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Research Article

A Study on the Effects and Influencing Factors of Agricultural Support and Subsidy Policies from Big Data Computing and Analysis

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Agriculture is the backbone of any country in any given situation. Without agriculture, it will be very difficult for any living being to survive. To increase productivity in agriculture, the farmers are dependent on government policies and subsidiaries provided to them. The policies and subsidiaries should support and encourage farmers to work hard and do some innovations in agriculture. In this research work, an agriculture dataset concerning the policies and subsidiaries of China is considered. The research proposed a subsidy distribution algorithm for evaluating the policies. The proposed model provided an accuracy of 98% in determining the research objectives. The study results revealed that procedural support for government subsidy policies and agricultural support is low. It is recommended to increase domestic policy to support agriculture.

1. Introduction

Agricultural growth in China has had ups and downs throughout the last two decades, reflecting the ups and downs of the country's economic growth. However, this is the case despite China's tremendous macroeconomic growth and the government's substantial support for agricultural programmes [1]. Recent studies on agricultural economic cycles in Spain, Cuba, and the United Kingdom have identified the underlying causes of these cycles, which have been confirmed by other researchers [2, 3]. According to new research, agricultural production cycles in Spain's regional economy are constrained by the natural environment and ecological limits but have profited from the country's rapid economic and social development as well as globalization. It has been demonstrated historically in Cuba that agricultural development is a nonlinear process that progress through four stages: growth, maturity, collapse, and transition. The adaptive renewal cycle serves as the foundation for this concept. Research conducted in the United Kingdom has revealed that agriculture has a long-term positive impact on cultural management and ecosystems and that this will have a broad impact on cultural service assets in general. After shifting several times since 1952, China's agriculture economic cycle has gone through four traditional economic cycles as well as three growth cycles during that period [4]. Contrary to the cyclical fluctuations in the economy, agricultural economies have evolved and developed in response to a variety of economic policies and structural reforms. Changes in Chinese government policy are the most significant source of agricultural variation [5]. The agricultural economy is vulnerable to cyclical fluctuations, which are attributed in part to institutional factors in agriculture. The paper is aimed at analyzing the influencing factors of agricultural support and subsidy policies from the point of view of farmers' production behavior. The paper is organized into five sections. Section 1 presents introduction and objectives of the study. Sections 2 and 3 highlight the related studies and methods used in this study. Section 4 focuses on results

and analysis of the study and Section 5 presents the conclusion.

The objectives of this study are to establish a typology of agricultural policies used to influence agricultural productivity and provide a preliminary overview of the subsidy policies given to farmer production. Hopefully, the results of this study will help us understand how we can affect the supply of healthier agricultural commodities while also informing policy discussions. It is important to rethink current production systems and switch to ones that are more environmental friendly if agricultural production systems are to keep up with rising demands and the depletion of natural resources and still provide enough food for the whole world.

2. Related Studies

In China, the productivity of agriculture has fallen significantly as a result of globalization. As a result of these factors, agricultural output geared toward export has, on the one hand, significantly improved access to agricultural goods in adverse environments [6]. On the other hand, countries all over the world have increased their export-oriented crop output as a result of these factors. Importers' food supply remains secure, but exporting countries are more dependent on agriculture-focused foreign investment. In this era of globalization and agricultural production, there are few difficulties more daunting than the availability of tobacco and crops used in the manufacturing of dangerous foods. Agriculture production in general and livestock production, in particular, are both sensitive to the dangers stated above as a result of the simultaneous process of trying to manage demand for these items while also dealing with market instability [7].

Understanding the relationship between government policy and agricultural supply involves the use of a multilayered strategy. International agency and regime prescriptions and regulations, as well as local environmental factors and the legacies of national or subnational institutions, all have an impact on how governments tackle agricultural issues in their own countries. Government approaches to agriculture are influenced by ideas about economic development and economic interests, among other things. It is necessary to put this puzzle together to properly comprehend how these components interact in agricultural production, policy, and public health research, among other applications [8]. These policies and programmes are evaluated to identify how they fit into the global political economy as a whole, putting this puzzle piece back together again. Government policy has a direct and palpable impact on agricultural productivity, and it is one of the more direct and tangible influences on agricultural production. Therefore, it is anticipated that more emphasis will be paid to agricultural output and unhealthy goods concerning disease load and overall health [9]. Finding out what lessons may be learned from prior attempts to improve agricultural production in some way is an important goal of this scoping review, and this is one of its primary objectives. Environmental sustainability is a key component of agriculture's commitment to taking excellent care of the natural systems and resources on which its business depends. Crop rotation and no-till systems (or reduced-till systems), integrated pest control, and precision farming are just a few examples of farming technologies that promote environmental sustainability [10]. Overall, sustainable agricultural policies seek both to protect the environment and to increase (or, at the very least, maintain) farm productivity as their primary goal.

