Journal of Applied Agricultural Economics and Policy Analysis, 2022, Vol. 5, No. 1, 19-24
Available online at http://pubs.sciepub.com/jaaepa/5/1/3
Published by Science and Education Publishing
DOI:10.12691/jaaepa-5-1-3

Study on the Factors that Stimulate Agricultural Exportation in the Largest Producing Countries of Agricultural Commodities

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Received September 08, 2022; Revised October 12, 2022; Accepted October 24, 2022

Abstract Trade is a key driver of economic expansion, food security, the eradication of poverty, and global development. Because it entails agreements, discussions, and deals between member nations across a range of socioeconomic borders, it is additionally a complicated and delicate topic for policymaking. In the context of agriculture, a sector that heavily depends on ecological and social dynamics, trade challenges become more challenging in that specific sector. As a result, this paper analyzes the factors that stimulate agricultural exportation in the largest producing countries of agricultural commodities. Therefore, panel data from 16 countries (Mexico, Ukraine, Iran, Russia, Chile, China, Brazil, India, Turkey, USA, South Africa, Japan, Australia, Peru, New Zealand, and Canada) from the period 2002 until 2022 was performed. In addition to that, a handful of variables such as Agricultural raw material export, Agricultural irrigated land, Agricultural land, Agriculture, forestry, and fishing added value, Annual freshwater withdrawals in agriculture, Employment in agriculture, Food Production, Rural population, and Arable land are chosen to carry on with the investigation. With that in mind, we find that most of the variables have a notable and significant impact on agricultural exports throughout all the models, with the exception of agricultural irrigated land and annual freshwater withdrawals in agriculture. Finally, the study will offer nations some evidence to support the agricultural sector and effective policies to encourage the export of agricultural products.

Keywords: *agricultural commodities, economics, exportation, policies, panel data*

Cite This Article: Sadik Aden Dirir, "Study on the Factors that Stimulate Agricultural Exportation in the Largest Producing Countries of Agricultural Commodities." *Journal of Applied Agricultural Economics and Policy Analysis*, vol. 5, no. 1 (2022): 19-24. doi: 10.12691/jaaepa-5-1-3.

1. Introduction

The volume of international trade has significantly increased over the previous two centuries. Global commerce in agricultural products reached 177 billion in 2021. According to [1], trade and exchange growth theories accelerate nations' economic growth rates. Due to this, both advanced and developing nations engage in international trade. Advocates for growth driven by agriculture where many of them established that agriculture does affect the earnings of people in rural areas and provide capital for industrial development to boost the economy, they believed that money invested in the farming sector, including supplemental infrastructure and organizations in related sectors, is a basic requirement for the country's economic growth [2].

Authors such as presented how several developing nations attempted to industrialize their economies without first establishing their agricultural sector, which resulted in depressing economic growth rates and unequal income distribution. A number of economists argued that agriculture could contribute to economic growth through a variety of cross-sectoral connections, including the provision of surplus labor from agriculture to manufacturing, enhanced supply of food and corresponding higher intake, industries for industrial output, savings for funding, and income from exported agriculture.

The great majority of emerging nations, especially those in Africa, have economies that are primarily dependent on agriculture. Approximately 50% of the GDP comes from agriculture, which also provides over 80% of benefit trade. The majority of people in agricultural countries work in that sector. Notwithstanding such predominance as well as the reality that agriculture is supported by solid policy documents and statements, most nations around the world still have chronically low levels of investment in the sector [3]. Additionally, ineffective post-harvest management, preservation, and process monitoring in between 30% and 40% of agricultural produce are lost. Consequently, there is a lot of room for lateral growth in the agriculture sector at all levels. It will be hard to reduce poverty and advance toward a greater economic status without modernizing agriculture [4].

Agriculture that is focused on exports is a pillar of the economy, making a large contribution to foreign exchange gains as well as, through investment, to rising income and employment. The foundation of a nation's structural economic development is its agricultural sector. Failure to ensure successful agricultural transformation translates to postponing (or at best postponing) the complete economic transformation, putting the total economy on the verge of the middle-income trap. In addition, it might make it more difficult to address the duality of disparity across rural and urban areas and between agriculture and other sectors, increasing the risk of social economic destabilization [5].

