Journal of Agricultural Economics and Social Sciences

Journal homepage: www.jaess.mans.edu.eg
Available online at: www. jaess.journals.ekb.eg

The Factors affecting the Relative Contribution of the Agricultural Sector to Egyptian GDP

Walaa A. Mohamed*

Department of Agricultural Economics, Faculty of Agriculture, Cairo University, Egypt.

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ABSTRACT

This paper aimed to identify the factors affecting the relative contribution of the agricultural sector to Egypt GDP, which can be divided into factors related to the economic growth indicators and the competitiveness of agriculture sector. The research conducted the vector error correction model, and it was found a significant impact of total external debt stocks, the exports of all goods and services and, national inflation rate on agricultural sector's contribution to GDP.

Keywords: Egypt, GDP, competitiveness, agriculture, VECM.

INTRODUCTION

The agricultural sector contributes to the Egyptian economy by providing a part of food security despite the increase in population, as well as its contribution to export revenues. Egypt is ranked 61th out of 113 countries on the World Food Security List 2018 because of the high quality of infrastructure (ports, storage) and small local production inflation. The Central Bank of Egypt (CBE) report also indicated that the Egyptian economy has improved significantly since 2016 due to the economic and financial reforms implemented. However, the agriculture sector showed negative results compared to the energy and tourism sector in its contribution to the GDP. The contribution of this sector to the GDP was limited to 11.4% according to December 2018 data. The share of agricultural exports in total merchandise exports was only 8.7%.

Justifications

Agricultural production is affected by many internal and external factors and determinants, as changes in these factors affect in turn the growth of agricultural output, so the problem is summarized up by low contribution of the agricultural sector to the gross domestic product compared to other sectors, so this paper aims to identify the factors affecting the contribution of Egyptian agriculture to GDP.

Data and measurement procedures:

Annual data covering the period (1977-2017) were used to estimate the impact of factors that have a significant role on the contribution of the agricultural sector to the Egyptian GDP. Demographic, monetary and financial data were obtained from the World Bank database, and agricultural trade data from the FAO database, with the calculation of the necessary percentages of some variables and factors affecting. The values of the financial statements are expressed in US dollars, based on the data of the World Bank.

Theoretical Model:

During the last three decades, the world witnessed a decrease in the contribution of the agricultural sector to the gross domestic product (GDP) with the progress of economic growth, and this decline did not occur only in developing countries, but also in developed countries such as the United States of America, as well as Japan, where (Yamashita 2008) explained the low contribution of the Japanese agricultural sector to GDP. The total domestic production between 1960 and 2005 increased by 8%, and the accompanying phenomenon is the decrease in the labor force in agriculture and its migration from rural to urban areas, where industrial progress. Likewise, the prices of agricultural and food commodities increased during the past years, as global food prices increased by 43% (USAID 2009) during the years 2007 and 2008, especially in developing countries and the poorest people directed their income towards food. This increase in prices has not only reduced purchasing power but also reduced food and nutritional security (USAID, 2009). Global food prices are expected to increase due to increased energy and fuel prices. And concern is increasing about the contribution of the agricultural sector to GDP due to the increase in the number of people who are undernourished, as the number increased from 792 million, representing 14% of the people who are undernourished in the world during (1995-1997) to 850 million, representing 13% (FAO 2013).

Methodology

The regression model approach was used to explain the factors affecting the agricultural sector's contribution to GDP, and the model used here is the vector error correction model (VECM). To estimate this model in our case, several steps are taken. Initially, it is necessary to determine the stationary of the time series of the variables or not using the Dickey Fuller test. If the original series is stationary then it is integrated from the zero I(0) order, and if it is otherwise we get the first difference, then if The first difference was stationary or stable, then the original series

* **Corresponding author.**
E-mail address: walaaali82@agr.cu.edu.eg
DOI: 10.21608/jaess.2020.102696

is integrated of the first I(1) order, and if it is stable, it must be determined if there is a common regression or integration and this procedure is carried out using the Granger causality test, which means that there is a causal relationship between (X) which explain and predicting changes in the variable (Y) in one way towards at least and the opposite can happen. Then after that, a Johansen test is conducted to determine the relationships of cointegration and determine the existence of balanced relationships, whether in the short or long run, then choose the lagged for the unrestricted vector autoregression model (VAR), then estimate the VECM in terms of the equilibrium relationships and lagged periods, then tests the validity of the model such as conducting residual autocorrelation LM test, heterogeneity test, and Wald test.

