Journal of Applied Science and Agriculture, 9(6) May 2014, Pages: 2625-2631

AENSI Journals

Journal of Applied Science and Agriculture

ISSN 1816-9112

Journal home page: www.aensiweb.com/jasa/index.html

The Role of Agriculture in Iran's Economic Growth (1961-2002): An Analytical-Econometric Analysis

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ARTICLE INFO

Article history:
Received 20 March 2014
Received in revised form 20 April 2014
Accepted 15 May 2014
Available online 1 June 2014

Keywords:
Agriculture Sector, Economic Growth, Investment, Employment.

ABSTRACT

This paper examines the role of agriculture sector in national economy and economic growth in Iran (1961-2002). The analytical obtained results show that the sector in non-oil exports, the share of the sector in national production and domestic investment as well as in employment is not of great significance. After proceeding the test of Phillips-Perron unit root Johansen co-integration, the results econometric models indicated that one percent increase in agricultural value leads to 0.13% increase in the economic growth. Also, one percent increase in the share of agricultural investment leads to 0.15% increase in the economic growth. The estimation of spillover effect showed that these is a one-by-one relationship between investment in agriculture sector and production in other sectors.

To Cite This Article: Tehranchian, A.M. and Behravesh M., The Role of Agriculture in Iran's Economic Growth (1961-2002): An Analytical-Econometric Analysis. ***J. Appl. Sci. & Agric.,*** *9(6): 2625-2631, 2014*

INTRODUCTION

Undoubtedly, the most important factor of the significance of agriculture for humankind has been satisfying the primary needs. The oldest ancient civilizations were formed in parts of the world which were geographically and environmentally available for agricultural activities. In fact, other economic sectors were formed later and to meet the needs of agricultural activities. The need for agricultural tools and machinery led to the development of industry, and also, the transportation of products led to the development of servicing sector. Although after the industrial revolution and the gradual omission of Feudal economic-politic principle, the sectors of industry and investment became of greater significance, this sector is still introduced as the axis of economic growth and development. Rather high rate of application of agriculture in comparison with sectors of mine and industry, as a consequence high rate of employment, the availability foreign exchange due to exportation, frugality in foreign exchange spending through the reduction of importation of agriculture goods via increasing domestic agricultural production, the strategic nature of some of its products, the provision of some necessary data for the sectors of industry and servicing, and a market for the output of other sectors, are some of the reasons of the significance and importance of agriculture in national economy.

The potential contribution of agriculture to economic growth has been an on-going subject of much controversy among development economists. Much of the early work on this issue coincided with the debate on the role of agriculture in promoting economic development in low-income nations in the aftermath of extended periods of colonial rule Lewis, 1954; Fei and Ranis, 1961; Jorgenson, 1961; Johnston and Mellor, 1961; Schultz, 1964; Awokuse, 2009).

Johnston and Mellor (1961) have introduced five inter-sartorial linkages for the role of agriculture in economic growth which are based on noticeable studies. These elements which include forward and backward linkages of agriculture with other sectors are:

A. Providing food for consumption
B. Labor supply (especially to industry sector)
C. Market for industrial products
D. Supplying savings
E. Possible pool of foreign exchange earnings

Although during the last decade, steps have been taken to develop industrial sectors in our country, the agriculture sector, directly and indirectly, is still the main component of economic activities for many people in

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our country. After the Islamic revolution, in all first, second, third of fourth development plans, agriculture has been named as the axis of development.

The centrality of agriculture's role in the process of economic growth was widely investigated in the literature of economic development and was debated virtually from two broad points of view.

Two polar views on the agriculture's role in the process of economic growth are prominent in the literature of economic development. At one pole, a substantial literature argues agriculture plays a negative role in the growth of national economy. At the other pole is the view that agriculture is of importance to economic growth. Agriculture plays a negative or insignificant role in developing countries. Agriculture is a declining industry during the process of economic growth, that is, the share of agriculture in GDP over time becomes smaller and smaller (Syrquin, M. and Chenery, 1989). Some people convince policy makers to consider agriculture as a black box and resources can be deprived from them without expense. Lewis (1954) asserts it is not worth investing as a low-productivity sector.

