI and trade liberalization can also inversely influence employment, particularly in labor-intensive production based countries. This means a contradictory relationship between GLB and UE (MİKE, 2020). This study focuses on the E-7 economies because E-7 industrialized countries consistently sustain their economies through the expansion of industries and trade (Habiba & Xinbang, 2023). Thus, it is necessary to investigate the impact of E-7 economies fast GLB process on UE, as it is useful for future policy making.

This paper contributes in multiple ways to existing research on E-7 countries: First, our study examines the influence of economic uncertainty, EG, and GLB on UE using data from 1990 to 2017. Second, to the best of our knowledge, this study is the first to examine the relationship between economic uncertainty and UE in E-7 economies. No existing study has revealed the effect of economic uncertainty on UE using a single or aggregate indicator. Thirdly, this study employs the EUI measure, comprised of GDP per capita, real GDP growth, annual inflation rate, budget balance as a percentage of GDP, and current account as a percentage of GDP, with scale-based uncertainty points assigned. Fourth, to have a better picture of the link between globalization and UE, his study uses a comprehensive measure of globalization (i.e., overall globalization) as compared to the previously used measure. The empirical findings of our study will aid policymakers in lowering the UE rate of nations.

The rest of this study is structured as: section 2-6 discuss the theoretical framework, literature review, data, method, econometric techniques, results description, and study conclusion and policy implications.

2. Theoretical Framework

2.1 Economic uncertainty and unemployment

The overall objective of economic uncertainty rating is to provide a measure for assessing a nation's current economic weaknesses and strengths. In normal terms, where the economic strengths outweigh economic weaknesses, economic uncertainty is lower; conversely, where economic weaknesses outweigh economic strengths, economic uncertainty is higher. These weaknesses and strengths are calculated by assigning the uncertainty points to the pre-set factor group, known as components of economic uncertainty. The minimum number of points that can be assigned to each component is zero, whereas the maximum number of points that can be assigned to a component based on a fixed weight, is specified in the overall economic uncertainty calculation. Lower uncertainty point (total) indicates that economic uncertainty is higher, and higher uncertainty point (total) indicates lower economic uncertainty. The components of the economic uncertainty index are the GDP per capita, growth of real GDP, annual inflation rate, balance budget as a % of GDP, current account as a % of GDP (Howell, 2011). Any change in these components will influence economic uncertainty, and lower or higher economic uncertainty will then determine the other factors, such as UE in our study. Figure 1 below shows the components' influence on economic uncertainty, as well as the effect of economic uncertainty on UE. A decrease in economic uncertainty indicates economic stability and a boost in the economic activities that necessitates more factors of production, including labor. In this way, as labor demand increases UE decreases and vice versa.

2.2 Economic growth and unemployment

In his seminal work on the relationship between unemployment and economic growth, Okun (1962) states that a 1% rise in the EG rate above the trend growth rate would lead to a 0.3% decline in UE. Reversing the relationship, 1% increase in UE will result in approximately a 3% decline in GDP. This association suggests that the GDP growth rate must be equal to its potential growth to maintain a constant UE rate. In order to reduce UE, the GDP growth rate must be higher than the potential growth rate of output (Tatom, 1978). The economic theory that illustrates the EG and UE relationship is Okun's law. As the relationship between UE and output growth was based on technology, law, social customs, demographics, and preferences, Okun's coefficient could change over time. Two methods for measuring Okun's coefficient were recommended; Okun's law can be shown in terms of gap method:

$$u_t - u_t^* = b(y_t - y_t^*) \quad (1)$$

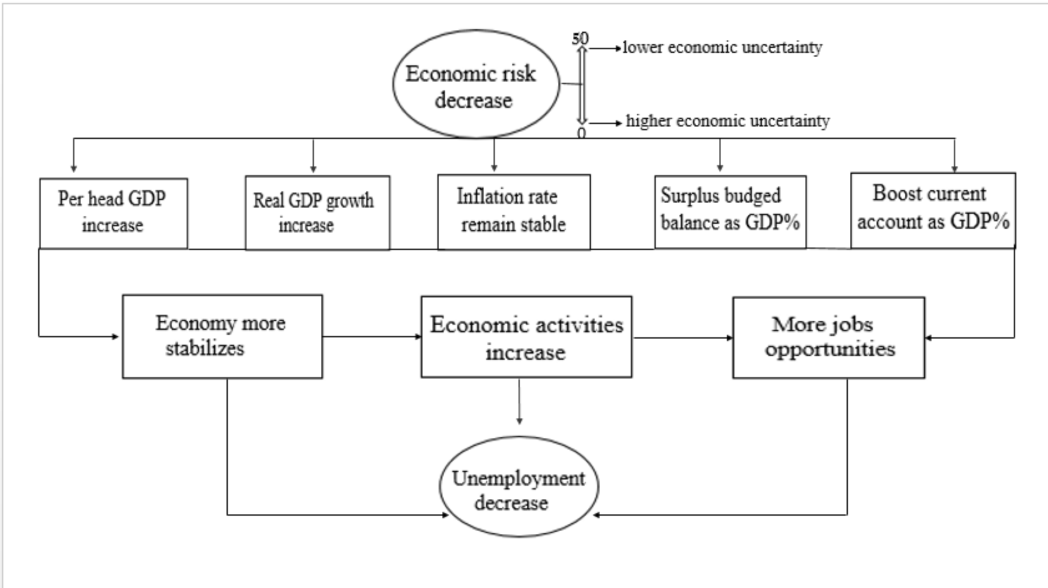

Figure 1. Flow Chart of the Economic Uncertainty and Unemployment
Source: Created by the author's

Where,

y_t = real output product (GDP)

y_t^* = potential output

u_t = natural level of UE

u_t^* = potential UE

b = Okun's coefficient

This indicates that the UE change is equal to a negative parameter (i.e. the sensitivity of UE to the output), multiplied by the change in output growth rate. The negative parameter illustrates that when output growth is more than the normal rate of growth, this will reduce UE. On the other hand, when growth of output is less than the normal rate of growth, this will increase UE.

