

Article

Divergence between Willingness and Behavior of Farmers to Purchase Socialized Agricultural Services: From a Heterogeneity Perspective of Land Scale

Meng Qu, Kai Zhao *, Renhui Zhang, Yuan Gao and Jing Wang

College of Economics and Management, Northwest A&F University, Xianyang 712100, China; qumeng@nwfau.edu.cn (M.Q.); zrh98218@nwfau.edu.cn (R.Z.); gaoyuan2020@nwfau.edu.cn (Y.G.); wangjing126@nwfau.edu.cn (J.W.)

* Correspondence: zhaokai@nwfau.edu.cn



Citation: Qu, M.; Zhao, K.; Zhang, R.; Gao, Y.; Wang, J. Divergence between Willingness and Behavior of Farmers to Purchase Socialized Agricultural Services: From a Heterogeneity Perspective of Land Scale. *Land* **2022**, *11*, 1121. <https://doi.org/10.3390/land11081121>

Academic Editors: Ioannis P. Kokkoris, Dimitris Skuras and Panayotis Dimopoulos

Received: 29 June 2022

Accepted: 16 July 2022

Published: 22 July 2022

Publisher's Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.



Copyright: © 2022 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

Abstract: The low-level dilemma of farmers' Socialized Agricultural Services (SAS) purchases is a realistic problem facing the construction of socialized service systems in China's major grain-producing areas. Existing research lacks the necessary attention on the decision-making mechanism of farmers' purchases of SAS, resulting in a large gap between theoretical research and real-world problems. Based on the data of 638 households in China's main grain-producing areas, this paper empirically analyzes the influence mechanism of heterogeneous land scale on deviation between farmers' willingness and behavior to purchase SAS, and discusses the heterogeneity of the influence mechanism under different production links. The findings indicate that the degree of divergence between farmers' willingness to purchase SAS and their behavior is large. (1) There is a significant threshold effect of land scale on the degree of divergence between farmers' willingness and behavior to purchase SAS, and the threshold value is ten mu. The increase in land scale will significantly enlarge the divergence between small-scale farmers' purchase willingness and behavior. However, it will significantly reduce the divergence between large-scale farmers' purchase willingness and behavior. (2) From the demand side, household income and health will significantly reduce the divergence among farmers of different business sizes. Family burden and land fragmentation are essential factors affecting the degree of divergence of small-scale farmers, while education and the value of their own machinery significantly affect the degree of divergence of large-scale farmers. From the supply side, whether there are local suppliers and their matching degree with farmers significantly reduces the divergence among farmers of different business scales. However, small-scale farmers are more sensitive to the price and quality of agricultural services, while large-scale farmers have higher requirements for the degree of regulation of supplying agents. (3) There is heterogeneity in the influence mechanisms of divergence between farmers' willingness to purchase SAS and their behavior under different product segments. In addition, our findings highlight how to realize the transformation from declarative preference to explicit preference in promoting farmers' purchases of SAS.

Keywords: land scale; socialized agricultural service; willingness and behavior; major grain-producing area

1. Introduction

Ensuring food security and achieving agricultural modernization are two critical goals of the Chinese government in agriculture. In 2003, the Chinese Ministry of Finance issued the Opinions on Reforming and Improving Certain Policy Measures for Comprehensive Agricultural Development, setting 13 provinces, including Henan, Shandong, and Heilongjiang, as the major grain-producing areas. The main grain-producing areas have assumed the primary responsibility for achieving stable and increased national grain production and have contributed significantly to ensuring China's food security [1]. Taking wheat production as an example, the wheat planting area and production in the 13 major

grain-producing areas have shown a primary trend of steady increase. Among them, the share of wheat planting area in the main grain-producing areas in the country expanded from 80.11% to 82.08%, and wheat production increased evenly from 103.4280 million tons (84.45%) in 2012 to 116.1817 million tons (86.54%). Meanwhile, the main grain-producing areas are the main battlefield for modernizing and transforming traditional agriculture. Agricultural production in major grain-producing areas is more mechanized and has faster technological progress than in other areas. It has resulted in higher total factor productivity and land-use efficiency of grain production [2,3]. However, major grain-producing areas also face multiple challenges regarding carbon emission reduction, economic and social benefits maximization, employment security for farmers, and ecosystem balance [4,5].

Compared with the main production areas in developed Western countries, such as the state of North Dakota in USA and Volga-Don River Basin in Russia, the establishment and development of China's major grain-producing areas have specific characteristics of policy interventions. Based on the market mechanism giving full play to the role of resource allocation, the Chinese government has planned and guaranteed the functions, production layout, and protection of arable land resources in the main grain-producing areas through a combination of policy instruments [6]. In addition, a more critical difference lies in land scale. Unlike the production pattern in Western, developed countries, where large-scale farmers are the main body, small-scale farmers are still the main body of agricultural production in China's major grain-producing areas. There are about 230 million smallholder farmers in rural areas in China, with an average farm size of less than 2 ha, totaling 70% of China's arable land [7]. The large number and persistence of smallholder farmers is an essential condition in China [8–10]. At the same time, with the rapid modernization of agriculture, the country's economy has been growing. At the same time, with the rapid progress of agricultural modernization, large-scale farmers have gradually become an emerging force in China's agricultural production. However, driven by the goal of profit maximization, large-scale farmers compete with smallholder farmers for the use of land elements. It induces smallholder farmers' exit from agricultural production through land abandonment and renting out [11]. It also creates concerns about resource allocation and income inequality [12]. Therefore, building the connection between smallholder farmers and modern agriculture is key to rural revitalization and an essential component of agricultural modernization [13–17]. On this basis, to cope with the crisis of smallholder production in the process of agricultural modernization, the construction and improvement of the Socialized Agricultural Services (SAS) system become an important initiative to realize the organic linkage between smallholder and modern agriculture.

With the advancement of agricultural labor division and specialization, outsourcing is becoming one of the most widespread trends in SAS [18]. Through such an arrangement, smallholder farmers can optimize the allocation of resources, reduce agricultural production costs and weak labor constraints, and improve agricultural productivity [19–21]. Then, smallholder farmers can participate in the vertical division of agricultural production to cope with the rising labor costs and stay viable in agricultural production [22]. Based on this, many scholars have empirically tested the effect of SAS on smallholder farmers' welfare and the impact mechanism. Qiao et al. (2020) take cotton farmers in Xinjiang as an example and point out that outsourcing agricultural production improves the welfare of small-scale farmers by increasing family income and consumer spending [23]. The study from Baiyegunhi et al. (2019) supports these views and points out that participation in outsourcing extension programs significantly contributes to an increase in the net farm income of smallholder farmers by R2700 in South Africa [24]. Samuel Benin (2015) also found that mechanized services effectively reduced smallholder farmers' labor constraints, reduced drudgery, and raised yield [25]. In contrast, Luo and Qiu (2021) combine the SAS with relative poverty governance and point out that the adoption of SAS by smallholders can achieve effective alleviation of relative poverty by reducing differences in labor endowment and differences in technology endowment [26]. On this basis, there are also heterogeneous effects of different types of SASs. Yang (2019) further shows that the welfare effects of out-

sourcing in the field management segment are higher than those in other product segments. The welfare effects of outsourcing in the seeding segment are insignificant [27]. Xue et al. (2021) also showed that outsourcing services in different product segments also differed regarding food losses [28].

In a comprehensive view, the improvement of farmers' welfare by SAS has been widely supported by data from various countries, which provide a critical practical basis for vigorously promoting the construction and improvement of SAS systems. However, objectively speaking, the existing studies lack the necessary attention to the decision-making mechanism of farmers' purchase of socialized services, resulting in a large gap between theoretical studies and real-world problems. At present, the real problem facing the construction of socialized service systems in China's major grain-producing areas is the low-level dilemma of farmers' purchase of SAS. This dilemma is manifested in the fact that although farmers have a strong purchase willingness (declarative preference), they cannot effectively transform them into purchasing behaviors (explicit preference). The divergence between purchase willingness and purchase behavior seriously hinders the construction and improvement of the SAS system. Therefore, the research problem is to clarify the influence mechanism of the divergence between farmers' willingness and behavior of SAS. It is a critical issue in solving the current realistic dilemma in the major grain-producing areas. In order to solve this problem, this paper adopts a threshold regression model based on data from 638 farm households in the major grain-producing areas of China. It follows the objective reality that small-scale farmers and large-scale operators coexist and explores the influence mechanism of the divergence between farm households' willingness and behavior to purchase SAS from the perspective of land-scale heterogeneity from both the demand and supply sides. The study aims to provide theoretical support for constructing and improving the SAS system from the micro-farmer scale. Furthermore, the study's results will provide some reference to countries with similar agricultural production patterns as China.

2. Theoretical Framework and Research Hypotheses

2.1. Mechanism of Divergences between Farmers' Purchase Willingness and Behavior

In transforming traditional agriculture and achieving efficient production, such modern technological elements of SAS can ensure that farmers obtain higher output and profit. Farmers, as consumers in the market of SAS, are bound to generate corresponding purchase willingness. Willingness is the precursor of behavioral decision-making and the subjective basis for individual decision-making behavior [29,30]. According to the theory of farmers' behavior of the rational small-scale farmer school, farmers' decision-making behavior of purchasing goods in the competitive market shows the characteristics of a rational economic man. Profit maximization is the essential criterion that influences the transformation of farmers' demand for SAS into actual behavior [31]. Guided by the criterion of profit maximization, consumers (farmers) eventually transform their purchase willingness into purchase behaviors by weighing the costs of factor inputs and the ultimate benefits. However, due to the influence of multiple factors such as household endowment, external environment, and policy subsidies [32,33], some farmers' willingness to purchase SAS cannot be effectively transformed into actual purchase behavior. Therefore, this phenomenon is called divergence in this paper. Based on this, this paper attempts to analyze the influence mechanism of the divergence between farmers' willingness and behavior from two dimensions: the demand side and the supply side (Figure 1).

