


Article

Informal Sector Employment and Economic Growth: Evidence from Developing Countries in SDG Perspective

Nahid Sultana ^{1,2,*}, Mohammad Mafizur Rahman ¹  and Rasheda Khanam ¹¹ School of Business, University of Southern Queensland, Toowoomba, QLD 4350, Australia² Department of Economics, Jahangirnagar University, Dhaka 1342, Bangladesh

* Correspondence: u1122964@uemail.usq.edu.au

Abstract: The understanding of the role of informal employment in economic growth is important to facilitate developing countries in safeguarding the decent work, productive employment, and inclusive growth agenda mentioned in Sustainable Development Goals (SDG) 8. The present study attempts to this end by investigating the role of informal employment on economic growth with an aim to assist in fulfilling target 8.3 of SDG. This study utilizes the data available for 20 developing countries for the period 2011–2019. Panel data analysis techniques have been applied, considering the percentage of total employment in the informal sector as the main explanatory variable of the models. The relevant macroeconomic indicators are included in the model as control variables. Empirical findings from Fully Modified Ordinary Least Squares (FMOLS), Dynamic Ordinary Least Squares (DOLS), and Dynamic Fixed Effect (DFE) models indicate a positive effect of informal employment on the economic growth of developing countries. The other macroeconomic indicators, per capita income, national expenditure, money supply, and economic freedom, are also found to contribute to the economic growth of the selected countries. This study reveals an important bidirectional causal association between informal employment and economic growth, a unidirectional causal link from per capita income to informal employment and from informal employment to national expenditure. Taking into account the contribution of the informal sector to the economy, this study fosters the need for achieving the targets mentioned in SDG 8 by adopting appropriate policies rather than punishing this sector immediately.

Keywords: informal sector; informal employment; economic growth; macroeconomic policies; developing countries



Citation: Sultana, N.; Rahman, M.M.; Khanam, R. Informal Sector Employment and Economic Growth: Evidence from Developing Countries in SDG Perspective. *Sustainability* **2022**, *14*, 11989. <https://doi.org/10.3390/su141911989>

Academic Editors: Luigi Aldieri and Jacob Arie Jordaan

Received: 11 August 2022

Accepted: 20 September 2022

Published: 22 September 2022

Publisher's Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.



Copyright: © 2022 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

Originating in the context of third-world countries, the informal sector constitutes a dominant part of the economy and is identified as an untapped reservoir of opportunities in terms of employment and the entrepreneurial capabilities of developing countries [1–8]; it is often called the subordinate zone of the overall economy that can play a significant role in the growth and socio-economic development of countries across the world [4,9]. The informal sector accounts for almost half of the economic activities in developing countries [2,9,10]. These activities were initially backed by the core assumptions of the classical theory that the informal economy would wither away after achieving persistent growth [10–12]. However, the new view of the informal economy features it as contemporary growth that should proceed as a result of the changed economic context of countries [11]. The prevalent feature of the informal economy around the globe provides support to the new view of informality, mentioned as a dichotomist's approach, which indicates that the informal economy will not wither away; rather, it will be contested in an arrangement of interdependent coexistence with distinctively different conditions, notably in terms of employment arrangements [12–15]. Therefore, it is important to investigate the long-run prospect of informal employment on economic growth with an aim to formulate

appropriate strategies for this sector aligned to the targets of the Sustainable Development Goals (SDG) mentioned by the United Nations.

The new view of informality anticipates that the internal heterogeneity of the informal economy makes it a resilient feature of modernization and economic growth [12]. Moreover, informal activities have the potential to affect sustainability, since they arise due to the improper functioning of the formal system [16]. Therefore, a comprehensive and holistic understanding of the features of the informal sector is important to pursue economic growth by avoiding the undesired effects of economic policy measures [17]. This provokes researchers around the globe to undertake more research on the informal economy to find the reliable and consistent drivers of the informal sector and its relation to economic growth [18], while economic growth itself remains a topic under investigation and debate [19]. The present study has contributed to this end by investigating the significance of the informal sector to the economic growth in terms of employment since informal employment constitutes a persistent structural pillar of the labor market in low-income and developing countries and is identified as a thematic area in at least two sustainable development goals (SDG-8.3 and SDG 10.2) by International Labor Organization (ILO).

In developing countries, employment in the informal sector is increasing over the years [20,21] and it is considered to be a resort against unemployment despite its significant low wage, as compared to the formal sector [21,22]. Informal employment includes the self-employed, paid workers in informal enterprises, unpaid workers in family businesses, casual workers without fixed employers, and sub-contract workers connected to both formal and informal enterprises as per the definition mentioned in the ILO guidebook (2018) which provides a detailed overview of the SDG labor market indicators pertain to Goal 8 (sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all). Informal employment is also linked to some extent to the other SDG goals, such as Goals 1, 5, and 10 since a vast portion of workers are pursuing their livelihoods in conditions of informality. Informality issues are addressed in SDG target 8.3 where the promotion of development-oriented policies are suggested to support productive activities, decent job creation, creativity and innovation, and entrepreneurship, along with an encouragement to the growth and formalization of micro, small and medium-sized enterprises [23]. The prospect of an informal economy in productive activities with the viewpoint of economic gains, improvement of physical and human capital, and the extraction of profit from the local economy may motivate to set this target [7].

Under this backdrop, this study aims to contribute to framing the development-oriented policies related to the informal sector, vis-à-vis, informal employment by investigating its impact on economic growth that will assist in fulfilling target 8.3 of SDG. Because informality has raised issues for public health [24,25], as informal laborers often have to work in small and undefined workplaces, and in precarious working conditions. Informal employment is also criticized for its low wages, lack of economic security due to irregularities in income, limited workplace rights and social security, random abuse and exploitation that contribute negatively to the health and wellbeing of workers [26]; These have a negative impact on revenues, fair competition, and the government's scope of action and reliability of institutions [23]. However, since informality is a development issue it must be dealt with caution [27]. Therefore, the contribution of informality to economic growth is needed to be evaluated to put forward the policies addressing justifiably the decent work deficit and productive inefficiency in the informal sector, which create the context of working poverty and economic distortion intimidating sustainable growth in developing countries. Assessment of the role of informal employment in economic growth will make this need more distinct and work for better policy coherence with an integration of social and economic policies that will promote the central aim of the sustainable development agenda: social, economic, and political inclusion of all people.

This study has attempted to this end by considering the broad definition of the informal sector that recognizes not only the enterprises but also the employment relationships in the informal sector following [20] and [28]. Data unavailability and inconsistency are an

inevitable part of the study of the informal sector, especially in developing countries. Taking account of this drawback this study has considered employment in the informal sector as a representation of the informal sector following the existing literature [12,13,29]. It is measured here as the share of informal employment to total employment and has combined with other macroeconomic indicators namely, per-capita income, national expenditure, unemployment, money supply, and economic freedom index of countries to empirically investigate its influence on the economic growth of countries. This study has relied on the UN's classification of developing countries and considers twenty of them on the basis of the availability of informal employment data.

The contributions of this study to the existing literature are as follows. Firstly, to empirically investigate the long-run contribution of informal sector employment to the economic growth of developing countries. This assessment will resonate with informal employment for critically addressing the issues of decent work deficit [23,30] mentioned in SDG 8 that encompasses inclusive and sustainable economic growth. Secondly, to assess the impact of informal employment on growth in a combination of other macroeconomic indicators. This will assist in macroeconomic policy-making that is helpful for informal enterprises to navigate to formality as targeted by SDG through turbulent global market conditions and ensure sustained wealth accumulation and competitiveness for these relatively poor economies by the achievement of formality [31]. Thirdly, to capture the joint influence of property rights, regulation, monetary policy, government intervention, business freedom and other variables in the model, this study has used the composite Economic Freedom Index (EFI) of countries which can be considered as a novel contribution. It is believed that economic freedom facilitates more effective macroeconomic policy formulation that will spur economic growth with sustainability. This study finds it relevant to assess the effect of economic freedom, components of which may influence the growth of the informal sector, on growth. Fourthly, to explore the long-run co-integration relationship of informal employment with economic growth by applying the most suitable econometric methods. Investigating the long-run relationship this study bears the potential to evaluate the prospect of the informal sector from a sustainability perspective. Fifthly, to reveal the causal relationship between informal employment and economic growth both in the short run and long run. This is important for framing policies toward sustainable and inclusive growth. To the best of the authors' knowledge, no study reveals the causal relationship between informal employment, economic growth, and other macroeconomic indicators for a panel dataset of developing countries.

After the introduction, the paper is organized as follows: Section 2 projects the theory and literature review that covers a number of aspects of informality in its nexus to the economic growth of countries, and Section 3 discusses data, methods and econometric approaches. Section 4 presents empirical findings with the help of tables and provides relevant discussion. Section 5 offers concluding remarks with some policy suggestions.

