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Investigation the Influencing Mechanisms & Short Term - Long Term Dynamism Impact of Iran's Oil Revenues on Value Added in Agriculture

Pouria Ghasabi Kohne Ghouchan[a]*, Mohammad Reza Lotfali Pour[b], Mohammad Taher Ahmadi Shadmehri[c]

[1] MA in economical science, Ferdowsi University of Mashhad, Mashhad, Iran
[2] Full Professor in economical science, Ferdowsi University of Mashhad, Mashhad, Iran
[3] Associate Professor in economical science, Ferdowsi University of Mashhad, Mashhad, Iran

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Abstract

In recent decade, oil revenues have become the most essential resource of state revenue in Iranian economics and have affected other sectors and main economical variables either directly or indirectly. Due to the importance of agriculture in economical growth and development, increasing social welfare and meeting men's alimentary needs have undoubtedly been affected by fluctuations of petroleum price and has been prevented from appropriate development. Accordingly, the recent work studies the effects of petroleum revenues on added value of agriculture during the period 1971-2012 by using vector autoregression (VAR) and vector error-correction methods (VECM). The estimated co-integrated vector by Johansen's and Juselius's method suggests the existence of long-term equilibrium relationship among agricultural added value, petroleum revenues, capital stock of agriculture sector, agricultural exports. So that petroleum revenues have a negative effect and capital stock of agriculture sector and agricultural exports have a positive effect on agriculture added value. Error-correction model (ECM) that shows equilibrium rate toward long-term has been estimated as 1 percent with a minus sign, and indicates that 1 percent of established in equilibrium is adjusted annually that suggests a slow equilibrium rate.

Keywords: agriculture sector, oil revenues, agricultural added value, vector autoregression (VAR) method, Johansen's and Juselius's method, vector error-correction methods (VECM).

1. Introduction

Iran's oil and its effects on other economic sectors is an important and widespread subject of debate developed also into other areas including sociology, politics and even technical problems. The main reason is that this part of national economy and the effects world has on it is important in both critical and non-critical conditions (Piri et al. 2011). As a primary sector for supplying the increasing population's demands for food products, agriculture has invariably played a significant role in Iran's economy. Apart from providing sufficient food, a developed agriculture can at the same time contribute to the provision of other economic needs (Sarvzadeh et al. 2012).

In Iran, the general state of economy and its subsections including agriculture are extremely affected by oil revenues. Any instability, thus, would critically influence all economic sections and the competitiveness of the traditional tradable sections such as agriculture would gradually decline. At time of oil boom and improved currency revenues, agriculture experiences a serious loss.

In many papers and research, extreme dependency on oil revenue has been expressed as the chief reason of economic turmoil. Theories of 'Resource Curse' and 'Dutch disease' have been examined in such framework. To this end, instead of owing its growth and development to the oil, Iran has been hit by it. There are many countries lacking such gifts but having more developed economy and taking advantage of their minimum potential and capacities to the favor of their economy. Apart from irreversible damages imposed to the whole body and the structure of economy, the windblown dollars have turned to an obstacle in the way of growth and development of other natural gifts and other economic sectors including agriculture. Thus, extensive studies have been done on Iran's oil and its effects on other economic sections.

In a study titled "oil prices, financial policy and the economic growth of Venezuela", El-Anshasy, A. , Bradley, M.D. and Joutz, F.L.(2006) examined the relationship between oil price and government's revenues, economic growth, consumption and funding. Results showed that economic dependency of Venezuela on oil price had gone up and such escalation had come with less growth in agricultural sectors and other non-oil industries. Price fluctuations have also had negative effects on the country's economic efficiency and it is now suffering from resource curse.

Levy, S.(2006) studied the influences of the agricultural policies on measures taken in Chad to protect the country against Dutch disease. Using CGE, he analyzed the effects of oil revenues on investment in basic infrastructures such as road networks and irrigation systems. Results reveal that the improved water supply has helped Chad less struggle with food aid dependency. Rural areas have experienced changes in family life and reduced the de-agriculture phenomenon.

Using Nigeria's seasonal data from 1980 to 2003 and VAR, Olusi and Olagunju (2005) confirmed that the oil boom and rising oil prices triggered off a depression in agricultural production and export. Accordingly, this, though with a delay, tended to cause "Dutch-Diseases" in the country. Contrary to the previous studies considering the industrial sector as an interchangeable sector during depression in less developed countries, they treated agriculture as the traditional interchangeable sector. They, finally, suggested that the government had to put more emphasis on agriculture.