The establishment of design reforms in agricultural exportation demands a thorough understanding of the variables influencing the rate of inventive growth of agriculture in nations. As a result, the study evaluates the factors that stimulate agricultural exportation by taking a proxy the largest producing countries of agricultural commodities. Therefore, we selected 16 countries (Mexico, Ukraine, Iran, Russia, Chile, China, Brazil, India, Turkey, USA, South Africa, Japan, Australia, Peru, New Zealand, and Canada). With the focus on identifying the factors that stimulate agricultural exportation various variables were appointed. Starting with the dependent variable the Agricultural raw material export was chosen. Whereas independent variables such as agricultural irrigated land, Agricultural land, Agriculture, forestry, and fishing added value, annual freshwater withdrawals in agriculture, Employment in agriculture, Food Production, Rural population, and Arable land. Thus, to carry on with the study, panel data from the period 2002 until 2022 was performed.

The findings exhibited revealed distinctive values across the different models. Pooled OLS displayed that the volume of agricultural exports is significantly influenced by employment in agriculture, food production, rural population, arable land, agriculture, forestry, and fishing added value. This suggests that expanding agricultural exportation requires an increase in the volume of these variables. Then, using a fixed effect model, we found that the rural population, the added value of agriculture, forestry, and fisheries, as well as agricultural land, had a substantial impact on agricultural exporting. Finally, the results presented the same output as the fixed effect model when the appropriate model, the random effect, was chosen for this investigation. To sum up, most of the variables, with the exception of agricultural irrigated land and yearly freshwater withdrawals in agriculture, have a notable and significant impact on agricultural exports throughout the models.

The paper will contribute to the previous investigation into agriculture and economics relations. It will also provide countries with some evidence to promote the agricultural sector and efficient policies to stimulate the agricultural exportation of goods. As well as a framework to reevaluate the local and international factors that have an influence on agricultural commodities.

2. Related Literature

Exporting has been the most popular form of doing business on the global market since it carries little risk to the business, uses little resources, and allows a lot of flexibility [6]. Governments in a number of nations, including Uzbekistan, have recently given raising the national income of the populace substantial consideration. In particular, numerous presidential decrees, government ordinances, and resolutions aimed at averting adverse effects on the agriculture industry were implemented in 2020. Since the cornerstone of any country's economy is agriculture, and the state of that sector's development directly affects both the standard of life of its citizens and the growth of other industries. Moreover, because agriculture has a significant impact on a country's ability to compete internationally, countries are under stress from both internal and external competition.

Agriculture has a huge investment gap. Since agricultural products will always be valuable, especially given that our modern society is centered on the consumption of things of a natural origin, agricultural investments are promising investments that can bring solid long-term revenue. Agribusiness investment is therefore more profitable and pertinent in the current economic climate [7]. Finding the best strategies for attracting investment and kicking off agricultural organizations' investment operations is a crucial challenge in this regard. In order to increase the exportation of agriculture, it is required to provide favorable economic conditions. Significant capital expenditures are required, as well as the creation of an efficient framework for investing money, in order to improve the competitiveness of agricultural products and boost the output potential of agricultural enterprises. This calls into question whether or not investment security is necessary [8].

One of the solutions offered to improve agricultural exportation is to secure appropriate investment for the sector. It refers to a group of prerequisites, resources, and controls required for the execution of the asset allocation to agriculture. In the scope of the investment process, investment security can be conceptualized as the creation and usage of direct and ancillary resources in every phase of the investment project execution [9].