The second way of expressing this law is by using Okun's first difference method which captures the sensitivity of output - UE variations as given below:

$$\Delta u = \alpha - b(\Delta y/y) \quad (2)$$

Then, $b\Delta u_t = \alpha - (\Delta y/y)$ (3)

The difference version is well-structured and represents the fluctuation in the rate of UE caused by the growth rate of real GDP. This focuses on the notion that increasing output requires more input, reducing UE. In the form of linear regression, the difference version is expressed as:

$$u_t - u_{t-1} = \alpha + \beta(y_t - y_{t-1}) + \varepsilon_t \quad (4)$$

Where,

u_t = UE rate in time t

y_t = real GDP level

ε_t = error term, which fulfil the general properties.

β = Okun's coefficient and show to have a negative sign

Thus, β estimates yields negative coefficient between UE and EG.

2.3 Globalization and Unemployment

GLB is known for its complex process with sweeping impacts. In this regard, studies have demonstrated the numerous dimensions of GLB since the 1970s (Robinson, 2007), including the social, economic, and political spheres (overall GLB or KOF). Concerning economic GLB, it is comprised of three crucial indicators namely international capital flows, technology transfer, and goods & services mobility across borders (Shangquan, 2000). These factors influence the labor market directly or indirectly, particularly in developing economies. The optimistic perspective posits that by encouraging investment and production in the appropriate sectors (agriculture and textiles) of developing economies, labor demand will be stimulated. This will generate new employment opportunities and reduce UE. Conversely, the negative perspective demonstrates that certain strategies (such as privatization and the elimination of trade barriers) adopted by developing economies to gain competitive advantage may increase UE rates. The increase in UE can be attributed to the inability of domestic producers to compete with foreign counterparts, who import technology-based goods; this leads to UE (MİKE, 2020; Rama, 2003).

2.4 Theoretical links

The following are the theoretical links on the relationship between economic uncertainty, economic growth, globalization, and unemployment.

- Economic uncertainty decrease → increase in GDP per capita → real GDP growth increase → annual inflation rate remains stable → increase in budget balance as a GDP% → boost current account as a GDP% → UE decrease.

- Economic uncertainty increase → decrease in GDP per capita → real GDP growth decrease → annual inflation rate not remains stable → decrease in budget balance as a GDP% → fall in current account as a GDP% → UE increase.
- EG → more economic activities → more production → more factor demand → more demand for workers → employment opportunities increase → UE decrease.
- UE decrease → more people hold jobs → more income → profit increase → more investment → economic activities increase → boost EG.
- GLB → international capital flows → technology transfer → mobility of G&S across borders → investment increase → production increase → labor demand increase → UE reduction.
- GLB → trade liberalization/privatization → domestic firms lose out to foreign competitors → increased imports of technology-based goods → higher UE.

3. Literature Review

3.1 Economic uncertainty and unemployment

Degirmenci and Aydin (2023) investigated the validity of the double dividend hypothesis for numerous African economies for the period 1994 to 2017. Using the Panel co-integration they found that environmental degradation and unemployment increase with the environmental taxes. Hye et al. (2023) examined the influence of eco-innovation, economic uncertainty, renewable energy, EG, and GLB on CO_2 emissions in E-7 economies using data from 1995 to 2018. Economic uncertainty, eco-innovation, and renewable energy are factors that contribute to the reduction in CO_2 emissions, whereas GDP and GLB were found to be the major determinants of CO_2 emission growth, as indicated by the FGLS and PCSE results. An inverted N-shaped relationship was also observed between eco-innovation and CO_2 emissions. Ahmad, Ahmed, Khan, and Alvarado (2023) examined the role of uncertainty, EG, energy transition, and natural resources in reducing CO_2 emissions. Using panel data of E-7 economies from 1990-2018, the study found that country uncertainty (including political and financial uncertainty) and green energy reduce CO_2 emissions, whereas rent from natural resources increases CO_2 emissions. E. Z. Wang and Lee (2023) explored the relationship between country uncertainty, FDI, and income inequality for 60 countries from 1998 to 2014. The findings revealed that FDI reduces income inequality under conditions of low economic, financial, and political uncertainty. On the contrary, FDI exacerbates income inequality under conditions of high economic, financial, and political uncertainty. Ayad, Sari-Hassoun, Usman, and Ahmad (2023) analyzed the relationship between economic uncertainty, energy consumption, EG, and environmental degradation for the Middle East and North Africa (MENA) economies from 1970 to 2020. The results of the NARDL threshold approach showed that the economic uncertainty index, population, and energy consumption accelerate environmental degradation. Iqbal, Chand, and Ul Haq (2023) investigated the impact of economic policy uncertainty, clean energy, and urbanization on environmental quality. The results of the ARDL technique revealed that economic policy uncertainty worsens environmental quality, while urbanization and clear energy helped to improve environmental quality. Ning, Lin Guo, and Chang (2022) examined the empirical link between economic uncertainty, green financing, political uncertainty, and CO_2 emissions in China for the period 1990-2020. The result showed that economic uncertainty and green finance influence CO_2 in both the long and short run and no association exists among political uncertainty, GDP, and CO_2. Additionally, they demonstrated that the bidirectional causal relationship between green finance and CO_2 and economic uncertainty and CO_2 was temporary. Vitenu-Sackey and Acheampong (2022) investigated the link between economic policy uncertainty, R&D, technological innovation, energy intensity and CO_2 emissions for the period 2005 to 2018. Utilizing the 2SLS, GMM, and FGLS, they found that the impact of economic policy uncertainty on CO_2 is heterogeneous, and that EG is positively associated with CO_2, while urbanization, renewable energy, FDI, and R&D have varying effects on CO_2. Syed, Bhowmik, Adedoyin, Alola, and Khalid (2022) examined the nexus between geopolitical uncertainty, economic policy uncertainty, renewable and non-renewable energy, urbanization, per capita GDP and CO_2 for BRICST countries. Geopolitical uncertainty increase CO_2 and economic policy uncertainty adversely influences CO_2, while others have a heterogeneous effect. Gokmenoglu, Kirikkaleli, and Eren (2019) explored the causal link between economic uncertainty and FDI in Turkey. This paper found that FDI significantly changed with economic uncertainty. Benegal (2018) examined the impact of economic uncertainty and UE on public opinion regarding anthropogenic climate change. The findings demonstrate that both Republicans and Democrats are more likely to deny the existence of climate change when confronted with increasing economic uncertainty.