Ismail (2005) studied Dutch disease according to the effect of export price index on the production of the interchangeable and non-interchangeable parts from 1980 to 2001. He, initially, defined the regression model of any of the economic sectors and confirmed that production was a function of export price index, inflation rate, government expenditure, non-oil GDP and value added in oil sector. He estimated then the model by OLS. Research results revealed the significantly negative effects of export price index on production of interchangeable sectors (agriculture, industry and mines). A higher export price index, on the other hand, would increase the volume of production in non-interchangeable sectors (construction) and confirm the existence of Dutch disease in the economy of Saudi Arabia.

Puyana (2000) evaluated the influences of rising oil revenues on Colombia's agriculture from 1980 to 1994. He presented convincing evidence of Dutch disease in the country's economy and agriculture. That is to say, ascending oil revenues moved practitioners in agriculture sector into other sectors and the growth rate in production, cultivated areas, and labor productivity sharply slumped.

As for local research, using seasonal data released by the Central Bank for 1988 to 2007 and applying VAR, Bahrami and Farshchi (2011) examined the symptoms of Dutch disease in Iran's agriculture. According to the results, value added in agriculture sector has not been significantly affected by oil shock. Relative prices of agricultural products, however, significantly declined with escalating oil prices. Hence, Dutch disease in Iran's agriculture was not rejected. Despite of supportive policies taken by government to avoid distasteful consequences of falling relative prices, such behaviors never guarantee the development of agricultural activities in future.

Piri et al (2011) studied the effects of oil export fluctuations on Iran's agricultural growth during 1971 to 2007, using Autoregressive Distributed Lag (ARDL) models. According to the results, a long-term and co-integrated correlation was observed between value added in agriculture and other variables. Value added in agriculture was also negatively and significantly affected by oil export instabilities. There was a positive significant correlation between capital inputs and export rate in agriculture sector and the growth rate (value added in agriculture).

Adopting co-integrated techniques and error correction mechanism, Rasekh Jahromi and Abedi (2011) studied the contribution of agricultural exports to economic growth of 1976 to 2009. Result revealed that value added in agriculture is positively and significantly affected by agricultural product export values, labor force and the gross fixed capital.

Mohammadi et al. (2011) examined the effect of bank credits and the real exchange rate on agricultural production growth of 1983 to 2006, employing Johansson convergence technique and vector error correction models. Accordingly, a significant positive effect was observed on agricultural export by value added, real exchange rate and relative export price.

Mehrara and Miri (2010) practiced co-integration analyses and the short-term and long-term Granger causality tests to study the effect of oil revenues on different economic sectors of three exporting countries: Iran, Mexico and Venezuela. Based on research results, ascending oil revenues caused an expansion in service sector and shrinkage in industry and agriculture. The evidence of Dutch disease was clearly observed in these countries.

2. Theoretical Principles

Oil dependence causes any negative oil shock and falling oil revenue to influence Iran's economy profoundly. Such dependence may result in a state in which the effect of oil fluctuations in long-term would reduce the economic growth due to the following reasons:

First, most oil exporting countries have a relative benefit in agriculture which is damaged as a result of Dutch disease. Loses caused by Dutch disease is usually irreversible in short-term. Second, revenues obtained by natural resources are unpredictable and unreliable. Relying on them, thus, would be followed by distasteful outcomes (Shirin-Bakhsh and Moghadas-Bayat, 2010).

Unlike developed countries, in which industry is the traditional interchangeable sector, in developing countries, agriculture serves as an interchangeable sector, which is mostly weakened due to abundance of resources (Yazdani and Sherafatmand, 2011). When Dutch disease thereupon occurs, the term deindustrialization is applied to developed countries and the term de-agriculturalization to developing countries (Stijns,J., 2003). In developed countries, the approach of transferring labor force from the traditional to progressing sector would result in a declining industry. Likewise, the same is true of developing countries in which the transferring approach ends in a fading agriculture (Olusi and Olagunju, 2005).

In Iran, agriculture prior to relying on oil revenues contributed significantly to the total employment and national GDP. Yet, rising oil revenues and emerging inclination for industrialization left it unattended (Bakhtiari & Haghi, 2001; Hamideh-pour et al. 2010). Gross domestic product (GDP) is the market value of all officially recognized final goods and services produced within a country in a year, or over a given period of time. Put it another, GDP is obtained by the total role any individual sector plays in domestic production of a country and calculated based on market prices.

