Analyzing determinants of economic growth on agricultural sector in Indonesia

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Abstract. Despite the crucial role of agriculture in safeguarding Indonesia's economy, some attention has given to the nation's agricultural development, banking dynamics, and macroeconomic landscape pre- and post-COVID-19 era. This study employs quarterly data spanning from 2010 to 2021, using multiple Ordinary Least Squares (OLS) regression techniques to analyse various variables. Key variables examined include the growth of agriculture's GDP shares over total GDP (GGDPRGDPT), agriculture's financing and total time deposits in Islamic banks (GFinPDT), Islamic banks' margin in agriculture (MARGIN), agriculture's financing and GDP in agriculture (GCPGDPP), inflation, and food prices. The findings underscore the imperative for Indonesia's agriculture sector to embark on a transformative journey toward enhanced productivity. Moreover, sustained support from the banking sector is considered essential for fostering financial deepening, causing a higher allocation of deposited funds towards agricultural financing. Amidst pandemics and crises, the resilience of Indonesia's agriculture sector is underscored by the indispensability of its products. However, collaborative efforts between farmers and financial institutions are called for, alongside proactive measures by banks to channel deposited funds into agricultural financing instruments. The sustainable growth of Indonesia's agricultural sector hinges upon robust macroeconomic conditions, effective management practices, and unwavering support from the banking sector.

1 Introduction

The agricultural sector has appeared as a cornerstone of Indonesia's economy, playing pivotal roles such as absorbing labour forces, giving employment opportunities to small family units, and serving as the primary source of food production. According to data from Indonesia's Statistical Central Board [1], the economic growth saw in the first quarter of 2022 saw the absorption of 4.55 million workers. Notably, agriculture, manufacturing, and commerce stand out as the top three industries in terms of employment, employing 1.86 million, 850,000, and 640,000 workers, respectively. Furthermore, statistics from the Central

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Statistics Board (BPS) reveal that the agricultural workforce in 2019 formed 33.4 million individuals. Notably, only 8% of these farmers fall within the age bracket of 20 to 39, standing for approximately 2.7 million individuals managing a staggering 7,463,948 hectares of raw rice fields.

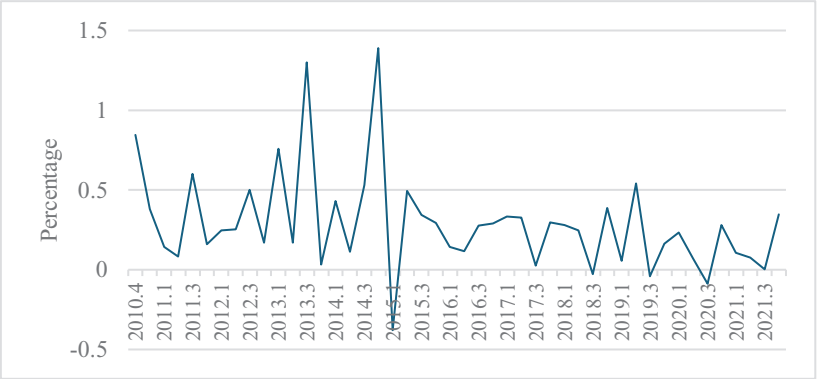

Fig. 1. Rate of Inflation in Indonesia from 2010 to 2021 [2]

The degree of price stability in the agricultural sector becomes one of the most influential factors influencing the demand for financing. Uncontrollable external shocks, such as natural disasters or climate issues, primarily cause it. According to [3], There are currently insufficient policy tools available to economists and decision-makers to reduce the volatility of food prices. Macroeconomic methods to national market price stabilization are unpromising. Social safety nets can lessen negative consequences and keep households from sinking into chronic poverty because they help those who are impoverished deal with income shocks. Nonetheless, they need solid institutional environments and efficient targeting methods. Therefore, Figure 1 shows that fluctuating inflation in Indonesia may have a negative impact on the agricultural sector, as it decreases farmers' incomes and their ability to meet financing demands.

Fig. 2. Margin in Agriculture Indonesia from 2010 to 2021 [2]

Most Indonesia's farmers are small and traditional. Small and marginal farmers cannot generate sufficient savings to finance fixed capital formation. As a result, they must rely on institutional financing to fund land expansion, minor irrigation, farm implements and machinery, related operations, and agricultural product purchases. Consequently, the margin would affect credit allocation, enhancing credit flow to small and marginal farmers in West Bengal agriculture [4]. Figure 2 proves that the margin rate tends to increase financing demand because it shows a lower level of agricultural sector income. This condition may reduce the demand for financing among Indonesian farmers.

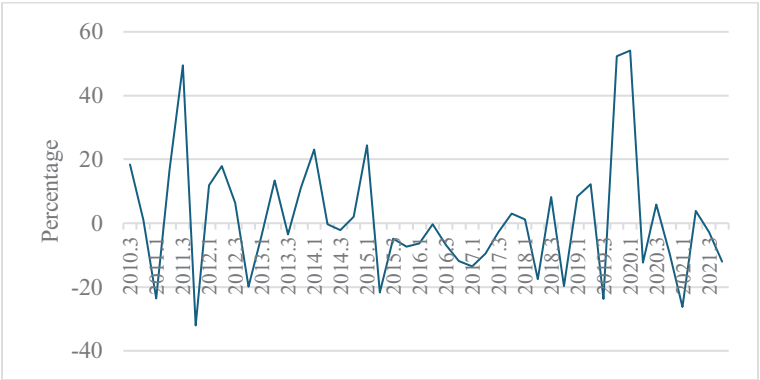

Fig. 3. Growth of Non-Performing Financing in the Agricultural Sector in Indonesia from Quartal 3 2010 – Quartal 2021 [2]

Figure 3 depicts the decreasing trend of non-performing financing in the agriculture sector in Indonesia. According to [5], the loan conditions of farmers influence the preference of banks to finance the agricultural sector.