3.2 Economic growth and unemployment

Degirmenci, Acikgoz, Guney, and Aydin (2024) examined the impact of economic growth, renewable energy consumption, and environmental policy stringency on environmental sustainability in eight high income economies, using data for the period 1990-2020. The results revealed that economic growth damages environmental quality in each of these economies except Sweden. In UK, renewable energy consumption improves environmental quality but damages environmental quality in China. Environmental policy stringency betters the environmental quality in South Korea and Denmark. Khan, Ghauri, Siddiqui, and Iqbal (2023) investigated the causality between UE and economic development in Pakistan from 1985 to 2019 using the ARDL method. The study used different macroeconomic factors including government expenditure, FDI, private investment, and exports. The findings showed that exports and FDI contributed to the decrease in UE, while private investment inversely influenced UE, and government expenditure had no effect on UE. Al Freijat and Hammouri (2022) explored the EG impact on UE in Jordan using the span 1980-2022. The ARDL estimates demonstrated the long-run cointegration link among variables. It means that an increase in EG helps to reduce UE, validating Okun's law. Alrakhman and Susetyo (2022) investigated the link between EG, UE, and inequality in the Sumatera Island. The panel dataset consisted of 154 regencies and cities of Indonesia's Sumatera Island for the period 2011-2020. Utilizing the Simultaneous equations models, they found a negative relation and a two-way causality between UE and EG, and a negative link and a one-way causality between inequality and EG.

Panaite, Prohozescu, and Pintilescu (2022) examined the determinants of UE for Romania using quarterly data for the period 2000-2020. The paper found that inflation, EG, and public debt influence the UE. Alrawashdeh and Alnabulsi (2021) used the cointegration and the Granger causality methods to determine the existence of a cointegration between the rate of EG and the rate of UE in Jordan for the period 2003-2018. The Ganger causality test found a one-way association between rates of EG and UE. Chuttoo (2020) also found a cointegration relationship between EG and UE in Mauritius. Akinyemi, Oyebisi, and Odot-Itoro (2018) investigated the trend between UE, entrepreneurship and EG in Nigeria for the period 1981-2011. The findings from the OLS and ECM analyses showed a positive relationship between entrepreneurial activities, investment, UE, and economic growth. Abraham and Osaru (2017) examined the EG and UE rate nexus in SSA utilizing the 1991-2013 dataset. The panel OLS tests showed the existence of Okun's law. Pitartono and Hayati (2012) and Rayhan, Rusdarti, and Yanto (2020) found that a minimal role of EG in reducing UE for ASEAN countries—it suggests that in the context of these ASEAN nations, focusing on economic growth alone may not be the most effective way to tackle unemployment problems, especially when other factors like inflation have a stronger influence.

3.3 Globalization and Unemployment

In existing research, the effect of GLB on UE is categorized into 2 parts. The first part considers FDI and trade liberalization as a major economic GLB indicators, and examines the link between foreign direct investment, trade liberalization and UE (Dutt, Mitra, & Ranjan, 2009; Felbermayr, Prat, & Schmerer, 2011; Hasan, Mitra, Ranjan, & Ahsan, 2012; Jenkins, 2006; Meidani & Zabihi, 2012; Ogunrinola & Osabuohien, 2010; Seyf, 2000; Shangquan, 2000; Zeb, Qiang, & Sharif, 2014). The second part deliberates the social and political dimensions of GLB (issued by KOF GLB index). For instance, Awad and Youssof (2016) investigated the relationship between economic GLB index and UE in Malaysia from 1980 to 2014. Using the ARDL method, the study found that economic GLB decreases the UE. Iftitah and Kusumawardani (2022) examined the impact of GLB (including social, political, and economic GLB), wage, and EG on UE in ASEAN for the period 2000-2017. The results revealed that GLB, EG, and wage negatively influence UE. Daly et al. (2017) explored the social, political, and economic GLB impact on UE utilizing the ARDL method for the period 1980-2013 in Pakistan and found that the social and political indicators have a positive effect, while the economic indicator of GLB revealed a negative relation with UE. Gozgor (2017) investigated the KOF GLB index impact on structural UE, and found that the KOF index has a negative but statistically insignificant impact on UE. Using the GMM method, Adamu, Kaliappan, Bani, and Nor (2017) demonstrated that only the political GLB had a mitigating impact on UE in Sub-Saharan African economies during the 2007-2014 period. Siddiqa, Hussain, Qasim, and Javed (2018) analysed the impact of political, social, and economic GLB on UE and EG from 2003 to 2013. The result showed that political and economic GLB contributed to reducing UE, while social GLB increased UE in developing countries. In their study, Malik, Chaudhry, and Javed (2011) examined the effects of economic GLB on UE in Pakistan from 1973 to 2009. The results underscored the significance of economic GLB, foreign direct investment, and worker remittances, all of which contributed to the expansion of employment prospects. On the contrary, trade openness and political and social GLB exerted an adverse impact on employment. Gozgor (2014) identified a negative association between UE, four trade openness indicators, and GLB from 1960 to 2011. According to the empirical findings of the least squares dummy variable (LSDV), the KOF index of GLB, real and nominal trade openness, and the GLB index all contributed significantly to reducing in UE in G7 countries.

