

Current Status of China's Sugarcane (Sugar) Industry and Prospects for Cooperation with Thailand

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Abstract. To gain a comprehensive understanding of the current development status of China's sugarcane (sugar) industry, the China Statistical Yearbook and the United Nations Food and Agriculture Organization database were utilized to analyze the production and trade conditions of China's sugarcane based on production concentration, regional comparative advantage index, trade competitive advantage index, and the WG model. In terms of production, China's sugarcane production areas are concentrated in the three dominant sugar-producing belts of central and southern Guangxi, southwestern Yunnan, and western Guangdong; the gap in sugarcane yield per unit area between China and Thailand is small, with Guangxi, Yunnan, and Guangdong provinces demonstrating strong regional comparative advantages in the comprehensive production advantages of China's sugarcane-producing provinces. In terms of trade, Thailand is an important source country for China's sugar imports, and there is ample space for China to import sugar from Thailand. The WG model study on the factors influencing the planting area of sugarcane in China found that the previous sugarcane planting area, the sold price per mu of the main product from previous sugarcane, and the sold value per mu of the main product from alternative crops (such as rice) significantly impact the current sugarcane planting area, while the impact of sugar industry support policies on the sugarcane planting area is not significant. It is suggested to strengthen scientific research and cooperation in the sugar industry between China and Thailand, expand the cooperation space in the sugar industry between the two countries, and enhance complementary advantages.

1. Introduction

The sugar industry is vital to people's livelihood and represents a strategic and fundamental sector in the development of the agricultural economy^[1]. It holds immense potential to create shared value for the people, communities, businesses, the economy, and the ecosystem^[2]. Sugarcane, a crucial sugar crop, is rich in sugar, moisture, vitamins, organic acids, and proteins, and is extensively used in the food, pharmaceutical, chemical, and cultural industries, making it an indispensable resource for humanity. Globally, 70% of sugar production comes from sugarcane, and China is a major producer and consumer of sugar as well as a leading grower of sugarcane. The cultivation of sugarcane in China is mainly distributed across provinces such as Guangxi, Yunnan, Guangdong, Fujian, Sichuan, Jiangxi, Guizhou, Hunan, Zhejiang, Hubei, and Hainan. The sugarcane industry has become a significant economic pillar in some provinces, with the value of the sugar industry accounting for 10%-11% of Guangxi's GDP^[3]. During the 2022/23 sugar production period, China produced a total of 8.97 million tons of sugar, including 7.89 million tons of sugar from sugarcane, which accounted for 88% of the annual sugar production. A cumulative of 8.53 million tons of

sugar were sold, with a sales rate of 95.1%. In recent years, the area of sugarcane cultivation in China has been shrinking, with the planting region shifting from the east to the southwest. The consumption of sugar in China has been steadily rising, and the import of sugar has maintained a high level. Thailand is the world's third-largest sugar exporter^[4], and in recent years, it has become an important source of sugar imports for China. In 2022, China imported 267,800 tons of sugar from Thailand. Against the backdrop of the "Joint Declaration on Building a More Stable, Prosperous, and Sustainable Community with a Shared Future," the "China-Thailand Strategic Cooperation Joint Action Plan (2022-2026)" signed between the Government of the People's Republic of China and the Royal Thai Government, and the "China-Thailand Cooperation Plan for Jointly Advancing the Belt and Road Initiative," there is broad scope for cooperation between China and Thailand in the sugar industry. This paper utilizes the China Statistical Yearbook, the Thailand Statistical Yearbook, the United Nations Food and Agriculture Organization database, and other sources such as the China Rural Revitalization Special Database, the China Rural Household Survey Yearbook, and the National Agricultural Product Cost and Benefit Compilation. It analyzes the production and trade status of sugarcane between China and Thailand based on the production concentration index, regional comparative

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advantage index, and trade competitive advantage index. The WG model is employed to analyze the factors affecting the area of sugarcane cultivation in China, aiming to comprehensively assess the current state of the sugarcane industry in China and Thailand and provide a reference for strengthening cooperation in the sugar industry between the two countries.