2. Theory and Literature Review

The causes and consequences of the informal sector and its relation to the formal economy is a topic of extensive research to the researchers. Economists are now more aware of the importance of the informal sector and researchers have found it necessary to relate its significance to economic growth [3,18,32]. This study has reviewed such literature and presents below some features of the informal sector that are related to many aspects of the economy, such as productivity, labor market and employment, socio-economic inequality, enforcement, and economic growth of countries, after discussing a brief theoretical background of the study.

2.1. A Theoretical Background of Informal Employment: Socio-Economic Safety Mechanism or Growth Engine

The theoretical background of informal employment particularly urban informal employment, is presented in the seminal paper of Lewis (1954). Later in 1970, Harris

Todaro explained the reason for urban unemployment that serves as an equilibrating force for rural urban migration and provides the foundation for the subsequent theories of informal employment. Field (1975) extended this in several directions by assuming that urban workers can choose to become informally employed rather than search for higher paying formal jobs [33,34].

Informal employment is considered to be a substitute for formal employment and is treated as a residual absorbing surplus, unskilled labor from the formal sector in the dualistic labor market approach. This group views informal employment as involuntary that utilizes traditional production technology, organizes with little to no capital, and provides a subsistence wage; it is seen to be a safety net for unemployed workers in the dualistic framework and incapable of accumulating capital for growth [35]. Based on this approach, poverty alleviation and providing unemployment insurance during the periods of unemployment are the most appropriate policies. However, in the context of developing countries it is hard to provide unemployment insurance or safety nets [27]. On the other hand, informal employment is considered as a voluntary strategy and compliment to formal employment in the neo-liberal approach; they opine that entrepreneurs are capable of establishing new firms and can avoid strenuous and costly labor regulations by adopting a cost-saving strategy. The entrepreneurs can accumulate a substantial amount of capital for their business and can be associated with formal markets through output demand and business relations with the formal firms [35]. In this way the informal sector becomes capable to accumulate capital and contribute to growth that creates a positive impact to the overall economy [36]. In such a situation entrepreneurs and business owners often enter the informal sector to escape excess labor costs that ultimately extends informal employment. Thus, this particular approach sees informal employment as a potential engine of growth [35]

Under such a theoretical debate, Structural Articulation approach, the third theory of informal employment is evaluated which sees the informal sector as heterogeneous and comprising of at least two distinct sub-sectors [37]. Entrepreneurs and small firms those attempt to grow by avoiding costly regulation are represented by one sub-sector and this sub-sector benefits the overall economy by providing lower consumer prices and labor costs since it is driven by labor demand. This is identified as a dynamic sub-sector that demonstrates pro-cyclical behavior with the overall economy. The other sub-sector argued by the Structural Articulation approach is largely detached with the formal economy and projects countercyclical behavior. This is identified as a static sub-sector that represents the involuntary subsistence strategies of surplus and unskilled workers who failed to find employment in the formal sector. As a result, growth policies and poverty alleviation strategies are required to apply discriminately to the appropriate sub-sector [35]. Based on the fact that, it is difficult to accurately identify each sub-sector, this study considers an integration of these two subsectors in informal employment and finds its impact on growth in order to target relevant policies suitable for both groups.

2.2. The Informal Sector, Productivity, Output, and Growth

It was revealed by [38] that the structure, nature, and evolution pattern of the economy and structural change in the informal sector could cause a rapid growth of output in the informal sector. [10] observed that the informal sector lacked investment from a government that could promote direct economic growth but promoted growth in entrepreneurship in the sector and thereby spurred economic growth. This study also opined that the growth of the informal sector was required to sustain the growth of the formal sector since agriculture was a part of the informal sector and the economies experiencing economic growth with informality didn't indicate a lack of development, rather they indicated the improved productivity of informal employment due to economic development. The productivity of output was also linked to the informal sector through the economic performances and policies of countries and thereby influenced economic growth in many ways. Productivity differences across countries were found to be important for analyzing the informal sector

by [39]. This study revealed a larger share of output from low-productivity firms of the informal sector in such countries that faced a low degree of debt enforcement and high costs of getting associated with the formal sector. The level of output i.e., GDP per capita of countries was found to be significant in the relationship between informality and growth by [19]. Using a novel data set of 161 countries, the size of the informal sector and the growth of real GDP per capita projected an inverted U relationship in this study. This study indicated that small and large size informal economies were associated with lower growth, and medium size informal economies were linked to a higher level of growth. The decomposition of growth into growth accounts confirmed the nonlinear result by observing the negative association of labor and capital-output ratio, and the positive association of total factor productivity and the large informal economy in this study. Refs. [4,40] also found a commendable and significant impact of the informal sector on growth in Nigeria and Pakistan, respectively. This brief review reveals that there are considerable channels through which informality and productivity can be linked to the growth of countries.

2.3. Enforcement, Informal Employment, and Growth

The conditions of regulations and enforcement were identified as critical to determine the size of the informal sector in both developed and developing countries by [18] and these had an impact on informal sector employment. In the presence of informality, a theoretical relationship between enforcement and the economic growth of society was developed by [41] and this discussion was found to be important by the study as the employment capacity of the formal sector was declining worldwide. When the enforcement level that encompassed the level of security of property rights, the integrity of contracts and checks of corruption, affected the formal and informal activities differently and imposition of taxes reduced the formal activities only, their simultaneous choice entailed growth as well. The growth rate and welfare functions projected inverted U shapes in this study that acted against the enforcement level. [1] found that product market deregulation reduced informality, unemployment, and wage inequality. Contrary to this finding, enhancement of enforcement level reduced informality by the study of [42] without increasing unemployment, allowing the reallocation of workers to more productive jobs that facilitated increases in wages and contributed to a reduction in inequality. Therefore, debate belongs to the nexus between informality, employment and enforcement level that impacts economic growth through the path of public policy and productivity.

2.4. Informal Employment, Income Inequality, and Economic Growth

Precarious employment and poor prospects reproduce and reinforce distinctive territorial inequalities and thus create a stern limitation for sustainable development. Observing this [43] has opined that for pursuing sustainable development, work arrangements have to be fair and stable. Unfortunately, these are absent in the informal sector and the inequality features are observed in informal employment. [20] revealed that increased employment and inequality in the informal sector due to the formal and informal wage gap had links to productivity and output. According to [42] low productivity was found both in the informal and formal sectors and in the transit between the two, but the informal sector paid significantly less than the formal one. The study observed that the movement of the Gini coefficient over time depended on the gap between formal and informal sector wages and therefore employment in the informal sector had the potential to contribute to improving income inequality in developing countries by improving the Gini coefficient value. The changes in the wages of the informal sector created a major impact on the Lorenz curve and the evolution of the Gini coefficient by this study. Ref. [44] also observed the same while investigating the conditions under the inverted U-shaped curve of the income distribution. The study found that the expansion of the informal sector and manual labor migration to this sector were vital for reducing income inequality. Using Gini index [45] observed the past level of inequality as a salient feature to explain the size of the informal economy. He showed countries with larger initial inequality had larger informal economies over time

and not necessarily the informal economy would naturally decline to the same steady state. Improvement in contractual and financial participation of informal firms could increase informal wages along with an expansion of the size of the informal sector according to [32]. These findings indicate that informal firms accessing institutional services and informal employment with a minimum wage gap have the potential to improve income inequality and foster economic growth.

2.5. Informality, Institutions, and Sustainable Development

Informality has been projected as a core aspect of sustainable development in [46] and this study establishes a strong association between the size of the informal sector and the socio-economic indicators. [14] has revealed an overall detrimental role of the informal sector in the sustainable development of developing countries while the working poor is used as a proxy for the informal sector. Acknowledging the informal economy and informal workforce as the broad base of the global economy and workforce [20] suggested a review of all economic and social policies in terms of their impact on the informal economy and its integral parts. The high correlation of informal activities to the level of economic development and institutional quality was revealed in [34,47] and in response to this result [34] pointed to the modern model of the informal sector that put emphasis on small-scale, unskilled labor-intensive, and self-financed activities with the potential to uphold the consequences of pro-growth policies accommodating a large informal sector. Considering informal labor in the form of unregulated and subcontract work [28] argued that decent work in the informal sector and economic growth issues should gain more focus to realize its promise.

From the above discussion, it is observed that there are several pathways through which informality is linked to formal economic processes such as employment generation, economic productivity, output growth, inequality reduction, institutional capacity, and socio-economic development. However, the dynamics of informality related to formality are yet to be understood completely compared to its wider influences on the economy and development of developing countries. Moreover, macroeconomic factors are rarely considered in this connection. Therefore, this study expects to contribute to the gap by establishing the impact of the informal sector on economic growth through the path of most promising informal employment in the presence of other macroeconomic factors. A particular emphasis on the developing countries with their ranking of economic freedom will add new insight to this analysis.

3. Data and Methodology

3.1. Data

This study has analyzed panel dataset of 20 developing countries (Albania, Armenia, Bangladesh, Bolivia, Bosnia and Herzegovina, Brazil, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Mali, Mongolia, North Macedonia, Paraguay, Peru, Serbia, South Africa, Vietnam) for the period 2011 to 2019. The countries and the time period are selected based on the availability of data on the informal employment level since data on the informal sector is usually unavailable especially in developing countries. The details of the data/variables and their expected relationships with the dependent variable are presented in Table 1 below.