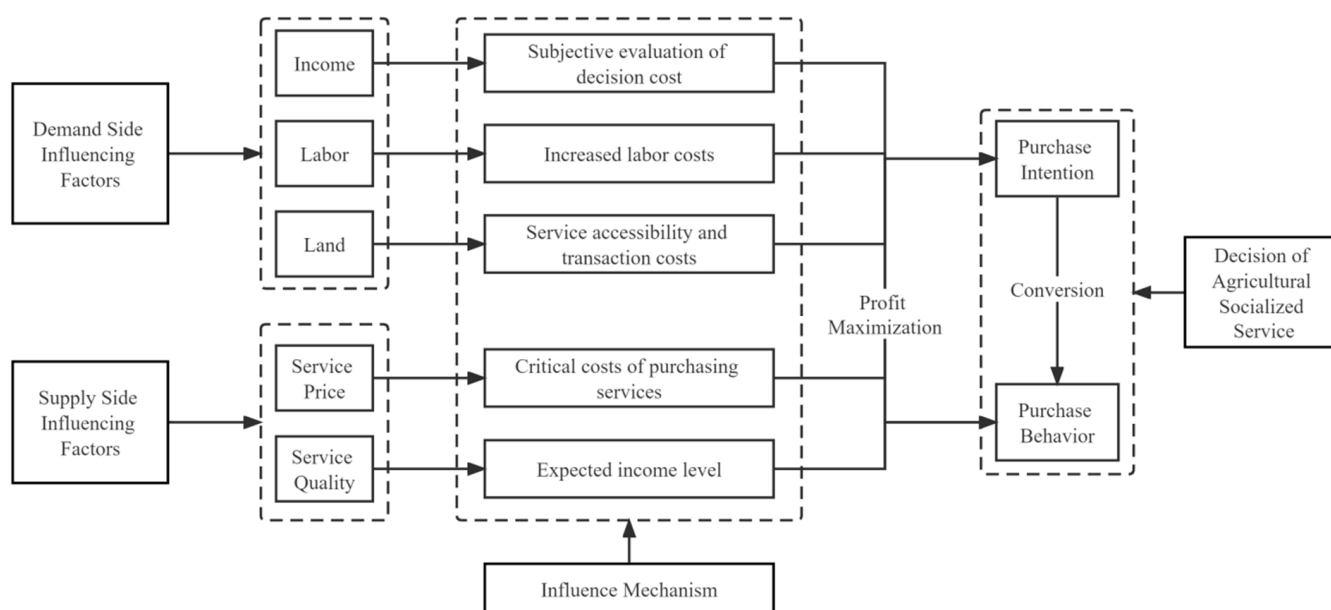


Figure 1. Theoretical analysis framework.

From the demand side, farm households face multiple capital, labor, and land constraints when making SAS purchasing decisions. Household income significantly affects farmers' subjective evaluation of decision costs [34]. Low-income households have difficulty coping with rising service costs, which leads to divergences between purchase willingness and purchase behavior. Labor endowment characteristics are also an essential constraint on farmers' agricultural production decisions [35]. With the transition of a large number of rural laborers to nonfarm employment, the labor constraints and opportunity costs of agricultural production are becoming increasingly high, which provides a significant opportunity for farmers to purchase SAS [36]. Land fragmentation is an essential constraint on agricultural production in China [37,38]. Excessively fragmented plot sizes significantly reduce unit yields by changing marginal agricultural inputs and increasing the cost of farm machinery operations [39]. It also significantly reduces the accessibility of SAS to small-scale farmers by increasing the operating costs and transaction costs of agricultural machinery [40].

From the supply side, individuals' attitudes toward the external environment are important influences that contribute to transforming their declarative preference into explicit preference behavior [41]. Expanding beyond agriculture, the extensive literature on service productivity suggests that factors such as price, regulation, matching, and service quality significantly impact productivity and production practices in the target industry [42,43]. Focusing on agricultural services, the increase in the price of agricultural mechanization services is not conducive to the survival of smallholder farmers, significantly increasing their transaction costs and even leading to their withdrawal from agricultural production [44]. In contrast, service quality and degree of matching can effectively increase farmers' expected returns [45], thus promoting farmers' conversion of purchase willingness to purchase behavior.

As a result, hypothesis 1 is proposed: There is a significant effect of demand side and supply side on the divergence between farm households' willingness and behavior to purchase SAS.

2.2. The Threshold Effect of Land Scale

Compared to other factor inputs solidified per unit area, land is the main controllable input factor for farmers in agricultural production, and land scale is the most critical factor affecting agricultural output. Most existing studies treat the relationship between operation scale and outsourcing behavior as a simple linear effect, arguing that the larger

the operation scale, the higher the willingness of farmers to purchase SAS and the higher the level of purchase [15,46]. However, this study argues that the degree of divergence between farmers' willingness to purchase and purchase behavior in the service market shows differences under different operation scales, and the influence of operation scale on the divergence between farmers' demand for SAS and purchase behavior is nonlinear. Based on this, this paper follows the current basic agricultural production pattern in the major grain-producing areas of China. It analyzes the influence of land scale on the divergence from two stages.

Stage 1: Expansion of land scale (smallholder production stage). According to demand–supply theory, increasing demand for socialized services from farmers will lead to the development of socialized service markets. The essential feature of land transfer is the squeezing and disintegrating of smallholder production. Its primary way is land flow from smallholder farmers to large capital-based, large-scale business entities [47]. At the demand level, the gradual expansion of the land scale drives farmers to gradually generate higher demand for SAS [48]. At the same time, the differentiation of subjects due to land transfer has led to the differentiated demand for SAS. However, the development of the agricultural social service supply market cannot match the growing demand for SAS in the short term. Meanwhile, the service market is not perfect enough to provide reasonable service prices, making it difficult for farmers to effectively transform their purchasing demand into purchasing behavior.

As a result, hypothesis 2 is proposed: The divergence between small-scale farmers' willingness and behavior to purchase SAS will gradually increase with the expansion of land scale.

Stage 2: Further expansion of land scale (large-scale production stage). Due to a sufficient supply of socialized services, initial accumulation of capital, and external policy promotion, large farmers have a strong incentive to expand. Due to higher production efficiency and lower transaction costs, scale management farmers gradually squeeze the living space of small-scale farmers and further cause the land to flow to scale management subjects by renting land. The large-scale operators eventually realize capital profit and capital accumulation. They often provide services autonomously to complete agricultural production while transforming into new SAS supply subjects [49,50]. At this time, the SAS system realized the reconstruction from small-scale farmers to large farmers as the center, thus promoting the further development of the SAS market. In this stage, the rapid development of the service market satisfies the willingness of large-scale farmers to purchase SAS and promotes the transformation of purchase willingness into purchasing behavior.

Thus, hypothesis 3 is proposed: The divergence between the willingness and behavior to purchase SAS of large-scale farmers gradually decreases with the further expansion of land scale.

3. Methodology

3.1. Study Area

Zhoukou City, Henan Province, is located in the hinterland of the Huang Huai plain, with a temperate monsoon climate (Figure 2a). Since 2016, Zhoukou City has achieved successive increases in arable land area and total grain production. In 2020, the city's grain sown area was 20,618,200 mu (land area unit, 1 mu = 0.0667 ha), and total grain production reached 18,686 million jin (quality unit, 1 jin = 0.5 kg), ranking first in Henan Province. Zhoukou City is "the granary of the Central Plains" and can be a microcosm of grain production in Henan Province and the whole country. Therefore, it is of great theoretical and practical significance for the major grain-producing areas and the whole country to realize agricultural modernization.

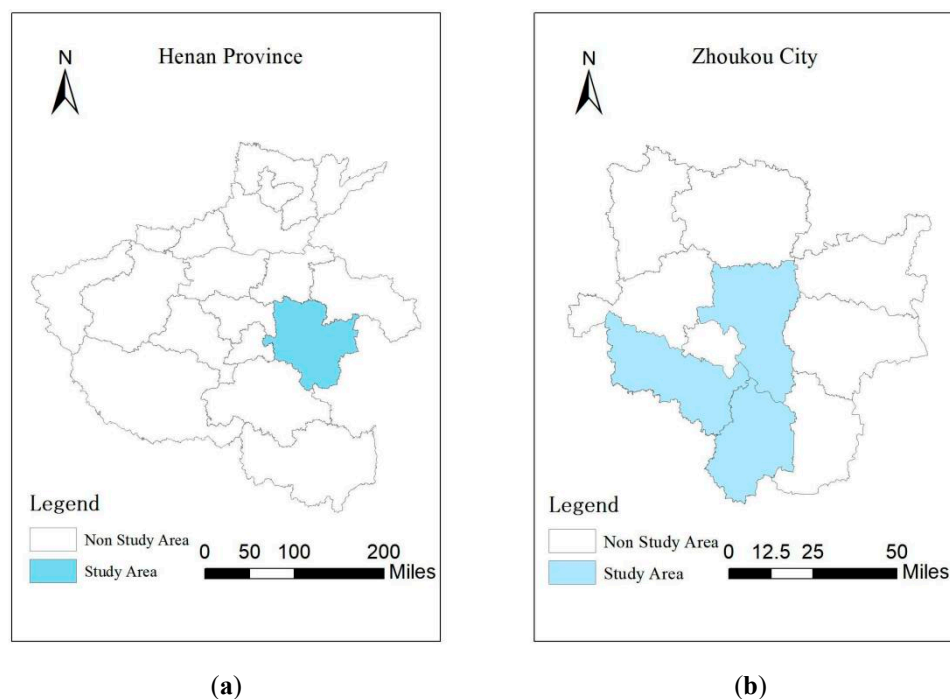


Figure 2. Location of the study areas.