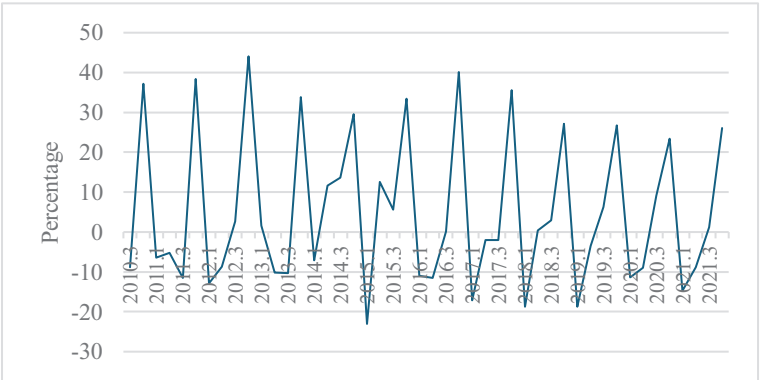

Fig. 4. Proportion growth between Financing and Gross Domestic Product (GDP) in Agriculture from Quartal 3 2020 to Quartal 4 2021 [2]

A decline in capital formation in agriculture, inadequate expenditure on irrigation and extension services in rural areas, and a shortage of inexpensive institutional credit resulted in a slowdown of agricultural growth and an increase in livelihood insecurity for a considerable proportion of those who depend on agriculture [4–31]. The proportion between financing and GDP formation (GCPGDPP) tends to decrease, as shown in Figure 4. It shows that the agricultural sector's productivity increases slowly, due to climate change and internal management issues.

Credit access is more significant in OECD countries and less significant in countries with a lower level of economic development [17]. Our analysis enables us to highlight the specific effects of credit in stimulating the development of the agricultural sector: in developing countries, access to credit has a significant impact on production, while, in developed countries, it also affects productivity. Figure 5 depicts the increasing trend of the proportional growth between financing and funding (GFinPDT) in Islamic banks for the agricultural sector, showing a greater commitment by banks to promote the growth of the agriculture sector.

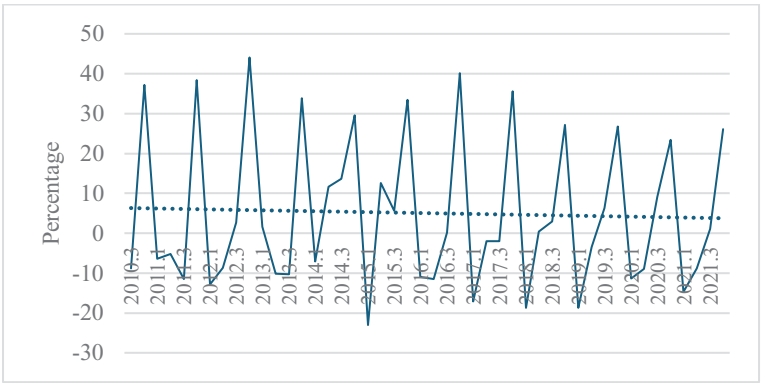

Fig. 5. Proportion growth between financing and time deposit in Islamic bank from Quartal 3 2020 to Quartal 4 2021 [2]

Institutional credit plays a crucial role in achieving agricultural growth in the nation. The model's other variables, such as agro-based industries, livestock, mechanized inputs, and agricultural exports, have a positive effect on agricultural growth and on the GDP growth of the economy [10]. Consequently, the nation's economy's overall growth is contingent on agriculture's progress. If the agricultural sector has access to credit, the country's gross domestic product (GDP) will increase, resulting in economic expansion [9]. According to Figure 6, the trend of GDP growth compared to total GDP (GGDPRGDPT) in Indonesia appears consistent. It is intriguing to note that the agricultural sector's contribution to the economy is small and, as such, requires further analysis.

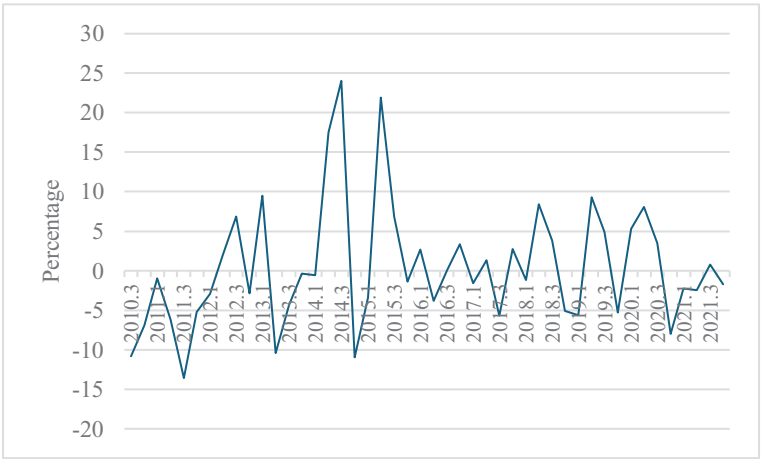

Fig. 6. Proportion Growth of GDP in Agriculture over Total GDP from Quartal 3 2020 to Quartal 4 2021 [2]

