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Sustaining Agricultural Growth: Traps of Socio–Demographics in Emerging Markets

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Abstract: This research aims to evaluate the effect of the global innovation index (GII), urban population (UP), rural population (RP), social globalization index (SGI), and Demographic Pressures (DP) on agriculture value added (AVA). The samples were collected from The Global Economy relating to four countries, namely, China, Indonesia, USA, and India during 2013-2020. The collected data were analyzed through comparative panel regression. The results show that, in the long term, the increase in UP is significantly correlated with AVA in China, Indonesia, and India. Then, an increase in RP is significantly associated with AVA in India, and SGI exerts a significant effect on AVA in the USA. In the short term, every increase in GII has a significant effect on AVA in Indonesia and the USA. Furthermore, RP has a significant impact on AVA in China. A case study in India, reported that a decrease in SGI and DP significantly affect AVA. Meanwhile, the short-term DP growth greatly influences the AVA in the USA. The novelty of this research lies in the finding that the agricultural sector's tendency expands our knowledge of how many agricultural clusters in rural communities change their functions as a large number of rural residents relocate to metropolitan areas. Further, the debate over the HR industry's level of competition does not create job possibilities. In China, Indonesia, and the USA, DP enhances AVA. Stakeholders are required to reduce housing density through innovative agriculture concepts that are more humanistic and creative, even though DP only suppresses AVA in India.

Keywords: Agriculture value added; Global innovation; Social globalization; Demographic pressures; Population; Comparative panel regression

1. Introduction

The supply of products from other countries has always been a necessity for a nation, resulting in international trading or what is frequently referred to as “export-import” (Hasanah, 2020; Muûls & Pisu, 2009). This transaction takes place across the country where a network of commodity importers and exporters engages in buying and selling (Seyoum, 2008). Sea and land corridors are often crowded with busy traders, while air travel is typically used for the exchange of weapons or other military defense equipment, logistical support during wartime emergencies, unpredictable natural disasters, and urgent or top-secret scientific advancements. Cooperation agreements between parties involved in legal, economic, geopolitical, cultural, and social elements are also inseparable from trade conflicts (Whitten et al., 2020).

The term “international trade issue” in a holistic sense denotes a volumetric competitive trade balance. The foreign exchange of a state contains a record of every export and import unit in history. The surplus or deficit of an anomaly of products or services is determined by the difference between income from exports and spending on imports. World Population Review (2022a) reports that the challenges faced by some countries with a high population density, such as China (rank 1), India (rank 2), USA (rank 3), and Indonesia (rank 4), actually foster

extraordinary polemics. If ignored, the Top-4's population explosion may result in fresh debates over human resources and productivity. Given that these four countries are also endowed with a wealth of natural resources, including a huge geographic region, this challenge must represent an opportunity that can be taken advantage of. China, India, USA, and Indonesia are classified as "agrarian nations". They have the capacity to expand agricultural areas with a sizable amount of land. Furthermore, the rising domestic demand for agricultural products has emerged as a potential asset for supplying food and ensuring global nutrition (Darma et al., 2022a). Agriculture is a particularly promising industry that integrates human populations with natural habitat clusters.

Nevertheless, the quick depletion of natural resources (e.g., the protected areas for wildlife and fauna) makes it hard for the four countries to cope with the surging market demand for agricultural products wisely. Urban populations have always expanded quickly relative to rural populations, despite that agricultural commodities could not initially be dammed for reasons of reducing hunger, meeting nutritional consumption standards, and satisfying the demand for food security. To avoid continuing their careers as farmers or plantation managers, many agricultural workers are moving to cities and working in manufacturing and services, due to the growing household income inequality (Baymul & Sen, 2020; Hirschman & Mogford, 2009; Lewis, 1979). In actuality, the agricultural revolution represents a multifaceted problem for human civilization (Ahmed & Turchini, 2021; Rissing et al., 2021; Svizzero & Tisdell, 2014; Talukder et al., 2020).

Agriculture is directly tied to the idea that unifies the interplay between innovation and human values. The issues surrounding agricultural productivity are emphasized. Labor cost-saving innovations from Sub-Saharan Africa have an effect on agricultural productivity (Djoumessi, 2021). The adoption of innovations in varying degrees of complementarity to support institutional processes and technical choices has initiated the goals of the social and cultural environment of agriculture in developing countries (Feder et al., 1985). Satterthwaite et al. (2010) recently reviewed the literature addressing the effects of urbanization on agriculture and food. While the demand for agricultural products is increasing in cities, rural poverty has decreased as a result of agricultural development. In the literature on innovation, sustainable agriculture is investigated to inform choices that assist Austrian farmers with educational capacities, extension services, a focus on achievement, and training in self-empowerment (Walder et al., 2019). On the one hand, the spread of innovation in agribusiness farming will determine the level of income success or failure. In fact, losing agricultural land makes the situation less prosperous. Interventions in technology and communication frameworks teach ASEAN farmers important lessons (Mardiana & Kembauw, 2021). According to Bjerke & Johansson (2022), Sweden adopts innovative capacity and its contribution gradually. Due to the distinctiveness of the agricultural basis, agricultural enterprises require more internal knowledge in contrast to their counterparts in other sectors. Surprisingly, social networks among farmers themselves in Eastern Ethiopia were what sparked intense agricultural innovation and social interaction (Wedajo & Jilito, 2020). The social system's openness to the community has been found to foster local communities that are well-established in a reciprocal context to build flexible social networks, observe indigenous norms, nurture member trust, and realize reciprocal cooperation despite the inconsistencies between social connectivity and intense agricultural innovation.

The stark difference between rural and urban areas should never be ignored. The village is a homogenous territory that generates natural resources, including agricultural products. In a broad sense, cities are seen as locations that are heterogeneous or heavily reliant on villages (Darma et al., 2022b). Despite their differences, villages and cities are nonetheless interconnected. Hence, the distinction between rural and urban areas is extremely dynamic and contrastive. In addition, the issue of "trade war" has been a concern for decades to come. The urgency of the world to control excessive growth of population goes hand in hand with the questions whether human behavior can promote sustainable agriculture, and how the government should improve the quality of integrated resources. Against this backdrop, the authors intended to identify the factors affecting agricultural growth, and measure the growth by the agricultural value added (AVA).

