Impact of Credits, Stock Market Index, and Trade Variables on Motivation for Investment in Agriculture Sector

Azadeh Shahbazian[1], Seyyed yaghoub Zeraatkish*[2], Amir Mohammadinejad[3]

[1] Ph.D. student in Agricultural Economics, Faculty of Agriculture, Islamic Azad University,Science and Research Branch, Tehran, Iran

[2] Assistant Professor, Department of Agricultural Economics, Faculty of Agriculture, IslamicAzad University, Science and Research Branch, Tehran, Iran

[3] Assistant Professor, Department of Agricultural Economics, Faculty of Agriculture, IslamicAzad University, Science and Research Branch, Tehran, Iran

* Corresponding Author: Dr. Seyyed yaghoub Zeraatkish

Abstract

The extant study was conducted to examine the impact of credits, stock market index, and trade variables on the motivation for investment in the agriculture sector. For this purpose, time-series data of the 1985-2018 period published by the Central Bank were used. The following variables were employed to test research hypotheses: Shadow Exchange Currency (E), stock market index of firms (SI), food price index (FP), and the dependent variable of Tobin's q. According to results obtained from econometric tests, including Johansen and Juselius cointegration and ARDL tests through Eviews and Microfit software, credits (CR) had a long-run positive and significant impact on Iran's agriculture sector. Results of data analysis indicated that SI had a positive and significant effect on motivation to invest in Iran's agriculture sector within the long term. In terms of other trade variables, long-run analysis results indicated independent variable of Y (shadow exchange currency) had no significant effect on dependent Tobin's q variable at 10% level (Prob.< 0.1). Moreover, interest rate (R) had a negative impact on dependent Tobin's q variable in long term, while food price index and agricultural sector export (EX) had positive impacts on dependent Tobin's q variable. The results of the analysis in the short-run trend indicated a positive and significant impact of CR in long term on motivation for investment in Iran's agriculture sector in short term. The stock market index (SI) had a positive and significant effect on the motivation to invest in Iran's agriculture sector. According to the results, the dependent variables of interest rate (R) and agriculture sector export (EX) were not statistically significant at the 10% level. In short term, the shadow exchange currency (Y) was effective contrary to the long term. According to results, rural inflation rate (P) had a higher effect on dependent Tobin's q variable in short term compared to the long-run trend. Contrary to the long term, the short-run effect of FP on dependent Tobin's q variable was lower.

Keywords: Investment, Credits, Stock Index, Agriculture Sector, Iran, ARDL

JEL Classification: E50, D25

Tob Regul Sci.™ 2022; 8(1): 298-323
DOI: doi.org/10.18001/TRS.8.1.29

Introduction

Capital is a key factor in the economic development process that plays a vital role as the most limited production factor in agriculture. It is inevitable to invest in the agriculture sector and expand the capital inventory of this sector due to user-based agricultural activities and their potential for job opportunities and adopt unemployed people in Iran. The reason for such necessity in the agriculture sector originates from the value-added and new jobs created by this sector that, in turn, results in a lower unemployment rate in the country. Moreover, expanded investment in the agriculture sector accelerates economic growth and leads to growth and development of the economy and higher employment rate indirectly due to the strong relationship between this sector and other economic sectors (Amini & Falihi, 1998). The most critical case for Iranian planners is providing sufficient capital to achieve the preset economic goals and allocated the limited resources to economic activities fairly. Different economic sectors compete to acquire these resources regarding the limited public capital and bank loans to mobilize capital resources. Profitability is the most important factor of competition between economic activities to acquire capital. If the firm profitability is used as the only measure for capital resource allocation, activities of the agriculture sector are taken as low-efficiency activities that cannot acquire the required capital due to dispersion of agricultural farms and far distance between farmers and instant urban amenities and information. Under such development conditions in rural and agricultural areas, food production would be at risk in the long term (Amini et al., 1998).

Governments in all developed and developing countries have obliged to support the agriculture sector to solve the issue mentioned above. In these countries, capital resources are allocated to agriculture through planning to obtain long-run profit, increase food, and decrease risks caused by malnutrition and food security threats. In our country, Iran, the government considers the agriculture sector as a significant economic sector that needs support. Hence, the Iranian government tries to support this sector within different forms of bank credits and budgets. For example, 25% of banking system credits have been assigned to the agriculture sector in third and fourth social-economic development plans. However, the agriculture sector has not still benefited from these capacities to achieve the considered goals.

Accordingly, it is necessary to be aware of the impact of bank credits and public budgets on the growth and development of the agriculture sector. In this way, public officials can take measures to design developmental plans and allocate the required credits based on full information (Amini et al., 1998).

Statement of Problem

Capital shortage and its allocation to economic activities are barriers and problems that developing countries face while trying to achieve economic growth and development. Proponents of the "unbalanced economic growth" theory argue that capital shortage, especially in developing countries prevents simultaneous investment in all economic activities. Therefore, the investment must be done in those activities that are vital for economic development (Mehregan, 1992).

Investment in the agriculture sector is the most crucial type of investment (Amini &

Falihi, 1998). Although the agriculture sector acquires less chare of capital inventory rather than other sectors this sector has a considerable contribution to economic growth. Hence, many policymakers believe that this sector can create a job (Khaledi & Haghighatnejad Shirazi, 2007). The investment funds in the agriculture sector are provided from agricultures' savings, bank loans, and the public budget of the government. Among these three resources, bank loans are the most important (Bakhtiari & Paseban, 2004).

Banking loans and credits that are given to the agriculture sector are directed credits that are granted to expand and grow agricultural products. Credits are essential factors for development that provide the capital farmers and entrepreneurs need for new investments or new technologies adoption.

Farmers cannot equip sufficient capital for production without receiving banking facilities and loans. For this purpose, all countries grant loans to farmers to increase investment in the agriculture sector. The facilities consider more available banking loans for the agriculture sector compared to other sectors. On the other hand, governments pay a part of banking loan interest to provide investment incentives in the agriculture sector (Ghorbani, 2007). Investment motivation in the economic literature is called Tobin's q, which equals the market value of capital assets divided by its assets' current cost. In Tobin's q, capital asset's market value indicates the total present value of expected capital revenues with real capital return rate's discount (rk), while replacement cost of capital assets represents the sum of the present value of capital's expected revenues with final efficiency discount rate (R) of capital. This definition is the base of an investment theory indicating if Tobin's q is greater than 1.0, then the capital in the market is worth more than the price paid for it; therefore, investors are encouraged to invest. If the value of capital is less than its replacement cost, the investor avoids investment ($q<1$) (Brainard & Tobin, 1977). According to this definition, q indicates all data about future investment decisions made by firms.

The q value shows how one additional monetary unit of capital affects the present value of earnings so that if q is at a high level then the firm is willing to increase capital inventory and if q value is at a low level then firms are willing to decrease capital. Accordingly, firms can find all future data they need for decision-making in q (Romer,2006).

Developing countries, such as Iran experience a high rate of instability in their macroeconomic variables. In these countries, inflation rate, exchange rate, interest rate, and other macroeconomic variables have more volatilities than those in developed and industrial economies. The volatilities, in turn, create an uncertain environment for investors preventing them from making an investment decision confidently and easily. Hence, it is highly critical to consider the capital market and its effective factors, such as inflation rate and their uncertainties to increase investment and achieve sustainable economic growth. Therefore, policymakers must examine the impact of macroeconomic variables on motivation for investment in agriculture, and design appropriate developmental plans.

