The effects of human capital on agricultural sector: The case of Iran

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ABSTRACT

This paper analyses the determinants of agricultural labor flows and the role of human capital in this process on the basis of the agricultural value added. The theoretical framework was designed based on this assumption that the total agricultural value added in the economy is divided into two sections, production for inside and production for export. The data were collected from 1971 to 2007 and was analyzed using Auto Regressive Distributed Lag (ARDL) model. The result of the analyses shows that there is significant relationship between human capital and agricultural value added growth. Together, the independent variables explained 92% of the variance in the dependent variables. In relation to that, it is concluded that explanatory power is high for the equation that shows that one percent change in human capital rate lead to 34% in agricultural value added growth. Therefore, a human capital is regarded as an important factor in Iran's agricultural value added.

Keywords: Gross Domestic Product (GDP), Augmented Dickey-Fuller (ADF) test, Auto Regressive Distributed Lag (ARDL).

INTRODUCTION

Given the complexity of the agriculture workforce, skills and training issues, a strategic and integrated approach between government and industry is crucial to addressing the issues. Challenges such as the global financial crisis, food security and climate change have created some uncertainty about future labor market trends, but the skills and labor demands of the agriculture industry are expected to grow, particularly given the long term demographic trends. Training workforce in agricultural sector aims to change behavior at the work place in order to stimulate efficiency and higher performance standards. It is concerned with work-based learning.

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In turn, learning is seen as a form of behavioral change. Training has been usefully defined as "the systematic development of the attitude, knowledge and skill and behavior pattern required by an individual in order to perform adequately a given task or job. Participative Management is one of the most popular and most commonly practiced management styles in modern organizations. Every organization has leaders who lead the organization to its ultimate objectives by setting the vision and mission and making sure these are implemented. The roles of leaders include not just the performance of all these duties and responsibilities but also the need to connect with their employees and to strike a note in their hearts. This is necessary to help ensure that the employees are willing to follow their leaders in whatever direction is desired. Human Resource Development (HRD) professionals also play a crucial role in terms of leadership management in each organization. Their duties involve not only recruitment, orientation, provision of training courses, coaching, enforcing organization's rules and regulations, and finally removing unwanted employees but, also, core duties, especially in innovative organizations, focus on strategic planning to create learning organizations and develop employees to have more potential and competencies.

Building workforce planning and human resource management skills in the industry is necessary to improve business performance, better equip the industry to respond and adapt to changes, and increase the industry's capacity to sustain productivity growth. There is a growing need for employers in agriculture to develop and implement appropriate workforce planning strategies. These strategies will help employers establish workplaces that attract and retain staff and which also better manage issues associated with skills gaps and shortages, the ageing workforce, evolving service demands and changing market and climate conditions. Nowadays, Human Resource Management (HRM) is one of the key success factors used for analyzing the internal environment of organizations, since it acts something like an indicator to measure the competitive advantages that organizations may have, especially in the newly-emerging world of the information or knowledge age [1]. The core objective of analyzing human resources in organization is to consider their weaknesses and the strengths and to compare them with business competitors. Consequently, HRM is now represented at the highest level of management [2].Furthermore, it is necessary to consider both HRM and HRD, which involves the deliberate and planned attempt to improve the quality of human resources with respect to their ability to be productive at work and to fulfill defined organizational goals. Consequently, both HRM and HRD professionals are increasingly involved in planning and executing corporate strategies. This is because, in a world in which supply of many basic products have either become commodities or for which supply exceeds primarily from the ability of people to create added value in one way or another. The primary HRD functions are training and development, organizational development and career development [3]. Nevertheless, HRD professionals also perform functions similar to public relations staff members who connect owners, board members and committees, employers and employees [4]. With these distinguishing roles and duties, HRD professionals currently have to enhance their competencies and use them in the proper directions and to promote sustainability as well. Generally, therefore, HRD professionals have powerful tools available to encourage employees to think creatively, to accept situations and to act accordingly. The ethical concern is that these tools are not used for exploitation but rather for the benefit of the organization [5]. Hence, the purpose of HRD is to enhance human learning, human potential and high performance in work related systems.