Natural resources are being depleted owing to competition for land and water. This might have long-term ramifications for farmers and other resource users, not to mention the general public [11]. By implementing sustainable agriculture practices, we save natural resources while boosting our ability to respond to climate change and uncertainty. As a result, employing them could result in major environmental benefits in the future. Adoption of sustainable practices can result in food systems that are more robust and productive. As a result of this programme, poverty will be decreased, and food security will be enhanced in the affected areas [12]. Another concern is food security, which affects both the macroeconomics and the microeconomics of a country. Agriculture has an impact on both the macroeconomics and the microeconomics of a country. Since most countries are still in the early stages of development and that a significant portion of the world's population is still underdeveloped, economic growth has become a popular topic in the global economy [13]. In 1946, it was observed that only a detailed understanding of the processes of change inherent in economic growth could effectively steer progress. Burns and Mitchell, both economists, agreed with each other. According to the agricultural surplus theory, a well-developed agricultural sector is essential for the development of the rest of the economy [14]. Since 2004, the Chinese government has established favorable agricultural policies in order to assist the country's agricultural businesses in thriving and prospering. For the previous few decades, China's gross domestic product (GDP) has increased by double digits, while the country's rate of growth has slowed slightly in recent months, it continues to be one of the world's fastest-growing economies overall. Even if short-term growth may be impressive, long-term agricultural expansion is constrained by issues such as over-exploitation of natural resources and environmental harm, among other things. A panel vector autoregressive model was used to investigate the role of water in China's agricultural development. Chinese infrastructure investment is a major contributor to the country's agricultural GDP growth [15]. In addition to climate, a wide range of additional elements can have an impact on agricultural output and development. Rainfall, currency exchange rates, and food exports, to name a few factors, all have an impact on agricultural productivity in Nigeria. The importation of food, the diversion of funding from agriculture, and the lack of widespread use of agricultural technology are the primary obstacles to Nigeria's agricultural development.

Additionally, research indicates that increasing agricultural research and development spending will aid in the acceleration of economic growth in the agriculture sector.

However, greater fiscal spending on agriculture, although it would help to expand agricultural production, has the potential to harm the quality of the agroecosystems [16]. Environmental protection, particularly soil and water conservation, has a substantial impact on the per capita income of rural Chinese households. The rural economic system needs to be strengthened in terms of reforms and innovation if agriculture is to prosper sustainably over the long run. The development of China's agricultural economy is assisted by a land system that is in accordance with the country's macroeconomic conditions. Land reform in Commonwealth of Independent States (CIS) countries, such as those in the former Soviet Union, has been connected to gains in agricultural output in the past. According to research undertaken in EU nations, as a result of CAP support, the average farm income has already caught up to the average non-farm income. Agricultural policies are crucial in the fight against poverty as well as the expansion of agricultural production [17]. Instead, faulty agricultural policies have the potential to stifle the country's development. It is possible to enhance agricultural output over the long term by implementing solid monetary and fiscal policies.

