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The Decision-Making and Moderator Effects of Transaction Costs, Service Satisfaction, and the Stability of Agricultural Productive Service Contracts: Evidence from Farmers in Northeast China

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Abstract: Agricultural producer service (APS) plays a crucial role in the sustainable development of modern agriculture. Enhancing the stability of contracts between farmers and APS is the key to promoting the high-quality development of the latter. This research aimed to explore the decision-making and moderator effects of transaction costs, service satisfaction, and the stability of APS contracts by constructing a theoretical framework. Based on survey data from 893 farmers in Northeast China's black soil area, we employed the Mvprobit model to examine the relationship between transaction costs, service satisfaction, and contract stability. The key findings are as follows: Firstly, transaction costs have a dual impact on contract stability in agricultural productive services, acting as both inhibitors and promoters. Higher information and execution costs reduce farmers' willingness to maintain current cooperative relationships, while higher negotiation costs make farmers more inclined to stick with the status quo. Secondly, farmers' satisfaction with services positively moderates the influence of transaction costs on contract stability, with highly satisfied farmers being more affected than those with lower satisfaction levels. Lastly, farmers' personal, family, and social characteristics all shape their preferences during the formation process. To mitigate cooperation risks and bolster cooperation contract stability, this study suggests that the government implement supervision and incentives to reduce transaction costs for farmers when procuring services and enhance the efficiency of farmer–service provider connections.

Keywords: farmers; transaction costs; service satisfaction; APS; contract stability; the sustainable development of modern agriculture

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Citation: Xue, Y.; Liu, H.; Chai, Z.; Wang, Z. The Decision-Making and Moderator Effects of Transaction Costs, Service Satisfaction, and the Stability of Agricultural Productive Service Contracts: Evidence from Farmers in Northeast China. *Sustainability* **2024**, *16*, 4371. https://doi.org/10.3390/su16114371

Academic Editor: Antonio Boggia

Received: 3 April 2024
Revised: 16 May 2024
Accepted: 20 May 2024
Published: 22 May 2024

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1. Introduction

China has a large population base and a higher demand for food. Food security is an important foundation for maintaining long-term social stability and achieving national security, and it is a top priority related to the national economy and people's livelihood [1–4]. In recent years, the domestic and international environment has been complex and changeable, and various instabilities and uncertainties have increased significantly. This has also led to challenges to our country's food security in the new era. In this context, how to improve the quality and efficiency of food production has become one of the hot issues [5–7]. With the rise and development of China's electronics, communications, transportation, digital, and other technologies, the lives and exchanges of urban and rural residents have been affected, which is gradually being reflected in the characteristics of free-flow factors, the rational allocation of resources, and integrated development [8–10]. The favorable living

and working conditions in the city have attracted a large number of agricultural workers of suitable age. As these young laborers feel that the barriers between urban and rural areas are weakening, they actively choose working environments with higher returns, and the structure of the urban and rural labor force has changed [11–13]. This flow of production factors has triggered a series of problems, such as the reduction in high-quality rural labor and lower production efficiency, posing a threat to China's food security and the sustainable development of modern agriculture [14,15]. In order to enhance the level of food supply and promote high-quality agricultural development, the APS industry has progressively improved with the increasing separability of agricultural production links. This has led to the substitution of disadvantaged labor forces with professional services, consequently enhancing the level of agricultural production. The emergence of this agricultural production and operation model makes up for the weakening of human resources caused by the transfer of rural labor to cities, organically links small-scale farmers with modern agriculture, and significantly stimulates the improvement in employment and welfare levels in rural areas [16,17]. In January 2022, the Central Committee of the Communist Party of China and the State Council issued the "Opinions on Comprehensively Promoting Key Works of Rural Revitalization in 2022". The document clearly stated that it sought to "accelerate the development of agricultural social services and support agricultural service companies, farmers' cooperatives, and rural areas". Collective economic organizations, grassroots supply and marketing cooperatives, and other entities have vigorously developed single-link, multi-link, and full-process production custody services and carried out order farming, processing logistics, product marketing, etc., to improve the comprehensive benefits of grain growing. The APS industry is a key link embedded in the agricultural product chain and an important measure for China to revitalize rural industries and enable agricultural modernization in the new era. Therefore, how to maintain the stable and healthy development of the APS industry is a topic that needs to be discussed in depth.

China's APS industry has begun to take shape after continuous development in recent years, but a series of problems persist, such as the imbalanced supply and demand structure, weak innovation, imperfect organizational structure, varying qualifications of employees, and high risk uncertainty [18,19]. In order to further improve the quality of industrial development in agricultural productive services and the service quality provided, discussions and judgments must be made based on the actual conditions of specific actors. In a preliminary small-scale survey conducted in Northeast China, the research team found that an important problem in the development of APS is that the stability of the contracts concluded between service providers and farmers is very weak, and interest relationships are highly volatile and difficult to achieve. The formation of a long-term cooperation model is not conducive to targeted agricultural services [17]. In the long-term production and operation process, farmer groups frequently change service providers and cooperate in a timely fashion. This unstable cooperation network affects service efficiency and the delineation of responsibilities. It reduces the schedule design of service providers and reduces the innovative development of the service industry. At the same time, as affected by the trust level, contracts in the cooperation process between farmers and service providers are mostly absent, and oral agreements are mainly used. This leads to the emergence of opportunistic behavior and increases risk uncertainty and potential transaction costs, including the costs of changing service providers, information costs, and even litigation costs [20]. In addition, the research team found that service contracts are generally signed once a year, and farmers are not very willing to sign long-term contracts. As a result, both farmers and service entities have to spend much money every year to find partners. How to improve the stability of the contract between farmers and agricultural productive service entities has become an urgent problem that needs to be solved. In the process of farmers purchasing agricultural productive services, they include the relevant information costs paid by potential service providers, fees incurred during price negotiations and other negotiation processes, and fees incurred from necessary supervision and inspections to ensure service quality. All these are manifestations of transaction

costs [21–23]. The transaction costs incurred by farmers in the entire process of purchasing APS have resulted in a low willingness to renew contracts, reduced sustainability of cooperative relationships, and a hindering of the high-quality development of the APS industry. Therefore, how to limit the transaction costs incurred by farmers in the process of purchasing APS, guide farmers to standardize production and management, and improve cooperation efficiency has become the focus and main challenge of attempts to promote the efficient development of the APS industry. By exploring the impacts of transaction costs on farmers' willingness to renew contracts when purchasing agricultural productive services, this study accurately identifies the effects of transaction costs in relation to maintaining the stability of cooperative relationships under the intervention of satisfaction. This also influences the effectiveness, thereby better promoting the large-scale development of agriculture and the healthy development of APS.

This research team has paid continuous attention to the phenomenon of unstable cooperative relationships in the development process of the APS industry. In previous research, we analyzed contract stability in the process of APS from the following perspectives: First, from a psychological perspective, we explored farmers' willingness to book the next round of services after the transaction period. Farmers' willingness to renew services is an important manifestation of contract stability [17]. In this study, farmers' contract renewal intention was mainly affected by three factors: subjective norms, perceived behavioral control, and behavioral attitude. Second, the impact of risk uncertainty on farmers' contract type choices is explored in depth from the perspective of Williamson transaction characteristics. The more standardized the contract type chosen by farmers, the stronger its legal effect and the more binding it is, which has a restraining effect on a series of factors that cause instability in the cooperative relationships that emerge in the later service process. The study found that under the influence of risk uncertainty, farmers' personal trust level played a suitable regulating role and effectively alleviated the psychological pressure brought by risk issues to farmers. Third, the improvement in farmers' welfare is further explained from the perspective of participation in agricultural productive services. It further verifies the importance of APS to China's farmers who mainly engage in small-scale production, as well as the necessity of the stable and healthy development of this industry to enhance collaborative sustainability. Overall, there is still much room for the explanation of contract stability issues.