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Human development, in turn, has important effects on economic growth. If a central element of economic growth is allowing agents to discover and develop their comparative advantage, an increase in the capabilities and functioning's available to individuals should allow more of them to pursue occupations in which they are most productive. In this sense human development can be seen as the relaxing of constraints which may have interfered with profit maximization. Furthermore, although human development represents a broader concept, many of its elements overlap significantly with the more traditional notion of human capital. Thus, to the extent that human development is necessarily correlated with human capital and human capital affects the economic growth of a nation, human development is bound to have an impact on economic growth.

The concept of human capital formation refers to a conscious and continuous process of acquiring and increasing the number of people with requisite knowledge, education, skill and experience that are crucial for the economic and political development of a country [6]. Burneth et al. [7] say that investing in education raises per capita GNP, reduces poverty and supports the expansion of knowledge. Education, it is argued, reduces inequality. Fishlow [8], Persson and Tabellins [9] and Alesina and Rodrik [10] agree that inequality is negatively related to growth. Lucas [11] introduced his theory of growth, based on Becker's human capital theory (1964). Lucas used a new structure of growth models which has concurrent effects on both physical capital and human capital. The nature of this concurrency is because of the effect of physical capital on human capital wages or human capital opportunity costs which are allocated to education sector. Production of human capital is a good substitute for technologic developments and also a suitable deal for long term development. This theory was assessed by Lucas [12] in East-Asian countries and is dubbed "great miracle" by him. In a study on convergence of growth in Canadian states, Coulombe and Tremblay [13] used Barro & Sali model [14] in which the full dynamic of capital in order to financially secure the human capital is assumed. Their findings show that accumulation of physical capital in Canada states (1951-1996) is a result of human capital accumulation process. The share of human capital variable in production is about 0.5. These results show that dynamic of human capital accumulation, leads to improvements in physical capital, income and production per capita. Stiglz [15] states, "successful development entails not only closing the gap in physical or even human capital, but also closing the gap in knowledge. Uwatt [16] empirically examined the impact of human capital on economic growth, using five variants of the original Solow Model linking physical capital, labor and human capital proxies by total enrolment in educational system to real Gross Domestic Product. The result showed that physical capital exerted a positive and very statistical impact on economic growth. Its coefficient was statistically different from zero at 5% significant level. Labor force that entered all the models in log form had also positive but statistically insignificant effect on economic growth.

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 [17], 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. [18] to test the sources of agricultural value added growth using data over the period 1971–2007. The ARDL approach to co-integration has some econometric advantages which are outlined briefly in the following

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section. Finally, we apply it taking as a benchmark Feder [17] 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 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 is summarizes the results and conclusions.

MATERIALS AND METHODS

The model
Generally, two approaches to model the instability (specially, exports instability) are considered: First approach is to model it as an index. Mir-Shojaei's (1997) approach is an example of this approach for The Organization of the Petroleum Exporting Countries (OPEC) members. Second approach is to model the instability variable in a production function. In this sense, Feder's [17] traditional approach has been the base for many studies. In his approach, he works on the relationship between exports and economic growth. Few studies usually tried to regulate Feder's model and adjust it with their own findings. Here, in our study we use the second approach and based on Feder's approach we follow the endogenous growth theory and consider human capital in agricultural sector (the number of employed workforce with a university degree) and we will survey the effects of oil exports on agricultural value added. Feder [17] divides the total production in economy in two parts: production for domestic market and production for exports. Each production is a function of two factors, capital and labor of a given specialty. Moreover the production of non-export sector depends on export capacity too:

$$Y = X + N \ , \ X = G(K_x, L_x, M_x) \ , \ N = F(K_n, L_n, M_n, X) \tag{1}$$

Where L_x and L_n are workforce employed in the relevant section and K_x and K_n are Capital reserves in the relevant section. If will be applied first and second order derivative, in this case based on the Pareto optimum condition following equality is established in terms of productivity divided by inputs L and K:

$$GK \ / \ FK = GL \ / \ FL \tag{2}$$

Considering the saving resulting from the high ratio of export production we can assume the following function than the above:

$$GK \ / \ FK = GL \ / \ FL = 1+d \quad d > 0 \tag{3}$$

Here d is the amount of savings rates. According to the function $Y = X + N$ and considering a number of assumptions and mathematical operations is extracted following models:

$$\frac{dQ}{Q} = N_K \frac{dK}{Q} + N_L \frac{dL}{Q} + N_M \frac{dM}{Q} + \left(N_X + \frac{d}{1+d}\right)\frac{dX}{Q} \tag{4}$$