The price mechanism and the land system both have the potential to assist in the transition of the agricultural sector from a low-growth to a high-growth state. Since the 1980s, China's agricultural development has become more stable, and the size of swings in the agricultural economic cycle has shrunk substantially in comparison to previous decades. The agricultural economic cycle in China is characterized by a high frequency of occurrence but a small degree of change in amplitude [18]. While China's agricultural industry experiences times of sluggish growth, the country's agricultural economy demonstrates great inertia. When agricultural output increases at a quick pace, the likelihood of shock increases proportionately as well. In addition to the fact that growth is gradual, the uncertainty associated with it is also small. Specific spatial correlations exist in agricultural economic cycles, which will increase agricultural economic swings as a result of cyclical spatial spillover, resulting in cyclical synergistic effects in agricultural economic cycles. From various perspectives, Chinese technical and institutional achievements should place a stronger emphasis on sustainable development that takes agriculture and the environment into consideration rather than generating policy objectives that are conflicting and often incompatible from various perspectives [19]. As a result of the Chinese government's agricultural policies, farmers' earnings have improved, and the country's long-term food security objectives have been met as a result of these policies. Such policies, on the other hand, have resulted in a price differential between the domestic and international markets for agricultural products, which has resulted in a major increase in agricultural imports as well as the accumulation of massive stockpiles [20]. China can assure food security and continue to grow its agriculture in the long run by applying the lessons acquired from prior attempts to reform agriculture through institutional reform, technical transformation, market reform, and agricultural investment. A more sustainable path forward for Chinese agriculture can be discovered in the moderately "small and precise" scale family farms that have grown across China in the last 30 years [21]. Agriculture's economic progress should not be at the expense of depleting natural resources or harming the environment; rather, it should place a high priority on long-and short-term coordination and balance in order to achieve long-term sustainability. To thrive and grow over the long term, sustainable agricultural economies rely on environmental friendly technological innovation to assist them in doing so. When it comes to agricultural economic growth, ecological agriculture technology innovation increases it by 0.375 per cent for every percentage point increase in agricultural output, while environmental technology dissemination boosts it by 0.542 per cent for every percentage point increase in agricultural output [22]. Agricultural economic development should be supported by acceptable ecological conditions, and the land use structure in the agropastoral zone should be modified to provide appropriate ecological conditions for agricultural economic development that is sustainable. The conservation of soil and water can aid in the development of China's agricultural sector and the reduction of rural poverty. Land size and agricultural labor are more important when it comes to poverty alleviation and economic progress than soil quality and capital inputs are. Soil and water conservation must be a primary priority for both governments and farmers if the agricultural industry is to flourish and rural poverty is to be alleviated. Scholars have employed a variety of Markov transfer (MS) models to statistically analyze the fluctuation dynamics of the Chinese economic cycle to evaluate the cycle's dynamic properties as they shift across regimes [23].

When it comes to China's agricultural subsidy policy, most of the country's literature focus on grain production, with two opposing opinions. The pro-subsidy side of the debate believes that the programme has increased farmers' incomes while also greatly expanding grain production [24]. Agriculture machinery and seed subsidies help increase grain production, notably the subsidies for agricultural machinery purchases, which have a substantial impact on increasing the revenue of large-scale farmers who plant and harvest with several machines. Some argue that subsidies do not affect farmers' willingness to increase agricultural investment because there is no cause-and-effect relationship between subsidies and farmers' investments. Since subsidies cannot offset the negative impact of rising production costs, they have no incentive function for farmers to increase their willingness to produce more grain, as the negative viewpoint believes. There has been little research on China's cotton subsidies, so researchers developed a model of multi-objective linear optimization with discrete data and simulated which subsidies could boost cotton production using historical data prior to 2007 and without subsidies throughout that period [25]. They concluded that it should be used instead of seed subsidies, such as irrigation and equipment subsidies.

3. Methods

Agriculture's share of revenue and employment falls with economic growth, as is well established in the development phase. Economic growth in the farm with non-farm sectors

is to blame for the shift in economic activity away from agriculture. In practice, increasing agricultural output, particularly in larger economies, has shown to be a potent factor.

In general, we can assume also that authorities within $\in$ region have given a H set of subsidy computation rules, which we will refer types are as follows:

$$\in = \{S_1(k_1, \ldots.., k_n), \ldots\ldots.., S_H(k_1, \ldots\ldots.., k_n)\}. \quad (1)$$

The level of funds assistance A_h^m granted to enterprise m in accordance with rule S_H is determined by the value of its performance measures for the most recent income statement:

$$A_h^m = S_h(k_1^m)^0, \ldots\ldots.., (k_n^m)^0. \quad (2)$$

Obviously, every subsidy allocation rule must be fiscally sustainable. It indicates that the entire amount of a subsidy cannot be greater than the amount of a budgetary allocation.

$$\sum_{m=1}^{M} A_h^m \le A. \quad (3)$$

The region investigates the relationship between socio-economic indicators of infrastructure investment and indicators of subsidy recipient performance. The $\overline{D}$ set has been specified. The quantitative relationship between each indicator's value and the enterprise's performance metrics is determined for each indicator:

$$D_j = D_j\left(k^1, k^2, \ldots\ldots\ldots, k^M\right), \quad j = 1, \ldots\ldots J, . \quad (4)$$