1.1 Agricultural Economy

Agricultural economics, taken in its broadest sense, is a sort of activity that involves humans managing biological resources for the composition of energy, food, the environment, and industrial raw materials, which play a crucial part in the framework of domestic economic development. Van Arendonk (2015) categorized this sector as a key economic structure. Agricultural economics aims to improve agriculture in relation to research operations. AVA is defined as the aggregation of national economic revenue from the agricultural sector's five sub-sectors, which include livestock, fisheries, forestry, plantations, horticulture, and food crops (Ishak, 2013). The AVA performance reflects the income level of workers/farmers, as indicated by the affordability of balanced diet.

The technological relationships that convert resources (inputs) into commodities are described by the production function (outputs). Another group of variables is transformed into a range so that each variable in the function domain has a single value (Koerniawati, 2013). The agricultural production function can be expressed as:

$$y = f(x) \quad (1)$$

where, y and x are the output and input, respectively. The domain of the function is all x values greater than or equal to zero. The outcome produced by using each input makes up the function range. It is impossible to tell from the shape how much output can be generated from a specific input. The function f(x) must take on a more precise shape in this situation. The aforementioned equation function is frequently used to evaluate the output of agricultural production utilizing such factors as: machinery, labor, capital, management, and weather.

1.2 Demographic Theories

In the 18th century, academics started analzying population systematically. In fact, this topic has long been debated in various circles. Karl Marx and Thomas Malthus, two “classical population” experts, were the first to examine the issue of population in the world (Roche, 2020; Szreter, 2018). Later, the issue was discussed by the following generation, most significantly in Thompson's “Demographic Transition Theory” (Kirk, 1996; Thompson, 1929). This theory inaugurates the population science, which is grounded on the dynamics of time-varying factors like aging, migration, death, and population movements.

Malthus in this book An Essay on the Principle of Population highlighted the danger of population growth, and argued that population growth depends on natural law (Rutherford, 2007). Petersen (1999), Weir (1991) and Wrigley (1988) explained that the population always increases faster than food, unless hampered by moral restrains like disease outbreaks, disasters, and degradation of agrarian fertility.

Marx rejected Malthus' theories. He argued that while human population does not interfere with food, it does have an impact on job opportunities (Charbit, 2009; Foster, 1997; Hughes & Southern, 2019). Rapid population growth is not the source of poverty; instead, it is the result of capitalists' avarice in removing some of the rights of workers. If technology does not replace people, productivity increases as human population increases (Pereira & Pereira-Pereira, 2021; Sinding, 2009). The number of births does not need to be reduced by humanity. The "Malthus theory" of moral restriction to lower birth rates seems incongruous in this situation. Socialism-adherent nations like North Korea, Vietnam, China, and Russia have defended this line of thinking (D'Arcy, 1977; Drezgić, 2010; Peterson, 2017; Whyte et al., 2015).

Furthermore, “Demographic Transition Theory” was developed once it became clear that Malthus' theory does not fully account for population expansion in the western hemisphere. Many western countries experienced slow population growth during and after the industrial revolution, and this persisted well into the 20th century, or more precisely after the First World War. The population expansion halted in some of these nations, like Scandinavia, France, and England. This phenomenon draws attention to a “new paradigm” that shapes the characteristics of explosive growth. This alternative was promoted by demographer Thompson in 1929 and was named the “Demographic Transition Hypothesis” (Szreter, 1993). Thompson and his colleagues continued to refine their hypothesis. Now, the hypothesis is more widely known as the "Theory of the Demographic Transition" (Ranganathan et al., 2015). This theory rests on four interrelated elements, each of which is illustrated according to population growth and transition (Rostiana & Rodesbi, 2020).

The above theory is frequently connected to societal prosperity in its application. High birth rates but low mortality rates are typical in developing nations due to improvements in healthcare. Because many development objectives are pulled into the rate of population growth, the government finds it challenging to improve welfare in this context. The demographic characteristics are distinctive among developed nations, as evidenced by the low birth and death rates. In affluent nations, this situation makes it simpler for governments to divide budgets in order to revive welfare through social security and health insurance. People in industrialized nations are expected to enjoy a more equitable allocation of welfare.

In reality, every person has a desire and a different proportion of needs than other people. These needs include social, economic, and psychological demands. If the need is not met, demographic pressure may be triggered. The motivation behind the pressure felt is inversely correlated with each person's capacity.

There are two angles that the populace can experience from the standpoint of pressure. When a person is within his/her pre-set tolerance range, he/she will not move by remaining in its original location and trying to adjust the facilities in his/her environment. More specifically, a person will consider moving to a different location where he/she expects better fulfilment of desires, if the pressure is outside or beyond his/her tolerance. Naturally, it is assumed that residents who relocate will raise any initially low location utility.

There are two actualizations in the mobility mission that permit population aggression. First, residents first feel stressed at home for different reasons. The level of lifestyle and status that residents must contend with increases with the degree of population heterogeneity in a region. Second, there is a difference in place utility from one location to another. Irwansyah et al. (2022) and Wijaya et al. (2021) concluded that, in Romania, demographic pressures are integrated into economic growth; in developing countries like Indonesia, demographic pressures control the GDP.

1.3 Innovation and Social Indices

The relationship between the social index and the innovation index in a global context shows how much the government is committed to encouraging innovation and brotherhood among its population as a strategy to raise the level of prosperity over the long term.

The mechanism of the global innovation index is a thematic component that tracks global innovation. In essence, it looks at how medical technical and non-technological advancements are reshaping healthcare globally (Vega-González, 2006). The index also contributes to medical advancements that influence the future of healthcare, and impacts economic growth.

In terms of complexity, the social globalization index, which contains the Konjunkturforschungsstelle (KOF), consists of three objects: political globalization, economic globalization, and social globalization. The index consists of the following factors: participation in United Nations (UN) peacekeeping missions, affiliation with international organizations, the number of ambassadors, high-tech exports, international students, overseas franchises, patent registration, immigration, international tourism, foreign exchange reserves, external debt, domestic investment, portfolio investment, foreign direct investment, and trade balance flows (Caselli, 2013; Gygli et al., 2019; Haelg, 2020; Vujakovic, 2010).

1.4 Framework

Figure 1 displays the proposed hypothesis and framework according to the relevance of publications to the demographic trap represented by innovation, urban population, rural population, social ties, and demographic pressures.

