Agro Bali : Agricultural Journal
Vol. 7 No. 3: 739-751, November 2024
e-ISSN 2655-853X
https://doi.org/10.37637/ab.v7i3.1773

Agricultural Credit Supply in Developing Eight Organization's Member Countries: The Behavior Towards Agricultural Risk

Ries Wulandari[1♥], Hermanto Siregar[2], Muhammad Firdaus[2], Irfan Syauqi Beik[3]

[1]Department of Islamic Economics, Faculty of Islamic Economics and Business, IAI TAZKIA, Bogor, Indonesia
[2]Department of Economics, Faculty of Economics and Management, IPB University, Bogor, Indonesia
[3]Department of Islamic Economics, Faculty of Economics and Management, IPB University, Bogor, Indonesia
♥Corresponding author email: rieswulandari@tazkia.ac.id

Article history: submitted: March 25, 2024; accepted: November 18, 2024; available online: November 25, 2024

Abstract. The 11th Global Food Security Index (2022) shows an increase in agriculture risk and a decline in the food environment for the third year which is feared to threaten global food security. It is urgent to have more concern for food security in advanced and emerging economies, such as Developing Eight (D-8) economies. This paper analyzes the determinants of agriculture credit supply in D-8's banking and how they affect agriculture risk. The study uses panel quarterly time series data from 2013Q01-2022Q04 and cross-section data from 7 countries as members of the Developing Eight (D8) Organization. This study employs the dynamic panel analysis, Panel Autoregressive Distributed Lag (PARDL) - Pooled Mean Group (PMG) approach. The result shows that agriculture credit supply and its explanatory variables have a significant relationship in the long run. Unfortunately, only previous credit supply and agriculture risk contribute to the agriculture credit supply in the short run. The result varies across countries in the short run. Banking in Indonesia considers agricultural risk by decreasing the agricultural credit supply while banking in Malaysia and Turkey maintains a positive agricultural credit supply despite the increase in agricultural risk.

Keywords: agriculture credit supply; agriculture risk; Developing Eight Organization

INTRODUCTION

Agricultural and agri-food systems around the world have experienced unprecedented impacts of disasters causing significant damage and loss (FAO, 2023). The disasters show increasing frequency from 100 in the 1970s to 400 disasters per year in the 2000s. These threats including extreme weather conditions such as floods and wildfires, pest outbreaks, and armed conflicts contributed to food security and sustainability of the agricultural sector globally (FAO 2023). Further, FAO highlights the staggering economic toll of disasters on agricultural and agri-food systems, estimating a total loss of approximately $3.8 trillion in agricultural production over the last 30 years. This equates to an average annual loss of $123 billion, equivalent to 5% of global agricultural GDP. The low and lower-middle-income countries have been impacted the most severely, with disasters inflicting losses ranging between 10-15% to their agricultural GDP.

Food security guarantees affordability, availability, quality, and safety, as well as sustainability and adaptation of food in a country and globally. The 11th Global Food Security Index (2022) shows a decline in the food environment for the third year which is feared to threaten global food security. It is urgent to have more concern for food security not only in advanced economies but also in emerging economies, such as Developing Eight (D-8) economies. The D-8 member countries are Iran, Indonesia, Bangladesh, Egypt, Malaysia, Nigeria, Pakistan, and Turkey. This organization was founded in the Declaration of the Summit of Heads of State in 1997 in Istanbul, Turkey (D-8 2022). With a combined Gross Domestic Product (GDP) of around USD 4.8 trillion and a population of around 1.15 billion in 2020, D-8 is one of the economic groupings of potential developing countries. Based on Price Waterhouse Coopers predictions, all D-8 member countries will be in 25 countries with the largest economies in 2050 (Indonesian Ministry of Foreign Affairs 2022).

Table 1 shows that the average availability score and sustainability score are lower compared to affordability and quality. Even though Indonesia and Malaysia show the highest score of affordability; also Turkey and Bangladesh show a higher score of availability, the availability and sustainability of food among the seven member countries of Developing Eight need to be highlighted. Another report from SGIE 2022 issued by

e-ISSN 2655-853X
https://doi.org/10.37637/ab.v7i3.1773

Dinar Standard (2022) supports this data. The five largest importing countries for food, specifically for halal food, are members of D-8: Indonesia, Bangladesh, Egypt, Pakistan, and Nigeria. Unfortunately, the demand for this product is supplied by non-member countries of D-8, namely Brazil, Russia, India, China, and the United States.

Table 1. Per capita food supply variability and global food security index in D-8

Country	Per capita food supply variability (kcal/cap/day) [a]	Global Food Security Index [b]				
		Overall score/ rank (113 countries)	Afford ability	Availability	Quality and Safety	Sustainability and Adaptation
Bangladesh	34	54/80th	52.1	61.5	58.4	43.9
Egypt	32	56/77th	65.2	54.2	45.9	55.8
Indonesia	39	60.2/63rd	81.4	50.9	56.2	46.3
Malaysia	35	69.9/41st	87.0	59.5	74.7	53.7
Nigeria	12	42.0/107th	25.0	39.5	55.6	53.7
Pakistan	22	52.2/84th	59.9	58.3	49.4	37.7
Turkey	34	65.3/49th	58.4	65.3	78.5	61.2
Iran	37	Not available				
Average	30.63	57.09	61.29	55.6	59.82	50.33

Source: a) Estimated Value of FAO 2022, b) Impact Economist Corteva Agriscience 2022

The last report from the Food Security Update (World Bank, 2024) states that some countries have announced trade policies, including Russia, China, and India. As of February 26, 2024, 16 countries had implemented 23 food export bans, and 8 had implemented 15 export-limiting measures. China bans exporting corn starch; India bans exporting broken rice, wheat, sugar, non-basmati rice, wheat flour, semolina, onions, and carrots; Russia bans exporting rice and rice groats, while Bangladesh as a member of D-8 also bans exporting rice (World Bank, 2024). The policy actions on food have surged since the beginning of the war in Ukraine and the pandemic Covid-19. The countries actively used trade policy to respond to domestic needs when faced with potential food shortages (World Bank, 2024).