2. Materials and Methods

2.1 Data Sources and Processing

The data on sugarcane planting area, yield per unit, total production, import and export trade, and related data on alternative crops in various provinces (regions) of China are sourced from the Rural Revitalization Special Database, China Statistical Yearbook, China Rural Household Survey Yearbook, National Agricultural Product Cost and Benefit Compilation, China Sugar Industry Association, Thai Cane and Sugar Board, Bangkok Office, German F.O.Licht Company, and provincial (regional) statistical yearbooks. For example, panel data from the 11 main producing provinces including Guangxi, Yunnan, Guangdong, Fujian, Sichuan, Jiangxi, Guizhou, Hunan, Zhejiang, Hubei, and Hainan are used, covering the time period from 2001 to 2021. Excel and SPSS software are employed for data visualization and analysis.

2.2 Research Methods

2.2.1 Cane Sugar Production Concentration

The geographic distribution and regional development of China's sugarcane industry not only relate to the national sugar security but also affect the income of sugarcane farmers and local economic development. The concentration of sugarcane production reflects the degree of geographic distribution concentration of sugarcane cultivation and production in various provinces (regions) of China. It is commonly measured by the proportion of a province's sugarcane output to the national sugarcane production.

2.2.2 Regional Comparative Advantage of Sugarcane

The regional comparative advantage of sugarcane involves the strengths and weaknesses of sugarcane cultivation in different areas, with various conditions affecting the comparative advantage, such as climate conditions, technical level, production costs, soil type, and policy conditions. The comparative advantages and disadvantages reflect the characteristics of sugarcane cultivation and the industry's development potential in different regions. To accurately reflect the comparative advantage of regional crops in terms of efficiency, scale, and comprehensiveness, indicators such as efficiency comparative advantage, scale comparative advantage, and comprehensive comparative advantage are used. An index

greater than 1 indicates a comparative advantage, while an index less than 1 indicates a lack of comparative advantage. Drawing on the research of Guo Wen et al.^[5], the specific calculation formulas are as follows:

A: Efficiency Comparative Advantage Formula:

$$ECA_{ij} = \frac{Y_{ij} / A_{ij}}{Y_{wj} / A_{wj}}$$

Y_{ij} represents the yield of crop j (sugarcane) in province i , and A_{ij} represents the planting area of crop j (sugarcane) in province i . Y_{wj} represents the national yield of crop j (sugarcane), and A_{wj} represents the national planting area of crop j (sugarcane).

B: Scale Comparative Advantage Formula:

$$SCA_{ij} = \frac{(AREA_{ij} / AREA_i)}{(AREA_{wj} / AREA_w)}$$

C: Comprehensive Comparative Advantage Formula:

$AREA_{ij}$ represents the planting area of crop j (sugarcane) in province i , and $AREA_i$ represents the total planting area in province i . $AREA_{wj}$ represents the national planting area of crop j (sugarcane), and $AREA_w$ represents the total national planting area.

$$OCA_{ij} = \sqrt{ECA_{ij} \times SCA_{ij}}$$

2.2.3 Analysis of Factors Affecting the Planting Area of Sugar Cane

A. Sample Selection and Data Source

This paper selects unbalanced panel data from the national sugarcane production provinces (regions) for the years 2001-2021. Data on sugarcane planting area, purchase price of sugarcane, price of substitute crops, fertilizer usage, cost of fertilizer per mu, farmers' income, per capita income, and crop planting area for each province (region) from 2001-2021 are sourced from the "Rural Revitalization Special Database," "China Statistical Yearbook," "China Rural Household Survey Yearbook," and "National Agricultural Product Cost and Benefit Compilation."

B. Variable and Indicator Design

Based on the WG model and drawing on Yang Xu's model, this paper constructs an influence model for the planting area of sugar cane. The specific model is as follows: For the temporary procurement and storage policy, a dummy variable is used to indicate its implementation. The temporary procurement and storage policy began in 2012, with a value of 1 indicating after 2012 and a value of 0 indicating before 2012. The specific variable types are defined in Table 1.