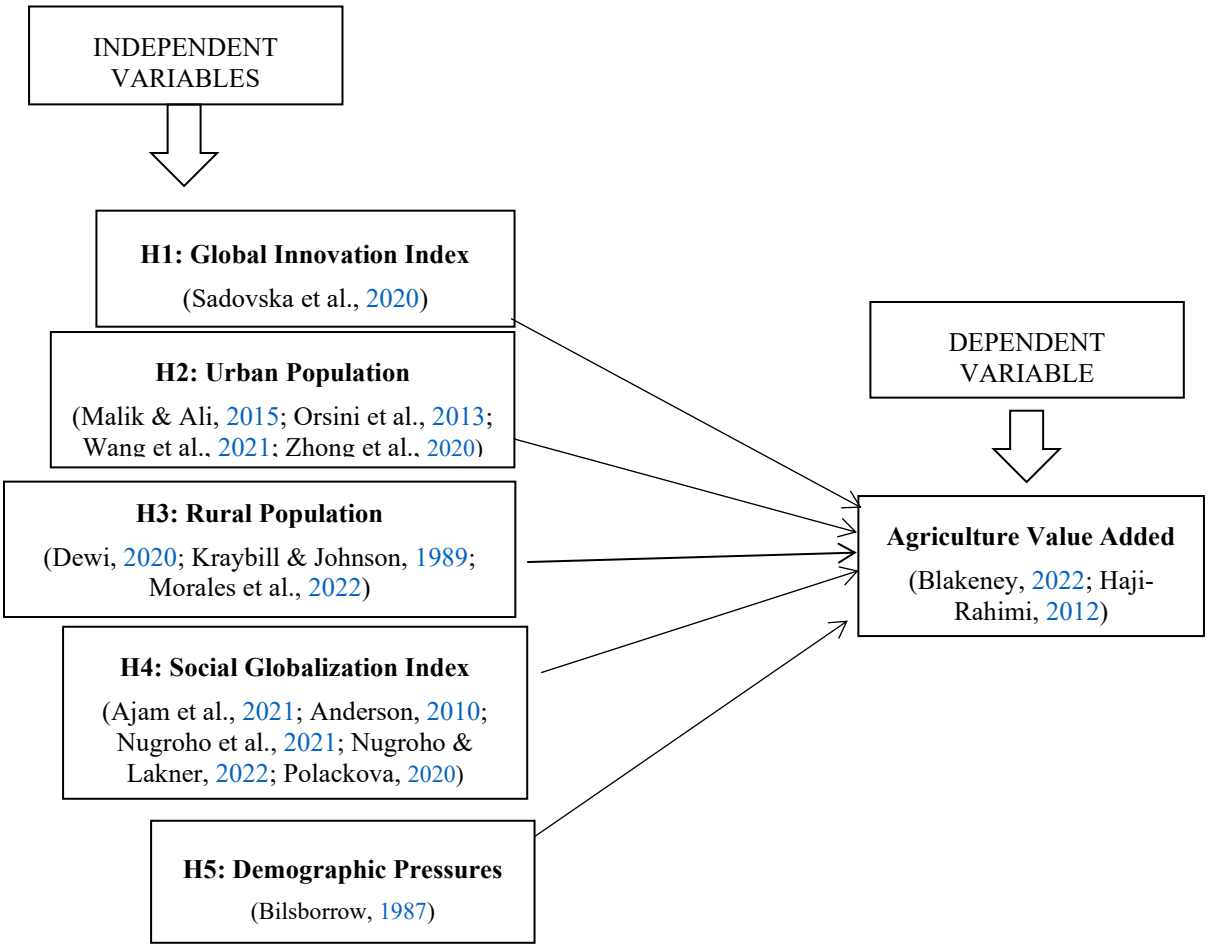

Figure 1. Conceptual design

2. Methodology

2.1 Database

The research data were collected from The Global Economy (2022). Each secondary data was processed using logarithms, due to the heterogeneity of benchmark/unit. After processing, the data related to innovation, urban population, rural population, social ties, and demographic stress were tabulated in Microsoft Excel.

Four countries were covered, including China, Indonesia, USA, and India. The sample period was divided into eight periods (2013-2020). The four countries were targeted for two reasons: they are the four most populous countries in the world, and they are dominant agricultural exporters in developing markets, thanks to their wide agricultural areas. The original dataset contains 192 populations, 48 samples for each case. After that, the data were pre-processed, all variables were normalized by logarithms.

2.2 Variables and Modeling

In total, there are six key variables, including one dependent variable (AVA) and five independent variables: global innovation index (GII), urban population (UP), rural population (RP), social globalization index (SGI), and demographic pressures (DP). These key variables are explained in Table 1.

Table 1. Core variables

Label	Variable	Measure
AVA	Agriculture value added	Net output of the agricultural sector after adding up all outputs and subtracting intermediate inputs, billion USD
GII	Global innovation index	Thematic component tracking the innovation input–output of a nation, points (0-100)
UP	Urban population	Population recorded living and settling part time/temporarily in urban areas, %
RP	Rural population	People living in rural areas, %
SGI	Social globalization index	Traditions reflect cultural closeness, personal contact, and the flow of information between a nation and the rest of the world, points (0-100)
DP	Demographic pressures	Pressure of a nation that comes from the population itself and the environment around it, points (0: low-10: high)

Source: The Global Economy (2022)

The data were interpreted through comparative panel regression and hypothesis tests: correlation analysis, descriptive statistics, F-test (simultaneous), T-test (partial), and determination test (R2). These approaches are to predict the feasibility of the relationship between variables. Hence, the basic function of the model can be expressed as:

$$Y_{i,t} = \alpha_0 + \alpha_{1\,i,t} + \alpha_{2\,i,t} + \alpha_{3\,i,t} + \alpha_{4\,i,t} + \alpha_{5\,i,t} + \mu_{i,t} \quad (2)$$

Then, the above function is projected into a logarithmic proxy of the variables:

$$\ln AVA_{i,t} = \alpha_0 + \alpha_1 \ln GII_{i,t} + \alpha_2 \ln UP_{i,t} + \alpha_3 \ln RP_{i,t} + \alpha_4 \ln SGI_{i,t} + \alpha_5 \ln DP_{i,t} + \mu_{i,t} \quad (3)$$

Hypothesis decision-making is applied in the following two schemes:

$$\text{when, } \rho > 0.05 \text{ or } \rho > 0.01, \text{ then reject } H_1 \text{ and accept } H_0 \quad (4)$$

$$\text{when, } \rho < 0.05 \text{ or } \rho < 0.01, \text{ then accept } H_1 \text{ and reject } H_0 \quad (5)$$

H_0 reflects no significant causality between GII, UP, RP, SGI, and DP to AVA; Conversely H_1 represents no significant causality between GII, UP, RP, SGI, and DP to AVA. The parameters in the above formulas are: logarithm (*ln*), time-series and cross-section ($_{i,t}$), constant (α_0), regression intercept ($\alpha_1, \ldots \alpha_5$), residual ($\mu$), probability ($\rho$), hypothesis 0 ($H_0$), and hypothesis 1 ($H_1$).