As importer countries, the members of the Developing Eight member countries probably will face challenges and problems in the future, when China, India, and Russia continually implement the export bans trade policy. The food security is no longer a light issue but a red lamp condition. On the other hand, this is a huge opportunity for D-8 countries to increase food availability by increasing the agriculture sector's productivity within members (D-8, 2022). To take this opportunity, the agricultural sector needs support from the financial sector.

Some previous research supports the important role of the financial sector in economic growth, including agriculture sector growth. The growth in the financial sector will encourage economic growth (e.g., Beck, Levine, and Loazya 2000 and Levine 2021). According to the endogenous growth literature, financial deepening leads to a more efficient allocation of savings to productive investment projects (Benciviega and Smith, 1991), and credit is positively and strongly associated with Total Factor Productivity in Bulgaria (Gatti and Love, 2008).

The role of credit in the agriculture sector showed different results. Institutional variables are undermining financial development, has a positive impact on agricultural performance in Nigeria (Raifu and Alarudee, 2020), financial development has a positive effect on agricultural growth in Pakistan (Shahbaz, 2013), the ARDL estimation results reveal that financial development has a significantly positive impact on agricultural production in both long-run and short-run in China (Chandio, et al 2020). The domestic credit, land, and physical capital impact positively the

e-ISSN 2655-853X
https://doi.org/10.37637/ab.v7i3.1773

agriculture value added in the Central African Economic and Monetary Community, CEMAC (Ngong, C.A. et al, 2023), agricultural credit has a positive and highly significant effect on wheat productivity, while the short-term loan has a stronger effect on wheat productivity than the long-term loan in Pakistan (Chandio et al, 2018), and credit stimulates agricultural value added only in the medium and long term in West African Economic and Monetary Union, WAEMU (Oloukoi, L 2022). On the other hand, previous research in China found that economic activity granger the financial sector, showing that at that time China's rural formal finance was still at status complying with the demand (Luo and Gao, 2012), changes in the volume of non-real-estate agricultural farm loans at commercial banks are principally driven by changes in excess demand for loans in 12 states in the US (Scott, et al 2022). Credit plays an important role in the agricultural sector. Farmers apply for credit beyond their assets to purchase production inputs, capital investments, and sources of short-term liquidity. However, farmers often cannot borrow as much as they need (Scott et al, 2022). Credit rationing limits a farmer's ability to accumulate capital and suppresses aggregate agricultural output (Barry et al, 2000; Briggeman et al, 2009).

Despite the various inconclusive results, credit's role from banking to the agriculture sector is still important for developing countries. This is because access to financing for agricultural activities appears to be very low compared to developed economies (Murungi, 2022). Following this, governments in several countries have sought to introduce banking sector regulations to facilitate increased funding to the agricultural sector (Murungi, 2022).

Various factors determine the credit supply from conventional banking. Oloukoi (2022) suggested it is imperative to implement a policy of lowering real short-term interest rates to support credit supply. Lowering the real interest rate, by lowering the cost of credit, contributes to lowering production costs. In addition, agricultural risk should be considered. The Central Bank of Kenya (CBK) had the motivation for the interest rate capping regulations in 2016 (Murungi, 2022), the results show that the introduction of the interest cap resulted in increases in the proportion and growth in agri-lending compared with the pre-interest cap period. Climate change also contributes to the production risk in agriculture. Relative to the baseline, agricultural output will decline by a range of 3.1% to 3.6% under the high climate scenario (higher temperatures and lower yields) in Bangladesh. In addition, a decrease in agricultural output results in declines in agricultural labor and household income (Hossain et al 2023).

Kim and Katchova (2019) used four groups of variables to determine agricultural lending supply in the United States: regulation using Basel III, farm variables, macroeconomic variables, and bank characteristics, and found that all variables have statistically significant effects. In China (Yin and Sha 2020) found several factors that are taken into consideration in providing credit are (i) the general characteristics of the agricultural sector, especially if the sector is in an underdeveloped area (ii) a longer repayment period, and (iii) a comparison of risks with providing credit in other sectors.

Our paper analyzes the determinant of supply of agricultural credit in Developing Eight Organization and for each member in Developing Eight Organization. We focus on D-8 countries because this group of economies most likely show similar behavior. All of them grouped as emerging economies would make it possible to cover a similar degree of financial development, the importance of the agriculture sector for their economy, and the role of banking credit from conventional banking in the agriculture sector. This research tests the role of agricultural risk as the variability of production, as a novelty to this research compared to the previous research in supply on agricultural credit from conventional banking.

Following this introductory section, the rest of the study is structured as follows.

e-ISSN 2655-853X
https://doi.org/10.37637/ab.v7i3.1773

Section 2 focuses on the methodological approach, model specification as well as data sources and description. Section 3 presents the findings while Section 4 concludes with policy recommendations.