Each allocation of cash can be represented as a modified value $p_m(A_m, A_h)$. The concept of rational funds allocation by management is concerned with establishing the management plan that will produce the greatest feasible profit:

$$\pi^m(k^m, p_m(A_m, A_h^m)) \longrightarrow \max. \quad (5)$$

On the condition, we get

$$k_n^m = \varphi_n^m\left((k^m)^O, , p_m\left(A_m, A_m^h\right)\right), \quad n1, \ldots\ldots.., N, \quad (6)$$

where $\pi^m(.)$ is the income of the firm, $k^m = k_1^m, \ldots\ldots., k_n^m$ is the number of economic performance measures (varying models), and m n is the rule for modifying the value of indication n for the organization m.

$$\tilde{k}_h^m = \left((k_1^m)^h, \ldots\ldots., (k_n^m)^h\right). \quad (7)$$

Following the third stage, all values of performance indicators which can be reached through rational allocation of funds for every subsidy receiver are established with relation to each subsidy determination rules $S_h(where\, h = 1, \ldots\ldots., H)$:

$$\tilde{k}_h = \left(\tilde{k}_h^1, \tilde{k}_h^2, \ldots\ldots., \tilde{k}_h^M\right), \quad h = 1, \ldots.., H. \quad (8)$$

Every option of a subsidy's allocation must be assessed separately:

$$D_j^h = D_j\left(\tilde{k}_h^1, \tilde{k}_h^2, \ldots\ldots., \tilde{k}_h^M\right), \quad j = 1, \ldots. J\, h = 1, \ldots\ldots., H. \quad (9)$$

For the further evaluation, the subsidy calculation procedures in which each R_hj indicator value falls within the permissible range T_j are picked. H': denotes the set of integers used in such rules.

$$H' = \left\{h: D_j^h \in T_j, j = 1, \ldots.., J\right\}. \quad (10)$$

To make that decision also on subsidy allocation rule, you must develop an efficient index that allows you to assess the degree of conformance to the goal values of a region's economic growth:

$$\varnothing\left(D_1, D_2, \ldots\ldots., D_j\right) = \sum_{j=1}^{J} \lambda_j . D_j^O\left(k^1, k^2, \ldots\ldots., k^M\right). \quad (11)$$

4. Results and Discussion

In Figure 1, the increased use of farm subsidies as a fundamental component of agricultural policies has raised two major concerns (among others). First, what should the magnitude of subsidies be? While the expense of support programmers is a source of debate in affluent countries as well, it is understandably more pressing in poor countries, where government expenditures are being squeezed by several under-funded commitments. Subsidies, in particular, must be avoided by policymakers in order to avoid crowding out agricultural investments and also delay structural change processes. The exchange was between the short and long term. Subsidies have reduced the relative price of production in comparison to alternative fertilizers. As a result, fertilizer application is significantly skewed against fertilizer, disrupting soil nutrient equilibrium (refer Table1).

In Figure 2, subsidies are split evenly between the federal and state governments. Subsidies from the state government account for the majority of expenses in conjunction with loan forgiveness. Without loan approvals, the entire subsidy spending is nearly evenly split between the center and the states. The fertiliszer subsidy is the most important central subsidy, whereas the electricity subsidy provides for the majority of state spending (refer Table 2). As a result of globalization, farm production in China has decreased dramatically. Agricultural output oriented for export has, on the one hand, considerably enhanced access to agricultural commodities in harsh settings as a result of these variables. On the other hand, as a result of these circumstances, countries all over the world have boosted their export-oriented agricultural output. The food supply for importers is stable, but exporting countries are increasingly reliant on agriculture-focused foreign investment. Few challenges are more daunting in this era of globalization and agricultural production than the availability of tobacco and crops used in the creation of harmful meals. In general, agriculture production and animal production in particular are vulnerable to the threats listed above.

