A Study on Effective Factors on Private Sector Investment in Iran's Agriculture: Unrestricted Error Correction Model Application

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Abstract

The agricultural sector has always been discussed as a major column in economic growth of a country. In this regard private investment is an important variable in the development of this sector. So the main aim of this study is investigating the effective factors on the investment of the private sector in Iran's agriculture and then providing appropriate solution to increase it. Thus, the ARDL Model Pesaran & Shin's framework was used for this purpose. The needed data for this study includes time-series data for the period of 1980-2010. The results showed that there is a long-run relationship between private investments, bank credit facilities to the agricultural sector, capital stock, inflation rate and wholesale prices. On the other hand, private investment is more sensitive than inflation in a way that one per cent increase in the inflation rate will cause 32/59 per cent increase in private investment and has less sensitivity to the bank credit facilities, including the banking system's inefficiency in resource allocation and its orientation to inject resources to the public sector. So by making the government smaller on one hand and developing financial institution and credit on the other (hand), the possibility of investment in the private sector can be widely provided.

KeyWords: ARDL Model (Pesaran and Shin's Method), Capital, ECM Model, Elasticity & Inflation.

Introduction

Agriculture sector is among the main sectors in a country's economy which bares the significant role of production, exports, employment and providing nutritional needs of a country. Developing agriculture sector is a prerequisite and essential need for developing economy. Other sectors will not prosper unless all the challenges in this sector is defeated. In addition, about a quarter of gross domestic product and foreign exchange earnings from non-oil exports, employment and also providing near 80 percent of nutritional needs in a society are done through this sector. On top of that, by the rapid growth in population, increase in demand for food and the increasing need of other economy sectors for agricultural crops, providing a change in this sector so that it could increase the quantity and variety of crops in a short period is of significance. (Hozhabrkiyani and Johnowislo, 2000)

On the other hand, among the investments in various economy sectors, investing in agriculture sector has an important position. Due to the increase in demand for food and other agricultural crop, investment in agriculture could help the production and employment growth. In fact, increase in demand leads to increase in prices and increase in prices could lead into increase in motivation for investment. Hence, more investment could result in increase in production and employment. (Amini and Falihi, 1998) Investment is among the main factors in economy development and also the most limited factors in agriculture sectors. Investment has an important role in increasing efficiency in other production factors such as land work forces. (Soltani, 2004) Capital and investment in agriculture sector have faced a lot of fluctuations due to high dependency on oil revenues and oil's high price volatility. Due to the presence of structural shortcomings and lack of financial facilities for most exploiters in agriculture sector, difficulties in investment

have been received more. Despite the fact that the agriculture sector has had a great role in gross domestic product and employment an also, it has provided the essential needs of society, investment in this sector has not been desirable during recent decades and its capital share in national economy during the past two decades has been equal to 5.9 percent. Although the ratio of investment on gross domestic product during the aforementioned period has be low and about 16.5 percent on average, this ratio in agriculture sector has been on average. In other words, only 3.9 percent of added value in agriculture sector has been returned in investment, while these ratios in services and industry sectors have been 24.6 percent and 15.4 percent, respectively. (Hojjati, 2001)

Hence, considering agriculture sector significance in economy growth and development, capital potentiality in increasing agricultural crops production and development in this sector, investment strategies in it is of importance. Meanwhile, private sector investment being influenced by some of past changes such as land reform, revolution, war and a series if structural factors such as government interventions and grants, have led to a decline in private sector investment. On the other hand, considering the dependence of various economy sectors on oil revenues and declines in oil revenues, private sector investment and its attraction and direction are of significance. (Hozhabrkiyani and Johnowislo, 2000)

The following research tries to study the private sector investment in agriculture sector in connection with main variables such as bank credit facilities to the agriculture sector, capital stock in agriculture sector, wholesale prices and inflation.

Bagheri & Torkamani (2000) have studied situation and relation between private and public investment in agriculture section using coaggregation test. The results of estimation for this study private investment showed that state investment, bank credits, prices index and state investment with one pause over private investment is effective and also there is one long-term balance relation between function variables by use of coaggregation test and the important result of this study is the positive effect of state investment on private investment.