To sum up, transaction costs, a significant expense in the service procurement process, have a crucial influence on the contract stability of limited rational farmers. Transactions with lower "friction" are more likely to have a lasting impact on both farmers and service providers compared to immediate service purchases. Contract stability is essential for farmers' scale benefits, enhancing production efficiency and ensuring the long-term stability of service providers. Understanding the factors that influence farmers' contract stability under transaction costs is a pressing issue. Farmers' contract stability is a combination of psychological willingness and practical actions that emerge during transactions, indicating potential transaction costs and susceptibility to external factors. This study establishes a theoretical framework for analyzing the stability of farmers' APS contracts based on transaction cost theory, aiming to identify influencing factors and their effects on farmers' decision making. Using data from 961 farmers in the black soil region of Northeast China and the Mvprobit model, this study empirically tests the theoretical framework. The model considers information costs, negotiation costs, and execution costs as joint factors influencing farmers' decision making while also incorporating the moderating effects of farmers' satisfaction with previous services. Personal, family, and social characteristics further contribute to shaping farmers' decision-making processes. On a micro level, the model aims to better capture the decision-making processes of small-scale farmers, presenting new research ideas, analytical frameworks, and methodologies for applying transaction cost theory and addressing ways to enhance the stable development of APS. On a macro level, this study can provide empirical evidence to support the vertical division of labor in agriculture, facilitating the integration of small-scale farmers into modern agri-

cultural practices. This integration could help address urban–rural structural imbalances, enhance agricultural production efficiency and resource utilization, and ultimately contribute to maintaining national food security and improving the sustainability of modern agricultural development.

2. Theoretical Framework Construction

The concept of transaction costs was expanded by Coase on the basis of the concept of "market transaction costs". He believed that transaction costs are generated by measuring, defining, and protecting exclusive rights, discovering transaction objects and transaction prices, signing transaction contracts, and supervising the performance of contract terms. Transaction costs refer to the costs of negotiating, signing, and fulfilling a contract. In addition, Coase believes that the transaction structure should include contracts and can also equate contract issues with organizational system issues so that transaction costs can be explained from the perspective of contracts [24–26]. Based on Coase's point of view, Williamson proposed that transaction costs can be divided into two categories: "ex ante" and "ex post", according to contract standards. The expenses incurred in signing a contract and stipulating the rights and responsibilities of both parties are defined as ex-ante transaction costs; after signing the contract, the expenses incurred in solving the problems of the contract itself are defined as ex-post-transaction costs. Current research using transaction cost theory has widely covered many interdisciplinary subjects, such as organizational business models, corporate intellectual property rights, homestead transfers, health and nutrition, and energy conversion [27–31]. Deng built a Tobit model based on transaction cost theory and used 350 pieces of data collected in seven villages in Nanhai District, Guangdong, in 2018. He conducted an in-depth study of the joint effects of transaction rules and human assets on rural collective construction land, innovatively integrating openness and fairness with justice [32]. Based on transaction cost theory, Liang used structural equation modeling to analyze the factors influencing the success of the shared business platform, further proving the importance of transaction costs and perceived benefits [33]. Existing research has achieved many valuable academic results using transaction cost theory, laying a solid foundation for this article's research on contract stability. On this basis, this study constructed a theoretical analysis framework for farmers to implement: "transaction costs–service satisfaction–contract stability" (Figure 1).

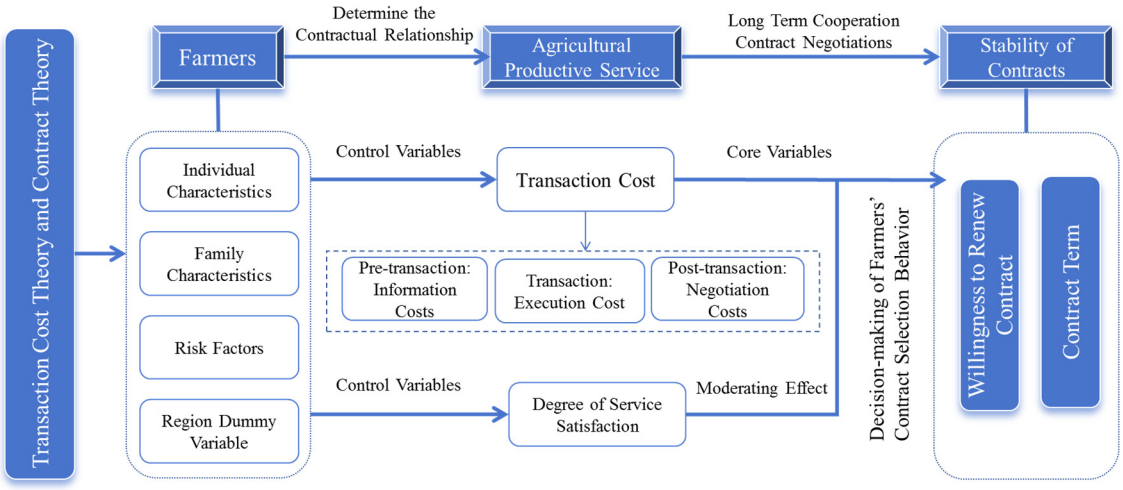


Figure 1. The impact mechanism of transaction costs on the stability of farmers' agricultural productive service contracts.

In APS transactions, pre-transaction information costs mainly include the costs for farmers to search for potential transaction partners and understand market information. The more time and energy farmers spend searching for information, the higher the information costs will be. Some studies have shown that if the two parties to the transaction are

related by "kinship and geography", farmers will spend less time searching for transaction information costs [34]. In the survey, it was also found that the service relationship between farmers and relatives or service providers in the village is relatively stable. Therefore, in the process of farmers renegotiating agricultural productive services, the relationship between the first-time cooperating farmer and the service provider, the degree of trust, the rationality of the price, and the degree of understanding of the contract will all affect the information costs of farmers cooperating again. According to the transaction cost theory, the smaller the cost of farmers searching for information and the smaller the transaction cost of farmers, the greater the stability will be in the contractual relationship between farmers and APS organizations. On the contrary, the greater the costs met by farmers searching for information, the more farmers, agricultural producers, and service organizations will be hindered. It is a stable relationship with agricultural productive services. Hypothesis 1 is thus put forward:

H1. *The smaller the information cost before the transaction of farmers, the greater the stability of the contractual relationship between farmers and agricultural productive services.*

Negotiation costs in transactions are mainly reflected in the negotiations between farmers and different service objects on the price, area, payment method, service guarantee, etc., of agricultural productive services. The more negotiations between the two parties, the greater the negotiation content and the higher the negotiation costs. In the first transaction, the more detailed the negotiation content between farmers and APS providers, the more formal the negotiation and the higher the negotiation cost; farmers will thus cherish this transaction very much and try their best to keep the transaction in the long term. In actual agricultural production services, some services are provided by self-employed individuals without formal enterprise management. Most of them are based on oral contracts without clear service terms. The negotiation cost between farmers and some service providers is relatively low. Therefore, the negotiation cost between farmers and some service providers is relatively low. Farmers change partners frequently, making it difficult to form a stable contractual relationship. Full-service hosting services will sign contracts with farmers, which will be more formal, and the negotiation costs will be higher. The renewal of the contract or long-term cooperation will save a lot of negotiation costs. Therefore, farmers will be more inclined to continue cooperation. This leads to Hypothesis 2:

H2. *The higher the negotiation cost, the greater the stability of the contract relationship between farmers and agricultural productive services to save costs faced by the next negotiation.*

Post-transaction execution costs are mainly reflected in whether the contract can be executed as promised and the cost of supervision to ensure the execution of the contract. During the actual investigation, it was found that due to the particularity of agricultural production, agricultural productive services are not executed immediately after the contractual relationship is finalized. The productive services for the next year are usually booked at the end of one year. Therefore, in the process of agricultural production services, the frequency of contact between farmers and service providers, the speed of service implementation, and the frequency of service supervision will all affect the sizes of implementation costs. Every time farmers cooperate with a new agricultural production service provider, due to the high levels of uncertainty and distrust, they will spend a lot on supervision to inspect the service performance of the service provider. Therefore, the smaller the implementation cost, the more inclined farmers will be to continue cooperation. In other words, the greater the implementation cost, the lower the stability of the relationship between farmers and agricultural productive services.