Influenced by oil revenues, agriculture is of sectors in which the contribution of value added to non-oil GDP has changed. Any time oil revenues significantly rise, it loses out to oil sector. Such changes are entirely consistent with Dutch disease model (Bakhtiari and Haghi, 2001). Negatively being effected (reduction of value added) has been posed as a symptom of Dutch disease in developing countries (Mehrara & Miri, 2010).

Value added in agriculture includes value added in subsections such as farming and gardening, animal husbandry and animal farming, jungle and grassland, fishery and aquatic animals, and agricultural services. And the growth index is determined in the sector of agricultural supply and product (Harab-Mazar & Ghasemi-Rad, 2009). In a one crop economy (for example oil), value added in agriculture is affected by oil export revenues (Bella Balassa, 1985).

Adopting neoclassical production function, Feder Gershon (1982) classified the total product of economy into two categories of domestic production and export production. He looked at the production of each category as a function of two factors of working and capital. According to him, non-export production depends on export production, as it results in improved efficiency and management in international competition, recognition of advanced production techniques, and etc. Feder defined:

$$\mathbf{N = F(K_n, L_n, X)}$$
$$\mathbf{X = G(K_x, L_x)}$$

where, N is non-export sector, X indicates export sector, K_n and K_x are export and non-export capital stock respectively, and L_n and L_x are labor force in export and non-export sectors. The above model is summarized and used as an applied model as follows:

$$\frac{\dot{Y}}{Y} = \alpha\frac{I}{Y} + \beta\frac{\dot{L}}{Y} + \theta\frac{\dot{X}}{Y}$$

where, Y indicates GDP (Y= X + N), I is total investment and L is total labor force. $\dot{\mathbf{Y}}$, $\dot{\mathbf{L}}$ and $\dot{\mathbf{X}}$ are growth variables of production, investment and labor.

Model Confirmation

Regarding the previous experimental studies and theoretical principles, the research model is confirmed as follows to study the effects of oil revenues on value added in Iran's agriculture:

$$\mathbf{LV = f(LOIL, LK, LX, DU5967)}$$

where LV displays value added in agriculture, LOIL is log of oil revenues, LK indicates log of capital stock in agriculture, LX is log of agricultural export, and DU5967 is the dummy variable of Iran-Iraq War.

Variables are annual and based on the constant price of 1997. As for scale differences, elimination of the variance of variable, feasibility of static test and using the model coefficients, natural log of variables were used. Since the volume of sample was limited, data were available and coefficients were statistically important, other variables were also employed as control variable. And because of not being satisfying, results were omitted from the final confirmation. Due to inaccessibility and undesirable quality of data, the variable of employment was also omitted.

3. Methodology

VAR is generally treated as an analytic tool for analyzing the correlation of agricultural variables and macroeconomics. It can be applied to find responses of major agriculture indices to macro-changes (Symz, 1996). Structural and non-theoretical models are developed for time series prediction. Theory-based structural models include single-equation and concurrent equations regression model. Non-theoretical models, however, are not theory-based and the future behavior of variables is determined by their previous behavior including an error which is not predictable. These models include Autoregressive Integrated Moving Average (ARIMA), Autoregressive (AR), Moving Average (MA) – in which Box-Jenkins is used - and Autoregressive Conditional Heteroskedasticitr (ARCH) (Hamideh-pour et al. 2010 and Gudarzi et al. 2012).

VAR is not analyzed in a similar way to structural equation (Hemati and Mobasherpour, 2009). Coefficients and explanatory level of model parameters are not as important as single-equation methods. Thus, in analyzing VAR, two widespread tools are particularly important: forecast error variance decomposition (FEVD) and impulse response function (IRF) (Behboudi et al. 2009; Jahadi and Elmi 2011).

Model Estimation and Result Analysis

The model was estimated by Microfit4 and Eviews7.1. As it is possible to apply unreliable time series to common econometric methods, it may result in fake regression. Before any estimation, therefore, the reliability of time series should be assured. Table 1 presented the augmented Dicky Fuller unit root test results. As seen in the table, all variables are unreliable, but by differentiating the variables once and for all, their augmented Dickey Fuller statistic would be larger than the critical values and variables would become reliable.

