
Determinants of Private Investment in Iranian Agricultural Sector

Javad Torkamani and Mohammad Bakhshoodeh*

I

INTRODUCTION

According to classical economists, demand for capital is a function of interest rate. Based on the concept of marginal utility, the neoclassical economists believe that prices have a key role to play in capital formation (Green and Villanueve, 1991; Ghali, 1998).

Keynes in 1956 stated that, investment depends on the ratio of marginal efficiency of capital to interest rates that explain the opportunity costs of investing sources (Blejer and Khan, 1984; Ghali, 2000).

Since the 1950s, the theories of capital formation were focused on simple growth models that are widely used afterwards. Regarding the simple accelerating principle, investment is a linear function of production changes. Based on this model, the required investment for a certain amount of production can be easily determined by the ratio of capital to output. The importance of investing in the agricultural sector of developing countries is mainly due to its effects on production, employment, etc. Like in many developing countries, a major part of the investment in Iran is usually made by the government and partly by the private sector due to the lack of capital markets. The public investments affect the volume of the private sector investment. As stated by Blejer and Khan (1984) and Serven and Solimano (1992), these two sources of investment complement each other.

Capital formation in Iranian agricultural sector is said to be one of the key elements particularly in creating new job opportunities that is a vital issue in the economy of Iran. This in turn can prevent the undesirable migration of farmers to cities.

In this context, the aim of this study is to show the trend of agricultural investment in Iran and to determine the factors accelerating the private investment in the rural areas where the majority of farm activities are concentrated and to determine the causal relationships between these factors and private investment in the rural areas.

* Associate Professor and Assistant Professor, respectively, Department of Agricultural Economics, College of Agriculture, University of Shiraz, Shiraz, Iran.

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II

MODEL

The concept of Granger (1969, 1981) cointegration and the methods for estimating a cointegrated relation or system provide a framework for estimating and testing for long-run equilibrium relationships between non-stationary integrated variables. This concept has been widely discussed and applied in the literature and a detailed explanation is beyond the scope of this paper. Based on Granger (1969), Engle and Granger (1987) and Johansen (1991) approaches, the private investment functions in the short run and long run are defined in equations (1) and (2):

$$IPA_t = a_0 + a_1IGA_{t-1} + a_2IPA_{t-1} + a_3PWA_t + a_4CRED_t + a_5DUM + E_t \quad \dots (1)$$

where IPA_t and IPA_{t-1} are private investment at the years t and $t-1$ respectively; IGA_{t-1} is that of public sector in year $t-1$; PWA_t indicates the ratio of agricultural capita per investment (CPI) to the total CPI at period t ; $CRED_t$ shows total agricultural credits in period t ; DUM is a dummy variable that stands for the revolution effects on investment taking the value '0' for 1979 and before and '1' otherwise, respectively; $CRED$ stands for government credit to agriculture sector in period t ; and E_t is the usual error term.

Whilst the interest rate is expected to be a basic factor on investment, this is not the case in Iran because of being under government control that fix the rate at a given period of time. Therefore, other money-based variables such as devoted credits to agricultural sector have been regarded in this study rather than the interest rate.

In order to estimate the short-run agricultural private investment function, the Vector Error Correction (VEC) model 2 was applied to the data:

$$D(IPA_t) = b_0 + b_1D(IGA_{t-1}) + b_2D(IPA_{t-1}) + b_3D(PWA_t) + b_4D(CRED_t) + b_5DUM + b_6E_{t-1} + w_t \quad \dots (2)$$

D refers to the first order difference, E_{t-1} is the lagged error terms of the long run function, and w_t is the short-run error term.

The time-series data were collected from the various publications of the Statistical Center of Iran and Central Bank of Iran for the period 1965-1996.