Model Specification

In this section, the regression model used to explain the variables that affect the contribution of the agricultural sector to the (GDP) as well as the economic justifications for using these variables and the model is formulated as follows:

$$AGDP_{it} = \beta_0 + \beta_1 PT_{it} + \beta_2 RP_{it} + \beta_3 LEB_{it} + \beta_4 FDI_{it} + \beta_5 ICP_{it} + \beta_6 EGS_{it} + \beta_7 EDS_{it} + \beta_8 EXIMa_{it} + \varepsilon_{it}$$

Variables Specification

$AGDP_{it}$: contribution of agriculture to the country's GDP in year t (%).

PT_{it} : Total Population of the country i per year.

Population increase in a country is considered a double-edged weapon, so that it can have a positive or negative effect. In some detail, the surplus of labor can be transferred to other sectors without reducing the supply of agricultural labor, thus allowing economic growth in both the agricultural sector and other sectors, especially when using modern technology in agriculture. Thus, the population increase in the rural area will have a role in economic growth, and the agricultural labor unions can have a positive impact on increasing the contribution rate to GDP. On the other hand, an increase in population growth can lead to land degradation, as this pressure leads to imperfect uses of resources or soil stress, which leads to a decrease in productivity. Thus, a population increase can negatively affect the contribution of agriculture to the GDP. The population growth factor has a negative sign.

RP_{it} : Rural population (%).

It is noted that if the rural sector retains a high percentage of its rural population without immigration or moving to other sectors, it will expected that the agricultural sector will contribute significantly to GDP.

LEB_{it} : life expectancy of the country's population i at birth.

The economic growth is expected to be accompanied by a high level of GDP, which helps citizens to improve their standard of living in improving their health, and will have a direct impact on improving the life expectancy at birth. In other words, the high life expectancy of the population is related to the countries with the highest level of economic growth and development, and the LEB coefficient has a positive sign, and in countries with low GDP it has a negative sign.

FDI_{it} : Foreign direct investment in the country i.

Foreign direct investment is suppose directly linked if it is directed to the agriculture and food sector, where the foreign direct investment factor has a positive sign if it is directed to the agricultural sector, and negative if it is directed in another sector (the non-agricultural sector).

ICP_{it} : National inflation rate.

There are two types of inflation, demand and cost push inflation. The inflation of demand is caused by an increase in the demand for food, which leads to an increase in production by the producers. As a result, this inflation must lead to an increase in the contribution of agriculture to the GDP, hence the positive ICP coefficient. The second type of inflation is caused by a decrease in the agricultural supply due to either an increase in wages or an increase in the inputs prices, this leads to a decrease in production and decreases the contribution of agriculture to GDP and therefore the ICP coefficient is negative.

EGS_{it} : The exports of goods and services of country i (% of GDP).

EGS coefficient can also be positive or negative. Where a country can direct its efforts towards strengthening agriculture and increasing its competitiveness externally at the expense of other sectors, and this leads to an increase in exports of goods and services, this means an increase in the percentage of agriculture's contribution to GDP. On the contrary, the country can direct a foreign policy for non-agricultural products at expense of agricultural products, thus agricultural exports and agricultural output decreases, which leads to a decrease in the contribution of agriculture to the GDP, and the EGS coefficient is negative.

EDS_{it} : The total external debt stocks of country i (% of GNI).

It is expected that a country will not be able to import its needs of agricultural and food commodities due to the decrease in the foreign currency earnings with the increase in its external debt due to the low competitiveness of its domestic production that limits exports, and thus the country is forced to increase its domestic production of food commodities and this means an increase in the percentage of contribution of agriculture to GDP. The EDS coefficient is expected to be positive.

$EXIMa_{it}$: The ratio of agricultural trade (% of total merchandise for country i).

