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Investment and loaning in Azerbaijan agriculture

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Abstract

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Since agruculture financing and lending are getting quite outstanding in the world, Azerbaijan is also taking serious steps towards it, as agricuture is one of the main branches of the state policy. Obviously, the development of agriculture has heavily tied with food security, environmental protection, eradicating extreme poverty, water purity, land consolidation etc. However, agriculture financinghas the potential to be resolved in Azerbaijan. Fortunately, government provides financial support to agriculture through investments and loans thatmay positively affect the financial sustainability of farmers and their competitiveness. The article analyzes the impact of public investment, renewal of fixed assets, credit allocations by banks for the development of agriculture by means of Autoregressive Distributed Lag (ARDL) modeling. Firstly, the stationary of series was checked, cointegration test was done based on ARDL–pounds testing and then, established models with diagnostic tests. As a result of analysis, a long-term cointegration was identified among agrarian GDP and investment, agrarian funds and agrarian credits. Also, a long-term cointegration was identified among gross agrarian products and agrarian investment, agrarian funds as well as agrarian credits. Research reveals that investment on agriculture positively influences GDP, plant-growing and husbandry. However, the more credits are allocated for agriculture the less the outcomes for plant-growing and husbandry will decrease. The result is unexpected – actually, the unexpected result of credits to agriculture in Azerbaijan means uncertain influence on economic develeopment.

Keywords: agriculture financing; investments; loans; economic develeopment

Introductıon

Agriculture is of paramount importance in the economic development of a developing country. In fact, the significance of agriculture for the overall well-being of the people is constantly growing. Many economists, such as Godfray et al. (2010), Herren et al. (2015), and Hilmi (2018), have also underlined the importance of this matter in their research and particularly focused on global food systems, building a healthy society and economy, and so on. Generally speaking, agriculture provides the population with food, cellulose, fuel and other products. In addition, it has a major impact on the ecosystem such as water and carbon. Furthermore, agriculture is quite big sector to contribute the solution of employment and livelihoods to some extent. Due to unbalanced and unstable development of regional economies, not only agrarian regions face more serious financial difficulties, but also farmers suffer from lack of various investments and credit constraints. However, the rural economy is the main functional unit of the national economy. From this point of view, financial provision for agriculture must be at the required level in order to achieve reliable development in agriculture. Thus, there are many factors that encourage or limit investment, financing, and lending to farms, especially small farmers. Agriculture finance plays a key role in agricultural development, and financial institutions are the one that are capable of solving financing problems (Khan, 2018).

The provision and use of financial services have always been an important catalyst for the sustainable development of agriculture (Paulo & Meyer, 1977). Claessens et al. (2006) found that the development of the financial sector significantly reduces the scale of starvation. They reaffirmed the existence of specific development channels for the financial sector, including expanding access to equipment, fertilizers and tractors that lead to increase productivity and crop yields, relevant incomes and overall quantitative and price effects. From this perspective, Azerbaijan takes serious steps to finance and give credits to agriculture. Financing agriculture, investing in agrarian sector, financial sustainability of farmers are the indicators of the importance of researches. In general, the main thing in social life or in economics is the requirement for agrarian products. To explain this further, the demand of some products and services decreased during COVID 19 period. Therefore, agriculture needs state support all the time because it meets the requirement of people for daily products.

Financial support of the state (through subsidies, grants etc), microfinance, lending, etc. plays a major role in the development of agriculture. Financial services are not only provided by individual states, but also by the International Monetary Fund (IMF), the World Bank(WB), United Nations (UN) and others international organizations (Besley, 1994; IFAD, 2003; Steel & Andah, 2003; Basu et al., 2004; Čihák & Podpiera, 2005; Sacerdoti, 2005; The World Bank, 2006; The World Bank, 2007); IFC, 2007; Christiaensen & Demery, 2007; Beck & Demirguc-Kunt, 2008; Beck et al., 2009; Goldberg & Palladini, 2010; Mhlanga, 2010; Fletschner & Kenney, 2011; Tubiello, 2011).

Researchers Malik & Nazli (1999), Yadav & Sharma (2015) have concluded that farmers in rural areas of developing countries still have hardships to access financial resources, investment and credits to increase production. Guirkinger & Boucher (2008), Godfray et al. (2010) found that difficulties in attracting financing to agriculture in rural areas leads to reduce production which, in turn, affectsGross domestic product(GDP) and national food security. Economists such as Lowder et al. (2014) and Kulyk & Grzelak (2018) have identified the need of increasing the share of public and foreign investment in agriculture. In addition, in the last century, Hayami & Ruttan (1971), Bencivenga & Smith (1991), Munnell (1992), Barro & Sala-i-Martin (1992), Garcia-Mila et al. (1996), Darrat (1999) and many other economists have analyzed the positive role of agricultural loans, and budget expenditures, as well as fiscal instruments of government and inferred that agriculture finance is important in the developing countries (Fan et al., 2008). The result of the analysis of agricultural expenditures in 30 sub-Saharan African countries revealed the importance of allocations on agriculture because financial resources have a direct and indirect impact on agricultural expenditures.