METHODS

Methodological approach

The research will analyze factors that determine the supply of agricultural credit in the Developing Eight's member countries, by considering the theory of monetary transmission mechanism using bank lending channel (Baoko, *et al*., 2017), the intermediary approach of banking (Yin dan Sha, 2020), and the consideration of agricultural risk as a novelty. The supply of agricultural credit presented on **Equation 1**.

$$ln\ Lsagri_{it} = \theta_0 + \theta_1 policyrate_{it} + \theta_2\ loanrate_{it} + \theta_3\ lnthirdpartyfund_{it} + \theta_4\ Risk_{it} + \varepsilon_{it} \ldots. (1)$$

We provide novelty ideas such as the effect of risk on agricultural credit is examined by agricultural risk. Agricultural risk calculated in this research is based on farm and handling activities. The variance of productivity calculates the risk during the research period. This research uses Panel Auto Regressive Distributed Lag (Panel-ARDL) to compute the dynamic of the factors among the panel.

Main model specification

The dynamic models that are considered for the 7 Developing Eight's member countries from the fourth quarter 2013 - the fourth quarter 2022. The study uses a dynamic panel (Pesaran, Shin, and Smith 1999) and Auto Regressive Distributed Lag method by Pesaran *et l*. (2001). The model is Panel-Autoregressive Distributed Lag (Panel-ARDL) following Pesaran, Shin, and Smith (1999) extended by Raifu and Alarudee (2020). The final model determinants of the credit supply for the agricultural sector presented inn **Equation 2**.

$$\Delta Lsagri_{it} = \mu_{it} + \left(\alpha_i lsagri_{i,t-1} + \beta'_{1i} policyrate_{it} + \beta'_{2i} loanrate_{it} + \beta'_{3i} lnthirdparty_{it} + \beta'_{4i} Risk_{it}\right) + \sum_{j=1}^{p-1} \lambda^*_{ij}\ \Delta Lsagri_{i,t-j} + \sum_{j=0}^{q-1} \gamma^{*'}_{1ij}\ \Delta policyrate_{i,t-j} + \sum_{j=0}^{q-1} \gamma^{*'}_{2ij}\ \Delta loanrate_{i,t-j} + \sum_{j=0}^{q-1} \gamma^{*'}_{3ij}\ \Delta lnthirdparty_{i,t-j} + \sum_{j=0}^{q-1} \gamma^{*'}_{4ij}\ \Delta Risk_{i,t-j} + \varepsilon_{it} \ldots (2)$$

where Δ is the first difference operator, μ_i symbolizes the drift component of the model, ε_{it} denotes the error term, α_i, $\beta'_{1i}\ to\ \beta'_{4i}$ are the long run multiplier for each the variable and the short run dynamic parameter include $\lambda^*_{ij}, \gamma^{*'}_{1ij}\ to\ \gamma^{*'}_{4ij}$. The null hypothesis of PMG-ARDL cointegration to be tested states there is no long-run relationship between variables.

Null hypothesis (H_0):

$$\alpha_i = \beta'_{1i} = \beta'_{2i} = \beta'_{3i} = \beta'_{4i} = 0$$

Alternative hypothesis (H_1):

$$\alpha_i \neq \beta'_{1i} \neq \beta'_{2i} \neq \beta'_{3i} \neq \beta'_{4i} \neq 0$$

If the model above is cointegrated, the error correction models (ECMs) that show the adjustment speed from the short run to the long run equilibrium in the economy are specified in **Equation 3**.

$$\Delta Lsagri_{it} = \mu_{it} + \sum_{j=1}^{p-1} \lambda^*_{ij}\ \Delta Lsagri_{i,t-j} + \sum_{j=0}^{q-1} \gamma^{*'}_{1ij}\ \Delta policyrate_{i,t-j} + \sum_{j=0}^{q-1} \gamma^{*'}_{2ij}\ \Delta loanrate_{i,t-j} + \sum_{j=0}^{q-1} \gamma^{*'}_{3ij}\ \Delta lnthirdparty_{i,t-j} + \sum_{j=0}^{q-1} \gamma^{*'}_{4ij}\ \Delta Risk_{i,t-j} + \omega\ \mathrm{ECM}_{i,t-j} + \varepsilon_{it} \ldots (3)$$

Where ECM stands for error correction term.

Data Sources and Description

The study uses quarterly data from 2013Q4 – 2022Q4 and seven countries as members of Developing Eight (D8) practicing dual banking systems so they have both conventional banking and sharia banking, namely Bangladesh, Egypt, Indonesia, Malaysia, Nigeria, Pakistan, and Turkey. Iran,

e-ISSN 2655-853X
https://doi.org/10.37637/ab.v7i3.1773

as a member of D8, practicing a full-fledged Islamic banking system, is not part of this study.

The data were sourced from the Central Bank for each country and the Food Agriculture Organization (FAO). The variables used include credit supply for the agricultural sector, bank lending channel, and intermediary theory proxies by policy rate, credit rate, and third-party funds; while the agriculture sector proxies by agricultural risk (**Table 2**). The variables are in natural logarithm and percent.

Table 2. The meaning of the abbreviated variables

Abbreviation	Full meaning	Unit
lsagri	Supply of agricultural credit from banking	USD base year 2015
policy rate	Central Bank policy rate	percentage
loan rate	The interest rate for credit	percentage
third party	Third-Party Fund	USD base year 2015
risk	Production risk in the agriculture sector	ratio

Source: Food Agriculture Organization and Central Bank

RESULTS AND DISCUSSIONS

Descriptive Statistics

From **Table 3**, it is found that, on average, the supply of agricultural credit (in natural logarithm) is 21,793, with a maximum supply of 24,075 and a minimum of 18,462. While the average of agricultural risk from variability of production is 0,009.