Because the composition of firms' investment demand and households' savings determine the invested ratio of GDP, investment demand can be considered as a potential affecting the long-run living standards. Moreover, investment fluctuations are introduced as important factors that create business cycles due to severe volatilities of investment in some theories such as Keynesian and real business cycles (Romer. 2001).
Investment decision faces three important issues, including expectations, lags, and risk, which is difficult for an economist to address all of them at the same time. James Tobin somewhat solved this issue by introducing q theory and using the financial markets data. Other theorists have also attempted to expand and revise this theory (Hayashi, 1982). The granted credits, stock market index, and other trade variables make up decisions and measures taken by monetary and governmental officials to affect the economic activities, such as investment motivation. The policies act by changing aggregate demand and its composition. These policies affect the different sectors unequally and subsequently change the ratio of demand for agricultural to non-agricultural products during the economic development process. This evolution stimulates change in relative prices, profitability, production incentives, investment, employment, foreign trade, and growth of each economic sector.
According to extreme classic views, macroeconomic policies may have short-run effects on GNP (value-added of the sector), price levels (price ratio between different economic sectors), employment, and investment, while these policies unbalance the price equilibrium between different sectors. The outcome of these policies is nothing for employment and value-added growth of the economic sector in long term. On contrary, neoclassic and Keynesian theories argue that these policies can have positive long-run effects on economic variables.
Because the composition of firms' investment demand and households' savings determine the invested ratio of GDP, investment demand can be considered as a potential affecting the long-run living standards. Moreover, investment fluctuations are introduced as important factors that create business cycles due to severe volatilities of investment in some theories such as Keynesian and real business cycles.
On the other hand, the agriculture sector of Iran's economy is highly important both historically and practically. The agriculture sector is responsible for job creation, food production, posterior and anterior connection, active involvement in the development of non-oil exports, and so forth.
In the extant study, the impact of credits on the investment motivation of Iran's agriculture sector during 1985-2018 by using an autoregressive distributed lag (ARDL) model and variables of Tobin's q, motivation for investment in the agriculture sector, the logarithm of agriculture exports, the logarithm of shadow exchange currency, the logarithm of food price index, logarithm of interest rate, logarithm of credits granted to the agriculture sector, logarithm of the stock market index, and stochastic residual (error term).

Subject Importance and motivation for choosing it

Population growth and exceeding the labor force its demand have led to limited job opportunities in society and increased unemployment. Capital shortage and allocation

are barriers and problems that developing face to achieve economic growth and development. Various options can be used to make the economic system more efficient. Economic support for manufacturers is one of the suggested options. Investment in agriculture can result in the production and employment growth of this sector due to the increasing demand for food and other agricultural products. Increased demand leads indeed to higher price levels, which, in turn, increases investment motivation. Therefore, the higher the investment rate, the higher the production and employment will be. In addition, the anterior and posterior connection between agriculture and other sectors contributes to production and employment growth in those sectors (Amini & Falih, 1998).

Other reasons are indicating the importance of credits in the agriculture sector of Iran: credits rationing, the risk of agricultural activities, and low income of small entities (Pazhouyan, Farzin Motamed, 2005). Many institutions finance the agriculture sector, such as agriculture banks, commercial banks, central organizations of rural cooperatives, unions and companies that are members of Jihad of Construction and Ministry of Cooperatives, borrowing funds, and nomadic cooperative companies (Alizadeh, 1999, 49).

The developing countries, such as Iran experience a high rate of instability in their macroeconomic variables. In these countries, inflation rate, exchange rate, interest rate, and other macroeconomic variables have more volatilities than those in developed and industrial economies. The volatilities, in turn, create an uncertain environment for investors preventing them from deciding on investment confidently and easily.

Therefore, it is highly critical to consider the capital market and its effective factors, such as inflation rate and their uncertainties to increase investment and achieve sustainable economic growth. Therefore, policymakers must examine the impact of macroeconomic variables on motivation for investment in agriculture, and design appropriate developmental plans.

Hence, it is necessary to quantify the outcome of macroeconomic policies for investment motivation in the agriculture sector and analyze its short-run and long-run impact; in this way, economic and agriculture policymakers can fulfill the strategic goals of the agriculture sector with a clearer attitude.

Research objectives

The main objective of this study was to quantify the impact of granted credits on the motivation for investment in Iran's agriculture sector, and the secondary goal was to propose some solutions and suggestions to achieve the strategic goals of the agriculture sector.

Data collecting method and tool

The required data were collected from datasets, computers, and internet networks. The data collecting method of this study was based on the bibliographic technique, and data of variables (employment, value-added rate, investment, and loans granted by Agriculture Bank) were extracted from Central Bank (www.cbi.ir), Agriculture Bank's website (ww.agri-bank.com) and Iran's Statistic Center website (www.amar.org.ir).

Research Area

The subjective area of study included the impact of credits, stock market index, and trade variables on motivation for investment in the agriculture sector. The spatial area of study was in Iran. The Time area of study covered the period of 2019-2020, and interval data of variables were extracted from 1985-to 2018.

Literature Review and Background

Banking credits are allocated to different economic activities based on developmental priorities. In this case, the agriculture sector enjoys these credits to develop production, investment, and employment. The largest part of credits granted to the agriculture sector (more than 50%) is financed by agriculture bank that plays a vital role in farmers' finance alternatives. Therefore, the appropriate performance of this bank can leave many significant positive effects on the production, revenue, investment, and employment of this economic sector. Although it has been mentioned in development literature that the employment share of the agriculture sector has been reduced and surplus labor of this sector has been transferred to the industry and service sector, it is worth noting that this condition occurs when all amenities are used completely (Qarabaghian, 1992, 554-556).

The land, water, different climates, technology, etc. are not used optimally in Iran; hence, the appropriate planning is still practical to use existing resources or create new ones to develop job-creation options in this sector. The subject's importance with emphasis on the existing capacities is rooted in this case that job-creation cost in the agriculture sector is lower than two other sectors. In the current situation of Iran due to shortage of revenues (in both domestic and exchange currencies), the most suitable solution for the unemployment crisis may be seen in changed attitudes not investment cost. If it is believed agriculture resources are not exploited fully and optimally and there is resources loss, then the little investment can provide new facilities to develop agricultural development and new job opportunities in this sector. Because the agriculture sector of Iran has not been saturated, this study aims to examine factors affecting (credits) employment rate of the agriculture sector and provide some solutions to develop the employment rate in this sector (Bakhtiari & Paseban, 2004).

The importance of the agriculture sector is seen in producing food and raw materials for industries. The agriculture sector was considered as the major part of economic activities in the past while it was changed after the formation and growth of capitalism in Europe due to industrial production so that it was integrated into industrial activities in developed countries (Razzaqi, 1988, 264).

The agriculture sector provided inexpensive labor for industries in the early steps of capitalism and industrialization in Europe. The extensive mandatory and sometimes voluntary immigrations from village to new cities made immigrants work in factories for low wages. The agriculture sector not only injected human force into the industry but also transferred the agricultural capitals to industrial activities from villages to cities due to the high profitability of these activities. In this way, the industrial capital density and growth rate of this sector were increased (Razzaqi, 1988, 264).