Table 1. Description of variables.

Variable	Source	Proxy or Definition	Hypothesis	Expected Sign
Economic Growth (<i>EG</i>)	World Development Indicators WB [48] https://databank.worldbank.org/source/world-development-indicators (accessed on 12 March 2021)	GDP growth rate (annual %)		
Informal sector (<i>IE</i>)	International Labor Organization [49] https://ilostat.ilo.org/data/ (accessed on 18 March 2021)	Rate of Informal employment (total) in total employment (%)	H1: Informal employment contributes positively to long-run economic growth [12,50,51]	+
Per capita income (<i>Y</i>)	WDI, WB [48]	GDP per capita, PPP (constant 2017 international \$)	H2: An increase in per capita income increases economic growth.	+
Gross National Expenditure (<i>GE</i>)	WDI, WB [48]	Gross national Expenditure as a percentage of GDP (annual %)	H3: An increase in national expenditure increases growth	+
Unemployment (<i>UN</i>)	WDI, WB [48]	Rate of Unemployment (annual %)	H4: An increase in unemployment rate decreases growth	-
Money Supply Growth rate (<i>MS</i>)	WDI, WB [48]	Broad Money or M2 money growth rate in terms of total GDP (annual %)	H5: An increase in money supply increases growth.	+
Economic Freedom (<i>EF</i>)	Index of Economic Freedom, 2021 [52] https://www.heritage.org/index/explore?view=by-region-country-year&=637509928185688064#top (accessed on 11 March 2021)	The index of Economic Freedom (overall) focuses on economic freedom, prosperity and opportunity by summing 12 economic freedom indices.	H6: An increase in economic freedom of countries increases growth.	+

Note: '+' sign indicates positive association and '-' indicates negative association with the dependent variable (*EG*).

3.2. Method

The empirical model of this study is based on endogenous growth theory that provides insights of the role of productivity in economic growth. This is a long-run economic growth where the rate is determined by the forces internal to the economic system and influenced by economic factors. Influenced by [19,40,53] this study has employed an econometric model which can be represented as follows:

$$EG = f(IE, Y, GE, UN, MS, EF) \quad (1)$$

Equation (1) implies that Economic growth rate (*EG*) is a function of Informal employment (*IE*), per capita income (*Y*), Government expenditure (*GE*), unemployment rate (*UN*), money supply growth (*MS*) and economic freedom (*EF*). To be more specific this equation can be written as,

$$EG_{i,t} = \alpha_0 + \beta_1 IE_{i,t} + \beta_2 Y_{i,t} + \beta_3 GE_{i,t} + \beta_4 UN_{i,t} + \beta_5 MS_{i,t} + \beta_6 EF_{i,t} + \varepsilon_{i,t} \quad (2)$$

Here $EG_{i,t}$ is the GDP growth rate for country i in period t and is the variable of interest. $IE_{i,t}$ is the main explanatory variable in this model, which represents the percentage of total employment in the informal sector in country i for the year t . The other important variables that can affect economic growth are also considered in this study as control variables, where $Y_{i,t}$ represents the per capita income and captures the effect of the demographic transition on the economic growth of developing countries [54]; it also reflects the possible link between growth and informality [55]. Following [56] this is used as a proxy of institutional quality in the model. $GE_{i,t}$ represents Gross National Expenditure expressed as a percentage of annual GDP and examined the fact whether higher national expenditure stimulates aggregate demand and economic activities, $UN_{i,t}$ represents the rate of unemployment in the economy, which is measured in percentages, and examines the expectation that a higher unemployment rate reduces economic growth. $MS_{i,t}$ refers to money supply growth rate as a percentage of GDP and is added to the model due to the role of monetary policy to economic growth and stability. $EF_{i,t}$ represents the overall Economic Freedom Index of countries that combines all 12 economic freedom indices and provides a comprehensive set

of facts for understanding the principles of economic growth and prosperity. The Index of Economic Freedom helps to track the advancement of a country in terms of economic freedom, prosperity, and opportunity over the period [52]. Based on earlier literature, this study aims to test the hypothesis (H1) that informal employment contributes to the economic growth of developing countries [10,12,50]. Therefore, the expected sign for the coefficient of informal employment is positive, while the expected signs for the other variables in relation to economic growth are also positive, except for unemployment.

3.3. Econometric Approaches

3.3.1. Cross-Section Dependence

The panel data set used in this study has considered a number of countries that can be integrated in many ways in a globalized world. Ignorance of the cross-section's dependence may lead to unreliable regression results. Therefore, the first task should be to check the statistical dependence among the cross-sections of the selected developing countries. Here the null hypothesis $H_0 : Cov(\varepsilon_{it}, \varepsilon_{jt}) = 0$, which implies that there is no dependency among the cross-section is tested against the alternative hypothesis $H_1 : Cov(\varepsilon_{it}, \varepsilon_{jt}) \neq 0$ implying dependence in at least one pair of cross-sections. In a data context where N is sufficiently large and T is relatively small, the Lagrange multiplier statistics for the cross-section developed by [57] is more suitable, and it is presented in Appendix A.1.

In the case where population-wise correlations are zero, the CD test may suffer from a lack of power. Therefore [58] suggested a bias-adjusted test, the Bias-adjusted LM test, which is also presented in Appendix A.1.

This study has checked both tests for investigating the cross-section dependence in the data.

3.3.2. Panel Unit Root Test

The second step in the econometric methodology is to check the stationarity of the variables. Among the available panel unit root technologies, the common unit root test Levin-Lin-Chu (LLC) [59] as well as the individual root tests of Im-Pesaran-Shin (IPS) [60], Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) Fisher test have been checked [61]. The details of all these tests are presented in Appendix A.2.

3.3.3. Panel Co-Integration Test

When it is confirmed that the selected variables are stationary at first difference i.e., $I(1)$, the study is permitted to proceed with the estimation of the long-run relationship among the variables. This study has employed Pedroni (1999) and Kao (1999) panel co-integration test to confirm the long run cointegration in the data [62]. After being confirmed the co-integration, the study has moved to estimate the long-run co-integrating vector using panel Fully Modified Ordinary Least Square (FMOLS) and panel Dynamic Ordinary Least Square (DOLS); these two methods are capable of avoiding bias estimate of small sample size arising in the application of OLS [63]; these methods are advantageous in accommodation of substantial heterogeneity across individual members of the panel. The other advantages of applying these co-integrated panel approaches are that they permit the short-run dynamics to be heterogeneous among the members of the panel and allow for the pooling of the long-run information restrained in the panel [64]. The serial correlation effect and endogeneity issues in the regression arising from the presence of a cointegrating relationship are accounted by FMOLS estimation that can also adjust least squares [65] while DOLS estimation provides better estimate result for small sample sizes [66].

However, in the pooled OLS regression analysis the cross-section and time series natures of the data set may ignore [67]. Since observations are pooled together, they cannot represent the heterogeneity or individuality of the individual variable [68]. All time invariant differences between individuals are controlled by fixed effects and therefore, a dynamic fixed effect model has been estimated in this study to capture the process of adaptation in economic growth during the period with a heterogeneous coefficient of

lagged dependent variable. The estimated coefficients of the Dynamic Fixed Effect (DFE) model tend to be unbiased due to their omitted time-invariant characteristics such as culture, religion, race, and gender [68,69].

3.3.4. Panel Granger Causality Test

This study investigates the causal relationship when the variables are found to be co-integrated. Engel Granger co-integration test that involves Vector Error Correction mechanism (VECM) is analyzed to find the short-run and long-run causal relationship. The Granger causality method, including the error correction term (ECT), is presented in Appendix A.3.

The optimal lag length is decided by Akaika Information Criteria (AIC).

4. Empirical Results and Discussion

At the beginning of the empirical result, descriptive statistics should be reported that will help in getting an overview of the dataset. The summary statistics of the data along with the correlation matrix, is presented below in Table 2.

Table 2. The summary and correlation coefficient between the variables.

	EG	Y	GE	IE	UN	MS	EF
Mean	3.551328	11303.57	107.5252	58.39694	11.17639	9.995592	60.58444
Median	3.214020	11886.73	106.1551	62.00000	7.150000	9.401226	61.50000
Maximum	17.29078	20296.82	131.8372	96.10000	43.30000	37.02960	71.70000
Minimum	−3.545763	1995.158	90.61637	12.40000	1.000000	−20.01024	42.30000
Std. Dev.	2.593877	4171.584	8.460830	21.58810	8.896780	6.559260	6.616078
Skewness	1.038185	−0.412887	0.546829	−0.336231	1.087047	0.115851	−0.434794
Kurtosis	7.416612	2.802238	2.446391	2.186718	3.185076	6.291390	2.389349
Observations	180	180	180	180	180	180	180
Correlation	EG	Y	GE	IE	UN	MS	EF
EG	1						
Y	−0.2237	1					
GE	0.0665	−0.1277	1				
IE	0.3021	−0.7939	−0.1635	1			
UN	−0.2068	0.3888	0.4532	−0.7384	1		
MS	0.4393	−0.2479	−0.1661	0.2128	−0.2354	1	
EF	−0.0090	0.4282	0.2819	−0.3313	0.3246	−0.1701	1

The dataset that has been considered is a short panel and the number of cross-sections (N) is larger than the number of years (T). Since $N > T$, the Pesaran CD and Bias-corrected scaled LM test result will be suitable to determine the cross-section dependence in the data set [57,58]. The non-rejection of the null hypothesis on the basis of p-values of both the Pesaran CD test and the Bias-corrected scaled LM test are sufficient to infer that there is no cross-section dependence in the data. The result of the cross-section dependence test is presented in Table 3.