Consequently, based on the data mentioned above in particularly Figure 4 until 6, the growth trends in the agricultural sector appear to be declining, even though the inflation rate shows a declining trend, the non-performing financing in the agricultural sector demonstrates a declining trend, and the financial deepening in agriculture also recorded a declining trend. Given these conditions, the agricultural sector shows a consistent trend compared to the total GDP. It shows that the level of productivity is not high enough to affect national income growth significantly. Intriguingly, however, support from Islamic banks tends to be greater, as showed by the proportional growth between agricultural financing and total time deposits. According to some sources, the most significant barrier to the expansion of the agricultural sector is the aid in gaining access to credit from banks. The higher proportion of

intermediation funds is expected to increase farmers' access to credit; however, some marginal farmers have difficulty obtaining funds due to their limited managerial ability and higher risk profile.

Consequently, there is no consensus about the origin of the problems in promoting the agricultural sector, particularly in Indonesia, especially considering the pandemic's shock. Considering banking, macroeconomic environment, and pandemic variables, this study aims to analyse the determinants of growth in the agricultural sector in Indonesia. The significance of this study is to find the most significant factors inhibiting agricultural sector growth, particularly during pandemics.

2 Literature review

According to several studies [3,4,8,32,33] bank credit is an essential factor in fostering the expansion of the agricultural sector. In addition, stable inflation and higher agricultural productivity appear to be the macroeconomic driver [34]. The government and banking sector education, knowledge, and empowerment programs [4,26–31,35]. However, few studies examine the effects of macroeconomics, banking support, and pandemic on agricultural development or growth in a single study, particularly in Indonesia.

According to [3], agriculture expanded more rapidly than the industrial sector. [8] discovered that despite the yield and price volatility inherent to agricultural production, agrarian finance banks offer higher returns than non-agricultural loans and are, therefore attractive. [26] stated that there are several ways to improve agricultural sectors: (1) Enhance input availability and reduce input unit costs for farmers by investing in infrastructure; (2) Promote complementary farm-level investments to improve fertilizer productivity and seed quality; (3) Coordinate input and output marketing systems better and provide incentives for private sector involvement; and (4) Enhance farmers' ability to buy inputs at competitive prices. Improvements in agriculture are necessary as a first step toward more comprehensive development, the eradication of poverty, and ultimate economic independence from undue reliance on subpar agricultural output, according to [34]. [30] stated that the level of technology adoption determines agricultural productivity, and that technology adoption is determined by education – education of the individual and the society, through matching the source and quality of information (rural agricultural graduate constituency), making technology significantly more effective, reliable, and of higher quality.

A collection of financial derivatives are the best financial instruments for banks (especially Islamic banks) functioning in conditions marked by agency issues and unfinished contracts [32]. [4] discovered that small and marginal farmers depend on institutional financing for investments in land expansion, minor irrigation, farm equipment and implements, related activities, and the acquisition of agricultural supplies because they are unable to save for fixed capital creation. [33] said that it is well-known that credit market constraints exist, which could explain a part of the clear underutilization of bought inputs in general. Farmers in Russia, for instance, are typically poor, and credit is needed for access to both bought inputs such as fertilizer and capital goods. Periodically, agricultural firms (previously collective farms) have received subsidized financing. Lenders want guarantee against default for borrowers to consistently get commercial credit at fair real interest rates; in the Russian context, this could be best achieved by using individual shares in their former collective farms as collateral. [16] discovered that the impact of agricultural cooperative credit on agricultural inputs, land improvement, production, and marketing of various holding groups is essential for evaluating credit use. The correlation coefficient between agricultural inputs and production level shows that there is a perfect positive relationship between the two, but it is limited to marginal farmers.

According to [22], There are three ways to look at agriculture's contribution to the economy: first, it gives consumers food and fiber for home industry; second, it generates limited foreign exchange gains; and third, it serves as a market for industrial goods. The study in Himachal Pradesh to investigates the notion that most public sector credit institutions are mismanaged and have the least ability to meet the needs of farmers and rural households. As a result, farmers depend more on non-institutional than on institutional financing systems. However, the high markup rate and other unfavourable terms and conditions of non-institutional sources exacerbate the poverty cycle; they give rise to the issue of forced labour; they limit the growers' ability to make investments and their socioeconomic freedoms; and they compel their offspring to be indebted from birth to death.

The supply and demand of credit are influenced by a number of important variables [31]. First, it was found to be remarkably successful to separate the various institutional and cultural elements influencing rural credit in China by using the 7 Cs as a guide. Within "Character," the writers talk about the informal lending and borrowing practices of Chinese farmers; in "Capacity," they talk about the difficulties in providing credit to farms with little resources; in "Condition," they talk about group guarantees, credit-worthy villages, credit rationing and insurance, and incomplete markets; and in "Capability," they talk about income inequality and difficulties with economies of scale.

