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The Impacts of Governance on Agricultural Efficiency

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Abstract.

The main goal of the study is to explain the interaction between governance and agricultural efficiency. The study used a Panel Data Regression Analysis to investigate the relationship between six governance indicators and agricultural efficiency. Agricultural efficiency was measured as the ratio of agricultural outputs to agricultural inputs by Data Envelopment Analysis (DEA). In this study, we combined DEA and a regression analysis. In the first stage, DEA model was used (output-oriented, constant return to scale model) to analyze the agricultural efficiency of countries. In the second stage, Panel Data Regression Analysis was used to find the effects of Worldwide Governance Indicators (WGI) and country type on country's efficiency. The results showed that governance indicators are not efficient on the agricultural efficiency.

Keywords

Agricultural Efficiency; Governance; Data Envelopment Analysis; Panel Data Regression.

JEL codes:

1. Introduction

Productivity growth in agriculture has captured the interest of economists for a long time. As agriculture develops, it releases resources to other sectors of the economy. This has been the base of successful industrialization in developed economies such as the Unites States, Japan or countries in the European Union. Therefore, agricultural development becomes an important precondition of structural transformation towards industrial development, as it precedes and promotes industrialization (Adelman and Morris, 1988).

Agricultural productivity is one of the most important problems of the world. High food prices, climate change, civil wars, and the global financial crisis bring very serious problems such as food safety, hunger and malnutrition in the world. Due to its importance the United Nations ' objective for the year 2015 is "fight against hunger and poverty".

The recent past has seen much research devoted to explaining why farmers in poor countries do not produce as much as their counterparts in rich countries. It is natural to ask whether agricultural production in poor countries is efficient. One main stream of thought, represented by Schultz (1964), argues that farmers in poor countries are ‘poor but efficient’; they allocate available resources rationally, but cannot achieve high levels of productivity, because they have a shortage of local-specific modern agricultural technologies. Therefore, in order to improve the agricultural performance of developing countries, more effort should be made to enhance the capacity of agricultural research institutions, the capacity of technology-supply industries, and the schooling and extension education of rural people (Ruttan, 2002).

Governance has become a hot topic on the critical role it plays in determining social welfare. In 2003, the former Secretary General of the United Nations, Kofi Annan, reflects a growing consensus when he states that good governance is perhaps the single most important factor in eradicating poverty and promoting development. Not surprisingly, governance as a term has progressed from obscurity to widespread usage, particularly in the last decade. Governance is about the more strategic aspects of steering: the larger decisions about direction and roles. That is, governance is not only about where to go, but also about who should be involved in deciding, and in what capacity (Graham et al. (2003)).

In this study, we employ the Panel Data Regression Analysis to examine the relationships between governance and agricultural efficiency (value-added) at the 10 (country) level. The main aim of this study is to explain the interaction between governance and agricultural productivity and to expose the impacts of governance on agricultural productivity by an international context using 10 countries over the period 2002-2012.For 10 countries, data are gathered from the World Bank database.

The rest of this paper is organized as follows: section 2 introduces the methodology and discusses our empirical model. Section 3 presents the data sources and variable definitions. Section 4 reports and discusses our empirical findings. Section 5 concludes the paper.

2. Literature Review

Lio and Liu (2008) analyzed 118 countries, whether a relationship exist between agricultural productivity and governance indicators for the years 1996, 1998, 2000 and 2002 in their study. They found that when independent variables included in the model separately, the rule of law, control of corruption and government effectiveness increase agricultural productivity. When all of the variables were included in the model at the same time while rule of law significantly increases the agricultural efficiency, political stability and voice and accountability have emerged a significant decrease in agricultural efficiency. In that study it is concluded that countries of which citizens respect to regulatory quality have higher efficiency in agriculture. Low agricultural efficiency has been seen in more democratic countries is one the other important finding.

Adkinset al.(2002) use the production frontier approach to investigate the effects of three institutional variables – namely, economic freedom, political rights and civil liberties – on macroeconomic efficiency for 76 countries for 1975, 1980 and 1985. They find that economic freedom is significantly associated with technical efficiency. However, the effects of political rights and civil liberties on efficiency are insignificant, and for different model specifications the coefficients of both variables range from negative (efficiency-improving) to positive (efficiency-reducing).

Me´on and Weill (2005) also utilise the stochastic frontier method to test the relationship between governance, measured by the six governance indicators used here, and macroeconomic technical efficiency on a sample of 62 countries. Their results show that, when entering the inefficiency model individually, each governance indicator is positively and significantly associated with efficiency. However, if all six indicators enter the inefficiency model and are tested against each other, then only 'government effectiveness' appears significantly efficiency-enhancing. 'Political stability', 'regulatory quality' and 'control of corruption' appear to be associated with inefficiency, though insignificantly. Therefore, although it seems reasonable to hypothesize that good governance is efficiency-improving for agricultural production, there are still reasons to be cautious as to the a prior relationship between governance and agricultural efficiency.