H3. *The higher the execution cost, the more it hinders the stability of the contractual relationship between farmers and agricultural productive services.*

In addition, farmers' satisfaction with service recipients is also an important indicator of whether farmers are willing to promote the stability of contractual relationships. The impact of satisfaction on farmers' behavioral intentions first appeared in the consumer field, and customer satisfaction will affect their re-consumption behavior [35,36]. In recent years, the field of agricultural technology selection has also received widespread attention. Studies have shown that members' satisfaction with cooperative agricultural technology services will affect farmers' choices It is worth noting that farmers' satisfaction with agricultural technology adoption has a positive impact on their re-adoption intention [37]. Similarly, in agricultural productive services, there is also a relationship between service and being served. If farmers are not satisfied with the service provider, they will not consider it in the future. This is similar to shopping or enjoying customer services. At the same time, service satisfaction may alleviate the negative impacts caused by transaction costs. The theory of rational small farmers suggests that the ultimate goal of farmers is to maximize profits. Farmers will have certain expectations of effects when choosing agricultural productive services. When the actual effects exceed the expected values, this spillover effect will weaken the impact of transaction costs on agricultural productivity. There are some negative impacts on the service. Therefore, this study believes that farmers will form an evaluation of services based on their last experience with them, and this evaluation will affect farmers' judgments about cooperation again. At the same time, due to the presence of different types of agricultural productive services (partial services and full custody services), their service contents and contractual relationships are different, resulting in farmers having different requirements regarding the service effects. In particular, for the full-service custody service, the service effect directly affects the income of farmers, so the satisfaction with the full-service custody service will have a greater impact on the stability of the contract. Based on this, Hypothesis 4 is proposed:

H4. *Farmer service satisfaction will have a positive regulatory effect on the impacts of transaction costs on the stability of farmers' agricultural productive service contracts. Furthermore, farmers' service satisfaction will play a positive regulatory role in the impact of full custody service contract stability, as well as in promoting regulation.*

3. Data and Method

3.1. Study Area

In order to verify the analytical framework of "transaction costs–service satisfaction–contract stability", this study used an on-the-spot farmer survey, mainly targeting small-scale farmer groups in the main grain-producing areas of Northeast China from July 2018 to August 2018. Although these data are from 2018, they are still valid because research results on similar topics have been published [38–41]. The research team carried out data collection work in Heilongjiang Province, Jilin Province, and Liaoning Province (see Figure 2). These three provinces span the mid-temperate zone and cold temperate zone from south to north, transitioning from humid and semi-humid areas to semi-arid areas. They have a temperate monsoon climate with four distinct seasons. The agricultural production in this region is mainly corn and soybeans, which occupy a very important position in the country [42]. The reasons for selecting this research area mainly include the following aspects. First, the level of economic development in the area is typical. The northeastern region of China has provided strong support to the country's economic development since the founding of the People's Republic of China. It has three main important industrial belts, such as Shenyang and Dalian, which have made outstanding contributions to the process of industrialization development. However, after more than half a century of major resource extraction, resource-based cities with many old industrial bases in Northeast China have gradually become resource-depleted cities, facing difficulties with economic growth due to the gradual depletion of natural resource stocks, serious environmental pollution, and the decline of leading industries [43]. This situation has led to the significantly unbalanced layout of the three industries. Investigation in this area

can help ensure the healthy development of the industry. Second, the soil resources are unique. The black soil area in Northeast China is one of the three largest black soil belts in the world, with a land area of 1.03 million square kilometers. The cultivated land area in the Northeast Black Soil Region accounts for 22.2% of the total cultivated land area in the country, and the total annual grain output accounts for about 20% of the country, playing a pivotal role in national food security status [44]. In addition, the area's terrain is flat and suitable for the development of mechanical farming and APS.

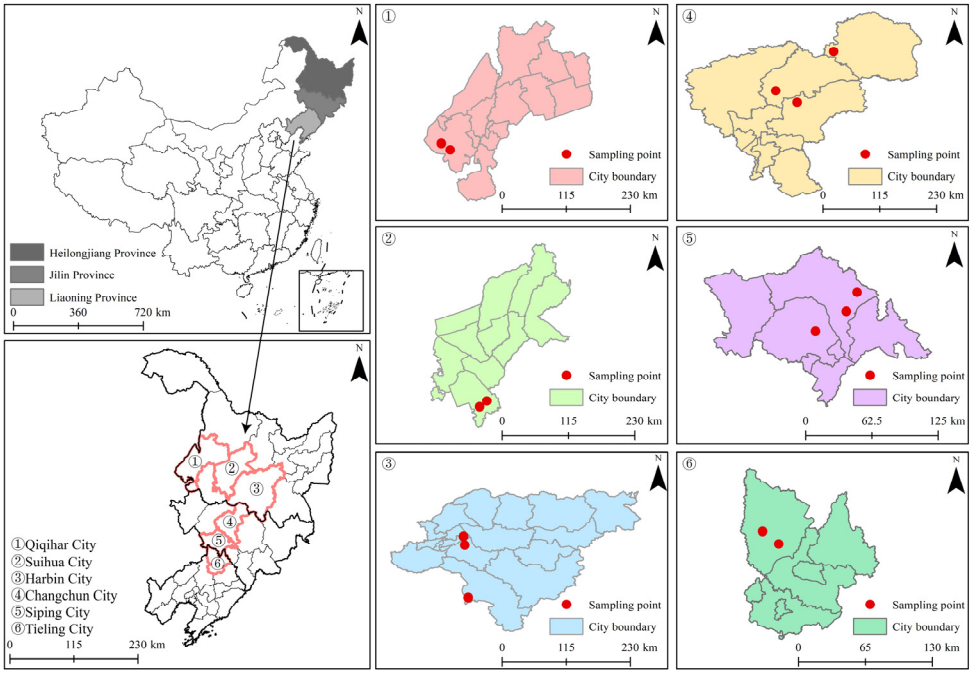


Figure 2. Map of the study area and spatial distribution of the sample villages.