The research team conducted field research in July 2020 in Shangshui County, Huaiyang County, and Xiangcheng City (Figure 2b). The field study's three sample counties (cities) were all the major grain-producing counties in Zhoukou City, Henan Province in 2019: Shangshui County, Huaiyang County, and Xiangcheng City. Shangshui County is located in the transition zone of an alluvial floodplain with flat topography and is one of the major grain-producing counties in the Central Plains. The county has a total area of 1270 square kilometers and a population of 1,253,600. There was a total of 1.39 million mu of arable land and a total grain output of 1207 million kilograms in 2020, with a steady increase in unit area production and total grain output. Huaiyang County has a mild climate and abundant rainfall in the North China Plain. The county has an area of 1334.56 square kilometers, a total population of 1.495 million people, and an arable land area of more than 1.5 million mu is the main production area of wheat and corn. Xiangcheng City is located in the southern part of the Yellow River Alluvial Plain, with a total area of 1086.3 square kilometers and a population of 1.26 million people. It is a traditional agricultural area with crops such as wheat, corn, beans, cotton, sesame, etc. The arable land area is maintained at more than 1 million mu annually. In total, 2,085,100 mu of grain crops were planted in 2020, with a total output of 918,900 tons.

3.2. Data Resource

In this study, we use a combination of typical and random sampling to select the sample areas and obtain the field survey data through participatory rural assessment (PRA). It is essential to mention that, to obtain more accurate data on household agricultural production, the respondents of this study were the primary laborers engaged in agricultural production. The questionnaire mainly covers the basic situation of farmers, income and consumption structure, agricultural production and operation, SAS purchase willingness and purchase behavior, and the development of the local SAS market. The research team distributed a total of 650 questionnaires. Combined with the variables required for the research content of this paper, 638 valid questionnaires were obtained by eliminating the invalid samples with many vacant values and inconsistent answers, and the effective rate of the questionnaire reached 98.15% (Table 1). Regarding regional distribution, 41.38% of the total sample were farmers in Shangshui County, 27.90% in Huaiyang County, and 30.72% in Xiangcheng City.

Table 1. Sample distribution.

County	Sample Size	Proportion	Town	Sample Size	Proportion
Shangshui	264	41.38%	Huahe	45	17.05%
			Tangdian	41	15.53%
			Shuzhuang	48	18.18%
			Yuanlao	30	11.36%
			Yaoji	52	19.70%
			Pingdian	48	18.18%
Huaiyang	178	27.90%	Doumen	36	20.22%
			Huangji	33	18.54%
			Lutai	39	21.91%
			Zhuji	34	19.10%
			Xinzhan	36	20.22%
Xiangcheng	196	30.72%	Dingji	51	26.02%
			Nandun	49	25.00%
			Wangming	52	26.53%
			Zhenguo	44	22.45%
Total	638	100%	–	638	–

3.3. Model Construction

Considering that the divergence between willingness and behavior to purchase SAS is affected by the nonlinearity of the land scale, this paper uses a threshold regression model for empirical analysis. With reference to the study by Bruce E. Hansen (2000) [51], the following model is constructed in this study.

$$y_i = \theta'_1 x_i + \varepsilon_i, q_i \leq \gamma$$

$$y_i = \theta'_2 x_i + \varepsilon_i, q_i > \gamma$$

where i denotes the different farm households in the sample. y_i is the degree of divergence between farmers' willingness and behavior. x_i is the explanatory variable, including the core explanatory variable land scale, the endowment of farmers on the demand side, and the supply of SAS on the supply side. q_i is the threshold variable. γ is the threshold value, which divides the sample into two groups (small-scale farmers and large-scale farmers). θ'_1 with θ'_2 are the regression coefficients of the two groups, and ε_i is the random error term.

3.4. Variables Description

3.4.1. Dependent Variable

The explanatory variable is the degree of divergence between farmers' willingness and behavior to purchase SAS. This study was conducted for wheat farmers in the major grain-producing areas, and 10 SASs were involved in the preproduction, production, and postproduction stages. Among them, the preproduction stage includes three items: formula fertilization method, deep tillage, and deep pine. The mid-production stage includes six items of machine plowing, machine sowing, machine harvesting, fertilization, pesticides, and irrigation. The postproduction stage includes two items: agricultural-products processing and transportation. In addition, it is necessary to define purchase willingness and purchase behavior clearly. Purchase willingness refers to the number of SAS that farmers are willing to purchase. Farmers need to answer yes or no to each SAS. If they are willing to buy, the answer is recorded as 1. Otherwise, it is 0. Purchase behavior refers to the actual number of SAS that farmers purchase. The assignment rule is the same as the purchase willingness. On this basis, the farmers' willingness and behavior level can be calculated by weighted average. It should be explained that the importance of each service is similar because the SAS in each stage of agricultural production is closely related to the final yield. Therefore, the paper assigns equal weights to each agricultural social

service. Based on this, the degree of farm household divergence can be calculated by the following equation.

$$D_i = (PD_i - PB_i) / 10$$

where PD_i denotes the number of SAS that farmer i wishes to purchase, and PB_i denotes the number of SAS that farmer i has purchased, both of which are continuous variables in $[0, 10]$. D_i is the degree of divergence between farmers' willingness and behavior, which is theoretically seen as a continuous value between $[-1, 1]$. If D_i is equal to 0, it means that the farmers' subjective willingness and objective behavior are in agreement. If D_i is negative, it means that farmers' demand for SAS is smaller than their actual purchasing behavior. Farmers do not have a strong demand, but are forced to purchase due to multiple factors. It should be mentioned that, according to the actual situation of the research and the statistical results of the data (Table 2), there are no farmers who are forced to consume in the sample.

Table 2. Farmers' willingness and behavior to purchase SAS.

	Willingness	Behavior	Divergence	Min	Max	Incidence
Overall	5.3887	3.8715	0.1517	0	0.6	65.52%
Preproduction	0.6317	0.2429	0.1944	0	1	30.41%
Production	4.4498	3.4545	0.1658	0	0.8333	47.96%
Postproduction	0.3072	0.1740	0.0666	0	1	10.50%

As seen in Table 2, the mean value of farmers' willingness to purchase SAS in the major grain-producing areas is 5.3887, which means that among the 10 SAS, each farmer has an average willingness to purchase 5.3887 items. It also indicates that the sample farmers have a strong demand for SAS, and the demand is concentrated in the mid-production stage. However, the strong demand for postproduction services has not yet been formed, which is related to farmers' knowledge of SAS on the one hand, and limited by the not-yet developed and mature market of SAS on the other. Meanwhile, the average level of farmers' purchasing behavior for SAS in the major grain-producing areas is only 3.8715, which means that among the 10 SAS, each farmer purchased 3.8715 items on average. This result indicates that the strong demand for SAS has not been effectively transformed into purchasing behavior, especially in the postproduction stage. In addition, the divergence between purchase willingness and behavior of the sample farmers (65.52%) has become an actual problem for constructing and improving the SAS system in the major grain-producing areas.

3.4.2. Independent Variables

(1) The core explanatory variable

The core explanatory variable is the land scale, which is expressed by the actual land area operated by the household in mu ($=0.0667$ ha). As shown in Figure 3, the land size was primarily concentrated in the range of 5–15 mu (83.70%), and the land they operated accounted for 53.68% of the total area. On the other hand, about 4.38% of the farmers with land size larger than 2 hectares and 23.27% of the total land area were operated. This conclusion shows that the coexistence of small and large-scale farmers is the most basic production pattern in the main grain-producing areas in China, and small-scale farmers are still the main force of agricultural production in the main grain-producing areas.

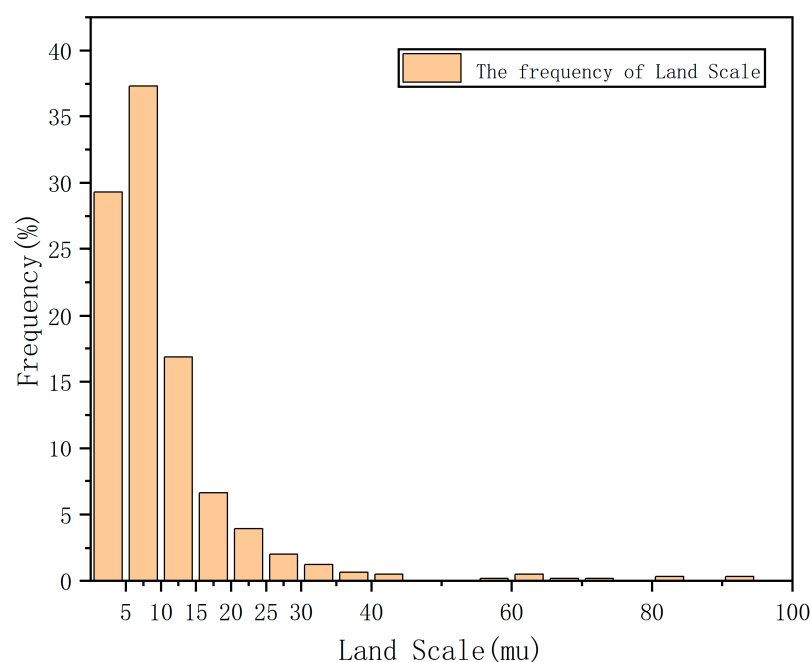


Figure 3. Distribution of the agricultural land scale.

Meanwhile, the mean value of the sample farmers' operation size was 10.2243 mu (Table 3). In longitudinal comparison with other studies in nongrain producing areas [52,53], the sample farming households in this study have an overall higher land scale. At the same time, the average land scale is similar to other studies in other major grain-producing areas [54,55]. This result indicates that the sample of this study can fully reflect the characteristics of agricultural production in the major grain-producing areas and is more representative. Moreover, it also indicates that the sample of this study has certain universality. Therefore, it is reasonable to use Zhoukou City, Henan Province, as the sample area for sampling the agricultural production of farm households in the main grain-producing areas. The sampling method of this study meets the requirement of randomness.

Table 3. Variables' description.