Using a concurrent model based on investment theory fundamentals, Sameti and Faramarzpur (2004) studied the private sector investment challenges in investing in agriculture sector during years of 1967-2000. Results suggested that exchange rate and added value are among the effective factors on private sector investment in agriculture sector. Private sector investment is mostly affected by added value ratio, comparing to other variables. Also, absorbing private sector investment is lower than public investment.

Using a self-explanatory method in extensive intervals, 'Abbasinejad and Yari (2007) studied the effectiveness of bank credit facilities interest on private sector investment in long term in Iran. They tested the authenticity of the relation between these two variables in short and long-terms. Results indicated that there is a negative significant relation between bank credit facilities interest and private sector investment in short and long-terms.

Using Vector autoregression (VAR) model though Johansen and Juselius co-integrated method, Ahangari and Sa'adatmehr (2008) studied the relation between risk and private sector investment in Iran, during the years 1984-2005. Results showed that investment risk has a significant effect on private sector investment in Iran, so that, one unit increase in investment risk index (combined risk) could decline the private sector investment in Iran with an average of 0.22 billion IRR.

Yousefi & Aziz Nejad (2009) have studied the effect of domestic gross production variables, state investment, inflation rate and role of organizations such as security, ownership rights, rules and regulations, official invalidity and social security on Iran private investment during 1363-1383 years. The results showed that while domestic gross production and substructures have had positive effect on private investment, but the most important inhibition of private investment in Iran has been related to law and rights problems, lack of investment security, ownership rights and invalidity.

Bairam and Bert (1993) studied the relation between private and public investments for 25memebers of Organization for Economic Cooperation & Development (OECD)[1]. They could figure the correlation between government spending and investment in 24countries out of 25meembers. Among the 24contries, 19 countries had a strong negative relation.

Argimon et al, (1997) studied the investment and public consumption effects on private sector investment. They came to this conclusion that public consumption and investments have negative effect on private sector investment, although public consumption is more considerable.

Rosegrant et al, (1998) studied the dynamic food provide effects in Indonesia. They studied the effects of technology, prices and investments in turnover growth for rice, corn, soy and cassava, using proper parameters for assessing prices and investment policies. They also studied the major impact of public investment in agriculture researches, development and irrigation on long-term turnover growth in Indonesia. Result suggested that removal of subsidies on chemical fertilizers and reinvestment due to the financial savings in researchers, development and irrigation could increase the profitability.

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[1] . Organisation for Economic Cooperation & Development

Loony (1999) studied the effective factors in private sector investment in agriculture sector, using Regression model. Results indicated that private sector investment; gross domestic product and agriculture facilities with a one year lag and underlying investment have positive effect on private sector investment while non-underlying investment has a negative effect on private sector investment.

Ghali (2000) has studied the relation among private and public investment by method of error correction and they have concluded that in long-term, public investment has negative effect on private investment and economical growth, but in short-term it has negative or no effect on private investment and growth respectively.

Emran et al (2003) have studied the effect of economical freedom on private investment in India via estimation of investment function as method of self-regression (ARDL).[1] The results showed that there is positive and significant relation between freedom and private investment.

Mizutani & Tanaka (2005) have studied the effect of public substructure on private section production and effect of economical policies on investment in public substructures. Their used information in this research is panel data related to 46 departmental domains in Japan in 1975, 80, 85, 90 & 95 years. They have applied coincident equations system consisted of private section production function, function to form public capital, governmental public investment function and regional public investment function. In this research, public capital is defined as sum of capital stock in transportation, seaport and airport, agriculture and national security sections. The results of these research shows that public capitals have effect on production efficiency in private section, and there is one complementary relation between regional or local and national governments investments. Political elements are not so effective on governmental investments in public section and national government supports to create public substructure result in local governments' investment.

Research Methodology

Applied Model

To study the presence of long-term relation and determining the effect of this relation on private sector investment in Iran's agriculture sector during the years of 1979-2010, Auto-Regressive Distributed Lag (ARDL) proposed Pesaran and Shin (1999) was used. Data for this study was collected through secondary data (time series data) which were provided by Bank Markazi and National Statistics Center of Iran.