Nowadays, agriculture finance has emerged the main concern in question. Jayne & Boughton (2018) supported that agriculture investment should be raised in order to ensure sustainable rural development. In addition, they specifically noted the need for appropriate measures to stimulate private capital inflows to rural areas with a view to improve financial services. Simultaneously, the role of microfinance is growing in order to increase the financial capacity of the agricultural sector. Thus, Khandker (2005), Imai et al. (2010), Hassan & Choudhury (2014), Muhammad et al. (2015), Lacalle-Calderon et al. (2018) concluded that microfinance has become an effective tool for poverty reduction and socio-economic development. They argued that microfinance could have a significant positive impact on poverty reduction by increasing farmers' incomes. Their studies suggested that microfinance contributes to increase farmers' access to credit and business efficiency. The microfinance system offers financial services worldwide, especially in emerging markets, to a population with limited access to the conventional financial markets (Garcia – Pérez et al., 2020). Microfinance is the provision of financial services to low – income people, including farmers (Philip, 2016). As a result, they will be able to finance their business activities, generate income, increase their assets, and use available funds to manage consumption and risks. Financial services include credit products (microcredit), as well as savings, money transfers and insurance. Thus, the access of farms to credit markets is an important factor in economic development.

Financing, subsidizing, lending, investment in the agricultural sector, including public investment, insurance, risk managementare subject to be addressed in the least developed and developing countries (Adams, 1971; Lele, 1974; Howse, 1974; Ijere, 1975; Shepherd, 1981; Blackman, 2001; Crooks, 2009; Meyer, 2011; Anyir & Oriaku, 2011; Salami & Arawomo, 2013; Weber & Musshoff, 2013; Ayalew et al., 2014; Verter, 2017; Feizabadi & Akbarian, 2018; Ojo & Olayinka, 2019; Kofarmata & Danlami, 2019; Buele et al., 2020).

There are many other researches on agriculture finance and credits in the developed countries of Europe and the United States (Eswaran & Kotwal, 1989; Allen et al., 1994; Barnett, 2000; Benjamin & Phimister, 2002; Katchova, 2005; Ahrendsen, et al., 2005; Pederson et al., 2012; Li, 2015; Kandilov & Kandilov, 2018).

Many economists conducted investigations on agriculture finance, rural financing and lending, investment obstacles and problems in Poland, Slovenia, Croatia, Czech Republic, Bulgaria, Kosovo, Hungary, Ukraine and Azerbaijan (Swinnen & Gow, 1999; Dries & Swinnen, 2004; Martin, 2004; Latruffe, 2005; Idzik, 2006; Spicka & Krause, 2013; Bojnec et al., 2014; Crncan et al., 2014; Humbatova & Hajiyev, 2016; Katan et al., 2018.; Shkodra & Shkodra, 2018; Borisov et al., 2019; Ortyński, 2019).

This research emphasizes the importance of a comprehensive approach to the methods of agriculture financing in Azerbaijan. Actually, it raises a disscussion on improving state financial support, the activities of financial institutions and investment in agriculture.

Financing in the field of Agriculture in Azerbaijan

One of the priorities in the development of Azerbaijan's non-oil sector is the growth of agriculture. As agriculture is one of the main sectors of the economy, it plays an important role in the life of society. The development of most sectors of the economy depends, to some extent, on the level of agricultural development. Therefore, as in any other sectors of the economy, the realization of existing opportunities and the achievement of the goals have to be solved mainly through the financing and lending of agricultural entities. From this point of view, it is very important to apply and continuously improve the advanced methods of financing and lending in the agricultural sector. The selection and application of advanced methods in agriculture finance requires to take the specifics of each country and region into account.

Since most of the entities in other sectors are directly related to agriculture, it is necessary to support financial mechanism of agricultural development. In other words, the improvement of agriculture finance, and the formation of a favorable environment for the application of advanced methods in this area is quite important for the development of competitiveness.

Conversely, along with the achievements in agriculture in recent years, the main challenge in a globalized economy is to ensure the efficient use of existing financial resources for the development of the agricultural sector and the discovery of new sources of funding. In this regard, scientific research is inevitable in order to explore the financial support and employement for agriculture. Therefore, the priority should be oriented to increase the effective use of existing financing in agriculture and to improve the level of provision of the population with environmentally-friendly and quality agricultural products. This is a fact that the stability of socio-economic development in agriculture as a whole ın Azerbaıjan regions, depends on financial security.

Agriculture finance has recently become more relevant and sharply different from other areas. The main reasons are the low income margins and weak cash flow and high risk in agricultural sector. However, what distinguishes this sector from other areas is the risk factor, profit margin and cash flow. The agricultural sector requires lower interest rates, different approaches, higher incentives, preferential schedulesin repayment of the loan. As this is a broad topic, we will have to assess the impact of investments, used fixed assets and loans in the development of the agricultural sector.

Due to the above mentioned factors, agriculture finance in developed and developing countries is mostly carried out by the support of the state. Funding serves mainly in 3 directions: the first direction, state-based funds which provide preferential loans to agriculture through financial institutions. Azerbaijan has both a National Fund for Entrepreneurship Support and a credit fund under the State Agency for Agricultural Credits under the Ministry of Agriculture of the Republic of Azerbaijan.The second direction is financing by individual banks and credit institutions, which accounts for about 20 –30% of total agriculture lending which is mainly focused on the processing and production of agricultural products.The third direction is the establishment of a bank specializing in agriculture in the country, where the main shareholding belongs to the state. Both finance officers and bankers, as well as spcialists in agriculture work here in order to mitigate credit risks, provide more efficient lending and strict control. The main sources of funding are concessional funds allocated by the state.