This indicates resources should be transferred from the agricultural sector to nonagricultural sectors due to nonagricultural sectors are more productive to modernize the economy and enhance the entire national output. Does a development strategy of "rapid industrialization", apparently the surest path to higher incomes, mean that agriculture should be squeezed for resources (Timmer, 1988). Fane and Warr (2007) conclude "The poor do much better if given amount of GDP growth is produced by technical progress in services or in manufacturing than if it is owing to technical progress in agriculture" (Tsakok, I., Gardner, 2007). Agricultural development and economic growth has appositive relationship. Most of the modern development economists agree that the role of agriculture and agricultural development are absolutely the main part of nation-building and healthy development (Johnston and Mellor, 1961). The new growth economics study's the agricultural potential role in promoting economic growth from the perspective of analysis (Barro and Sala-i-Martin. 2003). Lloyd (1953), Anderson and Hayami (1986), Timmer (1992) analyses how to stimulate the forward linkages between the growth process and agriculture. "Economic growth and the contribution of agriculture" is written by Kuznets (1961), a book which puts forward several "contribution" of agricultural sector to economic growth, namely product contribution (food a draw materials), market contribution, element contribution (including surplus capital and surplus labor), as well as exchange contribution. Time series techniques used by Kanwar (2000) and show that agricultural growth is causally prior to growth in manufacturing. Nichols (1963) emphasize the interdependence between a country's agriculture and its industry. This result alone argues that past investments in agriculture have had large economic returns (Mundlak, 2001).

Literature Review:

The first view argues that agriculture plays only a passive role as the most important source of resources (food, fiber, and raw material) for the development of industry and other non-agricultural sectors (Lewis, 1961; Hirschman, 1958; Johnston and Mellor, 1961; Bezemer, D., Headey, 2008).

This point of view suggests that agriculture provides input materials, capital and labor for the rest of the economy in order to raise total national output since the industrial sector is more productive than agriculture and the modernization of the economy and, therefore, the growth of the global output passes by a certain taxation of agriculture as means to develop the industrial sector and to transfer resources from agriculture toward the other sectors (forward linkage effects). This idea was mainly evoked in the context of dualistic models. In this traditional analysis of agriculture-industry linkages and the behavior of the real sectors in the economy, agricultural performance is treated as exogenous to the economy, while industrial performance is endogenous, owing in part to rain dependence of agricultural output (Chebbi, 2010).

The most recent view maintains the forward linkage effects of agriculture but also underlines its backward linkage to other sectors of the economy (Yao, 2000).

Agriculture not only provides resources to non-agricultural sectors, but is also an important market for industrial products and benefits in turn as industry helps modernize traditional production techniques by providing modern inputs, technology, and improved managerial skills (Hazell and Röell, 1983; Haggblade et al., 1989; Delgado, 1994). The end result is that both sectors benefit from each other and the nation benefits from their growth and increased efficiency (Chebbi, 2010).

Several empirical studies have investigated, using various methodological approaches (econometric and simulation techniques), the "multiplier" effects of agricultural growth rate on other sectors' growth rates and agricultural contribution to economic growth of both least developed and developing countries. While a number of linkages can be envisaged, the general idea seems to be one where agriculture's contribution to growth is significantly larger than its output share would suggest. In addition, these studies show that the magnitude and the transmission channels of agriculture's multiplier effects vary substantially, depending on the tradability of inputs and outputs, agricultural employment shares, consumption patterns, distributional impacts of income and assets, the abundance of underemployed resources, and, indirectly, a range of policy factors (Delgado, 1994; Humphries and Knowles, 1998; Block, 1999; Henneberry and Khan, 2000; Dorosh and Haggblade, 2003).