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Where $N_k = \alpha$ is the marginal productivity of capital in the agricultural non-export sector, $N_L = \beta$ is marginal productivity of labor in the agricultural non-export sector, $N_M = \theta$ is marginal productivity of import in the agricultural non-export sector and $(N_x + \dfrac{d}{1+d}) = \lambda$ is the difference between productivity and externality effect in the agricultural export sector. Thus on substituting in Eq. (4) gives:

$$\frac{dQ}{Q} = \alpha\,\frac{dK}{Q} + \beta\,\frac{dL}{Q} + \theta\,\frac{dM}{Q} + \lambda\,\frac{dX}{Q} \qquad\qquad (5)$$

Eq. (5) is similar neoclassical function about economic growth. By employing Bruno [19] statistical state solution assumption, Feder [17] 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 $N_L = \Psi(Q/L)$ and $dK = I$ into (5):

$$\frac{dQ}{Q} = \alpha\,\frac{I}{Q} + \beta\,\frac{dL}{L} + \theta\,\frac{dM}{Q} + \lambda\,\frac{dX}{Q} \qquad\qquad (6)$$

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 [20] model in logarithm form is used to examine the trade-growth nexus in agricultural sector in Iran. The logarithm equation corresponding to Eq. (6) and breakdown of the factors agricultural sector gives:

$$L(AVA)_t = \alpha_0 + \alpha_1 L(IA)_t + \alpha_2 L(HA)_t + \alpha_3 L(IMA)_t + \alpha_4 L(EXA)_t + e_t \qquad (7)$$

Where:
$L(AVA)_t$ is Logarithm of agricultural value added in 1997 constant prices based on million dollars, $L(IA)_t$ is Logarithm of investment in agricultural sector in 1997 constant prices based on million dollars, $L(HA)_t$ is Logarithm of human capital in agricultural sector based on thousands (the number of employed workforce with a university degree), $L(IMA)_t$ is Logarithm of agricultural imports in 1997 constant prices based on million dollars and $L(EXA)_t$ is Logarithm of agricultural exports in 1997 constant prices based on million dollars.

Our empirical analysis in next Section is based on estimating directly long-run and short-run variants of Eq. (7). All the data in this study are obtained from *Central Bank of Iran (2004)*[1], 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. (7) should incorporate the short-run dynamic adjustment process. It is possible to achieve this aim by expressing Eq. (7) in an error correction model as suggested by Engle and Granger [21]. Then, the equation becomes as follows:

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[1] *National Accounts of Iran in 1997 constant prices*

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$$\Delta AVA_{t,j} = b_0 + \sum_{i=1}^{m1} b_{1i,j}\Delta AVA_{t-i,j} + \sum_{i=0}^{m2} b_{2i,j}\Delta IA_{t-i,j} + \sum_{i=0}^{m3} b_{3i,j}\Delta HA_{t-i,j} \qquad (8)$$

$$+ \sum_{i=0}^{m4} b_{4i,j}\Delta EXA_{t-i,j} + \sum_{i=0}^{m5} b_{5i,j}\Delta IMA_{t-i,j} + \gamma e_{t-1,j} + \mu_t$$

Where ε_{t-1} is substituted by linear combination of the lagged variables as in Eq. (8):

$$\Delta AVA_{t,j} = c_0 + \sum_{i=1}^{n1} c_{1i,j}\Delta AVA_{t-i,j} + \sum_{i=0}^{n2} c_{2i,j}\Delta IA_{t-i,j} + \sum_{i=0}^{n3} c_{3i,j}\Delta HA_{t-i,j} + \sum_{i=0}^{n4} c_{4i,j}\Delta EXA_{t-i,j} \qquad (9)$$

$$+ \sum_{i=0}^{n5} c_{5i,j}\Delta IMA_{t-i,j} + c_6 AVA_{t-1,j} + c_7 IA_{t-1,j} + c_8 HA_{t-1,j} + c_9 EXA_{t-1,j} + c_{10} IMA_{t-1,j} + v_t$$