The credit, education, and road construction policies, according to [18], narrow this gap. Credit and road programs improve efficiency in the South Brazil, where losses in productivity have been the most severe. About agricultural development, [6] discovered that the most important concerns, like property rights, agricultural extension, rural infrastructure, and food price stabilization, should be given top priority by economists. Improving food security and creating practical coping strategies for those living in poverty are the most urgent issues. It has been impossible for economists and decision-makers to pinpoint effective policy tools to manage the volatility of food prices. Macroeconomic methods to national market price stabilization are unpromising. Social safety nets can lessen negative consequences and keep households from sinking into chronic poverty by helping those who are impoverished deal with income shocks. However, they need solid institutional environments and efficient targeting methods. Trade policies aimed at ensuring national food security and stabilizing prices have proved detrimental, harming the disadvantaged populace.

The growth determinants have either stayed the same or worsened, according to [20]. Growth regressions conducted between 1995 and 2005 reveal substantial relationships between economic growth and investment, private sector credit availability, government efficacy, exports, and the share of agriculture's value-added to GDP. Farmers' decisions about banks are influenced by a number of aspects, including individual trustworthiness, accessibility, loan terms, pricing, and dependability. The findings showed that farmers' decisions about banks were influenced by the institutions' trustworthiness and accessibility. When it came to agricultural loans, farmers who preferred private sector banks over public banks felt that private banks offered higher levels of reliability and accessibility. Farmers said local capital banks were more dependable, provided better services, offered better loan terms, and had less loan charges than international capital banks. Farmers who disapproved of Islamic banking methods said that services were less dependable and of lesser quality. The results of the study suggest that banks should make greater investments in accessibility and dependability to draw in and keep consumers. To entice farmers to use their services, foreign capital banks should lower the cost of their loans while improving the terms, reliability, and quality of their services. Islamic banks ought to improve the calibre of their client support and bolster their reliability.

During the reform period, the annual growth rate of total institutional credit for agriculture and allied activities was significantly higher than during the pre-reform period, according to [24]. During the reform regime in Brazil, there has been a notable increase in

the average institutional credit per hectare and as a percentage of agricultural GDP. A "U-shaped" pattern might be seen in the growth patterns of investment loans and production. It implies that the early 1990s banking sector reforms are primarily responsible for the rise in institutional lending for agriculture and related businesses during the reform period. According to modelling data [1], Africa will be the region most negatively affected by climate change in terms of welfare losses and slower economic growth. A concerted effort to adapt is required, and this should involve the introduction of temperature-sensitive varieties, diversification of livelihoods and production systems, a shift to sustainable agricultural intensification, a shift to irrigation agriculture, and the resolution of institutional issues like poor social and physical infrastructure, unsatisfactory markets, a lack of crop insurance, and restricted access to credit. Long-term focus should be on moving the economy away from agriculture and toward services and industry.

Hartarska et al (2015) discover a positive correlation between agricultural lending and the growth of agricultural GDP per rural resident; more loans, amounting to one-third of the real average, are linked to a state growth rate that is between 7 and 10 percent higher; this correlation was more pronounced in the 1990s. Financial resources need to be available to farmers [10]. It can be done through the establishment of Islamic trusts (waqf) created especially for this purpose, or by Islamic banks, since Islamic banking and finance are the only mainstay of Islamic economics discourse, which open programs for funding farmers. When considering waqf as one of the potential tools for repurposing idle agricultural land, it is crucial to emphasize two main aspects: the first is the establishment of waqf to tackle the issue of idle land, and the second is the management of waqf for the advancement of agriculture. For impoverished Muslim farmers who are unable to rely on interest-based finance because of the Riba restriction, riba-free funding is crucial, claims [28]. Additionally, the analysis shows that the Qard Hassan instrument is a desirable choice for satisfying this need and beneficial to Islamic banks and other financial institutions as well as farmers.

Trade conditions for agriculture in India would improve because of economic liberalization, enabling farmers to spend crop surpluses to build long-term land improvements and boost agricultural development and productivity [6]. Contrary to expectations, the terms of trade for agriculture did not noticeably increase during the reform period. Furthermore, there was a slowdown in agricultural growth and a rise in the insecurity of livelihood for a significant portion of the population that depends on agriculture due to a decline in agricultural capital formation, inadequate spending on irrigation and extension services in rural areas, and a lack of affordable institutional credit. [23] claimed that changing responsibilities are a reflection of Indonesia's constant aims, which include developing the palm oil industry to achieve economic growth, giving social equality considerable thought, and, more recently, focusing on environmental sustainability. [29] found that, particularly in emerging and under-developing countries, most farmers are members of lower socioeconomic groups. They were severely disadvantaged by this feature in all sides of their lives, including their agricultural pursuits. For example, they never can maximize the returns on their agricultural efforts and never seem to be able to meet their needs for crop and non-crop activities. Pakistani farmers are in the same situation as other people of underdeveloped countries. They ought to refrain from applying for interest-bearing loans from financial organizations as they are Muslims. The Islamic financial system provides a number of funding options as an alternative to these interest-based agreements. The most important of these is Istisn' (manufacturing), which may be applied successfully to a range of agricultural demands. On the other hand, its significance lies in its fulfilment of non-crop agricultural tasks, like manufacturing large agricultural machinery and equipment, setting up tube-wells and channels for a suitable irrigation system, building modest homes for farmers on their properties, etc.