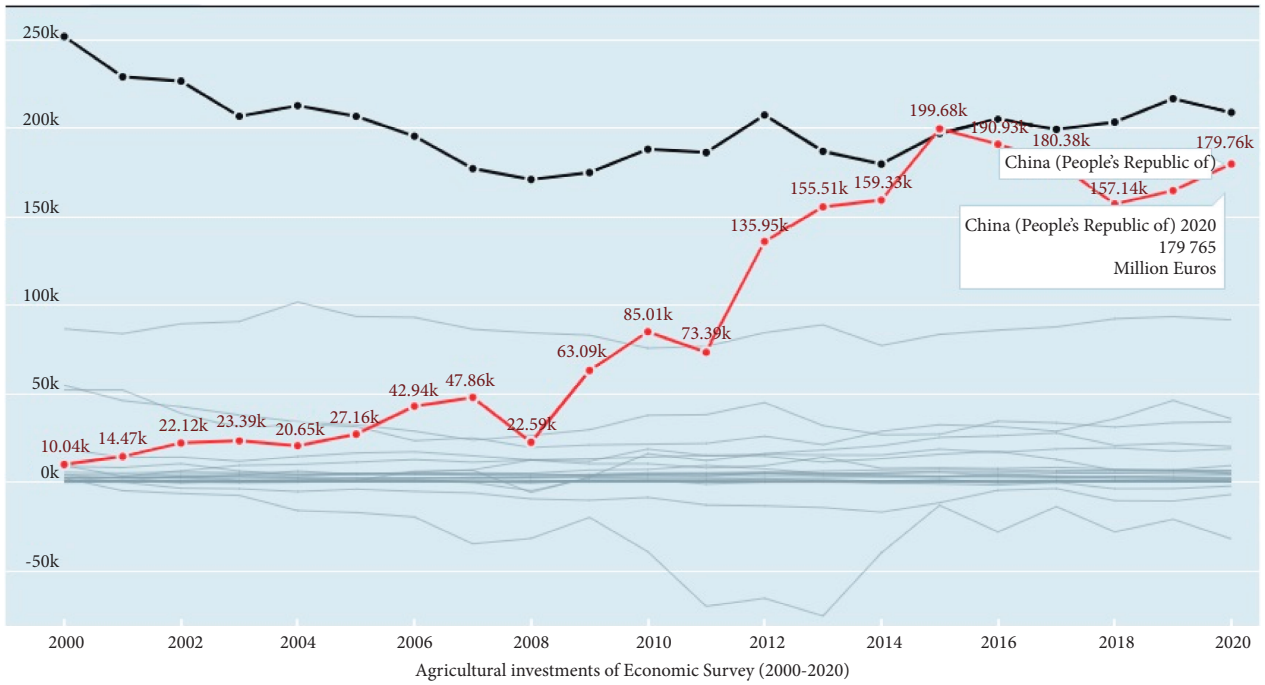

Figure 1: Agricultural investments of economic survey (2000–2020).

Table 1: Result analysis for agricultural investments of the economic survey (2000–2020).

Central government subsidies (China)	Amount
Fertilizer	80,000
Credit	25,000
Crop insurance	7,500
Price support	25,000
Total	1,37,500
State government subsidies (China)	
Power	95,000
Irrigation	19,500
Crop insurance	8,500
Loan waivers	1,33,200
Total	2,56,200

In Figure 3, as a result, although government farm subsidy spending is a large element of farm income, even a large increase in subsidies will also have (a) limited effects on farm anguish even though our farmers own small areas of land and (b) a slight impact on the generally reported gap because the gap is much too large. Subsidies are therefore too significant for farm incomes to be reduced, yet they do not represent feasible directions for the future of sustainable increases in farm incomes. The fundamental factors for rapid income increase continue to be the country's development activities (refer Table 3). Instead of establishing policy objectives that are inconsistent and frequently incompatible from multiple viewpoints, Chinese technical and institutional success should place a higher emphasis on sustainable development that considers agriculture and the environment. Farmers' wages have increased as a result of the Chinese government's agricultural policies, and the country's long-term food security objectives have been reached. On the other hand, such policies have resulted in a price gap between local and foreign markets for agricultural products, resulting in a significant rise in agricultural imports as well as the buildup of large inventories.

In Figure 4, despite recent increases, government investment in agriculture and irrigation (excluding flood management) remains clearly relatively low in LIS. While the proportion of LISs' social and economic spending in GSDP has remained high, at around 74% of the corresponding state level. Governments have prioritized expenditures in rural areas less. Agriculture spending increased at a 9.8 percent rate across states in 2020, and at a slightly higher 12.6 percent rate in MIS (Table 4). A multilayered method is employed in the interaction between government policy and agricultural supply. Prescriptions and rules issued by international agencies and regimes, as well as local environmental conditions and the legacies of national or subnational institutions, all have an effect on how governments address agricultural concerns in their respective nations. Ideas about economic growth and economic interests, among other things, have an effect on how the government handles agriculture.

