ISSN NO: 2770-0003
October 2024

The impact of Agriculture productivity on economic growth in Brazil

Otabaev Yodgorbek Marim o'g'li, Turin Polytechnic University in Tashkent, Senior Lecturer
Email: yotabaev777@gmail.com. Tel: (97) 423-06-03

Abstract
This study employes the time-series data analysis in terms of examining the impact of agriculture productivity on economic growth in case of Brazil throughout the period of 1973 and 2022. The outcomes of previous studies have been vary based on their empirical and theoretical approaches. The ARDL cointegration model is employed so as to interpret both short and long run relationships of independent variables with dependent variable. The outcome of this study suggested that, agriculture productivity is proposed to have negative impact on economic growth of concerned country in both short and long run relations. In addition to this, as a controlling variable some other variables are involved such as Inflation, gross capital formation, labor force and trade openness, the impact factor of those variables are also provided in the further paragraphs deeply. According to this, gross capital formation and labor force have presented positive integration while other variables showed the negative influence on economic growth during the provided time period in case of Brazil
Keywords: Brazil, Agriculture productivity, Economic growth, the ARDL model,

Introduction

One of the few nations with the ability to raise agricultural output is Brazil, which is the biggest nation in terms of arable land and ranks fifth in terms of size and inhabitants. Brazil has been strengthening its position as an important manufacturer of food goods and agricultural products, as well as a supplier to global markets, over the last 20 years. It is currently the world's greatest net exporter and in the top 5 producers of 34 products. Brazil's agricultural development plan is still centered on markets and diversification of goods and ongoing trade development. The long-term expansion of Brazilian agriculture is being hampered, meanwhile, by rising fertilizer and energy prices, restrictions on finance and preservation, an overworked port and transportation infrastructure, and environmental preservationist pressures.

Throughout the previous 20 years (2000–20), Brazil's the agricultural sector, encompassing crop cultivation and raising animals, has increased in worth by an average of 8% year when valued in U.S. dollars. During this time, agricultural output has doubled and livestock production has tripled. Brazil's transition from a large exporter of mostly tropical agricultural items like coffee, sugar, citrus, and cocoa to a major worldwide supplier of goods involving soybeans, grains, cotton, ethanol, and meats has quickened since the mid-2000s. One crop that has been particularly important to Brazil's agricultural sector's development and its rise to prominence as a major supplier of agricultural products worldwide is soybeans. Brazil's soybean exports currently account for 20% of US exports, compared to 40% of US exports in 2000. Brazil produces crops on 17% of its agricultural land, which accounts for over fifty percent of the global soybean industry. From 2000 to 2021, the worth of Brazil's agrarian exports—which include manufactured goods—grew by 9.4% annually on an average basis, making up 37% of the country's overall exports. Brazil is currently the third-biggest agricultural goods supplier in the world, after the United States and the European Union (EU), and it sends significant agricultural commodities and food items to 222 nations and regions.

Brazil is changing due to a number of factors, including higher yields from research on agriculture, a growing amount of agricultural land, substantial investments in methods of cultivation to create new crop and look for food different types, and a rise in worldwide demand for food and feed for animals, especially in the last ten years. Most importantly, Brazil stands out from other nations that produce grains and soybeans due to its capacity to harvest two to three harvests annually on the same piece of land. Additional variables involve macroeconomic policies focused on exports, protracted periods of the real's amortization, agricultural policy rewards tailored to particular crops, enhanced hygienic controls, the enlargement of foreign rivals, and an increasing number of foreign investments and multinational corporations operating in the nation.

ISSN NO: 2770-0003
October 2024

Brazil's GDP was made up of 8% of the country's livestock and agricultural manufacturing in 2021. Brazil's food and agricultural industry is anticipated to contribute 29 percent of the country's GDP, which is expected to reach $1.8 trillion in 2021, assuming manufacturing and distribution are taken into consideration by the University of São Paulo's Center for Advanced Studies on Applied Economics. A report from Brazil's most recent agricultural census, 15.1 million people work in rural enterprises related to agriculture, which accounts for 15% of the workforce.

Due in large part to reduced capital as well as land expenses, Brazil's resource costs for farming are lower than those of its rivals, making it simpler to expand area and boost production. Since local demand from customers has not kept up with output expansion, excess production is available for further exports. In 2021, Brazil's agricultural exports were valued at $125 billion, with the main commodities being citrus, sugar, corn, cotton, cattle, chicken, soybeans and soybean meal. The main driver of Brazil's export development remains the country's increasing interest from China. China made for 70% of Brazil's entire soybean export market in 2021 and 39% of all agricultural products exported from Brazil.

Literature Review

Essentially, there are several viewpoints in the theoretical field regarding how productivity in agriculture contributes to current economic growth. Several contend that when nations engage in massive farmers, agriculture can lead to economic development (Reardon and Berdegue, 2006; Maxwell, 2004; Collier and Dercon, 2009). Therefore, it is doubtful to what degree impoverished small-holding producers would benefit or promote to growth as a result of a pro-agriculture policy. Conversely, for others, employment opportunities and the growth of jobs in unconventional agro export industries might represent an indirect source of gain (Anriquez and Lopez, 2007; Maertens and Swinnen, 2009). Gollin (2010) also discussed the industry's contribution to national growth, pointing out that just because the agricultural industry is vast, it doesn't always follow that it would be the main driver of economic expansion. In actuality, compared to the rest of the economy, the agriculture sector in the majority of developing nations has extremely poor output. For him, growth may not come from growing a low-productivity sector. Put differently, in emerging nations such as the SSA, agriculture can only become a growth-driven sector through efficiency.