3. Results

3.1 Correlation and Descriptive Statistics

Tables 2, Table 3, Table 4, and Table 5 summarize the correlation scores and the acquisition of descriptive statistics (mean and standard deviation/S.D) for cases in China (CHN), Indonesia (IDN), United States of America

(USA), and India (IND). Learning from China, it is proven that with a probability of 1% (ρ <0.01), there is a negative correlation between AVA_Chn and RP_Chn (-0.911), GII_Chn with RP_Chn (-0.952) and DP_Chn (-0.932), and between RP_Chn and UP_Chn (-0.955) and SGI_Chn (-0.943). Another positive sign is the association of AVA_Chn with UP_Chn (0.907) and SGI_Chn (0.898), while GII_Chn appears to be strongly correlated with SGI_Chn (0.902), UP_Chn with GII_Chn (0.961) and SGI_Chn affects UP_Chn (0.964). There is a significant 5% probability (ρ <0.05) in the relationship of AVA_Chn to GII_Chn (0.759) and RP_Chn to DP_Chn (0.808). The correlation achievement that fell actually occurred in UP_Chn (-0.832) and SGI_Chn (-0.783) with DP_Chn. Table 2 also shows the mean (954.8) and S.D (85.43) points for the highest AVA_Chn. The lowest points are the mean and S.D points on DP_Chn, where the scores are 6.35 and 0.61.

Table 2. Correlation and descriptive statistics in China

	AVA_Chn	GII_Chn	UP_Chn	RP_Chn	SGI_Chn	DP_Chn	Mean	S.D
AVA_Chn	1	.759* (.029)	.907** (.002)	-.911** (.002)	.898** (.002)	-.550 (.158)	954.8	85.43
GII_Chn	.759* (.029)	1	.961** (.000)	-.952** (.000)	.902** (.002)	-.932** (.001)	50.39	3.68
UP_Chn	.907** (.002)	.961** (.000)	1	-.995** (.000)	.964** (.000)	-.832* (.010)	58.48	2.9
RP_Chn	-.911** (.002)	-.952** (.000)	-.995** (.000)	1	-.943** (.000)	.808* (.015)	41.52	2.89
SGI_Chn	.898** (.002)	.902** (.002)	.964** (.000)	-.943** (.000)	1	-.783* (.021)	56.28	1.19
DP_Chn	-.550 (.158)	-.932** (.001)	-.832* (.010)	.808* (.015)	-.783* (.021)	1	6.35	.61
N	48	48	48	48	48	48	48	48

Source: compilation of authors. Standard errors in parentheses: **ρ <0.01, *ρ <0.05

Table 3. Correlation and descriptive statistics in Indonesia

	AVA_Idn	GII_Idn	UP_Idn	RP_Idn	SGI_Idn	DP_Idn	Mean	S.D
AVA_Idn	1	-.731* (.039)	.904** (.002)	-.919** (.001)	-.309 (.456)	.517 (.190)	129.62	10.72
GII_Idn	-.731* (.039)	1	-.836** (.010)	.810* (.015)	.564 (.146)	-.053 (.901)	29.24	1.7
UP_Idn	.904** (.002)	-.836** (.010)	1	-.996** (.000)	-.180 (.670)	.228 (.588)	54.98	1.63
RP_Idn	-.919** (.001)	.810* (.015)	-.996** (.000)	1	.155 (.713)	-.280 (.502)	45.02	1.63
SGI_Idn	-.309 (.456)	.564 (.146)	-.180 (.670)	.155 (.713)	1	-.112 (.792)	53.68	.91
DP_Idn	.517 (.190)	-.053 (.901)	.228 (.588)	-.280 (.502)	-.112 (.792)	1	6.92	.27
N	48	48	48	48	48	48	48	48

Source: compilation of authors. Standard errors in parentheses: **ρ <0.01, *ρ <0.05

Table 4. Correlation and descriptive statistics in USA

	AVA_Usa	GII_Usa	UP_Usa	RP_Usa	SGI_Usa	DP_Usa	Mean	S.D
AVA_Usa	1	.172 (.684)	-.274 (.512)	.336 (.416)	-.331 (.424)	-.145 (.731)	194.81	14.69
GII_Usa	.172 (.684)	1	.514 (.192)	-.274 (.512)	.284 (.496)	.037 (.931)	60.8	.74
UP_Usa	-.274 (.512)	.514 (.192)	1	-.836** (.010)	.867** (.005)	.658 (.076)	82.16	.49
RP_Usa	.336 (.416)	-.272 (.515)	-.836** (.010)	1	-.923** (.001)	-.798* (.018)	17.83	.49
SGI_Usa	-.331 (.424)	.284 (.496)	.867** (.005)	-.923** (.001)	1	.709* (.049)	85.34	1.18
DP_Usa	-.145 (.731)	.037 (.931)	.658 (.076)	-.798* (.018)	.709* (.049)	1	3.61	1.03
N	48	48	48	48	48	48	48	48

Source: compilation of authors. Standard errors in parentheses: **ρ <0.01, *ρ <0.05

In Table 3, it is contrary to China, where there is a negative correlation value (ρ <0.01) in Indonesia: AVA_Idn to RP_Idn (-0.919), and GII_Idn to RP_Idn (-0.836), and UP_Idn to RP_Idn (-0.996). On the other hand, a positive

correlation at 1% probability triggers a positive correlation between AVA_Idn and UP_Idn (0.904). In 5% probability (ρ <0.05), only GII_Idn is positively related to RP_Idn (0.810), but AVA_Idn is negatively correlated to GII_Idn (-0.731). There are different means and S.D points between AVA_Idn and DP_Idn. The highest gain is for the mean (129.62) and S.D (10.72), while the smallest is for the mean (6.92) and S.D (0.27).

For Table 4, there is poor performance in the relationship UP_Usa with RP_Usa (-0.836) and RP_Usa against SGI_Usa (-0.923). With the same probability level (ρ < 0.01), UP_Usa actually has a positive impact on SGI_Usa (0.867). Based on 5% probability (ρ < 0.05), RP_Usa to DP_Usa is negative (-0.798), but SGI_Usa and DP_Usa are positively correlated (0.709). From the largest mean and SD scores: AVA_Usa (194.81; 14.69), then the smallest: DP_Usa (3.61) and UP_Usa and RP_Usa which both achieved 0.49.