In Figure 5, the expenses got so significant that industrialized countries devised a two-pronged policy approach to the stock accumulating issue. Policies continue to focus on non-excess procurement strategies, such as deficiency refunds and cash income transfers. Shortage payments, on the other hand, stimulate farmers to produce extra, and the issue of surplus supply (due to government assistance) will not disappear (refer Table 5). China is the most important and visible example of a developing country that has moved away from taxing and toward helping agriculture. Price subsidies and support in China have lately expanded at a rapid rate, and they have been linked to higher manufacturing costs. To

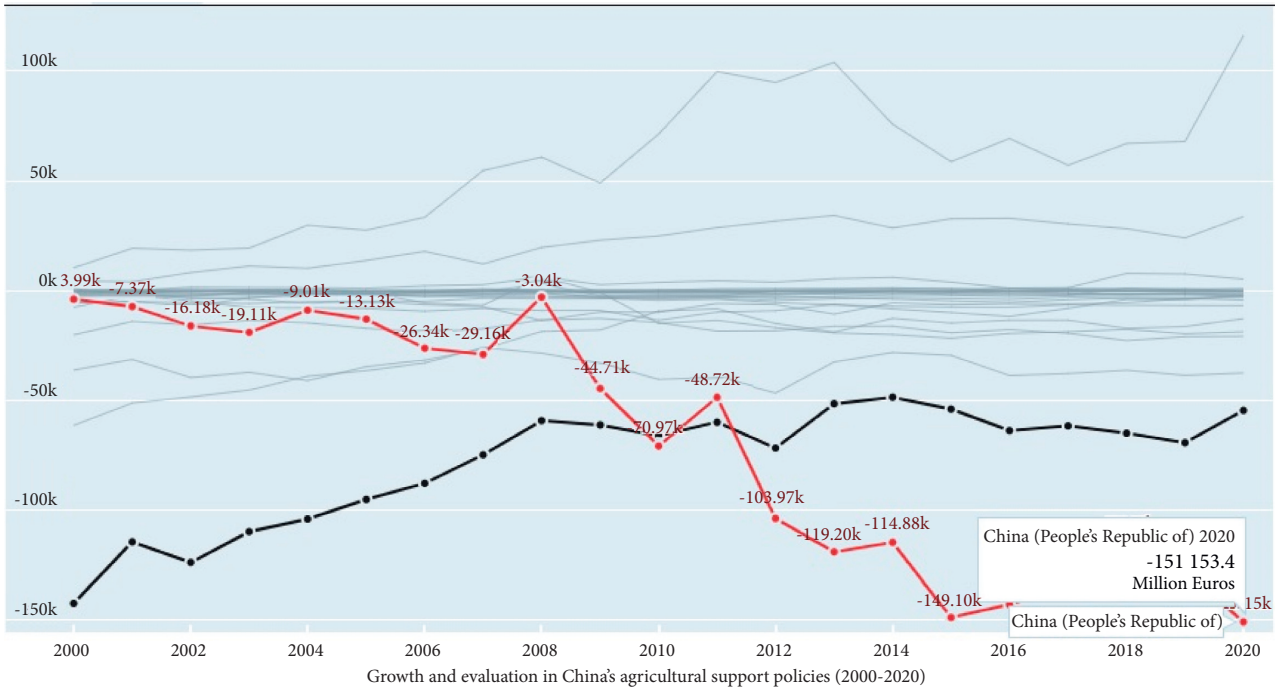

Figure 2: Growth and evaluation in China's agricultural support policies (2000–2020).

Table 2: Result analysis for China's agricultural support policies (2000–2020).

Name	Source	Year	Magnitude
Fertilizer	Union economical	2018/19	80,000
Power	Power finance establishment data	2016/17	95,000
Recognition	Union budget	2018/19	25,000
Irrigations	Essential water commission (2018)	2012/13	20,000
Crop insurance	Union economical	2018/19	15,000
Price funding	Author's approximation	2015/16–2017/18	27,000
Total (without filling to 2018/19 expense levels)			2,62,000
Loan relinquishments	PRS governmental investigation	2018/19	1,41,000