The structure of markets has been upended by the emergence of developing nations as new consumers of agricultural products and as fresh rivals in the world food supply. However, compared to food, which frequently has lower price elasticity, a volatile exchange rate, significant price fluctuation, and global demand seem to have a more significant impact on exports of agricultural commodities. This is especially true for emerging countries. Agricultural products are also more susceptible to global shocks due to weaker income elasticity. For instance, the cost of crude palm oil [10]. Income frequently appears as the main motivator of trade in the literature on the determinants of agricultural trade. Market size (population), along with income, is frequently linked to purchasing power or used as a stand-in for demand. Larger trading flows fueled by consumption growth are linked to high population growth rates, especially in free trade agreements where there is a lot of room for liberalization. A higher likelihood of trade creation is linked to a higher GDP and greater similarity between nations [11].

Prices, along with income, play a significant role in determining exports. A combination of lower pricing, a

good exchange rate, and steady prices may encourage greater exports. Despite this being a relatively minor positive influence, some authors discover higher agricultural exports during times of lower volatility. On the other hand, exchange rate depreciation may result in lower export prices and greater export flows, but it may also be accompanied by increased transaction costs, such as decreased trade. Exports may be impacted by exchange rate volatility [12]. The labor force should be considered while determining agricultural export. The notion of factor endowment states that industry should export products made with domestically available resources that are comparatively abundant.

Changes in agriculture are crucial. The demand for food and other agricultural goods is rising as a result of rising incomes, changing eating habits, and a growing human population. Nevertheless, the natural resource basis that supports agricultural output is also in danger due to the deterioration of land and water resources and mounting challenges to genetic variation. In addition to increasing the amount of food available, agriculture also increases food security by giving people the means to buy food. The rural poor can produce extra revenue to buy more food, including a wider variety of foods, thanks to increased agricultural productivity and farm profits [13]. A subcategory of economic development, agricultural development denotes a sustained rise in output and productivity over a respectable period of time, as well as an improvement in the well-being of farmers as seen by their greater extra unit revenue and quality of life. In addition to a sustained increase in the level of production and productivity of all rural residents, including farmers, and a sustained improvement in their well-being, as evidenced by an increase in per capita income and standard of living, rural development also contributes to a sustained improvement in the physical, social, and economic conditions of rural communities [14].

Particularly in developing nations, agriculture plays a significant role in the majority of rural economies. As was previously said, rurality is sometimes determined by the contribution of agriculture to the local economy. Therefore, a sustainable agriculture component would be present in every effective rural growth plan, while they do not constitute the same thing. While rural development aims to improve the welfare of rural populations through sustained growth of the rural economy, which includes agriculture but may not be its only component and is not always the most dynamic, agricultural development aims to enhance the living conditions of populations through sustained increases in the efficiency of the agricultural sector [15].

3. Methodology

3.1. Data Collection

The 18-year period included in this study runs from 2002 through 2022. To explore the volume of agricultural exportation well-known 16 countries for their agricultural activity were selected (Mexico, Ukraine, Iran, Russia, Chile, China, Brazil, India, Turkey, USA, South Africa, Japan, Australia, Peru, New Zealand, and Canada). The paper aimed to explore the factors that contribute to the agricultural exportation of these countries.

3.2. Variable of the Study

In this study, nine variables were chosen to determine the volume of agricultural exportation. Starting with the dependent variable the Agricultural raw material exports (RM) was chosen. Whereas independent variables such as agricultural irrigated land (AIL), Agricultural land (AL), Agriculture, forestry, and fishing added value (FFV), annual freshwater withdrawals in agriculture (FWA), Employment in agriculture (EP), Food Production (FP), Rural population (RP) and Arable land (N) were selected.