Unit Root Test Results

The results of unit root tests are presented using Breitung and Harris-Tzavalis (HT) test techniques. All the variables contain unit roots in the level I(0). The variables can only be made
stationary by first differencing them. All other variables are integrated in an order of 1 (stationary after the first difference).

Cointegration Testing

The cointegration testing is to examine whether there exists a long run relationship among the variables by employing the cointegration estimation method developed by Pedroni (1999 and 2001). This procedure covers three tests namely Modified Phillips-Perron, Phillips-Perron, and Augmented Dicky-Fuller. To determine the existence of cointegration among the variables, the p-value of three tests must be less than 0.05 to have all panels cointegrated.

The result shows that the supply of agricultural credit and other explanatory variables are cointegrated at 5 percent level of significance, thus we can conclude that cointegration exists in the model considered.

Table 3. The pooling results of the basic statistics variables

statistics	lsagri	policy rate	loan rate	third party	risk
mean	21,793	8,932	11,898	26,043	0,009
std. dev	1,433	5,062	5,333	0,7153	0,005
min	18,462	1,750	3,440	24,793	0,0003
max	24,075	24,000	29,740	27,014	0,0291

Note: lsagri, third party in natural logarithm (ln), policy rate, loan rate in percentage, risk in ratio

Estimation Results of the Dynamic Panel Model

To clarify whether the relationship between the supply of agricultural credit and the behavior of policy rate, loan rate, third party fund, and agriculture risk varies both in the long run and short run, following the empirical procedure of Pesaran et al(1999), this research uses Equation 5 as the empirical model to obtain three estimates using Pool

e-ISSN 2655-853X
https://doi.org/10.37637/ab.v7i3.1773

Mean Group (PMG), Mean Group (MG), and Dynamic Fixed Effect (DFE) estimation methods.

The result is shown in **Table 4**. The PMG estimation method suggests that the error correction coefficient $\omega_{i,t-j}$ is significantly negative, indicating a stable and converging long-run relationship between agricultural credit and explanatory variables. The long-run coefficient from all explanatory sector variables, policy rate, third-party fund, and agricultural risk is significantly positive. On the other hand, the loan rate is significantly negative.

The increasing policy rate announced by the Central Bank will increase the supply of agricultural credit as the incentive for delivering agriculture credit. The increase in third-party funds provides a pool of funds that can be distributed to the agriculture sector. The last variable is agriculture risk. Interestingly, the increasing risk will not reduce the supply of agriculture credit. The increase in loan rates in the long run will decrease the supply of agricultural credit. This is due to the behavior of the demanders; while the loan rate increases, then, the demand for agriculture credit will be evaluated.

Table 4. Estimation results of dynamic panel model (1,1,1,1,0)

Methods	PMG	MG	DFE
Dependent variable $\Delta Lsagri_{it}$			
Error correction term (ω)	-0.0486***(0.010)	-0.0842***(0.003)	-0.03679***(0.000)
Long run coefficient			
Polic yrate	0.0154** (0.028)	-0.2285 (0.265)	0.0332 (0.145)
loan rate	-0.0397*** (0.000)	-0.2428 (0.259)	-0.0643 (0.009)
third party	0.3432***(0.000)	-10.8659 (0.252)	-0.0693 (0.861)
risk	8.3939***(0.000)	-113.5485 (0.349)	12.2136 (0.284)
Short run coefficient			
lsagri	0.8526***(0.000)	0.8544***(0.000)	0.8508***(0.000)
policy rate	-0.0008 (0.486)	0.0015 (0.321)	0.0009 (0.454)
policy rate (-1)	-0.0002 (0.927)	0.0015 (0.293)	0.0016 (0.169)
loan rate	0.0030 (0.523)	-0.0055 (0.002)	0.0052 (0.000)
loan rate(-1)	0.0014 (0.434)	0.0029 (0.024)	0.0018 (0.178)
third party	0.0275 (0.523)	0.0827 (0.309)	0.0417 (0.042)
third party(-1)	-0.0119 (0.649)	0.0329 (0.163)	0.0413 (0.042)
risk	1.3832*(0.100)	1.2642 (0.068)	2.5957 (1.4905)
Country number	7	7	7
Observation	259	259	259

Note: parenthesis (.) is the P-value ***, **, * significant on 1%, 5%, 10%

The MG estimation results provide another long-run result (heterogeneous groups). The error correction coefficient is significantly negative, indicating a long-run relationship. In addition, because the long-run coefficients are insignificant, it implies that the long-run impact of these factors is unstable.

The next step applies Hausman to test PMG and MG and choose the best model that is more suitable for the panel data of this study. According to the test result, the null hypothesis of long-run heterogeneity cannot be rejected; in other words, the PMG estimation method is more suitable. Therefore, considering the long-run impact of bank lending channels, intermediary role, and agricultural risk on the supply of agricultural credit the PMG results should be adopted. Both PMG and MG methods show that short-run coefficients could be different in various countries, this research shows a similar result as supported by research from Wang (2015). To provide comprehensive

e-ISSN 2655-853X
https://doi.org/10.37637/ab.v7i3.1773

estimation results, the test uses the DFE estimation method. The DFE estimation method is the opposite extreme of the MG estimation method, which restricts both the long-run and short-run coefficients. In other words, the DFE estimation method assumes that the data for multiple countries is pooled in a single entity. Therefore, each explanatory variable has a common coefficient without the coefficients of individual countries (Wang 2015). As shown in the DFE estimation results have a significant relationship in the long run.

