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Investigating the effects of Technology and Education on labor productivity in the agricultural sector in Iran (A Nonlinear Approach)

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ABSTRACT: This research is about detecting and investigating effective factors of Technology and Education on labor productivity in the agricultural sector in Iran. In this regards, many opinions was proposed about Technology and Education on labor productivity in economic literature so that according to economic condition of countries, they proposes various opinions about ways of Technology and Education effectiveness on labor productivity in the agricultural sector. This study uses annual time series data (1961-2007) and unit root tests and analyze them using Smooth Transition Regression (STR) model. This nonlinear technique accommodates potential structural breaks that could undermine the existence of a long-run relationship between labor productivity and its main determinants.

Keywords: Technology and Education, labor productivity, Smooth Transition Regression (STR) model

Introduction

Technology is a system of integrated so that by entering one of its products, the way is opened for other system components. It is not detachable from their roots and to access it is necessary preparing specific preliminary. In addition, technology has culture of its own and use of technological products leads to cultural change in society by itself. At this moment, several countries in the world have already completed or nearly completed a demographic transition, which is a transition from a rural agrarian society with high fertility and mortality rates to an urban industrial society with low fertility and mortality rates (Lee and Mason, 2006). During such a period, working-age population (15 – 64 years old) is likely to grow slower than old-age dependent population (65 years old and over), leading to the diminishing proportion of working-age population and the increasing proportion of old-age population.

Change and beliefs, values and desirable behavior patterns through public education programs of the most important ways is changing. Some of the most important scientists, management training, and organizational activities are considered in the future. The training program should be in the study, the characteristics and patterns of behavior is undesirable and explains the basic elements of the desired pattern. To train personnel in various fields can increase efficiency, productivity and job satisfaction of people. Productivity of effort for a better life and philosophy and vision of community-based strategies aimed at improving the organization of forms which can be used as a chain of activities in all sections of society. Training for the long-term investment is not a current cost. Investment and human resource development is one of the main requirements for structural strength and performance to achieve competitive advantage and leading the organization in order to facilitate the business environment and services. Education is not only academic training in-service training is also included. Many empirical studies have proved the effectiveness of training on employee productivity. Philosophy is the labor productivity improvement in organizations think better to think and create innovation system approach finds its target instead of thinking that created past, present and future.

Information present in the data set processed to form the Bonn Basic Sciences and the increasing expansion of human knowledge means increased volume and variety of information. Under such circumstances, individuals, organizations and societies will be compatible with today's complex conditions of the equipotent optimum use of technology and new methods to existing information and knowledge, be important in situations of organizational and personal life. Since the training or learning mechanism, that is scientific and accurate information in the environment; internal organization and its people therefore use information, to empower individuals for compatibility with the new conditions. The development of countries, organizations and institutions are large and small groups of human knowledge. Increased knowledge and rapid change has led organizations, education programs in their heads. Because education is one of the most important factors in developing countries. There are studies in literature which focused on the same question (Bourles *et al* 2007, Belorgey *et al,* 2006 and Gust and Marquez 2004), But these studies mainly investigate the impact of information and communication technology development for productivity growth for the panel of highly developed economies. Their main aim is to explain the productivity differential between Europe and US. Moreover most of above mentioned studies covered the period of 1992-2001. There are various countries specific case studies exploring the determinant of labor productivity growth in a particular country (Dixon and Macdonald 1992, Brandolini *et al,* 2001 and Rice et al 2006).

When the economic history of developed countries is the current study, the importance of agriculture can be better understood. Because, before the industrial revolution to occur, the agricultural revolution took place in England with its limited land and the barn became Europe caused the development of agriculture, the industrial sector, using capital and labor released agricultural growth is rapid. Agriculture in economic development has a major task: The first and most important task of agriculture is food security and food security for growing populations. Another important task of agriculture sector creates economic surplus and capital development activities for agriculture and other economic sectors. Supply of raw materials needed to help develop industry and agriculture related industries and also provide needed foreign exchange for imports of capital goods and other economic activities from agriculture to other duties. Another vital task is to preserve agricultural and environmental improvement (Milani, 1377). Studies in Iran show that about 90 percent of Iranian territory is located in the Iranian Plateau. Generally, Iranian territory is mountainous and semi-arid. More than half of the total area of mountains is deserts and less than one-fourth to one-fourth that of other cultivated land is formed.