Andrea Desoisa (2003) in his study entitled "Foreign Direct Investment, Democracy an d Development" emphasized the role of FDI on economic development and assessed the democracy effects on economic growth. He resulted that FDI can play a supportive role for democracy and have a higher economic growth rather than internal investment.

HAtef and Karbasi (2013) studied the effect of governance indicators and foreign investment on private investment in Asian Countries for the period of 1996 to 2010. The population included a sample of 37 Asian countries in two sections of low-income countries and high-income countries. The results indicated that there is a complementary relationship between FDI and private investment in low-income countries and there is a replacement relationship between FDI and private investment in high-income countries. In addition, public investment and growth in real GDP is positive and has significant impact on private investment.

Heidary and Afshar (2012) introduced effective economic and social factors in the entrance of FDI among a set of 83 countries, OECD members and selected countries in the MENA region during the period of 1996 to 2007. By using the panel data, the effects of variables such as governance, human development index, environmental sustainability index, ICOR, GDP and economic freedom index to examine the inflow of FDI.

The results showed that GDP variable, as the superseded of market size, governance and stability indicator in the global model and OECD countries model is statically meaningful and had the most effects on the increasing of FDI attraction. While in MENA countries, market size, investment return and economic freedom indices has meaningful effect on the attraction of FDI.

3. The Model

3.1. Analytical Techniques

In the study, agricultural productivity was measured as the ratio of agricultural outputs to agricultural inputs by Data Envelopment Analysis (DEA) which is an efficiency measurement technique.

3.2. Data Envelopment Analysis

Data Envelopment Analysis (DEA) is a linear programming based nonparametric method for measuring the relative efficiency of Decision Making Units (DMUs). DEA creates a frontier function by comparing the ratios of multiple inputs to multiple outputs of similar units taken from the measured observations (Charnes, Cooper, and Rhodes 1978). It was first proposed by Charnes et al. (1978) based on the work of Farrell (1957). Since it was first proposed with CCR model by Charnes et al (1978), some extensions of the model have been developed. Over the years this methodology has been applied across a variety of sectors. An important advantage of DEA is that it is independent of the units measuring inputs and outputs allowing great flexibility in specifying the outputs/inputs to be studied. This is very important in the context of this study as the input and output variables have different units of measurement. Two models in DEA have been largely utilized in efficiency measurements (i) input-oriented and (ii) output-oriented models. With input-oriented DEA, the linear programming model is configured to determine how much the input use of a country could achieve the same output level. With this model, the possible reduction in the levels of the inputs conditional to fixed outputs is found. In contrast, by outputoriented DEA, the linear program is configured to determine a country's potential output given its fixed inputs. In the context of this study, output based efficiency measures are suitable for the country level inputs in our data. It is important to use a DEA output based model to measure how much output can be produced from a given level of inputs. The envelopment surface will differ depending on the scale assumptions that describe the model. Two scale assumptions are generally employed: constant returns to scale (CRS), and variable returns to scale (VRS). The latter comprises both increasing and decreasing returns to scale. CRS reflects the fact that output will change

by the same proportion as inputs are changed (e.g. doubling of all inputs will double output). VRS reflects the fact that production technology may demonstrate increasing, constant and decreasing returns to scale. In this study we use CRS model. An output oriented CCR DEA model in the literature, can be expressed below for m inputs, s outputs and n DMUs:

$$\text{Max } \theta_k = \phi_k + \varepsilon(\sum_{i=1}^{m} s_i^- + \sum_{i=1}^{s} s_r^+)$$

$$s.t$$

$$y_{rk}\phi_k - \sum_{j=1}^{n} y_{rj}\lambda_j + s_r^+ = 0, j = 1,...., n$$

$$x_{ik} - \sum_{j=1}^{n} x_{ij}\lambda_j - s_l^- = 0, i = 1,..., m$$

$$\lambda_j, s_i^-, s_r^+ \geq 0$$

The DMUk k is 1. If it is less than 1, DMUk is inefficient. The efficiency frontier defined by the above CCR model reveals constant returns to scale (CRS) (Cook and Zhu, 2005). As an extension of CCR DEA model, Banker et al. (1984) referred as BCC model for variable returns to scale (VRS).

3.3. Data and Variables

Data on 10 countries over the time period of 2002 through 2012 are used in the empirical analysis. Our country selection process depends on data availability in World Bank. The variables used in the first stage for DEA analysis given below.

Output: The agricultural total output is measured by agricultural value added in area as USD currency.