Awan et al. (2015) utilized economic indicators such as the gross domestic product, the consumer price index, the total labor force, fixed capital formation, agriculture exports, and other industries trade to evaluate and measure the contribution of agriculture trade to the economic expansion of Pakistan. They also calculated the connection between Pakistan's exports of agricultural goods and other than agriculture exports of goods. Statistics for a time series covering the years 1972–2008 was collected. The International Monetary Fund, Pakistan Bureau of Statistics, Pakistan State Bank, and the Economic Survey of Pakistan were the sources of the data. The importance of the association between economic factors was assessed using the granger causality models, vector error correction, Johansen co integration, and ordinary least square models. The findings indicate that exports other than agricultural products have a positive and considerable impact on economic growth, but exports of agricultural products have no such impact. There is a two-way causal relationship between the gross domestic product and non-agricultural exports. The Pakistani government was advised to take action to transform agriculture exports into goods with added value. Awokuse et al. (2009) made an effort to look into the ever-changing connection that exists between the efficacy of farming and growth in the economy in overall. They did this by using analysis of time series on fifteen economies that were developing or transitioning in Latin America, Asia, and Africa. Real export, agriculture value added per worker, real GDP per capita, population as an indicator for employment, and gross capital formation per employee as a proxy for investment were the economic indicators. Data were gathered from World Bank development indices and worldwide monetary systems from 1971 to 2006. To determine the empirical relationship between factors, the auto regressive distributed lag model and mutual integration were utilized. According to the findings, agriculture is a key factor for economic growth and development. The role of private and governmental investment in resources to infrastructure and agricultural expansion is supported by empirical research. It has been suggested that trade openness has a beneficial and beneficial effect on GDP per capita.

Awan et al. (2014) made an effort to examine some of the prerequisites for Pakistan's future economic growth as well as the effects of important macroeconomic indicators on the country's economic progress following the SAP restructuring project. The following economic indicators were considered: inflation annually, GDP per capita, trade openness measured as exports + imports / GDP, credit to private companies as a percentage

ISSN NO: 2770-0003
October 2024

of GDP for financial growth, and openness to finance represented by foreign direct investment. The time series information from 1991 Q1 to 2007 Q4 were obtained from the Global Financial Statistic, the Economic Survey of Pakistan, and Araby and Kemal (2004). The experimental association between each factor was determined using an auto regressive distributed lag model. The findings indicate that some of the incidental elements for Pakistan's continued economic growth following the structural adjustment program are still present. ARDL F-statistics verify the long-term association. The development of the nation's economy had a positive relationship with the growth of the banking industry, openness to trade, and remittances; the growth of the economy and inflation corresponded negatively.

There is some debate over the relationship between agricultural and economic development, despite the primary objective of numerous research. Although certain scholars (Gollin, Parente & Rogerson, 2002; Thirtle, Lin & Piesse, 2003) contend that agriculture ought to be the cornerstone of economic expansion, other individuals (Ranis and Fei, 2011; Jorgenson, 2014) contend that agriculture's creative structures and connections to other industries are insufficient.

Yet rather than being seen as a rivalry, the connection between the agricultural industry and other industries should be seen as interconnected, with stronger links allowing demand as well as supply in each area to be met (Adelman, 1984; Sabry, 2009). As an illustration, manufacturing is a crucial sector, and any country aiming for growth should seek to fortify its industrial base (Lewis, 1954). However, given the role that agriculture plays in the pursuit of modernization cannot be disregarded, as in the case of Nigeria.

Those who promote agriculture-led growth (ALG) contend that the growth of the agricultural sector is a necessary condition for manufacturing. This is because it increases rural incomes, provides industrial raw materials, creates a domestic market for industry, and, most importantly, releases assets for the benefit of industry (Schultz, 1964; Timmer, 2004). The corporate industry's preference for farming will only result in sluggish economic growth and income disparity. Thus, agriculture is a necessary and sufficient condition for igniting modernization in the early phases of development, even though it might not be able to entirely transform the economy (Byerlee, Diao, & Jackson, 2005).

The expansion of agricultural manufacturing for industrial uses is one indication of the connection between the agricultural and industrial sectors, according to a number of research studies (Mondal, 2014; Olmstead & Rhode, 2007; Souza, 2014). Earlier study findings suggested that the economy is undergoing a structural shift away from farming and manufacturing. A nation's manufacturing industry constantly develops alongside increases in efficiency and profitable development in the agricultural industry, according to a number of neoclassical economic growth theories and empirical studies of earlier research (Cervantes-Godoy & Dewbre, 2010; Kniivilä, 2004). A strong agriculture sector is necessary for the future growth of both the service and industrial sectors in a number of advanced countries (Briones & Felipe, 2013). In broad terms, expansion occurs in phases. The initial stage focuses on the growth of the farming sector and the industry that produces agricultural production amenities. The second phase focuses on the agricultural sector supporting the agro-industry, which in turn evolved to the manufacturing of metals and machinery.

Current expansion history demonstrates how economic growth has evolved and how relationships and interactions emerge between different sectors, such as the connections and interactions between the manufacturing, service, and agricultural industries.