To prevent any spurious regression, result this study has checked for unit root. Since there is no evidence of cross-section dependence in the data this study has applied all the first-generation unit root tests and the results are presented in Table 4.

Table 3. The results of the Cross-section Dependence Test.

Null: No Cross-Section Dependence (Correlation) in Residuals			
Test	Statistic	d.f.	Prob
Breusch-Pagan LM	242.14	190	0.01
Pesaran scaled LM	2.67		0.01
Bias-corrected scaled LM	1.42		0.15
Pesaran CD	−0.21		0.83

Decision: Null can't be rejected as per Pesaran CD and Bias-corrected scaled LM test

Table 4. The results of Unit root tests.

Variables	Levin, Lin & Chu Test (Common Unit Root)		Im, Pesaran & Shin (Individual Unit Root)		ADF Fisher Chi Square (Individual Unit Root)		PP Fisher Chi Square (Individual Unit Root)	
	Ind. Effect	Ind. Effect & Linear Trend	Ind. Effect	Ind. Effect & Linear Trend	Ind. Effect	Ind. Effect & Linear Trend	Ind. Effect	Ind. Effect & Linear Trend
EG	8.05 *** (0.00)	−8.04 *** (0.00)	−2.42 *** (0.01)	0.09 (0.53)	69.22 *** (0.00)	41.72 (0.39)	71.19 *** (0.00)	58.77 *** (0.00)
ΔEG	−14.54 *** (0.00)	−18.71 *** (0.00)	−5.48 *** (0.00)	−1.97 ** (0.02)	111.56 *** (0.00)	85.57 *** (0.00)	138.11 *** (0.00)	139.82 *** (0.00)
IE	−5.00 *** (0.00)	−14.77 *** (0.00)	−1.22 (0.11)	−0.69 (0.24)	61.10 ** (0.02)	55.86 ** (0.05)	62.97 *** (0.00)	57.00 ** (0.04)
ΔIE	−9.42 *** (0.00)	−11.05 *** (0.00)	−3.29 *** (0.00)	−0.73 (0.23)	80.14 *** (0.00)	58.99 ** (0.03)	112.00 *** (0.00)	108.69 *** (0.00)
Y	14.20 (1.00)	−5.45 *** (0.00)	7.55 (1.00)	−0.54 (0.29)	27.33 (0.94)	70.09 *** (0.00)	51.62 (0.1)	79.87 *** (0.00)
ΔY	−5.41 *** (0.00)	−8.66 *** (0.00)	−1.79 ** (0.04)	−0.22 (0.41)	67.89 *** (0.00)	47.53 (0.19)	69.60 *** (0.00)	99.71 *** (0.00)
GE	−5.80 *** (0.00)	−8.26 *** (0.00)	−1.82 ** (0.04)	−0.75 (0.22)	60.57 ** (0.02)	61.30 ** (0.02)	55.32 ** (0.05)	53.58 * (0.07)
ΔGE	−10.68 *** (0.00)	−12.92 *** (0.00)	−4.72 *** (0.00)	−1.04 (0.15)	101.29 *** (0.00)	69.88 *** (0.00)	103.15 *** (0.00)	129.86 *** (0.00)
UN	−4.26 *** (0.00)	−18.15 *** (0.00)	−1.34 * (0.09)	−1.72 ** (0.04)	73.72 *** (0.00)	73.68 *** (0.00)	64.05 *** (0.01)	48.79 (0.16)
ΔUN	−22.97 *** (0.00)	−11.99 *** (0.00)	−6.33 *** (0.00)	−1.01 (0.15)	112.71 *** (0.00)	67.75 *** (0.00)	94.46 *** (0.00)	130.31 *** (0.00)
MS	−8.37 *** (0.00)	−10.55 *** (0.00)	−2.71 *** (0.00)	−1.85 ** (0.03)	73.44 *** (0.00)	81.23 *** (0.00)	85.52 *** (0.00)	146.91 (0.00)
ΔMS	−14.58 *** (0.00)	−19.41 *** (0.00)	−8.03 *** (0.00)	−3.33 *** (0.00)	148.56 *** (0.00)	116.98 *** (0.00)	238.83 *** (0.00)	208.14 *** (0.00)
EF	−1.21 (0.11)	−6.64 *** (0.00)	0.77 (0.78)	−0.61 (0.27)	32.62 (0.79)	55.35 ** (0.05)	32.35 (0.79)	93.52 *** (0.00)
ΔEF	−10.78 *** (0.00)	−11.18 *** (0.00)	−5.50 *** (0.00)	−0.79 (0.21)	113.86 *** (0.00)	59.24 *** (0.00)	147.93 ** (0.02)	108.08 *** (0.00)

Note: ***, ** and * indicate the significance level, where. *** ≤ 0.01, ** ≤ 0.05, * ≤ 0.10. *p*-values are presented in the parenthesis.

Table 4 shows that almost all the variables have a common unit root both at their level and first difference according to Levin, Lin & Chu's test for both the individual effect model and the individual effect with trend model. The results of three individual unit root tests (Im, Pesaran and Shin, ADF-Fisher Chi square, and PP Fisher Chi square) have projected the variables as stationary at their first difference in both the individual effect model and the individual effect with trend model. Only a few variables are found stationary at their first differences either in the individual effect model or in the individual effect with the

trend model. The stationary of the data at their first difference prevents the spurious results of the regression analysis.

In the next step this study has moved to check the cointegrating relationship among the variables to find the evidence for long-run relationship. Both [70,71] cointegration test have been employed and the results are presented in Table 5.

Table 5. The result of co-integration tests.

Pedroni Test for Co-Integration		
	Statistic	p-Value
Modified Phillips-Perron t	7.7374	0.0000
Phillips-Perron t	−16.1279	0.0000
Augmented Dickey-Fuller t	−10.5762	0.0000
Kao test for co-integration		
Modified Dickey-Fuller t	−3.0892	0.0010
Dickey-Fuller t	−5.6972	0.0000
Augmented Dickey-Fuller t	−3.7840	0.0001
Unadjusted Modified Dickey-Fuller t	−4.4618	0.0000
Unadjusted Dickey-Fuller t	−6.2325	0.0000

The results from Table 5 imply that the variables considered in the model are co integrated and the model can be used for cointegration regression to find the long-run coefficient values of the regressors.

Table 6 presents the results of empirical estimations based on the FMOLS, DOLS and DFE along with the diagnostic test outcomes. The estimation results of three applied models present similar empirical findings. The detailed result of the estimated models guarantee a positive effect of informal employment on economic growth that satisfies the main hypothesis (H1) of this study; these results are similar to the findings of [72] for the developing countries of South Asia, for emerging countries (Pakistan) by [4,73] since informal employment is considered as a representative of the informal sector in this study. The estimated coefficients of per capita income (Y), Gross national expenditure (GE), Money supply growth (MS) and economic freedom of countries (EF) are also found to be statistically significant with their expected signs. This result satisfies the hypotheses H2, H3, H5 and H6, implying that all these indicators contribute positively to the economic growth of these countries. Hypothesis H3 for the unemployment rate (UN) has been satisfied with an altered sign implying that an increase in the unemployment rate (UN) contributes positively to economic growth. Although this result has opposed the expected outcome of this study, it provides evidence to the contribution of informal sector employment to economic growth since there is no necessity to have a trade-off between informality and unemployment, according to [1]. The Adjusted R squared values indicate that these models are able to explain a significant percentage of the variance of economic growth. The probability value of the F statistic also indicates the validity of the Dynamic Fixed Effect (DFE) model.

This study utilizes the panel Granger causality based on Vector Error Correction Model (VECM) where the directional causal associations among the variables are analyzed. The Granger causality test results are presented in Table 7. The long-run causal relationship is established by the significance of the t-statistic for the ECT coefficient while the short-run causal link is confirmed by the significance of the F-statistic of the lagged variables.

Table 6. The results of FMOLS, DOLS and DFE.