3.3. Model Specification

- **Pooled OLS**

$$Yit = \beta 0 + \beta 1xit + \beta 2xit + \ldots + \beta nxit + uit \quad (1)$$

$$\begin{aligned} \mathrm{RM}it = {} & \beta 0 + \beta 1\mathrm{AIL}it + \beta 2\mathrm{AL}it + \beta 3\mathrm{FFV}it \\ & + \beta 4\mathrm{FWA}it + \beta 5\mathrm{EA}it + \beta 6\mathrm{EP}it \\ & + \beta 7\mathrm{LRP}it + \beta 8\mathrm{N}it + \ldots + \mathrm{u}it \end{aligned} \quad (2)$$

- **Fixed Effect model**

$$Yit = \beta 1xit + ai + uit \quad (3)$$

$$\begin{aligned} \mathrm{RM}it = {} & \alpha i + \beta 1\mathrm{AIL}it + \beta 2\mathrm{AL}it + \beta 3\mathrm{FFV}it \\ & + \beta 4\mathrm{FWA}it + \beta 5\mathrm{EA}it + \beta 6\mathrm{EP}it \\ & + \beta 7\mathrm{LRP}it + \beta 8\mathrm{N}it + \ldots + \mathrm{u}it \end{aligned} \quad (4)$$

- **Random Effect model**

$$Yit = \beta 1xit + ai + uit + \varepsilon it \quad (5)$$

$$\begin{aligned} \mathrm{RM}it = {} & \alpha i + \beta 1\mathrm{AIL}it + \beta 2\mathrm{AL}it + \beta 3\mathrm{FFV}it \\ & + \beta 4\mathrm{FWA}it + \beta 5\mathrm{EA}it + \beta 6\mathrm{EP}it \\ & + \beta 7\mathrm{LRP}it + \beta 8\mathrm{N}it \ldots + \mathrm{u}it + \varepsilon it \end{aligned} \quad (6)$$

4. Results

In this paper, RM which is the agricultural raw material export is considered the dependent variable as a proxy for the agricultural output value. Whilst, explanatory factors such as AIL, AL, FFV, FWA, EA, FP, LRP, and N were regarded as proxies to determine the agricultural exportation volume. For all the agricultural products exported over the past 18 years, RM has a mean of 2.749%. Over this time, its standard deviation is predicted to be 2.888%. In the entire data set, RM has the lowest value at 2%. RM's highest value across the board is 13.407% of agricultural exports through 2020. The average for AIL is 5.812%. In the entire data set in 2020, the minimum figure for AIL, or agricultural irrigated land, is 4.3%. In contrast, the highest value of AIL across the board is 39.964%. In addition, factors such as AL, FWA, and N displayed a high level of volatility since the standard deviation is at 21.399%, 29.545%, and 16.345% respectively. Moreover, the FFV which is agriculture, forestry, and fishing added value presented the lowest percentage during the 18 years period. Finally, we observe

that FP and FWA presented a max of 118% and 92% which are the highest among the factors. See Table 1.

Table 1. Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
RM	304	2.749	2.888	2	13.407
AIL	304	5.812	11.188	4.3	39.964
AL	304	39.922	21.399	6.436	80.809
FFV	304	5.533	4.228	1.43	19.592
FWA	304	15.59	29.545	13.09	92.959
EA	304	14.689	13.807	5	58.6
FP	304	91.161	12.503	58.71	118.54
LRP	304	7.282	.778	5.738	8.953
N	304	14.942	16.345	1.515	56.824

Three estimating methods are considered in this study to support the null hypothesis. The main goal of the study was to ascertain how EA, FFV, N, LRP, AL, AIL, FP, and FWA are related to RM. Multi-collinearity in the group of variables chosen for the estimation is disregarded by Table 2. This is true since the inflation variance factor is under 10. Correlation analysis results further support the absence of multi-collinearity between the predictor factors. Apart from EA, which has a correlation with FFV that is greater than 0.5.

Table 2. Variance inflation factor

	VIF	1/VIF
EA	5.125	0.195
FFV	5.103	0.196
N	2.722	0.367
LRP	1.865	0.536
AL	1.647	0.607
AIL	1.612	0.62
FP	1.318	0.759
FWA	1.049	.953
Mean VIF	2.555	.

On the basis of a straightforward correlation matrix, the measurement items were then examined for multicollinearity. As seen in Table 3, none of them exhibit any multicollinearity issues except EA.