3.2. Data Source

The data used in this study came from field surveys carried out by the research team in Heilongjiang Province, Jilin Province, and Liaoning Province in the summer of 2018. In order to improve the design of the survey questionnaire and ensure the availability of data, the research team carried out a series of preliminary work before the formal survey and conducted the relevant training of the investigators. In order to verify the adequacy of the survey preparations, the research team selected rural areas in Tieling City, Liaoning Province, to conduct a small-scale pre-survey in the spring. During the formal survey process, the household questionnaires issued to farmers mainly included basic information about the sample farmers' family population, corn production and operation, input and output of each link, service selection, and psychological preferences. The formal sampling process is as follows. First, after comprehensively considering factors such as land, location, and agricultural economic development level, the research team selected three provinces as sample areas. Then, a multi-stage stratified random sampling method was used to conduct a survey on villages and households in six cities—Harbin, Qiqihar, Suihua, Siping, Tieling, and Changchun—that are under the jurisdiction of Heilongjiang Province, Jilin Province, and Liaoning Province (see Figure 2). From each city, 1–3 counties were randomly selected, and then 4, 6, or 8 villages were randomly selected from the counties. The survey was conducted through face-to-face interviews with household heads or key decision makers in agricultural production. In the formal survey, 893 responses were collected. The basic information of the surveyed areas and the descriptive statistics of variables are shown in Table 1.

Table 1. Basic characteristics of the sample (unit: farmer, %).

Index		City	Harbin	Suihua	Qiqihar	Changchun	Siping	Tieling	Total
Gender	Male	Freq	64	114	133	172	170	191	844
		Prop	7.58	13.51	15.76	20.38	20.14	22.63	100
	Female	Freq	1	3	1	21	4	19	49
		Prop	2.04	6.12	2.04	42.86	8.16	38.78	100
Education	Illiteracy	Freq	7	7	3	8	5	5	35
		Prop	20	20	8.57	22.86	14.29	14.29	100
	Primary school	Freq	20	71	57	85	77	83	393
		Prop	5.09	18.07	14.50	21.63	19.59	21.12	100
	Junior high school	Freq	33	33	68	82	71	109	396
		Prop	8.33	8.33	17.17	20.71	17.93	27.53	100
	High school and above	Freq	5	6	6	18	21	13	69
		Prop	7.25	8.7	8.7	26.09	30.43	18.84	100
Family size	1–2	Freq	26	44	33	49	43	66	261
		Prop	9.96	16.86	12.64	18.77	16.48	25.29	100
	3–4	Freq	28	38	69	73	70	97	375
		Prop	7.47	10.13	18.40	19.47	18.67	25.87	100
	More than 5	Freq	11	35	32	71	61	47	257
		Prop	4.28	13.62	12.45	27.63	23.74	18.29	100
Do you have non-agricultural income?	No	Freq	30	44	73	69	56	75	347
		Prop	8.65	12.68	21.04	19.88	16.14	21.61	100
	Yes	Freq	35	73	61	124	118	135	546
		Prop	6.41	13.37	11.17	22.71	21.61	24.73	100
Different types APS	Partial production process services	Freq	35	80	124	163	170	82	654
		Prop	5.35	12.23	18.96	24.92	25.99	12.54	100
	Full trusteeship service	Freq	30	37	10	30	4	128	239
		Prop	12.55	15.48	4.18	12.55	1.67	53.56	100

3.3. Method

3.3.1. Mvprobit Model

In order to confirm the farmers' theoretical framework of "transaction costs–service satisfaction–contract stability", this study used the Mvprobit regression method for quantitative testing. This regression model was chosen mainly due to the biased approach of cross-sectional comparisons of samples. Compared with other modeling methods, such as multivariate logit regression and the probit model, the advantage of using the Mvprobit model in this study is that multiple binary choice models can be used for simultaneous estimation to investigate the internal relationship between multiple binary models. This model allows for the simultaneous simulation of the estimated effects of a set of explanatory variables on each adaptation strategy while allowing unobserved and unmeasured variables (error terms) to be freely correlated in an orderly fashion. Therefore, the evaluation of multi-index logit or separate univariate probit equations in the presence of such correlations is biased and inappropriate. Specifically, the error terms of the Mvprobit regression extension have a multivariate normal distribution, with the mean and variance–covariance matrix of each error term being zero, whereby the variance and covariance allow for this correlation. Sources of correlation may include substitution capabilities and complementarity, representing negative and positive correlations between various adaptation strategies [45]. Existing research has used the Mvprobit model to solve the problem of horizontal comparisons of samples in many fields. For example, Zhang, Y et al. used this method to deeply explore the impact of benefit expectations on farmers' willingness and tendency to protect the quality of cultivated land [46]. Koech et al. used this method to analyze how marketing strategies can enhance consumers' food security through access to nutritious foods such as porridge powder [47].

The two aspects of the stable relationship between farmers and APS contracts are willingness to renew contracts for APS and farmers' willingness to engage in long-term

cooperation in APS. Generally speaking, the willingness to renew the contract and the willingness to cooperate for a long time are typical binary choice problems, which can be investigated by using the probit or logit models. However, if we choose the ordinary binary logit or probit method, we can only estimate the results separately, cannot make horizontal comparisons, and cannot see the overall relationship. Considering the interconnection and influence between the willingness to renew the contract and the willingness to cooperate for a long time, we need to jointly estimate the above two explained variables: willingness to renew contracts for APS and farmers' willingness toward long-term cooperation in APS. Therefore, in this section, we choose the Mvprobit model, which can handle multiple binary choices at the same time. The variables were selected based on the Mvprobit model, and the 2018 questionnaire was designed according to the data required for the variables. Therefore, the 2018 data are completely consistent with the research methods. Its general form is as follows:

$$\begin{aligned} y_{1i}^{*} &= \beta_1' X_{1i} + \varepsilon_{1i} \\ y_{2i}^{*} &= \beta_2' X_{1i} + \varepsilon_{2i} (*) \end{aligned} \tag{1}$$

$$y_{mi}^{*} = \beta_m' X_{mi} + \varepsilon_{mi} \tag{2}$$

The explained variable equation is set as follows:

$$y_m = \begin{cases} 1 & if \quad y_m^{*} > 0 \\ 0 & otherwise \end{cases} \qquad m = 1, 2, \cdots, m \tag{3}$$

Here, $y_m = 1$ and $y_m = 0$, respectively, indicate the willingness and unwillingness to continue the contractual relationship in the M way. m represents the number of equations, which is also the M kind of contractual relationship continuation behavior; i represents the number of independent variables, reflecting the N factors that affect the continuation of the contractual relationship; ε_{im} is the error term that obeys the multivariate normal distribution, and each mean is 0, while the variance is 1. We perform maximum likelihood estimation on equation (*) to obtain each β value.

3.3.2. Variable Selection

First, the explained variable set in this study is farmers' contract stability, which specifically includes farmers' willingness to renew contracts for agricultural productive services (C1a) and their willingness to engage in long-term employment relationships for agricultural productive services (C1b). Both are binary variables. When the farmer is willing to renew the contract, C1a takes the value 1; when the farmer is unwilling to renew the contract or terminates the cooperation, the value is 0. When farmers are willing to cooperate and maintain a long-term cooperative relationship, C1b takes a value of 1; if farmers are unwilling to maintain a cooperative relationship and plan to change service providers, C1b takes a value of 0.

Second, the explanatory variables include farmers' information costs (A1), negotiation costs (A2), implementation costs (A3), and service satisfaction (B1), of which the first three are proxy variables for transaction costs generated in the service process. Specifically, this study selects the degree of relationship between farmers and service providers, the degree of trust between farmers and service providers, the reasonableness of the prices charged by service providers, and the extent to which farmers understand the service content as proxy variables for information cost (A1). The indicators are all in the form of a five-category Likert scale. In addition, the current selection of contract type between farmers and service providers, the guarantee of output by service organizations, and the payment method of agricultural productive services transactions are selected as proxy variables for negotiation costs (A2). The proxy variable of execution cost (A3) is specified as the length of time farmers think they will have to wait from appointment to service, the time farmers think it takes to contact the service provider, and the difficulty of contacting agricultural production service providers during the service process. Finally, farmers' satisfaction with the service provider's service effect, farmers' overall satisfaction with the current service,

and service provider's service attitude satisfaction were selected as proxy variables for service satisfaction (B1).