Capital transfer from villages to cities also occurred in other ways. A large part of the capital was transferred from villages to cities and from agriculture to industry sector due

to the low price of agricultural products and the high price of industrial commodities consumed by villagers, taxes imposed on inexpensive credits granted for industrial capitalism by the central government (Razzaqi, 1988, 264).

Along with industrial growth, the agriculture sector covered the needs of this sector. Because industrial growth and urbanization occurred simultaneously, it was essential to meet the nutritional needs of the increasing population of cities, increase food products, and supply food at low prices. Industrial growth and mechanical life led to more need for raw agricultural materials, so the agriculture sector took responsibility to provide these materials at a low price (Khaledi & Haghighatnejad Shirazi, 2007).

However, this case did not occur in undeveloped and third-world countries where these two sectors were separated. Other imported and dependent industries were formed without any connection with agriculture in third-world countries where agriculture was grown without linking to domestic industry and its amenities. In these countries, agriculture is produced for the global market instead of meeting domestic needs. The capital was transferred from the domestic agriculture sector to the global economy, especially to capitalist countries due to low price and permanent reduction in products in the third world and high price of imports to the agriculture sector. In this way, market development and consumption growth of the domestic agriculture sector not only led to industrial growth but also provided the field for industrial growth in imperialist countries. In some third-world countries, immigration of inexpensive labor (simple and skilled worker) from different economic sectors, such as the agriculture sector besides transferred private capitals and foreign profits to imperialist countries destroyed domestic development of these countries while led to economic growth in developed countries (Razzaqi, 1988, 266).

Accordingly, the connections between two agriculture and industry sectors in the third world occurred in another way in the third world along with capitalism growth, which dependence is its most outstanding characteristic and existing facilities were lost in favor of foreign industries. In case of shortage, development, and dependence of domestic industries, the foreign industries cover the needs of the agriculture sector of the third world, intensify the dependence of the agriculture sector, and affect the whole economic growth of these countries.

According to the mentioned points, the agriculture potential for meeting the nutritional needs of people can provide a wide range of needs of undeveloped countries and alleviate their dependence (Ghirbani, 2007).

Foreign studies

Burgess and Pande (2003) [1] carried out a study in their country, India to examine the effect of the expansion of new branches opened by the Indian central bank (in which, about 50.000 branches were opened in rural areas during liberalization time from 1969 to 1992) on the rural development. Their results indicated that these branches led to change in output structure and employment, and lower poverty and inequality. Mong Naranjo and Hal studied the impact of access to credit on Costa Rican manufacturing forms and found the positive impact of access to credits on the performance and employment of manufacturing firms.

Baboucek and Jancar (2005) [2] used monthly data of the banking sector of Czech (1993-2005) and an unrestricted VAR model to measure the effect of macroeconomic shocks on the quality of loans. The non-performing loans-to-aggregate loans ratio was used as an indicator of the quality of considered loans. According to the estimated model, the impulse response function approved the strong relationship between the quality of loans and some economic variables. Some economic variables, such as unemployment rate, consumer price index (CPI), inflation, and credits risk increased non-performing loans, while real exchange rate and MI reduced non-performing loans based on the theory. In addition, stress testing was performed to measure the vulnerability of the banking sector of Czech considering the impact of extreme shocks on the economy. The most prominent warning signals of worsening loan portfolio quality are rising growth in None-Performance Loan (NPL) [3], high unemployment rate, and Inflationary Tendencies [4]. According to other stress tests, the banking sector's stability is compatible both with price stability [5] and with economic growth.

Wagle (1994) [6] proposed a logarithmic partial adjustment model to analyze the factors affecting private sector investment in agriculture. In this model, private sector investment in agriculture is a function of public sector investment in the current year, private sector investment with one-year lag, and Wholesale Price Index of agricultural crops-to-WPI of other products ratio. The results indicated a positive and significant effect of public sector investment, private sector investment with one-year lag, and WPI ratio on private sector investment.

Looney (2000) [7] examined the factors affecting private investment in agriculture in Pakistan by using a regression model. The empirical results of estimated equations showed that private investment, GDP, and agriculture credits were effective with a one-year lag, while infrastructural investment and non-infrastructural investment had positive and negative effects on private investment, respectively.

Gandelman and Rasteletti (2012) [8] conducted a study entitled "the impact of bank credit on employment formality in Uruguay" in which, reduces financial investments in different economic sectors led to reduced employment formality. They also found that this reduction in employment formality had a greater effect on women and younger workers. Despite the severe economic crisis and a sharp contraction of bank credit in the period of analysis, no evidence was found for the effect of bank credit on employment formality.

Chidoko and Zhou (2012) [9] carried out a study under the title of "impact of agricultural development on employment in Zimbabwe." The study found out that economic woes that Zimbabwe experienced over the past half-decade have contributed significantly to youth unemployment in agriculture in Masvingo Province as a result of low investment in the sector. The study recommends that heavy investment be put in agriculture and agriculture-related projects to enhance employment levels of the Zimbabwean youths in Masvingo province.

Data analysis method

The statistical population of this study comprised time-series data of 1985-2018 extracted from Iran's Statistic Center, Central Bank of Islamic Republic of Iran, and

Ministery of Agriculture Jihad. The mentioned time-series data were used through the ARDL method, as a significant method that determines cointegration relationships in the small sample, to examine the impact of credits on investment motive in the agriculture sector of Iran.

Introduction to research variables

In the present paper, the following model was used to examine the impact of credits, stock market index, and trade variables on motivation for investment in the agriculture sector of Iran:

$$Qt = b_0 + b_1 Y_t + b_2 PF_t + b_3 R_t + b_4 CR_t + b_5 SI_t + b_6 EX_t + e_t$$

Variables of the model are as follows:
Qt: Tobin's q in agriculture sector's logarithmYt: shadow exchange currency's logarithm
FPt: food price index's logarithm
Rt: interest rate logarithm

CRt: logarithm of credits granted to the agriculture sector SIt: logarithm of firms' stock market index
B6EXt: logarithm of exports of the agriculture sector and stochastic error term are macroeconomic variables affecting the motivation for investment in the agriculture sector.

Table 1. Variables

Qt	Tobin's q in agriculture sector's logarithm
SI	the logarithm of firms' stock market index
R	interest rate logarithm
Yt	shadow exchange currency's logarithm
EX	the logarithm of exports of agriculture sector
FP	food price index's logarithm
CR	ts granted to the agriculturesector

Testing variables' stationary status

The first step to time-series estimations is testing the stationary status of variables. In this case, Augmented Dickey-Fuller (ADF) and Phillips-Perron unit root tests were used to examine variables' stationary status [10]. Table 2 reports the relevant results.

Table 2. ADF and Phillips-Perron unit root tests

Variables	ADF statistic		Phillips-Perron statistic	
	Level	First-order difference	Level	First-order difference
Qt	-1.25	-5.8**	-1.28	-5.7**
SI	-1.9	-8.06**	-1.41	-7.91**
R	-2.53	-5.86**	-2.72	-5.91**
Y	-2.5	-5.89**	-2.72	-5.9**
EX	-2.42	-3.46*	-2.00	-3.34*
FP	-2.16	-4.06**	-1.93	-4.05**
CR	-2.07	-7.16**	-2.09	-7.2**
tical value at1% level	-3.56	-3.57	-3.56	-3.57
Critical value at 5% level	-2.92	-2.92	-2.92	-2.92

****: H0 is rejected at 1% level; *: H0 is rejected at 5% level (Source: researchcomputations)**

According to the results, ADF and Phillips-Perron tests reported similar outcomes for variables stationary. Accordingly, the null hypothesis (H_0) indicating the presence of unit root and non-stationary status was rejected for almost all variables at 99% confidence level after once differentiating (absolute value of computational test statistics in first-order difference was greater than the absolute value of critical value in case of all variables). Therefore, the first-order difference of variables was stationary, so all variables were I(1).