Variables	Regression Model					
	FMOLS		DOLS		DFE	
	Estimate	S.E	Estimate	S.E	Estimate	S.E
<i>EG</i> (−1)	-	-	-	-	0.2735 *** (3.6867)	0.0742
<i>IE</i>	0.1640 *** (3.0588)	0.0536	0.1364 *** (2.5275)	0.0539	0.0874 * (1.6571)	0.0527
<i>Y</i>	0.0007 *** (3.4456)	0.0002	0.0006 *** (3.3600)	0.0002	0.0006 *** (3.1999)	0.0002
<i>GE</i>	0.1074 *** (2.6952)	0.0398	0.1358 *** (3.4307)	0.0395	0.0707 * (1.7131)	0.0412
<i>UN</i>	0.1298 *** (2.9156)	0.0503	0.0798 ** (2.3722)	0.0547	0.1612 *** (3.2919)	0.0489
<i>MS</i>	0.1482 *** (5.4675)	0.0271	0.1347 *** (4.7735)	0.0282	0.0892 *** (3.3791)	0.0264
<i>EF</i>	0.2885 *** (3.1884)	0.0905	0.2174 ** (2.3876)	0.0911	0.1589 * (1.7758)	0.0895
<i>C</i>	-	-	-	-	−29.5814	0.0004
Diagnostic Test Results						
R squared	0.5848		0.6064		0.6475	
Adjusted R squared	0.5073		0.5425		0.5785	
S.E of regression	1.7084		1.7544		1.5801	
Long run variance	2.2425		3.0045		F-statistic: 9.3947 (0.00)	
Mean dep var	3.4088		3.5513		Durbin-Watson stat: 2.2162	

Note: ***, ** and * indicate the significance level, where. *** \leq 0.01, ** \leq 0.05, * \leq 0.10. The *t* values are presented in the parenthesis.

Table 7. The results of the Granger causality test.

Dependent Variable	Short Run						Long Run	
	Independent Variables							
	ΔEG	ΔY	ΔGE	ΔIE	ΔUN	ΔMS		ΔEF
ΔEG	-	3.9692 ** (0.0211)	2.3744 * (0.0969)	3.2701 ** (0.0410)	2.6190 * (0.0766)	0.3202 (0.7265)	0.2218 (0.7265)	−0.2353 *** (0.0011)
ΔY	3.4614 ** (0.0342)	-	2.3178 (0.1024)	5.0114 *** (0.0080)	1.2021 (0.3038)	1.0286 (0.3603)	1.7164 (0.1836)	−22.7928 *** (0.0103)
ΔGE	3.9901 ** (0.0207)	2.8465 * (0.0615)	-	0.7968 (0.4529)	4.4284 ** (0.0137)	0.7363 (0.4808)	1.0834 (0.3414)	−0.3135 *** (0.0064)
ΔIE	3.0350 ** (0.0514)	1.3509 (0.2625)	3.3135 ** (0.0394)	-	1.4778 (0.2318)	0.1972 (0.8211)	2.4063 * (0.0940)	0.2786 (0.0106)
ΔUN	0.0405 (0.9603)	1.6626 (0.1935)	0.0852 (0.9184)	0.1401 (0.8694)	-	0.1329 (0.8757)	2.0942 (0.1271)	−0.1553 (0.2696)
ΔMS	4.1952 ** (0.0171)	2.0245 (0.1360)	1.2838 (0.2803)	2.9740 ** (0.0545)	0.6479 (0.5247)	-	0.8710 (0.4209)	1.1641 (0.0000)
ΔEF	0.0173 (0.9828)	0.5794 (0.5616)	0.0342 (0.9664)	0.5173 (0.5971)	0.1456 (0.8646)	0.2217 (0.8014)	-	−0.0721 (0.2126)

Note: ***, ** and * indicate rejection of null at 1%, 5% and 10% significance levels, respectively. *p*-values are presented in the parenthesis.

The results of the Granger causality reveal a bi-directional causal association between economic growth and informal employment, economic growth and GDP per capita, and economic growth and gross national expenditure both in the short run and long run. This finding is similar to the result of [4] for Pakistan and opposite to the findings to [17] for Spain. One-way causal link moves from GDP per capita to informal employment, from informal employment to gross national expenditure, from money supply growth to economic growth and from gross national expenditure to unemployment rate both in the short run and long run. In the short run unidirectional causality runs from money supply growth to the informal sector.

5. Conclusions

The informal sector has all the potential to contribute to employment generation. Hence, this study has investigated the contribution of informal employment to the growth of developing countries. The ultimate aim of this study is to facilitate policy measures in achieving SDG with avoidance of any undesirable socio-economic consequences by confirming the contribution of informal employment in economic growth. Panel data analysis techniques have been applied, considering the percentage of employment in the informal sector as the core independent variable. Some macroeconomic indicators that usually reflect the level of economic development and the economic performance of countries are used to control the effect of other factors in the model. Empirical analysis has been conducted based on the availability of data for the countries spanning from 2011–2019. Long-run models FMOLS, DOLS, and DFE have been applied and the results have established the hypothesis that informal employment is a significant contributor to the economic growth of developing countries. The other macroeconomic variables incorporated in the model as control factors, per capita income, national expenditure, money supply growth and economic freedom of countries also contribute positively to economic growth, while the result of the unemployment rate indirectly justifies the contribution of informal employment to growth. A two-way causal relationship has also been established between informal employment and economic growth and vice-versa and one-way causal links have been found to run from per capita income to informal employment and from informal employment to the gross national expenditure of the countries for both the short-run and long-run. A short-run causal link has also been established from money supply to informal employment. These results provide evidence of the interdependent existence of the informal sector with the formal sector in terms of employment arrangements. The empirical findings of this study support the notion by [10,20,34] for a new paradigm of a hybrid economy that will assess and incorporate the informal sector in conjunction with other formal sectors through the pathway of informal employment.

The empirical evidence presented herein indicates that informality should be considered a good candidate for policy analysis in developing countries [1]. The present context has become more prone to this since the informal sector is expanding further in new economic restructuring induced by the COVID-19 pandemic [74]. Both the informal economy and informal employment need to be recognized in terms of their contribution to the economy and should be allowed to integrate accordingly to economic planning and legal structure. Measures should be taken to facilitate decent work and congenial employment conditions for informal workers so that the productivity of informal enterprises and workers can be enhanced and extraction of the employment effects of economic growth can be made possible. Extended social protection, expansion of health and safety protection, and availability of legal services for workers working in the informal sector can be the immediate policy approach. The informal workforce needs to be disaggregated by their risk status and should be addressed accordingly in policy prescription. As argued by [75], a distinction should also be made between the marginalized or survivalist informal sector and the productive informal sector, and should be targeted accordingly in policy measures to extract the benefit of informal employment on growth. Policies should be reviewed in terms of their impact on the informal sector because inappropriate policies

will drive informality in a way that may lead to a lack of development in socio-economic life, health, and environmental quality. Macroeconomic instruments can also be applied in the policy framing that aims to a gradual formalization of the informal enterprises as targeted in SDG 8. Efforts should be on to improve the attractiveness of the formal sector rather than taking immediate initiatives on eliminating the informal sector. The two-way causal relationship between informality and economic growth, which is revealed by this study indicates that they reinforce each other. Thus, any direct measure to penalize the informal sector will discourage growth and shut down the escape mechanism of the poor and unemployed in a rigid regulatory environment that hinders the process of economic inclusion. Therefore, considering the role of informal employment on economic growth policymakers should work to diminish the role of informality gradually without losing its benefit and facilitate the countries to strongly uphold the decent work, productive activities, entrepreneurship, and formalization issues of the informal sector for the achievement of United Nations' 30 agenda on Sustainable development.

Author Contributions: Conceptualization, N.S. and M.M.R.; methodology N.S.; software, N.S.; Validation, M.M.R. and N.S.; formal analysis, N.S.; investigation, N.S. and M.M.R.; resources, N.S.; data curation, N.S. writing-original draft preparation: N.S.; writing-review an editing, M.M.R. and R.K. visualization, N.S. and M.M.R., supervision: M.M.R. and R.K. All authors have read and agreed to the published version of the manuscript.

Funding: No funding is available for this study.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Data will be available on request under special consequences.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Appendix A.1. Cross Sectional Dependence Test

Pesaran CD test:

$$CD = \sqrt{\frac{2T}{N(N-1)}} \left(\sum_{i=1}^{N-1} \sum_{j=i+1}^N \hat{\rho}_{ij} \right) \implies N(0,1) \quad (A1)$$

where, $\hat{\rho}_{ij}$ represents the simple estimate of the pair wise correlation of the residuals (Pesaran 2020, 2021).

The Bias-adjusted LM test:

$$LM(\rho)_{adj} = \sqrt{\frac{2}{N(N-1)}} \sum_{i=1}^{N-1} \sum_{j=i+1}^N \hat{\rho}_{ij} \frac{(T-k)\hat{\rho}_{ij}^2 - \mu_{Tij}}{\sqrt{v_{tij}^2}} \implies N(0,1) \quad (A2)$$

Here, k is the number of regressors, μ_{Tij} is the exact mean and v_{tij}^2 is the variance of $(T-k)\hat{\rho}_{ij}^2$ (Pesaran et al. 2008).