Third, the control variables selected in this study mainly include four aspects: farmers' individual characteristics, family production and operation characteristics, identification variables, and regional dummy variables. Among them, the factor endowment of farmers is the key variable that needs to be examined. This study mainly explains the factor endowment with the following indicators. The first is the individual characteristics of farmers, mainly including their gender and education level. The second is the family characteristics of farmers, which mainly include whether the family has farm machinery, the degree of fragmentation of cultivated land, land terrain characteristics, degree of aging, family size, proportion of non-agricultural income, and household income at the level of the village. The dummy variable selects the provincial variable: Heilongjiang Province is set to 1, Jilin Province is set to 2, and Liaoning Province is set to 3. In addition, in order to ensure the identifiability of the model, farmers' awareness of the service provider was selected as an instrumental variable. The reason for choosing this variable as an instrumental variable is that the degree of familiarity between farmers and service providers has an important impact on farmers' purchasing of agricultural production services, but this variable does not directly affect the later stability of the contract. Taking into account the differences between different provinces, this section also introduces provincial dummy variables to control this factor. The specific model variable descriptions and their statistical descriptions are shown in Table 2.

Table 2. Descriptive statistics of the variables.

Variable Category		Variable Name	Description	Mean	S.D.	MIN	MAX
Explained variable		Farmers' willingness to renew contracts (C1a)	0 = No; 1 = Yes	0.62	0.49	0	1
		Farmers' long-term willingness to cooperate (C1b)	0 = No; 1 = Yes	0.43	0.50	0	1
Core explanatory variables	Information Cost (A1)	The relationship between farmers and service providers (a11)	1 = Very Good; 2 = Good; 3 = General; 4 = Poor; 5 = Very Poor	2.36	0.65	1	5
		Trust between farmers and service providers (a12)	1 = Very Good; 2 = Good; 3 = General; 4 = Poor; 5 = Very Poor	2.09	0.59	1	5
		The reasonableness of the price charged (a13)	1 = Very Good; 2 = Good; 3 = General; 4 = Poor; 5 = Very Poor	2.34	0.68	1	5
		Farmers' understanding of service content and term (a14)	1 = Very Good; 2 = Good; 3 = General; 4 = Poor; 5 = Very Poor	2.28	0.65	1	5
	Negotiation Cost (A2)	Farmers' current contract type selection (a21)	1 = Oral; 2 = Written	1.26	0.44	1	2
		Service organization guarantees output (a21)	1 = No; 2 = Yes	1.23	0.42	1	2
		Payment methods for agricultural productive services (a21)	1 = Full; 2 = Installment	1.22	0.42	1	2
	Execution Cost (A3)	The length of waiting time from appointment to service anticipated by farmers (a31)	1 = Very Not Long; 2 = Not Long; 3 = Average; 4 = Long; 5 = Very Long	2.17	0.59	1	5
		Time taken to contact service providers by farmers (a31)	1 = Very Little; 2 = Not Much; 3 = Average; 4 = A Lot; 5 = Very Much	2.20	0.62	1	5
		Degree of difficulty farmers encounter in contacting agricultural production services (a33)	1 = Very Easy; 2 = Easy; 3 = Average; 4 = Not Easy; 5 = Very Difficult	2.14	0.61	1	5
	Service Satisfaction (B1)	Farmers' satisfaction with service providers' service (b11)	1 = Very Poor; 2 = Poor; 3 = General; 4 = Good; 5 = Very Good	3.86	0.57	1	5
		Satisfaction with current services amongst farmers (b12)	1 = Very Poor; 2 = Poor; 3 = General; 4 = Good; 5 = Very Good = 5	3.83	0.62	1	5
		Service attitude satisfaction amongst farmers (b13)	1 = Very Poor; 2 = Poor; 3 = General; 4 = Good; 5 = Very Good	4.02	0.45	1	5

Table 2. *Cont.*

Variable Category		Variable Name	Description	Mean	S.D.	MIN	MAX
Control variables	Individual Characteristics	Gender	1 = Male; 2 = Female	1.05	0.23	1	2
		Education	Years	7.09	2.78	0	15
	Family Characteristics	Machinery	1 = With Machinery; 0 = Without Machinery	0.51	0.50	0	1
		Fragmentation	Number of land parcels	5.23	4.86	1	55
		Terrain	0 = Slope or Depression; 1 = Flat Land	0.77	0.42	0	1
		Aging	The ratio of the number of 55-year-old men	0.40	0.37	0	1
		Population	Numbers	35.04	37.70	1	8
		Land	Numbers	40.86	45.77	2.5	358
		Farmscale	1 = Yes; 0 = No	Y	0.40	0	1
		Non-farm	Ratio of household non-farm income	2.10	0.51	0	4.77
		Income level	1 = Upper; 2 = Medium; 3 = Lower	1.88	0.76	1	3
	Risk Factors	Disaster	The number of local natural disasters in the past five years.	1.92	1.32	0	10
	Identify Variables	Risk	0 = Familiar; 1 = Stranger	0.15	0.36	0	1
	Region Dummy Variable	Province	1 = Heilongjiang Province; 2 = Jilin Province; 3 = Liaoning Province	1.05	0.23	1	3

4. Result

4.1. The Impact of Transaction Costs on the Stability of Farmers' Agricultural Productive Service Contracts

This study used the Mvprobit model to analyze the impact of transaction costs on the stability of farmers' APS contracts, focusing on the impact of transaction costs generated during the contract process. Among them, Model 1 clusters information cost, negotiation cost, and execution cost into one factor through factor analysis; Model 2 brings the latent variables of information cost, negotiation cost, and execution cost into the model for specific analysis. The estimation results show that Atrho21 is significant at the 1% level, which shows that there is a mutually reinforcing relationship between the willingness to renew APS and the willingness to cooperate in the long term in APS. It is very reasonable to use this method. The specific estimation results are shown in Table 3.

Table 3. First-stage probit regression for predicting purchasing behavior.

Variable	Model 1				Model 2			
	Farmers' Willingness to Renew Contracts		Farmers' Long-Term Willingness to Cooperate		Farmers' Willingness to Renew Contracts		Farmers' Long-Term Willingness to Cooperate	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
A1	−0.3048 ***	0.0600	−0.2112 ***	0.0584				
A2	0.1539 ***	0.0522	0.1596 ***	0.0466				
A3	−0.0245	0.0486	−0.1037 **	0.0475				
B1	0.3562 ***	0.0630	0.2870 ***	0.0622	0.3662 ***	0.0656	0.2946 ***	0.0663
a11					−0.3442 ***	0.0903	−0.4729 ***	0.0901
a12					−0.1484 **	0.0763	−0.1063 **	0.0585
a13					−0.2224 ***	0.0770	−0.2160 ***	0.0763
a14					−0.0650	0.0833	0.0269	0.0819
a21					0.4889 **	0.2022	0.1742 **	0.0783
a22					0.1448	0.2050	0.1976	0.1834
a23					0.1811 **	0.0935	0.1234 **	0.0679
a31					−0.0901	0.0898	−0.2166 **	0.0940
a32					−0.1261	0.0842	−0.1789 **	0.0831
a36					−0.1339	0.0893	−0.2919 ***	0.0893
Machinery	−0.0199	0.1103	−0.1122	0.1037	−0.0044	0.1115	−0.0937	0.1057
Fragmentation	0.0068	0.0128	0.0102	0.0116	0.0041	0.0130	0.0067	0.0119
Terrain	0.2821 ***	0.1016	0.2096 *	0.1095	0.2930 ***	0.1127	0.1944 *	0.1118
Aging	−0.0003	0.1481	−0.3409 **	0.1420	−0.0191	0.1497	−0.3691 **	0.1448