Variable Description		Mean	SD	Min	Max
Core explanatory variables					
Land scale	Actual land area operated (Mu)	10.2243	12.0193	0.3	100
Demand Side					
Income	Household income per capita in 2018, taking the natural logarithm	9.2786	0.8535	3.6889	13.1538
Burden	Number of incapacitated people such as elderly, disabled, and children in the family	2.4273	1.5377	0	10
Land fragmentation	Number of cultivated plots actually operated by households	2.1771	1.0698	1	8
Education	Number of years of education for the head of household	5.7429	3.6516	0	15
Healthy	Self-assessment of health, 1 = very poor, 2 = fair, 3 = very good	2.4013	0.7362	1	3
Machinery	Total value of agricultural machinery owned by households, taking the natural logarithm	6.4805	3.3408	0	13.1303
Supply Side					
Regulation	Whether the SAS market is regulated, 1 = not regulated, 2 = general, 3 = regulated	2.3088	0.7351	1	3
Price	Whether the price of SAS is reasonable, 0 = unreasonable, 1 = reasonable	0.6489	0.4777	0	1
Quality	Whether the quality of SAS is qualified, 0 = unqualified, 1 = qualified	0.7994	0.4124	0	1
Matching	Can the supply of SAS meet your needs, 1 = not satisfied, 2 = fairly satisfied, 3 = fully satisfied	2.3840	0.5781	1	3
Local supplier	Whether there is a local SAS supplier, 0 = No, 1 = Yes	0.4169	0.4934	0	1

(2) Demand-side explanatory variables

The explanatory variables on the demand side mainly refer to the household endowment situation, which is the basis for farm households to make purchase decisions. Income, characterized by per capita household disposable income in 2018, is taken as the natural logarithm to eliminate heteroskedasticity. Burden is characterized by the number of in-

capacitated persons such as the elderly, disabled, and children in the household. Land fragmentation is characterized by the number of land plots operated by the household. Education is the number of years of education of the head of household. Health, which refers to the health level of the head of household, is assigned with the following rules: 1 is very poor, i.e., suffering from chronic or heavy diseases; 2 is average; and 3 is very good. Machinery is the total value of agricultural machinery owned by the household, taken as the natural logarithm.

(3) Supply-side explanatory variables

The supply-side explanatory variables mainly refer to the basic situation of SAS supply subjects. In this study, we choose to measure the corresponding indicators by farmers' subjective evaluation of SAS providers. It is due to the heterogeneity of farmers' endowments and the differences in their perceptions of SAS. The use of farmers' subjective evaluations can reflect the relationship between service providers and farmers more intuitively and effectively avoid the regression bias caused by the parity characteristics of objective evaluations of service providers. According to the assignment rules in the existing research [23,27,29,46], this paper deals with the supply-side explanatory variables as follow. Specifically, the local supplier is characterized by whether there is a local SAS supplier in the village, with 0 being no and 1 being yes. The degree of regulation is characterized by farmers' subjective evaluation of the degree of regulation of the socialized service market, with the assignment rules of 1~3, i.e., from not regulated to regulated. The service price and quality are characterized by whether the SAS price is perceived as reasonable and whether the quality is qualified, with 0 being unreasonable or unqualified and 1 being reasonable or qualified. The degree of matching is characterized by whether the SAS can effectively meet the demand of farmers, with 1 being unsatisfied, 2 being average, and 3 being fully satisfied.

4. Model Results and Analysis

4.1. Threshold Effect Test

Before estimating the threshold level and analyzing the impact mechanism, we first tested the sample data for the presence of a threshold effect. The test results are shown in Table 4, where the LM statistic and *p*-value are the results obtained by the "self-help method with 500 iterations". As can be seen from Table 4, the LM statistic significantly rejects the hypothesis of no threshold value at the 1% statistical level. It shows that there is a threshold effect of land scale, and there is only one threshold value. The threshold values and 95% confidence interval results obtained after the test are shown in Table 5. This paper classifies the sample farmers into large-scale farmers and small-scale farmers based on the threshold values. When the land scale is larger than the threshold value, they are large-scale farmers, and vice versa, they are small-scale farmers. Based on this, this paper analyzed the differences between small and large-scale farmers through *t*-tests. Although both groups practiced wheat cultivation, small-scale farmers had significant disadvantages in land scale, number of laborers, household income, and value of their own machinery compared to large-scale farmers. Moreover, we found that the threshold value of this paper is similar to the classification criteria of some studies for large-scale farmers [56]. It provides sufficient theoretical support for determining the threshold value in this study.

Table 4. Threshold effect test results.

	Single Threshold		Double Threshold	
	LM-Test	<i>p</i> -Value	LM-Test	<i>p</i> -Value
Overall	66.7663 ***	0.000	19.1540	0.286
Preproduction	41.5828 ***	0.000	12.8274	0.904
Production	50.0484 ***	0.000	19.1015	0.192
Postproduction	28.3680 ***	0.000	15.3344	0.428

Note: *** *p* < 0.01.

Table 5. Threshold estimation results and confidence intervals.

	Overall	Preproduction	Production	Postproduction
Threshold	10	13.6	10	8.5
Confidence interval	(10, 10.5)	(4, 17)	(8, 13.6)	(3, 9.6)

4.2. Threshold Regression Analysis

Table 6 shows the results of OLS and threshold regression models. From the core explanatory variables, the effect of land scale on the degree of divergence shows an inverted “U” nonlinear characteristic. Among them, the expansion of land scale significantly expands the degree of divergence of small-scale farmers’ willingness and behavior to purchase SAS, with a marginal effect of 0.0399, and hypothesis 2 is confirmed. With the further expansion of land scale, the divergence of large-scale farmers was significantly weakened, and the marginal effect was -0.0326 . Hypothesis 3 was confirmed.

Table 6. The regression results of OLS and threshold effect model.

	OLS		Scale ≤ 10		Scale > 10	
	Coef.	Std. Error	Coef.	Std. Error	Coef.	Std. Error
Core explanatory variables						
Land scale	0.0053	0.0061	0.0399 ***	0.0103	-0.0326 **	0.0142
Demand Side						
Income	-0.0272 ***	0.0069	-0.0152 **	0.0068	-0.0379 **	0.0151
Burden	-0.0085 ***	0.0032	-0.0127 ***	0.0040	-0.0008	0.0039
Land fragmentation	0.0197 ***	0.0046	0.0211 ***	0.0049	-0.0125	0.0076
Education	-0.0005	0.0014	0.0015	0.0014	-0.0069 ***	0.0024
Healthy	-0.0212 ***	0.0069	-0.0208 ***	0.0078	-0.0158 *	0.0090
Machinery	-0.0030 *	0.0016	-0.0006	0.0018	-0.0112 ***	0.0031
Supply Side						
Regulation	0.0006	0.0075	0.0148	0.0183	-0.0356 ***	0.0124
Price	-0.0266 **	0.0119	-0.0403 ***	0.0143	0.0153	0.0154
Quality	-0.0315 **	0.0137	-0.0505 ***	0.0163	0.0184	0.0153
Matching	-0.0445 ***	0.0109	-0.0417 ***	0.0127	-0.0487 ***	0.0147
Local supplier	-0.0507 ***	0.0107	-0.0546 ***	0.0128	-0.0289 **	0.0141
Intercept	0.6128 ***	0.0729	0.4148 ***	0.0742	0.9593 ***	0.1299
Observation	638		474		164	
R-square	0.2329		0.2674		0.5062	

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

From the demand side, household income and health show consistent negative effects on the divergence. In contrast, indicators such as household burden, land fragmentation, education level, and value of own machinery are affected by the heterogeneity of land scale. First, the increase in the number of burdens will further aggravate the labor constraints of smallholder households. In order to ensure that agricultural production and household income will not be affected, smallholder households will be forced to form the purchase behavior of SAS and then form the consistency of purchase willingness and behaviors. However, large-scale farmers have a higher level of purchasing SAS, and the labor constraint within the household can be alleviated by hiring workers, so they are not affected by the household burden. Second, the increase in land fragmentation means that the more significant the impediment for agricultural production to carry out large-scale and specialized production, the higher the cost that farmers have to pay for SAS, and the lower the possibility of converting demand to actual behavior. Again, improving education can effectively promote farmers’ objective knowledge of SAS, which can lead to purchasing demand. However, small-scale farmers constrained by household endowments cannot effectively convert demand into purchase behavior. Finally, large-scale farmers can provide

SAS on their own by acquiring large-scale machinery and transforming it into new SAS suppliers. However, for small-scale farmers, the accumulation of their machinery is often dominated by small machinery, which cannot meet the needs of agricultural production on a large scale, so there is no substitution effect on the purchase of socialized services.

From the supply side, the local supplier and the degree of matching can significantly weaken the divergence among farmers of different operation scales. This result indicates that if local supply agents can provide SAS matching with farmers, it will significantly reduce the time and monetary cost of purchasing services for farmers of different land scales. Therefore, it effectively promotes the consistency of purchase willingness and purchase behavior. The heterogeneity of land scale influences the degree of regulation, service price, and quality. Specifically, small-scale farmers are more sensitive to the price and quality of socialized services but not the degree of regulation. Service price is the most important economic cost for smallholder social service purchases under the profit maximization objective. In contrast, service quality is essential to smallholder food production and expected household income. Large-scale farmers are not sensitive to service price and quality but have higher requirements for the degree of regulation of local social service providers.

At the same time, the comparison reveals that the empirical results of OLS are no longer reliable once the mechanism variable is subject to threshold effects. For example, after estimation using OLS, the effect of operating size on the degree of divergence is positive but not significant. This finding suggests that using OLS for estimation will lead to directional bias in the study results. It is more reasonable to choose a threshold regression model for empirical analysis in this paper.

4.3. Heterogeneity Analysis of Production Stage

From the previous analysis, it is clear that farmers' willingness and behavior to purchase socialized services show distinct differences in different production links. Therefore, there may be heterogeneity in the influence mechanisms that cause the divergence of farmers' willingness and behavior to purchase SAS in different production stages. Based on this, this paper divides SAS into three stages: preproduction, production, and postproduction, and uses the same rules to measure the degree of divergence between farmers' purchase willingness and behaviors in different production stages. Further, a threshold regression model is used to test the influence mechanism of divergence between farmers' purchase willingness and behavior in different production stages. The results are shown in Table 7.