Appendix A.2. Unit Root Tests

Assuming homogeneity of the coefficients of the lagged dependent variables across the cross sections, the Levin-Lin-Chu (LLC) test is based on the following equation:

$$\Delta y_{i,t} = a_i + \rho y_{i,t-1} + \sum_{j=1}^{\rho_i} \theta_{i,j} \Delta y_{i,t-1} + \varepsilon_{i,t} \quad (A3)$$

where, $i = 1, 2, \dots, N$, $t = 1, 2, \dots, T$, $\varepsilon_{i,t}$ are *iid* $(0, \sigma_\varepsilon^2)$ across the unit root of the sample. In this model the null hypothesis $H_0 : \rho_i = 0$ is tested against the alternative $H_0 : \rho_i < 0$ for all, $i = 1, 2, \dots, N$ with the assumption about the individual effects under H_0 . Im, Pesaran and Shin (IPS) relax the homogeneity assumption about ρ and consider a linear trend model for each of the N cross-sections; it is based on the following equation:

$$\Delta y_{i,t} = a_i + \rho_i y_{i,t-1} + \sum_{j=1}^{\rho_i} \theta_{i,j} \Delta y_{i,t-1} + \varepsilon_{i,t} \quad (\text{A4})$$

In the IPS test, the null hypothesis of unit root $H_0 : \rho_i = 0$ for all i is tested against the alternative $H_0 : \rho_i < 0$ for all, $i = 1, 2, \dots, N_0$ and $\rho_i = 0$ for, $i = N_0 + 1, \dots, N$ with $0 < N_0 \leq N$. Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) Chi-square tests were proposed by Maddala and Wu (1999). Fisher's (1932) [76] suggestion of combining ρ_i values from the Augmented-Dickey Fuller (ADF) unit root test applied to cross-section unit i is the basis of these two tests. Assuming cross-section independence the statistic proposed by Maddala and Wu (1999) is defined as follows

$$P = -2 \sum_{i=1}^N \log(\rho_i) \quad (\text{A5})$$

For large N samples, Choi (2001) has proposed similar standardized statistics

$$Z = -\frac{\sum_{i=1}^N \log(\rho_i) + N}{\sqrt{N}} \quad (\text{A6})$$

In the ADF and PP unit root tests, both the asymptotic chi-square and the standard normal statistics are reported (Chapsa et al. 2018).

Appendix A.3. Panel Granger Causality Test

The Granger causality method can be represented as follows:

$$\begin{aligned} \Delta EG_{it} = & \alpha_{1i} + \sum_{p=1} \alpha_{11,ip} \Delta EG_{it-1} + \sum_{p=1} \alpha_{12,ip} \Delta Y_{it-1} + \sum_{p=1} \alpha_{13,ip} \Delta GE_{it-1} + \sum_{p=1} \alpha_{14,ip} \Delta IE_{it-1} + \sum_{p=1} \alpha_{15,ip} \Delta UN_{it-1} \\ & + \sum_{p=1} \alpha_{16,ip} \Delta MS_{it-1} + \sum_{p=1} \alpha_{17,ip} \Delta EF_{it-1} + \theta_{1i} ECT_{it-1} + \mu_{1,it} \end{aligned} \quad (\text{A7})$$

$$\begin{aligned} \Delta Y_{it} = & \alpha_{2i} + \sum_{p=1} \alpha_{21,ip} Y_{it-1} + \sum_{p=1} \alpha_{22,ip} \Delta EG_{it-1} + \sum_{p=1} \alpha_{23,ip} \Delta GE_{it-1} + \sum_{p=1} \alpha_{24,ip} \Delta IE_{it-1} + \sum_{p=1} \alpha_{25,ip} \Delta UN_{it-1} \\ & + \sum_{p=1} \alpha_{26,ip} \Delta MS_{it-1} + \sum_{p=1} \alpha_{27,ip} \Delta EF_{it-1} + \theta_{2i} ECT_{it-1} + \mu_{2,it} \end{aligned} \quad (\text{A8})$$

$$\begin{aligned} \Delta IE_{it} = & \alpha_{3i} + \sum_{p=1} \alpha_{31,ip} \Delta IS_{it-1} + \sum_{p=1} \alpha_{32,ip} \Delta EG_{it-1} + \sum_{p=1} \alpha_{33,ip} \Delta Y_{it-1} + \sum_{p=1} \alpha_{34,ip} \Delta GE_{it-1} + \sum_{p=1} \alpha_{35,ip} \Delta UN_{it-1} \\ & + \sum_{p=1} \alpha_{36,ip} \Delta MS_{it-1} + \sum_{p=1} \alpha_{37,ip} \Delta EF_{it-1} + \theta_{3i} ECT_{it-1} + \mu_{3,it} \end{aligned} \quad (\text{A9})$$

$$\begin{aligned} \Delta UN_{it} = & \alpha_{4i} + \sum_p \alpha_{41,ip} \Delta UN_{it-p} + \sum_p \alpha_{42,ip} \Delta EG_{it-p} + \sum_p \alpha_{43,ip} \Delta Y_{it-1} + \sum_p \alpha_{44,ip} \Delta GE_{it-p} + \sum_p \alpha_{45,ip} \Delta IE_{it-p} \\ & + \sum_p \alpha_{46,ip} \Delta MS_{it-p} + \sum_p \alpha_{47,ip} \Delta EF_{it-p} + \theta_{4i} ECT_{it-1} + \mu_{4,it} \end{aligned} \quad (\text{A10})$$

$$\begin{aligned} \Delta MS_{it} = & \alpha_{5i} + \sum_p \alpha_{51,ip} \Delta MS_{it-p} + \sum_p \alpha_{52,ip} \Delta EG_{it-p} + \sum_p \alpha_{53,ip} \Delta Y_{it-p} + \sum_p \alpha_{54,ip} \Delta GE_{it-p} + \sum_{p=1} \alpha_{55,ip} \Delta IE_{it-p} \\ & + \sum_p \alpha_{56,ip} \Delta UN_{it-p} + \sum_p \alpha_{57,ip} \Delta EF_{it-p} + \theta_{5i} ECT_{it-1} + \mu_{5,it} \end{aligned} \quad (\text{A11})$$

$$\begin{aligned} \Delta EF_{it} = & \alpha_{6i} + \sum_{p=1} \alpha_{61,ip} \Delta EF_{it-1} + \sum_{p=1} \alpha_{62,ip} \Delta EG_{it-1} + \sum_{p=1} \alpha_{63,ip} \Delta Y_{it-1} + \sum_{p=1} \alpha_{64,ip} \Delta GE_{it-1} + \sum_{p=1} \alpha_{65,ip} \Delta IE_{it-1} \\ & + \sum_{p=1} \alpha_{66,ip} \Delta UN_{it-1} + \sum_{p=1} \alpha_{67,ip} \Delta MS_{it-1} + \theta_{6i} ECT_{it-1} + \mu_{6,it} \end{aligned} \quad (\text{A12})$$

$$\begin{aligned} \Delta GE_{it} = & \alpha_{7i} + \sum_{p=1} \alpha_{71,ip} \Delta GE_{it-1} + \sum_{p=1} \alpha_{72,ip} \Delta EG_{it-1} + \sum_{p=1} \alpha_{73,ip} \Delta Y_{it-1} + \sum_{p=1} \alpha_{74,ip} \Delta IE_{it-1} + \sum_{p=1} \alpha_{75,ip} \Delta UN_{it-1} \\ & + \sum_{p=1} \alpha_{76,ip} \Delta MS_{it-1} + \sum_{p=1} \alpha_{77,ip} \Delta EF_{it-1} + \theta_{7i} ECT_{it-1} + \mu_{7,it} \end{aligned} \quad (\text{A13})$$

Here, Δ refers to first difference operator, p refers to lag length, θ refers to coefficient of error correction term (ECT) and μ refers to random disturbance term.

Table A1. A brief summary of recent literature related to the topic is presented in the table below.