They (Pesaran and Sheen 1999) showed that ARDL pattern give consistence estimations from long-time coefficient which are normal as the asymptotic and regressors can be I(0) or I(1). Also Inder (1993) showed that these patterns are useful for small samples (limited) and alternatively it is suggested that unrestricted error correction model (UECM)[2] enters dynamic to estimate of short and long time coefficients. Pesaran (1997) and Inder (1993) separately showed that to enter dynamic may correct regressors in ARDL and UECM. At last, it is prevented to create false regressions and unreliable estimations (Ghorbani et al 2007).

The private sector investment model in this study was considered to be like the following general form:

$$PI = F (BC, SI, PIA, P) \qquad (1)$$

In which,

PI: presents the private sector investment in agriculture sector with the constant price of the year 1997

BC: presents the remaining bank credit facilities to agriculture sector with the constant price of the year 1997

SI: presents the capital available in in agriculture sector with the constant price of the year 1997

PIA: presents the wholesale price with the constant price of the year 1997 and P: is the inflation.

As mentioned, the main advantage of Pesaran & Shin method is that pattern variables can be I(0) or I(1); it means that there is no longer need to be I(1) for all pattern variables. Besides, this pattern isn't suitable for small samples. So that Pesaran & Sheen (1995) divide ARDL approach in two stages.

The first stage is the co-integration test and the second stage is estimating the model parameters. In the first stage, using F static, presence of a long-term relation between studied variables is studied. To achieve this, ARDL model was estimated based on error modification method and subsequently, the variables lag levels significance were tested. To explain this method, the following model is transformed to ECM[3]:

$$PI_t = a_o + \sum_{i=1}^{p} \{_i\, PI_{t-i} + \sum_{i=0}^{q} S_i x_{t-i} + V_t$$

$$V_t \approx iid(o, u_v^2)$$

$$(2)$$

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[1] . Auto-Regressive Distributed Lag
[2] . Unrestricted Error Correction Model
[3] . Error Correction Model

In which, x_t is a vector of k × 1 from exogenous variable (BC, Si, PIA and P) and ß is a vector of k × 1 from corresponding parameters. v_t shave equal distribution from each other (iid).

The previous supposition is a part of ARDL definition. The ECM form of Model 2 is as the following:

$$\Delta PI_t = \Gamma_0 + \sum_{j=1}^{p-1} \{ {}^*_j \Delta PI_{t-j} + \sum_{j=0}^{q-1} S^*_j \Delta x_{t-j} + \oe_0 PI_{t-1} + \sum_{i=1}^{k} \oe_i x_{i,t-1} + v_t$$

(3)

Equation 3 which is estimated by OLS, is the USCM unlimited or conditional error modification. In Equation 3, K is the number of regressors or number of vector elements of x_t. In the aforementioned model, it is presumed that variables or exogenous. But if such data are not already available, the values with lag of $x_{t,i}$ (that is x_{t-q+1} ...., x_{t-1}) are used in the above equation. If $x_{i,t-1}$ and PI_{t-1} coefficient are significant, co-integration or a long-term balanced relation between model variables is approved. Hence, co-integration hypothesis test is as the following:

If some of the model variables are I(1), F static for the above test (co-integration) does not include standard asymptotic distribution. However, regardless of if variables are whether I(0) or I(1), Pesaran and Shin (1996) have proposed the critical integer values table for the aforementioned test for corresponding number of various regressors of K. in addition, this table varies based on the fact that if the ARDL model have intercept of (a_0) and trend of (a_1). If all variables are I(0), the critical value is the minimum integer which is the critical values of standard tables. If all variables are I(1), the maximum value for all variables must be considered. If some variable are variables are I(0) and some variables are I(1), the critical integer values between maximum and minimum are used. Hence, if F static is higher than maximum critical value of the table, the H_0 hypotheses – lack of co-integration – could be approved. There is no need for unit root test for determining variables agglomeration degree. However, if F static is in the aforementioned range (between critical maximum and minimum limits) a solid conclusion could not be reached. The second stage includes estimating long-term and short-term parameters. Lags length are determined, using various model selection criteria such as AIC, SBC and R^{-2} and subsequently, the ARDL model coefficients are estimated by OLS method. (Abrishami, 2002)

To study the presence of long-term relation in ARDL method of Pesaran and Shin, there is no need for unit root, since variables could be either I(0) or I(1). However, Owatra (2004) claims that if the model variables are I(2), F static related to Pesaran and Shin test is invalid, since the test is conducted under this assumption that variables are either I(0) or I(1). Hence, unit root test on ARDL method of Pesaran and Shin should be conducted to confirm none of the model variables are I (2).