Table 1 Variable Types and Definitions

Variable Type	Variable Name	Variable Definition
Dependent Variable	Sugarcane Planting Area (A_t)	The area of sugarcane planted in the current year (thousand hectares)
	Sugarcane Planting Area (A_{t-1})	The area of sugarcane planted in the previous period (thousand hectares)

Purchase Price of Sugarcane (Pt-1)	The price of the main product per mu of sugarcane sold in the previous period (CNY)
Fertilizer Price (CPT-1)	The fertilizer cost per mu of sugarcane in the previous period (CNY)
The output value of substitute crops sold (OVSt)	The sale value of the main product (rice) per mu of substitute crops (CNY)
Sugarcane Sale Value (VSSt)	The sale value of the main product per mu of sugarcane (CNY)
Non-Agricultural Employment Opportunities (NEOt)	The proportion of wage income in the total disposable income of rural residents (%)
Policy Factor (OPt)	Temporary Procurement and Storage Policy
Fiscal Expenditure on Agriculture (FEAt)	National fiscal expenditure on agriculture in year t
Net Profit Per Mu of Rice (NPRt)	Net profit per mu of rice in year t (CNY)
Number of Rural Employed Persons (NEPt)	Number of rural employed persons at the end of year t (in thousands)

C. Model Construction

The construction of the influence model on the planting area of sugar cane refers to the research of Yang Xu [6]. Since sugarcane is a perennial crop, the study focuses on the planting area of sugarcane and related policies, analyzing the relationship between the planting area of sugarcane and certain independent variables, based on the theories of the WG model and the supply response model. To avoid heteroscedasticity in the residual term, a double logarithm (log-log) model is used to study the elastic relationship between variables, capturing the nonlinear relationship between variables more effectively. The model is set up in a double logarithmic form. The WG model is as follows:

$$A_t = \alpha_0 + \sum_{i=1}^m \alpha_i A_{t-1} + \sum_{i=1}^m \beta_i P_{t-1} + \sum_{i=1}^m \theta_i S_{t-1} + u_i$$

Based on the WG model and drawing on Yang Xu's model, this paper constructs an influence model for the planting area of sugar cane. The specific model is as follows:

$$\ln A_t = \alpha_0 + \alpha_1 \ln A_{t-1} + \alpha_2 \ln P_{t-1} + \alpha_3 \ln CP_{t-1} + \alpha_4 \ln OVS_t + \alpha_5 \ln OP_t + \alpha_6 \ln NEO_t + \alpha_7 \ln VSS_t + \alpha_8 \ln FEA_t + \alpha_9 \ln NPR_t + u_t$$

3. ANALYSIS AND RESULTS

3.1 Sugarcane Planting Analysis

3.1.1 Basic Information of Sugarcane Production

Table 3: Concentration of Sugar Cane Production in Major Provinces of China from 2012 to 2022

	Guang xi	Yun nan	Guang dong	Hai nan	Jiang xi	Gui zhou	Fu jian	Hai nan	Zhe jiang	Si chuan	Hu bei
2012	67.65%	17.66%	12.69%	3.59%	0.54%	1.11%	0.49%	0.64%	0.60%	0.53%	0.27%
2013	67.95%	17.99%	13.02%	3.70%	0.55%	1.33%	0.49%	0.62%	0.54%	0.48%	0.24%
2014	68.68%	18.22%	13.00%	3.67%	0.56%	1.45%	0.46%	0.57%	0.54%	0.48%	0.26%
2015	70.10%	18.03%	13.57%	2.48%	0.62%	1.10%	0.35%	0.62%	0.58%	0.47%	0.30%

Based on the survey of China's sugarcane production data during the crushing seasons from 2012/13 to 2022/23, it is known that there are 11 main provinces where sugarcane is cultivated in China, including Guangxi, Yunnan, Guangdong, Hainan, Jiangxi, Sichuan, Guizhou, Hunan, Hubei, Zhejiang, and Fujian. Among these, Guangxi, Yunnan, and Guangdong are the primary sugarcane-growing provinces. Taking 2022 as an example, the total planting area of sugarcane in China was 1,289.17 thousand hectares, with Guangxi, Yunnan, and Guangdong provinces accounting for 94.19% of the total planting area. See Table 2 for details.