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. (9) 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. [18] the lagged level variables in Eq. (9) are replaced by EC_{t-1} as in Eq. (10):

$$\Delta AVA_{t,j} = \alpha_0 + \sum_{i=1}^{k1} \alpha_{1i,j}\Delta AVA_{t-i,j} + \sum_{i=0}^{k2} \alpha_{2i,j}\Delta IA_{t-i,j} + \sum_{I=0}^{k3} \alpha_{3i,j}\Delta HA_{t-i,j} \qquad (10)$$

$$+ \sum_{i=0}^{k4} \alpha_{4i,j}\Delta EXA_{t-i,j} + \sum_{i=0}^{k5} \alpha_{5i,j}\Delta IMA_{t-i,j} + \lambda EC_{t-1,j} + \mu_t$$

Methods such as Engel-Granger deal with small samples in non-validation studies because of neglecting the short-term dynamic responses existing between variables. Also since Johansen-Juselius tests are limitations on the condition stationary model variables, are used less than ARDL test. However, one of the major disadvantages of ARDL test is that cannot show more than one equilibrium relationship at estimation of model in unit it.

RESULTS AND DISCUSSION

Unit Root Test
The model employed here is based on Perron [22] test, for the existence of unit root in a series, which appears to be non-stationary. Accordingly, when structural break occurs, that may be occur one of the following three conditions: 1) change of constant function of time trend, 2) change of slope function of time trend, 3) change of constant and slope function of time trend. According to these three cases, it is necessary to be estimated the following regression relationship within the unit root test Perron [22]:

$$Y_t = C + \alpha_1 DU + dDTB + \beta_t + \gamma DT_t + \rho Y_{t-1} + \sum \theta_i \Delta Y_{t-1} + \varepsilon_t \qquad (11)$$

Where, Y_t: Dependent variable, C: constant, T: trend, $Y (-1)$: Y with one lag, TB: the time of structural break, DU: dummy variable (if $t > TB \rightarrow DU=1$ and The rest is zero years), DTB: if $t=$

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TB+1→ DTB=1 and the rest is zero years, *DT$_t$*: trend dummy variable (if *t > TB→ DT$_t$=t-TB* and Zero for years before it). Based on given results of the Perron [22] model, the unit root null hypothesis is rejected in favor of the alternative hypothesis if the t-statistic for ρ is greater than the critical values tabulated by Perron [22][1]. 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 [22] are drawn and tabulated. These critical values regarding to λ value show the ratio of structural break incidence time to the sample volume (λ=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 [23], zero hypotheses for the existence of unit root (non stationary) will be rejected. Results are given in Table 1.

Table 1: Results of Unit Root/ Stationary Test to determine structural break by Perron [22]

Variable	Model		T$_b$	λ	Critical value in level				t$_β$	Result
	Constant	Trend			1٪	2.5٪	5٪	10٪		
LAVA	*	-	1999	0.85	-4.12	-2.97	-2.69	-3.88	-4.6	**stationary**
LHA	*	*	1986	0.46	-4.23	-3.13	-4.45	-3.26	-3.98	**stationary**
LIMA	-	*	1991	0.36	-4.15	-4.33	-3.13	-3.45	-1.26	**Non stationary**
LIA	-	*	2002	0.59	-4.64	-4.54	-3.32	-3.13	-4.25	**stationary**
LEXA	*	*	1980	0.46	-4.54	-4.15	-4.02	-3.16	-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 1, the primary findings of the analysis are as follows. The results of the Perron [22] 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 *LIMA*. The computed break dates correspond closely with the expected dates associated with the effects of structural break in 1980, 1986, 1991 and 2002 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 next section.

ARDL model
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 dummy variables; 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 2.