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Although several studies have outlined the theoretical relationship between agriculture and economic growth, disagreements still persist and the causal dynamics between agriculture and economic growth is an empirical question worthy of further investigation, as described by Awokuse (2009).

Tsakok and Gardner (2007), in a critique of previous empirical analyses on the role of agriculture in economic growth, argue that early works based on econometric study of cross-sectional data for a panel of countries, or possibly regions within a country, have significant limitations and have not provided definitive results. In particular, given the presence of non-stationary, conventional regression techniques may yield spurious regressions and significance tests. Also, the results are limited to showing only that agriculture and GDP growth are correlated, but could not provide information on the direction of causality.

Awokuse (2009) notes that the issue of causality is dynamic in nature and is best examined using a dynamic time series-modeling framework.

Gardner (2005), in a cross-sectional panel of 52 developing countries, discovers no significant evidence of agriculture leading overall economic growth.

However, Tiffin and Irz (2006), using cointegration framework and Granger-causality tests on data for 85 countries, find statistical evidence that supports the conclusion that agricultural value added is the causal variable in developing countries, while the direction of causality in developed countries is unclear.

Awokuse (2009) examines the role of agriculture as an "engine of growth" by analyzing data for 15 developing and transition economies in Africa, Asia, and Latin America with the aid of the autoregressive distributed lag model proposed by Pesaran *et al.* (2001). His statistical results provide strong evidence indicating that agriculture is an engine of economic growth.

Yao (2000), in his country-specific study, demonstrates how agriculture has contributed to China's economic development using both empirical data and a cointegration analysis. Two important conclusions are drawn by this author. First, although agriculture's share in GDP declined sharply over time, it is still an important force for the growth of other sectors. Second, the growth of non-agricultural sectors had little effect on agricultural growth. This was largely due to government policies biased against agriculture and restriction on rural-urban migration.

In addition, it is important to note that with advances in time series econometric techniques, Kanwar (2000) and Chaudhuri and Rao (2004) recommend that in estimating the relationship between agricultural and non-agricultural sectors the former should not be assumed to be exogenous, rather, this should first be established.

In his study of Indian agriculture, Kanwar (2000) investigates the cointegration of the different sectors of the Indian economy (namely, agriculture, manufacturing industry, construction, infrastructure, and services) in a vector autoregressive (VAR) framework to circumvent problems of spurious regressions given the presence of non-stationary data.

Katircioglu (2006) analyzes the relationship between agricultural output and economic growth in North Cyprus using cointegration. The author uses annual data covering the 1975-2002 period, to find the direction of causality in Granger sense between agricultural growth and economic growth. Empirical results suggest that agricultural output growth and economic growth as measured by real GDP growth are in long-run equilibrium relationship and there is feedback relationship between these variables that indicates bidirectional causality among them in the long-run period.

The author concludes that agriculture still has an impact on the economy although North Cyprus suffers from political problems and drought.

Methodology:

In this study all the data are gathered using the method of library. The time domain of the research includes data from the years 1961-2002 and the data is gathered with regards to the information available in the country. To illustrate a clear picture about the role of agriculture in national economy, a part of this study is dedicated to the primary share of agriculture in national production, whole exportation, employment and total investment in the country. Also, to estimate the modulus of elasticity of economic growth over agriculture sector production, the following regression model is suggested:

$$RGDP = \alpha.RVAK + \beta.ARVAKH + \theta.RVAS + \lambda.RVAN + V_1 \quad (1)$$

In which RGDP, RVAK, RVAKH, RVAS, and RVAN in order represent GDP growth, value added growth in agriculture sector, services, mine and industry and Oil. Also, the coefficients of α, β, θ, and λ are the modulus of elasticity in the order presented for GDP over value added in agriculture sector, services, mine and industry, and oil and V_1 is disruption of the suggested model.