Inputs: Agricultural land (land): It is estimated by the arable land used for farming, forestry, and production activities. It is measured in km2.

Fertilizers: It refers to the sum of pure weight of nitrogen, phosphate, potash, and complex fertilizers which were used for agriculture. It is measured in tons.

Machinery (tractors): It is considered as capital input for the agricultural production activities such as plowing, irrigation, draining, harvesting, farm product processing, etc. It is measured in one unit of tractor.

Labor (labor): Participants in the economically active population in agriculture, i.e. employment in agriculture as a percentage of total employment.

The second main dataset is from Kaufmannet al.(2006), which provides aggregate indicators for six aspects of governance, including measures for the rule of law (Rulelaw), control of corruption (Concorr), government effectiveness (Goveff), regulatory quality (Reguqual), voice and accountability (Voiacc), and political stability (Polstab). The six governance indicators are measured in indices ranging from about dimension is ‘government action’

(Govact), measured by the mean value of Goveff and Reguqual. The third dimension 'selection of the authority' (Selauth) is measured by the mean value of Voiacc and Polstab.

To explore the impacts of the "good governance" on agricultural productivity, in the second stage, we constructed the following linear regression model: For the panel regression analysis dependent variable is country agricultural efficiency and independent variables are six governance indicators, country education index and country type (developed or developing). Analysis has been run for developing and developed countries separately as well.

$$efficiency_t = \hat{\beta}_0 + \hat{\beta}_1 Voice\ Acc_t + \hat{\beta}_2 PolStab_t + \hat{\beta}_3 GovEffec_t + \hat{\beta}_4 \operatorname{Re} gQual_t + \hat{\beta}_5 RuleLaw_t + \hat{\beta}_6 ContCorr_t + \hat{\beta}_7 Edu_t + \hat{\beta}_8 Edu_{t-1}$$

Durbin-Watson result (d=0,60) shows us the regression has autocorrelation, and the VIF value (VIF>10) shows us the high multicollinearity between independent variables. For this reason, we have the following modifications for all the variables in the model like

$$Efficiency_t = Efficiency_t - \rho.Efficiency_{t-1}$$

where $\rho = 1 - d/2 \cong 0.74$

so the model tested in the study is:

$$Efficiency_t - \rho.Efficiency_{t-1} = \hat{\beta}_0 + \hat{\beta}_1 (Voice\ Acc_t - \rho.Voice\ Acc_{t-1}) + \hat{\beta}_2 (PolStab_t - \rho.PolStab_{t-1}) + \beta_3 (GovEffec_t - \rho.GovEffec_{t-1}) + \hat{\beta}_4 (\operatorname{Re} gQual_t - \rho.\operatorname{Re} gQual_{t-1}) + \hat{\beta}_5 (RuleLaw_t - \rho.RuleLaw_{t-1}) + \hat{\beta}_6 (ContCorr_t - \rho.ContCorr_{t-1})$$

4. Results

According to the results obtained by Stata Software, there is no difference between fixed effect and random effect. The last column of the table shows the data analysis results. The results indicated that there is no meaningful variable. It mentioned that governing and governance policies had no effects on agricultural efficiency. Country's sovereignty and corruption control are factors that have a negative impact of efficiency in developing countries, which include dictatorship countries. Express opinion, political stability, law and control of corruption has negative impact on efficiency in developed countries. Regularity quality has a positive effect on agricultural productivity. On the other hand, the positive efficiency indicates that there is a positive relationship between the efficiency and the development of a country. It is clear that agricultural productivity in a developing countries lag behind the developed countries. This must be a result of cross-country heterogeneity in the tangible assets and technology. In developed countries, agricultural productivity is important and would study and support by agricultural technologies, while old agricultural

activities use people to do that. Analysis for developed and developing countries separately repeated. Hausman test also showed no difference between fixed and random effects models. The results show that selected countries increase their efficiency in agriculture by quality monitoring, permitting and promoting private sector development.

Tablo1: GLS regression results

	Overall		Developed		Developing	
	Z	B	z	B	z	B
VoiceAcc	2.64	0.047	2.15	0.01612	-0.03	-0.0103
PolStab	0.78	0.019	0.962	0.055	0.99	-0.0015
GovEffec	1.07	0.042	-0.43	-0.029	0.18	0.187
RegQual	1.1	0.034	0.9	0.04	1.87	0.183
RuleLaw	-0.61	-0.0117	0.025	-0.013	-0.46	-0.449
Constant	-0.07	-0.00218	0.58	0.028	-0.34	-0.0173
CountryType	3.11	0.235				
R.sq		0.532		0.496		0.721
between		0.647		0.663		0.639
overall		0.565		0.544		0.712
walld chi2		18.83		15.73		17.99
pro>chi2		0		0		0
Hausman		0		0		0

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