Table 3. *Cont.*

Variable	Model 1				Model 2			
	Farmers' Willingness to Renew Contracts		Farmers' Long-Term Willingness to Cooperate		Farmers' Willingness to Renew Contracts		Farmers' Long-Term Willingness to Cooperate	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Disaster	−0.0076	0.0373	−0.0988 ***	0.0357	−0.0032	0.0381	−0.1119 ***	0.0366
Risk	−0.6006 ***	0.1411	−0.3937 ***	0.1411	−0.5727 ***	0.1454	−0.2663 **	0.1360
Land	−0.0421	0.0877	−0.1001	0.0810	−0.0309	0.0887	−0.1074	0.0827
Farmscale	−0.0415	0.1239	−0.0268	0.1183	−0.0192	0.1261	−0.0175	0.1215
Gender	0.0808	0.2117	0.2023	0.1994	0.0026	0.2155	0.0801	0.2051
Education	0.0207	0.0175	0.0185	0.0165	0.0194	0.0178	0.0149	0.0170
Population	0.0233	0.0411	−0.0113	0.0396	0.0271	0.0416	−0.0036	0.0405
Non-farm	−0.0013	0.0014	−0.0010	0.0014	−0.0013	0.0014	−0.0010	0.0014
Income level	0.0524	0.0973	0.1151	0.0926	0.0834	0.0990	0.1581	0.0955
Province	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
Atrho21	0.6502 *** (0.0658)				0.6424 *** (0.0678)			
ρ_{21}	0.5718 *** (0.0442)				0.5667 *** (0.0461)			
Log likelihood	−969.4494				−943.2701			
Prob > chi2	0.0000				0.0000			
N	893				893			

Note: Standard errors are in parentheses; *** significant at $p < 0.01$, ** significant at $p < 0.05$, and * significant at $p < 0.1$.

4.1.1. The Impact of Transaction Costs on Farmers' Willingness to Renew Contracts for Agricultural Productive Services

Among the factors that affect farmers' willingness to renew contracts for agricultural productive services, information costs and negotiation costs in transaction costs have a significant impact. Among them, information cost has a negative impact on farmers' willingness to renew the contract at the 1% level. That is to say, the greater the information cost, the less willing farmers are to renew the contract. On the contrary, the smaller the information cost, the more willing farmers are to renew the contract. Specifically, the better the farmers get along with agricultural productive service providers, the higher the farmers' trust in the service providers, and the more reasonable the prices charged by farmers for agricultural productive services. These psychological perceptions will promote farmers' continued use of agricultural productive services. However, farmers' understanding of the content has no impact on their willingness to renew the contract. This may be because after providing complete agricultural productive services, farmers already have a certain understanding of the content, so their understanding of the content will not affect their willingness to renew the contract. Willingness to make an appointment has an impact. This is consistent with existing findings. Information asymmetry will increase transaction costs and affect farmers' behavior, which is the result of the negative impact of information costs [48]. Negotiation costs have a positive impact on farmers' willingness to renew contracts for APS at the 1% level, indicating that the higher the negotiation costs spent by farmers, the greater the farmers' willingness to renew contracts for APS. This is because when the costs of the farmers' last negotiation are higher, they will be more deeply embedded in the contractual relationship, and they will save negotiation costs when renewing the contract again. Specifically, formal contracts will promote farmers' willingness to renew agricultural productive services more than oral contracts. At the same time, the installment payment method also has a certain promotional effect on farmers' willingness to renew agricultural productive services. At the same time, relevant research also confirms this view. The high cost of negotiation will affect the difference in the selection of sales channels by beef cattle farmers [49] and also affect the price at which farmers sell their agricultural products [50].

The implementation and supervision costs have not passed the verification stage, indicating that the implementation costs have no impact on farmers' willingness to renew contracts for agricultural productive services. This may be because the costs farmers spend in transaction execution are mainly supervision costs. During the survey, it was found that farmers rarely carry out contract renewal. Although they sometimes follow and watch,

they do not consider this an act of supervision. Therefore, in the eyes of farmers, the implementation cost is not large, so it does not affect the willingness to renew the contract.

4.1.2. The Impact of Transaction Costs on Farmers' Long-Term Willingness to Cooperate in Agricultural Productive Service Contracts

Among the factors affecting the long-term cooperation willingness of agricultural productive services, information cost, negotiation cost, and execution cost among transaction costs all have a significant impact. Among them, information cost has a negative impact on farmers' long-term cooperation willingness in agricultural productive services at the 1% level. Specifically, this is consistent with the willingness to renew the contract. The better the farmers get along with agricultural production services, the more trust they will have in service providers. If farmers believe that the prices charged for agricultural productive services are more reasonable, their willingness to choose long-term cooperation in agricultural productive services will be increased. Negotiation costs have a positive impact on farmers' long-term cooperation willingness in agricultural productive services at the 1% level. Specifically, farmers' signing of formal contracts and installment payments will promote their long-term willingness to cooperate in agricultural productive services. It is particularly worth noting that implementation costs have an inhibitory effect on farmers' long-term cooperation willingness, which is consistent with Hypothesis 3. This shows that farmers are more cautious when considering long-term cooperation willingness than when considering contract renewal. The implementation cost has no significant impact on farmers' willingness to renew a contract, but it has a significant negative impact on long-term cooperation willingness. Specifically, farmers consider whether to form contracts with agriculture. When long-term cooperation with producer services occurs, the time farmers wait to make an appointment during the process of producer services, the time it takes to contact APS, and the difficulty of finding agricultural producer service providers during the implementation process will all affect farmers' willingness to cooperate in the long term. In other words, the more time it takes to implement costs, the more it inhibits farmers' long-term willingness to cooperate with agricultural productive services. This conclusion is consistent with relevant research. The results show that high transaction costs inhibit the contract execution rate between farmers and enterprises [51], and several aspects of transaction costs have a negative impact on farmers' willingness to join cooperatives [52].

4.1.3. The Impact of the Characteristics of Rural Households' Production and Operation on the Stability of Farmers' Agricultural Production Service Contracts

In addition to transaction costs, the characteristics of household production and the operation of rural households have an important impact on the stability of agricultural production service contracts in rural households. The empirical results show the following: Firstly, the land topography characteristics and transaction risk have a significant impact on farmers' willingness to renew contracts, and both of them have a positive impact at the 1% level. In other words, the flatter the land, the more willing the farmers are to renew their contracts with the agricultural production service providers, and the more familiar the service users are with the farmers, the more likely the farmers are to choose to renew the contract. This is in line with the reality whereby the flatter the land, the more conducive to mechanization, which will promote the development of agricultural productive services, and the more familiar the service objects are with farmers, the more they will enhance the trust of farmers, which in turn is conducive to the development of agricultural production services and will promote the renewal of farmers' contracts. Secondly, the land topography characteristics and the degree of aging have a significant impact on farmers' willingness to cooperate in agricultural productive services for a long time. The long-term cooperation of land topography with farmers' agricultural productive services was positively significant at 10%. In other words, the more platform the land topography, the more stable the contractual relationship between farmers and agricultural productive service subjects. However, the aging degree of farmers at the level of 5% has a negative effect on the willingness of farmers to cooperate with agricultural productive services for a long time. It can be explained

that the lower the degree of aging, the more inclined farmers are to choose long-term cooperation with agricultural production service providers. Finally, from the perspective of risk, both natural risk and transaction risk have a significant impact on the long-term cooperation of farmers' agricultural productive services, and they are negatively significant at the 1% level and the 5% level, respectively. This may be because when farmers are faced with greater risks, in order to avoid risks, they are more inclined to self-serve in order to avoid conflicts with service providers [53,54].