Vector Autoregressive Model

Akaike, Schwarz-Bayesian and Hannan- Quinin criteria are adopted to determine the number of optimum pauses. Table 2 shows the number of optimum pauses based on any of statistics. As Akaike criterion offers more pauses and there is limited data, Schwarz-Bayesian criterion is used because of not losing more freedom to choose the number of optimum pauses. The optimum pause of Model 1 is selected.

Impulse response functions are useful to study the interaction of variables. Except for disturbance, in this method, any of shock equations is inserted to the extent of a standard deviation. The effect of shock on endogenous variables is then traced. According to diagram 1, the effect of shock on value added in agriculture is an indicator of the positive but decreasing effect on value added in agriculture. Value added responses to a pulse on oil revenue in primary terms are fairly increasing and progressively show their effect on economy and finally result in a decreasing value added. Value added responses to a pulse on export revenue in primary terms are negative and progressively positive and increasing.

Variance decomposition is another tool for VAR models to study the short-time dynamic performance. Accordingly, the rate of variables' instability against shocks imposing on other variables is determined. Forecast error variance decomposition allows us to measure the effect of each variable on others over time.

According to table 3, in the first term, 99 percent of forecast error variance decomposition is designated by itself and variables have trivial effect on value added in agriculture. In the second term, 99 percent of forecast error variance decomposition is specified by itself and 0.17 percent is based on oil revenues and a little is explained according to the capital stock and agricultural export. Over time, the effect of value added on forecast error variance decomposition goes down and the effect of other variables goes up. In all terms, value added has the highest rate of effect on forecast error variance decomposition while, over time, oil revenue would influence it more. And it has more effect comparing with two other variables –capital stock in agriculture and agricultural export – up to the seventh term and after the seventh term relative to agricultural export.

Long-Term Dynamic Model

According to table (1), all available variables in collective models are of I(1) kind and it is required to use Johansen and Juselius co-integration method. Johansen and Juselius co-integration method is adopted based on Impact Test ($_{Trace}\lambda$) and Maximum Eigen Value Test ($_{Max}\lambda$) to identify the shape of error correction model and the number of co-integration vectors (Tashkini, 2005). Table 4 summarizes the results of ($_{Max}\lambda$) and ($_{Trace}\lambda$) for these three models.

According to table 4, in the second model, as for the fact that ($_{Max}\lambda$) and ($_{Trace}\lambda$) are smaller than the critical value presented in the level of 95 percent, it is assumed that there is a long-term convergent vector. Such vector indicates that there is an inverted correlation between value added in agriculture and oil revenues. Yet, a direct correlation was observed between stock capital and agricultural export. Since the variables are applied logarithmically, coefficients are interpreted as elasticity. The convergent vector is as follows:

$$LV = -1.4210\ LOIL + 3.8833\ LK + 0.10671\ LX$$
$$(2.6298) \qquad (6.8732) \qquad (0.55150)$$

Relative to oil revenues, long-term elasticity of value added in agriculture is -1.4210. That is to say, one percent growth in oil revenue reduces the value added by 1.4210 percent. Growing oil revenues raise the agricultural import and bring forth de-agriculture phenomenon and consequently Dutch disease. When oil revenues go up, value added in agriculture goes down. The estimated model, consequently, demonstrates an inverted correlation between oil revenues and value added. Long-term elasticity of value added relative to agricultural capital stock and export is +3.8833 and +0.10671.

Error Correction Model

Making connection between short-term fluctuation of variables and long-term equilibrium values, the error correction model considers the short-term dynamic responses of variables. In such model, error correction coefficient is the same as regression error of the long-term reliable model (ut) which shows the speed of returning to the equilibrium state. Vector error correction model for the equation of value added in agriculture can be displayed as follows:

$$DLV = +0.0013441DU5967 - 0.018461ecm1(-1)$$
$$DLV = +0.0013441DU5967 - 0.018461(LV + 1.4210\ LOIL - 3.8833\ LK - 0.10671\ LX) + \varepsilon$$

In short-term equation of value added in agriculture, dummy variable of Iran-Iraq War (1980–1988) is significant which shows that this shock has a positive role in demonstrating the short-term changes in value added during the considered term. Showing the speed of equilibrium toward long-term, ECM is estimated at 1 percent. The signal is negative and shows that 1 percent of non-equilibrium is annually adjusted.