Methodology

One of the main macroeconomic indicator of agriculture is the gross domestic product of agriculture. The impact of investments and loans for fixed assets on agriculture, during the year, was analyzed. However, the role of these factors in the gross agricultural output was also studied. In this regard, equations reflecting the interrelationships between the given variables (Table 1) have been constructed to identify and evaluate these effects. It was used as statistical information in the Internet data provided by the State Statistics Committee of Azerbaijan reflecting the last 23 years (1995 –2018).

To test the reliability of our results, and as an additional sensitivity test, we will first perform a distributed lag auto–regression (ARDL) analysis proposed by Pesaran & Shin (1999) for each variable. The ARDL method has several

Table 1.Equations reflecting the interrelationships between the variables, describing agriculture development in Azerbaijan (data and internet resource)

Variable and units	Acronym	Source of the data
Agricultural gross domestic product, million manat	*AGDP*	*www.stat.gov.az*
Agricultural investment million manat	*AI*	*www.stat.gov.az*
Basic agricultural funds mil manat	*BAF*	*www.stat.gov.az*
General product of Agriculture, million manat	*GPAT*	*www.stat.gov.az*
General product of agriculture (Crop production) million manat	*GPAG*	*www.stat.gov.az*
General product of Agriculture (Livestock Products) million manat	*GPAL*	*www.stat.gov.az*
Agricultural Loans mil manat	AL	www.stat.gov.az

All exponents have been converted to logarithm (log)

$$\Delta LAGDP_t = a_0 + \sum_{i=1}^{p} a_i\,\Delta LAGDP_{t-i} + \sum_{j=1}^{q} a_j\,\Delta LAI_{t-1} + \sum_{r=1}^{k} a_r\,\Delta LBAF_{t-1} + \sum_{v=1}^{l} a_v\,\Delta LAC_{t-1} + \theta_0 LAGDP_{t-1} + \theta_1 LAI_{t-1} + \theta_2 LBAF_{t-1} + \theta_3 LAC_{t-1} + \varepsilon_t \quad (1)$$

$$LGPAT_t = a_0 + \sum_{i=1}^{p} a_i\,\Delta LGPAT_{t-i} + \sum_{j=1}^{q} a_j\,\Delta LAI_{t-1} + \sum_{r=1}^{k} a_r\,\Delta LBAF_{t-1} + \sum_{v=1}^{l} a_v\,\Delta LAC_{t-1} + \theta_0 LGPAT_{t-1} + \theta_1 LAI_{t-1} + \theta_2 LBAF_{t-1} + \theta_3 LAC_{t-1} + \varepsilon_t \quad (2)$$

$$LGPAG_t = a_0 + \sum_{i=1}^{p} a_i\,\Delta LAGDP_{t-i} + \sum_{j=1}^{q} a_j\,\Delta LAI_{t-1} + \sum_{r=1}^{k} a_r\,\Delta LBAF_{t-1} + \sum_{v=1}^{l} a_v\,\Delta LAC_{t-1} + \theta_0 LGPAG_{t-1} + \theta_1 LAI_{t-1} + \theta_2 LBAF_{t-} + \theta_3 LAC_{t-1} + \varepsilon_t \quad (3)$$

$$LGPAL_t = a_0 + \sum_{i=1}^{p} a_i\,\Delta LAGDP_{t-i} + \sum_{j=1}^{q} a_j\,\Delta LAI_{t-1} + \sum_{r=1}^{k} a_r\,\Delta LBAF_{t-1} + \sum_{v=1}^{l} a_v\,\Delta LAC_{t-1} + \theta_0 LGPAL_{t-1} + \theta_1 LAI_{t-1} + \theta_2 LBAF_{t-1} + \theta_3 LAC_{t-1} + \varepsilon_t \quad (4)$$

$$\Delta LAGDP_t = a_0 + \sum_{i=1}^{p} a_i\,\Delta LAGDP_{t-i} + \sum_{j=1}^{q} a_j\,\Delta LAI_{t-1} + \sum_{r=1}^{k} a_r\,\Delta LBAF_{t-1} + \sum_{v=1}^{l} a_v\,\Delta LAC_{t-1} + \pi \mathrm{ECT}_{t-1} + \varepsilon_t \quad (5)$$

$$LGPAT_t = a_0 + \sum_{i=1}^{p} a_i\,\Delta LGPAT_{t-i} + \sum_{j=1}^{q} a_j\,\Delta LAI_{t-1} + \sum_{r=1}^{k} a_r\,\Delta LBAF_{t-1} + \sum_{v=1}^{l} a_v\,\Delta LAC_{t-1} + \pi \mathrm{ECT}_{t-1} + \varepsilon_t \quad (6)$$

$$LGPAG_t = a_0 + \sum_{i=1}^{p} a_i\,\Delta LAGDP_{t-i} + \sum_{j=1}^{q} a_j\,\Delta LAI_{t-1} + \sum_{r=1}^{k} a_r\,\Delta LBAF_{t-1} + \sum_{v=1}^{l} a_v\,\Delta LAC_{t-1} + \pi \mathrm{ECT}_{t-1} + \varepsilon_t \quad (7)$$

$$LGPAL_t = a_0 + \sum_{i=1}^{p} a_i\,\Delta LAGDP_{t-i} + \sum_{j=1}^{q} a_j\,\Delta LAI_{t-1} + \sum_{r=1}^{k} a_r\,\Delta LBAF_{t-1} + \sum_{v=1}^{l} a_v\,\Delta LAC_{t-1} + \pi \mathrm{ECT}_{t-1} + \varepsilon_t \quad (8)$$