Pooled Mean Group ARDL Short-Run Dynamics and Long-Run Result

Table 5 presents the results of short-run dynamics and long-run relationships between the supply of agricultural credit and factors that could be determinants. Two variables are used to proxy the monetary transmission mechanism using the bank lending channel: policy rate and loan rate, The variable is to proxy the role of the bank as an intermediary: third third-party fund, and to proxy the agriculture sector is agricultural risk. We divided our table by the result of short-run estimation from each cross-section (7 countries), pooled mean group long-run estimation, and ECM as short-run dynamic adjustment towards the long-run equilibrium.

The relationship among seven countries in the Developing Eight (D8) organization is an aggregate model, based on pooled mean group long-run estimation and short-run dynamic adjustment (ECM result). The aggregate analysis contributes to the D8 as a whole. On the other hand, the result of short-run estimation from each cross-section contributed to the determinants of agricultural credit supply for specifically each member country of D8. This analysis follows Pesaran, Shin, and Smith (2001), Simoes (2011), and Wang and Lee (2015).

The coefficients of error terms (ECT), which show the speed of adjustment from the short-run dynamics toward long-run equilibrium, follow expectations in terms of sign and significance. The coefficients are negative and significant as well as less than one. This implies that when shocks occur in the policy rate, loan rate, third-party fund, and agricultural risk, there is a high probability that the economy will return to normal equilibrium depending on the speed of adjustment. The coefficient of error terms stands at -0.0486. In the case of disequilibrium in the economy, the speed of adjustment towards long-run equilibrium is quick as it is about 4.86 percent of the disequilibrium caused by shocks, particularly in the previous quarter is corrected within a year.

The long-run result for the model shows that policy rate, loan rate, third-party fund, and agricultural risk agriculture has a significant impact on the supply of agricultural credit for Developing Eight organization. When examining bank lending channels this long-run finding supports that banking in D-8 has a significant contribution to agriculture credit. All central bank policy rate support at the beginning, followed by the increase of third-party funds, this contributed to the increasing credit supply.

Despite of the whole finding, the banking in D-8 apparently behaves as credit rationing. While the loan rate increases the supply of credit will decrease. The characteristics of the agricultural sector make it a consideration in granting credit, known as credit rationing. Credit rationing occurs because the credit market is not the same as the physical commodity market. In the standard market, delivery of goods will be carried continuously after the payment by the buyer. In the credit market, lenders provide debt capital to borrowers according to future repayment agreements. Asymmetry of information regarding debt payments allows adverse selection and moral hazard problems to occur (Akerlof 1970, Stiglitz and Weiss 1981). This could be a disincentive to the farmers, however, farmers often cannot borrow as much as they need (Kuethe et al, 2022). Credit rationing limits a farmer's ability to accumulate capital and suppresses aggregate agricultural output (Barry et al, 2000; Briggeman et al, 2009).

Unfortunately, the banking sector is less sensitive to agriculture risk in the long run.

e-ISSN 2655-853X
https://doi.org/10.37637/ab.v7i3.1773

While the agriculture risk increases, the supply of credit is still increasing. The finding is consistent with the condition of Pakistan, as one of D-8 members. The balanced role of internal and external compliance risk evaluation process of specialized agricultural financing is reasonably efficient in mitigating risk in farm credits in Pakistan (Bilal and Biq 2018). On the other hand, the research finding is not consistent with previous research (Settlage et al 2009). By examining the efficiency of agricultural banks, most banks in the US appear to be risk-averse.

Table 5. Determinants of the agricultural credit supply in the long run and short run for the 7 countries of developing eight – PMG ARDL (1,1,1,1,0) Model

Variables	**Long Run Estimation**			**ECT Short run**	**-0.0486**	**(0.010)***
policy rate	0.0154	(0.028)**		lsagri	0.8525	(0.000)***
loan rate	-0.0397	(0.000)***		policy rate	-0.0008	(0.486)
third party	0.3432	(0.000)***		policy rate(-1)	-0.0002	(0.927)
risk	8.3939	(0.000)***		loan rate	0.0030	(0.323)
				loan rate(-1)	0.0014	(0.434)
				third party	0.0275	(0.523)
				Third party(-1)	-0.0120	(0.694)
				risk	1.3831	(0.100)*

Variable	**Short Run Estimation**						
	Bangladesh	Egypt	Indonesia	Malaysia	Nigeria	Pakistan	Turkiye
ECT	-0.0818	-0.0183	-0.1403	-0.0004	-0.0033	-0.0357	-0.0598
	(0.000)***	(0.000)*	(0.000)***	(0.936)	(0.774)	(0.000)***	(0.000)***
lsagri	0.8491	0.8278	0.8792	0.7911	0.7935	0.9596	0.8677
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
policy rate	-0.0008	-0.0002	-0.0072	0.0022	0.0005	-0.0023	0.0019
	(0.651)	(0.752)	(0.209)	(0.277)	(0.911)	(0.001)***	(0.413)
policy rate	-0.0025	-0.0009	0.0096	-0.0038	-0.0046	-0.0012	0.0023
(-1)	(0.209)	(0.340)	(0.058)*	(0.038)**	(0.242)	(0.019)**	(0.347)
loan rate	0.0041	-0.0003	0.0129	0.0021	-0.0125	0.0047	0.0098
	(0.005)***	(0.824)	(0.001)***	(0.202)	(0.010)***	(0.000)***	(0.002)***
loan rate(-	0.004	-0.0006	0.0079	-0.0009	-0.0070	0.0030	0.0034
1)	(0.007)***	(0.626)	(0.074)*	(0.514)	(0.134)	(0.008)***	(0.216)
third party	-0.0093	-0.0231	-0.1133	0.0304	-0.0095	0.0626	0.2546
	(0.714)	(0.024)**	(0.000)***	(0.009)***	(0.616)	(0.000)***	(0.064)*
third party	0.0091	-0.0163	-0.0913	0.0612	0.0188	0.0792	-0.1445
(-1)	(0.683)	(0.088)*	(0.000)***	(0.000)***	(0.336)	(0.000)***	(0.307)
risiko	0.5300	0.1209	-0.6649	1.8419	2.2721	-0.5534	6.1353
	(0.178)	(0.691)	(0.001)***	(0.024)**	(0.201)	(0.385)	(0.000)***