4. Conclusion and Suggestions

In recent century, Iranian oil revenues have changed to a main source of revenue for government and directly and indirectly influenced other sectors and important economic variables. Respecting the importance of agriculture in economic growth and development, the society's well-being and food demands are undoubtedly affected by oil impulses and have not grown sufficiently. This paper is, therefore, aimed at studying the effect of oil revenues on value added in agriculture as Iran's one of economically active sector.

To study co-integration, Johansen and Juselius method was used. Estimation results of long-term dynamic model reveal the long-term equilibrium correlation of variables. According to results, estimated coefficients conform to theoretical hypotheses. In long-term model, the negative significant effect of oil revenues was observed on value added in agriculture. The coefficient of oil revenues was estimated at -1.4210. This shows that value added decreases with any reduction by 1.4210 percent and de-agriculturalization occurs in consequence. Results also suggest that in value added function, it goes up with agricultural capital stock and agricultural export. In short-term model, ECM is an indicator of very low adjustment of short-time non-equilibrium to long-term equilibrium. This coefficient is estimated at 1 percent which shows the short-term error equilibrium and lowers the process of placing in long-term route.
Suggestions are finally presented as follows:

- Studying the effect of positive and negative oil shocks on other agriculture variables;
- Supporting agriculture when oil shocks occur in particular;
- Protecting agriculture against excessive food imports with the aid of oil revenues;
- Government should allocate a share of oil revenues to reduce the cost of intermediate items; and
- Guaranteed purchase of agricultural products by government which intensifies farmers' motivation.

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Appendixes

Table 1: Unit root test results of the variables of value added model

Result	With y-intercept and without trend			With y-intercept and without trend			variable	
	Pause	Critical Values	Test Statistic	Pause	Critical Values	Test Statistic		Level
Unreliable	0	-3.5348	-3.2839	0	-2.9422	-0.59316	LV	
Unreliable	0	-3.5348	-2.2461	0	-2.9422	-1.0607	LOIL	
Unreliable	0	-3.5348	-2.3199	0	-2.9422	-0.64427	LX	
Unreliable	4	-3.5258	2	-2.9422	-2.9422	1.0694	LK	First Order Differentiation
Reliable	0	-3.5386	-8.3113	0	-2.9446	-8.4521	DLV	
Reliable	0	-3.5386	-7.0099	0	-2.9446	-6.8351	DLOIL	
Reliable	0	-3.5386	-4.6457	0	-2.9446	-5.5081	DLX	
Reliable	1	-3.5386	-3.6153	1	-2.9567	-2.9446	DLK	

Source: Research Calculation

TABLE 2: results of choosing the number of optimum pause of VAR

LR	LR	AIC	SBC	Order
203.7719 [0.000]	502.6373 [0.000]	-32.5199	-38.9635	0
74.6337 [0.171]	184.0964 [0.000]	110.7506	91.4196	1
64.5523 [0.056]	159.2290 [0.000]	107.1843	74.9660	2
47.5971 [0.037]	117.4061 [0.000]	112.0957	66.9900	3
34.2079 [0.005]	84.3796 [0.000]	112.6090	54.6160	4
--------	------	138.7988	67.9184	5