Note: Δ – differential operator, L – logarihm (log), a_0 – constant term, a_i, a_j, a_r and a_v – short-run coefficients, θ_0, θ_1, θ_2 and θ_3 – long-term coefficients, *t* – time. *p*, *q*, *k* and *l* – optimal delay size (lag order) *i*, *j*, *r* and *v* –, π – Error Correction Term coefficients, ε_t – is the error term that must be a white noise or it represents the residual term which is supposed to be well behaved important advantages. Dependent and independent variables can possess different lag lengths. Probably the biggest advantage of the ARDL approach is that it can be used for both "I(0)"variables and "I(1)" variables. Traditional cointegration processes require both variables to be "I(1)", and most standard regression processes require stationary. If any variable is defined as "I(2)" or higher, the ARDL method cannot be used ("I(0)", "I(1)" and "I(2)"—order of integration). The existence of a unit root was suggested by Dickey & Fuller (1979), Phillips–Perron (1988) and Kvyatkovsky et al. (1992). In statistics, a unit root test tests whether a time series variable is non-stationary and possesses a unit root. The null hypothesis is generally defined as the presence of a unit root and the alternative hypothesis is either stationary, trend stationary or explosive root depending on the test used.These tests allow us to determine if we can use ARDL analysis for all models.

The methodology used in this study is based on the ARDL–bounds testing approach — the unrestricted error correction model (UECM) (Pesaran et al., 2001). This approach consists of two stages: in the first stage, the ARDL model is evaluated by the Ordinary Least Squares(OLM). In this case, it is necessary to determine the existence of a long–term relationship between the relevant variables. The models test the null hypothesis that there is no long–term relationship between the variables. To do this, Wald F –test is performed. When the F –statistic is higher than the upper critical value, a null hypothesis about the long – term relationship is accepted, regardless of the integration procedures for the series. Conversely, if the test statistics fall below a critical level, the zero hypothesis cannot be accepted. However, if the statistics is between high and low critical values, then the result is not final (Table 3). Once long–term interactions or cointegrations are identified, they move on to the second stage. In this case, long–term ratios (, , and) are estimated. The general error correction model (ECM) is then developed (formulas 5–8).

The short–term effects in the above equations are determined by the coefficients of the first differentiated variables in the UECM model. The existence of a long–term relationship does not mean that the estimated ratios are necessarily stable. For this reason, it is necessary to perform several diagnostic tests on the selected model.

The results of stationary tests conclude that the ARDL analysis can be used in full. The full results of single root tests are given in Table 2. We built models with the number of delays suggested by the Akayke criterion.

Results and Discussion

As mentioned earlier, we begin by testing the integration of different variables using Augmented Dickey–Fuller (ADF), Phillips–Perron (PP) and Kwiatkowski –Phillips – Schmidt –Shin (KPSS) tests. The results of the three single root tests are given in Table 2. Approximately all three tests provide the same results confirming the reliability of our results (all variables are integrated I(1) and I(0)). We can assume that none of the variables are integrated into the second level.

Table 2. Unit root tests (ADF, PP, KPSS) (1996−2018)

Model	Variable	ADF−Stat	Phillips–Perron−*Stat*	Kwiatkowski–Phillips–Schmidt–Shin	Stationarity	Integrir I (0,1,2)
1	2	3	4	5	6	7
	level					
With Intercept only	*LAGDP*	–0.03	–0.08	0.66**	N/S	I (1)
	LAI	–0.96	–0.90	0.66**	N/S	I (1)
	LBAF	–3.31**	–2.03	0.66**	S	I (0)
	LGPAT	–0.70	–0.70	0.70 **	N/S	I (1)
	LGPAG	–0.95	–0.95	0.69**	N/S	I (1)
	LGPAL	–0.35	–0.35	0.70**	N/S	I (1)
	LAC	–4.38***	–3.88***	0.65**	S	I (0)
With Intercept & Trend	*LAGDP*	–2.47	–1.71	0.10	N/S	I (1)
	LAI	–1.83	–1.88	0.12*	N/S	I (1)
	LBAF	–1.08	–2.99	0.21**	N/S	I (1)
	LGPAT	–1.37	–1.58	0.10	N/S	I (1)
	LGPAG	–1.50	–1.58	0.11	N/S	I (1)
	LGPAL	–3.90**	–1.52	0.09	S	
	LAC	–2.32	–1.20	0.17*	N/S	I (1)