In addition to the model above, to estimate the effect of investment in agriculture sector on GDP and to compare its effect on other sectors, the following model is presented:

$$LGDP = \alpha.LSK + b.LSKH + c.LSN + d.LSS + V_2 \quad (2)$$

In which LSK, LSKH, LSN, LSS, and V_2 in order represent the natural logarithm of GDP, the share of agriculture, services, oil, and mine and industry sectors in total investment of the country and disruption of the model. The coefficients of a, b, c, and d are the modulus of elasticity of GDP over investment in the sectors listed in the same order.

In addition to the mentioned above, the effect of investment overflow in agriculture on the total production of other economic sectors is estimated using the following suggested model:

$$LGDPBK = m + n.LIK + V_3 \quad (3)$$

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In model 3, LGDPBK, LIK and V_3 are in order, the natural logarithm of GDP without the consideration of agriculture sector, the natural logarithm of investment in agriculture sector, and the disruption of the model. Here, the coefficient of n is the traction of GDP in other economic sectors over investment in agriculture sector.

The econometric models above were estimated using the OLS (ordinary Least Square) and via E-views software (Gujarati, 2011).

Results:

The information regarding the share of different economic sectors in GDP, industry, employment and exportation during years 1961-2002 are presented in the table 1. As the table shows, services and oil have had the most share and agriculture has had the least share in GDP during the time domain. According to this table, during this time domain, the share of agriculture sector has not had any significant increase. Also, the share of agriculture from the total investment has been the 5% which is lowest in comparison to other economic sectors, where most investments have been dedicated to services, mine and industry sectors. According to the data in this table, the growth rate of agriculture sector up until the year 1981 has been positive, while since then, despite its temporary rise and fall, it has been negative. Despite this fact, the share of agriculture sector in total non-oil exportation has been more than other economic sectors until the year 1997. The data in the following table shows that although until the year 1980 agriculture has had the most share in employment, since then most share of employment has been taken by the services sector.

Table 1: Comparison of Different Economic Sectors in Iran in Terms of Macroeconomic Indicators during 1961-2002.