4.2. The Moderating Effect of Service Satisfaction on the Stability of Farmers' Agricultural Productive Service Contracts

4.2.1. Moderating Analysis of the Impact of Service Satisfaction on Farmers' Willingness to Renew Contracts and Long-Term Cooperation for Agricultural Productive Services

This section further discusses the moderating role of service satisfaction in the impact of transaction costs on farmers' willingness to renew agricultural productive service contracts and long-term cooperation willingness. It can be seen from the estimation results of Model 3 that Atrho21 is significant at the 1% level, which can indicate that there is a mutually reinforcing relationship between farmers' willingness to renew contracts for APS and farmers' willingness to cooperate in the long term in APS. It is very reasonable to use this method. The specific estimation results are shown in Table 4. The estimation results show that, first of all, service satisfaction has no significant moderating effect on the impact of information cost on farmers' willingness to renew agricultural productive services, while there is a negative impact of information cost on farmers' willingness toward long-term cooperation on agricultural productive services. There is a positive moderating effect at the 1% level, indicating that in the short term, farmers pay more attention to immediate benefits, and the moderating effect of service satisfaction on contract renewal intention is not obvious, but in the long run, the higher the service satisfaction, the more positive the effect on information costs. The regulating effect is significant and will actively promote farmers' willingness to choose long-term cooperation in agricultural productive services.

Table 4. Estimated moderating effect of service satisfaction on the stability of farmers' agricultural productive service contracts.

Variable	Model 3			
	Farmers' Willingness to Renew Contracts		Farmers' Long-Term Willingness to Cooperate	
	Coef.	Std. Err.	Coef.	Std. Err.
A1	−0.3016 ***	0.0618	−0.2235 ***	0.0596
A2	0.1540 ***	0.0542	0.1825 ***	0.0493
A3	−0.0494	0.0496	−0.0963 **	0.0481
B1	0.4023 ***	0.0687	0.3529 ***	0.0693
A1*B1	0.0593	0.0475	0.1579 ***	0.0486
A2*B1	0.1541 **	0.0692	0.1138 **	0.0528
A3*B1	0.1228 ***	0.0460	0.0702 *	0.0411
Machinery	−0.0305	0.1116	−0.1043	0.1048
Fragmentation	0.0077	0.0130	0.0104	0.0117
Terrain	0.2808 **	0.1127	0.2292 **	0.1106
Aging	−0.0010	0.1496	−0.3472 **	0.1438
Disaster	−0.0123	0.0378	−0.0933**	0.0363
Risk	−0.6269 ***	0.1441	−0.3885 ***	0.1433
Land	−0.0396	0.0883	−0.1012	0.0814
Farmscale	−0.0453	0.1256	−0.0434	0.1195
Gender	0.0549	0.2118	0.2171	0.2027
Education	0.0185	0.0176	0.0195	0.0166
Population	0.0271	0.0414	−0.0125	0.0401
Non-farm	−0.0015	0.0014	−0.0010	0.0014
Income level	0.0397	0.0984	0.0985	0.0935
Province	Controlled	Controlled	Controlled	Controlled
Atrho21	0.6504 *** (0.0662)			
ρ_{21}	0.5719 *** (0.0445)			
Log likelihood	−956.5148			
Prob > chi2	0.0000			
N	893			

Note: Standard errors are in parentheses; *** significant at $p < 0.01$, ** significant at $p < 0.05$, and * significant at $p < 0.1$.

The estimation results show that service satisfaction has a reinforcing moderating effect on the positive impact of negotiation costs on farmers' willingness to renew agricultural productive services and long-term cooperation willingness. In other words, service satisfaction plays a promoting role in the positive impact of negotiation costs on contract stability, indicating that high negotiation costs and service satisfaction are in a mutually reinforcing relationship. The higher the service satisfaction, the higher the previous negotiation costs. This means a more stable contract relationship between farmers and agricultural productive services can be promoted. Service satisfaction has a positive moderating effect on the negative impact of implementation costs on farmers' willingness to renew agricultural productive services and long-term cooperation. The adjustment is significant at the 1% and 10% levels, respectively, indicating that service satisfaction can weaken the impact of implementation costs on farmers' agricultural productive services. This has a negative impact on the stability of APS for farmers; therefore, improving the service quality and effectiveness of APS will effectively reduce the negative impact of transaction costs and promote the stability of the contractual relationship between farmers and APS.

4.2.2. Mediation Analysis of the Impact of Service Satisfaction on the Stability of Different Service Types in Farmers' Agricultural Productivity

This section focuses on examining the impact of service satisfaction on the stability of farmers' participation in different types of agricultural productive service contracts (See Table 5). Models 4 and 5, respectively, bring the latent variables of information cost, negotiation cost, execution cost, and the moderating variable service satisfaction into the model used to analyze different types of agricultural productive services for farmers and thus examine specific indicator estimates. It can be seen from the estimation results of Model 4–Model 5 that Atrho21 is significant at the 1% level, which illustrates that there is a mutually reinforcing relationship between farmers' willingness to renew APS and farmers' willingness to engage in long-term cooperation in APS. Using this method is very reasonable. In Model 4, the implementation costs have no significant impact on farmers' willingness to renew contracts for some services, but after adding the adjustment term of service satisfaction, service satisfaction has a positive effect on the impact of implementation costs on farmers' willingness to renew some services. The results indicate that service satisfaction has a strong moderating effect on implementation costs. At the same time, it can be seen from farmers' willingness to cooperate in the long-term cooperation of selected partial services that service satisfaction has a positive moderating effect on the negative impact of information cost and execution cost on farmers' long-term cooperation willingness of partial services, but it has a positive regulating effect on negotiation costs. The adjustment effect is not big. This may be because, for some link services, the negotiation cost is relatively small and does not have an impact on their long-term cooperation willingness, so the impact is not significant. Model 5 shows that service satisfaction has an enhanced moderating effect on the negotiation cost on farmers' willingness to renew the full-service custody service and has a positive effect on the impact of implementation costs on farmers' willingness to renew the full-service custody service. The degree of information cost, negotiation cost, and execution cost all have significant moderating effects on farmers' long-term willingness to cooperate in full custody services, which shows that service satisfaction has a strong positive moderating effect on the farmers' full custody services.

Table 5. Estimated moderating effect of service satisfaction on the stability of different types of agricultural productive service contracts among farmers.

