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Sources of Agricultural Value Added Growth and Investigating the Effects of Oil Shocks on Agricultural Value Added in Iran

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ABSTRACT

This article estimates the major determinants of agricultural value added and investigates how effects of oil shocks have changed agricultural value added in Iran. The theoretical framework is based on this assumption that the agricultural sector comprises two sectors; one producing for an export market and the other producing for the domestic market. This study uses annual time series data (1961-2007) and unit root tests and analyze them using Auto Regressive Distributed Lag (ARDL) model by Pesaran *et al*. [29]. This co-integration technique accommodates potential structural breaks that could undermine the existence of a long-run relationship between agricultural value added growth and its main determinants.

Key words: Agricultural value added, unit root test, autoregressive distributed lag (ARDL).

Introduction

Achievement to value added growth in agricultural sector by an appropriate combination of economic activities is always one of the key and important goals of each country. By higher growth of production in agricultural sector and its suitable distribution, public welfare increases and economic position of the country in worldly field improves. Economic history provides us with ample evidence that agricultural revolution is a fundamental pre-condition for economic growth, especially in developing countries (Jones and Woolf [21]; Oluwasanmi [25]; Eicher and Witt [13]). Development economists in general and agricultural economists in particular, have long focused on how agriculture can best contribute to overall economic growth and modernization, premised on their in-grained believe that robust agricultural growth and productivity increases are crucial to sustained economic development, at least up till the mid 1980s. Since then, and despite this widely acknowledged role of agriculture in economic development, many policy makers, policy analysts and academics in developing countries, international agencies and donor communities appear to have lost interest in the sector, often relegating its role ‘from engine of growth to sunset status’ (Siamwalla [32]) and Harron *et al* [20] or arguing for its continuing relevance and importance because of its ‘multi functionality role’ (Abd Rahman [1]).

In most oil exporting developing countries, industrial sector developed during 1970s but agricultural sector weakened in these countries. In this same direction, one of the economists Fardmanesh [15] by introducing the effect of worldly price into classic model of Dutch disease has presented a pattern for the oil exporting developing countries and has predicted that after increase in oil incomes, these countries are undergone anti-agricultural phenomenon. In the Nigerian, agriculture has been an important economic sector in the past decades, and is still a major sector despite the oil boom; basically it provides employment opportunities for the teeming population, eradicates poverty and contributes to the growth of the economy.

But in Iran, following oil shocks, some changes were created in the structure of main sectors of economy (agriculture, industry and services) which some cases such as changes in the regulation of the fifth pre-revolution civil plan, changes in the production factors market and value added share of sectors in Gross Domestic Product (GDP) and change in total value of imports can be indicated. In this direction, agricultural sector influenced by each of these factors was undergone fundamental changes. In Iran, agricultural sector is one of the sectors which its value added share in non oil value added was changed following changes in oil incomes such that during the first oil shock (1974-1977), the share of this sector has decreased to 12.6 percent from 19.2 percent in non oil GDP. Also in oil shock during

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1982-1984, the share of this sector has decreased to 18.9 percent from 21.6 percent and after that during 1985-1994 except of some years, it has had an ascending trend. The share of agricultural sector in the third oil shock (1994-1997) has decreased to 21.7 percent from 25.9 percent while the share of this sector has always been placed on third rank after services and building sectors. In order to achieve endogenous and stability value added growth in agricultural sector and decrease in negative effects and increase in oil incomes in agricultural sector and also to prevent Dutch disease on one hand and to realize the goals of perspective document and future plans of economic development on the other hand, it is necessary to have scientific knowledge about the resources of value added growth in agricultural sector during economic development plans during pre-revolution and post-revolution periods until by exact awareness about the share of total productivity growth, factors in value added growth in agricultural sector during previous plans to increase this share in the future plans, instructions in direction of movement from surface agriculture to depth agriculture can be presented. The goal of this research is to achieve the determinants of value added growth in agricultural sector and study the effects of oil shocks on value added in agricultural sector in Iranian economy as an oil producing country during 1961-2007.