Table 3. Matrix of correlations

Variables	RM	AIL	AL	FFV	FWA	EA	FP	LRP	N
RM	1.000								
AIL	-0.278	1.000							
AL	-0.165	0.040	1.000						
FFV	-0.187	0.471	0.357	1.000					
FWA	-0.023	0.078	0.069	0.094	1.000				
EA	-0.323	0.393	0.282	0.849	0.110	1.000			
FP	-0.019	0.074	-0.099	-0.175	0.091	-0.342	1.000		
LRP	-0.619	0.408	0.314	0.540	0.038	0.601	-0.044	1.000	
N	-0.348	0.474	0.558	0.661	0.026	0.514	-0.079	0.506	1.000

Hausman test can be used to decide between the random and fixed effects models. Below we present the test outcome:

Table 4. Hausman specification test

Hausman Test Statistic: p-value = 0.976	The Hausman test compares fixed and random effects with the null hypothesis that each impact is uncorrelated with all the other regressors in the model. H1 was rejected since the results that supported the corresponding effects appeared statistically insignificant. Consequently, the random effects model is preferred.

Table 5. Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

Ho: sigma(i)^2 = sigma^2 for all i	Heteroscedasticity is identified using the Breusch-Pagan or Cook-Weisberg test. When the p-value for this test was discovered to be 0.1021 and the value of Chi2 revealed 2.78% from the result presented, it is stated that there is no heteroscedasticity.
chi2(1) = 2.78	
p-value = 0.1021	

Table 6. Regression results

Pooled OLS, Random Effects & Fixed Effects										
Dependent Variable (RM)			***C***	**Independent Variables**							
				AIL	**AL**	**FFV**	**FWA**	**EA**	**EP**	**LRP**	**N**
Coefficients	**Pooled OLS**		19.58*** (1.617)	-0.0119 (0.013)	0.0077 (0.007)	0.440*** (0.06)	-0.0003 (0.004)	-0.08*** (0.020)	-0.0185* (0.0112)	-2.17*** (0.214)	-0.051*** (0.0123)
	Panel Effects	**FE**	18.29** (8.525)	0.009 (0.008)	0.07*** (0.024)	0.112*** (0.034)	0.0011 (0.0012)	0.00597 (0.008)	-0.0002 (0.004)	-2.659** (1.179)	-0.00176 (0.0654)
		RE	20.29*** (4.770)	0.008 (0.007)	0.05*** (0.019)	0.118*** (0.033)	0.0012 (0.001)	0.0051 (0.008)	-0.0021 (0.003)	-2.68*** (0.68)	-0.0446 (0.0355)

	Pooled OLS Estimation	**Panel Effects Estimation**	
		Fixed Effects	**Random Effects**
R^2	0.476	0.107	0.100
Model Significance	F (8, 295) = 33.47	F (8, 280) = 4.17	χ^2 (8) = 40.73
	p-value = 0.000	p-value = 0.000	p-value> 0.000
Observation	304	304	304

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The dependent variable chosen was RM. Regression on RM was performed on AIL, AL, FFV, FWA, EA, EA, EP, LRP, and N. Except for AIL and AL, the other variables are significant at the 1% level and account for 10% of the variation in RM, according to pooled OLS estimation. Additionally, a positive association exists between RM, AL, and FFV in terms of the number of agricultural exports, and this relationship is supported by Table 6 at a 1% level of significance. Whereas, factors such as AIL, FFW, EA, EP, LRP, and N are decreasing the quantity of agriculture exported. For instance, an increase in 1% of AIL, FWA, EA, EP, LRP, and N decreased by 1% the quantity of agricultural exported and it is supported by 1% and 10% significance in the case of FFV, EA, EP, LRP, and N. The F-statistic for the model is 33.47, and it is 1% significant. R2 is used to quantify how much of the variation in the independent variables contributes to the variation in the dependent. Only 47.6% of the variation in the dependent variable can be explained by independent variables, according to the model's R^2 value of 47.6%. Despite the lower R2, the Wooldridge Test demonstrated that there is no autocorrelation issue.

