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An Investigation of Decreasing Level of Underground Water on Rural Economy of Iran

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ABSTRACT

Decreasing in underground waters is one of the most problems in agricultural sector of Iran. The aim of this paper is considering the impact of decreasing level of underground water on rural economy of Iran. For do the aim, this research has used regression analysis for agriculturall sector in Iran. Results indicate that decreasing level of underground water has a significant negative impact on agriculture value added in Iran. So, policy makers in Iran should employ suitable policies for developing sustainable agriculture in Iran,

Key words: Level of Underground Water, Rural Economy, Johansen's Procedure

Introduction

Decreasing in underground waters is one of the most problems in agricultural sector of Iran. There are few studies about relationship between decreasing level of underground water on rural economy.

Chen and *et al* [1] report on an underground water-source water-loop heat-pump (UWSWLHP) air-conditioning system for a tall apartment building in Beijing. Water at 14 °C was used as an external low-temperature heat-source. By analyzing field-test data for two years, the authors assessed the operating and controlling conditions of the system. Based on the electricity consumed by public-use air-conditioning power equipment and terminal heat-pumps, the authors put forward an overall evaluation of the energy-conservation characteristics of the system.

Ososkova and *et al* [8] estimated regional water resources and calculated of changes of some components of the hydrological cycle due to the expected climate changes were presented. Measures for adaptation in the southern part of the Aral Sea region were considered.

Salami and *et al* [7] provided economy-wide estimates of the costs of drought in the cropping sector of the Iranian economy, using a linear programming model to estimate the direct costs on agriculture, and a macroeconometric model to trace the indirect impacts on the rest of the economy. Their results indicated that a severe drought such as the one that occurred in the crop year 1999–2000 imposed a direct cost of 1605 million USD, equivalent to 30.3% of the total value added of the cropping sector in Iran. This, in turn, leads to a 12.7% reduction in the value added of other agricultural sub-sectors (livestock, fisheries and forestry). In the rest of the economy, the manufacturing and service sectors experience value added declines of 7.8 and 3.7%, respectively. They found that there is a substantial decrease in investment in the agricultural, manufacturing and service sectors. Thus, such a drought reduces overall GDP by about 4.4%, and it would also result in decreased non-oil exports, increased food imports, and a rise in inflation.

Datta and *et al* [2] were concerned with estimating a set of production functions relating wheat yield to initial soil salinity and water quantity and quality. Crop-water production functions were estimated from experimental data from wheat crop at Sampla village in Rohtak district of Haryana (India).

In study of Kulshreshtha and Brown [6], an historical value of water in irrigation had been estimated using the concept of producer surplus. The value of irrigation water was estimated both from private (farmer) as well as society's accounting stance. In the long-run, value of water for the farmer is estimated at $78.82 per ha in 1986 dollars or $20.70 per dam^3, whereas from society's accounting stance, the value was -$249.57 per ha in 1986 dollars, or -$65.52 per dam^3. These results suggested that the long-run value of water in irrigation was positive only from the farmers' standpoint. Under present crop mix and cultural practices, society had not realized a positive value for irrigation water.

The aim of this paper is considering the impact of decreasing level of underground water on rural

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economy of Iran. This paper is organized by four sections as following.

Research Method:

Hypothesis of this research is "Decreasing level of underground water has a negative impact on agricultural value added in Iran".

For testing above hypothesis, this paper has used regression analysis as following equation:

$$VAgri_t = \alpha + \beta DUM + \gamma L_t + \delta K_t + \theta Oil_t + \varepsilon_t \quad (1)$$

Where $VAgri_t$ is value added of agricultural sector, DUM is a dummy variable for decreasing level of underground water, L_t is labor force in agricultural sector, K_t is capital agricultural sector, Oil_t is oil revenue and ε_t is error term.

DUM is a dummy variable for decreasing level of underground water at years of drought on agriculture. In other word, this variable is 1 for years of drought and it is zero for other years.