Table 7. Heterogeneous effects of different production parts.

	Preproduction		Production		Postproduction	
	Scale \leq 13.6	Scale > 13.6	Scale \leq 10	Scale > 10	Scale \leq 8.5	Scale > 8.5
Core explanatory variables						
Business scale	0.1820 *** (0.0422)	−0.2064 ** (0.0910)	0.1062 (0.0887)	−0.1055 (0.0834)	0.1304 *** (0.0438)	−0.0301 (0.0618)
Demand Side						
Income	0.0260 (0.0325)	0.1176 (0.1068)	−0.1324 ** (0.0570)	−0.1354 * (0.0750)	−0.0619 *** (0.0233)	0.0062 (0.0491)
Burden	−0.0254 (0.0176)	0.0348 (0.0364)	−0.0881 *** (0.0329)	−0.0097 (0.0212)	−0.0052 (0.0147)	−0.0167 (0.0172)
Land fragmentation	0.0677 ** (0.0281)	−0.0133 (0.0154)	0.1335 *** (0.0436)	−0.0620 (0.0395)	0.0156 *** (0.0055)	0.0194 (0.0262)
Education	0.0031 (0.0074)	−0.1319 *** (0.0391)	−0.0015 (0.0123)	−0.0285 ** (0.0118)	0.0243 (0.0201)	−0.0062 (0.0091)
Healthy	−0.0850 ** (0.0403)	−0.1260 * (0.0753)	−0.1284 * (0.0717)	−0.0191 (0.0505)	0.0149 (0.0296)	−0.0315 (0.0386)
Machinery	−0.0160 (0.0082)	−0.0649 ** (0.0280)	0.0079 (0.0148)	−0.0255 ** (0.0128)	−0.0039 (0.0063)	−0.0176 * (0.0097)

Table 7. Cont.

	Preproduction		Production		Postproduction	
	Scale \leq 13.6	Scale $>$ 13.6	Scale \leq 10	Scale $>$ 10	Scale \leq 8.5	Scale $>$ 8.5
Supply Side						
Regulation	0.0463 (0.0410)	−0.0356 (0.0923)	0.0960 (0.0671)	−0.1504 ** (0.0612)	−0.0313 (0.0303)	−0.0002 (0.0435)
Price	−0.0569 (0.0644)	−0.1483 (0.1227)	−0.3672 *** (0.1190)	−0.0623 (0.0834)	0.0371 (0.0489)	0.0735 (0.0628)
Quality	0.0100 (0.0744)	−0.1216 (0.0854)	−0.3985 *** (0.1360)	0.0558 (0.1002)	−0.1346 ** (0.0559)	−0.0505 (0.0775)
Matching	−0.2140 *** (0.0577)	−0.5315 *** (0.1276)	−0.1261 (0.1043)	−0.1694 ** (0.0708)	−0.0624 (0.0406)	−0.1100 (0.0553)
Local supplier	−0.1843 *** (0.0581)	−0.3134 *** (0.0961)	−0.7335 *** (0.1043)	−0.2449 *** (0.0754)	0.0121 (0.0451)	0.0497 (0.0603)
Intercept	0.4012 (0.3642)	0.7928 (0.8320)	3.1964 *** (0.6167)	3.4432 *** (0.6413)	0.6853 *** (0.2494)	0.6092 (0.4357)
Observation	516	122	474	164	403	235
R square	0.1145	0.2633	0.2415	0.4208	0.0938	0.1192

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

The preproduction segment mainly includes soil testing, deep tillage, and deep loosening. As seen in Table 6, the effect of the land scale on the explanatory variables remains significant, and the direction of the effect remains unchanged. It indicates that there is still an inverted U-shaped nonlinear relationship between the land scale and the divergence in the preproduction social services. In the internal channel, the effect of household income on the explanatory variables is no longer significant, indicating that the monetary capital constraint is not an essential factor that facilitates the shift from farmers' willingness to purchase prenatal social services to their behavior. At the same time, the increase in the burden no longer significantly increases the purchasing behavior of farm households. Since the preproduction segment is technology-intensive, farmers do not purchase preproduction social services to mainly alleviate labor constraints but to improve wheat yields and product premiums through improved soil testing and deep plowing services. On the supply side, small-scale farmers are no longer sensitive to the service price and quality of preproduction link socialized services. In contrast, large-scale farmers are no longer sensitive to the degree of specification. However, both the degree of matching and the local supplier can significantly reduce the divergence between the purchase willingness and behaviors of farmers of different scales.

The mid-production segment mainly includes the socialized services of agricultural materials and farm machinery types. As shown in Table 6, the degree of divergence of land scale is no longer significant, and the degree of matching of social services for small-scale farmers is also no longer significant. Since the mid-production stage is labor-intensive, the adoption of socialized services of agricultural capital and agricultural machinery types can not only effectively alleviate household labor constraints but also effectively promote increased food production and household income. On this basis, farmers of different scales will show a strong willingness to purchase and more common purchasing behavior, thus achieving the consistency of purchasing willingness and behavior. Therefore, although the scale of land management and the degree of matching will increase farmers' willingness to purchase, they are no longer the critical factors influencing farmers' purchase behavior of services in the production chain. All other indicators remain highly consistent with the influence mechanism in Table 5.

The postproduction segment mainly includes agricultural processing services and transportation services. As shown in Table 6, both the land scale and fragmentation significantly increase the divergence between smallholder farmers' purchase willingness and behavior. Because the land scale increases, the willingness of smallholder farmers to demand services in the postproduction stage gradually increases. However, the increase in land fragmentation will lead to the expansion of transportation costs of agricultural products, so the purchase level of small-scale farmers is lower than in another segment. At the same time, once smallholders' willingness to demand postproduction services is formed, the service quality and household income will significantly affect whether the willingness

to purchase the services can be effectively transformed into purchase behavior based on the profit maximization goal. For large-scale farmers, only the value of their machinery can effectively reduce the divergence between purchase willingness and behavior. The possible explanation is that the large-scale farmers can transform themselves into the new supplier of agricultural transportation services by purchasing machinery and transportation tools. Therefore, they can effectively achieve the consistency between purchase willingness and behavior. At the same time, since wheat is a grain crop, agricultural processing services in the postproduction chain cannot provide higher added value. Therefore, the purchase level of large-scale farmers for it is lower and is not affected by other factors.

4.4. Robustness Test

This section attempts to achieve the robustness test of the findings of this study by replacing the explanatory variables and excluding some samples. The results are shown in Table 8. Columns 1 and 2 show the regression results after replacing the explanatory variables, and columns 3 and 4 show the regression results after excluding some samples.

Table 8. Results of robustness test.

	Variable Substitution		Rejection of Sample	
	Scale ≤ 12	Scale > 12	Scale ≤ 10	Scale > 10
Core explanatory variables				
Land scale	0.0719 ** (0.0351)	−0.2012 *** (0.0671)	0.0360 *** (0.0122)	−0.0401 *** (0.0152)
Demand Side				
Income	0.0119 (0.0203)	−0.1194 * (0.0610)	−0.0193 ** (0.0075)	−0.0361 ** (0.0153)
Burden	−0.0137 (0.0133)	0.0055 (0.0197)	−0.0127 *** (0.0040)	−0.0013 (0.0039)
Land fragmentation	0.0128 *** (0.0049)	−0.0930 *** (0.0323)	0.0235 *** (0.0050)	−0.0090 (0.0082)
Education	0.0521 (0.1520)	−0.0338 *** (0.0115)	0.0014 (0.0014)	−0.0075 *** (0.0025)
Healthy	−0.0794 *** (0.0253)	−0.0807 * (0.0448)	−0.0150 * (0.0080)	−0.0110 (0.0099)
Machinery	−0.0044 (0.0058)	−0.0448 *** (0.0092)	0.0006 (0.0020)	−0.0100 *** (0.0032)
Supply Side				
Regulation	0.0118 (0.0283)	−0.1310 ** (0.0597)	0.0133 (0.0088)	−0.0314 ** (0.0131)
Price	−0.0933 ** (0.0436)	−0.0625 (0.0791)	−0.0291 ** (0.0145)	0.0126 (0.0162)
Quality	−0.1321 *** (0.0450)	0.1805 *** (0.0684)	−0.0385 ** (0.0163)	0.0171 (0.0157)
Matching	−0.1174 *** (0.0351)	−0.1548 ** (0.0668)	−0.0494 *** (0.0137)	−0.0496 *** (0.0155)
Local supplier	−0.1489 *** (0.0431)	−0.1055 (0.0673)	−0.0806 *** (0.0136)	−0.0296 * (0.0152)
Intercept	0.9755 *** (0.2139)	3.9194 *** (0.5080)	0.4646 *** (0.0815)	0.9438 *** (0.1297)
Observation	509	129	404	151
R square	0.1869	0.4534	0.3070	0.5067

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

4.4.1. Variable Substitution

Substitution of explanatory variables is one of the most common robustness tests. Drawing on some scholars' studies, this paper characterizes the divergence by constructing binary dummy variables. The specific assignment rule is that when the degree of divergence is greater than 0, it is determined that there is a divergence between farmers' willingness to purchase and behavior, and the value is 1. Otherwise, it is 0. The regression results show that after replacing the explanatory variables, the threshold value is slightly increased to 12 mu. Comparing with the results in Table 4, it is found that the direction of

influence and significance of most of the explanatory variables do not change significantly. However, when the land scale is below the threshold, the effects of per capita income and household burden are no longer significant. In contrast, when the land scale is greater than the threshold, land fragmentation effectively improves the divergence between farmers' purchase willingness and behavior, with a marginal effect of -0.0930 , which is significant at the 1% statistical level. The possible explanation is that the higher the degree of land fractionation for large-scale farmers, the higher the demand for labor inputs. Therefore, to ensure higher wheat production, large-scale farmers will have a greater demand for SAS under the labor resource constraint. At the same time, since their financial constraints are relatively small, they tend to effectively transform their higher willingness to purchase demand into purchasing behavior.