Yao [34] has divided China's economy into five sectors (agriculture, industry, transportation, building and services) and using Vector Auto Regressive (VAR) technique concluded that during before the economic reforms (1952-1977), Non-agricultural growth has had less impact on agricultural products but during after reforms this effect has been more so that during the economic reforms, industry development has had positive effect on agricultural products. Uri [33] argued the effect of oil price on the employment in agricultural sector in the United States during 1947-1995 and using Granger causality, he concluded that there is a relationship between the employment in agricultural sector and changes in oil price such that increase in oil price causes decrease in employment. Bakhtiari and Haghi [3] studied the effect of increase in oil incomes on agricultural sector in Iran. The most important result of assessment analyses shows that the effect of oil incomes during 1974-1977 is followed by anti-agriculture phenomenon. Similarly, Pasban [26] in his paper called as "the effect of fluctuations in oil price on the production of agricultural sector in Iran" examined the effect of oil price on the growth of agricultural sector. According to the obtained results, boom of oil incomes resulted from increase in oil prices has verified many hypotheses of Dutch disease in Iran. Using of regression analyses and time series statistics during 1971-2000, he showed that the effect of oil price on agricultural sector in Iran is negative. On the other hand, his results showed that the effect of oil price shock on value added of agricultural sector decreases and removes over time. Block [5] has divided Ethiopia's economy into four sectors (agriculture, services, modern industry and traditional industry) and using two Sectors List Square (2SLS) method determined the relationship between these sectors and concluded that there are many communications between agricultural and services sector and there are somewhat communications between agricultural sector and traditional industry.

The present research explores from macro perspective an alternative way in which the value added growth in agricultural sector could be explored employing time series data. Following Feder [16], the total production is comprises two sectors; one producing for an export market and the other producing for the domestic market. For that purpose, we use the bounds testing (or ARDL) approach to co-integration proposed by Pesaran *et al*. [29] to test the sources of agricultural value added growth using data over the period 1961–2007. The ARDL approach to co-integration has some econometric advantages which are outlined briefly in the following section. Finally, we apply it taking as a benchmark Feder [16] study in order to sort out whether the results reported there reflect a spurious correlation or a genuine relationship between agricultural value added and the variables in question. This contributes to a new methodology in the agricultural value added literature. Next section starts with discussing the model and the methodology. Then in Section 3 we describe the empirical results of unit root tests, the F test, ARDL co-integration analysis, Diagnostic and stability tests and Dynamic forecasts for dependent variable and Section 4 summarizes the results and conclusions.

Materials and Methods

The Model:

The model proposed here is based on Feder [16]. In a much-cited contribution to the growth literature, Feder [16] proposed a model of growth for developing countries (LDCs) that recognized the importance of dualism in his case, technology differences between sectors. Feder [16] incorporated sectoral disequilibrium in the form of a productivity differential, and externality spillovers between two sectors, into a neoclassical growth model, using an export/non-export distinction. As regards the principles can be applied to any dualistic structure, below we use this model in agricultural sector. Based on this model, the agricultural sector comprises two sectors; one producing for an export market (*sector X*) and the other producing for the domestic market (*sector D*). The production functions for the two sectors are given by:

$$D = D(K_D, L_D, M_D, X) \quad (1)$$

$$X = X(K_X, L_X, M_X) \quad (2)$$

$$K = K_D + K_X \quad (3)$$

Where K is the allocation of capital in agricultural sector; L is the allocation of labor in agricultural sector, M is the allocation of imports in agricultural sector and Q is gross agricultural production. Based on the following Feder [16] is the beneficial effects of exports on the non-export sector, so that the output of D is dependent on the amount of exports produced. This externality, which is assumed to be positive (but need not be so), can be thought of as coming from increased productivity in the agricultural sector as a whole if export sectors are more competitive (i.e. spillovers from exports to average productivity). We assume a constant marginal productivity differential between export and non export that is equal for all factors. It means that marginal factor productivity is more in the export sector because of being more competitive environment, better management and more skilled workers in the export sectors. Thus we have:

$$\frac{X_k}{D_k} = \frac{X_L}{D_L} = \frac{X_M}{D_M} = 1 + d \quad (4)$$

Where X_k and D_k are marginal productivity of capital, X_L and D_L are marginal productivity of labor; X_M and D_M are marginal productivity of imports and $d > 0$. By assuming that D and X is homogeneous of degree 1 and by mathematical operations we have:

$$\frac{dQ}{Q} = D_K \frac{dK}{Q} + D_L \frac{dL}{Q} + D_M \frac{dM}{Q} + (D_X + \frac{d}{1+d}) \frac{dX}{Q} \quad (5)$$