Literature Gap

Particularly, the study by Degirmenci, Erdem, and Aydin (2025) explored the effect of human development, industrial employment, financial development, and urbanization on the environmental quality for the E7 economies. A thorough examination of the existing literature indicates that there is a dearth of empirical research concerning the interplay between GLB, economic uncertainty, UE, and economic growth in the E7 economies. Therefore, to the best of our understanding, our research is the initial attempt to address this deficiency as it examines the effects of economic uncertainty, EG, and GLB on UE in E7 countries.

4. Data and method

The study uses data for the E-7 economies from 1990 to 2017 to investigate the relationship between economic uncertainty, EG, GLB, and UE. UE, which is the dependent variable in this study, is measured by the UE rate. The economic uncertainty variables in this study are the following: economic uncertainty index (EUI), which is calculated using the following variables: annual real GDP growth, budget balance, current account as a percentage of GDP, and inflation rate. ERI is scaled from 0 to 50, with 0 indicating the highest level of economic uncertainty and 50 indicating the lowest. EG is economic growth calculated as GDP PC in 2015 constant dollars. The KOF GLB index represents all of GLB (including economic, political, and social GLB) in a single calculation. A comprehensive description of the variables in question is presented in Table 1.

Table 1. Variables description

Variables & Code Explanation		Sources	Existing research
Unemployment (UE)	Unemployment rate	(WB, 2022)	(Kokotović, 2016)
Economic uncertainty (EUI)	Economic risk index, “An index with a number to 0 represents high uncertainty and 50 shows low uncertainty”	(ICRG, 2018)	(Howell, 2011; Hye et al., 2023)
Economic growth (EG)	GDP PC (constant 2015 US $)	(WB, 2022)	(Dou, Ul-Haq, Visas, Aslam, & Khanum, 2023; Ul-Haq, Visas, Umair, Hussain, & Khanum, 2023)
Globalization (GLB)	KOF trade globalization index, including economic, social, and political globalization	(KOF, 2019)	(Adamu et al., 2017; Hye et al., 2023; Suci & Ramdansyah, 2019)

Source: Compiled by the author’s

Investigate the impact of economic uncertainty, economic growth, and globalization on unemployment in E-7countries, the following empirical panel model is used:

$$\mathrm{UE}_{it} = \beta_0 + \beta_1 EUI_{it} + \beta_2 EG_{it} + \beta_3 GLB_{it} + \varepsilon_{it} \quad (1)$$

In this model, UE is unemployment in country i (i.e., E-7) at time t. EUI is economic uncertainty, EG is economic growth, and GLB is globalization. The intercept is β_0, and β_1, β_2 and β_3 are the coefficients of economic uncertainty, EG, and GLB. The reduction in economic uncertainty is expected to reduce UE, as UE reduces as economic uncertainty falls. Thus, our study expects a positive role of economic uncertainty in reducing UE, and this is considered as hypothesis (1). On the other hand, the growth of economic activities, large scale investment, and flourishing industries, promote EG and consequently increase employment in an economy. Therefore, we also anticipate that EG will reduce UE, which is hypothesis (2) of this paper. Further, GLB is predicted to have either a positive or negative sign as it is the process of integration and interaction among people, industries, and governments across the world. Thus, it can play a crucial role in reducing UE. However, it may also have an adverse impact on UE, as the latest technology, innovations, knowledge, skills and many other factors also matter in determining level of employment.

4.1. Unit roots and diagnostics tests

This study starts by implementing the cross-sectional dependence (CSD) test. The current body of literature on modern panel methodology has placed greater emphasis on CSD. This is because, in practice, residuals are not independent in the real term, whereas the interrelation among different units of observations is entirely natural. Therefore, when dealing with panel data, conducting CSD testing can be advantageous in resolving numerous concerns and producing reliable outcomes. Therefore, it confirms the reliable and robust findings at later stages. More precisely, this study has used the following CSD equation.

$$CSD_{TM} = [\frac{TN(N-1)}{2}]^{1/2} \bar{\rho} N \quad (2)$$

In this equation (2), pair-wise parameters correlation is indicated as $\bar{\rho}N$, T is time period and N is cross-sections. Moreover, it is crucial to highlight that in the existences of CSD, the results obtained through first-generation unit root tests are found to be unreliable. For this reason, it is compulsory to use the second generation unit root tests namely cross-sectionally augmented IPS (CIPS) and covariate-augmented Dickey-Fuller (CADF) tests proposed by Hansen (1995), to confirm the integration order for economic uncertainty, EG, GLB, and UE. Our study chooses the CADF test because of its significant properties and the fact that it provides better results as compared to others (Costantini & Lupi, 2013). The explanation of CADF is as follow:

$$\Delta y_{i,t} = \gamma_i + \gamma_i y_{i,t-1} + \gamma_i \bar{x}_{t-1} + + \sum_{i=0}^{p} \gamma_{il} \Delta \bar{y}_{t-l} + \sum_{i=1}^{p} \gamma_{il} \Delta y_{i,t-l} + + \varepsilon_{it} \quad (3)$$

Where: $\bar{y}_{t-1}$ is lagged parameter and $\Delta\bar{y}_{t-1}$ denotes the first difference. The statistics of CIPS is estimated through the CADF average, and is described in following equation:

$$\widehat{CIPS} = \frac{1}{N} \sum_{i=1}^{n} CADF_i \quad (4)$$

While, CIPS t-statistics is taken as:

$$Z^{\mu} = \frac{N^{1/2}\{\bar{t}^{\mu} - \mathrm{E}(t_0^{\mu})\}}{\sqrt{V(t_0^{\mu})}} \quad (5)$$

Additional, BPLM test by Breusch and Pagan (1980) is also used to check CSD between residual. Utilizing the OLS method, BPLM test is preceded, which is applicable for a fixed N and greater T. The specification of LM test is as below:

$$LM_{BP} = T\sum_{i=1}^{N}\sum_{j=i+1}^{N}\hat{\rho}^{2}{}_{\mathrm{it}} \quad (6)$$