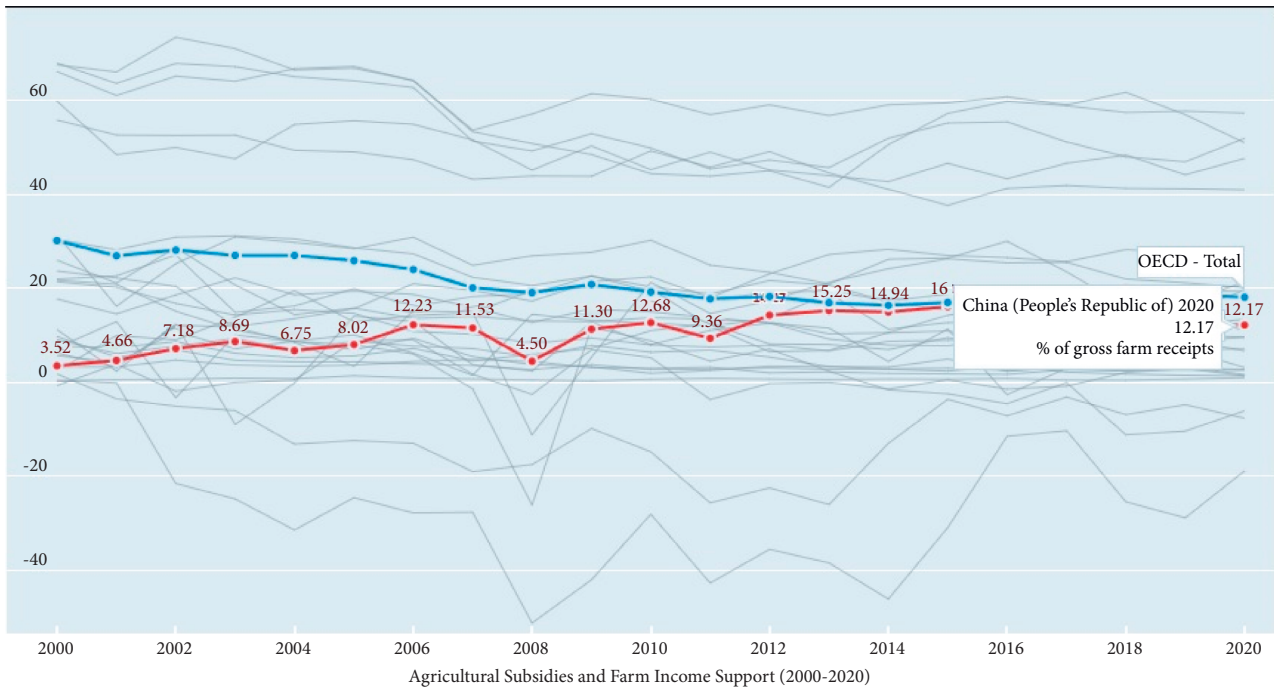

Figure 3: Agricultural subsidies and farm income support (2000–2020).

Table 3: Subsidy spending as a percentage of farm income.

For 2018/19	In 2006/7 prices
Subsidy of input for every hectare	8750
Subsidy to funding for every hectare	1250
Overall subsidy earnings	9800
Earnings for every hectare for farm cultivators	45,764
Income from subsidies/farm earnings	30%

encourage incentives and help in the procurement of agricultural imports, the government began to enhance price

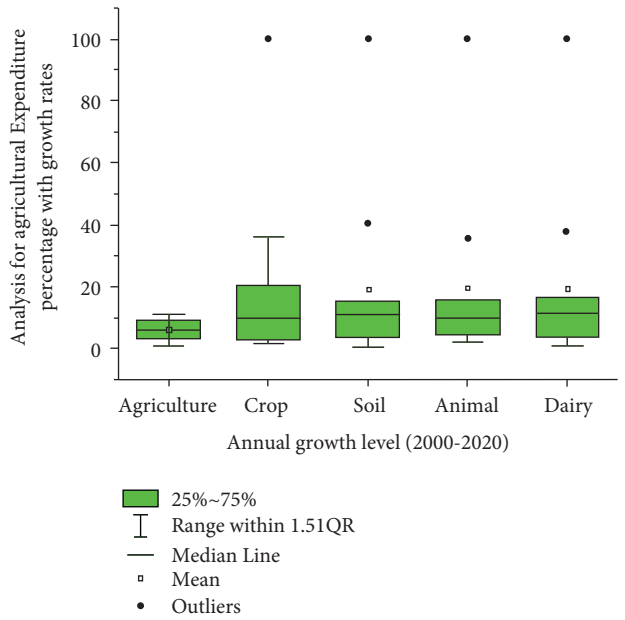

Figure 4: Expenditure percentages with growth rates for different agricultural operations.

Table 4: Result analysis for expenditure percentages with growth rates for different agricultural operations.

Annual growth level (2000–2020)	LIS	MIS	HIS	ALL
Agriculture	100	100	100	100
Crop farming	35.99	40.60	35.64	37.56
Soil as well as water protection	5.00	3.65	7.24	5.67
Animal farming	11.57	10.90	15.22	13.56
Dairy growth	2.32	3.75	4.30	3.45
Fisheries	2.90	3.23	4.21	3.56
Forestry and environment	20.43	15.23	15.67	16.35
Food, packing, and warehousing	15.06	14.43	9.45	12.90
Agricultural R&D learning	6.49	6.34	9.67	7.93
Cooperation	9.67	11.34	10.56	11.23
Others	1.67	0.45	1.89	0.96

Low-income states are referred to as LIS; middle-income states are referred to as MIS; and high-income states are referred to as HIS.