Year	Share of Value added in GDP				Share of all sectors in total investment				Share of sectors in non-oil exportation			Share of sectors in employment		
	Agriculture	Oil	Mine and Industry	Services	Agriculture	Oil	Mine and Industry	Services	Agriculture	Mine	Industry	Agriculture	Mine and Industry	Services
1961	16.5	36.8	8	39.6	5.79	8.21	28.99	57.1						
1962	15.6	38.6	8.1	38.7	5.51	6.04	21.26	67.19						
1963	15.1	39.2	8.8	38.1	5.51	6.3	17.41	70.79						
1964	13.7	40.2	8.5	38.8	6.8	4.53	19.58	69.09						
1965	12.8	40	9	39.4	3.86	8.96	22.57	64.62						
1966	12.1	41.5	8.7	39	3.18	6.99	25.68	64.16						
1967	11.8	41.9	8.9	38.7	3.72	10.19	26.67	59.41						
1968	11.5	43.3	9.3	37.4	3.64	10.09	27.37	58.9						
1969	10.3	45.8	9.2	36.4	3.68	8.67	27.81	59.84						
1970	9.7	46.6	9.6	36	3.61	5.92	27.32	63.15						
1971	8.5	47.2	9.6	36.6	4.29	7.33	28.52	59.82						
1972	8.3	45.6	9.2	38.9	4.69	6.72	28.02	60.57	72	4	23			
1973	8.1	47	10.8	36.7	4.19	5.5	27.5	62.81	80	4	17			
1974	7.5	41.6	10.9	44.1	5.47	5.68	24.81	63.77	66	6	28			
1975	7.8	34.9	11.4	50.5	4.16	4.49	32.85	58.5	70	6	25			
1976	7.4	33.6	14.2	48.7	3.26	10.26	30.86	55.62	70	2	28			
1977	7.3	31.6	13.6	51.6	2.84	7.23	30.89	59.05	72	0	27			
1978	8.4	24.3	15.4	56.9	2.9	7.8	23.65	65.65	68	2	30	37	30.4	32.4
1979	9.4	19.7	13.3	61.5	3.96	6.02	17.25	72.78	89	3	8	35.6	30.8	33.5
1980	11.4	7.6	16.3	69.1	4.1	3.61	16.76	75.53	93	3	4	35.1	29.5	35.3
1981	12.2	8.5	16.4	66.1	4.48	4.6	20.7	70.22	95	1	4	34.7	28	37.2
1982	11.6	17.2	15	58.3	3.59	6.7	22.03	67.65	90	3	8	33.6	27.4	39.1
1983	10.9	15.8	15.6	58.7	3.4	5.68	21.38	69.54	89	4	7	32.1	26.9	41
1984	12	12.8	15.7	60.7	2.49	4.87	23.39	69.25	82	11	8	30.9	26.6	42.6
1985	12.6	12.8	14.8	60.7	3.36	3.29	19.85	73.46	80	6	14	29.8	26.1	44.1
1986	14.6	12.1	16.4	57.6	3.76	3.96	16.13	76.15	85	3	12	28.9	25.6	45.5
1987	15.1	14	17.3	54.1	4.16	2.34	17.2	76.3	85	3	11	28.1	25.8	46.1
1988	15.9	16.1	16.2	52.3	4.34	2.52	22.64	70.5	74	3	22	27.6	25.4	47
1989	15.6	16.3	15.7	52.8	4.79	1.62	24	69.58	86	3	12	26.8	25.7	47.5
1990	15.2	17.1	17.4	50.9	4.92	3.18	25.42	66.47	79	2	18	25.8	26.3	47.8
1991	14.3	17.4	19	50.2	4.88	2.59	29.59	62.94	73	2	25	24.6	27.7	47.7
1992	15.2	16.7	18.6	50.3	4.03	2.01	27.37	66.59	67	1	32	24.2	28.3	47.5
1993	15.1	17.3	18.3	50.2	4.57	2.33	29.65	63.45	67	1	32	24.1	28.3	47.8
1994	15.4	16.2	18.4	51.2	4.58	4.16	25.61	65.65	68	1	31	23.8	28.8	47.4
1995	15.5	16	17.6	51.6	4.28	4.26	25.98	65.47	58	2	39	23.6	29.6	46.8
1996	15.1	15.2	19.3	51.4	4.66	6.98	22.54	65.82	53	2	46	23	30.7	46.3
1997	14.8	14	20	52.4	3.95	6.16	23.4	66.49	43	2	55	22.9	30.2	46.9
1998	15.9	13.9	18.7	52.5	3.39	5.86	25.06	65.69	47	0	53	22.9	29.4	47.7
1999	14.5	13	20	53.5	5.5	7.78	22.18	64.54	44	1	55	22.8	29	48.1
2000	14.3	13.4	21	52.4	4.61	5.84	23.32	66.23	39	1	60			
2001	13.8	11.9	22.2	53.2	4.22	.84	20.76	69.19	38	2	60			
2002	14.3	11.6	23.1	52	4.21	5.97	21.35	68.47	35	4	61			

Source: the information regarding the share of economic sectors in GDP, investment, and non-oil exportation have been obtained from Iran's economic illustrator software packages; and the information regarding the share of economic sectors in employment has been obtained from the website http://www.iran-economy.com.

Since non-stationary variable may be considered a factor of invalidity for the suggested coefficients in the models, the Phillips-Perron (1988) unit test root has been taken for all the variables. The results of this estimation are presented in table 2 below.

Table 2: The Results Obtained from Phillips-Perron Final Test.

Variable	MacKinnon critical value	Status reliability
LSK	-3.5	Persistent at 15% Error level
LSN	-2.5	Non-stationary
LSS	-2.9	Persistent at 5% Error level
LSKH	-3.01	Persistent at 5% Error level
LGDP	-2.02	Non-stationary
LGDPBK	-2.4	Non-stationary
LIK	-1.5	Non-stationary
RGDP	-3.5	Persistent at 5% Error level
RVAK	-7.5	Persistent at 1% Error level
RVAKH	3.7	Persistent at 1% Error level
RVAS	5.7	Persistent at 1% Error level
RVAN	5.4	Persistent at 1% Error level

Source: researcher's findings

As table 2 shows, the variables of the share of investment in industry, GDP (with and without the inclusion of agriculture), and investment in agriculture sector are non-stationary. Therefore, to ensure the validity of these regression variables, the co-integration Johansen test has been implemented. The existence of co-integration vectors in the suggested model in fact shows the existence of a long-term balanced relationship, hence the estimation of the model using OLS. The results of the Johansen test are presented in table 3 below.