III

RESULTS

A historic look at the level of agricultural investment in Iran reveals that capital formation has fluctuated since early 1962 when the land reforms began. As indicated in Table 1, capital formation in the agricultural sector has fluctuated during the period under study. Among the reasons, the landowners' reaction to the land reform plan of 1962 can be highlighted. To keep their ownership, they tried to transform their croplands to horticulture, a decision by which the level of private investment increased. Despite this, they decided to revert their investment direction to the other

sections mainly towards other industries and services. Therefore, the investment in the agricultural sector declined again such that it declined from 37.2 milliard rials in 1965 to 32.6 milliard rials in 1966 indicating a negative growth of -12.4 per cent (the Central Bank of Iran). The level of investment in the agricultural sector improved once more during the periods of the third and the fourth development plans ending in 1973 mainly due to the increasing private investment in these periods. As a result of an increase in oil price in 1971 and rapid increase of public investment in 1974, the agricultural investment increased annually by nearly 6 per cent between 1973 and 1977, that is, the fifth development plan period. It is worth mentioning that public investment in the other sectors increased and therefore despite an increase in the gross national product (GNP), the agricultural investment declined during the last few years of this period. The main reason behind this fact is the uncertain economic

TABLE 1. TOTAL CONSTANT AGRICULTURAL INVESTMENT BY PRIVATE AND PUBLIC SECTORS
(1982=100)

(1)	Total investment (milliard rials)			Proportion of total (per cent)	
	Public (2)	Private (3)	Total (4)	Public (5)	Private (6)
1965	11.3	25.9	37.2	30.4	69.6
1966	12.3	20.3	32.6	37.7	62.3
1967	11.3	42.6	53.9	21.0	79.0
1968	10.6	47.1	57.7	18.4	81.6
1969	24.8	37.0	61.8	40.1	59.9
1970	29.2	38.7	67.9	43.0	57.0
1971	46.1	50.6	96.7	47.7	52.3
1972	55.1	76.5	131.6	41.9	58.1
1973	50.5	86.8	137.3	36.8	63.2
1974	102.1	72.4	174.5	58.5	41.5
1975	100.8	100.8	201.6	50.0	50.0
1976	80.5	107.3	187.8	42.9	57.1
1977	80.6	84.1	164.7	48.9	51.1
1978	92.9	26.3	119.2	77.9	22.1
1979	90.1	23.9	114.0	79.0	21.0
1980	35.2	85.7	120.9	29.1	70.9
1981	40.5	87.9	128.4	31.5	68.5
1982	48.7	60.2	108.9	44.7	55.3
1983	66.1	84.4	150.5	43.9	56.1
1984	64.6	41.9	106.5	60.7	39.3
1985	43.4	67.3	110.7	39.2	60.8
1986	45.4	48.6	94.0	48.3	51.7
1987	34.1	52.8	86.9	39.2	60.8
1988	29.6	53.7	83.3	35.5	64.5
1989	34.5	43.9	78.4	44.0	56.0
1990	42.6	66.3	108.9	39.1	60.9
1991	38.5	85.5	124.0	31.0	69.0
1992	35.6	72.9	108.5	32.9	67.2
1993	54.7	65.1	119.8	45.7	54.3
1994	47.7	47.4	95.1	50.2	49.8
1995	59.9	58.4	118.3	50.3	49.7
1996	67.4	83.4	150.8	44.7	55.3

Source: The Central Bank of Iran, *Annual Economic Reports* (various issues).

environment during the early years of the 1979 revolution in Iran and the adverse terms of trade of agriculture. The level of investments fluctuated during the post-revolutionary years due to various events such as an eight-year war with Iraq, and decline in imports of capital goods due to the economic sanctions against Iran, all of which caused an uncertain environment for new investments. Again, the total investment in the agricultural sector increased in 1983 because of an increase in the oil income. However, the trend was in the opposite direction in the following years due to decline in the oil price and continuity on the boycott that made the private sector reluctant in investing. Despite a slow increase in agricultural investment in 1989-1993, the investment share of this sector was low compared with the other sectors. In general, taking into account the average annual growth of total investment, capital formation in the agricultural sector has been low.

The Augmented Dickey-Fuller Test (ADF) results for the basic variables of the model 1 are summarised in Table 2. As is used in previous studies (e.g., Holden and Perman, 1994; Wagle, 1994), the optimum lag was selected using *Akaiiec* criterion. As shown, none of the variables are stationary and are all cointegrated of degree one, a result that was also confirmed by the Johansen test, and therefore can be corrected through the first difference degree. This result implies that there are long run relationships among the variables.