Table 2 Sugarcane Planting Areas in Main Provinces of China in 2022

Unit: Thousand Hectares

Province	Area	Proportion	Cumulative Proportion
Guangxi	847.9	65.77%	65.77%
Yunnan	219.1	17.00%	82.77%
Guangdong	147.2	11.42%	94.19%
Hainan	13.7	1.06%	95.25%
Jiangxi	13.7	1.06%	96.31%
Sichuan	9.6	0.74%	97.05%
Hunan	7.6	0.59%	97.64%
Guizhou	7.3	0.57%	98.21%
Hubei	6.3	0.49%	98.7%
Zhejiang	6.3	0.49%	99.19%
Fujian	5.2	0.4%	99.59%

Data Source: China Statistical Yearbook, Rural Revitalization Special Database.

3.1.2 Analysis of Sugar Cane Production Concentration

The concentration of production reflects the changes in the regional layout of sugarcane cultivation in China's main producing areas. This study focuses primarily on China's major sugarcane-growing provinces, such as Guangxi, Yunnan, Guangdong, Hainan. As shown in Table 3, among the major sugarcane-growing provinces, Guangxi has the highest concentration of sugarcane production, ranging from 67.47% to 72.28%. Yunnan and Guangdong rank second and third in sugarcane production concentration, respectively. Overall, sugarcane cultivation in China has shown a trend of shifting from eastern regions to central and western regions. Currently, Guangxi, Yunnan, and Guangdong are the main sugarcane-growing areas. The sugarcane planting area in Yunnan and Guangdong is decreasing, while that in Guangxi is relatively stable. The concentration of sugarcane production in Guangxi remains in a relatively stable range, while the concentration of sugarcane production in other provinces is on a declining trend.

2016	72.28%	16.84%	14.33%	1.99%	0.64%	1.14%	0.36%	0.64%	0.60%	0.48%	0.36%
2017	68.31%	14.52%	12.87%	1.27%	0.64%	0.48%	0.25%	0.32%	0.36%	0.34%	0.26%
2018	67.47%	15.17%	13.07%	1.23%	0.60%	0.58%	0.24%	0.31%	0.38%	0.33%	0.26%
2019	68.48%	14.35%	13.12%	1.05%	0.57%	0.58%	0.24%	0.31%	0.41%	0.34%	0.26%
2020	68.56%	14.77%	12.64%	0.98%	0.56%	0.56%	0.25%	0.32%	0.43%	0.35%	0.26%
2021	69.05%	14.85%	12.25%	0.88%	0.57%	0.51%	0.27%	0.33%	0.39%	0.37%	0.25%
2022	68.84%	15.03%	12.50%	0.74%	0.61%	0.40%	0.28%	0.34%	0.38%	0.37%	0.26%

Data Source: China Statistical Yearbook, Rural Revitalization Thematic Database

3.1.3 The average yield of sugarcane in China.

As shown in Table 4, the overall trend of the average yield per hectare of sugarcane in China is on the rise, with a growth of 17.47% from 2012 to 2022. There is a significant difference in the yield per hectare among the main sugarcane-producing provinces in China. Over the past eleven years, Guangxi, Guangdong, Hainan, and Yunnan have consistently performed well, with Guangxi and Guangdong remaining at the leading level. Hainan's sugarcane yield per hectare exceeded the national average

in 2012 but has not reached the national average since then. Looking at the individual provinces, from 2012 to 2022, the average yield per hectare in Guangxi increased from 69.41 to 83.93 tons, a growth of 20.91%; Guangdong's average yield decreased from 88.81 to 87.78 tons, a reduction of 1.16%; Yunnan's average yield increased from 61.65 to 70.91 tons, a growth of 15.01%; Hubei's average yield increased from 40.10 to 42.35 tons, a growth of 5.62%. Other provinces such as Hainan, Jiangxi, Guizhou, Fujian, Hunan, Zhejiang, and Sichuan all experienced a decline in their average yield per hectare of sugarcane.