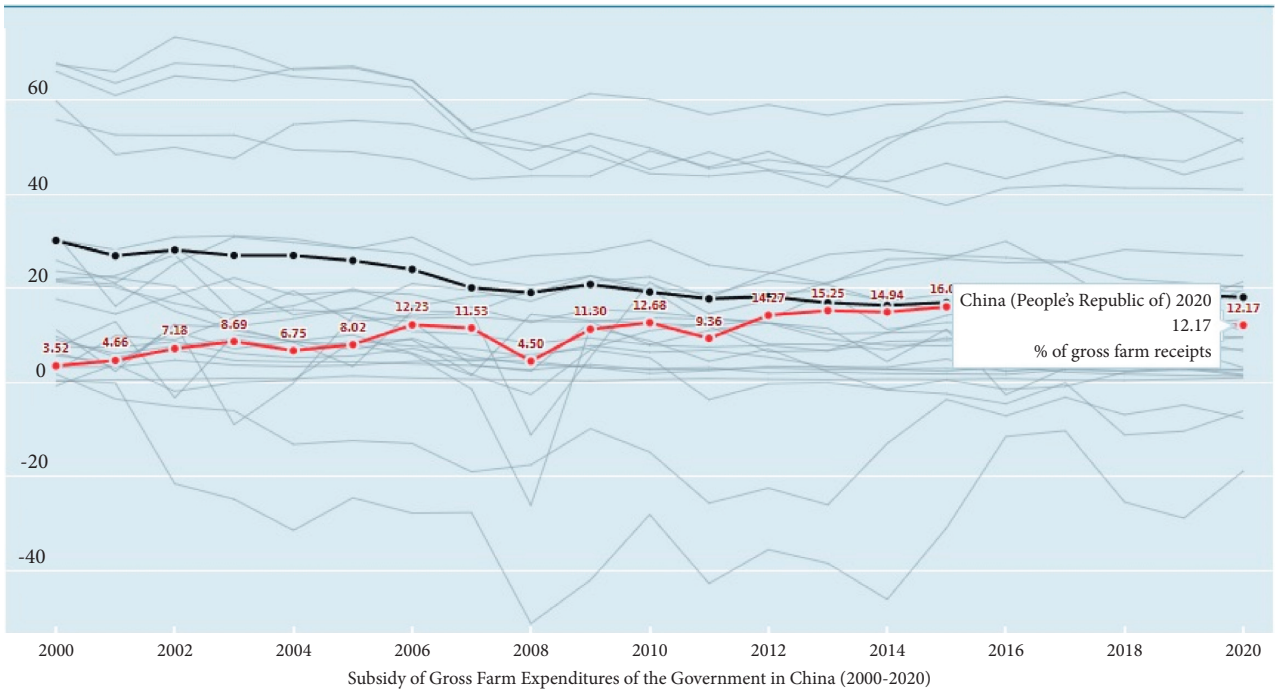

Figure 5: Subsidies of gross farm expenditures of the government in China (2000–2020).

Table 5: Result analysis for subsidies of grass farm expenditures of the government in China (2000–2020).

China government agriculture subsidy	Procedure support estimate (PSE)	Overall accuracy of gross farm (%)
2000	3.52	
2002	7.18	
2004	6.25	
2006	12.23	
2008	4.50	
2010	12.68	21.13
2012	14.27	
2014	14.94	
2016	15.56	
2018	12.97	
2020	12.17	

subsidies. The findings of the survey indicated that the level of support for government farm subsidies is fairly low. Because of this, it is suggested that China's leaders improve their support for agriculture at home.

5. Conclusion

China is the most significant and prominent aspect of a developing country which has transformed from taxing to supporting agriculture. Chinese price subsidies and support have recently increased at a rapid pace, and they have been linked to higher production costs. The government began to increase price supports in order to motivate incentives and aid in the acquisition of agricultural imports. The study results revealed that procedure support is comparatively low for government agriculture subsidies. Hence, it is recommended that Chinese officials increase domestic policy support for agriculture. Due to the integration of policies, the agricultural sector in China faces competitive pressures and is becoming more commercialized. For future research, it is highly recommended to analyze the implementation of enhanced domestic policies for supporting agriculture.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The author declares that there are no conflicts of interest.

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