Contribution of Agricultural Sector to GDP and Unemployment Rate in Bangladesh: A Cointegration Analysis

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Abstract

Agricultural sector is one of the vital economic sectors in Bangladesh but now a days its role in the national economy is declining at a rapid pace. Disregarding the rural segment either openly or secretly has driven the nation to a burdensome jobless circumstance. Unemployment is both a social and a political emergency of this contemporary world. This paper attempts to realize the connection between agricultural sector share on GDP and unemployment rate in the context of Bangladesh. For that, Johansen cointegration test has been applied to check the long run connections between the concerned factors. Auto Regressive Distributed Lag (ARDL) technique has been used to find out the coefficients of the factors and discover the short run as well as long run connection among the factors. The outcome of this research work states that the increasing trend in agricultural sector contribution to GDP may reduce unemployment rate in Bangladesh. The government should strengthen the peripheral farmers by assuming control over the overflow of agrarian products keeping in mind the end goal of designating it appropriately. However, increased attention in farming will produce facilitated work opportunities for the unemployed people of the nation.

Keywords: Agricultural sector, Unemployment rate, GDP growth rate, Cointegration, ARDL

1. Introduction

In today's world, unemployment is one of the most discussed economic, social and political crisis which ultimately leads to poverty. This study is concerned with unemployment, not poverty. But it should also be considered that most of the poor in the third world countries are involved in the agricultural sector. The people having no or limited skills involve themselves in nothing but agricultural work. That is why, this study attempts to investigate the impact of the share of agricultural sector to GDP on the unemployment rate in Bangladesh. For this purpose, some latest econometric

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techniques have been used in conducting this research. In 1971, Bangladesh achieved independence from Pakistan and after that the country was just a war-ravaged state for several years. Initially, it seemed impossible to improve the condition of the country. But now the country has developed its status in social, cultural, political, economic, national as well as international level. The economic growth of Bangladesh is accelerating rapidly and it has brought Bangladesh the status of a developing country. According to Quarterly Labor Force Survey around 2.6 million people of the 6.21 crore strong labour force of the country were unemployed in the fiscal year 2015-16 which comprised only 4.18% of the total labour force (QLFS, 2015-16). After the independence of the country in 1971, around 90 percent of the total population were involved in agriculture sector. Bangladesh has achieved outstanding economic growth in the last 7 (seven) fiscal years from 2010-11 to 2016-17 which is more than 6 (six) percent of total GDP growth.

In accordance with the report of the Bangladesh Economic Review the GDP growth rate of the country is 7.28% in 2016-17 fiscal years (BER, 2017). It is a great achievement for the government as well as the people of the country. Some very important factors (mega projects) which are involved in maintaining this level of economic growth initiated by the government of the country for the last 10 (ten) years are the Padma Bridge, Ruppur Nuclear Power Plant, Metro Rail Project of Dhaka city, 4 (four) lane road of Dhaka to Chittagong and Dhaka to North-western region of the country etc. According to the report of the Bangladesh Economic Review, the contribution of the service sector to GDP in 1979-80 fiscal years was 49.72%, the industrial sector was 17.08% and the agriculture sector was 33.21% respectively (BER, 2005). But BER published in 2016-17 fiscal year, the service sector contributed 52.85%, the industrial sector 32.42% and the agriculture sector 14.74% to the GDP of the country (BER, 2017). The contribution of the agriculture sector to GDP has decreased by a great percentage compared to the other two major sectors of the country. So, the major concern of this research is to investigate the exact effect of the share of agricultural sector to GDP on the unemployment rate of the country. By the following figure from the year of 1991 to 2017, share of agricultural sector to GDP (AG) is decreasing and at the same time unemployment rate (UR) is increasing though GDP growth rate has an increasing trend.

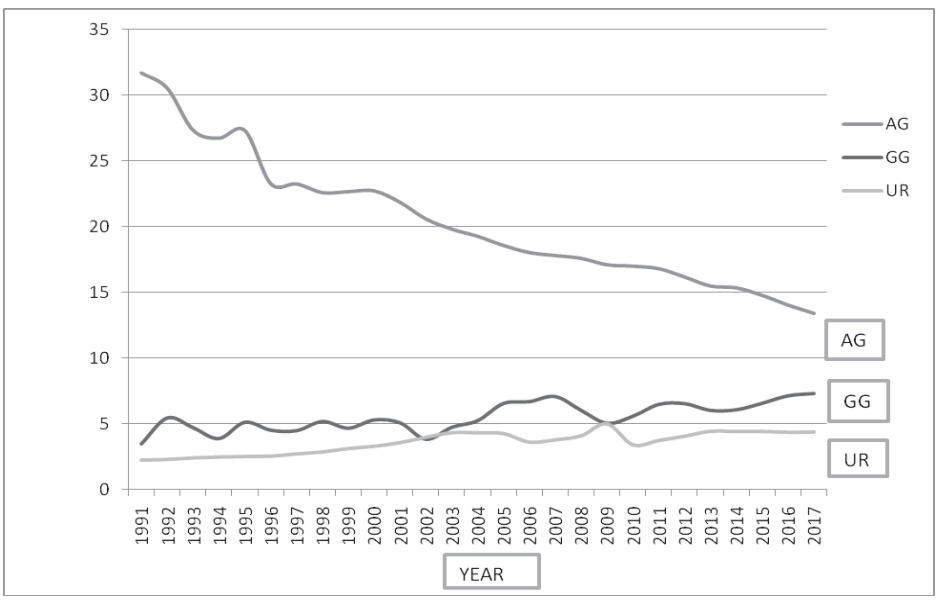

Figure 1: Year-wise Agricultural Sector Contribution to GDP (AG), GDP Growth Rate (GG) and Unemployment Rate (UR): 1991-2017 (World Bank, 2018)

2. Review of Literature

Agriculture was the key driving force of the economy of Bangladesh after its independence in 1971 but now a days its importance is declining. Around 14% commitment of GDP originates from farming area and 62 percent of employment is created by this sector (Mirza, 2015). So, offering concentration to this area can be a fruitful endeavour for the development of the country. Loayza and Raddatz (2009) inspected the distinctive division of development and its connection with destitution. They found that poverty can be decreased by emphasizing the untrained intensive sectors. Dollar and Kraay (2005) investigated and found that there is a strong relationship between economic growth and poverty. Thorbecke and Jung (1996) found that poverty was reduced by the growth of agricultural sector and service sector relative to the growth of industrial sector. Khan (1999) examined that the growth of the agriculture sector and the service sector reduced poverty in South Africa. There was a strong relationship between the agriculture sector and the growth of the service sector with poverty reduction but the industrial sector contributed very little to reduce poverty (Ravallion and Datt, 1996). Yusuf (2002) established that the life standard was positively affected by the development in the agriculture sector in Nigeria. Olatunji (2002) investigated that agriculture is the key sector to generate employment in Nigeria. Ayinde (2008) conducted cointegration analysis (Granger causality test) and recommended that agricultural sector should be focused for generating employment as well as reducing poverty in Nigeria. Oluremi and Gbenga (2011) examined that there was a strong association between GDP growth and employment generation in Nigeria.

Mundlak et. al. (1989) emphasized on agricultural productivity to alleviate poverty. Sabur (2004) conducted time series analysis of the growth in agricultural sector and its relationship with rural poverty in Pakistan. In that article, a significant relationship between agricultural growth and poverty reduction was found. According to the findings of that study, 0.25% of rural poverty was reduced by the 1% increase in agricultural growth. Three economic variables were employed in that research which are economic growth, agricultural growth and unemployment. GDP growth or economic growth is a very significant factor for shrinking the unemployment rate as stated by Ahmed et al. (1996) in their article. They found that there is a strong negative relationship between economic growth and unemployment rate in the context of Egypt. Moreover, dependency rate was increased by the decrease in economic growth in Kuwait (Khalil, 1994). Okun (1962) empirically investigated the relationship between economic growth and unemployment rate and formulated one of the essential laws of financial matter. By utilizing Auto Regressive Distributed Lag (ARDL) for exploring the long run relationship, Ting and Ling (2011) experimentally explored Okun's Law (1962). However, it is evident from above literature that the study on agricultural sector contribution to GDP and unemployment rate is not new. Yet, no significant academic study on contribution of agricultural sector to GDP and Unemployment Rate in Bangladesh has been found, which indicates that this particular area has not yet been adequately focused on. Therefore, this paper seeks to discover the connection between agricultural sector contribution to GDP and unemployment rate in the context of Bangladesh.

3. Objective of the Study

The main objective of this research is to identify the connection between agricultural sector contribution to GDP and unemployment rate in the context of Bangladesh. Based on the data of World Development Indicators (WDI), the specific objective of this research paper is to explore the short term as well as long term relationship between agricultural sector contribution on GDP and unemployment rate of Bangladesh through ARDL and Johansen Cointegration techniques.

4. Methodology

4.1. The Model

The concerned area of this study is Bangladesh. The sets of data used in this research are the time series data obtained from WDI of World Bank. The composed data are on agricultural sector contribution on GDP, GDP growth rate and unemployment rate in Bangladesh (1991 – 2017). The analytical tools engaged in this research consist of unit root test, Johansen cointegration test and ARDL model for cointegration. The ARDL approach has been used to examine the short run and long run linkages between agricultural sector contribution on GDP and unemployment rate. On the basis of Okun's Law (1962), a model has been developed for this research. So, the empirical model can therefore be represented as follows where URt is unemployment rate, AGt is agricultural sector contribution on GDP, GGt is GDP growth rate, δ0 is intercept and €t is disturbance term.

$UR_t = \delta_0 + \phi_1 AG_t + \phi_2 GG_t + \epsilon_t$ ……(i)

4.2. Description of Variables

There are broad choosing factors of unemployment rate in various nations around the world e.g. local pay, the genuine loan cost, open speculation, the accessibility of credit (and along these lines money related improvement) and so on. Yearly information of Bangladesh from 1991 to 2017 have been utilized to lead this examination. The data of the incorporated variables have been taken from the World Development Indicators of the World Bank.

Table 1: Description of Variables and Sources

Variables	Description	Sources
AG	Agricultural Sector Contribution on GDP (annual %)	World Bank national accounts data of WDI
UR	Unemployment Rate (annual %)	International Labour Organization of WDI
GG	GDP Growth Rate (annual %)	World Bank national accounts data of WDI

4.3. Model Specification: Johansen Cointegration Test

In order to determine the cointegration relationship for testing the existence of long-term relationship among the variables, Johansen cointegration method has been used (Johansen, 1988; Johansen and Juselius, 1990; Johansen, 1995). For this purpose, trace statistics (trace of matrix eigenvalue) and max statistics (maximum eigenvalue) have been used in this research. Johansen cointegration test has been used to find out whether a group of non-stationary series (such as GDP growth rate, unemployment rate and agricultural sector contribution on GDP) has a long-run relationship or not.

4.4. ARDL Model

With a specific end goal to avoid a wrong yield from general cointegration tests when there is of I (1) and I (0) arrangement, Pesaran et. al. (2001) developed ARDL model which directs the bound test in a basic bound to check the cointegration among the factors (Pesaran and Shin 1995a, 1995b; Pesaran et al., 1996, 2001). Attributable to its focal points of not just taking care of the issue of arrangement comprising of contrasting requests yet handling little example issue (26 perceptions), ARDL bound testing strategy has been widely used in various investigations in the past (Abbot et al., 2001; Bentzen and Engsted, 2001; Ghatak and Siddiki, 2001). The ARDL display considers the mistake adjustment term in its slacked period. The investigation of mistake revisions and auto regressive slacks completely covers both the long-run and short-run connections of the factors tried. It is an Unrestricted Error Correction Model (UECM).

For the ARDL analysis, the researchers have tested the presence of long-run cointegrating relationship among the variables. Ordinary least squares (OLS) approach has been utilized to check for the presence of a long-run relationship among the variables and by conducting the F-test for the joint significance of the coefficients of the lagged levels of the variables, i.e. against the alternative. Following Pesaran et al. (2001), applying the ARDL model in the equation number (i),

Dependent Variable Unemployment Rate

$$\Delta UR_t = \sum_{i=1}^{p} \theta_i \Delta UR_{t-i} + \sum_{i=0}^{p} \varphi_i \Delta AG_{t-i} + \sum_{i=0}^{p} \phi_i GG_{t-i} + \lambda_1 UR_{t-1} + \lambda_2 AG_{t-1} + \lambda_3 GG_{t-1} + €_t \text{ ……...……(ii)}$$

Now we use the null hypothesis of the cointegration from the above equation defined by H_0: $\lambda_1 = \lambda_2 = \lambda_3 = \lambda_4 = \lambda_5 = 0$, is tested against the alternative of H_0: $\lambda_1 \neq \lambda_2 \neq \lambda_3 \neq \lambda_4 \neq \lambda_5 \neq 0$, by using the recognized F-test. If the calculated F-statistics lies above the upper level of the band, the null hypothesis will not be accepted, indicating cointegration. If the calculated F-statistics falls below the lower level of the band, the null cannot be rejected, supporting the lack of cointegration. If, however, it falls within the band, the result is inconclusive. In the concluding step, the researchers have obtained the short-run dynamic parameters by estimating an error-correction model associated with the long-run estimates (Pesaran et al., 2001), i.e. the short-run conditional error-correction model (ECM) of the ARDL model where all variables are as previously defined. All coefficients in the short-run equation relate to the dynamics of the model's convergence to equilibrium and λ is the speed of adjustment. So, the ECM of the ARDL model from equation number (ii),

Dependent Variable Unemployment Rate

$$\Delta UR_t = \sum_{i=1}^{p} \theta_i \Delta UR_{t-i} + \sum_{i=0}^{p} \varphi_i \Delta AG_{t-i} + \sum_{i=0}^{p} \phi_i GG_{t-i} + \lambda ECT_{t-1} + €_t \text{ ……(iii)}$$

5. Results and Discussion

To conduct Johansen Cointegration test, at first the researchers tested for the stationary of all variables which are considered in this research. Johansen cointegration test needs all variables in the same level. That is why, the order of integration of the variables is the main concern of conducting cointegration. Hence, Augmented Dickey Fuller (ADF, 1981) test, one of the standard methods of stationary tests, has been applied in this study. However, since the ADF test is often questioned by many researchers for low power, so the Phillips-Perron (1988) test has additionally been led in this research. The Schwarz Information Criterion has been considered for the slack length in the ADF test. Then again, the data transfer capacity determination depends on Newey-West (1994) in the Phillips-Perron test.

5.1 Stationary Test

Table 2: Result of Unit Root Test

Variable	A.D.F. test statistic		P.P. test statistic		Result
	Level	First difference	Level	First difference	
AG	-0.78	-5.32**	-0.92	-5.50**	I (1)
UR	-2.26	-13.35**	-2.79	-21.68**	I (1)
GG	-2.89	-6.82**	-2.93	-9.51**	I (1)
Significance level	1% level	5% level	1% level	5% level	
Critical Value	-3.72	-2.98	-3.72	-2.98	

** denotes 5 % level of significance

5.1.(A). Unit root test demonstrates that all variables are the order of I (1) in Table 2. Along with these lines, the Johansen cointegration testing approach as well as ARDL approach has been utilized for finding out long run relationship among the factors. The statistical software Eviews 9 for conducting Johansen cointegration test and Microfit 5.5 for conducting ARDL approach are employed in this study.

5.2 Johansen Cointegration Test

Table 3: Johansen Cointegration Test Result

Date: 12/08/18 Time: 13:31
Sample (adjusted): 3 27
Included observations: 25 after adjustments
Trend assumption: Linear deterministic trend
Series: UR AG GG
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.56	33.72	29.79	0.01
At most 1	0.42	13.83	15.497	0.08
At most 2	0.01	0.45	3.84	0.49

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.56	19.88	21.13	0.07
At most 1	0.42	13.37	14.26	0.06
At most 2	0.01	0.45	3.84	0.49

Max-eigenvalue test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

5.2.(A). The Johansen cointegration test result indicates 1 (one) cointegrating equation regarding Trace statistic test at the 0.05 level of significance of the variables such as UR, AG, GG respectively and no cointegrating equation regarding maximum Eigen statistic test at the 0.05 level of significance of the variables such as UR, AG, GG respectively. Thus, the null hypothesis of no cointegration is hereby rejected at the 0.05 per cent level of significance. This test therefore provides an evidence of a long run cointegrating relationship among the variables of the study. Table 3 presents the test results of Johansen cointegration test.

5.3 F-statistics of ARDL Model

Table 4: The Result of F-Statistics of ARDL for Cointegration, Lag Selection based on Akaike Information Criterion

Dependent variable	Calculated F-statistics	Lag structure	Decision
UR	4.4175	1,0,1	Cointegration
Critical bound's value	Lower	Upper	
5% Level of significance	3.1313	4.3930	
10% Level of significance	2.3825	3.4898	

5.3.(A). The F-test shows that there is a long run relationship. Be that as it may, if the F-measurement falls inside the upper esteem and lower esteem, at that point we cannot achieve any unequivocal conclusions (Pesaran et al., 2001). Basic esteems are taken from Pesaran (2001). So, from the table 4, F-statistics value is greater than upper esteem.

Table 5: Estimated Short Run Coefficients using the ARDL Model, Lag Selection based on Akaike Information Criterion

Regressor	Dependent variable is UR(1,0,1)
UR (-1)	0.0075705 *** (5.2257)
AG	-0.0036348 * (-0.29806)
GG	-0.010075** (-0.079086)
GG (-1)	-0.16884 (1.4226)
Observations	26

The calculated t-statistics are presented in parentheses: * 10 % level of significance; ** 5 % level of significance, *** 1 % level of significance

5.3.(B). In table 5, the estimated coefficients of the short-run relationship states that there is a negative association between unemployment rate and agricultural sector contribution on GDP and it is also the same for GDP growth rate. Unemployment rate decreased by 0.0036348% when agricultural sector contribution on GDP is increased by 1%, but this is not a significant result. On the other hand, unemployment rate decreased

by 0.010075% when GDP growth rate increased by 1%. The first lag of unemployment is also responsible for raising the unemployment rate in Bangladesh.

Table 6: Estimated Long Run Coefficients using the ARDL Model, Lag Selection based on Akaike Information Criterion

Regressor	Dependent variable is UR(1,0,1)
AG	-0.014961* (-0.28276)
GG	-0.65347 ** (-3.6074)
Observations	26

The calculated t-statistics are presented in parentheses: * 10 % level of significance; ** 5 % level of significance

5.3.(C). In table 6, the estimated coefficients of the long-run relationship states that there is a negative relationship between unemployment rate and agricultural sector contribution on GDP and it is also the same for GDP growth rate. Unemployment rate is decreased by 0.014961% as a result of 1% increase in agricultural sector contribution on GDP. On the other hand, unemployment rate decreased by 0.65347% as a result of 1% increase in GDP growth rate. Both in the short run and the long run, agricultural sector contribution on GDP affects unemployment rate though it does not refer to a highly significant relationship between these two variables.

5.4 Error Correction Model and Diagnostic Tests

Table 7: Estimated Error Correction Term using the ARDL Approach, Lag Selection based on Akaike Information Criterion

	Dependent variable is UR (1,0,1)
Short run error correction coefficient ECT(-1)	-0.51559 * (-1.2205)
Diagnostic Tests	
Serial Correlation	3.3351*
Ramsey's RESET test	3.2157
Normality	0.39177
Heteroscedasticity	0.33818*

The calculated t-statistics are presented in parentheses: * significant at 10 % level

5.4.(A). In Table 7, the short run error correction term is consistent with the long run relationship among the variable because the sign of error correction term is negative. So, the error is corrected up to 51% in two years because of lag selection criterion. Banerjee et al. (1998) stated that a highly significant error-correction term is another evidence of the existence of established long run relationship. So, some diagnostic tests have been conducted to find out whether the model is correctly fitted or not. From these diagnostic tests the model is correctly specified, has no serial correlation and also normally distributed.

6. Conclusion

The target of this study is to empirically find out the dynamic interrelationship between the agricultural sector contribution on GDP and unemployment rate in Bangladesh. Based on the analysis in this research, the researchers have found some possibilities to bring benefit for the country. Both the government's consideration and individual effort are needed to increase the agricultural production in Bangladesh. The dynamic change in rural section, specially the agricultural sector, can rapidly accelerate the economic development of a lower middle-income country like Bangladesh. Poverty can be checked and kept at a minimum level if we can improve the base of our economy i.e. agriculture. This will help to lessen unemployment and reduce poverty at a good rate. For this, programs and policies favorable to agricultural production growth should be introduced and applied with proper monitoring by the government and other affiliated organizations. The agricultural development of any country largely depends on the initiatives taken by the government. The adverse effects of the increase of food cost should be analyzed and efforts should be taken to minimize it. According to the Labour Force Survey, 32.4% of total labor force was skilled agricultural worker in Bangladesh (LFS, 2016-17). So, it can be said that a great portion of our population need to depend on agriculture for their livelihood. But the contribution of this sector to the total GDP (Gross Domestic Production) of the country is decreasing day by day whereas it used to contribute about half of our total GDP in past years. So, the development of this sector is really a dire need for ensuring the development of the country and reducing the unemployment rate. This research encourages both public and private initiatives for ensuring the development of the agricultural sector of Bangladesh.

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