4.4.2. Rejection of Sample

The research orientation of this paper is to achieve a high willingness and high behavior consistency among farmers. However, some farmers in the sample may have negative purchase willingness and behaviors, i.e., low purchase willingness and low purchase behaviors, forming a low-low consistency. This sample is contrary to the basic orientation of this study and prone to unreliable research findings. Meanwhile, considering the basic situation, farmers are more willing to purchase socialized services of machine plowing, machine sowing, and machine harvesting in the mid-production stage. Therefore, this paper excludes the farmers with a level of purchase willingness lower than 3 from the sample. A total of 79 samples were excluded. After the regression, the threshold value is still 10 mu. The core explanatory variables showed consistent direction and significant influence at different stages. However, the marginal effects decreased from 0.0399 to 0.0360 and increased from -0.0326 to -0.0401 , respectively. This result indicates that although there were some farmers in the sample whose purchase willingness and behavior were negatively consistent, they did not affect the findings of this paper.

5. Discussion

This paper mainly has three contributing points which can make up for the shortcomings of previous research. First, the land is the essential element of agricultural production and the basis for agricultural production decisions made by farm households. Previous studies, mainly from a linear perspective, have described the relationship between operation scale and farmers' agricultural production decisions, which led to the conclusion that expanding land scale can effectively encourage farmers to form more active agricultural production decisions [57–59]. However, the relationship between smallholder farmers and large-scale operators has been described from a linear perspective. However, the coexistence of small-scale farmers and large-scale operators is the primary production pattern in China's major grain-producing areas. The difference in land scale leads to significant differences in the purpose of agricultural production, production efficiency, and endowment level [60,61], which will present two different sets of decision mechanisms. Based on this, this study adopts a threshold regression model to construct criteria for small and large-scale farmers. It focuses on the differences between the two in terms of purchase willingness and purchase behavior divergence mechanisms. It was found that there was a nonlinear effect of operation size on the degree of divergence between farmers' purchase willingness and purchase behavior, which is consistent with the inverted "U"-shape relationship found in the study by [62,63]. At the same time, the proof of the inverted "U"-shape relationship provides crucial empirical support for hypotheses 2 and 3. Further, it also demonstrates that the discussion of the linear relationship in existing studies may be somewhat misunderstood.

Second, this paper focuses on exploring the heterogeneity of the mechanisms influencing farmers' purchase willingness and behavioral divergences under different product segments. Most existing studies focus on the critical role of agricultural mechanization services in agricultural production [25,33,64–66]. However, there is insufficient attention to

agricultural services in the preproduction and postproduction stages. As labor-intensive services, agricultural mechanization services are significantly different from technology-intensive services such as soil testing in the preproduction stage and agricultural product processing in the postproduction stage. Therefore, there are also differences in farmers' decision-making mechanisms for SAS in different production stages. At the same time, the development of China's SAS market also shows the differences in production links. The supply of SAS focuses on mechanized services in the middle of production [67,68]. It lacks due attention to other production links. However, due to the rapid development of agricultural mechanization services, it tends to give priority to meeting the purchase demand of large-scale farmers [47,69]. In addition, there is a tendency for large-scale farmers to purchase their machinery and become a new supply subject [49,62]. The small-scale farmers have a natural disadvantage in purchasing mechanization services due to their limited land scale. Therefore, from both theoretical and practical perspectives, it is vital to comprehensively explore the heterogeneity of different production links to promote the balanced and healthy development of the SAS system.

Third, this study uses data from a study of 638 farm households in Henan Province, China. Henan Province is one of the critical major grain-producing areas in China. It contributes to ensuring China's food security and is one of the main battlefields for promoting agricultural modernization in China. The study area has the following two characteristics: firstly, the agricultural production pattern of small-scale farmers and large-scale farmers coexist; and secondly, the agricultural social service system needs to be developed urgently. Therefore, the findings of this paper can provide valuable references for the construction of agricultural social service systems and agricultural modernization in some other Chinese provinces (e.g., Shandong, Heilongjiang, Anhui) and other developing countries (Pakistan, India, Vietnam).

In addition, this paper differs from previous studies in that it focuses on the divergence between farmers' willingness and behavior. Based on this, this paper empirically illustrates the reasons farmers' willingness cannot be effectively transformed into behavior, which provides a new perspective to enrich the analytical framework of farmers' decision making. At the same time, the theoretical framework constructed from the demand and supply sides further expands the factors influencing farmers' decision making from their endowments to the external environment, which provides a more comprehensive understanding of farmers' decision-making mechanisms.

Although this study discusses the factors influencing farmers' agricultural social service purchasing decisions as comprehensively as possible, the following limitations remain. The incentive effect of subsidy policy on farmers' agricultural production decisions and the efficiency improvement effect of agricultural production have been widely studied [70–72]. However, due to the difficulty of obtaining data, the subsidy policies used by local governments to incentivize agricultural operators to purchase SAS are not considered in the analysis framework. The subsidy policies in the main grain-producing areas include subsidies for purchasing agricultural machinery, which can effectively motivate large-scale farmers to purchase large-scale machinery and transform them into social service providers. Therefore, future research will provide richer support for local governments' policy formulation in agricultural development if the subsidy policy is included in the analysis framework of farmers' decision making. Meanwhile, SAS can promote the further expansion of business scale by operating agents [27,73,74], which may result in potential endogeneity problems. However, the threshold regression model does not have an appropriate solution to the endogeneity problem, so we can only avoid this problem by controlling as many variables as possible. At the same time, this paper also conducted a robustness check by replacing the explanatory variables and excluding some samples. In addition, the study area selected in this paper is Henan Province, one of the most important of the 13 major grain-producing areas. Although it is highly representative, future research can expand the study area and the size of samples to improve the universality of conclusions further.

In general, this study examines the inverted “U”-shaped relationship between land size and the divergence between willingness and behavior of farmers to purchase SAS. At the same time, this paper sorts out the factors influencing farmers’ decision making from the demand and supply sides and further points out the heterogeneity of farmers’ decision-making mechanisms in different production segments. The study findings will help construct and improve the socialized agricultural service system and enrich the theory of farmers’ decision making.

6. Conclusions

Using research data from 638 farm households in major grain-producing areas of China, this paper empirically analyzes the influence mechanism of farm households’ willingness to purchase SAS and behavioral divergences under the perspective of heterogeneity in land scale using a threshold regression model. Further, it explores the heterogeneity of the influence mechanism under different production stages by dividing SAS into three types: preproduction, production, and postproduction.

The findings show that (1) the divergence between farmers’ willingness and behavior is an actual practical problem facing the development of SAS in the major grain-producing areas. Farmers in the sample showed a strong willingness to purchase SAS, especially in the mid-production stage. However, 65.52% of the farmers failed to convert their purchase willingness into purchase behavior, especially in the preproduction stage. (2) There is a significant threshold effect of land scale on the divergence between farmers’ willingness and behavior regarding SAS, and the threshold value is 10 mu. This result indicates that an increase in land scale for small-scale farmers significantly expands the divergence between farmers’ purchase willingness and purchase behavior. An increase in land scale significantly reduces the divergence between farmers’ purchase willingness and the behavior of large-scale farmers. (3) From the demand side, the degree of household income and health significantly reduces the degree of divergence among farmers of different business sizes. Family burden and land fragmentation are essential factors affecting the degree of divergence of small-scale farmers, while education and value of own machinery significantly affect the degree of divergence of large-scale farmers. From the supply side, the local supplying agents and the degree of matching significantly reduce the divergence among farmers of different land scales. However, small-scale farmers are more sensitive to the price and quality of SAS. In contrast, large-scale farmers have higher requirements for the degree of regulation of the supplying agents. (4) There is heterogeneity in the influence mechanism of farmers’ divergence under different production links. In the preproduction stage, household income and burden are no longer critical factors influencing farmers’ willingness and behavior divergence. Small-scale farmers are no longer sensitive to the price and quality of SAS in the preproduction stage. In contrast, large-scale farmers are no longer sensitive to the degree of regulation. In the mid-production stage, there is no longer a significant influence of the land scale and local SAS providers on the divergence between farmers’ willingness and behavior. In the postproduction stage, household burden and health are no longer significant factors affecting the divergence of small-scale farmers. Small-scale farmers are more sensitive to the service quality of SAS. Among the various influencing factors for large-scale farmers, only the value of machinery significantly negatively affects the divergence between their willingness and behavior.

Based on this, this study provides the following policy insights for regions with similar agricultural production patterns as the main grain-producing areas in China. It is important to focus on matching the subjective willingness of farmers with their actual behavior to crack the current dilemma of agricultural social service development, especially for differentiated service supply for farmers with different operation scales. First, considering the demand side, willingness is the subjective basis of behavior. The cognition of agricultural operators about preproduction, postproduction, and other SAS can be strengthened through training, propaganda, and technology going to the countryside, which will, in turn, promote farmers’ willingness to form effective purchases of technology-intensive

services. Second, from the supply side, expanding the service scale does not mean farmers' diversified demands for SAS can be fully satisfied. Therefore, we should pay attention to the structural reform of the supply side of the SAS market. The local government should guide the staggered development, division of labor, and network linkage of different service entities, focus on the comparative advantages of different service entities, and promote the structural optimization of the SAS system. Again, subsidies and financial and tax incentives vigorously support the development of agricultural service households and service professionals and guide the supplier to expand their service business. At the same time, it is more important to increase the importance of the willingness of various types of service providers to purchase for small-scale farmers. Finally, the policy of promoting land transfer as an aid to the development of the SAS market. It will continue to promote the transfer of land to large-scale management farmers and orderly guide the employment of surplus rural labor to agricultural co-operatives, family farms, and other agricultural institutions to achieve a win-win situation for all parties.