Table 5. Correlation and descriptive statistics in India

	AVA_Ind	GII_Ind	UP_Ind	RP_Ind	SGI_Ind	DP_Ind	Mean	S.D
AVA_Ind	1	.770* (.025)	-.945** (.000)	.977** (.000)	.860** (.006)	.184 (.663)	401.6	65.94
GII_Ind	.700* (.025)	1	-.825* (.012)	.795* (.018)	.717* (.045)	-.025 (.953)	34.79	1.67
UP_Ind	-.945** (.000)	-.825* (.012)	1	-.987** (.000)	-.886** (.003)	-.236 (.574)	66.15	1.05
RP_Ind	.977** (.000)	.795* (.018)	-.987** (.000)	1	.911** (.002)	.284 (.496)	33.84	1.05
SGI_Ind	.860** (.006)	.717* (.045)	-.886** (.003)	.911** (.002)	1	.262 (.531)	51.39	1.19
DP_Ind	.184 (.663)	-.025 (.953)	-.236 (.574)	.284 (.496)	.262 (.531)	1	8	.22
N	48	48	48	48	48	48	48	48

Source: compilation of authors. Standard errors in parentheses: **ρ <0.01, *ρ <0.05

Referring to Table 5 above, there is a match in the correlation scores of China and India. Overall, at 1% probability (ρ <0.01), a positive correlation is connected between AVA_Ind against RP_Ind (0.977) and SGI_Ind (0.860), then RP_Ind with SGI_Ind (0.911). In addition, there are three negative correlations: AVA with UP_Ind (-0.945), UP_Ind to RP_Ind (-0.987) and SGI_Ind (-0.886). At 5% probability degree (ρ <0.05), it was found that AVA_Ind to GII_Ind (0.770), GII_Ind to SGI_Ind (0.717), and RP_Ind to GII_Ind (0.795). Yet, a negative correlation was found in the relationship between GII_Ind and UP_Ind (-0.825). The largest mean and SD scores were AVA_Ind (401.6; 66.94), while the smallest was DP_Ind (8; 0.22).

3.2 Regression Estimation

In Table 6, describe the output of the comparative regression technique. Sequentially, various results are displayed in the four models. R Square (R2) indicates the strength of the dependent data explained by the combination of independent variables. When compared, the coefficient of R Square in India is far near perfect (99.9%). This figure is far above the coefficient of China (99.4%), Indonesia (95.2%), and the smallest is USA (57.7%).

Table 6. Empirical calculation

	CHN	IDN	USA	IND
R Square	.994	.952	.577	.999
S.E	.013	.034	.112	.007
F-Statistics	65.195 (.015)*	7.886 (.036)*	.200 (.936)	742.021 (.001)**
Constant	-8.260 (.472)	13.970 (.794)	9.839 (.894)	-81.925 (.008)**
GII	-1.656 (.087)	.484 (.043)*	3.392 (.024)*	-.019 (.881)
UP	5.851 (.004)**	.518 (.009)**	-6.589 (.734)	12.616 (.010)**
RP	.865 (.027)*	-1.960 (.742)	1.810 (.730)	12.563 (.003)**
SGI	-1.404 (.400)	-1.556 (.386)	1.148 (.000)**	-1.826 (.023)*
DP	.127 (.600)	.434 (.453)	.180 (.013)*	-.945 (.015)*
N	48	48	48	48

Source: compilation of Authors. Standard errors in parentheses: **ρ <0.01, *ρ <0.05

The closer to one (1), the model issued by the Indian regression is indicated to be very workable. It is known that 0.1% is a variable outside the fourth model (India), while in China, there are 0.6% of variables that are not covered in the first model, 4.8% are variables that are not taken into account in the second model (Indonesia), and variables outside the third model (USA) as much as 42.3%. The standard error (S.E) implies that the prediction error in the regression in India is actually the lowest (0.7%), followed by China (1.3%), Indonesia is in third place (3.4%), and the last or fourth position, i.e. USA (11.2%). In detail, simultaneous testing in the case of India, proved that GII, UP, RP, SGI, and DP had a significant impact on AVA ($\rho<0.01$). Systematically, a simultaneous relationship was also found in China and Indonesia ($\rho<0.05$). Interestingly, in the USA it had no significant effect ($\rho = 0.936$). Although the constant in India was severe, where the score reached -81.925 ($\rho=0.008$), the UP and RP variables had a significant effect on AVA ($\rho<0.01$). The SGI and DP variables partially also have an effect on reducing AVA, if both increase, it will increase AVA in the long term, where $\rho<0.05$. Table 6 also shows that when the value of the constant in China decreases by 8.260, it further increases the partial impact between UP ($\rho<0.01$) and RP ($\rho<0.05$) on AVA.

Other attention is also focused on the case of Indonesia. With a constant score of 13.970, partially significant correlation between GII ($\rho<0.05$) and UP ($\rho<0.01$) on AVA. The implication in the USA is the exact opposite with India. Technically, the increase in the positive constant (9.839) was proven to affect AVA through GII and DP ($\rho<0.05$) and AVA also increased through SGI ($\rho<0.01$) in the short term.

4. Discussion

Agriculture is an ancestral heritage that holds the continuity of life in the country. Today, every nation is competing to improve the agribusiness system, so that it becomes a source of national income. Even so, the implementation of the domestic agricultural sector also controls global food security, where trade flows allow cooperation across countries (see Figure 2).