Information Technology in Iran's Agricultural: Iran's scientific and research activities in agriculture in general in 1300 with the first decade of plant breeding and research related activities in Iran and in particular, the 1309 crops with modified seeds and landraces operation were start. Due to the increased efficiency of agricultural production inputs, especially improved seeds, in order to meet the increasing demand for food, the effect of this type of innovation in the distribution of income between producers and consumers is very important. However, research projects and promotes its findings among low-income farmers in Iran and all countries are faced with the problem of financing. Norman (1991) says that reducing the financial support of agricultural research in low-income countries to increase production of the basic problems in these countries. In Iran the same problem and the delay in allocation of research funding has led many research projects be implemented in the time needed by researchers so plenty of accuracy and quality of the results is reduced. Thus, according to the results of research projects related to the introduction of improved varieties in increasing production of wheat in the country, part of the costs of agricultural research is necessary to continue research activities with the quality and accuracy required to be supplied by producers and consumers of these products.

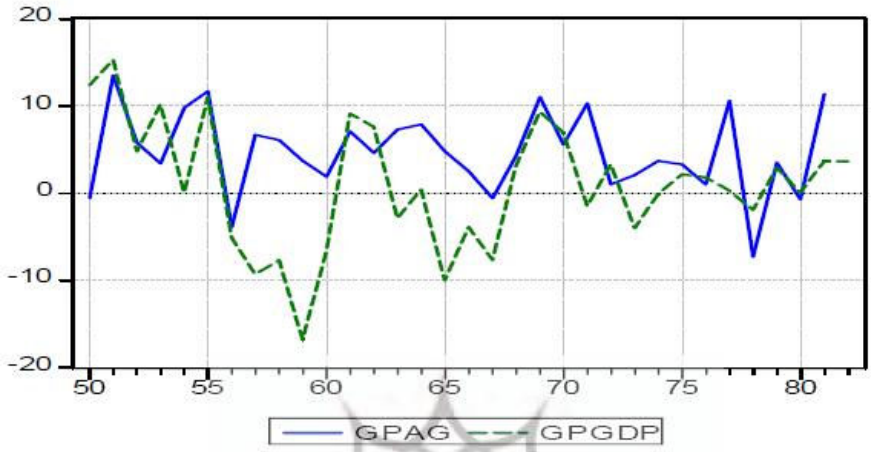

Figure 1. Gross Domestic Product growth and agricultural value added per capital growth constant price 1997 (Sources: Central Bank of Iran and National Accounts of Iran)

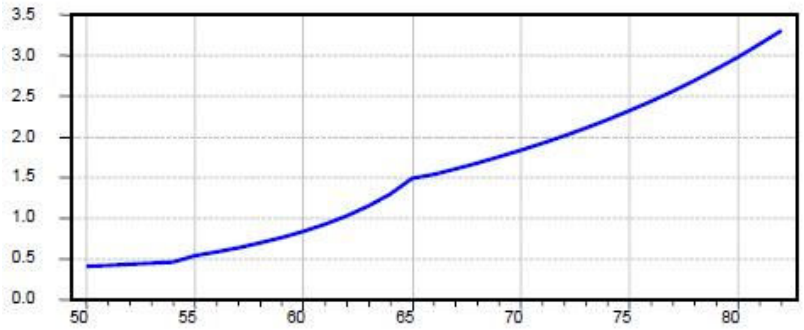

Figure 2. The average years of schooling employed in agriculture

The present research explores from macro perspective an alternative way in which the labor productivity in agricultural sector could be explored employing time series data. For that purpose, we use the Smooth Transition Regression (STR) approach to test the Technology and Education on labor productivity in the agricultural sector using data over the period 1961–2007. The Smooth Transition Regression (STR) approach to co-integration has some econometric advantages which are outlined briefly in the following section. Finally, we apply it taking as a benchmark In order to sort out whether the results reported there reflect a spurious correlation or a genuine relationship between Technology and Education on labor productivity and the variables in question. This contributes to a new methodology in the agricultural sector literature. Next section starts with discussing the model and the methodology. Then in next section, we describe the empirical results of unit root tests, STR co-integration analysis, Diagnostic, stability tests and Dynamic forecasts for dependent variable and last section summarizes the results and conclusions.