Author Contributions: M.Q.: Conceptualization, methodology, writing—original draft preparation, writing—review and editing. K.Z.: funding acquisition. R.Z.: Investigation, Methodology, Data curation. Y.G.: Investigation, Data curation. J.W.: Investigation, Data curation. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the Shaanxi Provincial Social Science Fund Project (No. 2020R037).

Institutional Review Board Statement: No applicable.

Informed Consent Statement: No applicable.

Data Availability Statement: The data presented in this study are available on request from the corresponding author.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Luo, F.; Ma, W.; Sun, C.; Tian, M.; Zhou, Y. Analysis of the Performance of Government Investment and Interventions to Promote Small-Scale Irrigation Works in China's Major Grain-Producing Areas-Based on the Two-Step Model of Malmquist-FGLS. *Irrig. Drain.* **2017**, *66*, 293–304. [\[CrossRef\]](#)
2. Zhang, D.; Wang, H.; Lou, S. Research on Grain Production Efficiency in China's major grain-producing areas From the Perspective of Grain Subsidy. *Environ. Technol. Innov.* **2021**, *22*, 101530. [\[CrossRef\]](#)
3. Xie, H.; Zhang, Y.; Choi, Y. Measuring the Cultivated Land Use Efficiency of the major grain-producing areas in China under the Constraints of Carbon Emissions and Agricultural Nonpoint Source Pollution. *Sustainability* **2018**, *10*, 1932. [\[CrossRef\]](#)
4. Lu, S.; Liu, Y.; Long, H.; Guan, X. Agricultural Production Structure Optimization: A Case Study of Major Grain Producing Areas, China. *J. Integr. Agric.* **2013**, *12*, 184–197. [\[CrossRef\]](#)
5. Tian, P.; Lu, H.; Heijungs, R.; Li, D.; Xue, Y.; Yang, Y. Patterns of carbon footprints of main grains production in China: A comparison between main and non-main producing areas. *Environ. Sci. Pollut. Res.* **2022**, *29*, 23595–23606. [\[CrossRef\]](#) [\[PubMed\]](#)
6. Zhang, Z.; Meng, X.; Elahi, E. Protection of Cultivated Land Resources and Grain Supply Security in major grain-producing areas of China. *Sustainability* **2022**, *14*, 2808. [\[CrossRef\]](#)
7. Huang, J.; Ding, J. Institutional innovation and policy support to facilitate small-scale farming transformation in China. *Agric. Econ.* **2016**, *47*, 227–237. [\[CrossRef\]](#)
8. Jin, S.; Min, S.; Huang, J.; Waibel, H. Falling price induced diversification strategies and rural inequality: Evidence of smallholder rubber farmers. *World Dev.* **2021**, *146*, 105604. [\[CrossRef\]](#)
9. Jiao, X.-Q.; Zhang, H.-Y.; Ma, W.-Q.; Wang, C.; Li, X.-L.; Zhang, F.-S. Science and Technology Backyard: A novel approach to empower smallholder farmers for sustainable intensification of agriculture in China. *J. Integr. Agric.* **2019**, *18*, 1657–1666. [\[CrossRef\]](#)
10. Li, W.; Shuai, C.; Shuai, Y.; Cheng, X.; Liu, Y.; Huang, F. How Livelihood Assets Contribute to Sustainable Development of Smallholder Farmers. *J. Int. Dev.* **2020**, *32*, 408–429. [\[CrossRef\]](#)
11. Qiu, T.; Choy, S.T.; Li, Y.; Luo, B.; Li, J. Farmers' Exit from Land Operation in Rural China: Does the Price of Agricultural Mechanization Services Matter? *China World Econ.* **2021**, *29*, 99–122. [\[CrossRef\]](#)
12. Zuo, Y.; Ma, L.; Cai, H.; Wu, T.; Xin, X. China's On-Going Debates Over Large-Scale Farming: What are the Pros and Cons? *China Agric. Econ. Rev.* **2015**, *7*, 338–343. [\[CrossRef\]](#)

13. Zheng, Y.; Zhu, T.; Jia, W. Does Internet Use Promote the Adoption of Agricultural Technology? 14 Chinese Provinces. *J. Int. Agric.* **2022**, *21*, 282–292. [\[CrossRef\]](#)
14. Zhang, L.; Luo, B. How does smallholder production fit into the modern agricultural development track?: Empirical Evidence from China's Main Wheat Production Areas. *Econ. Stud.* **2018**, *53*, 144–160. (In Chinese)
15. Cai, L.; Wang, L. Analysis on outsourcing service behavior of rice pest and disease control based on Heckman selection model—A case study of ten counties in Fujian Province. *PLoS ONE* **2021**, *16*, e0254819. [\[CrossRef\]](#) [\[PubMed\]](#)
16. Sheng, Y.; Chancellor, W. Exploring the relationship between farm size and productivity: Evidence from the Australian grains industry. *Food Policy* **2019**, *84*, 196–204. [\[CrossRef\]](#)
17. Xie, L.; Luo, B.; Zhong, W. How Are Smallholder Farmers Involved in Digital Agriculture in Developing Countries: A Case Study from China. *Land* **2021**, *10*, 245. [\[CrossRef\]](#)
18. Zhang, Q.; Yan, B.; Huo, X. What Are the Effects of Participation in Production Outsourcing? Evidence from Chinese Apple Farmers. *Sustainability* **2018**, *10*, 4525. [\[CrossRef\]](#)
19. Zheng, H.; Ma, W.; Guo, Y.; Zhou, X. Interactive relationship between non-farm employment and mechanization service expenditure in rural China. *China Agric. Econ. Rev.* **2021**, *14*, 84–105. [\[CrossRef\]](#)
20. Chen, T.; Rizwan, M.; Abbas, A. Exploring the Role of Agricultural Services in Production Efficiency in Chinese Agriculture: A Case of the Socialized Agricultural Service System. *Land* **2022**, *11*, 347. [\[CrossRef\]](#)
21. Verkaart, S.; Bernard, G.M.; Kai, M.; Jeffrey, D.M. Welfare Impacts of Improved Chickpea Adoption: A Pathway for Rural Development in Ethiopia? *Food Policy* **2017**, *66*, 50–61. [\[CrossRef\]](#) [\[PubMed\]](#)
22. Zhang, X.; Yang, J.; Thomas, R. Mechanization outsourcing clusters and division of labor in Chinese agriculture. *China Econ. Rev.* **2017**, *43*, 184–195. [\[CrossRef\]](#)
23. Mi, Q.; Li, X.; Gao, J. How to improve the welfare of smallholders through agricultural production outsourcing: Evidence from cotton farmers in Xinjiang, Northwest China. *J. Clean. Prod.* **2020**, *256*, 120636. [\[CrossRef\]](#)
24. Baiyegunhi, L.J.S.; Majokweni, Z.P.; Ferrer, S.R.D. Impact of Outsourced Agricultural Extension Program on Smallholder Farmers' Net Farm Income in Msinga, KwaZulu-Natal, South Africa. *Technol. Soc.* **2019**, *57*, 1–7. [\[CrossRef\]](#)
25. Benin, S. Impact of Ghana's agricultural mechanization services center program. *Agric. Econ.* **2015**, *46*, 103–117. [\[CrossRef\]](#)
26. Luo, M.; Qiu, H. Agricultural Machinery Socialization Service Adoption, Endowment Differences, and Relative Poverty Alleviation in Rural Economies. *South China J. Econ.* **2021**, *2*, 1–18. (In Chinese)
27. Yang, Z.; Rao, F.; Zhu, P. The Impact of Agricultural Socialization Services on Land Scale Operation: An Empirical Analysis Based on the Perspective of Farmers' Land Transfer. *China Rural Econ.* **2019**, *3*, 82–95. (In Chinese)
28. Qu, X.; Kojima, D.; Nishihara, Y.; Wu, L.; Ando, M. Can Harvest Outsourcing Services Reduce Field Harvest Losses of Rice in China? *J. Integr. Agric.* **2021**, *20*, 1396–1406. [\[CrossRef\]](#)
29. Zhang, Y.; Wang, Y.; Bai, Y. Knowing and Doing: The Perception of Subsidy Policy and Farmland Transfer. *Sustainability* **2019**, *11*, 2393. [\[CrossRef\]](#)
30. Elliott, M.A.; Lee, E.; Robertson, J.S.; Innes, R. Evidence that attitude accessibility augments the relationship between speeding attitudes and speeding behavior: A test of the MODE model in the context of driving. *Accid. Anal. Prev.* **2015**, *74*, 49–59. [\[CrossRef\]](#)
31. Ding, G.; Ding, M.; Xie, K.; Li, J. Driving Mechanisms of Cropland Abandonment from the Perspectives of Household and Topography in the Poyang Lake Region, China. *Land* **2022**, *11*, 939. [\[CrossRef\]](#)
32. Lander, F.; Thgersen, J. Understanding of Consumer Behaviour as a Prerequisite for Environmental Protection. *J. Consum. Policy* **1995**, *18*, 345–385. [\[CrossRef\]](#)
33. Belton, B.; Win, M.T.; Zhang, X.; Filipski, M. The rapid rise of agricultural mechanization in Myanmar. *Food Policy* **2021**, *101*, 102095. [\[CrossRef\]](#)
34. Anang, B.T.; Asante, B.O. Farm household access to agricultural services in northern Ghana. *Heliyon* **2020**, *6*, e05517. [\[CrossRef\]](#)
35. Zhang, J.; Chen, M.; Huang, C.; Lai, Z. Labor Endowment, Cultivated Land Fragmentation, and Ecological Farming Adoption Strategies among Farmers in Jiangxi Province, China. *Land* **2022**, *11*, 679. [\[CrossRef\]](#)
36. Li, F.; Feng, S.; Lu, H.; Qu, F.; D'Haese, M. How do non-farm employment and agricultural mechanization impact on large-scale farming? A spatial panel data analysis from Jiangsu Province, China. *Land Use Policy* **2021**, *107*, 105517. [\[CrossRef\]](#)
37. Tan, S.; Heerink, N.; Qu, F. Land fragmentation and its driving forces in China. *Land Use Policy* **2006**, *23*, 272–285. [\[CrossRef\]](#)
38. Qiu, L.; Zhu, J.; Pan, Y.; Wu, S.; Dang, Y.; Xu, B.; Yang, H. The positive impacts of landscape fragmentation on the diversification of agricultural production in Zhejiang Province, China. *J. Clean. Prod.* **2019**, *251*, 119722. [\[CrossRef\]](#)
39. Lu, H.; Xie, H.; He, Y.; Wu, Z.; Zhang, X. Assessing the impacts of land fragmentation and plot size on yields and costs: A translog production model and cost function approach. *Agric. Syst.* **2018**, *161*, 81–88. [\[CrossRef\]](#)
40. Yang, Y.; Li, R.; Wu, M. Analysis of the Constraint Path of Land Fragmentation on Farmers' Purchase of Farm Machinery Operation Services. *Agric. Technol. Econ.* **2018**, *10*, 17–25. (In Chinese)
41. Kaiser, F.G.; Oerke, B.; Bogner, F.X. Behavior-based environmental attitude: Development of an instrument for adolescents. *J. Environ. Psychol.* **2007**, *27*, 242–251. [\[CrossRef\]](#)
42. Choi, K.; Lee, D.; Olson, D.L. Service quality and productivity in the U.S. airline industry: A service quality-adjusted DEA model. *Serv. Bus.* **2013**, *9*, 137–160. [\[CrossRef\]](#)
43. Calabrese, A. Service Productivity and Service Quality: A Necessary Trade-Off? *Int. J. Prod. Econ.* **2012**, *135*, 800–812. [\[CrossRef\]](#)