Table 4: Yield per Hectare of Sugarcane in Main Producing Provinces of China from 2012 to 2022

Province	Unit: Tons per Hectare										
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Guangxi	69.4	72.0	73.5	77.1	78.5	81.4	82.3	84.1	84.7	85.9	83.9
Yunnan	61.7	62.7	62.1	62.0	61.6	63.2	63.1	63.8	67.8	69.5	70.9
Guangdong	88.8	89.8	89.3	89.5	91.4	79.4	81.9	84.6	86.0	87.1	87.8
Hainan	66.6	68.5	68.6	58.2	63.3	62.7	63.8	62.1	59.0	56.3	56.0
Jiangxi	44.8	44.6	45.1	45.6	45.3	46.0	45.0	44.8	45.1	45.3	45.7
Guizhou	58.8	57.1	60.4	58.3	56.3	60.8	59.1	59.4	59.9	59.2	56.3
Fujian	60.7	61.2	61.9	58.1	54.5	53.4	53.3	54.3	55.0	55.8	55.8
Hunan	51.1	51.2	49.3	49.7	49.4	46.0	45.8	46.0	46.0	46.4	46.1
Zhejiang	63.7	62.0	62.1	62.4	65.4	65.6	66.0	64.6	64.7	63.6	62.1
Sichuan	41.4	40.6	40.6	40.2	38.4	38.4	38.7	38.7	39.2	40.1	39.9
Hubei	40.1	38.3	40.1	37.8	42.0	41.1	42.9	43.1	42.4	42.8	42.4

Data Source: China Statistical Yearbook, Rural Revitalization Thematic Database

3.1.4 Total Sugarcane Production in China and Production in Main Producing Areas

According to the China Statistical Yearbook, from 2012 to 2022, the total sugarcane production in China showed a downward trend, decreasing from 115.75 million tons in 2012 to 103.38 million tons in 2022, a decline of 10.69%.

Specifically, the total sugarcane production in Guangxi decreased by 9.1%, Yunnan by 23.97%, Guangdong by 12.05%, Hainan by 81.49%, Guizhou by 67.97%, Fujian by 49.12%, Hunan by 52.7%, Zhejiang by 44.29%, Sichuan by 37.7%, and Hubei by 12.9%. Jiangxi was the only province that saw a growth of 1.6% in total sugarcane production. The detailed data are presented in Table 5.

Table 5: Total Sugarcane Production in China and Provincial Productions from 2012 to 2022

	Unit: Ten Thousand Tons				
	Guangxi	Yunnan	Guangdong	Hainan	China
2012	7830	2044	1469	416	11575
2013	8104	2146	1553	441	11926
2014	7953	2110	1505	425	11579
2015	7505	1930	1453	265	10706
2016	7461	1738	1479	205	10322
2017	7132	1516	1344	133	10440
2018	7293	1640	1413	133	10810
2019	7491	1570	1435	115	10939
2020	7413	1597	1367	106	10812
2021	7365	1584	1307	94	10666
2022	7117	1554	1292	77	10338

Data Source: China Statistical Yearbook, Rural Revitalization Thematic Database

3.1.5 Comparative Advantage of Sugarcane in Different Regions

The analysis of the regional changes in the comprehensive comparative advantage of sugarcane production in China is presented in Table 6. Guangxi (1.05) and Guangdong (1.16) have an advantage in terms of sugarcane cultivation efficiency, while the remaining provinces are at a relative disadvantage in sugarcane cultivation efficiency. Guangxi (17.86), Yunnan (3.81), Guangdong (3.34), and Hainan (3.93) have a comparative advantage in the scale of sugarcane cultivation, with Guangxi having a more pronounced comparative advantage, and the other provinces being at a disadvantage in the scale of sugarcane cultivation. Guangxi (4.33), Yunnan (1.81), Guangdong (1.97), and Hainan (1.81) have a significant comprehensive comparative advantage, with Guangxi having the most comprehensive comparative advantage, and the other sugarcane-growing provinces being at a comprehensive comparative disadvantage.