Econometric Method:

Unit Root Tests:

Of particular interest to us is the Augmented Dickey-Fuller (ADF) test that has been developed to test univariate time series for the presence of unit roots or non-stationarity. The extended maintained regression used in the ADF test can be expressed in its most general form as:

$$\Delta Y_t = \mu + \gamma Y_{t-1} + \sum_{j=1}^{p} \alpha_j \Delta Y_{t-j} + \beta t + \omega_t \quad (2)$$

Where μ is the drift term, t denotes the time trend, and p is the largest lag length used. In order to analyze the deterministic trends, we used modified versions of the likelihood ratio tests suggested by Dickey and Fuller [3]. We followed the testing sequence suggested by Patterson (2000), which suggests the following maintained regressions, test statistics, and hypotheses:

$$\Delta Y_t = \mu + \gamma Y_{t-1} + \sum_{j=1}^{p} \alpha_j \Delta Y_{t-j} + \beta t + \omega_t \quad (3)$$

$\hat{\tau}_\beta, H_0: \gamma=0, H_a: \gamma<0, \phi_3, H_0: \gamma=0, \beta=0, H_a: \gamma\neq 0,$ and/or $\beta \neq 0$

$$\Delta Y_t = \mu + \gamma Y_{t-1} + \sum_{j=1}^{p} \alpha_j \Delta Y_{t-j} + \omega_t \quad (4)$$

$\hat{\tau}_\mu, H_0: \gamma=0, H_a: \gamma<0, \phi_1, H_0: \mu=0, \gamma=0, \beta=0, H_a: \mu\neq 0,$ and/or $\gamma \neq 0$

$$\Delta Y_t = \gamma Y_{t-1} + \sum_{j=1}^{p} \alpha_j \Delta Y_{t-j} + \beta t + \omega_t \quad (5)$$

$\tau, H_0: \gamma = 0, H_a: \gamma < 0$

Johansen's [4,5] Procedure:

Intuitively, the Johansen test is a multivariate version of the univariate DF test. Consider a *reduced form* VAR of order p:

$$y_t = A_1 y_{t-1} + ... + A_p y_{t-p} + Bx_t + u_t \quad (6)$$

where y_t is a *k*-vector of I(1) variables, x_t is a n-vector of deterministic trends, and u_t is a vector of shocks. We can rewrite this VAR as:

$$\Delta y_t = \Pi y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-i} + Bx_t + u_t \quad (7)$$

where $\Pi = \sum_{i=1}^{p} A_i - 1, \Gamma_i = -\sum_{j=t+1}^{p} A_j$

The error correction model (ECM), due to Engel and Granger (1987). The Π matrix represents the adjustment to disequilibrium following an exogenous *shock*. If Π has reduced rank *r* < *k* where *r* and *k* denote the rank of Π and the number of variables constituting the long-run relationship, respectively, then there exist two $k \times r$ matrices α and β, each with rank *r*, such that $\Pi = \alpha\beta'$ and $\beta' y_t$ is stationary. *r* is called the *cointegration rank* and each column of β is a cointegrating vector (representing a long-run relationship). The elements of the α matrix represent the *adjustment* or *loading* coefficients, and indicate the speeds of adjustment of the endogenous variables in response to disequilibrating shocks, while the elements of the Γ matrices capture the short-run dynamic adjustments. Johansen's method estimates the Π matrix from an unrestricted VAR and tests whether we can reject the restrictions implied by the reduced rank of Π. This procedure relies on relationships between the rank of a matrix and its characteristic roots (or eigenvalues). The rank of Π equals the number of its characteristic roots that differ from zero, which in turn corresponds to the number of cointegrating vectors. The asymptotic distribution of the Likelihood Ratio (Trace) test statistic for cointegration does not have the usual χ^2 distribution and depends on the assumptions made regarding the deterministic trends.

Results:

First of all, Augmented Dickey Fuller test for all variables indicate that all variables are non-stationary at 5% significance level. So, this paper has tested cointegration test by Johansen procedure for the model. Table 1 indicates cointegration test with Johansen procedure. Results indicate that there is a longrun relationship between all variables of the model.