Table 3: The Results Obtained from the co-integration Johansen test.

Series: RGDP, RVAK, RVAKH, RVAS and RVAN			
Hypothesis No. of CE(s)	1% critical value	5% critical value	Likelihood statistic
*None**	67.1	68.5	119.3
*At Most 1**	54.5	47.2	75.6
*At Most 2**	35.7	29.7	44.9
*At Most 3**	20	15.4	25.8
Series: LGDP, LSK, LSN, LSS, LSKH			
Hypothesis No. of CE(s)	1% critical value	5% critical value	Likelihood statistic
*None**	76.1	68.5	90.7
*At Most 1**	54.5	47.2	52.5
*At Most 2**	35.7	29.7	21.5
*At Most 3**	20	15.4	8.9
*At Most 4**	6.7	3.8	3.5
Series: LGDPBK, LIK			
Hypothesis No. of CE(s)	1% critical value	5% critical value	Likelihood statistic
*None**	20	15.4	17.2
*At Most 1**	6.7	3.8	4.7

Source: researcher's findings
** Refers to the disregarding of the claim of invalidity of co-integration vectors in significance level of one percent.*

According to the data from table 3, the long-term relationship between dependent and independent variables in the suggested models is significant.

Therefore, the suggested models can be estimated using OLS. The results of the estimation of the suggested models above are presented in table 4 below.

Table 4: The Results Obtained from the Estimation of Regression Models.

Dependent Variables	Constant Coefficient c	Independent Variables										
		RVAK	RVAKH	RVAS	RVAN	LSKN	LSKH	LSN	LSS	LIK	$\bar{R}^2$ statistic	Durbin–Watson statistic
RGDP	-	0.13 (1.9)	0.45 (9.5)	0.22 (6.3)	0.1 (11)	-	-	-	-	-	91%	2.1
LGDP	-	-	-	-	-	0.15 (2.2)	2.21 (26)	0.24 (6.6)	0.92 (1.9)	-	97%	1.8
LGDPBK	6.1 (13.8)	-	-	-	-	-	-	-	-	0.8	93%	1.9

Source: researcher's findings

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Numbers in parentheses are the statistic

As table 4 shows, with one percent increase in the value added of agriculture sector, economic growth increases by 0.13% on average, while services sector has more effect on economic growth in comparison. With one percent increase in the investment in agriculture sector, GDP will be increased by 0.15%. The results of the estimation of the modulus elasticity of GDP –without the inclusion of agriculture sector- over investment in agriculture shows that one present increase in investment in agriculture sector increases the production of other sectors by 0.8% on average.

Conclusion:

Population, the need of other economic sectors for agriculture sector, employment, the need for foreign exchange earnings, alongside the expandable opportunities of agriculture products regarding different climates, the availability of sea, farmable lands and jungles and trained and experienced workers have all added to the importance of agriculture sector.

The present article showed that despite the aforementioned regarding the share of agriculture sector during the time domain of 1961-2002, which has not been significant, and the share of agriculture sector in GDP and the modulus elasticity over the agriculture sector which have all been low, the main reason for this matter seems to be low investment in agriculture sector in comparison to other economic sectors. Therefore, it is suggested that efforts be taken in order to attract investment towards this economic sector. Tax privileges, production subsides, financial support with precise supervision, presentation of technical and scientific consults, the expansion of farming complexes, and national and international marketing can all be ways to develop agriculture sector and to efficiently use the potential in this sector.

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