Materials and Methods

Model: Feder (1982) 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:

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

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

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:

$$\frac{X_k}{D_k} = \frac{X_L}{D_L} = \frac{X_M}{D_M} = 1 + d \qquad (3)$$

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 $d > 0$.

$$\frac{dQ}{Q} = \alpha \frac{I}{Q} + \beta \frac{dL}{L} + \theta \frac{dM}{Q} + \lambda \frac{dX}{Q} \qquad (4)$$

Indeed this equation can show the relationship between output growth, physical capital growth, workforce growth and export growth in agricultural sector.

$$L(YA)_t = \alpha_0 + \alpha_1 L(IA)_t + \alpha_2 L(LA)_t + \alpha_3 L(MA)_t + \alpha_4 L(XA)_t + e_t \qquad (5)$$

Where:
$L(YA)_t$ 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, $L(LA)_t$ is Logarithm of human capital in agricultural sector based on thousands (the number of employed workforce with a university degree), $L(MA)_t$ is Logarithm of agricultural imports in 1997 constant prices based on million dollars and $L(XA)_t$ is Logarithm of agricultural exports in 1997 constant prices based on million dollars

Methodology: The paper adopts the recently developed Smooth Transition Regression (STR) framework to establish the direction of causation between variables. Recent advances in accounting literature dictate that the long run relation in Eq. (5) should incorporate the short-run dynamic adjustment process. It is possible to achieve this aim by expressing Eq. (5). There are three stages for estimation of Smooth Transition Regression (STR) so that Detection model, the model estimation and Assessment Model. Generally a STAR model for a univariate time series y_t observed in t = 1 - p, 1 - (p-1), …, -1, 0, 1, …, T - 1, T is defined as follows:

$$y_t = \beta_0 + \sum_{j=1}^{p} \beta_j y_{t-j} + (\beta_0^* + \sum_{j=1}^{p} \beta_j^* y_{t-j} F(s_t)) + u_t, \qquad t = 1,2,..., T \qquad (6)$$

Where: y_t = The variable of interest, b_i and b^*_i i = 0, 1... p = Autoregressive parameters
F (S_t) = A transition function allowing the model to switch smoothly between regimes which is bounded by zero
u_t = A random error component believed to satisfy the assumption $u_t \sim iid(0,s^2)$
The model in Eq. 1 can be estimated if the null hypothesis of constancy in parameters is rejected. This estimated model might provide information about where and how the parameters change. It is important to have the STR model in (1) as the alternative hypothesis to the null. Two forms of the transition functions given in Terasvirta are the logistic function:

$$F(0) = [\{1 + \exp(-\gamma(s_t - c))\}^{-1} - \frac{1}{2}] \qquad (7)$$

And the exponential function:

$$F(0) = \{1 - \exp(-\gamma(s_t - c)^2)\} \qquad (8)$$

A third re-parameterized version of (2) proposed by Liews (2002) the Absolute Logistic transition function is:

$$F(0) = (1 + \exp\{-\gamma(|s_t| - c)\})^{-1} - 0.5 \qquad \gamma \succ 0 \qquad (9)$$

Our model is:

$$F(0) = [\{1 + \exp(-\gamma(e_{t(AR_{(p)})} - c))\}^{-1} - \frac{1}{2}] \qquad (10)$$

The LSTAR model describes an asymmetric realization, that is, this model can generate one type of dynamics for increasing growth rate of inflation and another for reductions of the rate of inflation. The objectives of this study are: First, to evaluate the forecasting performances of LSTAR, ESTAR, ALSTAR models. Second, we shall evaluate our proposed ELSTR model using the AR, LSTAR and the ALSTAR models as benchmark. We shall accomplish this task by investigating the Mean Square Error (MSE) and the robustness of this criterion is subjected to Meese and Rogoff (1983) test.