Author	Studied Area	Variable	Findings
Duarte, P. (1917) [16]	Spain	GDP, currency, energy, informality	GDP and informal economy has no causal relation.
Alberola, E. and Urrutia, C. (2020) [77]	Mexico	Labor, informality rate, employment rate, unemployment rate	Informality mitigates inflation volatility for various types of shocks and makes monetary policy less effective.
Khuong, N.V. et al. (2020) [4]	Pakistan	GDP, GNP, inflation rate, growth rate of real GDP, foreign currency accounts, demand deposits, currency in circulation, money supply, banking services and total tax revenues.	Informal sector contributes significantly to GDP. The growth rate of real GDP causes GDP.
Ozgun, G. et al. (2021)	160 economies	Informal economy as percentage of GDP, indicators related to health, economy, environment, education, and social variables.	The size of the informal sector is negatively associated to GDP per capita. The effect of larger informal sector size is stronger in less developed economies.
Pham, T.H.H (2017) [78]	Developing countries	Informality, economic and non-economic indicators of globalization	Trade integration, trade diversification and concentration, de facto and de jure financial openness, and social globalization significantly affect informality. The size of the informal sector in developing countries depends not only on some specific aspects of globalization but also on other macroeconomic aspects, i.e., economic growth, working-age population, government policies and regulation.
Elgin, C. and Birinchi, S. (2016) [19]	161 countries	GDP growth rate, Informal sector, GDP per capita, trade openness, government expenditure, inflation, fiscal deficit, financial depth, corruption control, and law and order, indices.	medium levels of the size of the informal economy are associated with higher levels of growth and small and large sizes of the informal economy are associated with little growth.
Yelwa, M. and Adam, A.J. (2017) [40]	Nigeria	official economy nominal GDP, informal economy nominal GDP, currency in circulation, demand deposit, ratio of currency in circulation to demand deposit, narrow money, informal economy as percentage of official economy	A commendable impact of informal sector economy on economic growth.
Lv, Z. (2020) [9]	96 countries	Informality, tourism, GDP per capita, Govt. size, unemployment, corruption, credit market regulation, labor market regulation	Tourism establishes a u-shaped relationship with informality
Gutierrez-Romero, R. (2021) [45]	138 countries	Informal sector, Gini index, instrumental variables	Past levels of inequality are salient feature to explain the size of informal sector.
Ruiz, M.E. et al. (2017) [24]	Chile	Employment profiles, self-rated health, socio-demographic variables (sec, age, educational level, occupation, economic activity)	Consistent relation between informal employment and self-rated physical and mental health.
Sultana, N. et al. (2022) [14]	50 developing countries	Sustainable development indices, informal sector (working poor), economic growth, national expenditure, economic freedom.	Informal sector plays a detrimental role to sustainable development of developing countries.

References

- Charlot, O.; Malherbet, F.; Terra, C. Informality in developing economies: Regulation and fiscal policies. *J. Econ. Dyn. Control* **2015**, *51*, 1–27. [[CrossRef](#)]
- Charmes, J. The Informal Economy Worldwide: Trends and Characteristics. *Margin* **2012**, *6*, 103–132. [[CrossRef](#)]
- Gerxhani, K. The Informal Sector in Developed and Less Developed Countries: A Literature Survey. *Pub. Choice* **2004**, *120*, 267–300. [[CrossRef](#)]
- Khuong, N.V.; Shabbir, M.S.; Sial, M.S.; Khanh, T.H.T. Does informal economy impede economic growth? Evidence from an emerging economy. *J. Sustain. Financ. Investig.* **2020**, *11*, 103–122. [[CrossRef](#)]
- La Porta, R.; Shleifer, A. Informality and Development. *J. Econ. Per.* **2014**, *28*, 109–126.
- Misati, R.N. The role of the informal sector in investment in Sub-Saharan Africa. *Int. Entrep. Manag. J.* **2010**, *6*, 221–230. [[CrossRef](#)]
- Ruzek, W. The informal economy as a catalyst for sustainability. *Sustainability* **2015**, *7*, 23–34. [[CrossRef](#)]

8. Smit, S.; Musango, J.K. Towards connecting green economy with informal economy in South Africa: A review and way forward. *Ecol. Econ.* **2015**, *116*, 154–159. [[CrossRef](#)]
9. Lv, Z. Does tourism affect the informal sector? *Ann. Tour. Res.* **2020**, *80*, 102816. [[CrossRef](#)]
10. Ghose, A.K. Informality and Development. *J. Lab. Econ.* **2017**, *60*, 109–126. [[CrossRef](#)]
11. Chen, M.A. The Informal Economy: Definitions, Theories and Policies. Women in Informal Employment Globalizing and Organizing, Working Paper No 1. 2012. Available online: https://www.wiego.org/sites/default/files/publications/files/Chen_WIEGO_WP1.pdf (accessed on 31 March 2021).
12. Nordling, D. Growth and Informal Economy: A Study on the Effect of Growth on the Relative Size of the Informal Economy in the Developing World. Working Paper. 2017. Available online: <http://lup.lub.lu.se/student-papers/record/8906207> (accessed on 12 February 2021).
13. Heintz, J.; Pollin, R. *Informalization, Economic Growth and the Challenge of Creating Viable Labor Standards in Developing Countries*; PERI Working Paper 60; Elsevier: Amsterdam, The Netherlands, 2003; pp. 2–22. Available online: <https://ssrn.com/abstract=427683> (accessed on 18 February 2021).
14. Sultana, N.; Rahman, M.M.; Khanam, R. The effect of the informl sector on sustainable developemnt: Evidence from developing countries. *Bus. Strat. Dev.* **2022**, *2*, 1–15. [[CrossRef](#)]
15. Todaro, M.P.; Smith, S.C. *Development Economics*, 10th ed.; Pearson Education Limited: Harlow, UK, 2009.
16. Briassoulis, H. Sustainable development and the informal sector: An uneasy relationship? *J. Environ. Dev.* **1999**, *8*, 213–237. [[CrossRef](#)]
17. Duarte, P. The relationship between GDP and the size of the informal economy: Empirical evidence for Spain. *Empir. Econ.* **2017**, *52*, 1409–1421. [[CrossRef](#)]
18. Goel, R.K.; Nelson, M.A. Shining a light on the shadows: Identifying robust determinants of the shadow economy. *Econ. Model.* **2016**, *58*, 351–364. [[CrossRef](#)]
19. Elgin, C.; Birinci, S. Growth and Informality: A Comprehensive Panel Data Analysis. *J. Appl. Econ.* **2016**, *19*, 271–292. [[CrossRef](#)]
20. Chen, M.A. The informal economy: Recent trends, future directions. *New Solut.* **2016**, *26*, 155–172. [[CrossRef](#)]
21. Shahen, M.E.; Kotani, K.; Kakinaka, M.; Managi, S. Wage and labor mobility between public, formal private and informal private sectors in a developing country. *Econ. Anal. Policy* **2020**, *68*, 101–113. [[CrossRef](#)]
22. Bargain, O. The Informal Sector Wage Gap: New Evidence Using Quantile Estimations on Panel Data. *Econ. Dev. Cult. Change* **2014**, *63*, 117–153. [[CrossRef](#)]
23. International Labour Organization. *Decent Work and the Sustainable Development Goals: A Guidebook on SDG Labour Market Indicators*; Department of Statistics (STATISTICS): Geneva, Switzerland, 2018.
24. Ruiz, M.E.; Vives, A.; Martínez-Solanas, È.; Julià, M.; Benach, J. How does informal employment impact population health? Lessons from the Chilean employment conditions survey. *Saf. Sci.* **2017**, *100*, 57–65. [[CrossRef](#)]
25. López-Ruiz, M.; Artazcoz, L.; Martínez, J.M.; Rojas, M.; Benavides, F.G. Informal employment and health status in Central America Health behavior, health promotion and society. *BMC Public Health* **2015**, *15*, 698. [[CrossRef](#)]
26. Albertini, J.; Fairise, X.; Terriau, A. Health, wealth, and informality over the life cycle. *J. Econ. Dyn. Control* **2021**, *129*, 104170. [[CrossRef](#)]
27. Loayza, N.V.; Rigolini, J. Informal Employment: Safety Net or Growth Engine? *World Dev.* **2011**, *39*, 1503–1515. [[CrossRef](#)]
28. Rai, S.M.; Brown, B.D.; Ruwanpura, K.N. SDG 8: Decent work and economic growth—A gendered analysis. *World Dev.* **2019**, *113*, 368–380. [[CrossRef](#)]
29. Loayza, N.V.; Rigolini, J. *Informality Trends and Cycles*; World Bank Group: Washington, DC, USA, 2006. [[CrossRef](#)]
30. International Labour Organization. Decent Workers Convension 2011. Available online: <https://www.ilo.org/dyn/normlex/en/f?p=NORMLEXPUB> (accessed on 18 February 2021).
31. Arvin, M.B.; Pradhan, R.P.; Nair, M.S. Are there links between institutional quality, government expenditure, tax revenue and economic growth: Evidence from low-income and lower middle-income countries. *Econ. Anal. Policy* **2021**, *70*, 468–489. [[CrossRef](#)]
32. Loayza, N.V. Informality in the Process of Development and Growth. *World Econ.* **2016**, *39*, 1856–1916. [[CrossRef](#)]
33. Kucera, D.; Roncolato, L. Informal employment: Two contested policu issues. *Int. Labor Rev.* **2008**, *147*, 321–348. [[CrossRef](#)]
34. Pratap, S.; Quintin, E. *The Informal Sector in Developing Countries: Output, Assets and Employment*; WIDER Working Paper Series 2006/130; The United Nations University World Institute for Development Economics Research (UNU-WIDER): Helsinki, Finland, 2006. Available online: <http://hdl.handle.net/10419/63326> (accessed on 12 February 2021).
35. Kay, D.D. *The Relationship between Formal and Informal Employment in South Africa*; University of Illinois at Urbana-Champaign: Urbana, IL, USA, 2011.
36. Maloney, W.F. Does Informality Imply Segmentation in Urban Labor Markets? Evidence from Sectoral Transitions in Mexico. *World Bank Econ. Rev.* **1999**, *13*, 275–302. [[CrossRef](#)]
37. Portes, A.; Castells, M.; Benton, L.A. (Eds.) The policy implications of informality. In *The Informal Economy: Studies in Advanced and Less Developed Countries*; The Johns Hopkins University Press: Baltimore, ML, USA, 1989; pp. 298–311.
38. Arvin-Rad, H.; Basu, A.K.; Willumsen, M. Economic reform, informal-formal sector linkages and intervention in the informal sector in developing countries: A paradox. *Int. Rev. Econ. Financ.* **2010**, *19*, 662–670. [[CrossRef](#)]
39. D’Erasmus, P.N.; Moscoso Boedo, H.J. Financial structure, informality and development. *J. Monet. Econ.* **2012**, *59*, 286–302. [[CrossRef](#)]