Table 6 Comparative Advantage Index of Sugarcane Planting Regions in China from 2012 to 2022

Province	Regional comparative advantage		
	ECA _{ij}	SCA _{ij}	OCA _{ij}
Guangxi Province	1.05	17.86	4.33
Yunnan Province	0.86	3.81	1.81
Guangdong Province	1.16	3.34	1.97

Table 7: China's Sugar Import Volume from 2012 to 2022

Unit: Ten Thousand Tons

Province	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Import Volume	375	455	349	485	306	229	280	339	527	567	527

Data Source: China Statistical Yearbook, Rural Revitalization Thematic Database, China Monthly Export Statistical Report

3.2 Sugar Production and Export in Thailand

Thailand is a major producer and exporter of sugar in the world, ranking behind Brazil, India, and the European Union. Its main export destinations include Indonesia, Japan, China, Malaysia, South Korea, Cambodia, and Taiwan, China. Following the signing of the China-ASEAN Free Trade Agreement (ACFTA), China has

Hainan Province	0.83	3.93	1.81
Jiangxi Province	0.60	0.39	0.49
Guizhou Province	0.78	0.35	0.52
Fujian Province	0.76	0.30	0.48
Hunan Province	0.64	0.15	0.31
Zhejiang Province	0.85	0.34	0.54
Sichuan Province	0.53	0.15	0.28
Hubei province	0.55	0.09	0.22

Data Source: China Statistical Yearbook, Rural Revitalization Thematic Database

3.1.6 China's sugar import volume

In recent years, China has maintained a high volume of sugar imports. From 2012 to 2022, China's sugar import volume increased by 40.53%. According to data from the Mutian Technology Sugar Industry Information Sharing Platform, taking 2022 as an example, China's sugar imports mainly come from countries such as Brazil, India, and Thailand. China imported 4.1796 million tons, 274.9 thousand tons, and 267.8 thousand tons of sugar from Brazil, India, and Thailand, respectively, accounting for a cumulative 89.61% of the total sugar imports for that year. Imports from Thailand accounted for only 5.08% of the total sugar imports for that year, indicating that there is significant room for cooperation between China and Thailand in the sugar trade. As show in table 7.

become a major destination for Thai sugar exports. In 2012, Thailand exported 996.7 thousand tons of sugar to China, accounting for 26.58% of China's sugar imports that year. In 2017, Thailand's sugar exports to China reached 457 thousand tons, making up 19.96% of China's sugar imports. By 2022, Thailand's sugar exports to China were 267.8 thousand tons, constituting 5.08% of China's sugar imports for that year. In recent years, the volume of sugar exported from Thailand to China has decreased, indicating a significant potential for trade in sugar between the two countries. As show in table 8.

Table 8: Thailand's Sugarcane Cultivation, Production, Export, and Yield per Hectare

Period	Sugarcane Cultivation Area (Ten Thousand Hectares)	Total Sugarcane Production (Ten Thousand Tons)	Sugar Production (Ten Thousand Tons)	Sugar Export Volume (Ten Thousand Tons)	Sugarcane Yield per Hectare (Tons)
2015/2016	150	10735	1002.48	780.50	71.57
2016/2017	152	9368	1029.87	707.56	61.63
2017/2018	180	13600	1502.66	974.59	75.56
2018/2019	175	13191	1486.68	1006.02	75.38
2019/2020	174	12400	1300.02	1067.35	71.26
2021/2022	160	9417	1015.7	701.2	58.86
2022/2023	165	9669	1015.9	950	58.60
2023/2024	165.5	8253	940	1000	49.87