The greater ratio of agricultural exports to agricultural imports, the greater the competitiveness of agricultural products, therefore the greater the percentage of the contribution of agriculture to the GDP. The coefficient of this variable is positive.

ε_{it} : Random error.

Results of Estimating

Based on the analysis of variance using the E-Views9 statistical program and the above-mentioned equation, the effect of ICP, EGS, and EDS variables is statistically significant and their effect on AGDP, while effect of the rest of the variables hasn't been proved. These variables explain about 58% of the changes in AGDP (Table 1), as the Dickey-Fuller test indicates that the dependent variable AGDP and the explanatory variables ICP, EGS, EDS are non-stationary, but they are proven stable in first difference (Table 2), meaning that the variables are complementary of the same degree and their integration degree is one. The Granger Causality test also indicated that the changes in EGS are responsible for the changes in AGDP with 98% (table 3) confidence level considering that the country pursued an internal or external policy for the agricultural sector during the period 1977-

2016 and there is a causal relationship between AGDP and ICP with a 96% confidence level.

The estimating Johansen test results are given in table 4 to determine the relationships of cointegration between the variables shows there is at least a long-run equilibrium relationship between the dependent variable and the explained variables, thus this leads to determine lag degrees in the VAR which obtained in table 5, which shows that all tests are statistical significant at one lag degree, that means the EDS, EGS, ICP variables in the previous year affect the percentage of agricultural sector's contribution to GDP this year.

Table 6 shows the results of the VECM model, which estimates the effect of EDS, EGS, ICP on the percentage of agricultural sector's contribution to GDP in the short and long-run with a single equilibrium relationship and one lag period. The error correction coefficient is negative and equal 0.49, which is significant (prob = 0.01), which means There is a long-run equilibrium relationship between EDS, EGS, ICP and AGDP, meaning that in the long run these three variables explain 49% of the AGDP changes, which is a relatively large explanation rate.

Table 1. Error Correction Equation.

Variable	Coefficient	S.E	T. Statistic
EDS(-1)	-0.075566	0.00534	-14.1516*
EGS(-1)	-0.015546	0.03196	-0.48648*
ICP(-1)	0.212332	0.04633	4.58327*
Constant	-13.47774	-	-
R-squared	0.639432	Mean dependent var	-0.304451
Adjusted R-squared	0.583094	S.D. dependent var	0.979773
S.E. of regression	0.632623	Sum squared resid	12.80677
Durbin-Watson stat	1.830847		

Source: World Bank Indicators. - E-Views9 computations.
Notes: * significant at 5%.

Table 2. Results of the Augmented Dickey-Fuller (ADF).

Variable	Test	Intercept		Intercept&Trend		None		cointegration
		coefficient	T statistic	coefficient	T statistic	coefficient	T statistic	
AGDP	Level	-0.12	-2.45	-0.53	-4.44*	-0.02	-2.53*	Non stationary
	1stDifference	-2.24	-6.66*	-2.24	-6.41*	-2.22	-6.78*	stationary
EGS	Level	-0.38	-3.33*	-0.22	-2.24	-0.02	-0.78	Non stationary
	1stDifference	-1.68	-5.99*	-1.69	-5.91*	-1.68	-6.06*	stationary
EDS	Level	-0.02	-0.55	-0.19	-2.27	-0.03	-1.17	Non stationary
	1stDifference	-2.45	-10.22*	-2.45	-10.12*	-2.45	-10.38*	stationary
ICP	Level	-0.55	-2.72	-0.70	-3.38	-0.04	-0.49	Non stationary
	1stDifference	-4.94	-8.27*	-4.98	-8.28*	-4.94	-8.41*	stationary

Source: World Bank Indicators. - E-Views9 computations. Notes: * significant at 5%.