A vital role for developed nations in quickening economic growth is theirs. In the meantime, advanced countries play a similar role to those of oil-producing nations (Sahoo & Sethi, 2012). As evidence that certain nations have been successful in boosting economic growth via equality, the emergence of the manufacturing industry has had a major impact on the growth of the economy. Nonetheless, the nation experiences significant inequality (Sahoo & Sethi, 2012). Typically, the manufacturing industry dominates and expands more quickly than other industries. Nevertheless, manufacturing's share of GDP in low-income nations is rather modest, and its direct contribution to overall growth is minimal (Loren et al., 2008).

Qualified factory workers make up a larger portion of the workforce in industries such as manufacturing than novice farmers (Pingali, 2010). On the other hand, Awokuse & Xie (2014) asserted that no nation could advance its industrial sector if its agricultural sector did not continue to grow. Complicated connections between various sectors—especially the agricultural, industrial, and service sectors—lead to economic growth.

Depending on the policies implemented in each nation, every sector affects economic growth both directly

ISSN NO: 2770-0003
October 2024

and indirectly. Urbanchuk's (2009) research revealed that the industrial sector's output, including ethanol production, would add a major worth to the agricultural goods supplied and had made a big contribution to US economic expansion.

The results of Awokuse & Xie (2014) show that the agricultural sector indirectly affects overall economic growth, that can lead to improved calorie nutrition for the impoverished, food price equilibrium, employment opportunities, particularly in countries with low incomes, and the improvement of labour and capital quality—the two main production factors—as well as the reduction.

Furthermore, growth theory already acknowledged that the agricultural sector was a great way to finance the industrial sector's development (Loren et al., 2008). Proponents of the opposing viewpoint contend, contrary to the previous contention, that there isn't a significant relationship between the agricultural sector and other industries. Only productivity growth and a faster rate of export evolution in this industry require a sufficient inventive structure (Pingali, 2010; Stringer & Pingali, 2004).

By taking into account the possible contribution of agriculture, the empirical method of assessing its effect on economic growth—such as the research done by Botri (2013) and Singh (2010)—is helpful in the development of natural expansion theories. Moreover, research has been done by Dercon & Gollin (2014), Lin (2014), and Mcmillan et al. (2015) on the interconnection of the agricultural and industrial sectors, particularly in developing nations. According to their research, the expansion of the agricultural sector aided in the expansion of the industrial sector, although the two sectors could not have grown more apart.

Research question and objectives

The major research issue of this study is to investigate and measure empirically the influence of agriculture productivity on economic growth in case of Brazil throughout the period of 1980 and 2022. It is irrefutable fact that, the relationship between agriculture productivity and economic growth has been examined by a number of scholars in case of various countries. This topic is still considered as active area for modern world since the demand for agriculture products are rising alarmingly year by year. However, not many countries are able to contribute the fulfill demand for agriculture products throughout the world. Yet it is essential to note that, the role of Brazil is considerably high since this country is standing among one of the fifth nations in terms of making up high share of agriculture products exports around the world. Thus, studying the role of agriculture productivity on economic growth of the concerned country seems logical and the following objectives are standing for the major backbone of this interesting empirical study as follows:

- To clarify the significance of agriculture productivity
- To estimate the impact of agriculture productivity on Brazil’s economic growth
- To figure out vital determinants of agriculture productivity
- To estimate both short and long run behavior of agriculture productivity and its influence on economic growth of Brazil.

In the following paragraphs these objectives are going to be explained both theoretically and empirically in deep as possible as.

Methodology

A number empirical styles have been employed in terms of examining the role of agriculture productivity on economic growth. ARDL model is targeted to employ for this study in order to reveal the short and long run relationships between agriculture productivity and economic growth in case of Brazil. This section is going to deal with some basic econometric problems such as stationarity of the data, auto regressive distributed lags model and bound testing procedure which are targeted as the major empirical analysis of this study. As stated in the handbooks, the Augmented Dickey and Fuller (ADF) test is employed to find out the integration level of variables. This is because, the implication of ARDL model is based on the outcome of ADF test as if all variables are integrated in various orders like I(0) and I(1) and after that the implication of auto regressive distributed lags model (ARDL) might be employed. However, if all variables are found as integrated on only I(0), then the employment of ARDL model is regarded as not appropriate and instead the simple ordinary least square method (OLS) is utilized. Yet, if all selected variables are found as integrated on I(1), then the implication of Johansson co-integration technique is employed. So, as expected the variables are going to find as integrated in different levels, the general methodologic view of the model looks as the following:

$$GDPC = \beta_0 + \beta_1 GCF + \beta_2 ELF + \beta_3 TOP + \beta_4 INF + \beta_5 AgR + \varepsilon$$

ISSN NO: 2770-0003
October 2024

Based on the equation above, this is the general view of the model where, GDPC is using for real gross domestic production per capita in annual percentage growth standing for dependent variable. While the following variables are gross capital formation, employed labor force, trade openness, inflation and the major concerned independent variable agriculture value added are included in order to reveal the influence of them on the changes of dependent variable. As stated above, the major concern of this study is to illustrate the short and long run relationships of the selected variables with dependent variable and thus, the ARDL model is targeted to employ and below the general equation of both scenarios of the model is presented:

Short run relationship:

$$\Delta(GDPC)_t = \beta_0 + \sum_{i}^{a} = 1\,\beta_1(GDPC)_{t-i} + \sum_{i}^{b} = 0\,\beta_2(GCF)_{t-i} + \sum_{i}^{c} = 0\,\beta_3(ELF)_{t-i} + \sum_{i}^{d} = 0\,\beta_4(TOP)_{t-i} + \sum_{i}^{e} = 0\,\beta_5(INF)_{t-i} + \sum_{i}^{f} = 0\,\beta_6(AGR)_{t-i} + \beta_7(GDPC)_{t-1} + \beta_8(GCF)_{t-1} + \beta_9(ELF)_{t-1} + \beta_{10}(TOP)_{t-1} + \beta_{11}(INF)_{t-1} + \beta_{12}(AGR)_{t-1} \dots\dots\dots$$