Data Source: China Sugar Association, Thai Sugar Cane and Sugar Board, Bangkok Office, F.O.Licht Company, Germany

3.3 Analysis of the Impact of Sugar Crop Area Model Estimation Results

To ensure data stability, a second-order difference was applied to the data, and the ADF (Augmented Dickey-Fuller) test was conducted on the differenced time series data. The results showed that $p = 0.000 < 0.01$, indicating that the time series data is stable and can be used for data analysis. The model has passed the F-test, with an R-squared value of 0.935, as indicated by Table 9: Estimation Results of the Sugar Crop Area Model. This suggests that the model has a high degree of fit. Therefore, the results of this model can be used to analyze the factors influencing the sugar crop area.

Table 9: Estimation Results of the Sugar Crop Area Model

Variable	Variable Explanation	Sugar Cane Material
A_{t-1}	The previous period's sugarcane planting area	0.899***(6.406)
P_{t-1}	The previous period's sugarcane sales price per mu	0.290*** (4.082)
CP_{t-1}	The previous period's fertilizer cost per mu for sugarcane	-0.008 (-0.632)
OVS_t	The value of rice output per mu for substitute crops	-0.145* (-1.918)
NEO_t	The proportion of wage income in the disposable income of farmers	0.324 (0.980)
OP_t	Temporary procurement and storage policy	-0.022 (-0.542)
VSS_t	The sale value of the main product per mu of sugarcane	-0.120 (-1.259)
FEA_t	National fiscal expenditure on agriculture	-0.043 (-0.767)
NPR_t	The net profit per mu of rice	0.015 (0.913)
Constant	Constant	-0.447 (-0.465)
adj.R ²	Adjusted R-squared	0.935
F-test	F(9,11)=17.555,P=0.000	Passed

***, **, * denote significance at the 1%, 5%, and 10% levels, respectively.

From the estimation coefficient results in Table 9, the following conclusions can be drawn:

3.3.1. The impact of the temporary procurement and storage policy

In terms of sugarcane planting area, the correlation coefficient of the temporary procurement and storage policy is negative and the impact is not significant. This indicates that the incentive effect of the temporary procurement and storage policy on sugarcane planting is small. Due to changes in China's sugar import tariff quota, the import volume of sugar in China has been increasing in recent years. The profit level of sugar imported within and outside the tariff quota has more advantages than domestically produced sugar in China. Due to the low mechanization rate of sugarcane harvesting in China and

the high cost of sugarcane production, a "market-supporting effect" may have been produced, affecting the enthusiasm of domestic sugarcane farmers in China for planting sugarcane.

3.3.2. The impact of sugarcane purchase prices

The selling price of sugarcane in the previous period has a significant positive impact on the planting area of sugarcane for sugar production. The expectations of sugarcane growers regarding the purchase price will affect the area dedicated to sugarcane cultivation. A reasonable sugarcane purchase price policy can encourage the investment of sugarcane growers, increase their enthusiasm for planting, ensure the stable production of sugarcane for sugar, and promote the smooth development of the sugar industry.

3.3.3. The impact of alternative cash crops and costs

The purchase price of alternative cash crops is negatively correlated with the planting area of sugarcane for sugar production. Therefore, the higher the purchase price of alternative cash crops, the less enthusiastic sugarcane growers are about planting sugarcane. Growers may choose to plant crops with higher economic value, thereby reducing the area dedicated to sugarcane cultivation.

3.3.4. The impact of Previous Sugarcane Planting Area

Based on the analysis results, with a confidence level of 99%, there is a positive correlation between the previous period's sugarcane planting area and the current period's sugarcane planting area. Sugarcane is a perennial crop, and the current planting area is influenced by the previous planting area. According to the principle of supply response, the impact of previous prices on the current period can be traced back through an iterative relationship.

3.3.5. The impact of Other Factors

The proportion of wage income in the disposable income of rural residents, national fiscal expenditure on agriculture, and the net profit per mu of rice do not show a significant correlation with the area of sugarcane cultivation. This indicates that, at present, these three factors have a relatively small impact on the area of sugarcane cultivation.