Note: parenthesis (.) is the P-value ***, **, * significant on 1%, 5%, 10%

In the short run, the agricultural credit supply is significantly affected by previous credit supply and agriculture risk (**Table 5**). This finding supports that as an organization, D-8's long-term consideration is more significant than the short-run. The coordination of agricultural credit supply to support agricultural growth is not only in the short run.

The last result from Table 5 is the short-run estimation in various countries. Supported by research from Pesaran, Shin, and Smith (2001), Simoes (2010), and Wang and Lee (2015), Pooled Mean Group estimation results could be different in various countries in the short run.

From short-run estimation for all countries, the result shows that all coefficients of error terms (ECT) follow expectation in terms of sign and significance, that is, the coefficients are negative and significant. Malaysia and Nigeria perform negatively insignificant but still consistent with expectation. This model PMG ARDL (1,1,1,1,0) is the most consistent and follows expectations in terms of signs of ECT. We have re-estimated more than 8 combinations of lag and found that the ECT does not follow the expectation in terms of sign and significance. If the ECT is not negative, then there is no corrective mechanism; the ECT is not valid.

e-ISSN 2655-853X
https://doi.org/10.37637/ab.v7i3.1773

The relationship between agricultural credit supply and the previous agricultural credit supply is positively significant in all member countries. Agricultural risk is significantly positive in the short run for all member countries with a coefficient of 1.3831. The supply of agricultural credit in the case of increasing agricultural risk is consistent in the short run and long run. The decrease does not follow the increase in agricultural risk in agricultural credit supply.

The short-run analysis for each member country shows variation results. The policy rate is significant only in Indonesia, Malaysia, and Pakistan with the coefficient and p-value: 0.0096 (0.058), -0.0038 (0.038), and -0.0023 (0.001). The loan rate is significant in all members of D-8 except Egypt and Malaysia. Third-party funds are significant in Egypt, Indonesia, Malaysia, Pakistan, and Turkiye. Interestingly, the increase in third-party funds has a negative and significant effect on the supply of agricultural credit in Egypt and Indonesia. While Malaysia, Pakistan, and Turkey have been positively significant. On the other hand, agriculture risk in Indonesia has a negative significant effect with a coefficient of -0.6649 (0.001) while in Malaysia and Turkey have a positive significant effect.

The table shows that the supply of agricultural credit has a positive relationship with the previous supply of agricultural credit and agricultural risk. This finding is consistent with Levine, Loazya, and Beck 2001, Levine 2021, Raifu and Alarudee, 2020 that the intermediary role is important for economic growth. The financial structure in Developing Eight influences the investment and economic decisions, but there is still a lack of perfect information and the transaction cost is not zero. The information on credit, interest rates, and subsidy, if any, between banking as a supply unit and the agriculture sector as a demander needs to be improved among D-8's member countries and within the country.

The result is as follows to have an efficient finding of determinants of agricultural credit supply for each member country of D8 in the short run (Table 5.).

Bangladesh

Table 5 shows that two variables: usage has a coefficient of 0.08491, and loan rate has a coefficient of 0.0041, significantly affecting agriculture credit supply at p-value < 0.01 and p-value < 0.005. The supply of agricultural credit is supported significantly by the previous supply of agricultural credit and loan rates.

Egypt

The supply of agriculture credit is supported significantly by the previous supply of agricultural credit, loan rate, and third-party funds.

Indonesia

The supply of agriculture credit is supported significantly by the previous supply of agricultural credit, policy rate, loan rate, third-party fund, and agricultural risk. Banking in Indonesia considers agricultural risk by decreasing the agricultural credit supply. Agricultural risk may come from climate change, as reported by Bengkulu (Sumartono 2021). Credit can be used to reduce or eliminate the impact of climate change on food crop production. Some programs to reduce the climate change impacts are: crop rotation (Sumartono et al 2021 and Yastika et al 2023), crop diversification, and the application of production enhancement technologies (Sumartono et al 2021).

Malaysia

The supply of agriculture credit is supported significantly by the previous supply of agricultural credit, policy rate, loan rate, third-party fund, and agricultural risk. Banking in Malaysia maintains the positive agricultural credit supply despite the increasing agricultural risk.

Nigeria

The supply of agriculture credit is supported significantly by the previous supply of agricultural and loan rates.

Pakistan

The supply of agriculture credit is supported significantly by the previous supply of agricultural credit, policy rate, loan rate, and third-party fund.

e-ISSN 2655-853X
https://doi.org/10.37637/ab.v7i3.1773

Turkey
The supply of agriculture credit is supported significantly by the previous supply of agricultural credit, policy rate, loan rate, third-party fund, and agricultural risk. Banking in Turkey maintains a positive agricultural credit supply despite the increasing agricultural risk.