The equation above shows the short run relationship between dependent and independent variables and Υ_0 is standing for providing information on intercept term as well as the short run coefficient of variables which are under this equation $\beta_1, \beta_2, \beta_3 \dots\dots\dots \beta_n$ and the long run estimations of the variables are as shown which are $\beta_7, \beta_8, \beta_9, \dots\dots\dots \beta_{12}$ $whereas, \varepsilon_i$ is the disturbance term and it involves all the ignored variables in the provided equation.

After implication of ARDL equation, the employment of the Wald test (F-statistics) is requested as it is used to reveal to observe whether there the long run relationship between dependent and independent variables is exist. The following equations are going to give information about hypothesis estimation:

Null Hypothesis

$$H_0 = \beta_7, \beta_8, \beta_9, \beta_{10}, \beta_{11}, \beta_{12} = 0$$

As it is standing for explaining no long run relationship

Alternative Hypothesis

$$H_a = \beta_7, \beta_8, \beta_9, \beta_{10}, \beta_{11}, \beta_{12} \ddagger 0$$

The alternative hypothesis is standing for providing information about as there is long run relationship between variables. Which hypothesis should be selected is observed by the outcome of F-test and if the result of F-test becomes greater than the tabulated value then the alternative hypothesis is accepted and the conclusion can be as there is long run relationship between variables, whereas if the opposite observed then, null hypothesis is accepted and this means that, there is found as no long run relationship between variables.

Long Run Relationship

$$(GDPC)_t = \alpha_0 + \sum_{i=1}^{z1} \alpha 1i\,(GDPC)_{t-i} + \sum_{i=0}^{z2} \alpha 2i\,(GCF)_{t-1} + \sum_{i=0}^{z3} \alpha 3\,(ELF)_{t-1} + \sum_{i=0}^{z4} \alpha 4\,(Top)_{i-1} + \cdots\dots\dots + \varepsilon_i.$$

Augmented Dickey Fuller test

Clarifying on the basic econometric issues in time series data is related with observing regarding to stationarity of data, auto regressive distributed lags model and bound testing procedure. For identifying the stationarity of data, the Augmented Dickey and Fuller (ADF) test is employed so as to specify the order of integration. The implication of ARDL model should be justified on the basis of ADF test like if all variables are integrated in various orders like I (0) and I (1) only then auto regressive distributed lags model (ARDL) suggested to use. If all variables are integrated on I (0) the implication of simple ordinary least square method (OLS) is preferred. In addition to this, if all variables are integrated on I (1), then the implication of Johanson co-integration technique is proposed to employ and the following table gives information regarding to the outcomes of ADF test.

Variables	Test statistics	1% critical value	5% critical value	10% critical value	At levels
GDPC	-5.25	-3.594	-2.963	-2.602	I(1)
ELF	-6.938	-3.594	-2.963	-2.602	I(1)
INF	-3.553	-3.587	-2.933	-2.601	I(0)
TOP	-6.972	-3.594	-2.963	-2.602	I(1)

ISSN NO: 2770-0003
October 2024

GCF	-6.750	-3.594	-2.963	-2.602	I(1)
AGR	-10.493	-3.587	-2.933	-2.601	I(0)

Source: Author's calculations.

As shown in the above table some variables are observed in mix trend. Some variables such as inflation and agriculture productivity are integrated at level, while economic growth, labor force, trade openness and gross capital formation are found as integrated at 1st order. Thus, as variables are integrated in different orders, the implication of ARDL model is argued as applicable for further research study.

Bounds test

note: estat btest has been superseded by estat ectest
as the prime procedure to test for a levels relationship.
(click to run)

Pesaran/Shin/Smith (2001) ARDL Bounds Test

H0: no levels relationship F = 4.565
t = -3.449

Critical Values (0.1-0.01), F-statistic, Case 3

[I_0]	[I_1]	[I_0]	[I_1]	[I_0]	[I_1]	[I_0]	[I_1]
L_1	L_1	L_05	L_05	L_025	L_025	L_01	L_01
2.260	3.350	2.620	3.790	2.960	4.180	3.410	4.680

accept if F < critical value for I(0) regressors
reject if F > critical value for I(1) regressors
Critical Values (0.1-0.01), t-statistic, Case 3

[I_0]	[I_1]	[I_0]	[I_1]	[I_0]	[I_1]	[I_0]	[I_1]
L_1	L_1	L_05	L_05	L_025	L_025	L_01	L_01
-2.570	-3.860	-2.860	-4.190	-3.130	-4.460	-3.430	-4.790

accept if t > critical value for I(0) regressors
reject if t < critical value for I(1) regressors
k: # of non-deterministic regressors in long-run relationship
Critical values from Pesaran/Shin/Smith (2001)

As presented in the result of Bounds test, which is conducted in order to show whether there is long run relationship exist between variables or not. As shown in outcome, the variables are also integrated in the long run and below the long run ARDL model result is also presented.