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[1] ρ *is number of Lags required for independent variable in order to eliminate correlation between error sentences. Based on zero hypothesis (ρ = 1) and λ values (λ = TB / n), Perron statistics critical values was calculated in each of the three cases in own table.*

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Table 2: 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	0.12	6.31[001]	DLIA	0.19	5.13[000]
LHA	0.17	5.54[002]	DLHA	0.21	2.65[001]
LEXA	0.14	5.32[001]	DLEXA	0.18	5.32[010]
LIMA	0.08	5.45[002]	DLIMA	0.09	8.08[007]
C	4.24	0.21[006]	DC	2.31	0.87[002]
DU1980	-0.13	-4.64[000]	DDU1980	-0.12	-4.98[001]
DU1986	-0.12	-4.17[001]	DDU1986	-0.11	-4.99[032]
DU1999	-0.11	-4.28[008]	DDU1999	-0.10	-5.21[008]
DU2002	-0.14	-4.30[000]	DDU2002	-0.12	-5.12[002]
			ECM(-1)	-0.42	-3.18[000]

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

Table 2 shows that in the long run most coefficients are statistically significant and also, war coefficient 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 an important effect on agricultural value added. In addition, the coefficient of *LHA* in this model is statistically significant. It means that during the war, 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 2, 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.* [24] 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 42 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 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.

These tests which have been proposed by Brown *et al.* [25] was tested the stability of model coefficients. Its foundation is based on that initially, a regression equation including the variable

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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, [26]). 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).
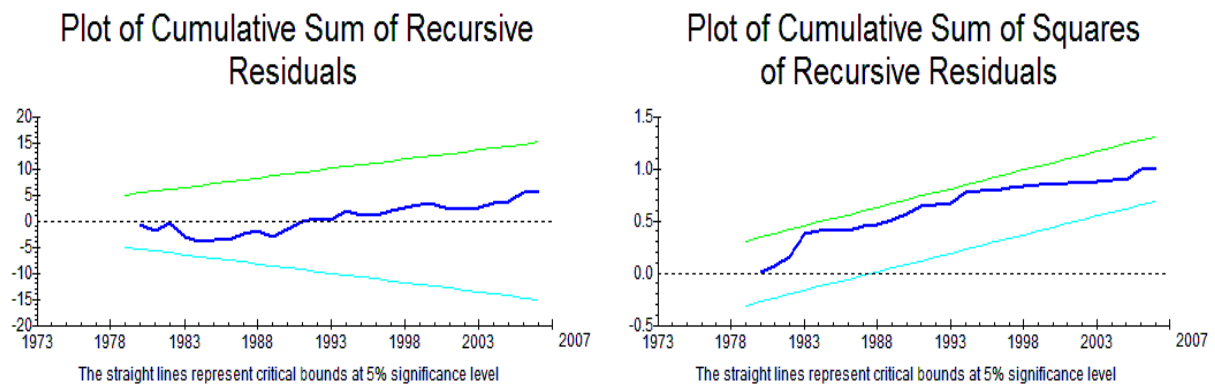

Fig. 1. Plots of CUSUM and CUSUMQ statistics for coefficients stability tests

According to Pesaran and Shin [27] the stability of the estimated coefficient of the error correction model should also be empirically investigated. A graphical representation of CUSUM and CUSUMSQ was shown in Fig. 1. Following Bahmani-Oskooee [26] 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., [25]). 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.

CONCLUSION

This paper has provided a relationship between agricultural value added and human capital in agricultural sector and also has explored the determinants of agricultural labor flows in Iran. In this research at first we study variables Stationary and non-stationary by using from Phillips-

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Perron, more than half of non-stationary variables with considering structural breaks show Stationary process. Human capital coefficient in agricultural sector is positive and equal to 0.17 which shows that whit every percent increase in years of educated labor, agricultural value added growth will increase by 0.17 percent. Therefore the analysis of the determinants of exit from agricultural value added clearly shows that human capital plays a crucial role for agricultural value added.

Consequently, one of the main and crucial factors in inefficiency is the improper utilization of productive capacity in which we should also seek technologic changelessness in the country's production. Training is an important factor in human resources productivity improvement in producing goods and services which causes growth. We should also mention that we should also pay attention to training during work, vocational and technical trainings and public advanced trainings; the last one is only limited to staff in Iran and has not been put into action yet. Since human capital (educated sector) is the effective factors on GDP and also has a positive effect with more time lag on GDP, so is recommended to reduce the time lag by improving quality of workforce Training and implementing policies that lead to accelerating the positive effects of human capital on GDP.

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