Source: Research Calculation

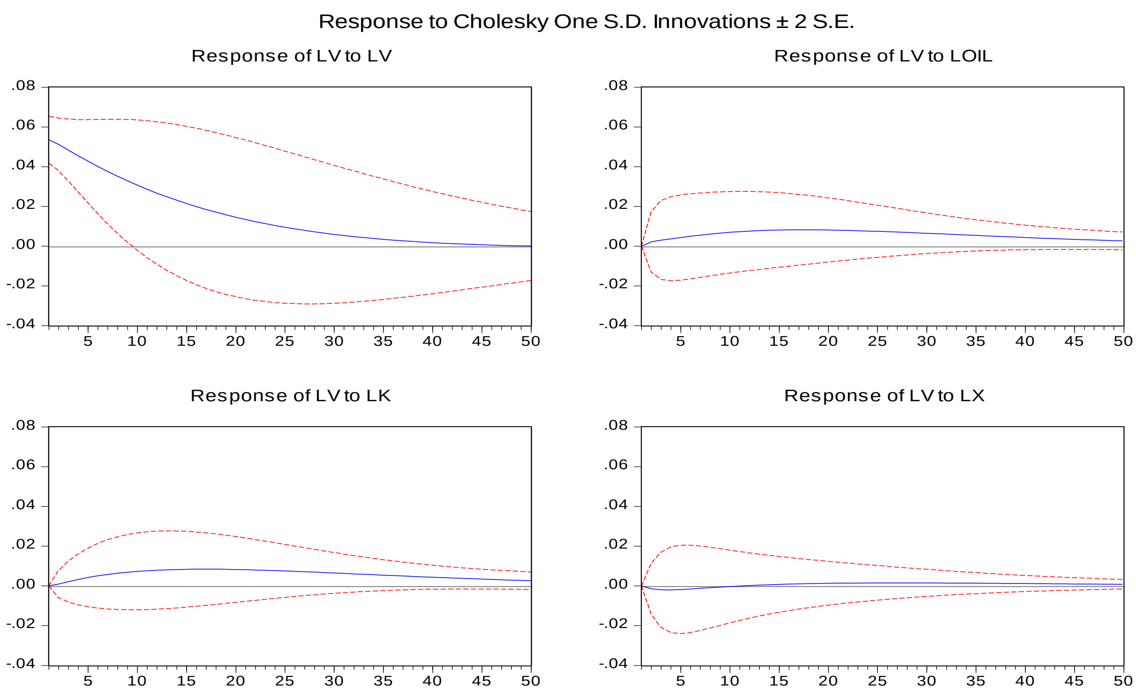

Diagram 1: Value added responses to the standard deviation of a pulse in other variables

Table 3: Results of LV variance decomposition

LX	LK	LOIL	LV	Period
0.00	0.00	0.000	1.0000	1
0.3702 E-3	0.1485 E-3	0.8330 E-3	0.99865	2
0.7333 E-3	0.6711 E-3	0.0017664	0.99683	3
0.9720 E-3	0.0015917	0.0027704	0.99467	4
0.0010945	0.0028648	0.0039154	0.99213	5
0.0011341	0.0044338	0.0052438	0.98919	6
0.0011218	0.0012476	0.0067686	0.98586	7
0.0010813	0.0082618	0.0084829	0.98217	8
0.0010292	0.010438	0.010368	0.97816	9
0.9763 E-3	0.012742	0.012400	0.97388	10
0.9296 E-3	0.015143	0.014551	0.96938	11
0.8931 E-3	0.017612	0.016794	0.96470	12
0.8689 E-3	0.020125	0.019103	0.95990	13
0.8581 E-3	0.022658	0.021454	0.95503	14
0.8605 E-3	0.025191	0.023825	0.95012	15
0.8755 E-3	0.027704	0.026195	0.94523	16
0.9024 E-3	0.030182	0.028545	0.94037	17
0.9398 E-3	0.032610	0.030862	0.93559	18
0.9866 E-3	0.034977	0.033130	0.93091	19
0.0010414	0.037272	0.035339	0.92635	20
0.0011029	0.039487	0.037479	0.92193	21
0.0011700	0.041615	0.039542	0.91767	22
0.0012413	0.043652	0.041523	0.91358	23
0.0013158	0.045593	0.043416	0.90968	24
0.0013925	0.047436	0.045218	0.90595	25
0.0014704	0.049180	0.046928	0.90242	26

Source: Research Calculation

Table 4: Matrix test and identifying the availability of trend and y-intercept in the model of value added

		Forth Model		Third Model		Second Model		
		T Statistic	Critical Value	T Statistic	Critical Value	T Statistic	Critical Value	
r=0	r=1	61.1238	31.7900	29.6388	27.4200	68.7580	28.2700	λ Max
r=2	r≤1	21.3799	25.4200	18.6740	21.1200	19.6080	22.0400	
r=3	r≤2	12.7751	19.2200	11.7961	14.8800	13.3276	15.8700	
r=4	r≤3	3.7894	12.3900	1.2864	8.0700	2.9151	9.1600	
r≥1	r=0	99.0682	63.0000	61.3953	48.8800	104.6087	53.4800	λ Trace
r≥2	r≤1	37.9444	42.3400	31.7565	31.5400	34.8507	34.8700	
r≥3	r≤2	16.5645	25.7700	13.0825	17.8600	16.2427	20.1800	
r=4	r≤3	3.7894	12.3900	1.2864	8.0700	2.9151	9.1600	

Source: Research Calculations

Critical values are in confidence level of 95 percent.