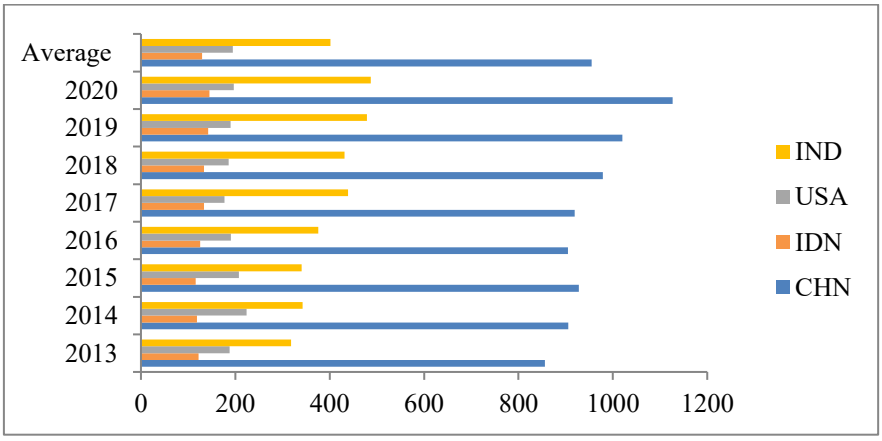

Figure 2. Dynamics of AVA in CHN–IDN–USA–ENG, billion US$
Source: The Global Economy (2022)

During 2013-2020, the average frequency of AVA in China: US$ 954.8 billion or ranks first. In second place is India: 401.6 billion US$, third from the USA: 194.8 billion US$ and lastly or fourth in Indonesia: 129.6 billion US$. The year 2020 is the period with the largest AVA in China: 1,126.70 billion US$, while in Indonesia at the same time as China: 145.1 billion US$, USA in 2014: 223.8 billion US$, and India in 2020: 487.2 billion US$. The success of AVA China in first place is inseparable from the popularity of rice product producers. Heilongjiang province continues to maintain its title as the producer of the highest quality rice in China. In fact, the area of rice plantations is around 15.94 million hectares. The government also facilitates renewable technology to farmers, so that they are able to maximize the total agricultural area of 80.47 million hectares per year. The province is also home to 37.73 million people with an area of 473,000 km^2, which concretely recorded a Gross Regional Domestic Product value of up to 1.6 trillion yuan, an increase of 4.7% compared to 2018. List of largest agricultural commodity producing countries (2013) informs that India (rank 2) and Indonesia (rank 3) are the countries producing rice products in the world. Rice is seen as a leading commodity that is not only enjoyed by the lower-middle class, but also the upper-middle class, and the rich (Felipe et al., 2012; Ferreira et al., 2013). From India, it is expansive to become the world's rice granary, and it is in Bangalore province and Jaipur province. India's rice export volume to all corners of the world reached 9.5 million tons. The Asian region dominates the world's rice exporters. Six out of ten rice exporting countries come from Asia, the rest from the Americas. The staple food of most Asian people is rice so that rice is the main product of agricultural products in several Asian regions (Katadata, 2016).

Side by side with China and India, the locomotive producing rice commodities is the most skilled in Indonesia, such as the cluster of Central Java-East Java-West Java. In 2020, rice production in Indonesia will reach 31.33 million tons. Even though it has an area that is not wider than other provinces, most regions on the island of Java have controlled the highest rice production in Indonesia (Rifky, 2021). The exodus to sorghum in the USA is the highest at the global level and far outperforms Mexico in 2nd place and Nigeria in 3rd place. Sorghum is speculated as an alternative food to grow from a small discussion platform to a big discussion. The durability of this food alternative in dry areas, especially in uncertain weather such as in the province of Kansas which in 2021 produces the largest volume of any US state. In Kansas, about 265 million bushels of sorghum are produced into grain products (Statista, 2022).

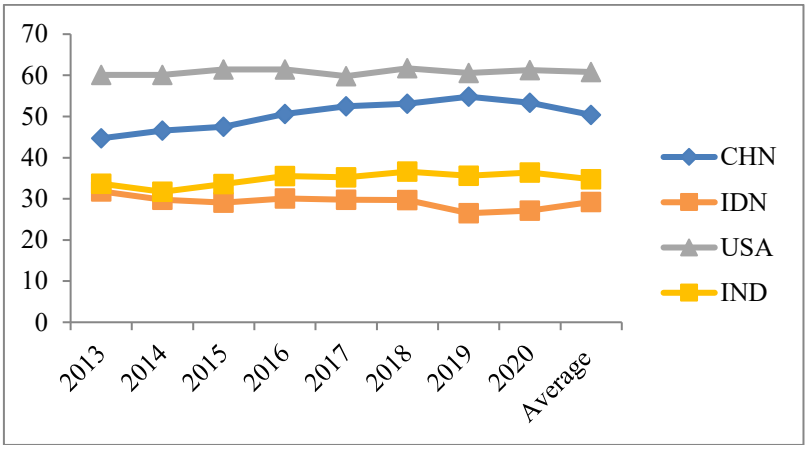

Figure 3. Dynamics of GII in CHN-IDN-USA-IND, points
Source: The Global Economy (2022)

For 8 periods, compared to the three countries, the USA has the largest average GII of 60.8 points. Then, followed by rank 2: China (50.4), rank 3: India (34.8), and rank 4: Indonesia (29.2). This is the worst thing for Indonesia, considering that its population will reach 278,163,604 people in 2022 or its growth from 2002 to 2022 is around 29.9%. The year 2015–2016 was the highest GII period in the USA with 61.4 points, while in China in 2019: 54.8 points, in 2018 for India: 36.6 points, and in Indonesia: 31.8 points (see Figure 3). One of the indications that affect the smallest level of GII in Indonesia, such as barriers to marketing, management, slow flow of investment in manufacturing, access to finance, and institutional gaps, and raw materials for business agglomeration (Dhewanto et al., 2013; Hartono, 2018; Safrianti et al., 2021).

The experiments reviewed by Baryshnikova et al. (2022), Devaux et al. (2018), Horton et al. (2022), and Zeng (2017) attempted to examine inclusive value chains in agriculture through the effectiveness of innovation. As a result, the orientation in the technological revolution changes the innovation web on traditional food to the 5.0 agricultural system. Innovation value chain planning affiliated through an international network of professionals, intervening in complex farmer livelihood frameworks. The participatory market chain approach in innovative applications, has made a commitment to facilitators to respond more efficiently to the commercialization of agriculture in Latin America, the European Union (EU), Asia and Africa. The trend in the 59 countries that are members of the Organisation for Economic Co-operation and Development-World Trade Organisation (OECD-WTO), the reaction to more innovative technology, makes the research and development system (R&D) effective to compete at the international level. Especially in China, it makes sense to incorporate inputs such as R&D to stimulate innovation–technology into outputs.

Based on Figure 4 and Figure 5, there are points of unequal distribution of population in the "top-4" of the world's largest population. In fact, the population in urban areas increases sharply every year, but, in rural areas, it decreases. The distribution of urban population in the USA is the highest, where the average is 82.17%. Then, it is ranked 2nd in India: 66.16%, followed by China: 58.48%, and the last rank is Indonesia: 54.98%. Although the population density ratio in these four nations is below countries such as Macao, Monaco, Singapore, Hong Kong, and Gibraltar, the population levels in some cities in China, Indonesia, USA, and India tend to be abnormal. In 2022, India and China are listed in the "10 most populous cities" in the world, of which 32,065,760 residents live in Delhi, Mumbai with 20,961,472 residents, Shanghai is home to 28,516,904 residents, and 21,333,332 residents live in Beijing. On the one hand, Indonesia occupies the 29th position with a large population in the capital (Jakarta) up to 11,074,811. Then, 8,930,002 residents thronged big cities like New York, bringing the USA to 41st (World Population Review, 2022b).