Variable	Model 4: Adjustment Estimates of Service Satisfaction in Some Links				Model 5: Full Managed Service Satisfaction Adjustment Estimate			
	Farmers' Willingness to Renew Contracts		Farmers' Long-Term Willingness to Cooperate		Farmers' Willingness to Renew Contracts		Farmers' Long-Term Willingness to Cooperate	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
A1	−0.2219 ***	0.0733	−0.1516 **	0.0737	−0.4313 ***	0.1067	−0.3505 ***	0.1010
A2	−0.1349	0.1528	−0.0662	0.1446	0.2973 ***	0.1100	0.2915 ***	0.0971
A3	−0.0223	0.0589	−0.1001 *	0.0584	−0.0701	0.0770	−0.1550 **	0.0728
B1	0.5683 **	0.1747	0.3372 **	0.1412	0.3345 ***	0.1257	0.6359 ***	0.1471
A1*B1	0.0695	0.0584	0.1131 *	0.0645	0.0023	0.0771	0.2971 ***	0.0804
A2*B1	0.3403	0.2573	0.1273	0.2065	0.1972 **	0.0959	0.1596 *	0.0876
A3*B1	0.1279 **	0.0620	0.1119 *	0.0614	0.1436 **	0.0668	0.1511 **	0.0657
Machinery	−0.1413	0.1294	−0.0608	0.1260	−0.1629	0.2285	−0.0275	0.1995
Fragmentation	0.0085	0.0140	0.0096	0.0130	0.0139	0.0194	0.0384	0.0205
Terrain	0.1573 *	0.0917	0.1246	0.1320	0.4736 ***	0.1793	0.1927	0.1707
Aging	−0.1673	0.1729	−0.4689 ***	0.1730	0.2250	0.2598	0.2085	0.2373
Disaster	−0.0014	0.0447	−0.1280 ***	0.0441	−0.0123	0.0655	−0.0840	0.0617
Risk	−0.8074 ***	0.1763	−0.7206 ***	0.1974	−0.4137 *	0.2261	−0.0252	0.2123
Land	−0.0566	0.0993	−0.1511	0.0960	−0.0349	0.1659	−0.0664	0.1472
Farmscale	−0.0471	0.1519	−0.1125	0.1513	0.0934	0.2159	0.0977	0.1957
Gender	0.3112	0.2553	0.3731	0.2430	−0.1475	0.3892	−0.1980	0.3718
Education	0.0215	0.0200	0.0186	0.0193	0.0304	0.0337	0.0059	0.0315
Population	0.0461	0.0460	−0.0132	0.0460	−0.0218	0.0822	−0.0439	0.0750
Non-farm	−0.0008	0.0015	−0.0005	0.0015	−0.0039	0.0033	−0.0007	0.0030
Income level	0.0564	0.1144	0.1185	0.1120	0.0158	0.1773	0.0828	0.1559
Province	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled	Controlled
Atrho21	0.6709 *** (0.0815)				06999 *** (0.1172)			
ρ_{21}	0.5856 *** (0.0536)				0.6043 *** (0.0744)			
Log likelihood	−720.5194				−322.7582			
Prob > chi2	0.0000				0.0000			
N	654				342			

Note: Standard errors are in parentheses; *** significant at $p < 0.01$, ** significant at $p < 0.05$, and * significant at $p < 0.1$.

5. Discussion

5.1. Contribution of This Study

The existing research on farmers' transaction costs and contract stability is more focused on contract farming, agricultural product sales, land contracting, and transfer [44,55]. For example, Liu Xinyue and Zhou Li creatively used prospect theory to measure farmers' risk attitudes with three indicators (risk aversion coefficient, loss aversion coefficient, and low probability event emphasis coefficient) so as to further study the heterogeneity of risk attitudes among farmers with different types of risk sharing abilities. We assessed contract attribute preferences [56]. On the basis of transaction cost theory, Zhijian et al. used research data from the Chinese Household Finance Survey (CHFS) to determine how the identity of village cadres who play an important role in the formation of village rules and regulations will affect the farmland transfer period [57]. Compared with the existing literature, this study makes marginal contributions in several aspects. Firstly, it takes a novel research perspective by focusing on agricultural productive services and exploring the influence of farmers' contract stability on this industry. This approach not only enhances agricultural production efficiency but also supports the healthy development of APS. Secondly, this study emphasizes the impacts of transaction costs on farmers' contract decisions and considers the moderating role of service satisfaction. Analyzing the decision-making process of farmers in renewing contracts identifies key factors influencing long-term cooperative relationships. Moreover, the focus on contract stability goes beyond the existing literature that primarily examines purchasing behavior, highlighting the benefits of maintaining stable cooperative relationships for agricultural efficiency and technological innovation. Thirdly, the research integrates the theoretical framework of "transaction costs–service satisfaction–contract stability" to establish a logical research path and hypotheses, offering

valuable insights for future studies on agricultural productive services. Fourth, there is reference significance in the research area. This paper takes the black soil region of Northeast China as an example, which provides a suitable reference for countries with black soil anywhere in the world. The development of agricultural productive services is inseparable from the fertile soil environment and topographical conditions. The first step is to start from the black soil area, with the rapid development of agricultural productive services; it is very important to standardize contracts, and encourage farmers and agricultural productive service subjects into stable and long-term cooperation. Therefore, taking the black soil region of Northeast China as an example, this paper contributes by providing references for the development of agricultural productive services in the global black soil regions.

5.2. Shortcomings of the Study

This study has some limitations that should be addressed. Firstly, the quantification of transaction costs in the contract process, a crucial aspect of the research, poses a significant challenge. Future studies should aim to enhance the precision of measurements of transaction costs to ensure more robust conclusions. Secondly, the survey design lacked consideration of the service subject perspective due to time and funding constraints. It is essential to explore contract stability from the perspectives of both farmers and service recipients in future research. Moreover, although there are limitations associated with where the data were collected, future research can enhance the validity of the theoretical analysis framework by increasing the sample size and exploring similar cases to validate the research findings through comparison with the current study. Future studies should also focus on the impacts of different types of APS providers, such as agricultural machinery households, producer cooperatives, or agricultural enterprises, on contractual relationships. Third, this study still lacks control over time series issues, as the stability of service contracts relates to a dynamic process. Various types of farmers will make distinct decisions at different time points based on alterations in their endowment characteristics and policy environment. Analyzing contract stability issues under the transaction cost framework using cross-sectional data is essentially a "static" approach. The absence of time factor consideration is a limitation in current academic research on contract stability. Future studies should aim to dynamically investigate these related issues.

5.3. Future Research Prospects

In future research, it is recommended to delve deeper into several aspects. Firstly, researchers should consider expanding the scope of the study to include the heterogeneity of service subjects. Additionally, due to the current lack of a standardized measurement index system for transaction costs in agricultural productive services, it is suggested that variables be optimized through index optimization to enhance the project's rigor and universality. Furthermore, the study of farmers' decision-making behavior involves various disciplines such as psychology, behavior, and informatics. It is advised to employ different theoretical frameworks and multidisciplinary cross-analysis to comprehensively understand farmer behavior. Secondly, incorporating dynamic analysis into the research is crucial. Follow-up investigation methods, such as coverage surveys or telephone information return visits, can provide insights into the long-term effects of the cooperative relationship between farmers and service providers. By utilizing panel data analysis techniques, researchers can identify threshold effects of policy and environmental changes, understand the impact curves of various factors on farmers' behavior, and offer targeted policy recommendations. Thirdly, conducting a comparative analysis across multiple regions in China will enhance the depth of the study and bolster the credibility of the findings. Exploring the impact of various transaction scenarios on contract stability between farmers and service providers through the lens of regional terrain heterogeneity can provide valuable insights, especially in contrasting regions or for different agricultural products. Fourthly, due to the limited space in this paper, we have focused on the mechanism of the impact of transaction costs on the stability of farmers' agricultural productive service contracts and found that service

satisfaction plays a moderating effect. The mechanism of the effects of service satisfaction on the stability of farmers' agricultural productive service contracts is a topic worthy of in-depth discussion in future research, and trust is a suitable starting point. Additionally, utilizing randomized trials can help in meticulously controlling intervention variables and establishing scientific experimental and control groups to enable a more comprehensive investigation into strategies for large-scale agricultural development.

6. Conclusions

This study developed an analytical framework to examine the impacts of transaction costs on the stability of farmers' agricultural productive service contracts in the process of cooperation between farmers and service providers. