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An Empirical Analysis of Causal Relationships Between Agricultural Labour and Agricultural GDP in Libya

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Abstract
The agricultural sector is the second largest sector contributing to the economy of Libya; yet empirical studies focusing on Libyan agricultural sector appear to be limited. Hence, the paper aims to investigate the causal relationship between agricultural labour and agricultural GDP in Libya over the study period of 2000-2019. The method employed in this study is the time-series technique which consists of the unit–root tests, cointegration and the Granger causality test. The results of this study show that there is a cointegration between variables as per the Johansen Co integration test, while there is a uni-directional causal relationship running from agricultural GDP to agricultural labour in the long and short- run. Nevertheless, agricultural labour does not cause agricultural GDP in the long and short run. The findings imply that the Libyan government should focus more on the integration of technology advancement in the agricultural sector.
Keywords: Agricultural Labour, Agricultural GDP, Libya

Introduction

The agricultural sector continues to play a crucial role in development as the basic pillar to generating income and employment in rural areas and providing food at reasonable prices in urban areas (Dethierand & Effenberger, 2011), as well as its role in providing the largest amount of food needs for the population (Jha, 2009), in addition to providing raw materials needed for many manufacturing industries. Moreover, its role in merchandise exports (Moise et al., 2013).

The agricultural sector in Libya is one of the important productive sectors and the tributaries of economic and social development for its important role in the employment of agricultural labour (Al-Samaa, 2014) because agricultural labour is one of the productive resources for the advancement of agricultural production and the higher productivity can be ensured by adopting technological innovations and making optimum utilisation of the human resources (Tiwari, 2000) and the natural resources cannot be utilised in the absence of labour (Vengedasalam & Madhavan, 2010).

Although the agricultural sector plays a vital role in bringing about economic development in Libya, this role did not achieve high participation rates in the gross domestic product. It is still minimal participation, as its contribution decreased from about 8.17 per

cent in the year 2000 to 3.69 per cent in 2019, and this is due to the failure of the agricultural policy of successive governments in to manage the productive elements, including the aspect of agricultural labour the agricultural labour component, which did not achieve the desired results. Therefore, this study is concerned with the effectiveness of agricultural labour on agricultural GDP. The research question can be outlined as follows: Does agricultural labour in Libya foster agricultural GDP? It is hoped that this research fills the existing gap in the literature by providing empirical evidence to make the result more meaningful and to improve its effect on agricultural GDP in Libya.

Previous Empirical Studies

A stream of studies offers support to the positive nexus between labour and production. Abd (2009) analysis the determinants of agricultural production in Iraq during the period 1985-2005, and the elasticity of labour coefficient shows a positive impact (0.525). Rfoa and Bakeer (2020) aimed to estimate the production function of six private economy sectors representing Jordan during the period (2000- 2015). The analysis showed that the Cobb-Douglas production function model is the most appropriate model for estimating the production function. The results show that the labour elasticity is around 0.58. In Syria, the study of (Al Zagout et al., 2016) used a random sample of 268 observations during 2012. The study found that agriculture positively affects non-irrigated apples in Suwayda and the labour elasticity is 0.11.

Past studies in Libya also support the positive nexus between the agricultural GDP and labour; for instance, Ali (2007) examines the relationship between the agricultural GDP and labour inputs by employing the Cobb-Douglas production function. The results show a positive relationship between the agricultural GDP and labour. A similar finding was reported in a much earlier study (Hamid, 2005), which aims to investigate the effect of agricultural work on agricultural GDP from 1962 to 2000 in Libya. Next, Saed (2008), in his study during the period 1990-2006, found that the elasticity of agricultural labour is 2.29. Additionally, Elsayed (2020) considers a substantial negative link between the GDP growth rate and the unemployment rate over medium and long durations, which supports Okun's law in both senses. Furthermore, a recent study by Bdawi (2022) stated that the corresponding regression was statistically significant at the 5% level between the agricultural labour and economic growth of Libya based on the Quandt-Likelihood Ratio test (based on the Chow test).

In the same context, Razak (2007) finds out the most important factors determining wheat production in Libya. The findings suggest there are nine variables to cause changes in the production of wheat, and interestingly, the number of human working hours is found to be the most critical factor. Finally, Nagm (2012) estimates the production function in Libya from 1985-2007, and the findings show a positive relationship between agricultural labour and domestic agricultural products. According to Jiang et al (2022), agricultural labour is rising to meet market demand, which shows a relationship between agricultural work and agricultural GDP. In addition, Demir (2021) found that employment in the agricultural sector did not significantly affect economic growth based on the ARDL co-integration bounds test. In India, research made by Agarwal et al (2021) stated that there is a relationship between agricultural labour and economic growth as this study stressed that the labour force, especially in rural places in India, needs to be changed to produce higher GDP for the country. On the other hand, Balezentis et al (2021) found that the agricultural labour force does not add up to productivity, which can affect China’s economic growth.

Data Sources and Methodology

Source of Data and Period of the Study

The study employed secondary data from 2000 to 2019 to assess the causal relation between agricultural Labour and Agricultural GDP. This data is extracted from various secondary sources, including statistical reports from multiple Libyan institutions, economic bulletins issued by the Central Bank of Libya, and data from the Ministry of Planning, in addition to the annual statistical reports of the Arab Organization for Agricultural Development.

Methodology

Model Specification

$AGDP_t = f(AL_t)$

$AL_t = f(AGDP_t)$

Thus, the model of the causal relationship between agricultural labour and agricultural GDP is as follows

$$AGDP_t = \alpha_1 + \sum_{i=1}^{k} \beta_i \, AGDP_{t-i} + \sum_{i=1}^{k} \gamma_j \, AL_{t-j} + e_{1t} \quad (1)$$

$$AL_t = \alpha_2 + \sum_{i=1}^{k} \theta_i \, AL_{t-i} + \sum_{i=1}^{k} \delta_j \, AGDP_{t-j} + e_{2t} \quad (2)$$

where,

AGDP is Agricultural Gross Domestic Product

AL is Agricultural Labour

Result and Discussion

Unit Roots Test

The first step is to check the series stationary. The augmented Dickey-Fuller and Phillips-Perron approach was adopted and the tests' results are presented in tables 1 and 2. The results show that all the series are non-stationary at levels and stationery at first differences. Since the series became stationary after one differencing, the series is said to be integrated at the order one I (1).

Table 1

Augmented Dickey-Fuller (ADF) Test

Variable	ADF test (levels)	ADF test (first differences)
In (AG)	-1.2607	-6.2303*
In (AL)	-1.6195	-5.8909*

Stationary at 0.01 % critical levels

Table 2

Phillips-Perron Test (PP) Test

Variable	ADF test (levels)	ADF test (first differences)
In (AGDP)	-0.8676	-10.5648*
In (AL)	-1.7824	-5.8909*

Stationary at 0.01 % critical levels

Lag Selection

The appropriate lag selection can be obtained using tests like Akaike Information Criterion (AIC), Schwarz Information Criterion (SC), etc. To use the lag in the Johansen co-integration test and the Vector Error Correction Model, we depend on the lag selection criteria on AIC, which indicate that the optimum lag is 4; hence the optimum lag will be 4.

Table 3
Lag Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-67.31151	NA	0.179952	3.960658	4.049535	3.991338
1	-19.39135	87.62544	0.014640	1.450934	1.717565*	1.542975*
2	-18.85031	0.927486	0.017895	1.648589	2.092974	1.801991
3	-15.83393	4.826209	0.019063	1.704796	2.326935	1.919558
4	-5.447507	15.43126*	0.013403*	1.339858*	2.139751	1.615981

** Indicates lag order selected by the criterion*
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Cointegration Test

Track and Maximum eigenvalue statistics were employed to investigate the existence of a long run among study variables. This suggests that there exists a maximum of one vector. The results are shown in Table 4. It is revealed that the statistics value of Track and Maximum eigenvalue statistics are more significant than the critical value (None), which established a long-run cointegration relationship in the model.

Table 4
Johansen Cointegration Test

Hypothesised no. of CE(s)	Trace Statistic	5% critical Value	Prob	Max-Eigen Statistic	5% Critical Value	Prob
Non*	26.4526	15.49471	0.0008	24.83560	14.26460	0.0008
At most 1	1.61707	3.841466	0.2035	1.617073	3.841466	0.2035

Trace and Max-Eigen value test indicate one cointegration eqn (s) at the 0.1 level.

Long Run Causality

The vector error correction mechanism examined the causal relationship between agricultural labour and agricultural GDP. The result of the extended run causality test in table 5 shows a uni-directional causal relationship from agriculture GDP to agricultural work at a 1 per cent level. This implies that agricultural GDP has a significant backwards effect and contributes to agricultural employment in the agricultural sector.

Table 5
Long Run Causality Test Based on Vector Error Correction Model

Error Correction Term	Coefficient	t-Statistic	Prob
C (1)	-0.000362	-0.006791	0.9946
C (11)	-0.171117	-4.311430	0.0001

Short Run Causality

Table 6 shows the Granger causality test results from the Wald test in the short run. The Granger causality test examines the presence and direction of causality between dependent variables and the explanatory variable. The results indicate a uni-directional causal relationship impact of agriculture GDP to agriculture labour.

Table 6
VEC Granger Causality/Block Exogeneity Wald Tests (Short Run)

Dependent Variable: D (AGDP)			
Excluded	Chi-sq	Df	Prob
AGDP	2.034838	4	0.7294
Dependent Variable: D (AL)			
Excluded	Cho-sq	Df	Prob
D (AL)	36.96309	4	0.0000

Conclusion

The agricultural sector plays a vital role in providing income and job opportunities for a large proportion of the population. Although agriculture in Libya invested in huge financial allocations, their contribution to the gross domestic product was insignificant. There is a deficit in meeting the increasing demand for agricultural commodities and dependence on foreign labour utilisation. Therefore, this study came to test the causal relationship between the farm GDP and agricultural Labour to understand the causal relationship between them using the Error Correction Model (VECM). The empirical results from the analysis confirm that the extended and short-run causality test shows uni-directional causality from agricultural GDP to agricultural labour. On the other hand, they revealed a causal relationship and reliance on agricultural GDP to employ labour in the farming sector. The results show there is a significant nexus between the agricultural labour and the GDP of Libya in the farming sector. It is interesting to highlight that there is a causality relationship between the GDP and the agricultural labour market whereby the GDP in the agricultural sector fosters the agricultural labour. On this note, the Libyan government should invest more in the agricultural by focusing on the large scale of farming in order to increase the production as well as the productivity of the sector.

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