Generalized Dicky-Fuller test

In this method, it is used first-degree differential terms with pause or auto-regression AR (p) to solve the correlation problem. The numbers of pauses are determined based on this point that disturbance term, u_t time series doesn't have serial correlation. This test can be stated as follow:

$$\Delta y_t = c + S_t + \Gamma y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-i} + u_t \qquad u \approx iid \left(o, u^2\right)^2$$

$$H_0 : \Gamma = 0$$

$$H_1 : \Gamma \prec 1$$

In this test, H_0 hypothesis implies existence of unit root and opposite hypothesis shows series stand. Therefore, if calculated t-statistic absolute value is larger than critical absolute value, this means to reject H_0 hypothesis (existence of unit root).

It is worth to point out that to select form (having time procedure and width from origin) and also suitable pause to test ADF in results are effective, so that increase in pause numbers will result in decrease test power; because, on one hand, it is increased the number of estimated parameters, and on the other hand, it is decreased the number of useful observation and therefore, Test power is also decreased by decrease in freedom degree.

Results and Discussion

To study the private sector investment stagnation in agriculture sector expanded Dicky-Fuler test (ADF) was used and the results are presented in Table 4-1. As it could be observed in the table, all variables except banks credit facilities to agriculture sector are at a non-reliable level and their first-rank difference is reliable. In other words, these pattern variables are sum of I (1).

Table 1 ADF Test Results

ADF	Variable First Rank Difference	ADF	Variable	
-4.21	DPI	-0.47		PI
		-3.73	BC	
-3.54	DSI	-0.75	SI	
-4.32	DPIA	-0.84	PIA	
-3.01	DP	-0.95	P	

Critical value of ADF statistic at 5% level: -2.97

To study the long-term relation between private sector investments in agriculture sector, banks credit facilities to agriculture sector, capital stock in agriculture, wholesale prices and inflation rate, F-test was conducted and the results are presented in Table 4-2.

Table 4-2 shows the maximum and minimum critical values which are presented by Pesaran and Shin (1996) at 1percent and 2.5 percent. Hence, since F static is higher than the maximum at 1 percent and 2.5 percent, the hypothesis of lack of long-term relation between pattern variables is refuted. To put it another way, there is a long-term relation between private sector investments in agriculture sector, banks credit facilities to agriculture sector, capital stock in agriculture, wholesale prices and inflation rate. Results to long-term and short-term coefficient estimation based on OLS method are presented in Table 4-3. Considering the Schwartz-Bizin test, lag length is determined to be 2.

Table 2- F-Test Results for Long-term Relation Existence (Co-Integration) with Intercept

at 97.5 Percent		at 99 Percent		
I(0)	I(1)	I(0)	I(1)	F- Static
3.29	4.51	3.81	5.12	15.03

Reference: Research Result

Table 4-3 results indicate that private investment in long-term is affected by itself for a short lag. In other words, investments related to a prior period have a negative significant effect on private sector investment. The credit facilities, wholesale price and inflation have a positive effect on private investment and they are statistically significant. Capital stock has a negative effect on private sector investment in agriculture sector and it is statistically insignificant, since in recent years, according to the guaranteed purchase of crops and increase in demand for crops, investment in stock decline from year to year. On the other hand, net investment is not high and as a result, it leads to decrease in gross investment.

Table 3- Public Investment Pattern Estimation in Agriculture Sector through UECM Method

Significance	t -Statistic	Coefficient	Variable
**	2.556	6697.6	Intercept ©
Ns	-1.061	-0.250	DBC_{t-1}
***	6.011	1.410	DBC_{t-2}
Ns	0.796	0.098	DSI_{t-1}
Ns	0.983	0.123	DSI_{t-2}
Ns	-1.447	-168.215	DP_{t-1}
***	-5.713	-33.697	DP_{t-2}
Ns	0.726	42.782	$DPIA_{t-1}$
*	1.991	68.693	$DPIA_{t-2}$
***	-3.212	-2.057	PI_{t-1}
***	3.496	0.397	BC_{t-1}
Ns	-0.620	-0.055	SI_{t-1}
*	1.953	249.017	P_{t-1}
**	2.137	212.855	PIA_{t-1}