Where $D_k = \alpha$ is the marginal productivity of capital in the agricultural non-export sector, $D_L = \beta$ is marginal productivity of labor in the agricultural non-export sector, $DM = \theta$ is marginal productivity of import in the agricultural non-export sector and $(D_X + \frac{d}{1+d}) = \lambda$ is the difference between productivity and externality effect in the agricultural export sector. Thus on substituting in Eq. (5) gives:

$$\frac{dQ}{Q} = \alpha \frac{dK}{Q} + \beta \frac{dL}{Q} + \theta \frac{dM}{Q} + \lambda \frac{dX}{Q} \quad (6)$$

Eq. (6) is similar neoclassical function about economic growth. By employing Bruno [7] statistical state solution assumption, Feder [16] sets the marginal sector products of labor equals to the average labor product for the economy as a whole. Then one would arrive at the fairly conventional growth equation by substitute $D_L = \Psi(Q/L)$ and $dK = I$ into (6):

$$\frac{dQ}{Q} = \alpha \frac{I}{Q} + \beta \frac{dL}{L} + \theta \frac{dM}{Q} + \lambda \frac{dX}{Q} \quad (7)$$

Indeed this equation can show the relationship between output growth, physical capital growth, workforce growth and export growth in agricultural sector. The following modified Salehi [31] model in logarithm form is used to examine the trade-growth nexus in agricultural sector in Iran. The logarithm equation corresponding to Eq. (7) and breakdown of the factors agricultural sector gives:

$$L(YA)_t = \alpha_0 + \alpha_1 L(IA)_t + \alpha_2 L(LA)_t + \alpha_3 L(MA)_t + \alpha_4 L(XA)_t + e_t \quad (8)$$

Where:

$L(YA)_t$ = Logarithm of agricultural value added in 1997 constant prices based on million dollars $L(IA)_t$ = Logarithm of investment in agricultural sector in 1997 constant prices based on million dollars.

$L(LA)_t$ = Logarithm of human capital in agricultural sector based on thousands (the number of employed workforce with a university degree).

$L(MA)_t$ = Logarithm of agricultural imports in 1997 constant prices based on million dollars and $L(XA)_t$ = Logarithm of agricultural exports in 1997 constant prices based on million dollars.

Our empirical analysis in Section 3 is based on estimating directly long-run and short-run variants of Eq. (8). All the data in this study are obtained from *Central Bank of Iran (2004)*, the *Islamic Republic of Iran Customs Administration* during the period 1961-2007.

The Methodology:

Recent advances in econometric literature dictate that the long run relation in Eq. (8) should incorporate the short-run dynamic adjustment process. It is possible to achieve this aim by expressing Eq. (8) in an error correction model as suggested by Engle and Granger [14]. Then, the equation becomes as follows:

$$\Delta YA_{t,j} = b_0 + \sum_{i=1}^{m1} b_{1i,j} \Delta YA_{t-i,j} + \sum_{i=0}^{m2} b_{2i,j} \Delta IA_{t-i,j} + \sum_{i=0}^{m3} b_{3i,j} \Delta LA_{t-i,j} + \sum_{i=0}^{m4} b_{4i,j} \Delta XA_{t-i,j} + \sum_{i=0}^{m5} b_{5i,j} \Delta MA_{t-i,j} + \gamma e_{t-1,j} + \mu_t \quad (9)$$

Where Δ represents change, m_i is the number of lags, γ is the speed of adjustment parameter and ε_{t-1} is the one period lagged error correction term, which is estimated from the residuals of Eq. (8). The Engle–Granger [14] method requires all variables in Eq. (8)

are integrated of order one, *I* (1) and the error term is integrated order of zero, *I* (0) for establishing a co-integration relationship. If some variables in Eq. (8) are non-stationary we may use a new co-integration method proposed by Pesaran *et al*., [29]. This approach is also known as Auto Regressive Distributed Lag (ARDL) that combines Engle and Granger [14] two steps into one by replacing ε_{t-1} in Eq. (9) with its equivalent from Eq. (8). ε_{t-1} is substituted by linear combination of the lagged variables as in Eq. (10).

$$\Delta YA_{t,j} = c_0 + \sum_{i=1}^{n1} c_{1i,j}\Delta YA_{t-i,j} + \sum_{i=0}^{n2} c_{2i,j}\Delta IA_{t-i,j} + \sum_{i=0}^{n3} c_{3i,j}\Delta LA_{t-i,j} + \sum_{i=0}^{n4} c_{4i,j}\Delta XA_{t-i,j} + \sum_{i=0}^{n5} c_{5i,j}\Delta MA_{t-i,j} + c_6 YA_{t-1,j} + c_7 IA_{t-1,j} + c_8 LA_{t-1,j} + c_9 XA_{t-1,j} + c_{10} MA_{t-1,j} + \nu_t \quad (10)$$