Findings and Results

Descriptive Statistics

The following table is providing information on some important statistics of the selected variables, and according to this, the dependent variable is explained by economic growth which is generated by collecting data on GDP per cap in case of Brazil throughout the period of 1973 and 2022. In response to this, the mean value of economic growth is found as 6998 USD while the min and max values are considered as between 4699 and 9216 USD respectively in different periods of time in case of Brazil. As stated in the topic, the major interest of this study is to explain empirically the influence of agriculture productivity on economic growth in Brazil throughout the period and regarding to the average value of the agriculture value added it is argued as

ISSN NO: 2770-0003
October 2024

being equal to 3.287 which is found as considerably higher by compared to other agriculturally developed nations. Information about other controlling variables is also involved in the table below.

Variable	Obs	Mean	Std. Dev.	Min	Max
Economic growth	50	6998.317	1253.974	4699.44	9216.132
Agriculture value ~d	50	3.287	4.662	-8.02	14.97
Gross capital form~n	50	2.272e+11	7.907e+10	1.212e+11	4.047e+11
Inflation	50	251.699	595.407	3.195	2947.733
Labor force	50	79056336	16914074	62129127	1.084e+08
TO	50	.184	.072	.096	.288

Correlation Matrix

Checking the correlation of variables with each other is essential in empirical analysis, since observing higher level of correlation might cause to multicolliniarity issue in the model. Thus, taking consideration on correlation of variables is pivotal and according to the table, there is negative correlation has been found at (0.036) percent which means that, with high probability there is opposite relation between economic growth and agriculture productivity. In addition to this, high level of correlation has been observed between economic growth and gross capital formation at 0.954 percent which means that there is high level of similarity in meaning of the variables. On top of that, the correlation between inflation and economic growth has revealed as having negative correlation at (0.283) percent. The correlation of remaining variables is also provided below, in first glace there seems to have some model related issues as there are high level of correlation have observed in case of several variables.

Variables	(1)	(2)	(3)	(4)	(5)	(6)
(1) Economic_growth	1.000					
(2) Agriculture_va~d	-0.036	1.000				
(3) Gross_capital_~n	0.954	-0.006	1.000			
(4) Inflation	-0.285	-0.157	-0.332	1.000		
(5) Labor_force	0.933	-0.060	0.886	-0.366	1.000	
(6) TO	0.929	-0.048	0.909	-0.323	0.978	1.000

OLS Results

According to the table below, there is outcome of linear regression analysis is provided and in response to this, one percent changes in the value added of agriculture cause to rise of economy by 2.15 USD, but as revealed below, the influence of this factor is argued as statistically insignificant. It is essential to note that, the sign in the relationship between agriculture value added and economic growth has presented the same conclusion as mentioned in previous studies, but it is not statistically significant, this condition can be mitigated by implication of some advance econometric approaches and in the further stages information about those approaches will be delivered with clear explanations. Furthermore, the relationship of other selected controlling variables has represented statistically significant influence on economic growth while the sign value of them is difference in accordance on directional relations of them with dependent variable as shown in the table below. To be more precise, one percent changes in the level of gross capital formation results in rise of economy by the value of coefficient and the most noticeable fact that the influence of this variable is found as statistically significant at 1 percent significance level. On top of that, while this seems as unusual, if country observe grossing level of inflation, this can be argued as the country has high demand for services and products in general, and this particularly leads to economic growth and as seen in the outcome, one percent of inflation is found as causing to rise of economy by 0.183 percent and it is also found as statistically significant at 5 percent significance level in case of Brazil throughout the selected periods. The impact factor of other selected controlling variables is also matched the findings of previously conducted studies as shown in below.

Economic_growth	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Agriculture_value_~d	2.15	8.959	0.24	.511	-15.906	2.256	

ISSN NO: 2770-0003
October 2024

Gross_capital_form~n	1.5e-08	1.25e-09	8.43	.000	7.99e-09 1.30e-08	7.99e-09 1.30e-08	***
Inflation	.183	.077	2.39	.021	.028	.337	**
Labor_force	0.0055	.0000021 0	4.44	0	.0000293	.0000293	***
TO	-6151.866	3108.599	-1.98	.054	- 12416.83 7	113.104	*
Constant	1445.672	489.633	2.95	.005	458.882	2432.461	***

Mean dependent var	6998.317	SD dependent var	1253.974
R-squared	0.954	Number of obs	50
F-test	181.448	Prob > F	0.000
Akaike crit. (AIC)	710.612	Bayesian crit. (BIC)	720.172

*** $p<.01$, ** $p<.05$, * $p<.1$

Short-run relationship
ARDL(1,1,1,1,1,1) regression
Sample: 1974 - 2022 Number of obs = 49
F(11, 37) = 470.14
Prob > F = 0.0000
R-squared = 0.9929
Adj R-squared = 0.9908
Log likelihood = -296.11526 Root MSE = 117.2937

Economic_growth	Coef.	Std.Err.	t	P>t	[95%Conf.	Interval]
Economic_growth						
L1.	0.778	0.067	11.560	0.000	0.642	0.915
Agriculture productivity						
--.	-1.550	0.250	-6.200	0.000	-1.62	-0.062
L1.	-1.966	0.167	-11.70	0.000	-1.409	-0.476
Gross_capital_formation						
--.	0.820	0.015	8.890	0.000	0.615	0.965
L1.	-0.000	0.000	-3.750	0.001	-0.000	-0.000
Inflation						
--.	-0.009	0.038	-0.240	0.811	-0.086	0.068
L1.	-0.022	0.038	-0.590	0.558	-0.098	0.054
Labor_force						
--.	0.450	0.212	2.290	0.028	0.360	0.545
L1.	-0.000	0.000	-1.270	0.211	-0.000	0.000
TO						
--.	-2249.487	2260.087	-1.000	0.326	-6828.857	2329.884
L1.	-449.947	2569.146	-0.180	0.862	-5655.531	4755.637
_cons	402.894	246.850	1.630	0.111	-97.272	903.059