Cointegration test of ARDL

In this step, the ARDL model that was introduced by Pesaran, Shin, and Smith (2001) [11] was used to test cointegration and long-run and short-run relationships between variables of the model. According to the Schwarz-Bayesian criterion and significance of regression coefficients, classic standards were observed and the maximum order of lags equaled 2 for the model designed for extant study. The error correction form is as follows:

Table 3. Results of cointegration test of ARDL

Dependent variable/Explanatoryvariables	F-statistic	Prob.	sence of long-run relationship
F(Q2/SI,Fp,R,Y,CR)	1.30	0.32	Rejected
F(SI/Q2,Fp,R,Y,CR)	6.6	0.00	Confirmed
F(Fp /Q2,SI ,R,Y,CR)	5.06	0.00	Confirmed
F(R/Q2,SI ,FP,Y,CR)	5.26	0.004	Confirmed

F(Y/Q2,SI ,FP,R,CR)	3.45	0.023	Confirmed
F(CR/Q2,SI ,FP,R,Y)	2.07	0.11	Confirmed
Sig.	Critical values		
	Lower bound I(0)	Upper bound I(0)	
1%	3.02	4.29	
5%	2.36	3.55	
10%	2.03	3.15	

Source: research computations

If the calculated F-statistic is greater than the upper bound of the critical value measured by Pesaran et al. (2001), the null hypothesis of the cointegration test (long-run relationship between variables) will be rejected and the long-run relationship will be confirmed. If F-statistic is less than the lower bound of critical values, the long-run relationship will be rejected. If the calculated F-statistic is between upper and lower blunders, there will be no idea about the presence or absence of a long-run relationship. Furthermore, the H0 will be rejected if prob.<0.05. Accordingly, the results of the tests confirmed at meats five long-run relationships between variables. The results of the estimated ARDL model have been reported in Table 4. The optimal lag number of each variable was determined based on the Schwarz-Bayesian criterion and showed in form of ARDL(2,1,0,1,0,0,0,1).

Table 4. Results of estimated optimal ARDL model (dependent variable: Tobin's q)

Variable	Coefficient	Standard Err.	t-statistic	Prob.
Qt-1	0.313***	0.094	3.311	0.004
SI	-0.079**	0.034	-2.336	0.032
R	-0.033	0.097	-0.339	0.738
Rt-1	-0.0299***	0.101	-2.953	0.009
FP	0.396***	0.088	4.482	0.000
CR	0.368***	0.056	6.571	0.000
EX	-0.084	0.061	-1.370	0.189
EXt-1	0.269***	0.067	3.971	0.001
Y	0.264***	0.087	3.037	0.007
Et-1	-0.332***	0.093	-3.566	0.002
C	-5.845***	0.992	-5.890	0.000
R^2=0.9988	R^2=0.9982	D.W=2.641	F.st=1657.6	$\sum e^2$=0.030

*** and ** indicate significance at levels of 1% and 5%, respectively Source: research computations

It is worth noting that various models were specified regarding the second power of each variable alone and binary second power of variables, the second power of variables, the third power of P, with and without consideration of interest rate to achieve an ideal and acceptable model to find factors affecting Tobin's q. In this case, it was tried to consider

all Tobin's q models suggested in previous studies. Finally, the model presented in the present study had more better and acceptable results than the previous one in terms of explanatory power, model stability, coefficients' significance, and classic assumptions. The model was estimated as an optimal model for the period of 1985-2018 using Microfit software. The model fit was performed in a way to cover all specifications required for a good econometric model, such as theoretical foundations of the relationship between variables, the statistical significance of parameters, relative consistency of parameters' signs and theoretical expectations, and high explanatory ability (R^2=0.99 & $\overline{R}^2 = 0.98$). The model consistency was examined based on the error tests shown in Table 5.

Table 5. Results of error test of the dependent variable[4] [12]

Ho	LM statistic	F-statistic
Lack of series correlation	0.181	0.298
on error of subsequent form ofmodel	0.859	0.891
Normal distribution of error term	0.763	-
Homoscedasticity	0.420	0.433

Source: research computations

According to the computational results of the error test, the final probability levels were greater than 0.05. Therefore, null hypotheses of LM and T statistics were confirmed, and the estimated model was consistent. The results of long-run relationships estimated in the optimal ARDL model have been reported in Table 6.

Table 6. Results of long-run relationship estimated in optimal ARDL model

Variable	Coefficient	Standard Err.	t-statistic	Prob.
SI	0.116**	0.049	2.333	0.032
R	-0.482***	0.125	-3.874	0.001
FP	0.577***	0.109	-5.283	0.000
EX	0.269***	0.062	4.334	0.000
Y	-0.098	0.091	-1.084	0.293
CR	0.251***	0.076	3.302	0.000
C	-8.516***	0.886	-9.605	0.000

*** and ** indicate significance at levels of 1% and 5%, respectively

According to Table 6, the following results have been concluded.

[4] Values reported in the table indicated final probability levels (Prob.)

1) The impact of CR on motivation for investment in Iran's agriculture sector

The results of data analysis indicated a positive and significant impact of granted credits (CR) on the motivation for investment in Iran's agriculture sector within the long term.

2) The impact of SI on motivation for investment in Iran's agriculture sector

The results of data analysis indicated a positive and significant impact of SI on the motivation for investment in Iran's agriculture sector within the long term.

3) The impact of trade variables on motivation for investment in Iran's agriculture sector

The analysis results of the long-run impact of other trade variables showed that the independent variable of Y had no significant effect on dependent variable Tobin's q at 10% significance level (Prob.<0.1). As seen in the table, R had a negative effect on Tobin's q within the long term, while FP and EX had positive effects on Tobin's q.
The model estimation of error correction based on the Schwarz-Bayesian criterion has been presented in table 7.

Table 7. Error correction model and results of estimated short-run relationships obtained fromoptimal ARDL model

Variable	Coefficient	Standard Err.	t-statistic	Prob.
dSI	0.079**	0.034	2.336	0.030
dR	-0.033	0.097	-0.339	0.737
dFP	0.396**	0.088	4.482	0.000
dEX	-0.084	0.061	-1.370	0.186
dY	0.0264***	0.087	3.037	0.006
dCR	5.845***	0.992	5.890	0.000
ecm	-0.689***	0.094	-7.244	0.000

*** and ** indicate significance at levels of 1% and 5%, respectively

According to Table 7, the following results have been obtained.