* Significant at 10% level, **Significant at 5% level, ***Significant 1% level
Ns: Insignificant

Also, absorbing investment in other sectors decreases the private sector investment and absorbing investment in agriculture does not have a good turnover and leads to transferring capital from this sector to other sectors. All these factors have resulted in decreasing capital stock in private sector.
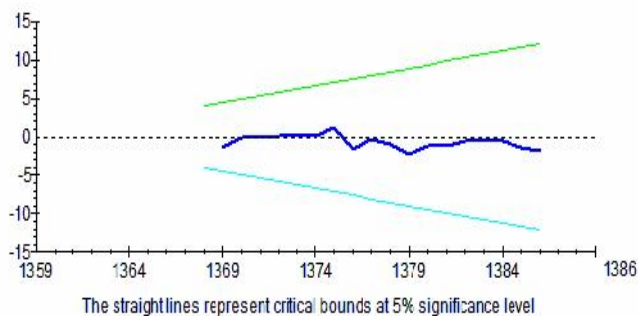
Table 4 Results Related to Absorptions Estimation (Estimated in Linear Order)

Elasticity	Variables
14.42	BC
-31.37	SI
28.15	PIA
32.59	P

Considering the data presented in Table 4-4, it could be observed that variables' absorption on credit facilities, wholesale price and inflation are 14.42, 28.15 and 32.59, respectively; that is, if their conditions are unchanged, if the amount of each variable is increased by one percent, the private sector investment will decrease by 14.42, 28.15 and 32.59, respectively. Also, by a one percent increase in capital stock, private sector investment decreases to 31.37 percent. Table results indicate that private sector investment is the most sensible to inflation, so that one percent increase in inflation leads to 32.59 percent in private sector investment.

It was used Ramsey's reset test in order to study absent or present affirmation error, the results of test showed absent of affirmation error in pattern. Self-correlation test showed that there isn't self-correlation disturbance between terms. It was used cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) Braven et al (1975) in order to study estimated parameters stability. In this test, in spite of some tests such as Chaw, it is not necessary to determine structural break point, Diagram 1 and 2 showed the result of this test.

Plot of Cumulative Sum of Recursive Residuals

The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals

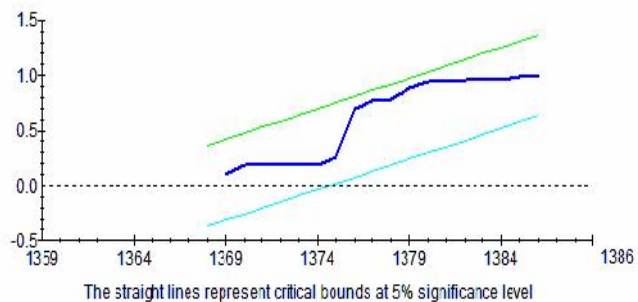The straight lines represent critical bounds at 5% significance level

Figure 1 (above) and 4-2 (below) Plot of Cumulative Sum of Squares of Recursive Residuals

There two diagrams show that estimated parameters in pattern are stable.
The short-term function for private investment in agriculture sector is as following:

$$\Delta(PI)_t = -11.06 + 0.13\Delta(BC)_t - 0.10\Delta(SI)_t - 45.15\Delta(P)_t + 29.67(PIA)_{t-1} - 0.58ECM(-1)$$

T: (-0.07)   (0.51)   (-0.95)   (-2.55)   (1.98)   (-4.38)

$$R^2 = 0.62 \qquad \overline{R}^2 = 0.54 \qquad D.W = 1.92 \qquad F = 7.94$$

It is explained 0.54 percent of short-time changes of dependent variable by independent variable in this estimated equation, and term coefficient of error correction shows that it is corrected 0.58 percent of lack of balance in next period in each one and modification is toward long-term.

Conclusion

According to the results, private sector investment has is the most sensible to the inflation since most capital in agriculture sector is on subsidy. Hence, increase in inflation does not affect them highly. Therefore, increase in output price increases the investment in agriculture sector and the promotion for investment. It has the lowest sensitivity to banks credit facilities. This indicates that the low efficiency in banking system in Iran for allocating sources and its attitude towards injecting sources to the public sector. Hence, by decreasing the size of government and developing financial institution could provide a better field for investment of private sector.

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