ISSN NO: 2770-0003
October 2024

Based on the requirement of ARDL model implication, prior to conduct both short and long run relationship regression analysis, the lags selection process of variables must be done in order to evaluate how long the lags selection process must be in terms of presenting the influence of them on current changes of dependent variable. As stated above almost all variables are found as lagging by one period back and the influence of them are revealed in the short run relationship table above. According to this, one percent changes in the level of agriculture productivity causes to reduction of economy in both periods by (1.550) and (1.966) percent in case of Brazil and the relationship between variables are found as statistically significant at 1 percent significance level. On top of that, gross capital formation and labor force have found as having positive impact on economic growth of Brazil and the impact factor of those variables are also found as statistically significant in short term. While the effect of other controlling variables such as Inflation and Trade openness presented negative integration with economic growth in short run relationship analysis, but it is essential to mention that, the relationship between those variables and economic growth has found as not statistically significant.

Long-run relationship

ARDL (1,1,1,1,3,1) regression

Sample: 1976 - 2022 Number of obs = 47

R-squared = 0.8380

Adj R-squared = 0.7742

Log likelihood = -279.05354 Root MSE = 109.4197

D.Economic_growth	Coef.	Std.Err.	t	P>t	[95%Conf.	Interval]
ADJ						
Economic_growth						
L1.	-0.278	0.081	-3.450	0.002	-0.442	-0.114
LR						
Agriculture productivity	-28.770	12.925	-2.220	0.0052	-35.583	-15.043
Gross_capital_formation	0.089	0.015	5.030	0.000	0.064	0.098
Inflation	-0.136	0.159	-0.860	0.397	-0.459	0.187
Labor_force	0.075	0.026	2.480	0.019	0.058	0.088
TO	-1.20e+04	6899.062	-1.730	0.093	-2.60e+04	2086.168
SR						
Agriculture productivity						
D1.	3.942	1.246	3.160	0.000	2.696	4.580
Gross_capital_formation						
D1.	0.0525	0.015	3.550	0.001	0.000012	0.000135
Inflation						
D1.	0.033	0.035	0.950	0.350	-0.038	0.105
Labor_force						
D1.	0.000139	0.000119	1.170	0.249	-0.000102	0.000381
LD.	0.000245	0.000136	1.810	0.080	-3.07e-06	0.000522
L2D.			0.290	0.774	-	

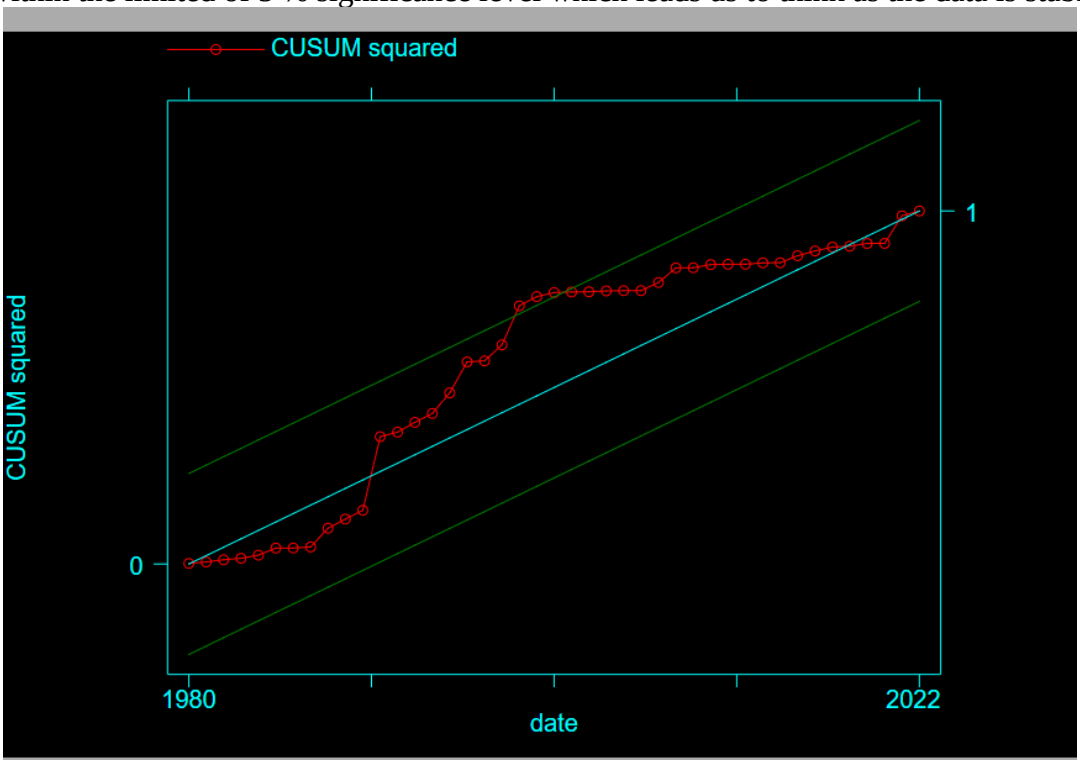
ISSN NO: 2770-0003
October 2024

	4.2000e6	0.000146			0.000256	0.00034
TO D1.	-74.149	2538.520	-0.030	0.977	-5238.808	5090.509
_cons	577.034	294.395	1.960	0.058	-21.917	1175.984