Table 2. Continued

1	2	3	4	5	6	7
None	*LAGDP*	3.06	2.95	N/A	N/S	I (1)
	LAI	1.49	1.68	N/A	N/S	I (1)
	LBAF	1.96	1.95	N/A	N/S	I (1)
	LGPAT	5.43	5.08	N/A	N/S	I (1)
	LGPAG	3.55	3.58	N/A	N/S	I (1)
	LGPAL	3.85	7.22	N/A	N/S	I (1)
	LAC	0.43	1.24	N/A	N/S	I (1)
	1st difference					
With Intercept only	*D(LAGDP)*	–4.30***	–4.31***	0.12	S	I (0)
	D(LAI)	–5.15***	–5.19***	0.15	S	I (0)
	D(LBAF)	–5.59***	–8.77***	0.33	S	I (0)
	D(LGPAT)	–4.75***	–4.77***	0.13	S	I (0)
	D(LGPAG)	–4.80***	–4.77***	0.13	S	I (0)
	D(LGPAL)	–4.90***	–4.88***	0.13	S	I (0)
	D(LAC)	–2.12	–2.12	0.51**		I (0)
With Intercept & Trend	*D(LAGDP)*	–4.40**	–4.40**	0.09	S	I (0)
	D(LAI)	–4.39**	–5.03***	0.14*	S	I (0)
	D(LBAF)	–6.01***	–13.8***	0.25***	S	I (0)
	D(LGPAT)	–4.60***	–4.63***	0.11	S	I (0)
	D(LGPAG)	–4.67***	–4.67***	0.08	S	I (0)
	D(LGPAL)	–4.83***	–4.80***	0.13	S	I (0)
	D(LAC)	–3.10	–3.18	0.063		I (0)
None	*D(LAGDP)*	–3.52***	–3.53***	N/A	S	I (0)
	D(LAI)	–4.55***	–4.55***	N/A	S	I (0)
	D(LBAF)	–1.93*	–6.11***	N/A	S	I (0)
	D(LGPAT)	–2.77*	–2.82***	N/A	S	I (0)
	D(LGPAG)	–3.49***	–3.54***	N/A	S	I (0)
	D(LGPAL)	–0.64	–2.38**	N/A	S	I (0)
	D(LAC)	–1.79*	–1.70	N/A	S	I (0)

Note: ADF denotes the Augmented Dickey–Fuller single root system respectively. The maximum lag order is 2. The optimum lag order is selected based on the Shwarz criterion automatically. PP Phillips–Perron is single root system. The optimum lag order in PP test is selected based on the Newey–West criterion automatically. The critical values are taken from MacKinnon (1996)
KPSS denotes Kwiatkowski –Phillips –Schmidt –Shin (Kwiatkowski et al., 1992) single root system. The optimum lag order in KPSS test is selected based on the Newey –West criterion automatically
Symbols '***','** ' and '*' indicate rejection of the null hypotheses at the 1%, 5% and 10% significance levels respectively
The critical values are taken from Kwiatkowski –Phillips –Schmidt –Shin. (1991) Assessment period: 1996−2018
Legend: S –Stationarity; N/S–No Stationarity, N/A –Not Applicable
I(0) and I(1) —order of integration

The results of the ADF, PP and KPSS tests used to check the stationary time series are given in Table 2. According to the ADF test equation With Intercept only, LBAF (**) and LAC (***) are stationary (integrated I (0)), and the rest are variables (time series) non–stationary (integrated I (1)). According to the Equation With Intercept & Trend LGPAL (**) is stationary (integrated I (0)), the rest are variables (time series) non –stationary (integrated I (1)) and according to the equation No Intercept & No Trend all variables are variables (time series) non –stationary (I (1)). According to the Phillips – Perron test equation With Intercept only, only LAC (***) is stationary (integrated I (0)), and the rest are variables (time series) non –stationary (integrated I (1)). According to the With Intercept & Trend equation and the No Intercept & No Trend equation, all variables (time series) are non –stationary (integrated I (1)). According to the Kwiatkowski – Phillips – Schmidt – Shin test equation With Intercept only, all variables (time series) were stationary (integrated I (0)). The results of these tests substantiate the ARDL method to use to determine the interactions between variables.

Table 3. Results from bound tests

Significance								
DependentVariable	Functions				*F* –Test Statistics			
LAGDP	Model 1: F_{LAGDP} $(LAGDP \mid LAI, LBAF, LAC)$				3.995589*			
LGPAT	Model 2: F_{LGPAT} $(LGPAT \mid LAI, LBAF, LAC)$				1.705974			
LGPAG	Model 3: F_{LGPAG} $(LGPAG \mid LAI, LBAF, LAC)$				2.021909			
LGPAL	Model 4 : F_{LGPAL} $(LAGDP \mid LAI, LBAF, LAC)$				6.411859***			
Asymptotic CriticalValues								
	10%		5%		2.5%		1%	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
	2.72	3.77	3.23	4.35	3.69	4.89	4.29	5.61

Note: Symbols '***', '**' and '*'indicate that the F-statistic exceeds the upper bound corresponding to the 1%, 5% and 10% significance levels, respectively, as reported in Pesaran et al.(2001)

The results of the co–integration test based on the ARDL–bounds testing approach are reported in Table 3. However, the lack of cointegration the two models (model 1 (*) and model 4 (***)) rejects the null hypothesis.