In rural areas, the average Indonesian population living in villages is 45.02%. China: 41.52% (second position), India: 33.85%, and USA: 17.84%. In the 1990s, the government issued a massive "transmigration" policy that

moved some urban residents to remote areas throughout Indonesia as a preventive measure to stabilize national development, including cultivating land for agricultural cultivation. The logical factor that triggers the small number of villagers is the "migration effect" of people moving from one location to another, either from the USA or abroad. Second, generally post-retirement workers prefer to enjoy old age and want happiness through a village atmosphere, some even among retirees who buy land to cultivate crops (Luborsky & LeBlanc, 2003). Villagers in the USA who are classified as productive age tend to choose to work in cities (Pateman, 2011).

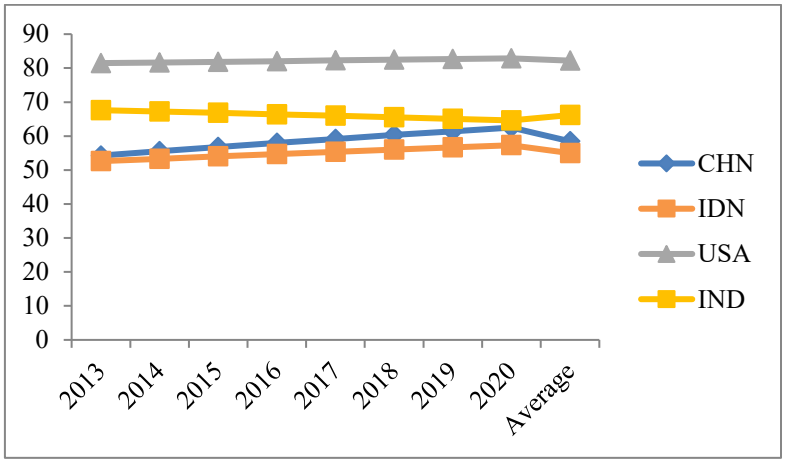

Figure 4. Dynamics of UP in CHN–IDN–USA–ENG, %
Source: The Global Economy (2022)

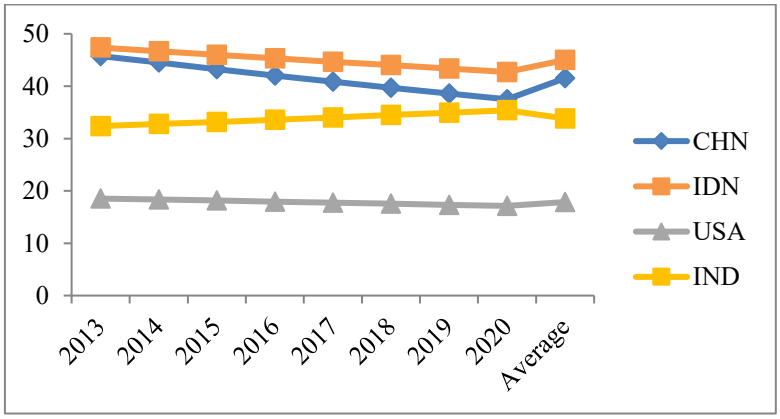

Figure 5. Dynamics of RP in CHN-IDN-USA-IND, %
Source: The Global Economy (2022)

Gebre & Gebremedhin (2019), Lagakos (2020), Riaz et al. (2022), and Tacoli (2003) examine rural-urban perspectives on agricultural ecosystems. The mutual benefit in the level of dependence of the village with the city and vice versa should not ignore agriculture as the mainstay of the economy in rural areas. The manifestation of rural development is absolutely necessary for urban areas to function. A series of recent evidence reveals that the rural–urban gap is, in fact, fueled by substantial uncontrolled migrants. The extraordinary sensitivity of diversity from the failure to strengthen decentralization has actually pushed the urban poor to adjust to moving to agricultural areas. For example, in Pakistan, cointegration in the linkage between polemic urbanization, reduces agricultural growth.

The social level in the global context, which is converted to SGI, proves that the percentage of SGI in the USA is above the average SGI in China, Indonesia, and India, which is 85.34 points. In 2013-2020, the average SGI in China: 56.38 (position 1), Indonesia: 53.68 (position 2), and India: 51.40 (position 3). The dominance of SGI points in China, USA, and India is supported by its biggest achievements in 2020: 57.96, 86.91, and 53.46. Too, only Indonesia with the highest SGI was in 2018 at 54.74 points (see Figure 6). The collapse, culture, social, and tradition when the recession of trust triggered by SARS-CoV-2 in 2019 or what was called "COVID-19" featured news content related to the issue of "transporting", so that it was conveyed with negative perceptions to the public (Gandasari & Dwidienawati, 2020). The collapse of public trust also creates health vulnerabilities, especially existential mental threats (Alamsyah et al., 2021).

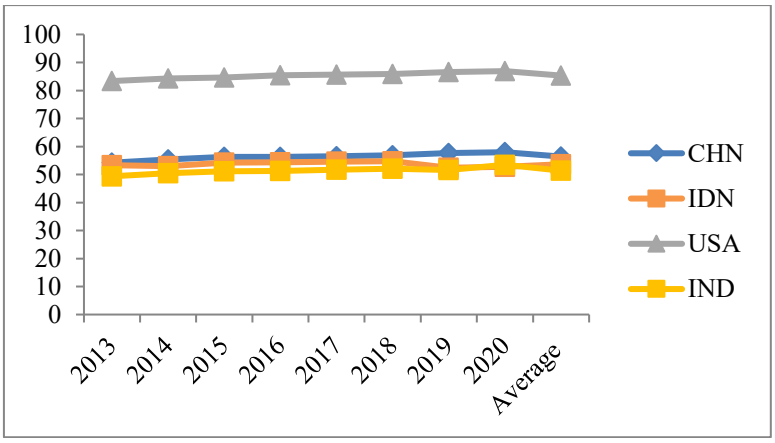

Figure 6. Dynamics of SGI in CHN-IDN-USA-IND, points
Source: The Global Economy (2022)

Arifin (2013), Ceylan & Özkan (2013), Dos-Santos (2020), Kołodziejczak (2020), and Meikle (2016) state that market expansion and globalization, brought reactions to fast-growing middle-high and middle-income nations in the market developing that offers opportunities for agricultural producers. Characteristics such as: Product innovation, flexibility of delivery time, cost, and quality of the farm, create a different value chain by market participants. In the concept of "Solow Growth", the per capita income of the agricultural economy in EU integration is semi-elastic. The essence of the introduction of employment in agriculture, framed by the level of surplus demand for services. In competence, the performance of the most vital agricultural commodities in Indonesia include: Manga, cashew, cocoa, tea, and coffee, the level of competitiveness tends to be conservative. The future of local agribusiness in the Mississippi Delta–USA is aligned with global development.