TABLE 2. THE ADF RESULTS FOR THE BASIC VARIABLES OF THE MODEL 1

(1)	ADF statistic (2)	Optimum lag (3)	Cointegration degree (4)
IPA _t	-3.110	0	I(1)
D(IPA _t)	-6.017	0	I(0)
IGA _t	-2.052	0	I(1)
D(IGA _t)	-5.506	0	I(0)
PWA _t	-2.562	0	I(1)
D(PWA _t)	-6.246	0	I(0)
CRED _t	-2.246	0	I(1)
D(CRED _t)	-7.535	0	I(0)
E _t	-5.837	0	I(0)

Table 3 indicates the estimated coefficients of long-run investment in the agricultural sector of Iran. As can be seen, all the coefficients and constant are found to be statistically significant with expected signs. Various lagged variables for public investment were included in the model among which only that in the form of first lagged was statistically significant. This implies that the public investment can encourage the volume of capital formation by the private sector. Similar econometric results were witnessed with regard to different degrees of lagged private investment. This reveals that private investment can increase in future periods as a result of the current volume of the private investment.

TABLE 3. ESTIMATED COEFFICIENTS OF THE LONG RUN PRIVATE AGRICULTURAL INVESTMENT IN IRAN

(1)	Coefficient (2)	Std Deviation (3)	T-value (4)
Constant	67.08	15.67	4.28
IGA _{t-1}	0.47	0.12	3.98
IPA _{t-1}	0.23	0.12	1.94
PWA _t	-76.68	25.17	-3.05
CRED _t	0.23	0.09	2.63
DUM	-58.98	11.17	-5.28
R ² =0.71			
DW=2.06			
F=12.14			

The negative coefficient of -76.68 for the capita per investment (CPI) ratio is due to the fact that prices of non-agricultural products are usually increasing more rapidly than that of the agricultural products. In other words, the reason behind this negative coefficient may be investigated on dependency of the agricultural production costs to the growing prices of the other sectors' products.

The results of the error correction model that indicate the short run agricultural investment are shown in Table 4. The negative coefficient of the error term of the model refers to the fact that 0.93 of the difference between actual amount of Iranian private investment in agriculture (IPA) and that in the long run will be corrected in each period. The coefficients of the agricultural credit in the short run and long run reveal that the private investment can be improved by the amount of the credit basically in the short run.

TABLE 4. ESTIMATED COEFFICIENTS OF THE SHORT RUN PRIVATE AGRICULTURAL INVESTMENT IN IRAN

(1)	Coefficient (2)	Std deviation (3)	T-value (4)
Constant	0.04	3.99	0.01
D(IGA _{t-1})	0.25	0.24	0.49
D(IPA _{t-1})	0.12	0.25	1.10
D(PWA _t)	16.44	49.18	0.33
D(CRED _t)	0.52	0.19	2.70
DUM	-43.90	16.53	-2.70
E _{t-1}	-0.93	0.37	-2.50
R ² =0.53			
DW=1.68			
F=4.35			

Finally, as shown by the coefficient of the dummy variable DUM, the atmospheres during the first years of the Iranian revolution had led to low private investment in the agricultural sector. As was referred to earlier, the causal relationships between the two sources of agricultural investments; private investment and the CPI ratio; as well as between private investment and credit were also examined using the Johansen test and VEC model. Based on the results, the causal relationships were recognised between the private and public investments. However,

while the former had a negative effect on the latter in the short run, a reverse effect was realised in the long run in terms of the effect of public investment on that of the private sector. The cointegrated vector for the private investment and the CPI ratio revealed that there is a negative long run relation between these two variables. The private investment was found to be negatively affected by the ratio in the long run, as confirmed by the VEC model. However, there was not any clue to the relationship in the short run. Similar results were found in terms of the relationship between private investment and credits as earlier discussed in Models 1 and 2.

IV

POLICY IMPLICATIONS

Based on the findings, one may conclude that to improve the potential role of the agricultural sector in Iran especially in terms of self-sufficiency, particular attention should be given to this sector mainly through increasing its share of public funds. Moreover, as was revealed by the relationship between the amount of private investment and the ratio of agricultural price index to the wholesale price index, an effective and efficient pricing policy should be set for all outputs. This may be considered as an urgent issue when the dependency of agricultural production costs to prices of other goods is taken into account. Another policy implication of this study is that because of uncertain turnover of investment in agriculture, providing relevant environment for investment should be given top priority to ensure that the private sector can invest with as low risk as possible. Lastly, larger public investment in the agricultural sector can encourage private investment in this sector. However, as is emphasised by many economists, the government is expected to pay greater attention to infrastructure projects and leave the profitable activities for the private sector.

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