1) The impact of CR on motivation for investment in Iran's agriculture sector
The results of data analysis indicated the long-run positive and significant impact of granted credits (CR) on the motivation for investment in Iran's agriculture sector within the short term.
2) The impact of SI on motivation for investment in Iran's agriculture sector
The results of data analysis indicated a positive and significant impact of SI on the motivation for investment in Iran's agriculture sector within the short term.
3) The impact of trade variables on motivation for investment in Iran's agriculture sector
According to the results obtained at the 10% level, independent variables of R and EX were not statistically significant in short term, while Y had a significant short-run effect contrary to the long-run trend. As seen in the table, the rural inflation rate (P) had a higher effect on the dependent variable of Tobin's q within the short term compared to

the long term. Moreover, the FP index had a lower impact on Tobin's q within the short term compared to the long-run trend.

Stability CUSUM[5] [13] and CUSUMSQ[6] [14] tests

CUSUM and CUSUMSQ tests were done to examine the stability of the parameters. Diagrams 1 and 2 indicate CUSUM and CUSUMSQ values.

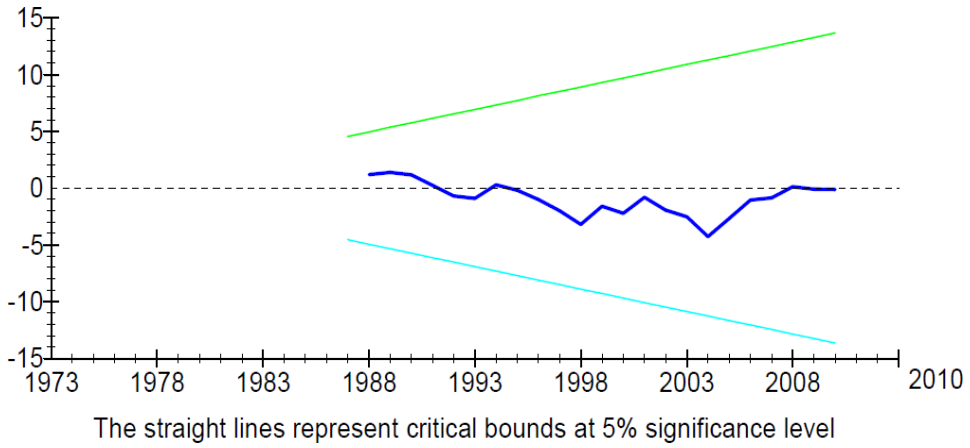

Diagram 1. CUSUM to test the stability of coefficients of optimal ARDL model Source: research computations

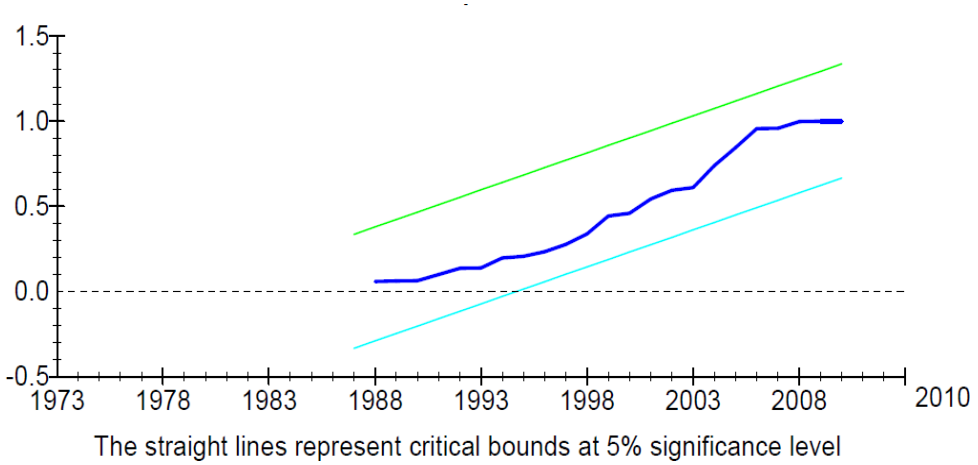

Diagram 1. CUSUMSQ to test the stability of coefficients of optimal ARDL modelSource: research computations

These diagrams depict that there is no instability in coefficient during the studied area because the curves of both values are inside the critical bounds related to parameters' stability at 5% level. Therefore, the designed model has long-term stability in the studied sample.

Johansen-Juselius cointegration test

The optimal order of optimal vector autoregression (VAR) model (i.e., an optimal lag that guarantees the stationary state of residuals of the vector error correction model (VECM)) must be determined to perform the Johansen-Juselius cointegration test and find the number of cointegration vectors between Q, SI, Y, CR, R, EX, FP. There are various criteria, including Akaike information criterion (AIC), Schwartz Bayesian criterion (SC), Hannan-Quinn information criterion (HQ), Final Prediction Error criterion (FPE), and LR value used to select the optimal lag. According to SC, classic regression assumption, and VECM stability in this research, the optimal lag of 1 was selected for the model.

Table 8. Selecting the optimal lag in the VAR model

lag	LR	FPE	AIC	SC	HQ
0	-	4.15×10^{-8}	0.029215	0.557055	0.213445
1	219.5886	1.26×10^{-10}	-5.813235	-3.701876*	-5.076314
2	52.42479*	1.06×10^{-10}	-6.196180	-2.501302	-4.906569
3	45.89464	8.06×10^{-11}	-7.064595	-1.786199	-5.222293
4	43.21298	$3.31\times10^{-11*}$	-9.385893*	-2.523978	-6.990901*

***: the optimal lag selected by criterion (Source: research computations)**

The effect and maximum eigenvalue tests were used to find the number of cointegration vectors. To perform these tests, their values were calculated and compared with the given critical values. If the test value is greater than the critical value, H_0 (presence of r cointegration vector) will be rejected. The H_0 will be confirmed if the test value is less than the given critical value. The obtained results have been reported in Table 9.

Table 9. Results of effect and maximum eigenvalue tests

Null hypothesis	Effect test		Maximum eigenvalue test	
	Effect test statistic	Critical value at 5% level**	Effect test statistic	Critical value at 5% level**
Absence of cointegration vector	135.19*	95.75	65.97*	40.07
The presence of one tegration vector maximally	69.21	69.81	41.61*	33.87
The presence of two cointegration vectors maximally	27.59	47.85	16.29	27.58
The presence of three egration vectors maximally	11.30	29.79	7.47	21.13

***: H_0 was rejected at 5% level, **: final probability levels of McKinnon-Hog-Miklos (1999) (Source: research computations)**

According to Table 9, the effect test statistic confirmed the presence of one cointegration vector, and the maximum eigenvalue statistic indicated the presence of two cointegration vectors. In this way, there was a long-run relationship between variables; hence, it was possible to specify and use VECM.

Discussion and Conclusion

The extant study was conducted to examine the impact of credits, stock market index, and trade variables on motivation for investment in the agriculture sector. To do so, time-series data of 1985-2018 were published by the World Bank and Central Bank of the Islamic Republic of Iran. Research hypotheses were tested by using shadow currency exchange, stock market index, food price index, and the dependent variable of Tobin's q. According to the obtained results of performed econometric tests through Microfit and Eviews software, Johansen-Juselius cointegration, and ARDL tests, CR had a positive and significant long-run impact on the investment motive in Iran's agriculture sector. The analysis results indicated the long-run positive and significant effects of SI on investment motive in Iran's agriculture sector. In terms of other trade variables, long-run analysis results indicated independent variable of Y (shadow exchange currency) had no significant effect on dependent Tobin's q variable at 10% level (Prob.< 0.1). Moreover, interest rate (R) had a negative impact on dependent Tobin's q variable in long term, while food price index (FP) and agricultural sector export (EX) had positive impacts on dependent Tobin's q variable.