The table above is going to provide information about the long run relationship between variables and according to this, one year lag of economic growth leads to reduction of present year economic growth by (0.278) unit and it is statistically significant at one percent significance level. The major concern of this study agriculture productivity presented negative relationship with economic growth as it has shown in the short run relationship analysis. To be more precise, one unit increase in the agriculture productivity causes to drop down of economy by (28.770) unit in the long run and it is statistically significant at one percent significance level. As observed in the short run model the impact of gross capital formation and labor force have been positive and one unit rise in the level of gross capital formation and labor force cause to rise of economic growth by 0.089 and 0.075 units respectively and it is found as statistically significant at one percent significance level. Furthermore, one-unit changes in the value of inflation and trade openness lead to reduction of economy by (0.136) and (-1.20) units, but it is important to mention that, the integration of inflation is not statistically significant while that of represented statistically significant relationship with economic growth in the long run estimations.

Stability test

The following graph below is going to give information regarding to CUSUM stability test in auto regressive distributed lags method (ARDL) to present the stability of data. Based on the outcome of graph, the variables and data can be assumed as stable due to the fact that the cumulative sum of recursive residuals CUSUM graph is standing within the limited of 5 % significance level which leads us to think as the data is stable.



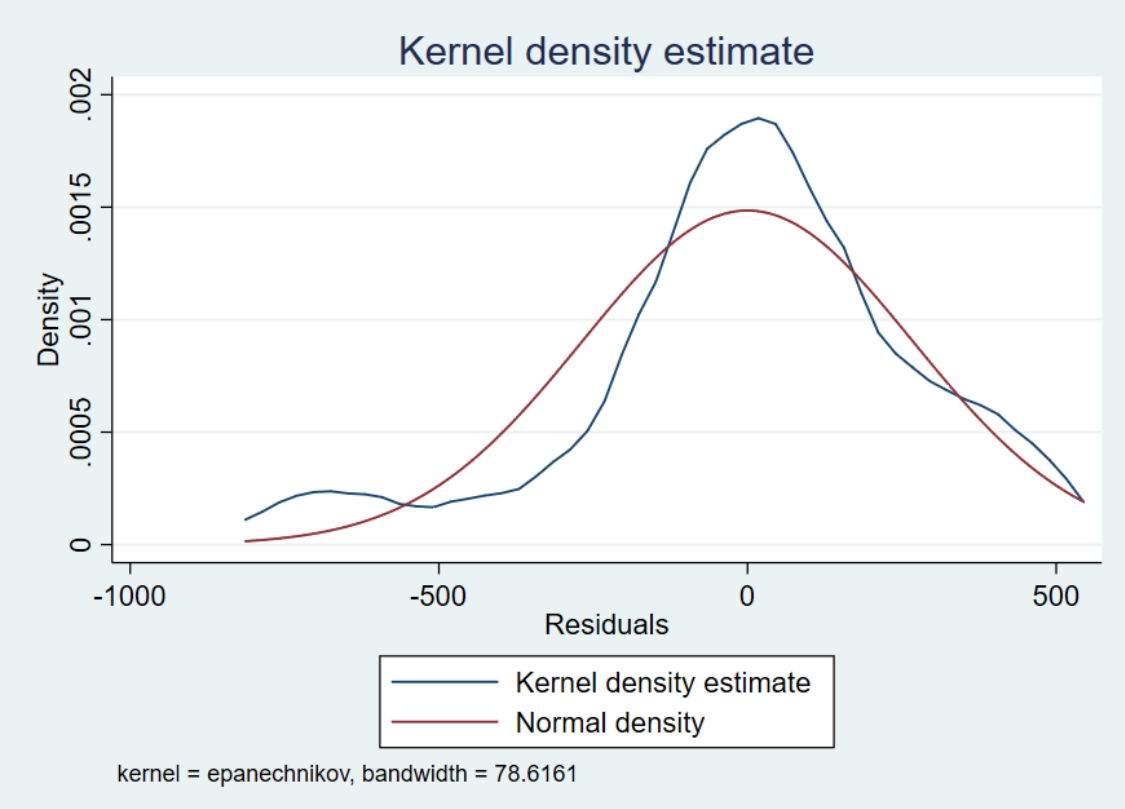
Source: Author calculation.

Kernal normality test

The subsequent graph represents information about the Kernal density estimation of residuals. According to the graph there are two mount shaped lines which are colored with red and blue, the former one is normality density in population case, while the further one is kernel density estimates on employed data residuals. It can

ISSN NO: 2770-0003
October 2024

be concluded that, while there is some significant distinction in the shape of estimations between population and kernel density, the residuals of the current employing data can be argued as distributed normally since we are still observing mount shaped distribution of residuals.



Source: Author calculations.