$\hat{\rho}_{\mathrm{it}}$ signifies sample estimates of the residuals cross sectional pairwise correlation, T symbolize time, i indicates entity, and N represents cross-section number. $\hat{\rho}_{\mathrm{it}}$ is calculated as:

$$\hat{\rho}_{\mathrm{ij}} = \frac{\sum_{t=1}^{T}\hat{\mu}_{it}\,\hat{\mu}_{jt}}{\sqrt{\sum_{t=1}^{T}\widehat{\mu_{it}^{2}}}\sqrt{\sum_{t=1}^{T}\widehat{\mu_{jt}^{2}}}} \quad (7)$$

$\hat{\mu}_{it}$ is a estimate of the u_{it} in above equation. LM is identically distributed as the χ^2 along with N(N-1) degrees of freedom within null hypothesis. Although, substantial distortions are expected in case of larger N and finite T in this technique.

With the use of linear panel data models, it is possible to face the issue of serial correlation which yields inconsistent estimates. Therefore, the Wooldridge (2010) is used to confirm serial correlation among the study variables, as it is more flexible, with less assumptions as compared to others, and also easy to implement. It is calculated as follows:

$$\begin{aligned} \mathrm{y}_{\mathrm{it}} &= \alpha + \mathrm{X}_{\mathrm{it}}\beta_1 + \mathrm{Z}_{\mathrm{i}}\beta_2 + \mu_{\mathrm{i}} + \\ &+ \epsilon_{\mathrm{it}}\mathrm{i} \in, \mathrm{t} \in \{1,2,\ldots,\mathrm{T_i}\} \end{aligned} \quad (8)$$

While, the dependent is y, independent is X, and controlled variables are indicated by Z. t represents time and i is an index for country. α, β are the parameters in the model and μ and ε indicates error terms of distinct variables and the whole model. Moreover, if μ_i is linked with their concerned variable it will yield inefficient parametric estimates. Thus, to overcome the issue of serial correlation, the Wooldridge test is better than the others. It accounts for the model's first difference to overcome serial correlation (Drukker, 2003).

$$\begin{aligned} y_{it} - y_{it-1} &= (X_{it} - X_{it-1})\beta_1 + \epsilon_{it} - \epsilon_{it-1} \\ \Delta y_{it} &= \Delta X_{it}\beta_1 + \Delta\epsilon_{it} \end{aligned} \quad (9)$$

Moreover, with respect to the issue of heteroscedasticity, the conventional belief is that linear regression ought to possess a consistent variance, as mathematically represented by the expression $(\varepsilon_i) = \sigma$^2, where ε_i represents the error term and σ^2 represents the constant. Therefore, this assumption is challenged when panel data are considered, as groupwise heteroscedasticity occurs when the error term approaches homoscedasticity within cross-sectional units but varies across units. In order to address this issue, the modified Wald test is implemented to identify heteroscedasticity in GroupWise statistics. The modified Wald test equation for heteroscedasticity is as follows:

$$V_i = T_i^{-1}(T_i - 1)^{-1}\sum_{t=1}^{T_i}\left(e_{it}^2 - \hat{\sigma}_i^2\right)^2 \quad (10)$$

Whereas, σi's denotes variances, N shows cross-sectional units, and t signifies time.

$$W = \sum_{i=1}^{N_g}\frac{\left(\hat{\sigma}_i^2 - \hat{\sigma}^2\right)^2}{V_i} \quad (11)$$

4.2 Pooled Mean Group (PMG) technique

After the analysis of unit root and check of CSD, this study utilizes pooled mean group (PMG) technique proposed by Pesaran, Shin, and Smith (1999). The heterogeneity lower degree considered by PMG, as it executes homogeneity for the long term estimates as well as heterogeneity in short term estimates. Remarkably, PMG is useable in cases when stationarity is confirm at levels, first difference or both levels and first difference (Erülgen, Rjoub, & Adalıer, 2020; Hongxing, Abban, Boadi, & Ankomah-Asare, 2021). The PMG equation for empirical testing is as:

$$y_{i,t} = \sum_{j=0}^{\rho} \delta_{ij}\, y_{i,t-j} + \sum_{j=0}^{q} \Omega_{ij}\, X_{i,t-j} + + \omega_i + \mu_{it} \quad (12)$$

The above equation is a general panel ARDL form. While in our study, y_{it} is the dependent variable namely UE. The $y_{i,t-j}$ term demonstrates the lag of the dependent variable. The lagged explanatory variables (ERI, EG, and GLB) are represented by vector $X_{i,t-j}$. The subscript t indicate time (1990-2017) and i shows entities (1,2,…7). In addition, fixed effect is shown by ω_i, and regressand variable coefficient is symbolize as δ_{ij}. Further, Ω_{ij} are the m×1 coefficient vectors (lagged explanatory); and the error term is u_{it}. Generally, it is easy to work with re-parameterization form of equation 12 to examine the long term and short term parameter estimates concurrently. Thus, the panel PMG re-parameterized version is stated as:

$$\Delta Unemp_{i,t} = \theta_i\left(Unemp_{i,t} + \alpha_i X_{i,t-1}\right) + + \sum_{j=0}^{q-1} \Omega_{ij} \Delta X_{i,t-j} + \omega_i + \mu_{it} \quad (13)$$

$$\Delta Unemp_{i,t} = Unemp_{it} - Unemp_{i,t-1,}\theta_i = = -(1 - \sum_{j=1}^{p} \delta_{ij}), \alpha_i = \sum_{j=0}^{q} \Omega_{i,j}\delta_{i,j} = -\sum_{k=j+1}^{p} \delta_{ik,}\, j = = 1,2,\ldots,p-1, \Omega_{ij}$$

Where, $= -\sum_{k=j+1}^{q} \Omega_{ik,} j = 1,2,\ldots,q-1,$

Equation 13, indicates "speed of adjustment of UE to long period equilibrium. The coefficients Ω_{ij} and δ_{ij} indicate the short period influence of the variables.