The results of the analysis in the short-run trend indicated a positive and significant impact of CR in long term on motivation for investment in Iran's agriculture sector in short term. The stock market index (SI) had a positive and significant effect on the motivation to invest in Iran's agriculture sector. According to the results, the dependent variables of interest rate (R) and agriculture sector export (EX) were not statistically significant at the 10% level. In short term, the shadow exchange currency (Y) was effective contrary to the long term. According to results, rural inflation rate (P) had a higher effect on dependent Tobin's q variable in short term compared to the long-run trend. Contrary to the long term, the short-run effect of FP on dependent Tobin's q variable was lower.

The results indicated the significant effect of agriculture sector exports in Tobin's q of the agriculture sector. Therefore, expanded export of the agriculture sector is a way to increase Tobin's q of the agriculture sector. The positive effect is expected since increased export means increased income of farmers and subsequently expanded investment in the agriculture sector. Hence, a rise in crops' exports provides sufficient motivation for producing high-yield food products, which results in diversity in consuming products and services that are inexpensive, improved living standards of villagers, higher investment, and increased Tobin's q index in the agriculture sector.

The results showed the negative impact of rural inflation rate on Tobin's q of the agriculture sector, i.e. increased rural inflation rate that prevents farmers from producing and directs them towards consumerism. The import-dependent consumerism policies have harmed self-reliance in villages that have accelerated the price index of rural consumers compared to urban consumers. In this case, the self-reliance of villagers

converts to import dependence. Accordingly, the caused by increased subsidies paid to villagers by the government may reduce production and employment, while increasing costs of rural households. The mentioned case, in turn, leads to lower investment in the agriculture sector.

An increase in banking interest rate may downsize the attraction of investment in the agriculture sector due to two reasons regarding the negative and significant effect of this rate on Tobin's q index of the agriculture sector. First, the financial resources of agriculture investors will flow in banks instead of the agriculture sector to obtain a risk-free profit. Second, farmers' cost of finance from banks and credit institutions will be increased, and their profit will be reduced because of increased banking and loans interest rate. According to the points mentioned above, the higher the banking interest rate, the lower Tobin's q index in the agriculture sector.

Therefore, an adjusted interest rate paves the way for more investment in the agriculture sector. The exchange rate had a positive impact on Tobin's q index in the agriculture sector within the short term. This effect is positive because an increased exchange rate increases exports that, in turn, improves the livelihood situation and income of rural households, and expands investment in the agriculture sector. Therefore, a rise in the exchange rate (reduction in the value of national currency) due to lower prices of domestic committees against foreign commodities leads to higher foreign demand for domestic commodities. In this case, the price of export products and agriculture sector export will rise. Thus, a rise in crops' exports provides sufficient motivation for producing high-yield food products, which results in diversity in consuming products and services that are inexpensive, improved living standards of villagers, higher investment, and increased Tobin's q index in the agriculture sector.

The food price index had a positive effect on Tobin's q index of the agriculture sector, so an increase in the FP index expands investment in the agriculture sector. The reason for such relationship is that majority of food products are obtained from agricultural activities, so a rise in the price of food products leads to an increase in income of farmers, which, in turn, makes them motivated to produce more and diverse products, and invest in the agriculture sector that leads to higher Tobin's q index in the agriculturesector.

Recommendations

Some recommendations have been proposed based on the results of the extant study:

1. Regarding the negative effect of banking deposit's interest rate on Tobin's q of agriculture sector and this point that this rate is determined by the government in Iran, it is suggested to consider all aspects and effects of interest rate on agriculture sector to make required decisions and policies. The policies must be made in a way that economic measures help to attract capital direct it towards the agriculture sector, and reduce the attraction of investment in banks.
2. The government must motivate farmers to develop agriculture sector exports. The government can apply some trade policies, such as import tariffs, export subsidies, fewer export barriers, and paying subsidies for production inputs to encourage farmers to produce and export more products.
3. The results indicated the negative impact of rural inflation on investment in the

agriculture sector. On the other hand, inflation has monetary roots due to the expanded money volume in Iran. Hence, it is suggested to pay more attention to expansionary monetary policies that inject money into the rural economy.

4. The government must determine exchange rates in a way to reduce exchange rate volatilities that cause uncertainty for farmers and make them pessimist about export. In this case, the lower production of crops leads to investment risk.

References

[1]. Soltani, G.R. (2017). Determination of rate of return on investment in the agricultural sector,Journal of Agricultural Economics and Development, Issue 45.
[2]. Qarabaghian, M. (2016). Development economics, Ney Publications.
[3]. Nourad, A. (2016). Cooperative firms and bank for farmers, Faroos Publications.
[4]. Hojati, M. (2014). Agricultural development and investment security, Journal of AgriculturalEconomics and Development, Vol. 9, Issue 33.
[5]. Poorian, H. (2011). Factors affecting saving in economic literature and perception of saving barriers in Iran.
[6]. Tafazoli, F. (2011). Macroeconomic theories and policies, Ney Publications, Tehran.
[7]. Amini, A. (2011). Investigation of investment in the agriculture sector, Journal of Planning andBudgeting.
[8]. Irannejad, Zh. (2016); Hojati, M. (2007). Agricultural development and investment security,Journal of Agricultural Economics and Development, Vol. 9, Issue 3.
[9]. Darvishi, A. (2004). Capacity and potential of sustainable agriculture development, Journal ofAgricultural Economics and Development, Vol. 2, issue 5.
[10]. Berjisian, A. (1998). Factors affecting private investment in Iran, MA Thesis.
[11]. Branson, W. (2015). Macroeconomic theory and policy, Translated by Abbas Shakeri, Ney Publications, Tehran.
[12]. Branson, W. (2016). Macroeconomic theory and policy, Translated by Abbas Shakeri, Ney Publications.
[13]. Food and agriculture data, FAOSTAT: Data: Detailed trade matrix. Food and Agricultural Organization of the United Nations, (2015). Available from: http://www.fao.org/faostat/en/#data/TM.
[14]. The Islamic Republic of Iran Customs Administration, (2015). Available from: http://www.irica.gov.ir/web_directory/55334.
[15]. Saghaian Y, Reed M, Saghaian S (2014) Export Demand Estimation for U.S. Corn and Soybeans to Major Destinations. Selected paper prepared for presentation at the 2014 Southern AgriculturalEconomics Association (SAEA) Annual Meetings in Dallas: 8–16.
[16]. Curzi D, Raimondi V, Olper A (2013) Quality Upgrading, Competition, and Trade Policy: Evidence from the Agri-Food Sector. Paper prepared for presentation at the International Agricultural Trade Research Consortium's (IATRC's) 2013. Symposium: Productivity And Its Impacts on Global Trade June 2–4, 2013, Seville, Spain: 3–18.
[17]. Luckstead J, Devadoss S, Mittelhammer RC (2013) Strategic Trade Policies in the U.S Orange Juice Market: Competition between Florida and São Paulo. Selected Paper prepared for presentation at the Agricultural &Applied Economics Association's 2013 AAEA & CAES Joint Annual Meeting, Washington, DC, August 4–6, 2013: 2–23.
[18]. Pierre B, Aikaterini K, Marie-Luise R (2013) Trade openness and investment in North Africa. Paper prepared for the 2013 International Agricultural Trade Research Consortium Symposium Productivity and Its Impacts on Global Trade: 2–21.