Conclusion

This study struggled to explain the impact of agriculture productivity on economic growth of Brazil throughout the period of 1973 and 2022. The data for this study has been collected from different databases such as World Bank development, IMF and Fred.com. The outcome of the study somehow has been contradicting to some of the previously conducted papers. To be more accurate, majority of studies on the same topic have found as suggested the positive influence of agriculture productivity on economic growth of various countries, but while some of them have proposed the negative influence of agriculture productivity on economic growth, under the study the outcome of the ARDL model revealed the negative influence of agriculture productivity on economic growth of Brazil, which is unusual condition in case of the focused country. This is because, Brazil is regarded as one of the most demanded countries around the world in terms of exporting and producing various types of agriculture products, however, the outcome of this study suggested the different scenario. On top that, the impact of gross capital formation and labor force contributed positively on economic growth of Brazil and this is suggested that, government of Brazil needs to start to take the steps to enhance the employments of labor force and provide job opportunities in order to enhance economic growth in both short and long runs. Government of Brazil needs to take a number of steps to increase the productivity of their agriculture sphere in order to rise the share of economic growth in the both periods, this is because, it is clear that, agriculture is one of the essential spheres in the world as we are a life, we are demanded on food and other agriculture products for survive, thus from these perspective, having a huge power in terms of producing and trading agriculture products needs to give significant power to those major production countries while the current study shows us different picture regarding to this.

Bibliography

1. Ahmad, K., Chaudhary, M.A., and Ilyas, M. (2008). Trends in Total Factor Productivity in Pakistan Agriculture Sector. Pakistan Economic and Social Review, 48 (2): 117-132.

ISSN NO: 2770-0003
October 2024

2. Awan, A.G. (2014) "The Enigma of US Productivity Slowdown: A theoretical Analysis" Journal of Economics and Sustainable Development, 6(3): 116-126.
3. Awan, A.G. (2012) "Shifting Global Economic Paradigm" Asian Business Review; 4(3): 35-40.
4. Awan, A.G., Nasir Nadeem and & Beenish Rashid (2015). "Factor Affecting Women Labour Supply in Agriculture Sector: A case study of District Rajanpur, Pakistan.
5. Awan, A.G. & Vashma Anum (2014) "Impact of Infrastructure Development on Economic Growth", Journal of Development and Economic Sustainability; 2(5): 1-15.
6. Awan, A.G. (2014) "Changing World Economic Scenario: Advanced Versus Aging Economies" LAP Publishing Academy, Germany.
7. Awan, A.G. (2015) "Comparative Analysis of Literature on Economic Growth in the perspective of advanced and emerging economies" Science International, 27(3): 2579-2587.
8. Awan, A.G., Nasir Nadeem, and Abu Bakar Nawaz. (2015) "Analysis of the Profitability of BT Cotton Growers in District Multan-Pakistan" Journal of Resources Development and Management; 5(1): 1-7.
9. Awan and Bilal Ahmad Sheikh (2015) "The Enigma of Education and Wealth on Poverty Alleviation: A Case study of District Rahimyar Khan (An unpublished Thesis), Institute of Southern Punjab, Multan. Pakistan.
10. Hariyani, I. (2010). Restrukturisasi Penghapusan Kredit Macet (Restructuring in Writing off Bad Loans). Jakarta: Kompas Gramedia.
11. Hasan, Z. (2008). Credit Creation and Control: An Unresolved Issue In Islamic Banking. MPRA paper no.8130.
12. Herijanto, H. (2017). Moralitas Bank (Bank Morality). Jakarta: Universitas Trisakti.
13. Huda, N., & Nasution, M. E. (2014) Current Issue Lembaga Keuangan Syariah (Current Issues in Islamic Financial Institutions). Jakarta: Prenada Media Group.
14. Ibrahim, A., & Rahmati, A. (2017). Analisis Solutif Penyelesaian Pembiayaan Bermasalah di Bank Syariah: Kajian pada Produk Murabahah di Bank Muamalat Indonesia Banda Aceh (Solutive Analysis of Problem-Solving Financing in Sharia Banks: A Study on Murabaha Products at Bank Muamalat Indonesia Banda Aceh). Iqtishadia, 10(1), 71-96
15. Indroes, F. (2008). Manajemen Risiko Perbankan (Banking Risk Management). Jakarta: PT Raja Grafindo Persada.
16. Jassud, N., & Kang, K. (2015). Strategy For Developing a Market for Non-Performing Loans in Italy. IMF Working Paper, WP/15/24/2015.
17. Jayant, A., Paul, V., & Kumar, U. (2015). Application of Analytic Network Process (ANP) in Business Environment: A Comprehensive Literature Review. IJRMET, 5(1), 29-37.
18. Kasmir. (2015). Dasar-Dasar Perbankan (The Basic of Banking). Jakarta: PT. Raja Grafindo Persada.
19. Kettle, B, (2011). Introduction Sharia Banking and Finance. United Kingdom: Design and Patents Act.
20. Khan, M., & Bhatti, M. (2008). Development in Sharia Banking the case of Pakistan. New York: Palgrave Macmillan.
21. Khaskhelly, A. Z. (2015). Comparative Analysis of Performance of Sharia Vis a Vis Conventional Banking of Pakistan during Global Financial Crisis 2007-2010. Romanian Statistical Review Supplement, 63(3), 29-42.
22. Koju, L., Koju, R., & Wang, S. (2018). Does Banking Management Affect Credit Risk? Evidence from the Indian Banking System. International Journal of Financial Studies, 6(67), 1-11.
23. Korankye, A. A. (2014). Causes and Control of Loan Default/Delinquency in Microfinance Institutions in Ghana. American International Journal of Contemporary Research, 4(12), 36-45.
24. Kwambi, K. D., & Wandera, M. (2013). Effects Of Credit Information Sharing on Nonperforming Loans: The Case of Kenya Commercial Bank Kenya. European Scientific Journal, 9(13), 168-193.