To obtain Eq. (10), one has to solve Eq. (8) for ε_t and lag the solution equation by one period. Then this solution is substituted for ε_{t-1} in Eq. (9) to arrive at Eq. (10). Eq. (10) is a representation of the ARDL approach to co-integration. Pesaran *et al*. [29] co-integration approach, also known as bounds testing, has some methodological advantages in comparison to other single co-integration procedures. Reasons for the ARDL are: i) endogenous problems and inability to test hypotheses on the estimated coefficients in the long-run associated with the Engle and Granger [14] method are avoided; ii) the long and short-run coefficients of the model in question are estimated simultaneously; iii) the ARDL approach to testing for the existence of a long-run relationship between the variables in levels is applicable irrespective of whether the underlying regressors are purely stationary *I*(0), purely non-stationary *I*(1), or mutually co-integrated, and iv) the small sample properties of the bounds testing approach are far superior to that of multivariate co-integration, as argued in Narayan [22]. The procedure is no longer valid in presence of *I* (2) series (integrated of order 2). Given that Pesaran *et al*. [29] co-integration approach is a relatively recent development in the econometric time series literature, a brief outline of this procedure is presented as follows. The ARDL approach involves two steps for estimating the long-run relationship. The bound testing procedure is based on F-statistics and is the first step of the ARDL co-integration method.

Accordingly, a joint significance test that implies no co-integration under the null hypothesis, (H_0: c_4=c_5=c_6=0), against the alternative hypothesis, (H_1: at least one c_4 to $c_6 \neq 0$) should be performed for Eq. (10). The F test used for this procedure has a non-standard distribution. Thus, Pesaran *et al*. [29] computed two sets of asymptotic critical values for testing co-integration for a given significance level with and without a time trend. One set assumes that all variables are *I* (0) and the other set assumes they are all *I* (1). If the computed F-statistic exceeds the upper bound critical value, then the null hypothesis of no co-integration can be rejected. Conversely, if the F-statistic falls below the lower bound critical value, the null hypothesis cannot be rejected. Lastly, if the F-statistic falls between these two sets of critical values, the result is inconclusive. The short-run effects between the dependent and independent variables are inferred by the size of coefficients of the differenced variables in Eq. (10). The long-run effect is measured by the estimates of lagged explanatory variables that are normalized on estimate of c_4. Once a long-run relationship has been established, Eq. (10) is estimated using an appropriate lag selection criterion. At the second step of the ARDL co-integration procedure, it is also possible to obtain the ARDL representation of the Error Correction Model (ECM). To estimate the speed with which the dependent variable adjusts to independent variables within the bounds testing approach, following Pesaran *et al*. [29] the lagged level variables in Eq. (10) are replaced by EC_{t-1} as in Eq. (11):

$$\Delta YA_{t,j} = \alpha_0 + \sum_{i=1}^{k1} \alpha_{1i,j}\Delta YA_{t-i,j} + \sum_{i=0}^{k2} \alpha_{2i,j}\Delta IA_{t-i,j} + \sum_{I=0}^{k3} \alpha_{3i,j}\Delta LA_{t-i,j} + \sum_{i=0}^{k4} \alpha_{4i,j}\Delta XA_{t-i,j} + \sum_{i=0}^{k5} \alpha_{5i,j}\Delta MA_{t-i,j} + \lambda EC_{t-1,j} + \mu_t \quad (11)$$

A negative and statistically significant estimation of λ not only represents the speed of adjustment but also provides an alternative means of supporting co-integration between the variables.

Structural Stability Tests Cumulative Sum (CUSUM) And Cumulative Sum Of Square (CUSUMSQ):

These tests which have been proposed by Brown *et al.* [6] was tested the stability of model coefficients. Its foundation is based on that initially, a regression equation including the variable desired is estimated using of estimated to be at least observations. Then, one observation is added to the observations of previous equation and next estimation is performed and in this same way, it is added to the observations a unit. In this way, after the estimation of each step, one coefficient is obtained for any of the variables which finally is concluded a time series of variables coefficients. These tests presents Cumulative sum (CUSUM) and cumulative sum of Square (CUSUMSQ) diagrams between two straight lines (the bounds of the 95 percent).If the diagram presented be within the boundaries, zero hypothesis is accepted which is based on lack of structural break and if the diagram go out of the boundaries (it means that if dealt to them), zero hypothesis is rejected which is based on lack of structural break and the presence of structural break is accepted (Bahmani-Oskooee, [2]). CUSUM statistics is useful to find systematic changes in long term coefficients of regression and CUSUMSQ statistics is helpful when deviation from regression coefficients stability is randomized and occasional (short term).