With respect to the PMG estimation technique, as stated previously, the reliability of PMG estimators is contingent on the long-term slope homogeneity assumption of the model. If the data indicates the existence of CSD in addition to slope heterogeneity, results derived from PMG or ARDL would be skewed. Cross-sectional independence is also accounted for in the ARDL method when calculating residuals for regression specifications. The presence of CSD residuals appears to be a contributing factor to the issue of biased results (Phillips & Sul, 2003).

4.3 Cross Sectional Autoregressive Distributed Lag (CS-ARDL) model

After PMG estimation, our study also used the Chudik and Pesaran (2015) suggested model, known as cross-sectionally autoregressive distributed lag model (CS-ARDL) (Mehmood, 2022), to explore the link between the study series. CS-ARDL is attributed for the issue of heterogeneity and CD in data and yield reliable results as opposed to others (Adebayo & Rjoub, 2021; K.-H. Wang, Liu, Adebayo, Lobonţ, & Claudia, 2021). This technique provide short run and long run estimates. ARDL approach considers both the combination of exogenous and endogenous variables. This approach initially proposed by Pesaran and Smith (1995) and further improved by Chudik and Pesaran (2015), is used when T>N (Westerlund, 2007). In addition, this approach can also be used in case of different order of integration but not at order 2. This approach is commonly used in the case of analyzing heterogeneous panel data but the issue is that it is limited in finding CSD error (Wooldridge, 2010). Therefore, by navigating the inter-country dependency, CS-ARDL technique permits us to retrieve the short run and long run elasticity coefficients (Chudik & Pesaran, 2015). Moreover, this technique produces error correction term, which shows the speed with which the system reestablishes an equilibrium in occurrence of disequilibrium (Chudik, Mohaddes, Pesaran, & Raissi, 2013). This technique is more suitable as compared to ARDL technique due to the reason that it anticipates possible structural breaks when calculating the elasticity coefficients. In addition, excessive sensitivity for the lag-length selection can be anticipated as the limitation of CS-ARDL technique. However, all diagnostic tests suggest the use of CS-ARDL technique. The other advantage of using this approach is that it account less time as well as solve many issue related to non-stationary, mixed integration order, as well as endogeneity. Moreover, it presents better results for a small sample size. In the same way, if all of the study's variable are I(1), then there is no need to include more regressors in estimating long run results. Considering these attributes, CS-ARDL is more appropriate and suitable technique for investigating the effect of economic uncertainty, EG, and GLB on UE in E7 economies. The modified equation version with additional cross-sectional lag term is as follows:

$$Unemp_{i,t} = \sum_{j=1}^{p} \delta_{ij}\, Unemp_{i,t-j} + \sum_{j=0}^{q} \Omega_{ij} X_{i,t-j} + + \sum_{j=0}^{r} \beta_{ij,}\, I\bar{Z}_{t-1+}\omega_i + \mu_{it} \quad (14)$$

While, $\bar{Z}_{t-1} = (\overline{Unemp}_{i,t-j,}\bar{X}_{i,t-j})$ are regressor and regressand averages, p,q, show lags for every variables and r is cross-sectional averages lags numbers to be involved. Further, $\bar{Z}$ shows the average of cross-section and eludes CSD (Hasanov, Liddle, & Mikayilov, 2018). CS-ARDL long run coefficients estimates can be computed as:

$$\hat{\lambda}_{CS-ARDL,ij} = \frac{\sum_{j=0}^{q} \hat{\Omega}_{ij}}{1-\sum_{j=1}^{p} \hat{\delta}_{ij}} \quad (15)$$

Additional, error correction form can be stated as shown in below equation:

$$\Delta Unemp_{i,t} = \vartheta_i\left(Unemp_{i,t-j} - \lambda_{ij} X_{i,t}\right) - - \sum_{j=1}^{\rho-1} \delta_{i,j} \Delta Unemp_{i,t-1} + \sum_{j=0}^{q} \Omega_{ij} \Delta X_{i,t} + + \sum_{j=0}^{r} \beta_{i,} I\bar{Z}_{t-1} + \omega_i + \mu_{it}$$

Whereas, $\Delta_I = t - (t-1)$ (16)

4.4 Panel Granger Causality tests

Once the short-term and long-term relationships between the variables in question have been examined, it becomes imperative to assess the direction of causality in order to derive the most suitable policy conclusions. The JKS proposed by Juodis, Karavias, and Sarafidis (2021) is used as outperforms the Dumitrescu and Hurlin (2012) (Malik et al.) test. The DH approach is not appropriate for causality testing due to some limitations as it indicates heterogeneous slopes under both the null as well as alternative hypothesis and only suitable where $N/T^2 \rightarrow 0$. On the other hand, JKS approach is superior to DH as initially, it uses split Panel Jackknife (SPJ) method to overcome "Nickel bias". Next, JKS technique is simultaneously suitable for both the heterogeneous and homogenous panels. Further, JKS method has the better finite sample properties as compared to DH test (Juodis et al., 2021). Following Juodis et al. (2021), this study itemized the JKS approach to panel Granger non-causality equation for simplest linear dynamic panel data long with independent variables as followed:

$$y_{i,t} = f_{0,i} + \hat{\text{Â}}_{p=1}^{P} f_{p,i} y_{i,t-p} + + \overset{\text{Â}}{\underset{q=1}{b_{q,i}}} x_{i,t-q} + e_{i,t}; t = 1, \ldots, T \quad (17)$$

Furthermore, the following hypothesis is testing:

H_0:$b_{q,i}$=0 for all i and q, against H_a:$b_{q,i}$π0 for some i and q

5. Results and discussion

Table 2 shows the mean value and their corresponding standard deviation (S.D) as well as the maximum and minimum value of the variables. The average and S.D for the UE are 6.68898 and 2.573644 respectively. For economic uncertainty, the average and S.D are 32.4463 and 7.478993 respectively. The mean value and S.D of EG is 8.342103 and 0.8550812 respectively. The average value of GLB is 58.34269 and S.D is 9.033936.

