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Total Factor Productivity in Agricultural Sector of Iran

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ABSTRACT

Background: Total Factor Productivity (TFP) can be taken as a measure of an economy's long-term technological change or technological dynamism. **Objective:** The aim of this paper is considering the impact of TFP of agricultural sector on economic growth in Iran. We have used The Kalman Filter algorithm for estimation TFP. **Results and Conclusion:** Results indicate that the growth of TFP has a significant positive impact on economic growth in agricultural sector in Iran. Also, Growth of labor and investment ratio have a significant positive impact on economic growth. The variable of growth of government expenditure multiple government size has not significant impact on economic growth.

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INTRODUCTION

Limited availability of agriculturally usable soils and the lack of water are the most important natural barriers for agriculture in Iran. Due to topography and unfavorable climate, only the mountainous north, northwest and west receive sufficient precipitation to carry out spatially extended agriculture. That the agriculturally usable land is limited, only 15 per cent may be considered as farmland and another 25 per cent of the total land of the country as rangeland. The biggest part of the country (6pprox.. 50 percent) is sterile desert or desert-steppe, which may be usable only for periodic pasturing, while the rest is mainly degraded forests.

In theory, Iranian agricultural policy is intended to support farmers and encourage the production of strategically important crops. The policy is twofold: first, to purchase certain crops at guaranteed prices and second, to encourage the production of specific crops through farm subsidies. The policy of purchasing agricultural crops from farmers at guaranteed prices was put in place in the 1989 crop year. On average, the guaranteed prices increased at the rate of inflation over the past 15 years. Individual subsidy levels for major crops, however, vary annually. In the 1990s and early 2000s, government agricultural planning was only marginally successful. According to government figures, during the 1990s—coincident with the first two Islamic Republic economic plans—only 40.5 percent of the agricultural modernization projected by those plans was accomplished, and only 40.2 percent of government and private-sector financial commitments materialized. Because wheat is considered Iran's most strategically important crop, it received the largest subsidies, and its production grew at the fastest rate between 1990 and 2005. From FY 2003 to FY 2004, wheat subsidies increased by 17.2 percent, reaching a record of US$1.5 billion. Between 1981 and 2004, the area cultivated with wheat remained stable at 5 million hectares, but wheat production increased from 5.7 million to more than 11 million tons. Beginning in 1990, the government expanded its agricultural support programs to include a guaranteed purchase price for major agricultural crops, subsidies, favorable interest rates, government investment, and favorable foreign-trade policies. Primarily because of government support for domestic agriculture, between 1989 and 2003 the import volumes of wheat, sugar, and red meat declined by 77.7 percent, 39.6 percent, and 88.2 percent, respectively. Concurrently, the value of agricultural exports increased from US$461.5 million in 1989 to US$1.7 billion in 2004. However, over the same period total food and live animal imports increased from US$1.37 billion to US$2.65 billion

Review of Literature:

Several researchers used econometric approaches to estimate the level of TFP and growth rate of TFP in manufacturing. In this approach, the

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growth rate of TFP is measured as the residual growth in value added in manufacturing, after accounting for the contribution of input growth to value added. Lach [3], Rushdi [6], Eslava et al [2], Lam and Lam [4] and Mollick and Cabral [5]. In these researches, Translog production function and Cobb-Douglas production function form have been applied to estimate TFP growth and estimate the share of production inputs that utilized in index method. In recent years, several attempts have been made to investigate productivity in different sectors of Iran economics.

Most studies in productivity have only been carried out in a sectoral or regional areas of economy, for example; Salimifar [7] utilized translog production function for computing total factor production growth in Khorasan province industry of Iran. The scholar applied Kendrik index for accounting total factor production level. Bakhshali and Mojtahed [1] carried out a comparative investigation of technology change on productivity of inputs in the industrial and agricultural sectors. The scholars utilized Cobb-Douglas production function to obtain technology change on productivity and found that the effects of technology change in industrial sector was more than the agricultural sector, technology change for industry and agricultural were 0.04 and 0.03 respectively.

So far these studies have only been applied to investigate productivity in total industries. On the other hand, lack of research related to productivity in agricultural sector of Iran has existed as a problem for many years. To fill the existing gap discovered within the Iranian context, the current study will estimate TFP as a series during time. We have used The Kalman Filter algorithm for estimation TFP. (A in the Cobb-Douglas form)

Model Specification:

The equation below (in Cobb–Douglas form) represents total output (Y) as a function of total-factor productivity (A), capital input (K), labor input (L), and the two inputs' respective shares of output (α and β are the capital input share of contribution for K and L respectively). An increase in either A, K or L will lead to an increase in output. While capital and labor input are tangible, total-factor productivity appears to be more intangible as it can range from technology to knowledge of worker (human capital).

$$Y = AK^{\alpha} L^{\beta}$$

We have used the Cobb-Duglas production function as following:

$$Y_t = A_t K_t^{\alpha} L_t^{\beta} e^{U_t} \qquad (1)$$

Where, total output (Y) as a function of total-factor productivity (A), capital input (K), labor input (L), and the two inputs' respective shares of output (α and β are the capital input share of contribution for K and L respectively. U_t is residual.

We have used this model as logarithm form in a state-space system as following:

$$\ln(Y_t) = \ln(A_t) + \alpha \ln(K_t) + \beta \ln(L_t) + U_t$$
$$\ln(A_{t+1}) = \gamma \ln(A_t) + \varepsilon_{t+1} \qquad (2)$$

Where $\ln(A_t)$ is a $T \times 1$vector of possibly unobserved state variables. The unobserved state vector is assumed to move over time as a first-order autoregression.