[19]. Martínez-Zarzoso I (2013) The log of gravity revisited Applied Economics, 45: 311–327. Available from:
[20]. Gandelman Nestor, Rasteletti Alejandro (2012) The Impact of Bank Credit on Employment Formality in Uruguay
[21]. Danaeifard, H., Shool, H. & Azar, A. (2011). Framework Plan for the proposal of public policy: Combined Research. *Majlis & Rahbord*, 18(68): 7-32. *(In Persian)*
[22]. Abounoori, E. & Maleki, N. (2008). The poverty line in Semnan Province during developmentprograms (1989-2004). *Social Welfare*, 7(28): 215-237. *(In Persian)*
[23]. Chen Ch, Yang J, Findlay Ch (2008) Measuring the Effect of Food Safety Standards on China'sAgricultural Exports. Rev World Econ 144: 84–102.
[24]. Sumner, A. & Jones, N. (2008). The politics of poverty policy. *IDPR*, 30(4): 359-376.
[25]. Khan, S. (2008). The case in the case-based design of educational software: A methodological interrogation. *Education Tech Research Dev*,56: 423–447.
[26]. Khaledi, K., Yazdani, S. & Haghighatnejad Shirazi, A. (2008). Study of Iran's rural poverty and determining its effective factors by an emphasis on investment in the agricultural sector. *The Economic Researches of Iran*, 10(35): 205-228. *(In Persian)*.
[27]. G (2006) A Panel Data Analysis of the Impact of Trade on Human Development. J Socio-Economics 35: 868–876.
[28]. Mehregan, Nader, Ezzati, Morteza and Hossein Asgharpour (2006), Investigation of the causal relationship between interest rates and inflation using panel data", Quarterly Journal of EconomicResearch, Year 6, Number 3.
[29]. Romer, P. (2006). Advanced Macroeconomics, (Third Ed). New York
[30]. Bennett, A. & Elman, C. (2006). Complex causal relations and case study methods: The exampleof path dependence. *Political Analysis*, 14: 250-267.
[31]. Pazhouyan J., Farzin Motamed A. (2005) «Surveying The Impact of Agricultural Bank Granted Credit Effectiveness on Investment and Employment in Agricultural Sector» Peyke Noor Journal Summer 2006, Volume 4, Number 2 (Economics 2); Page(s) 15 To 33.
[32]. Harrison, G. W., Rutherford, T.F., Tarr, D. & Gurgel, A. (2004). Trade policy and poverty reduction in Brazil. *TheWorld Bank Economic Review*, 18(3):
[33]. 289-317.
[34]. Bakhtiari, S. and Paseban F.(2004) «The Role of Bank Loans in the Development of Job Opportunities», Agriculture Economy and Development Journal, Year 12, No.46, pp.73-105(in Persian).
[35]. Robin Burgess and Rohini Pande (2003), Do Rural Banks Matter? Evidence from the Indian SocialBanking Experiment BREAD Working Paper No. 037 July.
[36]. W. Randy R. (2002). The Personal Nature of Agriculture: Men Seeking Help. University of Wyoming Extension Bulletin B-1134, November. http://www. wyoextension.o igelrg/agpubs/pubs/B1134
[37]. Razzaqi, Ebrahim, (2002), Introduction to Iranian Economy, Fourth Edition. Tehran, Ney Publishing.
[38]. Arab Mazar, A. & Hoseininejad, M. (2004). Estimating the measure of poverty and its intensity in different job groups of Iran's rural households. *Agricultural economics and development*, 12(45): 113-140. *(In Persian)*
[39]. Dijkstra, A. (2004).Governance for sustainable poverty reduction: The social fund in Nicaragua. *Public Administration and Development*, 24(3): 197-211.
[40]. Hertel, T. W., Ivanic, M., Preckel, P. V. & Cranfield, J. A. L. (2004). The earnings effects of multilateral trade liberalization: Implications for poverty. *The World Bank Economic Review*, 18(2): 205-236.

[41]. Jahanian, N. (2003). *The development goals by a systematic approach*. research institute for contemporary thought and culture. Tehran. *(In Persian)*
[42]. Imig, D. R. (2002). Book review: American Politics: Who speaks for the Poor? National interest groups and social policy, By R. Allen Hays, 277 p., New York: Routledge; *The American PoliticalScience Review*, 96(3): 640.
[43]. Campbell, J. (2001). Human rights and poverty eradication: A talisman for the commonwealth. *Asia-pacific journal on human rights and the low*, 2:
[44]. 134-148.
[45]. Canagarajah, S. & Thomas, S. (2001). Poverty in a wealthy economy: The case of Nigeria. *Journalof African economies*, 10 (2): 143-173.
[46]. Collier, P. & Dollar, D. (2001). Can the world cut poverty in half? How policy reform and effective aid can meet international development. *world development,* 29(11): 1787-1802.Mc Kinley, T. (2001). *Macro-Economic Policy, Growth and Poverty Reduction*. St. Martin press. Palgrave. NewYork.
[47]. Dorosh, P. A. & Sahn, D. E. (2000). A general equilibrium analysis of the effect of the macroeconomic adjustment on poverty in Africa. *Journal of Policy Modeling*, 22(6): 753-776.
[48]. Hartman D, Sheldon I, Tweeten L (1999) Location of Vertically Linked Industries under Free Trade: Case Studies of Orange Juice and Tomato Paste in the Western Hemisphere. Working Paper99–10. Available from: http://www.umn.edu/iatrc.
[49]. Ghai, D. (1999). Some proposals for an employment strategy for human development, poverty eradication, and environmental regeneration. *Development*, 42(3): 90-96.
[50]. Veit-Wilson, J. (1999).The tax threshold: Policy, principles, and poverty. *Twentieth-Century British History,* 10(2): 218-234.
[51]. Williams, L., Kjonstad, A. & Robson, P. (2003). *Law and poverty: The Legal System and PovertyReduction*. International Studies in Poverty Research/Zed Books. London.
[52]. Looney, E. R. (1999). Private Sector Investment in Pakistani Agriculture; The Role of Infrastructural Investment. Journal of Development Studies, 15(2, 188-204).
[53]. Souri, D. (1998). Poverty and Economic Macro policies (1988-1998). *Plan and Budget*. 3(10/11):155-183. *(In Persian)*
[54]. Amini, AR., & Falihi, N. (1998). The study of the Level of investment in agriculture. Journal of Planning and Budget, 33, 95 - 120.
[55]. Qarabaghian, Morteza (1996) Growth, and Development Economy, Ney Publishing. 16. Karroubi, Mehdi, Ghaderi, Ismail and Jalilian, Negar, 1398, Feasibility Study of Event Tourism Development (with Emphasis on Cultural Events) and Its Impact on Seasonal Modification of Tourist Destinations (Case Study: Hamedan City), Tourism Management Studies Quarterly, Volume 14, Number 45, Spring 1398. (in Persian)
[56]. Tobin, J., and Brainard, W.C. (1977) Asset Markets and the Cost of Capital. In: Fellner, W., Balassa, B.A. and Nelson, R.R., Eds., Economic Progress, Private Values and Public Policy, Essays in Honor of William Fellner, North-Holland Publishing Company, Amsterdam
[57]. Hayashi, F., (1982), Tobinís marginal q and average q: A neoclassical interpretation, Econometrica50(1), 213-224.