CONCLUSION

The role of banking as an intermediary institution in economic growth has contributed important attention from scholars and policymakers over time. However, the determinants of agriculture credit supply need to be evaluated. Empirical results appear to be mixed and have different views. This study examines the determinants of supply of the agriculture credit in 7 member countries in the Developing Eight (D8) Organization during the period from 2013Q4 to 2022Q4. Several novelties are added to this study. First, the study examines the determinants of credit allocation for the agriculture sector, which is different from previous research. Second, based on the monetary transmission mechanism theory and the intermediary role of banking, the study interacts with bank lending channel variables and risk in agriculture to examine short-run dynamics and long-run relationships for aggregate results and specific countries. Third, Dynamic panel analysis and Autoregressive distributed lag (ARDL) estimation methods are applied for estimating as novelty compared to some previous research focusing on time series analysis on one single country. Pooled Mean Group - ARDL (1,1,1,1,0) shows the most robust and consistent model. Fourth, the study evaluating determinants for agriculture credit supply in the members of the Developing Eight Organization is still limited. The study also conducts preliminary tests such as the unit root and cointegration tests. First, the unit root test results show that all variables at level, contain unit roots. These variables are stationer after the first difference. Based on Pedroni's approach to cointegration, the variables are cointegrated. In other words, there is a long-run relationship between the supply of agriculture credit, policy rate, loan rate, third-party fund, and agriculture risk. Based on Pooled Mean Group-ARDL estimation, it is also found in the long- run all explanatory variables have a significant effect on agriculture credit supply. In the short run, the previous number of agricultural credit supply and agriculture are positively significant. The result for each member country supports the important role of bank lending channels and agriculture risk. Banking in Indonesia considers agricultural risk by decreasing the agricultural credit supply while banking in Malaysia and Turkey maintains the positive agricultural credit supply despite the increasing of agricultural risk.

For the long-term agenda, there is a need to mitigate policy rate and loan rate to support credit supply and to strengthen the role of conventional banking for the agriculture sector. While for the short-term agenda, there is a need to mitigate agriculture risk and previous credit supply. This agenda is supported by the finding that the practice of banking in D8 significantly affects the supply of agriculture credit itself.

REFERENCES

Barry, P. J., R. W. Bierlen, and N. L. Sotomayor (2000). Financial structure of farm businesses under imperfect capital markets. American Journal of Agricultural Economics 82(4), 920–933. https://doi.org/10.1111/0002-9092.00091

Bilal, A.R., and Baig, M.M.A. (2018). Transformation of Agricultural Credit Management. The new horizon of regulatory compliance in farm credits. Agricultural Finance Review. November 2018. http://dx.doi.org/10.1108/AFR-05-2018-00038

Beck, T., Levine, R., & Loayza, N. (2000). Finance and the sources of growth. *Journal of Financial Economics*, *58*(1), 260-300. https://doi.org/10.1016/S0304-405X(00)00072-6

Beck, T., Kunt, Asli-D., & Levine, R. (2002). Law and Finance: Why Does Legal Origin

e-ISSN 2655-853X
https://doi.org/10.37637/ab.v7i3.1773

Matter? *Working Paper 9379*. National Bureau Of Economic Research. Cambridge, MA. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=359316

Bencivenga, V. R. and Smith, B. D. (1991). Financial Intermediation and Endogenous Growth. Review of Economic Studies 58: 195-209. https://doi.org/10.2307/2297964

Briggeman, B. C., C. A. Towe, and M. J. Morehart (2009). Credit constraints: their existence, determinants, and implications for U.S. farm and nonfarm sole proprietorships. American Journal of Agricultural Economics 91(1), 275–289. https://doi.org/10.1111/j.1467-8276.2008.01173.x

Chandio, A.A. Jiang, Y., Wei, F., and Guan, X. 2017. Effects of Agricultural Credit on Wheat Productivity of Small Farms in Sindh, Pakistan Are short-term loans better?. Agricultural Finance Review 78 (5), 592-610. http://dx.doi.org/10.1108/AFR-02-2017-0010.

Dinar Standard. (2022). State of the Global Islamic Economy (SGIE) Report 2022. Retrieved from https://www.dinarstandard.com/post/state-of-the-global-islamic-economy-report-2022

D-8 Organization for Economic Cooperation. (2022). Retrieved from https://developing8.org/about-d-8/brief-history-of-d-8/

FAO. (2021). World Food and Agriculture - Statistical Yearbook 2021. Rome. Retrieved from https://www.fao.org/documents/card/en/c/cb4477en

FAO. (2023). Estimation of the Impact of Global Disasters on Agriculture. Retrieved from https://www.fao.org/newsroom/detail/first-ever-global-estimation-of-the-impact-of-disasters-on-agriculture/en

Gatti, R. & Love, I. (2008). Does access to credit improve productivity? Evidence from Bulgaria. Economics of Transition. The European Bank for Reconstruction and Development. *Journal compilation*, *16*(3), 445–465. https://doi.org/10.1111/j.1468-0351.2008.00328.x

Global Food Security Index. (2022). The 11th Global Food Security Index Report. Economist Impact. Corteva Agriscience. https://impact.economist.com/sustainability/project/food-security-index/explore-countries/indonesia

Hossain, S.S., Cui, Y., Delin, H., and Zhang, X. (2023). International Journal of Climate Change Strategies and Management , 15(3), 353-370, https://doi.org/10.1108/IJCCSM-10-2021-0123

Kim, K.N. and Katchova, A.L., (2020). Impact of the Basel III Bank Regulation on US Agricultural Lending. Agricultural Finance Review 80 (3), 321-337. https://doi.org/10.1108/AFR-11-2019-0124

KNEKS. (2021). Strategi Percepatan Ekspor Produk Halal Usaha Kecil dan Menengah di Indonesia. Retrieved from https://kneks.go.id/beranda