Table 4 shows the models that reflect the dependence between the variables. We are interested in determining the dependence between short–term and long–term variables. Thus, in Model 1, as a result of a 1% increase in investment in the agricultural sector (LAI), the gross domestic product of the agrarian sector (LAGDP) would be 0.66%, the gross output of the agrarian sector (LGPAT) – 0.32%, the crop production in the agrarian sector (LGPAG) – 0.26%, andagricultural livestock production (LGPAL) would increase by 0.20%. However, in the two models (Model 1 (LAGDP) and Model 2 (LGPAT)), the agricultural investment (LAI) ratios are statistically significant at 0.01%. In the other two models (model 3 (LGPAG) and model 4 (LGPAL)) these ratios are statistically insignificant. As a result of 1% increase in funds used in the agricultural sector (LBAF) during the year, the gross domestic product of the agrarian sector (LAGDP) would be 0.18%, the gross output of the agrarian sector (LGPAT) – 0.18%, the crop production in the agrarian sector (LGPAG) – 0.13%, and agricultural livestock production (LGPAL) would increase by 0.27%. However, in one model (model 4 (LGPAL)), the coefficients of funds used during the year in the agricultural sector (LBAF) are statistically significant at 0.05%. In the other three models (model 1 (LAGDP), model 2 (LGPAT) and model 3 (LGPAG)), these ratios are not statistically significant.

As a result of a 1% increase in loans to the agricultural sector (LAC), the gross domestic product of the agricultural sector (LAGDP) would be 0.68%, the gross output of the agrarian sector (LGPAT) – 0.18%, the crop production in the agrarian sector (LGPAG) – 0.10%, and livestock production (LGPAL) in agriculture would decrease by 0.03%. In all models, the coefficients of loans to the agricultural sector (LAC) are not statistically significant.So the impact is not statistically significant.

The results of short–term dynamics arising from long–term relationships are also presented in the same table. In terms of the statistical significance of the coefficients, the results reflecting the short–term dynamics are close to the results of the models reflecting the long–term relationships. Thus, the coefficients of investment in the agricultural sector (DLAI) are statistically significant in model 1 (DLAGDP), model 2 (DLGPAT) and model 3 (DLGPAG) 0.001%. In Model 4 (DLGPAL), the coefficient is not statistically significant. In the agricultural sector, the coefficients of funds disbursed during the year (DLBAF) are statistically significant at 0.05% in only one model, model 1 (DLAGDP). In Model 2 (DLGPAT), Model 3 (DLGPAG) and Model 4 (DLGPAL),the relationship in these models is not statistically significant.

The coefficient of the error correction model, ECM(–1) , are statistically significant at 0.05% in only two models, model 2 (DLGPAT) and model 3 (DLGPAG) got the expected negative sign. In the other two models, the ECM (–1) ratios are not statistically significant in Model 1 (DLAGDP) and Model 4 (DLGPAL). However, it got the expected negative sign.Since the ECM coefficient must have . It measures the speed of adjustment towards long-run equilibrium.This confirms that there is a long–term relationship between the variables. This may indicate that the changesfor Model 1 (DLAGDP) would be 13% per annum, for Model 2 (DLGPAT) – 22%, for Model 3 (DLGPAG) – 42%, and for Model 4 (DLGPAL) – 18%. Thus, these are confirmed by a negative ECM (–1) coefficient, which means that any changes is cleared at 13%, 22%, 42% and 18% per annum, respectively. As with long–term regimes, the results of short–term dynamic models show that AL(Agricultural investment), BAF(Basic agricultural funds)and AC (Agri-

Table 4. Models and coefficients that reflect the dependence between the variables in agriculture development of Azerbaijan