Pacheco et al (2018) determine that a number of factors (the gross added value of just agriculture, the average total household income, and the population that is economically active) positively affect agricultural diversification; on the other hand, the total gross added value of each province was negatively impacted by the volume of credit, the unemployment rate, and the educational attainment of the population [22]. According to [36], farmers experience a range of financial restrictions because of their differing productivity levels, which might worsen the internal income disparity that already exists. Our results support the notion that credit limits affect rural populations generally and that the impact of farmer credit on farmer income varies significantly among strata. Higher income farmers have a greater chance of getting bank financing and raising their revenue further conversely because they are less able to build up wealth, farmers with lower incomes are more prone to fall into a "vicious circle of poverty". Improving farmers' access to financing is crucial for fostering a more fair and long-term growth in their incomes. Furthermore, promoting healthy competition among county financial institutions and accelerating the creation of inclusive financial systems are crucial. It may help ensure that rural and agricultural economies continue to thrive sustainably.

Gökçekuş et al (2019) suggested that, considering the significance of agricultural sector output to economic activity in Nigeria, the agricultural sector is a tangible part of the economy that cannot be ignored or underestimated [9]. As a result, the advancement of agriculture is essential to the country's overall economic success. The country's gross domestic product (GDP) would rise, and the economy will expand if the agriculture sector gets access to finance. [15] proved that the country's agricultural growth is significantly influenced by institutional loans. The model's other factors, which include livestock, automated inputs, exports of agricultural products, and agro-based enterprises, all have a favorable impact on the expansion of agriculture and the GDP of the national order to attain the ultimate goal of agricultural growth in Pakistan, the government needs to increase funding for institutional credit, support modern technology and agro-based industries, supply farmers involved in livestock production with cutting-edge techniques, and encourage agricultural exports to generate foreign exchange profits. claimed that to free the fishing community from the bonds of moneylenders and wholesalers, the Salam contract was customized to fit its needs. It included buyers, Islamic banks, Islamic insurance, and members of the Islamic microfinance institutions (MFIs), farmers, and fishers. A community of fishers and farmers can help one another out financially. This community is managed by Islamic MFIs collaborating with fisheries and agriculture firms and an integrated contract application system called Salam for Islamic MFIs.

Turvey et al (2011) discovered that Islamic banking in Indonesia gives less than 10 percent of total financing to the agricultural sector [35]. The result is consistent with the farmer's predicament. According to the interview, the agriculture industry's primary issue is restricted access to capital sources. The second finding relates to the lack of a role for Islamic banking in agricultural financing due to a feeling of considerable risk and a lack of competent human resources to keep agricultural financing. Due to negative shocks in direct payments and solvency, [18] discovered that agriculture income has decreased. Our findings do not support the hypothesis that increased direct payments would increase agricultural income. Moreover, while solvency has a negative impact on agriculture income, investment has a positive impact on agriculture income. [37] demonstrated that operational costs, profitability, and risk mitigation strategies are the most crucial factors for banks to consider when financing the agricultural sector with Bay' Salam. As a means of ensuring food security, [21] argued that the government should tailor its financing policies to increase agricultural output. It should address risk aversion among lenders and insufficient credit guarantee, subsidies, and agricultural budgetary allotments. It will ensure the lenders' commitment to agriculture and support agricultural insurance.

A strong direct correlation exists between agricultural development and higher farm productivity and production. The degree of reliance of the rural population on the land for subsistence is high in all states, with fewer regional variations; however, agricultural development shows greater regional variation, resulting in a low degree of parallelism between the two. [9] proved that financing variables in the economic sectors of agriculture, forestry, and agricultural facilities, trade, restaurants, and hotels significantly negatively affect Non-Performing Financing. [25] argued that higher economic growth was associated with higher total agriculture credit, a greater number of people employed in agriculture, forestry, and fishery, higher agricultural function expenditure, a greater proportion of households with access to safe water, and a higher literacy rate for the 15-year-old population. [3] argued that age, education level, income level, non-agricultural income level, saving ability, duration of working in agriculture, land size, and region are all significantly associated with farmers' preference for using Islamic banks. Knowledge level, belief of religious conformity, ability to save, and cost concern are statistically significant determinants of the likelihood of using Islamic banks.

The analysis of the share of gross value added in the Gross Domestic Product of agricultural entities revealed that agriculture's share in the Kyrgyz Republic is declining [14]. In addition, there is a slight improvement in the lending practices of commercial banks and credit institutions. [38] showed that the agricultural sector was perceived to be quite risky, resulting in low funding commitments from financial institutions. The results of credit programs using the interest system are unsatisfactory. Consequently, this can result in contemporary issues such as increased debt and poor credit among farmers. The study concludes that Sharia financing can potentially strengthen agricultural sector capital. [17] argued that. Credit access is more significant in Organisation for Economic Co-operation and Development (OECD) countries than in nations with a lower level of economic development. The analysis enables us to highlight the specific effects of credit in stimulating the development of the agricultural sector: in developing countries, credit access has a significant impact on production, while in developed countries, it also affects productivity.

2.1 Hypotheses

This study proposes the following hypotheses to figure out the relationships between the selected independent and dependent variables:

1. Growth of Non-Performance Financing in Agriculture has a positive and significant effect on the proportional growth of agriculture because of banking support for the agriculture sector and the banking industry's stability. Thus, despite the increased risk associated with the agriculture industry, the financing support stays robust to increase the sector's productivity and economic contribution to farmers.
2. Due to the boom phase of business cycles, inflation has a positive and significant effect on the proportional growth of agriculture. During the boom phase of the business cycle, even though the inflation rate rises, the demand for goods stays high because purchasing power can offset this increase. This condition will persist until the business cycle enters the phase of expansion.
3. Margin in Agriculture Financing has a significant and positive effect on the proportional growth of agriculture. It is due to increased agricultural profitability. Consequently, there is a relationship between the financing costs incurred by the banking sector and the return of agricultural products.
4. Growth in credit/GDP in agriculture has a positive and significant impact on the growth of agriculture's proportion. It shows a financial expansion in the agricultural sector. The financial expansion enables farmers to use bank financing to improve their agricultural techniques, increasing their income.