Study begins by identifying serial correlation, heteroscedasticity, and CSD problems in the dataset. The results of these diagnostics tests conducted using the Wooldridge, Modified Wald, and the BPLM tests are detailed in Table 3.

As there is cross-sectional dependence, the second generation panel unit root tests

Table 2. E-7 Descriptive Statistics

	N	Average	S.D	Min	Max
UE	196	6.68898	2.573644	2.37	13.26
EUI	203	32.4463	7.478993	10	46.5
EG	203	8.342103	0.8550812	6.270796	46.5
GLB	203	58.34269	9.033936	32	72

Source: Authors' Computation

Table 3. Diagnostics tests

Modified Wald test	6005.91***
Wooldridge test	167.881***
BPLM test	98.236***

Note: ***shows significance at 0.01 level.

Source: Authors' Computation

Table 4. Second-generation unit roots tests (CADF & CIPS)

CADF				
	At level		First-difference	
	Const.	Const. & trend	Const.	Const. & trend
UE	-2.175	-2.539	-2.550***	-3.185***
EUI	-1.755	-1.923	-2.865***	-3.370***
EG	-2.094	-2.588	-2.672 ***	-2.961***
GLB	-1.794	-2.286	-2.943***	-3.046***
CIPS				
UE	-1.600	-1.580	-2.999***	-3.185***
EUI	-2.380	-2.510	-5.116***	-5.079***
EG	-2.111	-2.034	-3.301***	-3.582***
GLB	-2.381	-2.774	-5.063***	-5.152***

Source: Authors' Computation

(CIPS and CADF) are employed to confirm the variables stationary properties. Table 4 shows these test results at level and at first difference. The results of CIPS and CADF illustrate that all the variables of interest are stationary at first difference (I(1)). The CIPS test null hypothesis is that all series are non-stationary. Based on panel unit root test results which show an integration order of 1, CS-ARDL and PMG are employed for short run and long run empirical estimates. The CS-ARDL and PMG results are shown in Table 5.

Note: In CADF test the critical value at 1%, 5%, & 10% are -2.570, -2.330, & -2.210, with constant and -3.100, -2.860, & -2.730, with constant and trend for the second generation unit root test and In CIPS test the critical value at 1%, 5%, & 10% are -2.57, -2.33, & -2.11, with constant and -3.1, -2.86, & -2.73 with constant and trend for the second generation unit root test.

According to the CS-ARDL method, the coefficient of EUI exhibits a statistically significant negative sign in the short run. Significant at the 1% level, the EUI coefficient of -0.0648 indicates that a 1% decline in EUI (or an increase in economic stability) results in a 0.0648% reduction in UE. Moreover, in the long run, EUI demonstrates a negative trend, suggesting that it reduces UE; a result which is statistically significant at the 1% level. Therefore, it is undeniable that a reduction in economic uncertainty stimulates economic activity, which in turn stimulates demand and augments GDP that necessitates more labor. Furthermore, sustained EG and increased

Table 5. Impact of ERI, EG, and GLB on UE (CS-ARDL & PMG)

	CS-ARDL	PMG
Short run estimates		
Error Correction	-1.2868*** (0.0245)	-0.1401* (0.0843)
Δ.EUI	-0.0648*** (0.0292)	0.0020 (0.0191)
Δ.EG	-6.8005* (3.6721)	-11.1854*** (4.7329)
Δ. GLB	-0.0339 (0.0491)	0.0332 (0.0533)
Long run estimates		
EUI	-0.0496*** (0.0216)	-0.0488*** (0.0163)
EG	-5.5948* (3.0228)	-0.9472*** (0.0729)
GLB	-0.0244 (0.0392)	0.1822*** (0.0165)
Observations	196	196
Countries	7	7

Note: standard error are presented in parentheses. Asterisk shows the significance level at 1%, 5%, and 10% (***, **, &*).

Source: Authors' Computation

aggregate demand mitigate the unpredictability of UE, as these factors occur while industries or operational sectors are in operation (Hye et al., 2023). The negative relation between EUI and UE is in line with the study of Hye et al. (2023). It can be stated that EG serves as a prerequisite for the improvement of productive employment; therefore, its effects are a combination of labor productivity and employment growth. Consequently, the EG rate establishes the strictest boundary within which labor productivity and employment growth are permissible (Irawan, 2022). The PMG results indicate that EUI has a negative sign (positive role) in the long run and is statistically significant at 1%, but a positive and insignificant coefficient (negative role) in the short run.

Regarding the short-run relationship between EG and UE, the coefficient of EG is negative. At 10% significance level, EG and UE are associated. A 1% increase in EG causes UE rate to fall by 6.8005%. Furthermore, we found an inverse relationship between UE and EG in the long run. This finding demonstrates that in the long run, a unit increase in EG reduces UE by 5.5948%; a result which is significant at the 10% level. This finding aligns with the Okun's law, which shows the relationship between EG and UE to be inverse. Furthermore, our results align with empirical studies conducted by Hjazeen, Seraj, and Ozdeser (2021) and contrast the findings of Pitartono and Hayati (2012) and Rayhan et al. (2020) for the ASEAN countries. Abraham and Osaru (2017) also found an inverse relationship between EG and UE. However, in the case of specific economies, a positive relationship between EG and UE was identified, indicating the existence of non-inclusive growth. Thus, the observed negative coefficient demonstrates the existence of the Okun's law in a limited number of low-income economies in SSA.