Table 3. Pairwise Granger Causality Tests

Null Hypothesis	Obs	F-Statistic	Prob.
DEDS does not Granger Cause DAGDP	37	0.87207	0.4278
DAGDP does not Granger Cause DEDS		0.07511	0.9278
DEGS does not Granger Cause DAGDP	37	4.25911	0.0229
DAGDP does not Granger Cause DEGS		1.27267	0.2939
DICP does not Granger Cause DAGDP	37	1.83005	0.1768
DAGDP does not Granger Cause DICP		3.65541	0.0372
DEGS does not Granger Cause DEDS	37	0.46282	0.6337
DEDS does not Granger Cause DEGS		1.91990	0.1631
DICP does not Granger Cause DEDS	37	2.37395	0.1093
DEDS does not Granger Cause DICP		1.93576	0.1608
DICP does not Granger Cause DEGS	37	3.59540	0.0390
DEGS does not Granger Cause DICP		3.86819	0.0313

Source: World Bank Indicators. - E-Views9 computations.

Table 4. Unrestricted Cointegration Rank Test (Trace).

Hypothesized No. of CE(s)	Eigen value	Trace Statistic	0.05 Critical Value	Prob (*).
None *	0.616188	50.90438	47.85613	0.0251
At most 1	0.238980	14.51545	29.79707	0.8105
At most 2	0.097383	4.137816	15.49471	0.8921
At most 3	0.006413	0.244471	3.841466	0.6210

Source: World Bank Indicators. - E-Views9 computations.
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.

Table 5. VAR Lag Order Selection Criteria.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-475.6442	NA	2137733.	25.92671	26.10087	25.98811
1	-363.3326	194.2687*	11799.65*	20.72068*	21.59145*	21.02767*
2	-349.6510	20.70719	13825.85	20.84600	22.41338	21.39858
3	-339.0367	13.76994	20144.31	21.13712	23.40111	21.93528

*** 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.

Table 6. Regression coefficients (elasticity) of VECM in short run.

Coefficient	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.490529	0.083511	-5.873825	0.0000
C(2)	-0.370958	0.128226	-2.892990	0.0045
C(3)	-0.026279	0.012100	-2.171705	0.0317
C(4)	-0.096992	0.034295	-2.828190	0.0054
C(5)	-0.008477	0.019954	-0.424838	0.6717
C(6)	-0.502393	0.117285	-4.283514	0.0000
C(7)	1.870320	1.325395	1.411142	0.1606
C(8)	-0.268407	2.035069	-0.131891	0.8953
C(9)	0.038971	0.192044	0.202925	0.8395
C(10)	-0.491749	0.544286	-0.903474	0.3680
C(11)	-0.141738	0.316688	-0.447563	0.6552
C(12)	-2.000872	1.861424	-1.074915	0.2844
C(13)	1.017570	0.403147	2.524066	0.0128
C(14)	-0.080963	0.619010	-0.130794	0.8961
C(15)	-0.000157	0.058414	-0.002680	0.9979
C(16)	0.202138	0.165556	1.220963	0.2243
C(17)	0.034378	0.096327	0.356888	0.7218
C(18)	-0.278588	0.566192	-0.492039	0.6235
C(19)	0.706744	0.727561	0.971389	0.3332
C(20)	3.695793	1.117129	3.308297	0.0012
C(21)	0.326544	0.105421	3.097531	0.0024
C(22)	0.299730	0.298780	1.003181	0.3177
C(23)	-0.187558	0.173842	-1.078895	0.2827
C(24)	1.800289	1.021808	1.761866	0.0805
Determinant residual covariance		3295.976		

Equation: D(AGDP) = C(1)*(AGDP(-1) - 0.0755658659516*EDS(-1) - 0.0155461622804*EGS(-1) + 0.212332369847*ICP(-1) - 13.4777390528) + C(2)*D(AGDP(-1)) + C(3)*D(EDS(-1)) + C(4) *D(EGS(-1)) + C(5)*D(ICP(-1)) + C(6)

R-squared	0.639432	Mean dependent var	-0.304451
Adjusted R-squared	0.583094	S.D. dependent var	
S.E. of regression	0.632623	Sum squared resid	
Durbin-Watson stat	1.830847		

Source: World Bank Indicators. - E-Views9 computations.