5. The ratio of financing to time deposits has a significant and positive impact on the proportional growth of agriculture. It exists due to banking support and commitment to expanding agriculture, as this sector requires financial aid to increase its productivity and output.
6. Covid-19 has a negative and significant impact on agricultural proportion growth. It reflects the structural economic change in the economy that restricts the mobility of people and decreases productivity.

3 Materials and methods

Using Quarterly Data from 2010:3 to 2021:4, this study examines the effects of a few selected variables on agriculture's proportional growth in Indonesia. The data was selected to capture various cycles in the economy, either normal or crisis. The information is obtained from the Statistical Central Board (BPS). These intervals span the non-pandemic and pandemic periods. Variables employed are:

1. As an independent variable, GFinPDT refers to the proportion of Growth between Financing in Agriculture and Total Time Deposit in Islamic Banks. The data is presented as a percentage.
2. Margin (MARGIN) of Islamic Banks in Agriculture as an independent variable referring to the rate of return provided by Islamic banks in the agriculture sector. The data is presented as a percentage.
3. As a dependent variable, GGDPRGDPT is the Proportion Growth of GDP share in Agriculture over Total GDP. The data is presented as a percentage.
4. GCPGDPP is the Growth Proportion between Agriculture Financing and Agriculture GDP as an independent variable. This refers to the total amount of financing provided by Islamic banks to the agriculture sector. The data is presented as a percentage.
5. The rate of inflation (INFLATION) refers to the increase of food, beverage, and tobacco price inflation and is treated as an independent variable. The data is presented as a percentage.
6. GNPFP is the independent variable Proportion Growth of Non-Performing Financing in Agriculture Sector. The data is presented as a percentage.
7. As an independence variable, Covid 19 (COVID) contains the binary data (0 and 1) 0 and 1. The binary data represents the period of covid-19 in Indonesia, where period of 2010:3 to 2019:4 is set to 0 (no pandemic) and period of 2020:1 to 2021:4 is set to 1 (pandemic) (pandemic period).
8. GGDPRGDPT is the percentage growth of the agriculture's Gross Domestic Product (GDP) share over the total GDP in Indonesia. The data for this dependent variable are expressed as a percentage.

Ordinary least square is the method used, along with several classical assumption tests, such as the multicollinearity test, heteroscedasticity test, autocorrelation test, normality test, and linearity test. Principal assumptions of linear regression include a linear relationship. Multivariate normality, negligible or no multicollinearity, the absence of autocorrelation, and homoscedasticity. The model's specification are as follows:

$$GGDPRGDPT_t = a_0 + a_1 GFinPDT_t + a_2 MARGIN_t + a_3 GGDPRGDPT_t + a_4 GCPGDPP_t + a_5 INFLATION_t + a_6 GNPFP_t + a_7 COVID_t + e_t \quad (1)$$

Where, *GGDPRGDPT* was the proportional growth of agriculture's Gross Domestic Product (GDP) share over total GDP; *GFinPDT* was Ratio of Growth between Agriculture Financing and Total Time Deposits in Islamic Banks; *MARGIN* was Margin in Agriculture for Islamic Banks; *GGDPRGDPT* was Proportional Growth of Agriculture's Share of GDP over Total GDP; *GCPGDPP* was Proportional increase between Agricultural Financing and

Agricultural GDP; *INFLATION* was Inflation Rate; *GNPFP* was Proportional Growth of Non-Performing Agriculture Financing; *COVID* equals the pandemic covid-19 viruses; *a0*,…7 was estimator; *t* was time; *e* was Error Term.

4 Results and discussion

According to Table 1, no classical assumption tests, such as normality, autocorrelation, multicollinearity, and heteroscedasticity, apply to any data. These tests show.

1. In the absence of autocorrelation, residuals are independent. In time series data, there is no correlation between consecutive residuals.
2. No Multicollinearity denotes a linear relationship, i.e., the independent and dependent variables have a linear relationship.
3. No Heteroscedasticity denotes that the residual variance is constant across all independent variable levels.
4. Normality shows that the residuals of a model have a normal distribution.

The summary mentioned above shows that the constructed model satisfies the OLS linear regression model, and thus the estimators are valid. Equation 1 depicts the estimation model for the estimators denoted by C, including the sign (positive or negative). In the meantime, equation 2 displays the signs and values of the estimator for each variable. R^2 indicates that the variation of all independent variables can account for 91% of the variation of the dependent variable; other variables explain the remaining 10%.