	Least Squares				ARDL				ARDL ECM				ARDL (D)				ARDL Cointegrating And Long Run Form				ARDLLong Run				ARDL Bounds Test Least Squares			
	LAGDP	LGPAT	LGPAG	LGPAL	LAGDP	LGPAT	LGPAG	LGPAL	DLAG-DP	DLG-PAT	DLG-PAT	DLG-PAL	DLAG-DP	DLG-PAT	DLG-PAT	DLG-PAL	LAGDP	LGPAT	LGPAG	LGPAL	LAGDP	LGPAT	LGPAG	LGPAL	DLAG-DP	DLG-PAT	DLG-PAT	DLG-PAL
LAGDP													–0,05															
LGPAT														–0.05														
LGPAG															0.28													
LGPAL																–0.13												
LAI	0,36***	0.30***	0.28***	0.32***	0,20***	0.12***	0.16***	0.04					0,06	–0.03	–0.13*	0.03					0,66**	0.32**	0.26	0.20				
LBAF	–0,02	0.04	0.03	0.04	–0,01	0.03*	0.04*	0.02					0,04	0.06*	0.07*	0.04					0,18	0.18	0.13	0.27*				
LAC	–0,04	0.06	0.05	0.07	–0,10**	–0.03	–0.03	0.09					–0,09	–0.02	–0.05	0.01					–0,68	–0.18	–0.10	–0.03				
LAGDP (–1)					0,85***																				–0,13			
LGPAT (–1)						0.82																				–0.21*		
LGPAG(–1)							0.69***																				–0.46*	
LGPAL(–1)								0.51												–0.28								–0.20**
LGPAL(–2)								0.29																				
LAI(–1)					–0,09*	–0.07	–0.07																		0,08	–0.07*	0.14*	0.02
LBAF(–1)					0,03*			0.01												–0.02					0,03	0.02	0.03	0.07**
LBAF(–2)								0.02																				
DLAGDP(–1)									0,21				0,06															
DLGPAT(–1)										–0.03				–0.09														
DLGPAG(–1)											–0.02				–0,05													
DLGPAL(–1)												–0.06				–0.18												–0.37
DLAI									0,17***	0.11***	0.16***	0.07	0,15**	0.12**	0.20***	0.04	0,20***	0.12***	0.16***	0.04					0,20	0.13***		
DLBAF									–0,03*	0.01	0.01	0.00	–0,05*	–0.01	0.001	–0.01	–0,01	0.03*	0.04*	0.02					0,00			0.03
DLAC									–0,07	0.00	0.01	–0.03	0,02	0.16*	0.22 –	0.09	–0,10**	–0.03	–0.03	0.09								0.12
DLBAF(–1)																												–0.03*
LAC(–1)								–0.09																	–0,09	–0.02	–0.01	0.001
ECT(–1)									–0,13	–0.22*	–0.42*	–0.19																
C	6,18***	5.80***	5.34***	4.84***	0,96*	1.02*	1.63	0.78	0,04	0.07	0.04	0.10	0,29	0.07	–1.93	0.48					6,39***	5.83***	5.20	3.96***	0,74	1.35*	2.51*	0.75*
CointEq (–1)																	–0,15*	–0.19*	–0.31*	–0.20***								
	Cointeq = *LAGDP* – (0.66* *LAI* + 0.18* *LBAF* –0.68* *LAC* + 6.39)																											
	Cointeq = *LGPAT* – (0,32* *LAI* + 0,18* *LBAF* –0,18* *LAC* + 5,83)																											
	Cointeq = *LGPAG* – (0.26* *LAI* + 0.13* *LBAF* –0.10* *LAC* + 5.20)																											
	Cointeq = *LGPAL* – (0.20* *LAI* + 0.27* *LBAF* –0.03* *LAC* + 3.96)																											
R –sq	0,91	0.96	0.98	0.94	0,99	0.99	0.99	1.00	0,73	0.59	0.57	0.55	0,76	0.70	0.69	0.55									0,80	0.60	0.58	0.67
Adj R –sq	0,89	0.96	0.97	0.93	0,99	0.99	0.99	1.00	0,65	0.47	0.44	0.41	0,62	0.51	0.50	0.27									0,73	0.48	0.46	0.47
S.E. of regr	0,20	0.16	0.12	0.22	0,06	0.05	0.08	0.04	0,07	0.06	0.08	0.05	0,07	0.06	0.08	0.05									0,06	0.06	0.08	0.05
Sum sqresid	0,82	0.50	0.27	0.94	0,05	0.05	0.10	0.02	0,07	0.05	0.11	0.04	0,07	0.04	0.08	0.04									0,06	0.06	0.12	0.03
Log lik	6,53	12.45	19.80	4.84	37,17	37.66	29.80	43.80	31,36	34.88	26.83	38.58	32,67	38.22	30.49	38.45									35,71	35.49	27.89	42.03
F –st	65,34	172.03	269.09	107.66	405,75	788.75	329.20	890.69	8,83	4.66	4.28	3.93	5,26	3.78	3.68	1.95									10,97	5.12	4.76	3.33
Pr (F –st)	0,00	0.00	0.00	0.00	0,00	0.00	0.00	0.00	0,00	0.01	0.01	0.02	0,00	0.02	0.02	0.14									0,00	0.00	0.01	0.03
Mean dtvar	7,39	7.78	7.15	7.01	7,42	7.83	7.20	7.11	0,07	0.09	0.08	0.10	0,07	0.09	0.08	0.10									0,08	0.10	0.09	0.10
S.D. dtvar	0,62	0.76	0.70	0.84	0,61	0.73	0.67	0.79	0,12	0.08	0.11	0.06	0,12	0.08	0.11	0.06									0,12	0.08	0.11	0.06
Aic	–0,21	–0.70	–1.32	–0.07	–2,62	–2.75	–2.07	–3.16	–2,31	–2.63	–1.89	–2.96	–2,15	–2.66	–1.95	–2.68									–2,50	–2.56	–1.90	–3.00
Sc	–0,01	–0.51	–1.12	0.13	–2,28	–2.46	–1.77	–2.72	–2,01	–2.33	–1.60	–2.66	–1,71	–2.21	–1.51	–2.23									–2,15	–2.27	–1.61	–2.56
H –Qc.	–0,16	–0.65	–1.26	–0.02	–2,54	–2.68	–1.99	–3.06	–2,24	–2.56	–1.82	–2.89	–2,05	–2.55	–1.85	–2.57									–2,41	–2.49	–1.83	–2.90
D –Wst	0,40	0.61	1.01	0.50	1,85	2.26	2.09	2.23	1,79	1.84	1.95	1.61	1,90	2.87	2.41	2.35									1,82	2.31	2.19	2.27