Table 1: Cointegration Test Johansen

Lags interval (in first differences): 1 to 1				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.759297	98.48710	79.34145	0.0009
At most 1 *	0.628316	61.45814	55.24578	0.0129
At most 2 *	0.559462	35.72567	35.01090	0.0418
At most 3	0.351542	14.41197	18.39771	0.1653
At most 4	0.114098	3.149865	3.841466	0.0759
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None	0.759297	37.02896	37.16359	0.0518
At most 1	0.628316	25.73247	30.81507	0.1845
At most 2	0.559462	21.31369	24.25202	0.1168
At most 3	0.351542	11.26211	17.14769	0.2916
At most 4	0.114098	3.149865	3.841466	0.0759
Max-eigenvalue test indicates no cointegration at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

After make sure the cointegration, this paper has estimated the model as Table 2.

Table 2: Estimation Results of the Model

Method: Least Squares				
Date: 01/20/12 Time: 18:26				
Sample (adjusted): 1980 2007				
Included observations: 28 after adjustments				
Newey-West HAC Standard Errors & Covariance (lag truncation=3)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.82E+10	2.45E+09	-7.417441	0.0000
K	-3777746.	14668904	-0.257534	0.7990
L	5778.986	767.3696	7.530902	0.0000
D1	-1.23E+09	3.92E+08	-3.129556	0.0046
R-squared	0.959700	Mean dependent var		1.18E+10
Adjusted R-squared	0.954662	S.D. dependent var		3.90E+09
S.E. of regression	8.30E+08	Akaike info criterion		44.04372
Sum squared resid	1.65E+19	Schwarz criterion		44.23403
Log likelihood	-612.6121	Hannan-Quinn criter.		44.10190
F-statistic	190.5099	Durbin-Watson stat		0.799204
Prob(F-statistic)	0.000000			

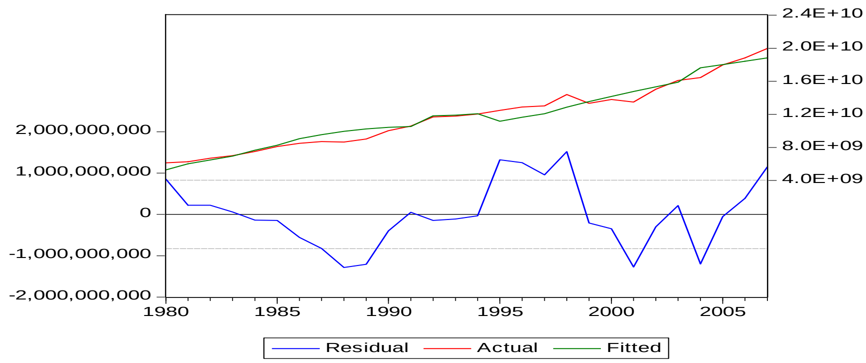
Table 2 indicates estimation results of the model. Results indicate that decreasing level of underground water has a significant negative impact on agriculture value added. Also, labor force in this sector has a significant positive impact on agriculture value added in Iran. Capital in this sector has not significant impact on agriculture value added.

Conclusion:

Decreasing in underground waters is one of the most reasons in Drought of agricultural sector in developing countries as Iran. Drought decreases value added of agricultural sector and it decreases economic growth. Decreasing economic growth caused unemployment.

In this paper, we have used a regression analysis for the impact of decreasing in underground waters on value added of agricultural sector in Iran. We have used a dummy variable for decreasing in underground waters. Results indicate that decreasing level of underground water has a significant negative impact on agriculture value added in Iran.

Therefore, policy makers in Iran should employ suitable policies for developing sustainable agriculture in Iran.



Plot 1: Actual, Fitted and Residual

Plot 1 indicates Actual and fitted of agricultural value added of the estimated model. F-Statistic indicates that the regression is significance. R-squared is 0.95 that is suitable for this model.

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