Levine R. (1997). Financial Development and Economic Growth: Views and Agenda. *Journal of Economic Literature, XXXV*, 688-726. http://links.jstor.org/sici?sici=0022-0515%28199706%2935%3A2%3C688%3AFDAEGV%3E2.0.CO%3B2-X

Luo, Dancheng & C, Gao. (2012). An Empirical Study of China's Rural Formal Financial Development and Rural Income Inequality. Technology for Education and Learning, Advances in Intelligent System and Computing. (136), 459–464. Springer, Berlin, Heidelberg. Retrieved from https://doi.org/10.1007/978-3-642-27711-5_61

Ngong, C.I., Onyejiaku, C., Fonchamnyo, D.C., Onwumere, J.U.C. 2023. Has Bank Credit Really Impacted Agricultural Productivity in the Central African

e-ISSN 2655-853X
https://doi.org/10.37637/ab.v7i3.1773

Economic Monetary Community?. Asian Journal of Economics and Banking 7(3), 435-453. http://dx.doi.org/10.1108/AJEB-12-2021-0133

Ministry of Foreign Affair Republic of Indonesia. (2022). Daftar Kerjasama Multilateral. Retrieved from https://kemlu.go.id/portal/id/read/143/halaman_list_lainnya/developing-eight-d-8#:~:text=D%2D8%20terdiri%20dari%20delapan,Nigeria%2C%20Pakistan%2C%20dan%20Turkiye

Murungi, K., Alhassan, A.L., and Zeka, B. 2023. Regulation and Agriculture Financing in Kenya. Agricultural Finance Review. 83(4/5), 783-799. https://doi.org/10.1108/AFR-10-2022-0130

Oloukoi, L. (2022). Comparative effect of short-term credit granted to agriculture on agricultural added value in the West African countries. *Journal of Economics and Development*, 24(2), 176-195. https://doi.org/10.1108/JED-12-2020-0198

Pesaran, M.H. & Shin, Y. (1999). An autoregressive distributed lag modeling approach to cointegration analysis in Strom, S. (Ed.). Econometrics and Economic Theory in the 20th Century: The Ragnar Frisch Centennial Symposium. Chapter 11. Cambridge University Press, Cambridge. https://www.cambridge.org/core/books/abs/econometrics-and-economic-theory-in-the-20th-century/an-autoregressive-distributedlag-modelling-approach-to-cointegration-analysis/0A3624D5C624BED6E2A963190403653A

Raifu, I.A. & Alarudee, A. (2020). Financial development and agricultural performance in Nigeria: what role do institutions play?. *Agricultural Finance Review*, *80*(2), 231-254. https://doi.org/10.1108/AFR-06-2018-0045

Scott, F., Kuethe, T.H. , Kreitman, Ty., & Oppedahl, D. (2022). The Supply and Demand of Agricultural Loans. Research Working Paper. July 2022 RWP 22-06. Federal Reserve Bank of Kansas City. Retrieved from https://www.kansascityfed.org/research/research-working-papers/the-supply-and-demand-of-agricultural-loans/

Settlage, D.M., Preckel, P. V., and Settlage, L.A. (2009). Risk-adjusted efficiency and risk aversion in the agricultural banking industry. *Agricultural Finance Review*, 69(3), 314-329 https://doi.org/10.1108/00021460911002699

Shahbaz, M., Muhammad, S.S., & Muhammad, S.B., (2013). Effect of Financial Development on Agricultural Growth in Pakistan New Extensions from Bounds Test to Level Relationships and Granger Causality Tests. *International Journal of Social Economics*, *40*(8), 707-728. https://doi.org/10.1108/IJSE-01-2012-0002

Simões, M. C. N. (2011). Education Composition and Growth: A Pooled Mean Group Analysis of OECD Countries. Panoeconomicus, 58(4), 455-471. https://www.researchgate.net/publication/227639641_Education_Composition_and_Growth_A_Pooled_Mean_Group_Analysis_of_OECD_Countries

Sumartono, E., Mulyasari, G., and Sukiyono, K. (2021). Assessment Model Impact of Climate Change on Potential Production for Food and Energy Needs for the Coastal Areas of Bengkulu, Indonesia. Agro Bali : Agricultural Journal, 4(2), 159-169. https://doi.org/10.37637/ab.v4i2.714

Yastika, P.E., Vipriyanti, N.U., Partama, I.G.D., Suparwata, I.W.E., and Sudiarta, I.K. (2023). Analisis Respon Petani Terhadap Perubahan Iklim dan Curah Hujan di Subak Jatiluwih, Tabanan Bali, Indonesia. Agro Bali : Agricultural

e-ISSN 2655-853X
https://doi.org/10.37637/ab.v7i3.1773

Journal, 6(3), 783-792. https://doi.org/10.37637/ab.v6i3.1262

Yin, Z., Meng, L., & Sha, Y., (2020). Determinants of Agriculture-Related Loan Default: Evidence From China. *Bulletin of Monetary Economics and Banking*, Special Issue 2020, 129 – 150. https://doi.org/10.21098/bemp.v23i0.1160

Wang, G. (2019). Marx's Monetary Theory and Its Practical Value. *China Political Economy*. 2(2), 182-200. https://doi.org/10.1108/CPE-10-2019-0026

Wang, KM and Lee, Y, 2015. Dynamic Heterogeneous Panel Analysis of The Correlation Between Stock Prices And Exchange Rates. *Economic Research Ekonomska Istraživanja*, 28(1), 749-772. https://doi.org/10.1108/CPE-10-2019-0026

World Bank. 2024. Food Security Update World Bank Response to Rising Food Insecurity. Retrieved from https://www.worldbank.org/en/topic/agriculture/brief/food-security-update