Results and Discussion

Unit Root Tests

During the last three decades, the methods of estimation of economic relationships and modeling fluctuations in economic activity have been subjected to fundamental changes. Nelson and Plosser [24] were of the view that almost all macroeconomic time series one typically uses have a unit root. Since the testing of the unit roots of a series is a precondition to the existence of co-integration relationship, originally, the Augmented Dickey-Fuller [12] (ADF) test was widely used to test for stationary. However, Perron [27] showed that failure to allow for an existing break leads to a bias that reduces the ability to reject a false unit root null hypothesis. To overcome this, Perron [28] proposed allowing for a known or exogenous structural break in the (ADF) tests.

Traditional Unit Root Test:

ADF test investigates the presence of unit root in time series data. Strong negative numbers of unit root reject the null hypothesis of unit root at some level of confidence. ADF framework to check the stationary of time series has been given in following equation:

$$\Delta X_t = \beta_1 + \beta_2 t + \theta X_{t-1} + \sum_{i=1}^{n} \alpha_i \Delta X_{t-1} + \varepsilon_t \qquad (12)$$

Where, ε_t is white noise error term. Basically, this test determines whether the estimates of θ are equal to zero or not. Fuller [18] has provided cumulative distribution of the ADF statistics by showing that if the calculated-ratio (value) of the coefficient is less than critical value from Fuller table, then x is said to be stationary. However, this test is not reliable for small sample data set due to its size and power properties (Dejong *et al* [11]; Harris, [19]). For small sample data set, these tests seem to over reject the null hypotheses when it is true and accept it when it is false. The results of ADF test is displayed in Table 1.

Table 1: Results of unit root by ADF test.

Variables	Level	1st Differences	integrated of order
LYA	-1.25	-4.65*	I(1)
LIA	-1.03	-5.48*	I(1)
LLA	-0.64	-4.02*	I(1)
LXA	-2.99	-6.59*	I(0)
LMA	-2.93	-5.99*	I(0)

Note: * denote statistical significance at 1%

The results reported in Table 1 show that null hypothesis of ADF unit root is accepted in case of *LYA*, *LIA* and *LLA* variables but rejected in first difference at 1% level of significance. This unit root test indicate that *LYA*, *LIA* and *LLA* variables considered in the present study are difference stationary *I* (1) while *LXA* and *LMA* variables are level stationary *I*(0) as per ADF test. On the basis of this test, it has been inferred that *LYA*, *LIA* and *LLA* variables are integrated of order one I (1), while *LXA* and *LMA* variables are integrated of order zero I (0).

Unit Root Tests In The Presence Of Structural Break:

Perron's [27] procedure is characterized by a single exogenous (known) break in accordance with the underlying asymptotic distribution theory. Perron [27] uses a modified Dickey-Fuller [12] unit root tests that includes dummy variables to account for one known, or exogenous structural break. The break point of the trend function is fixed (exogenous) and chosen independently of the data. Perron's [27] unit root tests allows for a break under both the null and alternative hypothesis. Based on Perron [27], the following three equations are estimated to test for the unit root. The equations take into account the existence of three kinds of structural breaks: a 'crash' Eq. (13) which allows for a break in the level (or intercept) of series; a 'changing growth' Eq. (14), which allows for a break in the slope (or the rate of growth); and lastly one that allows both effects to occur simultaneously, i.e one time change in both the level and the slope of the series (15).

$$x_t = \alpha_0 + \alpha_1 DU_t + d(DTB)_t + \beta t + \rho x_{t-1} + \sum_{i=1}^{p} \phi_i \Delta x_{t-1} + e_t \qquad (13)$$

$$x_t = \alpha_0 + \gamma DT_t^* + \beta t + \rho x_{t-1} + \sum_{i=1}^{p} \phi_i \Delta x_{t-1} + e_t \qquad (14)$$

$$x_t = \alpha_0 + \alpha_1 DU_t + d(DTB)_t + \gamma DT_t + \beta t + \rho x_{t-1} + \sum_{i=1}^{p} \phi_i \Delta x_{t-1} + e_t \qquad (15)$$

Where the intercept dummy *DUt* represents a change in the level; *DUt* =1 if (*t* > *TB)* and zero otherwise; the slope dummy *DTt (also DTt*)* represents a change in the slope of the trend function; *DT** = *t-TB* (or *DTt* *= *t* if *t* > *TB*) and zero otherwise; the crash dummy *(DTB)* = 1 if *t* = *TB* +1, and zero otherwise; and *TB* is the break date. Each of the three models has a unit root with a break under the null hypothesis, as the dummy variables are incorporated in the regression under the null. The alternative hypothesis is a broken trend stationary process.