Dependent Variable: Q
Method: ARDL
Date: 12/28/20 Time: 23:31
Sample (adjusted): 1364 1397
Included observations: 33 after adjustments
Maximum dependent lags: 2 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (2 lags, automatic): CR R Y SI EX FP
Fixed
regressors: C
Number of models evaluated: 231
Selected Model: ARDL(2, 0, 2, 2, 0, 2)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Q(-1)	0.432329	0.101820	4.246016	0.0010
Q(-2)	-0.594190	0.099719	-5.958665	0.0000
CR	0.000245	0.000143	1.712608	0.1105
R	-0.102044	1.159686	-0.087993	0.9312
R(-1)	1.747607	1.015391	1.721118	0.1089
R(-2)	3.476195	1.203328	2.888817	0.0127
Y	-0.152517	0.048452	-3.147767	0.0077
Y(-1)	0.064008	0.055071	1.162274	0.2660
Y(-2)	-0.111441	0.054794	-2.033826	0.0629
SI	-10.34625	4.809065	-2.151405	0.0508
EX	-0.001154	0.008327	-0.138632	0.8919
EX(-1)	-0.034408	0.018836	-1.826645	0.0908
EX(-2)	0.021261	0.011853	1.793723	0.0961
FP	0.062154	0.021412	2.902761	0.06321
C	-7.986293	8.055327	-0.991430	0.3396
R-squared	0.909331	Mean dependent var		4.622222

Adjusted R-squared	**0.818663**	**S.D. dependent var**	**3.574088**
S.E. of regression	1.521980	Akaike info criterion	3.984051
Sum squared resid	30.11350	Schwarz criterion	4.655966
Log-likelihood	-39.78469	Hannan-Quinn criter.	4.183847
F-statistic	10.02916	Durbin-Watson stat	2.675357
Prob(F-statistic)	0.000095		

*Note: p-values and any subsequent tests do not account for model selection.

ARDL Bounds Test
Date: 12/29/20 Time: 00:44
Sample: 1364 1397
Included observations: 33
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	k
F-statistic	14.98330	5

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	2.26	3.35
5%	2.62	3.79
2.5%	2.96	4.18
1%	3.41	4.68

Test Equation:
Dependent Variable: D(Q)
Method: Least Squares
Date: 12/29/20 Time: 00:44
Sample: 1364 1397
Included observations: 33

Variable	Coefficient	Std. Error	t-Prob. Statistic

D(Q(-1))	0.489168	0.108286	4.517367	0.0005
D(R)	0.420168	1.210627	0.347067	0.7337
D(R(-1))	-3.249941	1.292380	-2.514695	0.0248
D(Y)	-0.009189	0.057153	-0.160775	0.8746
D(EX)	-0.002191	0.010319	-0.212344	0.8349
D(EX(-1))	-0.006608	0.016581	-0.398534	0.6962
C	-9.976099	7.961271	-1.253079	0.2307
CR(-1)	0.000179	0.000200	0.893589	0.3866
R(-1)	4.938361	2.125909	2.322941	0.0358
Y	-0.116517	0.063016	-1.849015	0.0857
SI(-1)	0.703480	0.301234	2.335327	0.0006
EX(-1)	-0.008412	0.014529	-0.578984	0.5718
FP	0.064008	0.055071	1.162274	0.2660
EG(-1)	-1.075750	0.120039	-8.961642	0.0000

R-squared	0.906991	Mean dependent var	0.355556
Adjusted R-squared	0.827269	S.D. dependent var	4.272482
S.E. of regression	1.775684	Akaike info criterion	4.292431
Sum squared resid	44.14273	Schwarz criterion	4.916353
Log-likelihood	-44.94783	Hannan-Quinn criter.	4.477956
F-statistic	11.37691	Durbin-Watson stat	2.265643
Prob(F-statistic)	0.000031		

ARDL Cointegrating And Long Run Form
Dependent
Variable: Q
Selected Model: ARDL(2, 0, 2, 2, 0, 2)
Date: 12/29/20 Time: 00:55
Sample: 1364 1397
Included observations: 33

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(Q(-1))	0.594190	0.099719	5.958665	0.0000
D(CR)	0.000245	0.000143	1.712608	0.1105
D(R)	-0.102044	1.159686	-0.087993	0.9312
D(R(-1))	-3.476195	1.203328	-2.888817	0.0127
D(Y)	-0.152517	0.048452	-3.147767	0.0077
D(Y)	0.111441	0.054794	2.033826	0.0629
D(SI)	0.654635	0.264102	2.478720	0.0108
D(EX)	-0.001154	0.008327	-0.138632	0.8919
D(EX(-1))	-0.021261	0.011853	-1.793723	0.0961
FP	0.031001	0.029581	1.048003	0.0084
CointEq(-1)	-1.161861	0.104685	-11.098629	0.0000

Cointeq = Q - (0.0002*CR + 4.4082*R -0.1721*Y -8.9049*SI -0.0123*EX-0.0102* FP -6.8737)

Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CR	0.2510110	0.0760132	3.302012	0.0000
R	- 0.482012	0.1250130	-3.874042	0.0001
Y	-0.098001	0.091000	-1.08400	0.0293
SI	.0116100	0.049910	2.324183	0.0320
				0
EX	0.2690122	0.062222	4.323425	0.000
FP	-0.012308	0.009382	-1.311927	0.2122
C	-8.516000	0.886701	-9.604139	0.0000

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	3.645384	Prob. F(2,11)	0.0610
Obs*R-squared	10.76230	Prob. Chi-Square(2)	0.0606

Test Equation:
Dependent Variable: RESID
Method: ARDL
Date: 12/29/20 Time: 01:23
Sample: 1364
1397
Included observations: 33
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Q(-1)	0.059326	0.090094	0.658490	0.5238
Q(-2)	0.055677	0.091787	0.606585	0.5564
CR	0.000179	0.000138	1.296276	0.2214
R	0.287057	0.991432	0.289537	0.7776
R(-1)	0.181470	0.865912	0.209571	0.8378
R(-2)	1.428676	1.146011	1.246652	0.2384
Y	-0.064992	0.047586	-1.365791	0.1993
Y(-1)	0.030599	0.048604	0.629546	0.5418
Y(-2)	0.001989	0.047171	0.042160	0.9671
SI	-5.314866	4.523103	-1.175049	0.2648
EX	0.006037	0.007374	0.818638	0.4304
EX(-1)	-0.015930	0.017026	-0.935610	0.3696
EX(-2)	-0.001388	0.010170	-0.136495	0.8939

FP	0.269011	0.099521	02.70306 0.3321
C	-5.900983	7.135969	-0.826935 0.4258
RESID(-1)	-0.883935	0.337234	-2.621127 0.0238
RESID(-2)	-0.662714	0.327168	-2.025605 0.0678

R-squared	0.398604	Mean dependent var	1.23E-15
Adjusted R-squared	-0.421482	S.D. dependent var	1.076202
S.E. of regression	1.283112	Akaike info criterion	3.623698
Sum squared resid	18.11015	Schwarz criterion	4.391601
Log-likelihood	-32.91992	Hannan-Quinn criter.	3.852036
F-statistic	0.486051	Durbin-Watson stat	2.319011
Prob(F-statistic)	0.903100		