According to the CS-ARDL results, GLB (as a whole) has a negative and insignificant value in both the short run and long run, suggesting that an increase in GLB (KOF index) will result in a decrease in UE. The positive coefficient of GLB in the Short-term and long-term as reported by PMG, indicates that GLB leads to a rise in UE. Nonetheless, its coefficient only becomes significant in the long run. Awad and Youssof (2016) provided evidence that, in the short run, GLB tends to increase UE. The argument posits that trade liberalization will result in job losses for workers in the import industries, while adjustment time is required for labor absorption in the export industries. In addition, GLB, specifically economic GLB has a positive effect on UE, which is consistent with the Heckscher-Ohlin (H-O) model a ccording to which trade openness increases UE. The relationship between GLB and UE can be broadly characterized as having two distinct interpretations, namely positive and negative effects. Positive perspectives demonstrate that trade liberalization, technology transfer, and foreign direct investment (FDI) augment employment prospects in developing economies. Investment in industries with comparative advantages will contribute significantly to reducing UE. This suggests that GLB is actively promoting workforce development, specifically in rural regions, which will ultimately lead to a decrease in UE. Conversely, the negative perspective illustrates how GLB could amplify UE in nations characterized by a non-competitive economic system and labor that is predicated on production. Due to these two divergent perspectives, the effect of GLB on UE remains indeterminate. However, our findings align with the second perspective and is in

Table 6. Juodis, Karavias and Sarafidis (2021) Granger non-causality Test

Null Hypothesis	HPJ Wald test	P-value
Collectively		
ERI, EG, GLB does not Granger-cause UE	18.2667	0.005
Individually		
ERI does not Granger-cause UE	15.5224	0.000
LGDPPC does not Granger-cause UE	8.3512	0.015
GLB does not Granger-cause UE	5.3955	0.020

Source: Author's Computation

line with Kreickemeier (2017) and Hasan et al. (2012), but contradicts the first perspective put forth by Suci and Ramdansyah (2019) and Daly et al. (2017). Previous studies (Gozgor, 2017; Iftitah & Kusumawardani, 2022) have determined that the economic GLB has a positive influence on the UE, while political and social GLB collectively have detrimental effects. UE rate is a key indicator for the Sustainable Development Goals, as it is directly targeted in SDG-8 which seeks to promote inclusive and sustained economic growth, productive and full employment.

The granger causality JKS approach, proposed by Juodis et al. (2021) as a granger non-causality test, is utilized to establish a causal relationship between the variables of the study. The results of the causal relationship are summarized in Table 6.

Our study establishes a unidirectional causal relationship between economic uncertainty, EG, GLB, and UE. The p-values of the HPJ Wald test are statistically significant. Additionally, the JKS is employed to validate the causal relationship between the predictor variables and the UE (dependent), both individually and collectively. The Granger causality underscored the significance at the 1% level for all the half-panel Jackknife (HPJ) Wald statistics. Our results on causality testing is in line with Michael, Emeka, and Emmanuel (2016). The study of Daniami Mujitapha, Affendi, Othman, and Muda (2021); Michael et al. (2016) demonstrate a uni-directional causality between EG and UE, with causality running from EG to UE, confirming the Okun's law. The studies of Padder and Mathavan (2021); Agboola, Adelakun, and Yusuph (2019) found no causality between the variables of Okun's law. On the other hand, Agboola et al. (2019) found a uni-causality from UE to EG. Awad and Youssof (2016) found a strong causality in the long while Effiong, Udfia, and Okon (2020) found no causality between GLB (political) and UE, but social and economic GLB revealed bidirectional causality with UE.

6. Conclusion, policy recommendations, and limitations.

6.1 Conclusion

A number of economic indicators exert an impact on the UE rate. Economic uncertainty is a pivotal indicator that has the potential to significantly impact UE. Thus, our study examines the effect of economic uncertainty, EG, and GLB on UE in E-7 economies from 1990 to 2017. To measure economic uncertainty, this study employs the EUI measure, comprised of GDP per capita, real GDP growth, annual inflation rate, budget balance as a percentage of GDP, and current account as a percentage of GDP, with scale-based uncertainty points assigned. Further, to measure globalization, the KOF trade globalization index, including economic, social, and political globalization is used. Using the CIPS and CADF tests of the second generation, our study demonstrated that all variables are integrated at order 1. The results of the CS-ARDL and PMG indicate that, over time, UE reduces as economic uncertainty reduces. UE and economic uncertainty are statistically significantly linked. A higher economic uncertainty value signifies reduced economic uncertainty, which in turn contributes to lower UE rate. EG also contributes to reducing the UE levels. In contrast, the PMG results indicate a significant positive relationship between GLB and UE, whereas the CS-ARDL results indicate a negative impact of GLB on UE.

6.2 Policy recommendations

Based on the study's finding, the government should implement policies that can reduce economic uncertainty. Stabilizing the annual inflation rate, GDP per capita, growth of real GDP, balance budged as a GDP%, current account as the GDP% become imperative. These improvements will reduced the economic uncertainty and lead to more economic activities which will create more employment opportunities. Moreover, the empirical results suggest that the UE challenges could be resolved on individual, regional, and country basis by starting the effective policy actions to lower the whole UE rate through the generation of numerous jobs on the basis of labor-intensive sectors in developing economies. Also, the findings suggest that policymakers should adopt plans aimed at increasing EG in E-7 by endorsing overall demand through enhancing spending levels on investment and attracting greater foreign investment to increase jobs opportunities. Further the policy makers should adopt those globalization policies that can help in generating employment opportunities. Thus, it is essential that policies be adopted to reduce UE by prioritizing innovative jobs policies. These policies will help in promoting the SDG-8 goal about the productive employment creation. Moreover, technological change and automation will meaningfully reshape the labor markets in the E-7 economies, leading to new opportunities and the job displacement.

6.3 Limitations and future research

The limitation of this research is the use of a dataset for the period 1990-2017 based on data availability which might affect the study findings. In future research, this research will cover this shortcoming for better results.

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