Then, for considering the impact of TFP of agricultural on economic growth, we have used the Ram (1986) model as following:

$$\dot{Y}_t = \beta_0 + \beta_1 (\frac{I_t}{Y_t}) + \beta_2 g_{L_t} + \beta_3 g_{G_t} (\frac{G_t}{Y_t}) + e_t \qquad (3)$$

Regression (1) shows that the variables which affect economic growth ($\dot{Y}$) include the investment rate ($\frac{I}{Y}$), growth of labor force (g_{L_t}), and the multiplication effects of government expenditure growth (g_{G_t}) times government size (G/Y).

We modify this model for entrance the agricultural sectors in this model. We have used the government size in agricultural sector ($\frac{G_{At}}{Y_t}$) instead of total government size and the government expenditure growth in agricultural sector ($g_{G_{At}}$) instead of total government expenditure growth. Government size in agricultural sector is government spending in agricultural sector divided by GDP. In addition, we identify the multiplication effects through the sign of β_3. This indicates that the government sector has a reciprocal effect on economic growth through two ways: one is the direct contribution of the government sector and the other is the indirect effect through the non-government sector (externality effect).

For add the TFP of Agricultural sector on the model, we have used TFP instead of β_0 because of intercept in growth model play role of productivity.

There are two main benefits to representing a dynamic system in state space form. First, the state space allows unobserved variables (known as the state variables) to be incorporated into, and estimated along with, the observable model. Second, state

space models can be analyzed using a powerful recursive algorithm known as the Kalman Filter. The Kalman Filter algorithm has been used, among other things, to compute exact, finite sample forecasts for Gaussian ARMA models, multivariate (vector) ARMA models, MIMIC (multiple indicators and multiple causes), Markov switching models, and time varying (random) coefficient models. The Kalman Filter is a recursive algorithm for sequentially updating the one-step ahead estimate of the state mean and variance given new information. Details on the recursion are provided in the references above is a recursive algorithm for sequentially updating the one-step ahead estimate of the state mean and variance given new information.

Empirical Results:

We have used the annual data report from Central Bank of Iran. Data have been used at 1960-2009 period.

Table 1 indicates Kalman Filter estimation of TFP in agricultural sector in Iran during 1980 to 2009 periods.

Table 1: Kalman Filter Estimation

Method: Kalman filter				
Sample: 1353 1388				
Included observations: 36				
Valid observations: 28				
	Final State	Root MSE	z-Statistic	Prob.
$ln(A_t)$	37.09131	0.184711	200.8072	0.0000
Log likelihood	14.39363	Akaike info criterion		-1.028116
Parameters	0	Schwarz criterion		-1.028116
Diffuse priors	1	Hannan-Quinn criterion.		-1.028116

Final state is 37.09 that is significantly in 99% confidence level. We have shown TFP series in Table 2. TFP has slowly increased during 1980-2009.

Table 2: TFP

Year	TFP	Year	TFP	Year	TFP
1980	29.45	1991	32.15	2002	35.22
1981	29.90	1992	32.48	2003	35.42
1982	30.15	1993	32.76	2004	35.65
1983	30.30	1994	33.09	2005	35.78
1984	30.57	1995	33.66	2006	35.99
1985	30.72	1996	33.83	2007	36.26
1986	30.99	1997	33.99	2008	36.53
1987	31.29	1998	34.33	2009	36.81
1988	31.40	1999	34.53		
1989	31.66	2000	34.78		
1990	31.82	2001	34.91		

Table 3: Estimation Results from model (3)

Method: Least Squares				
Date: 07/27/12 Time: 11:26				
Sample (adjusted): 1360 1385				
Included observations: 26 after adjustments				
Newey-West HAC Standard Errors & Covariance (lag truncation=2)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.176838	0.058724	-3.011351	0.0064
D(LOG(TFP))	6.336793	2.328838	2.721011	0.0125
RL	2.308742	0.591537	3.902957	0.0008
IRGDP	0.237496	0.119292	1.990876	0.0591
R-squared	0.362995	Mean dependent var		0.038073
Adjusted R-squared	0.276131	S.D. dependent var		0.072920
S.E. of regression	0.062041	Akaike info criterion		-2.581414
Sum squared resid	0.084679	Schwarz criterion		-2.387861

Log likelihood	37.55839	Hannan-Quinn criter.	-2.525678
F-statistic	4.178878	Durbin-Watson stat	2.127597
Prob(F-statistic)	0.017458		

Table 3 indicates estimation results from equation 3. Results indicate that the growth of TFP has a significant positive impact on economic growth in agricultural sector in Iran. Also, Growth of labor and investment ratio have a significant positive impact on economic growth. The variable of growth of government expenditure multiple government size has not significant impact on economic growth.

Conclusion:

Productivity is a notion that has profound importance in our lives. It can have major effects at the national, industrial and individual levels. TFP can be taken as a measure of an economy's long-term technological change or technological dynamism. Lack of research related to productivity in agricultural sector of Iran has existed as a problem for many years. To fill the existing gap discovered within the Iranian context, the current study will estimate TFP as a series during time and the impact of TFP on economic growth in agricultural sector of Iran. We have used The Kalman Filter algorithm for estimation TFP. Then, we have used a growth model in agricultural sector of Iran for considering the impact of TFP on economic growth in Iran. Results from estimation of growth model indicate that the growth of TFP has a significant positive impact on economic growth in agricultural sector in Iran. Also, Growth of labor and investment ratio have a significant positive impact on economic growth. The variable of growth of government expenditure multiple government size has not significant impact on economic growth.

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