Under zero hypothesis (presence of unit root), t-statistics related to X_{t-1} coefficient (i.e. t_β) has limit distribution. The required critical values to perform the test by Perron [27] are drawn and tabulated. These critical values regarding to λ value show the ratio of structural break incidence time to the sample volume ($\lambda=T_b/n$). test statistic related to other estimated coefficients has normal standard limit distribution when H_0 is rejected. Therefore, critical values of normal standard distribution can be used for significant coefficients test. If t-statistic for β is bigger than the critical value tabulated by Perron [28], zero hypotheses for the existence of unit root (non stationary) will be rejected. Results are given in Table 2.

Table 2: Results of Unit Root/ Stationary Test to determine structural break by Perron [27].

Variable	Model		T_b	λ	Critical value in level				t_β	Result
	Constant	Trend			1%	2.5%	5%	10%		
LYA	*	-	1994	0.85	-4.27	-3.97	-3.69	-3.28	-4.6	stationary
LLA	*	*	1974	0.46	-4.9	-4.53	-4.24	-3.96	-3.98	stationary
LXA	-	*	1999	0.36	-4.55	-4.20	-3.94	-3.66	-1.26	Non stationary
LIA	-	*	2001	0.59	-4.57	-4.20	-3.95	-3.66	-4.25	stationary
LMA	*	*	1982	0.46	-4.9	-4.53	-4.24	-3.96	-4.03	stationary

Note**:** (*) denotes that the model contains an intercept or a trend and (-) denotes that the model don't contain an intercept or a trend.

Based on the results reported in Table 2, the primary findings of the analysis are as follows. The results of the Perron [27] model indicate that all series under investigation are non-stationary in level and with one structural break function show strong evidence against the unit root hypothesis in all of the variables under investigation except *LXA*. The computed break dates correspond closely with the expected dates associated with the effects of the oil boom in 1974, 1982, 1994 and 2001 and the effects of the drought in 1999. Under these circumstances and especially when we are faced with mix results, applying the ARDL model is the efficient way of the determining the long-run relationship among the variable under investigation. Therefore, we will apply this methodology in the section 3.3.

The F Test:

In order to test the presence of long-run relationship between *LYA*, *LIA*, *LLA*, *LXA* and *LMA*, Eq. (11) is estimated. A general to specific modeling approach guided by the short data span and Schwarz's Bayesian Criterion (SBC) respectively to select a maximum lag order of 2 for the conditional ARDL-VECM is preferred because of annually frequency. Firstly, an Ordinary Least Square (OLS) regression is estimated for the first differences part of equation and then tested for joint significance of the parameters of the lagged level variables. The joint null hypothesis of the coefficients being equal to zero means no long-run relationship has been tested with F-statistics. The presence of co-integration between the variables is accepted if F-statistics reject the null at 95 per cent critical bound values generated by Narayan [22] for small sample.

Table 3: Bound Test for Co-integration.

Dependent Variable (Intercept and no trend)	SBC Lag	F-Statistic	Probability	Outcome
F_{LYA} (LYA| LIA, LLA, LXA,LMA)	1	5.1254*	0.001	Co-integration
F_{LIA} (LIA | LYA,LLA, LXA,LMA)	1	0.5687	0.325	No Co-integration
F_{LLA} (LLA | LYA,LIA, LXA,LMA)	1	0.4659	0.245	No Co-integration
F_{LXA} (LXA | LYA,LIA, LLA,LMA)	1	1.2154	0.412	No Co-integration
F_{LMA} (LMA| LYA,LIA, LLA,LXA)	1	1.3782	0.129	No Co-integration

* Significant at 1 per cent level.

The calculated F statistic presented for agricultural value added as dependent variable in Table 3 is 5.6512 and is higher than the upper bound at 1% level of significance. Thus, null hypothesis of no co-integration is rejected, implying that there exists a long-run relationship among the variables *LYA*, *LIA*, *LLA*, *LXA* and *LMA*, when the regression is normalized on logarithm of agricultural value added (*LYA*). It may, however, be noted that null hypothesis of no co-integration is accepted at 95 per cent critical value when regression is normalized on variables other than *LYA*. This implies that there exists only one long-run co-integrating relationship.