Table 1. Classical Assumption Tests Summary

No	Classical Assumption Tests	Measurement	Remark
1	Auto Correlation	Prob. Chi-Square (1) 0,7714 > 0,10	No Autocorrelation
2	Multicollinearity	Correlation matric < 0,85	No Multicollinearity
3	Heteroscedasticity	Prob. Chi-Square (26) 0,5213 > 0,10	No Heteroscedasticity
4	Normality	Prob. Jarque – Bera 0,47 > 0,10	Normal

Estimation Equation:

$$GGDPRGDPT = C(1)*GNPFP + C(2)*INFLATION + C(3)*GFINPDT + C(4)*GCPGDPP + C(5)*COVID + C(6)*MARGIN + C(7) \quad (2)$$

Table 2. Regression Results

Dependent Variable: GGDPRGDPT			
No	**Independent Variable**	**Coefficient**	**Significance**
1	CONSTANTA	4.383	Not Significant
2	GNPFP	-0.028	Not Significant
3	INFLATION	1.052	Not Significant
4	GFINPDT	0.401	Significant at 1%
5	GCPGDPP	0.701	Significant at 1%
6	COVID	0.414	Not Significant
7	MARGIN	0.610	Not Significant
Adjusted R^2 = 0.91			

According to equation 2, we can infer the following relationship between variables:

1. **Relationship between Proportion Growth of Non-Performing Financing (GNPFP) and Proportion Growth of Gross Domestic Product (GDP) Share in Agriculture in Relation to Total GDP (GGDPRGDPT).**

Given that banks rely on external financing, the GNP per capita is related to the banks' viability. Thus, a bank's ability to generate income and profit would be affected if the

financing is not performing well or if it defaults. Referring to the regression result, the size of the relationship could be either positive or negative. If the indicator is positive and significant, it shows that Islamic banks are not alarmed by the increase in non-performing loans (NPF). In other words, under these conditions, Islamic banks can absorb any potential shocks caused by a higher level of NPF, while staying committed to financing the agricultural sector.

In contrast, if the sign was negative and significant, it shows that Islamic banks are sensitive to defaults in the agriculture sector financing funds. Credit access becomes the primary means for farmers to increase their level of productivity, in line with research [5,11–19]. Thus, the lower financing funds would reduce their operational ability to raise the quality and quantity of agricultural products.

Equation 2 shows that the variable is statistically negative, but not significant, showing that the agriculture sector receives a negative response from the banking sector when its defaults on financing are greater. However, statistical significance is lacking in this instance, showing that the agricultural sector in Indonesia does not rely heavily on bank financing. It may be because some farmers are not bankable or because they manage the agriculture sector through a partnership program [27].

2. **Relationship between Inflation (INFLATION) and Gross Domestic Product (GDP) share growth in agriculture compared to total GDP growth (GGDPRGDPT).**

The inflation rate is proportional to the purchasing power of consumers compared to goods and services. If the inflation rate is positive and significant compared to GGDPRGDPT, it shows that the inflation is demand-pull inflation, where people have strong demand or buying power because the economy is in an expansionary phase. In the meantime, if negative and significant, cost push inflation existed and people's purchasing power began to decline.

Per the second equation, the sign is positive but insignificant. It shows that the rate of inflation would have a small but positive impact on the proportional growth of agriculture's GDP, in line with research [39]. Since it is classified as a primary need, it implies that consumers will continue to buy farmers' products despite rising inflation. In addition, the traditional management system in Indonesia's agricultural sector is another reason the production of goods cannot increase GDP, despite the positive effects of inflation on GDP.

3. **Margin (MARGIN) and proportional growth of Gross Domestic Product (GDP) share in agriculture compared to total GDP (GGDPRGDPT).**

Margin relates to the return of financing for agriculture in Islamic banks. It also stands for the cost of capital associated with the agricultural sector's productivity level. A higher margin shows that this industry has a greater return from a banking standpoint. A positive indicator shows that agriculture sector productivity is at its highest level, thereby promoting the sector's growth. A negative sign shows that the GDP responds negatively to a higher margin. There are a number of causes, including a decrease in productivity and an increase in the dangers posed by product quantity or climate change.

According to equation 2, the sign is positive but not statistically significant, showing that the return on investment in this sector is low and insufficient for generating profits due to traditional management and a low level of productivity, in line with research [13].

4. **Relationship between the proportional growth of agriculture's financing and gross domestic product (GCPGDPP) and the proportional growth of agriculture's share of total GDP (GGDPRGDPT).**

GCPGDPP refers to the agricultural sector's financial development in Indonesia. Financial deepening refers to the expansion of the availability of financial services. It can refer to both a broader choice of services and improved access to bank financing for farmers. If the sign is positive and significant, it shows that the development of the agriculture sector leads to the expansion of the financial sector. In other words, as the agricultural sector grows, so does the

demand for financial services. In contrast, if the negative sign and significance are present, the finance sector precedes the agriculture sector, and as agriculture expands, the finance sector expands. In other words, the growth of the agriculture sector is contingent upon financial support.

According to the second equation, the sign is significant and positive. It suggests that the agriculture sector in Indonesia leads the growth of the financial sector. It also notes that agricultural GDP has a strong correlation with the growth of agricultural products financed by banks. This finding shows that the development of the agricultural sector in Indonesia must be managed by integrating sound managerial skills with financial sector support as a source of financing [40].

5. Relationship between proportion Growth between Financing in Agriculture and Total Time Deposit in Islamic Banks (GFINDT) and proportion Growth of Gross Domestic Product (GDP) Share in Agriculture in Relation to Total GDP (GGDPRGDPT).

GFINDT refers to the level of intermediation of deposited funds (time deposits) for agriculture sector financing. The positive indicator proves Islamic banks' dedication to fostering the expansion of agriculture's financial infrastructure. Conversely, the negative sign shows that a negligible proportion of banks' financing comes from deposited funds.