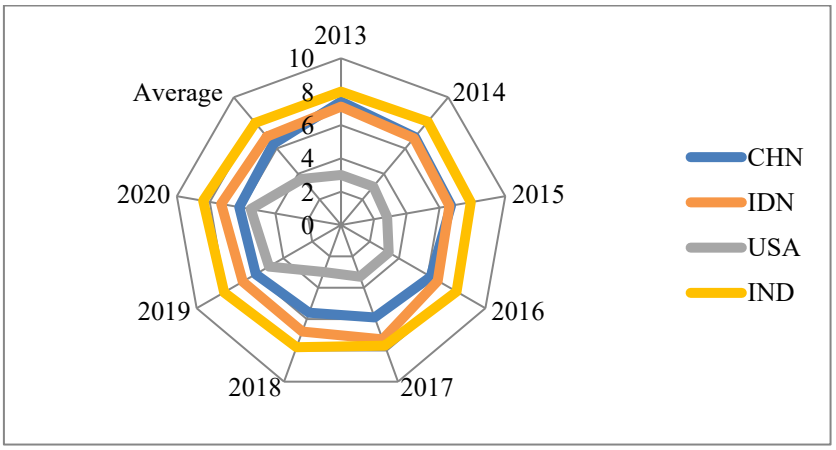

Figure 7. Dynamics of DP CHN-IDN-USA-IND, points
Source: The Global Economy (2022)

Surprisingly, from Figure 7, the proportion of DP in the USA is the lowest when compared to China, Indonesia, and India. The averages throughout 2013-2020 was 3.6 points. China with the lowest DP: 6.4, ranks 3rd in Indonesia: 6.9, and the highest in India: 8. In aggregate, the level of DP in the four case studies fluctuates. In 2020, DP reached 8.4 points in India and 5.5 points in the USA as the largest, followed by China in 2014 (7.4), and Indonesia for 2017 and 2020 (7.3). This fact is in line with the Investopedia (2022). Of the "top 10 economies" at the global level, despite India's reputation as a rich nation, its GDP growth was 8.9% and its GDP per capita touched 2,277 US$. It is only contemporary, where due to the inequality of population across regions, the population is experiencing demographic pressure. In 2021, the USA, whose GDP grew by 5.7%, was able to simulate a GDP per capita of around US$ 69,287, but the happiness of the population was high enough, thus eliminating demographic pressures. Another overview based on Investopedia (2022) also highlights China in 2nd place with GDP rate and GDP per capita level: 8.1% and 12,556 US$, respectively. Finally, Indonesia is in the 16th position which has a GDP rate of 3.7% and a nominal GDP per capita of 4,291 US$.

Rationally, anticipating climate change, especially the level of agricultural health, urges permanent mitigation policies considering that health and migration patterns in India are determined by terrestrial water storage

anomalies (Bhargava, 2019). Calicioglu et al. (2019) focus on solutions to agricultural intensification that are useful in maintaining the food supply of the world's population, which always brings climate change.

5. Conclusions

The open economy has polarized the entire market share, agriculture is no exception. Consequently, it makes all nations race to increase innovation and social level to integrate the agricultural sector. At the same time, the population density is not balanced, causing turmoil between rural and urban areas, thus potentially triggering demographic pressures. Priorities in research to investigate the factors that influence AVA include: GII, UP, RP, SGI, and DP. The result, concluded four points: (1) The effect of increasing UP and RP, has a significant effect on AVA in China; (2) The increase in GII, SGI, and DP has a significant effect on the increase in AVA in Indonesia; (3) The increase in GII, SGI, and DP also significantly affects AVA in the USA; and (4) Although UP, RP, SGI, and DP have a significant effect on AVA, but SGI and DP have a negative effect that reduces AVA in India. Internal reasons that highlight the four nations are more focused on areas that have large populations, but there is an inequality of occupancy between urban and rural, so that it has an impact on demographic pressure. Here, the external emphasis is on the case in AVA, where there must be implicit policies to prevent food vulnerability and crises. Long-term efforts will focus on mitigating the narrowing of agricultural land.

By examining the negative implications of each variable in the four observations above, practitioners and the academic community can develop the discipline of agricultural economics, referring to the novelty of this research. The weak value of GII in Indonesia indicates barriers in the management of marketing works or intellectual products developed domestically, so this requires specific actions and is addressed in improving the quality of education, encouraging knowledge and creativity, stimulating more relevant bureaucratic partnerships and leaving governance conservative, expanding international business aspects, improving infrastructure, modernizing technology, and the essential thing is collaboration between universities through research partnerships. Next studies also follow up on the prospect of AVA, which highlights not only emerging markets, but also frontier markets.

Finally, all interested stakeholders consider public policies related to modern agricultural convergence. The polemic of increasingly narrow agricultural space and cornered by "extortion" of non-integrated economic sectors, such as the manufacturing industry, requires emergency action, designing structural recommendations, and initiating intense communication between agricultural institutions.

Author Contributions

Each author contributed substantially to each work with the following details. Conceptualization, Z.H., methodology, D.C.D., software, D.C.D., validation, J.J., formal analysis, S.D., investigation, J.J. and Z.H., resources, S.D., Z.H., and J.J., data curation, D.C.D., writing-original draft preparation, J.J., and Z.H., writing-review and editing, D.C.D., and visualization, S.D., and J.J., supervision, Z.H., project administration, D.C.D., and funding acquisition: Z.H., and J.J. All authors have read and agreed to the published version of the manuscript.

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Data Availability

The data set in this study was obtained from the Global Economy report. Data related to indicators in macroeconomics is filtered, modified, and supports the interpretation of the analysis.

Conflicts of Interest

The authors declare no conflict of interest.

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