ARDL Co-Integration Analysis For Agricultural Value Added With Oil Shocks As Structural Breaks:

The empirical result based on ARDL tests repeated showed that the most significant break for variables of under investigation are consistent with time of oil boom. Therefore, at this stage we include four dummies variable of oil shocks (oil boom in 1974, 1982, 1994 and 2001); in order to take into account the structural breaks in the system. The estimated coefficients of the long-run relationship and Error Correction Mode (ECM) are displayed in Table 4.

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Table 4: Estimated Long-run and ECM Coefficients using ARDL (1,0,0,0,0) Model.

Estimated long-run coefficients			*Estimated ECM coefficients (LYA as dependent variable)*		
Regressor	Coefficient	t-Ratio(prob)	Regressor	Coefficient	t-Ratio(prob)
LIA	0.21	4.21[000]	DLIA	0.29	5.24[001]
LLA	0.07	7.54[032]	DLLA	0.07	8.65[021]
LXA	0.12	4.85[001]	DLXA	0.15	5.32[010]
LMA	0.18	5.37[006]	DLMA	0.07	8.08[002]
C	3.64	0.24[004]	DC	2.54	0.87[004]
DU1974	-0.16	-4.65[001]	DDU1974	-0.15	-4.98[001]
DU1982	-0.14	-4.87[004]	DDU1982	-0.13	-4.98[002]
DU1994	-0.12	-4.98[009]	DDU1994	-0.11	-5.21[008]
DU2001	-0.13	-4.90[000]	DDU2001	-0.12	-5.12[004]
			ECM(-1)	-0.392	-3.08[000]

Note: The order of optimum lags is based on the specified ARDL model.

Table 4 shows that in the long run most coefficients are statistically significant and also, oil boom coefficients have a very significant effect on agricultural value added and increase in this variables leads to decrease in agricultural value added. Alternatively, human capital in agricultural sector does have not an important effect on agricultural value added. In addition, the coefficient of *LLA* in this model is not statistically significant. It means that during the oil boom, employment has had negative growth rate and its share has declined while in these years employment growth rate in industrial and services sectors has climbed.

Imports in agricultural sector do have an important effect on agricultural value added. Since most exchange incomes are obtained by oil incomes; consequently, increase in oil incomes has a good effect on imports demand such that during oil boom period, just share of the consumed goods is increased out of total imports and this is created due to increase in domestic demand resulted from consumption in special levels of the society and insufficiency of domestic products to respond the created demand overload.

As we see in Table 4, ECM version of this model show that the error correction coefficient which determined speed of adjustment, had expected and significant negative sign. Bannerjee *et al* [4] holds that a highly significant error correction term is further proof of the existence of a stable long-term relationship. The results indicated that deviation from the long-term in inequality was corrected by approximately 39.2 percent over the following year or each year. This means that the adjustment takes place relatively quickly, i.e. the speed of adjustment is relatively high.

Diagnostic and Stability Tests:

Diagnostic tests for serial correlation, normality, heteroscedasticity and functional form are considered, and results are show that short-run model passes through all diagnostic tests in the first stage. The results indicate that there is no evidence of Autocorrelation and that the model passes the test for normality, and proving that the error term is normally distributed. Functional form of model is well specified but there is existence of white heteroscedasticity in model. The presence of heteroscedasticity does not affect the estimates and time series in the equation are of mixed order of integration, i.e., *I (0)* and *I (1)*, it is natural to detect heteroscedasticity.

Also, analyzing the stability of the long-run coefficients together with the short run dynamics, the cumulative sum (CUSUM) and the cumulative sum of squares (CUSUMSQ) are applied. According to Pesaran and Shin [30] the stability of the estimated coefficient of the error correction model should also be empirically investigated. A graphical representation of CUSUM and CUSUMSQ are shown in Fig. 1.