The elasticity results obtained in the regression model in Table (6) indicate a negative and statistically significant effect of the EDS, EGS, and ICP variables on the AGDP in the short run, as a 10% increase in the total external debt stocks (EDS), The exports of goods and Services of country (EGS), Rate of national inflation (ICP) will result in a decrease of 0.26%, 0.97%, 0.08% in the percentage of agriculture's contribution to GDP.

The model performance quality was confirmed in table 7 as Residual Serial Correlation LM Tests showed that there is no self-correlation of the residual, as was shown by the Heteroskedasticity test that the residuals have a homogeneous variation in table 8, then the Wald test which shows that the sign of coefficients is negative, which means that the negative effect for the EDS, EGS, ICP variables on the AGDP in the short run –table 9.

Table 7 . VEC Residual Serial Correlation LM Tests.

Lags	LM-Stat	Prob
1	15.40499	0.4952
2	11.43547	0.7818
3	22.85789	0.1176
4	14.74119	0.5437
5	11.07636	0.8047
6	17.19453	0.3731
7	11.81635	0.7565
8	12.29729	0.7233
9	21.70686	0.1529
10	11.28936	0.7913
11	12.24781	0.7268
12	19.08697	0.2642

Source: World Bank Indicators. - E-Views9 computations.
Probs from chi-square with 16 df

Table 8. VEC Residual Heteroskedasticity Tests

Chi-sq	df	Prob.
118.7563	100	0.0972

Source: World Bank Indicators. - E-Views9 computations.

Table 9. Wald Test

Test Statistic	Value	df	Prob.
Chi-square	13.31930	3	0.0040
Null Hypothesis: C(3)=C(4)=C(5) =0			
Null Hypothesis Summary:			
Normalized Restriction (= 0)		Value	Std. Err.
C(3)		-0.026279	0.012100
C(4)		-0.096992	0.034295
C(5)		-0.008477	0.019954
Restrictions are linear in coefficients.			

Source: World Bank Indicators. - E-Views9 computations.

CONCLUSION

From results that were previously reviewed, important points can be conclude, that the main factors for the contribution percentage of agriculture to GDP are total external debt stocks, exports of goods and services, and the rate of inflation.

First: In spite of the hypothetical positive effect of the total external debt stocks on agriculture's contribution to GDP, the Egyptian reality imposes the opposite, where the increase in non-agricultural exports with high added value such as iron and steel exports, textiles, petroleum and chemical products, and construction requirements, thus the contribution of the industry and services sectors to GDP increases at the expense of agriculture to meet external debt.

Second: In Egypt where exports of all goods and services increase, their impact is negative on the agriculture contribution to GDP, because of increase in exports of all goods and services, thus the competitiveness of the agricultural sector decreases due to decline in its contribution to the gross domestic product.

Third: The inflation rate has a negative effect on the Egypt's agriculture contribution to the GDP, driven by the increase in agricultural labor wages and agricultural production requirements, which contributed to a decrease in the percentage of agriculture in GDP.

RECOMMENDATION

Considering that the agricultural sector has multiple relationships in the national economy as well as its contribution to GDP, the study recommends diversifying and increasing agricultural exports to encourage investment in this field, which helps to increase agricultural output and thus increase its contribution to the gross domestic product.

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العوامل المؤثره علي الاسهام النسبي للقطاع الزراعى في الناتج المحلي المصرى

ولاء على محمد أحمد

جامعة القاهرة- كلية الزراعة

تستهدف هذه الورقة البحثيه دراسة العوامل التى تؤثر على الاسهام النسبى للقطاع الزراعى فى الناتج المحلى الإجمالى المصرى، والتى يمكن تقسيمها إلى عوامل تتعلق بمؤشرات النمو الاقتصادى واخرى تتعلق بالقدرة التنافسية للقطاع الزراعى. وقد تبين من خلال تقدير نموذج تصحيح الخطأ الاتجاه (VECM)، وجود تأثير كبير لكل من إجمالى أرصدة الديون الخارجية، وصادرات جميع السلع والخدمات، ومعدل التضخم على الاسهام النسبى لقطاع الزراعة فى الناتج المحلى الإجمالى المصرى.

الكلمات الرئيسية: مصر، الناتج المحلى الإجمالى، القدرة التنافسية، الزراعة، VECM.