Results and Discussion

Since the testing of the unit roots of a series is a precondition to the existence of co-integration relationship, originally, the Philips Perron (PP) test was widely used to test for stationary. However, Perron (1989) 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 (1988) proposed allowing for a known. The results of Philips Perron test is displayed in Table 1.

Table 1: Results of unit root by Philips Perron test

Variables	*Level Constant*	*Level Constant & Trend*
LLP	-15.12[000]	-19.32[000]
LK	-4.77[000]	-6.32[000]
LL	-19.54[000]	-22.12[000]
LTE	-7.21[000]	-10.32[000]

Determine the optimal lag: The first step in estimating STR models is determining the optimal intervals for model variables. In this regards, according to the seasonal nature of the research period, lag 8 is considered for each of the variables. For this purpose, optimal intervals for LLP, LK, LL and LTE variables is considered respectively 4, 3, 0 and 2. The estimated STR is displayed in Table 2.

Table 2. Select the type and model variable transmission

proposed model	Value of F_2 statistic	Value of F_3 statistic	Value of F_4 statistic	Value of F statistic	Variable transmission
LSTR1	0.000	0.024	0.258	0.021	LLP (t-1)
Linear	0.041	0.012	0.113	0.034	LLP (t-2)
LSTR1	0.163	0.045	0.012	0.019	LLP (t-3)
LSTR1	0.047	0.254	0.034	0.001	LLP (t-4)
LSTR1	0.000	0.146	0.115	0.034	LK (t)
LSTR1	0.000	0.002	0.021	0.000	LK (t-1)*
Linear	0.042	0.217	0.071	0.016	LK (t-2)
LSTR1	0.125	0.321	0.119	0.017	LK (t-3)

The next step is choosing the proper transfer of variables between the variables proposed to model the nonlinear transfer. Quantity of final estimated for γ parameter is 4.39 and for growth of moving moment is 2.51. Therefore, transmission function is as following:

$$G(4.39, 2.51, LK_{T-1}) = \left(1 + \exp\left\{-4.39\prod_{k=1}^{I}(LK_{t-1} - 2.51)\right\}\right)^{-1} \qquad (11)$$

Table 3. Results of final estimation by STR model in form of linear

Part of linear	Coefficient of Φ	Quantity of t statistic	Value of probably t statistic
LLP (t-2)	0.021**	1.26	0.070
LLP (t-4)	-0.32*	-3.24	0.000
LK (t)	-0.12**	-2.59	0.040
LK (t-3)	0.24***	1.134	0.080
LL (t)	-0.23*	-6.26	0.000
LTE (t)	-0.16**	-2.032	0.050
LTE (t-1)	0.014*	2.38	0.040
LTE (t-2)	-0.03***	-4.23	0.000

*Significant of 1 percent, **Significant of 5 percent, ***Significant of 10 percent

Table 4. Results of final estimation by STR model in form of Nonlinear

Part of Nonlinear	Coefficient of Θ	Quantity of t statistic	Value of probably t statistic
Constant	-0.31**	-3.54	0.020
LLP (t-1)	-0.45*	-4.31	0.000
LLP (t-2)	0.35*	1.87	0.070
LK (t)	-0.46*	-6.21	0.000
LK (t-2)	-0.31*	-5.29	0.000
LL (t)	-0.36*	-2.31	0.040
LTE (t)	0.21*	5.21	0.000
LTE (t-1)	-0.43*	-7.31	0.000
LTE (t-2)	-0.12*	-4.19	0.000

*Significant of 1 percent, **Significant of 5 percent, ***Significant of 10 percent

In the first regime G=0 and in the second regime G=1 therefore, for first regime we have:

LL (t) = 0.021LLP (t-2)-0.32LLP (t-4)-0.12 LK (t) + 0.24 LK (t-3)-0.16LTE (t) +0.014LTE (t-1)-0.03LTE (t-2)

In addition, for second regime we have:

LL (t) = -0.31-0.45 LLP (t-1) +0.35 LLP (t-2) -0.46LK (t) -0.31 LK (t-2) + 0.21 LTE (t) -0.43 LTE (t-1) -0.12 LTE (t-2)