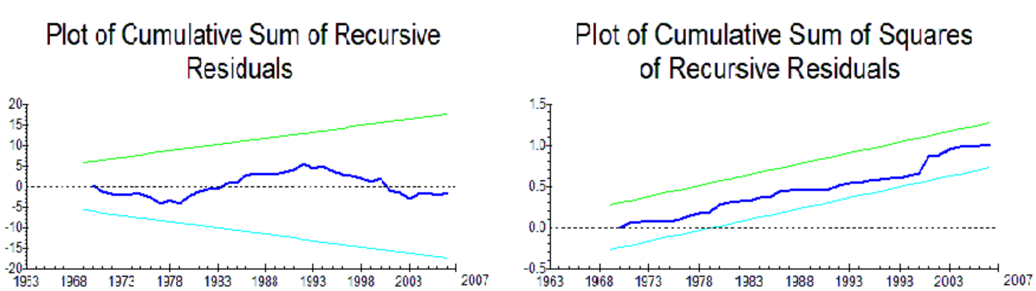

Fig. 1: Plots of CUSUM and CUSUMQ statistics for coefficients stability tests.

Following Bahmani-Oskooee [2] the null hypothesis (i.e. that the regression equation is correctly specified) cannot be rejected if the plot of these statistics remains within the critical bounds of the 5% significance level. As it is clear from Fig. 1, the plots of both the CUSUM and the CUSUMSQ are within the boundaries and hence these statistics confirm the stability of the long run coefficients of regressors which affect the inequality in the country. The stability of selected ARDL model specification is evaluated using the cumulative sum (CUSUM) and the cumulative sum of squares (CUSUMSQ) of the recursive residual test for the structural stability (see Brown *et al*., [6]). The model appears stable and correctly specified given that neither the CUSUM nor the CUSUMSQ test statistics exceed the bounds of the 5 percent level of significance.

Dynamic Forecasts LYA As Dependent Variable:

Fig. 2 represents the forecasting errors and the plots of the graphs of the actual and forecast values for model. These graphs show that dynamic forecast values for the level of *LYA* as well as the change in the level of *LYA* are very close to the actual data for both equations.

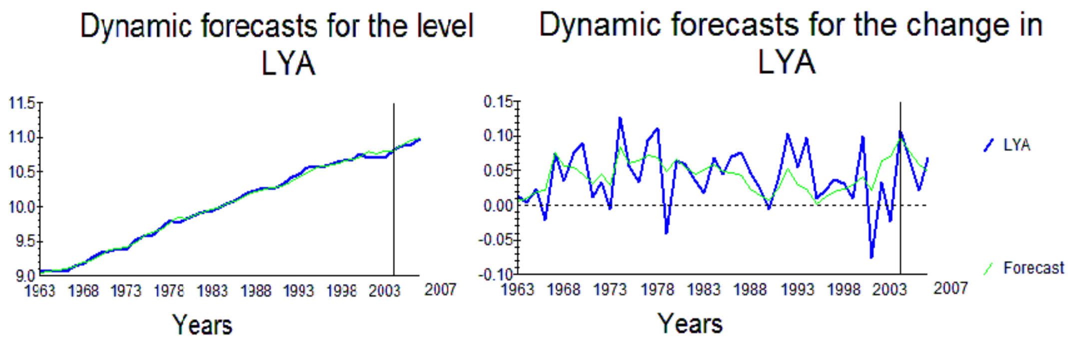

Fig. 2: Plots of the actual and forecasted values for the level of LY and change in LY.

Regarding to these diagrams, value added in agricultural sector has changed very much so that during the years of oil incomes boom, value added in agricultural sector has a descending trend and after the end of these times (stagnation of oil incomes), value added in agricultural sector has had an ascending trend.

Results and Discussions

The goal of this paper was to test the existence of long run relationship determinants of agricultural value added growth in Iran. This objective was aided by the technique of Pesaran *et al* [29] approach to co-integration which presents non-spurious estimates. Subsequently, our work provides fresh evidence on the long run relationship between agricultural value added growth and oil shocks in Iran. The results at relationship between agricultural value added growth and oil shocks confirm the studies of Pasban [26] and Bakhtiari and Haghi [3] but our results are more robust.

Results of this study represent very significant effect of oil incomes and their roles in changing agricultural value added in Iran (as oil exporting country). Therefore, change in share of agricultural value added depends on absorption value of this sector by incomes resulted oil shocks. It means that if the oil incomes attracted can be spend to fundamental investments and essential solution of problems in agricultural sector, it leads to value added growth in the after oil shock years. If not, after sectional increase, we will witness decrease share of agricultural sector in Gross Domestic Product (GDP). Of measurements which should be performed to contrast against negative effects of increase oil incomes in agricultural sector including to make appropriate policies to remove the dependency of agricultural sector on oil incomes, to save the overload of oil export incomes, using of oil incomes for investment and addressing infrastructure affairs in agricultural sector.

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