According to the second equation, the sign is significant and positive. It is consistent with earlier findings on financial deepening that the banking sector must provide financial support. Given that agriculture sector banking intermediation is greater than financial sector banking intermediation, agriculture sector GDP proportional growth would increase if agriculture sector were assumed to lead financial sector [41].

6. Relationship between COVID-19 (COVID) and the proportional growth of agriculture's share of total Gross Domestic Product (GDP) (GGDPRGDPT).

Covid-19 has altered Indonesia's economic structure. This modification may reduce either the agricultural or total income. From a macroeconomics standpoint, covid-19 may alter business cycles from boom to bust or bust to boom (procyclicality behaviour). If the indicator was positive, it showed that covid-19 did not have a negative impact on the agricultural sector, as this sector continued to run normally (resilience condition). In contrast, a negative sign showed that covid-19 had a negative impact on the agricultural sector (vulnerability impact).

The sign is positive but insignificant according to equation 2. It implies that Covid-19 has negligible impact on the agriculture sector, given that it is the primary sector for human life. However, because the level of productivity is not yet best, its contribution cannot increase the national income proportionally. In addition, the report shows that agriculture is a resilient industry despite the pandemic, though it requires improvement.

Several intriguing findings indicate that the development of the agriculture sector in Indonesia must integrate improvement in agriculture itself by increasing the level of productivity through more professional managerial skill and technological application, and continuous support from the banking sector for further financial deepening, by allocating a greater proportion of deposited funds for agriculture sector financing. In addition, the agriculture sector is resilient during the pandemic because its products are not particularly sensitive to price fluctuations because they are essential to human survival. Therefore, promoting growth in the agriculture sector needs an integrated factor including farmers' abilities to further deepen the sector through financial institution support and banks' financial support through a proportional allocation of deposited funds to financing instruments for the agriculture sector.

5 Conclusions

The proportion of agricultural GDP to total GDP serves as a critical indicator of the agricultural sector's performance, displaying its susceptibility to periodic fluctuations. These fluctuations are influenced by the sector's resilience to various internal and external shocks, including managerial and banking sector support, as well as macroeconomic conditions. Given its small share of national income, any shocks experienced by the agricultural sector can significantly affect Indonesia's agricultural industry. Through the evaluation of quarterly data and multiple regression techniques, empirical studies have shed light on several key findings:

Firstly, the financial resilience proved by Islamic banks in Indonesia enables them to effectively manage the risks associated with bad loans in the agricultural sector, safeguarding their ability to provide financing to agricultural enterprises. Despite the lack of profitability, Islamic Banks continue to prioritize agricultural financing, emphasizing their commitment to supporting the sector's growth and development. Moreover, Islamic bank support for intermediation stays pivotal in driving an increase in the agricultural sector's income share, highlighting the importance of financial institutions in helping agricultural expansion.

Secondly, while support for intermediation is crucial, its success relies heavily on the collaboration and ability of agricultural actors. By using agricultural ability, financial institutions can ensure that agricultural financing initiatives generate substantial added value, fostering sustainable growth within the sector. Additionally, despite inflationary pressures within the economy, the agricultural sector appears resilient, with consumers continuing to prioritize the purchase of primary agricultural products.

Lastly, amidst structural changes and economic decline, the COVID-19 pandemic has surprisingly had minimal impact on people's consumption of agricultural products. This resilience underscores the enduring importance of the agricultural sector in providing essential goods and sustaining societal needs during times of crisis. In conclusion, the findings highlight the resilience of the agricultural sector in navigating challenges and emphasize the critical role of Islamic banks and agricultural stakeholders in driving its continued growth and development.

5.1 Recommendation

Strengthen Islamic banks' support for the agricultural sector, they should focus on increasing their Capital Adequacy Ratio (CAR) to enhance financial resilience and ensure continued financing for agricultural stakeholders. Additionally, creating a specialized financing scheme tailored to the agricultural sector with favourable terms is crucial for addressing the unique challenges in this field and promoting sustainable growth. Islamic banks should also aim for a best Financing-to-Deposit Ratio (FDR) to balance liquidity needs while meeting the demand for agricultural financing. Increasing musharakah financing in agriculture is another effective strategy, as it enhances managerial abilities and promotes transparency and accountability. Therefore, the government should implement countercyclical policies to stabilize the economy and protect buying power, ensuring long-term agricultural growth and resilience, particularly during economic fluctuations. These measures will help sustain agricultural development, even during challenging times like pandemics when demand for agricultural products stays stable.

5.2 Future Studies

Analysing the ideal inflation rate is essential to ensuring the agricultural economy's sustainability. To withstand shocks from agricultural sector risks, it is also necessary to

carefully examine the computation of the Capital Adequacy Ratio (CAR), the best way to distribute financing, the Financing to Deposit Ratio (FDR), and the ideal part of financing for the musharakah scheme in Islamic banking. It is also crucial to incorporate the digital economy into the technical sides of the agriculture sector. It is critical to gauge public interest in buying agricultural products during the pandemic. In addition, to help the growth of the agricultural sector, it is necessary to incorporate climate change issues, Islamic social finance instruments like waqf and qard, and infrastructure variables like irrigation, road access, and agricultural sector education. Finally, while applying for loans with Islamic banks, applicants must consider various aspects, including age, education level, income, and non-agricultural income as well as savings ability, years of agricultural experience, land size, and region.

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