Note: Symbols'***', '**' and '*' – 1%, 5% and 10% significance levels respectively; D – differential operator, *ECT* – long term white noise error, *CointEq* – Error Correction Term, *R – sq* – Coefficient of determination, *Adj R – sq* – Adjusted R-Squared, *S.E. of regr* – Standard Error of the Regression vs. R-squared,
Sum sq resid – Residual sum of squares (RSS), ***Loglik*** – Logarithmic likelihood function, F –st–F-statistics (also known as fixation indices), ***Pr (F –st)*** – Probability (F-statistic), ***Mean dt var*** – average of the dependent variable, *S.D.dtvar* – standard deviation of the dependent variable, *S.D.dtvar Aic* – Akaike information criterion, *Sc* – Schwartz information criterion, *H – Qc* – Hannan-Quinn information criterion, *D – Wst* —Durbin–Watson statistic

cultural Loans) do not have an unambiguous effect on agricultural development (including AGDP, GPAT, GPAG and GPAL).

The results of the diagnostic tests applied to the models are given in Table 5, Jarque − Bera Normality, Breusch − Godfrey Serial Correlation LM, Ramsey RESET test, ARCH and Breusch − Pagan − Godfrey Heteroskedasticity test results show that in the models given in equations (5) – (8) (ARDL), errors with a significance level of 5% are normally distributed, serially uncorrelated and homoscedastic. Finally, the results of the tests of the Cumulative Sum of Recursive Residuals (CUSUM) and CUSUM squares are shown, respectively stable. It is shown that the calculation line is located between the two critical boundaries at the 5% significance level in all descriptions. Therefore, the coefficients of the models are dynamically stable. Thus, we can say that our ARDL models are reliable.

Conclusion and Recommendations

The purpose of this article was to empirically study the impact of investments fixed assets and loans in the agricultural sector in Azerbaijan. For this reason, ARDL–bounds testing approach Unrestricted Error Correction model (UECM) was used. The research reveals that the increase in investment in the agricultural sector has a positive impact on the gross domestic product, the gross output, crop production, and livestock production in the agricultural sector. As a result, funds in the agricultural sector during the year also increase. However, as a result of the increase in loans to the agricultural sector, the gross domestic product, the gross output, crop production, and livestock production in the agricultural sector will unexpectedly decrease. This result contradicts our expectations. In fact, the main unexpected result of this study is the uncertain impact of lending on economic growth in the agricultural sector in Azerbaijan.

Table 5. Diagnostic test results

		F –statistic	Chi –Square (χ2)
Breusch – Godfrey Serial Correlation LM Test	*LAGDP*	0.041308 (0.9596)	0.134931 (0.9348)
	LGPAT	0.285612 (0.7556)	0.843747 (0.6558)
	LGPAG	0.087110 (0.9170)	0.264069 (0.8763)
	LGPAL	0.538403 (0.5983)	1.961590 (0.3750)
Heteroskedasticity Test: Breusch – Pagan –Godfrey	*LAGDP*	1.462130 (0.2528)	8.144984 (0.2277)
	LGPAT	0.416124 (0.8310)	2.508002 (0.7753)
	LGPAG	1.242872 (0.3327)	6.156978 (0.2912)
	LGPAL	1.697988 (0.1903)	11.24161 (0.1884)
Heteroskedasticity Test: ARCH	*LAGDP*	0.089358 (0.7681)	0.097856 (0.7544)
	LGPAT	1.712911 (0.2054)	1.735560 (0.1877)
	LGPAG	0.001542 (0.9691)	0.001696 (0.9672)
	LGPAL	2.047480 (0.1687)	2.042861 (0.1529)
Ramsey RESET Test	*LAGDP*	1.648598 (0.2186)	1.283977 (0.2186)
	LGPAT	0.356883 (0.5586)	0.597397 (0.5586)
	LGPAG	1.452209 (0.2457)	1.205076 (0.2457)
	LGPAL	3.394463 (0.0902)	1.842407 (0.0902)
Jarque − Bera Normality:	*LAGDP*	N/A	1.328327 (0.5147)
	LGPAT	N/A	0.902595 (0.6368)
	LGPAG	N/A	0.452818 (0.7973)
	LGPAL	N/A	1.176947 (0.5551)
CUSUM (Cumulative Sum of Recursive Residuals) 5% significance	*LAGDP*	Stability	
	LGPAT	Stability	
	LGPAG	Stability	
	LGPAL	No stability	
CUSUMSQ (Cumulative Sum of Squares of Recursive Residuals) 5% significance	*LAGDP*	Stability	
	LGPAT	Stability	
	LGPAG	Stability	
	LGPAL	Stability	

Note: N/A –No Applicable; χ2– Chi-Square (χ2) Statistic Definition, ( ) –Probability

The political consequences of the empirical results are related to the favourable development of the agricultural sector. However, much remains to be done to ensure that financing and lending have the full potential of economic growth in Azerbaijan. These include improving financing mechanisms for agriculture, developing mechanisms for the introduction of innovative and unsecured loans to the sector, risk management affecting the agricultural sector, development of agricultural insurance, promotion of investment in agriculture, increasing financial literacy of agricultural producers.The results of established models reveal that the increase of agriculture credits by state had a not good impact on plant-growing and hunbandry because of the small amount of credits. That shows the unimporatance and tiny amount of credits. It is recommended to increase the volume of credits in order to expect positive results.

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