40. Yelwa, M.; Adam, A.J. Informality and Economic Growth in Nigeria: 1080–2014. *J. Econ. Pub. Financ.* **2017**, *3*, 405–417. [CrossRef]
41. Maiti, D.; Bhattacharyya, C. Informality, enforcement and growth. *Econ. Model.* **2020**, *84*, 259–274. [CrossRef]
42. Meghir, C.; Narita, R.; Robin, J.M. Wages and informality in developing countries. *Am. Econ. Rev.* **2015**, *105*, 1509–1546. [CrossRef]
43. Senoret, A.; Ramirez, M.I.; Rehner, J. Employment and sustainability: The relationship between precarious work and spatial inequality in the neoliberal city. *World Dev.* **2022**, *53*, 105840. [CrossRef]
44. Bhattacharya, P.C. Informal sector, income inequality and economic development. *Econ. Model.* **2011**, *28*, 820–830. [CrossRef]
45. Gutierrez-Romero, R. Inequality, persistence of the informal economy and club convergence. *World Dev.* **2021**, *139*, 105211. [CrossRef]
46. Özgür, G.; Elgin, C.; Elveren, A.Y. Is informality a barrier to sustainable development? *Sus. Dev.* **2021**, *29*, 45–65. [CrossRef]
47. Dreher, A.; Schneider, F. Corruption and the shadow economy: An empirical analysis. *Pub. Choice* **2010**, *144*, 215–238. [CrossRef]
48. WDI. *World Dev. Indicators*; World Bank: Washington, DC, USA, 2021. Available online: <https://databank.worldbank.org/source/world-development-indicators> (accessed on 12 March 2021).
49. ILOSTAT. International Labour Organization 2021. Available online: <https://ilostat.ilo.org/data/> (accessed on 18 March 2021).
50. Chen, M.A. Rethinking the informal economy: Linkages with the formal economy and the formal regulatory environment. In *Linking the Formal and Informal Economy: Concepts and Policies*; Oxford University Press: Oxford, UK, 2006; Volume 46. [CrossRef]
51. Gillanders, R.; Parviainen, S. Corruption and the shadow economy at the regional level. *Rev. Dev. Econ.* **2018**, *22*, 1729–1743. [CrossRef]
52. Index of Economic Freedom 2021. Available online: <https://www.heritage.org/index/explore?view=by-region-country-year&u=637509928185688064#top> (accessed on 11 March 2021).
53. Nguyen, T.A.N.; Luong, T.T.H. Corruption, Shadow Economy and Economic Growth: Evidence from Emerging and Developing Asian Economies. *Mon. J. Econ.* **2020**, *16*, 85–94. [CrossRef]
54. Dao, M.Q. Population and Economic Growth in Developing Countries. *Int. J. Acad. Res. Bus. Soc. Sci.* **2012**, *2*, 6–17.
55. Rei, D.; Bhattacharya, M. *The Impact of Institutions and Policy on Informal Economy in Developing Countries An Econometric Exploration*; Working Paper No. 84; Policy Integration and Statistics Department International Labour Office: Geneva, Switzerland, 2008.
56. Friedman, E.; Johnson, S.; Kaufmann, D.; Zoido-Lobaton, P. Dodging the grabbing hand: The determinants of unofficial activity in 69 countries. *J. Pub. Econ.* **2000**, *76*, 459–493. [CrossRef]
57. Pesaran, M.H. General diagnostic tests for cross-sectional dependence in panels. *Empir. Econ.* **2020**, *60*, 13–50. [CrossRef]
58. Pesaran, M.H.; Ullah, A.; Yamagata, T. A bias-adjusted LM test of error cross-section independence. *Econom. J.* **2008**, *11*, 105–127. [CrossRef]
59. Levin, A.; Lin, C.F.; Chu, C.S.J. Unit root tests in panel data: Asymptotic and finite-sample properties. *J. Econom.* **2002**, *108*, 1–24. [CrossRef]
60. Im, K.S.; Pesaran, M.H.; Shin, Y. Testing for unit roots in heterogeneous panels. *J. Econom.* **2003**, *115*, 53–74. [CrossRef]
61. Chapsa, X.; Tabakis, N.; Athanaseas, A.L. Investigating the catching-up hypothesis using panel unit root tests: Evidence from the PIIGS. *Eur. Res. Stud. J.* **2018**, *21*, 250–271. [CrossRef]
62. Baltagi, B.H.; Feng, Q.; Kao, C. A Lagrange Multiplier test for cross-sectional dependence in a fixed effects panel data model. *J. Econom.* **2012**, *170*, 164–177. [CrossRef]
63. Phillips, P.C.B.; Moon, H.R. Linear Regression Limit Theory for Nonstationary Panel Data. *Econometrica* **1999**, *67*, 1057–1111. [CrossRef]
64. Pedroni, P. Fully Modified OLS for Heterogeneous Cointegrated Panels. In *Nonstationary Panels, Panel Cointegration, and Dynamic Panels*; Emerald Group Publishing Limited: Bingley, UK, 2001; pp. 93–130.
65. Phillips, P.C.B. Fully Modified Least Squares and Vector Autoregression. In *Cowles Foundation Discussion Paper 1047, Cowles Foundation for Research in Economics*; Yale University: New Haven, CT, USA, 1993.
66. Kasman, A.; Duman, Y.S. CO₂ emissions, economic growth, energy consumption, trade and urbanization in new EU member and candidate countries: A panel data analysis. *Econ. Model.* **2015**, *44*, 97–103. [CrossRef]
67. Hill, R.C.; Griffiths, W.E.; Lim, G.C. *Principles of Econometrics*, 5th ed.; John Wiley & Sons Inc.: Hoboken, NJ, USA, 2007.
68. Nwakuya, M.T.; Ijomah, A. Fixed Effect Versus Random Effects Modeling in a Panel Data Analysis; A Consideration of Economic and Political Indicators in Six African Countries. *Int. J. Stat. Appl.* **2017**, *7*, 275–279. [CrossRef]
69. Greene, W.H. *Econometric Analysis*; Prentice Hall: Hoboken, NJ, USA, 2008.
70. Pedroni, P. Critical values for cointegration tests in heterogeneous panels with multiple regressors. *Ox. Bull. Econ. Stat.* **1999**, *61*, 653–670. [CrossRef]
71. Kao, C. Spurious regression and residual-based tests for cointegration in panel data. *J. Econom.* **1999**, *90*, 1–44. [CrossRef]
72. Islam, T.; Alam, J. The Relationship between Informal Economy and GDP Growth: A Study on South-Asian Developing Countries. *Can. J. Bus. Inf. Stud.* **2019**, *1*, 1–9. [CrossRef]
73. Schneider, F. Shadow economies around the world: What do we really know? *Eur. J. Polit. Econ.* **2005**, *21*, 598–642. [CrossRef]
74. International Labour Organisation. *COVID-19 Crisis and the Informal Economy: Immediate Response and Policy Challenges*; ILO: Geneva, Switzerland, 2020; pp. 1–8. Available online: https://www.ilo.org/wcmsp5/groups/public/---ed_protect/---protrav/---travail/documents/briefingnote/wcms_743623.pdf (accessed on 25 February 2021).

75. Bhattacharya, S. *Informal Sector Dynamics and Its Role in the Capital Accumulation Process: The Contrasting Cases of India and South Africa*; University of Delhi: Delhi, India, 2007. Available online: www.policyinnovations.org/ideas/policy_library/data/informal_sector_dynamics/_res/id=sa_File1/PAPER.pdf (accessed on 2 February 2021).
76. Fisher, A.G.B. The New Zealand Economic Problem—A Review. *Econ. Rec.* **1932**, *8*, 74–87. [[CrossRef](#)]
77. Alberola, E.; Urrutia, C. Does informality facilitate inflation stability? *J. Dev. Econ.* **2020**, *146*, 102505. [[CrossRef](#)]
78. Pham, T.H.H. Impacts of globalization on the informal sector: Empirical evidence from developing countries. *Econ. Model.* **2017**, *62*, 207–218. [[CrossRef](#)]