In the second approach panel Data Analysis, it is also demonstrated that AIL, FWA, EA, EP, and N have an insignificant value in relation to RM when regression is estimated using the Fixed Effect method. Whereas, AL, FFV, and LRP presented an impact on the quantity of agriculture exported. As a result, we determine that a 1% increase in AL and FFV rises the RM by 0.07% and 0.112% sequentially. Nevertheless, in terms of LRP, we perceive that a 1% expansion, diminishes the quantity of agricultural exported to -2.65%. The f-statistic for the fixed-effect model is 4.17 and significant at 1%. The R^2 is used to quantify how much of the variation in the independent variables contributes to the variation in the dependent variable. Only 10.7% of the variation in the dependent variable can be explained by independent variables, according to the model's R^2 value of 10.7%.

When the Hausman test did not support the use of the Fixed Effect estimation method in panel data analysis the paper was forced to employ Random Effect estimation. This new estimation presents that AL, FFV, and LRP are significant at a 1% level. Whilst, AIL, FWA, EA, and EP revealed an unremarkable impact on RM. Accordingly, we notice that 1% growth in AL and FFV increase by 0.008% and 0.0012% the agricultural exportation. On the other hand, as was mentioned in the fixed effect model a rise in LRP appears to be reducing agricultural exportation by -2.68%. The f-statistic for the random-effect model is 40.73 and significant at 1%. The R^2 is used to quantify how much of the variation in the independent variables contributes to the variation in the dependent variable. Only 10 % of the variation in the dependent variable can be explained by independent variables, according to the model's R^2 value of 10%.

5. Discussion

Manufacturing capacity, the prices of goods, trade regulations, local agricultural subsidies, and international market shocks are the five key thematic categories into which agricultural trade factors can be roughly categorized. With the exception of export taxes, many trade policies, and agricultural support programs in importing, nations are regarded as demand-side limitations. Despite the fact that production capacity and trade costs are alluded to as supply-side restraints. Global food, oil, and economic turmoil are viewed as market-level trade limitations that have an impact on imports and exports in a variety of ways and to varying degrees from both the supply and the demand sides. In countries that produce agriculture, government involvement in the industry is not new. The intervention has been used to increase governmental revenue, ensure food supply, stabilize farmer wages, and take advantage of market power. The discussion of the component that encourages agricultural exports has become of greater significance in light of the country's economic transformation and the weak investment in that sector. The findings unveiled various impacts on agricultural exportation. First, the pooled OLS demonstrated that employment in agriculture, food production, rural population, arable land, agriculture, forestry, and fishery added value have a significant influence on the quantity of agriculture exported. This implies an increase in the volume of these factors expands agricultural exportation. Next, we observed with the fixed effect model that agricultural land, agriculture, forestry, and fishery added value, and the rural population denote a significant impact on agricultural exportation. Lastly, with the appropriate model selected for this study which is the random effect, the results manifested identical output as the fixed effect model. To conclude we determine that except for agricultural irrigated land and annual freshwater withdrawals in agriculture the rest of the variables have a noteworthy and significant influence on agricultural exportation across the models.

6. Conclusion

From many perspectives, agricultural exports are seen as one of the primary engines of national economic expansion and long-term stability. They are considered to be an essential tool for obtaining money, promoting agricultural investment, raising the employment rate, and eradicating poverty. Finding the factors that influence this latter category of exports would therefore be crucial. Consequently, this paper investigated the factors that stimulate agricultural exportation, especially in the largest producing countries of agricultural commodities. Panel data from the period 2002 until 2022 was performed and eight factors were selected to determine the agricultural exportation volume. According to the findings, we concluded that except for agricultural irrigated land and annual freshwater withdrawals in agriculture the rest of the variables have a noteworthy and significant influence on agricultural exportation across the models. The paper will contribute to the previous investigation into agriculture and economics relations. It will also provide countries with some evidence to promote the agricultural sector and efficient policies to stimulate the agricultural exportation of goods. As well as a framework to reevaluate the local and international factors that have an influence on agricultural commodities.

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