The arguments in this paper, the effect of technology on labor supply and unemployment in the new communities will provide. Comparing the situation in our country we reach points that are very important. This condition does not produce so much talk about the role that technology plays in unemployment and employment and entrepreneurship, is irrational. Regardless of the situation, the technology to contemporary society and its rule to all areas of life, a fact that the world is now engaged and is no escape from it, developed countries taking the help of appropriate strategies, employ technology and its problems are solved one after another, then what is problematic, not technology, but also how to apply it and it completed a full cycle in the society. In this case the appropriate technology in exchange for removing workers from the factories employing them in service occupations provides. Now what, the pathological condition of using technology in our society there is not the reality of the technology itself. Content before it can be concluded that the average productivity and marginal productivity that they require constant calculated by considering all factors except factor is desired, was criticized by experts.

Conclusions

Results of this study represent very significant effect of Technology and Education on labor productivity in the agricultural sector in Iran. Therefore, change in share of Technology and Education depends on absorption value of this sector by incomes resulted agricultural sector. 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.

In the agricultural sector, reducing power and improving the quality of working capital, reduction in industrial and labor laws provide for labor and capital where they can easily be adapted and decrease in the granted facilities and trained manpower in the service sector. Indices of average labor productivity in the agricultural sector growing trend, at least after the end of war, and this may improve the livelihood status of forces will be employed in these sectors. For further improvement of this indicator, is recommended that employees be trained in all economic sectors and the lateral force caused by creating job opportunities for the withdrawal of surplus from the agricultural sector. To avoid a decrease in the average productivity of capital in major economic sectors also recommended preventing the outflow of capital in the productive sectors and projects that half of all capital in the economy is no returns, be completed by faster.

REFERENCES

Belorgey N, Lecat R, Maury T (2006) Determinants of productivity per employee: An empirical estimation using panel data. Econ. Lett. Elsevier. 91(2):153-157.

Bourles R, Cette G (2007) Trends in "structural" productivity levels in the major industrialized countries: Britain. Reg. Sci. Urb. Econ. Elsevier. 36(6):727-752.

Brandolini A, Cipollone P (2001) Multifactor Productivity and Labour Quality in Italy, 1981-2000, Temi di discussione (Economic working papers) 422, Bank of Italy, Econ. Res. Dep.

Dixon PB, McDonald D (1992) a Decomposition of Changes in Labour Productivity in Australia: 1970-71 to 1989-90. The Economic Record, Econ. Soc. of Aust. 68(201):105-117.

Feder G (1982) on exports and economic growth. J. Dev. Econ. 12:59-73.

Gust C, Marquez J (2004) International Comparisons of Productivity Growth: The Role of Information Technology and Regulatory Practices. Lab. Econ. 11(1):33-58.

Lee R, Mason A (2006) What is the Demographic Dividend? Finance and Development. Econ. Lett. Elsevier. 95(1):151-156.

Liew VKS, Ahmad Z, Sie-Hoe L (2002) Forecasting Performance of Logistics STAR Exchange Rate Model: The Original and Reparameterized Versions. Unpublished Technical report, Dep. Econ. Univ. Putra, Malaysia. http://mpra.ub.unimuenchen.

Meese R, Rogoff K (1983) Empirical exchange rate models of the seventies: Do they fit out of sample? J. Int. Econ. 14(1): 3-24. http://ideas.repec.org/a/eee/inecon/v14y1983i1- 2p3-24.html

Milani A, (1998) Iran's Agricultural. Journal of Ettelaate Siasi Eghtesadi. Inst. of Ettelaat: Tehran: 137-138.

Norman DW, (1991) Farming systems research in a declining donor environment. Dep. Agr. Econ. Kansas state university Staff Paper. 92-102.

Perron P, (1989) The great crash, the oil price shock and the unit root hypothesis. Econometrica. 57(6):1361-1401.

Phillips PCB, Perron P (1988) Testing for a Unit Root in Time Series Regressions. Biometrika. 75(2):335-346.

Productivity growth in the agricultural sector is considered important in the Sub-Saharan region of Africa if agricultural sector output is to improve at a rate equal to or greater than the population growth rate to meet the demand for food and raw materials. Also, productivity performance in the agricultural sector is critical to improvement in the economic well being of these countries.Â This problem could not be alleviated by an approach to productivity analysis with panel data that uses the full set of observations.