4. Conclusion

China's sugarcane planting area is experiencing a downward trend. Sugarcane cultivation is mainly concentrated in regions such as Guangxi, Guangdong, and Yunnan, where the concentration of sugarcane production is also declining, with the shift of sugarcane cultivation from the eastern to the western regions. The mechanization level in sugarcane production is relatively low, and the production costs are high, which affects the

interests and development of the sugar industry. Due to the use and promotion of superior sugarcane varieties, the average yield per hectare of sugarcane has been increasing. Regions such as Guangxi, Guangdong, Yunnan, and Hainan have regional comparative advantages. China's sugar imports are maintaining a growth trend, with Thailand being the main source of sugar imports for China, indicating significant future cooperation potential. With the support of the "Common Action Plan for Strategic Cooperation between the Government of the People's Republic of China and the Government of the Kingdom of Thailand (2022-2026)" policy, in addition to strengthening trade cooperation in food bran, China and Thailand can also enhance cooperation in sugarcane cultivation and the food grain processing industry. The planting area of sugarcane in China is influenced by the previous planting area and the previous sales price in a positive manner, and is negatively correlated with the sales price of alternative products. The correlation between the temporary storage policy and the sugarcane planting area is not obvious."

5. Suggestions and prospects

5.1 Improving Varieties to Increase the Rate of Mechanization

According to the report "Analysis of the Development Status of Sugar Cane Mechanization in China" by Luo Xiwen, President of the Chinese Academy of Engineering, one of the important reasons for the annual decrease in sugarcane planting area in China is the low level of mechanization. The mechanization rate of sugarcane harvesting does not exceed 6%, which is the lowest among China's nine major crops. Therefore, there is still significant room for improvement in the mechanization rate of sugarcane harvesting in China, requiring active participation from agricultural machinery research and development, agricultural improvement, government policy support, and sugar industry enterprises. Traditional sugarcane breeding techniques are monotonous and need to integrate breeding technologies and diversify breeding methods; strengthen cooperation with Thailand on high-quality sugarcane breeding technology to promote the introduction of quality varieties.

5.2 Strengthen the Promotion of Sugarcane Technology and China-Thailand Sugar Industry Cooperation

Based on the signed "Joint Statement on Building a More Stable, Prosperous and Sustainable Community with a Shared Future", the "Common Action Plan for Strategic Cooperation between the Government of the People's Republic of China and the Government of the Kingdom of Thailand (2022-2026)", and the "China-Thailand Cooperation Plan for Jointly Promoting the Construction of the Belt and Road", there is significant scope for cooperation between China and Thailand. In particular, there is a focus on strengthening cooperation in sugarcane breeding and planting technology between the two

countries to reduce the cultivation costs of sugarcane; enhancing cooperation between Chinese and Thai sugar companies to improve the level of development of the sugar industry in both countries. This ensures that Thailand has a stable market for sugar exports, securing stable income for the Thai sugar industry, while also ensuring the sugar security for China.

5.3 Strengthening Policy Guidance to Ensure the Safety of the Sugar Industry

Further enhance the three national sugar industry belts in the central and southern parts of Guangxi, the southwestern part of Yunnan, and the western part of Guangdong and the northern part of Hainan. Strengthen the development of the sugar industry in the provinces of Guangxi, Yunnan, Guangdong, and Hainan, and introduce policies to increase the enthusiasm of farmers for planting sugarcane material to ensure the safety of the sugar industry.

5.4 Strengthening the Construction and Operation of the Sugar Industry Big Data Cloud Platform

Under the background of the "Belt and Road" initiative, Thailand is an important investment destination for Chinese enterprises, and China has been Thailand's largest trading partner for many consecutive years. Strengthening the construction and operation of the sugar industry big data cloud platform will promote the efficient development of the sugar industry chain between China and Thailand, which is important for China's sugar security and Thailand's sugar export safety.

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