44. Qiu, T.; Shi, X.; He, Q.; Luo, B. The Paradox of Developing Agricultural Mechanization Services in China: Supporting Or Kicking Out Smallholder Farmers? *China Econ. Rev.* **2021**, *69*, 101680. [\[CrossRef\]](#)
45. Gibson, J.; Olivia, S. The Effect of Infrastructure Access and Quality on Non-Farm Enterprises in Rural Indonesia. *World Dev.* **2010**, *38*, 717–726. [\[CrossRef\]](#)
46. Sun, D.; Rickaille, M.; Xu, Z. Determinants and impacts of outsourcing pest and disease management. *China Agric. Econ. Rev.* **2018**, *10*, 443–461. [\[CrossRef\]](#)
47. Zhou, J. The Reconstruction of Socialized Agricultural Service System in the Context of Land Transfer and the Dilemma of Small Farmers. *J. Nanjing Agric. Univ.* **2017**, *17*, 141–151. (In Chinese)
48. Si, R.; Lu, Q.; Zhang, Q.; Liang, H. The Impact of Land Transfer on Farmers' Demand for Production Socialization Services: An Empirical Analysis Based on PSM Model. *Res. Sci.* **2018**, *40*, 1762–1772. (In Chinese)
49. Qiu, T.; Choy, S.B.; Luo, B. Is small beautiful? Links between agricultural mechanization services and the productivity of different-sized farms. *Appl. Econ.* **2021**, *54*, 430–442. [\[CrossRef\]](#)
50. Qian, L.; Lu, H.; Gao, Q.; Lu, H. Household-Owned Farm Machinery Vs. Outsourced Machinery Services: The Impact of Agricultural Mechanization on the Land Leasing Behavior of Relatively Large-Scale Farmers in China. *Land Use Policy* **2022**, *115*, 106008. [\[CrossRef\]](#)
51. Hansen, B.E. Sample Splitting and Threshold Estimation. *Econometrica* **2000**, *68*, 575–603. [\[CrossRef\]](#)
52. Zhu, J.; Sun, Y.; Song, Y. Household Livelihood Strategy Changes and Agricultural Diversification: A Correlation and Mechanism Analysis Based on Data from the China Family Panel. *Land* **2022**, *11*, 685. [\[CrossRef\]](#)
53. Deng, X.; Xu, D.; Zeng, M.; Qi, Y. Does Outsourcing Affect Agricultural Productivity of Farmer Households? *China Agric. Econ. Rev.* **2020**, *12*, 673–688. [\[CrossRef\]](#)
54. Ma, L.; Wang, S.; Wästfelt, A. The Poverty of Farmers in a major grain-producing area in Northeast China. *Land* **2022**, *11*, 594. [\[CrossRef\]](#)
55. Zhang, X.; de Vries, W.T.; Li, G.; Ye, Y.; Zheng, H.; Wang, M. A behavioral analysis of farmers during land reallocation processes of land consolidation in China: Insights from Guangxi and Shandong provinces. *Land Use Policy* **2019**, *89*, 104230. [\[CrossRef\]](#)
56. Liu, R.; Gao, Z.; Nian, Y.; Ma, H. Does Social Relation or Economic Interest Affect the Choice Behavior of Land Lease Agreement in China? Evidence from the Largest Wheat-Producing Henan Province. *Sustainability* **2020**, *12*, 4279. [\[CrossRef\]](#)
57. Jiang, Y.; Kang, M.; Schmidt-Vogt, D.; Schrestha, R.P. Identification of agricultural factors for improving sustainable land resource management in northern Thailand: A case study in Chiang Mai Province. *Int. J. Sustain. Dev. World Ecol.* **2007**, *14*, 382–390. [\[CrossRef\]](#)
58. Chen, Y.; Fu, X.; Liu, Y. Effect of Farmland Scale on Farmers' Application Behavior with Organic Fertilizer. *Int. J. Environ. Res. Public Health* **2022**, *19*, 4967. [\[CrossRef\]](#)
59. Xu, D.; Ma, Z.; Deng, X.; Liu, Y.; Huang, K.; Zhou, W.; Yong, Z. Relationships between Land Management Scale and Livelihood Strategy Selection of Rural Households in China from the Perspective of Family Life Cycle. *Land* **2020**, *9*, 11. [\[CrossRef\]](#)
60. Nuhu, A.S.; Liverpool-Tasie, L.S.O.; Awokuse, T.; Kabwe, S. Do benefits of expanded midstream activities in crop value chains accrue to smallholder farmers? Evidence from Zambia. *World Dev.* **2021**, *143*, 105469. [\[CrossRef\]](#)
61. Lay, J.; Nolte, K.; Sipangule, K. Large-scale farms in Zambia: Locational patterns and spillovers to smallholder agriculture. *World Dev.* **2020**, *140*, 105277. [\[CrossRef\]](#)
62. Qiu, T.; Luo, B. Do small farms prefer agricultural mechanization services? Evidence from wheat production in China. *Appl. Econ.* **2021**, *53*, 2962–2973. [\[CrossRef\]](#)
63. Xu, Y.; Xin, L.; Li, X.; Tan, M.; Wang, Y. Exploring a Moderate Operation Scale in China's Grain Production: A Perspective on the Costs of Machinery Services. *Sustainability* **2019**, *11*, 2213. [\[CrossRef\]](#)
64. Cossar, F.; Jimah, K.; Aboagye, P.O. Agricultural Mechanization in Ghana: Is Specialization in Agricultural Mechanization a Viable Business Model? *Am. J. Agric. Econ.* **2013**, *95*, 1237–1244.
65. Van Loon, J.; Woltering, L.; Krupnik, T.J.; Baudron, F.; Boa, M.; Govaerts, B. Scaling agricultural mechanization services in smallholder farming systems: Case studies from sub-Saharan Africa, South Asia, and Latin America. *Agric. Syst.* **2020**, *180*, 102792. [\[CrossRef\]](#) [\[PubMed\]](#)
66. Yang, J.; Huang, Z.; Zhang, X.; Reardon, T. The Rapid Rise of Cross-Regional Agricultural Mechanization Services in China. *Am. J. Agric. Econ.* **2013**, *95*, 1245–1251. [\[CrossRef\]](#)
67. Jiang, M.; Hu, X.; Chunga, J.; Lin, Z.; Fei, R. Does the Popularization of Agricultural Mechanization Improve Energy-Environment Performance in China's Agricultural Sector? *J. Clean. Prod.* **2020**, *276*, 124210. [\[CrossRef\]](#)
68. Qing, Y.; Chen, M.; Sheng, Y.; Huang, J. Mechanization services, farm productivity and institutional innovation in China. *China Agric. Econ. Rev.* **2019**, *11*, 536–554. [\[CrossRef\]](#)
69. Zhong, L.; Wu, H.; Liang, D. Collective coordination: An organizational path for the organic interface between small farmers and modern agriculture: Insights from the practice of collective land management in village K of Heilongjiang Province. *J. Nanjing Agric. Univ.* **2021**, *21*, 126–135. (In Chinese)
70. Garrone, M.; Emmers, D.; Lee, H.; Olper, A.; Swinnen, J. Subsidies and agricultural productivity in the EU. *Agric. Econ.* **2019**, *50*, 803–817. [\[CrossRef\]](#)
71. Huang, J.K.; Wang, X.B.; Rozelle, S. The subsidization of farming households in China's agriculture. *Food Policy* **2013**, *41*, 124–132. [\[CrossRef\]](#)

-
72. Zou, B.; Mishra, A.K.; Luo, B. Grain subsidy, off-farm labor supply and farmland leasing: Evidence from China. *China Econ. Rev.* **2019**, *62*, 101293. [[CrossRef](#)]
 73. Cai, B.; Shi, F.; Huang, Y.; Abatechane, M. The Impact of Agricultural Socialized Services to Promote the Farmland Scale Management Behavior of Smallholder Farmers: Empirical Evidence from the Rice-Growing Region of Southern China. *Sustainability* **2021**, *14*, 316. [[CrossRef](#)]
 74. Yu, X.; Yin, X.; Liu, Y.; Li, D. Do Agricultural Machinery Services Facilitate Land Transfer? Province, China. *Land* **2021**, *10*, 466. [[CrossRef](#)]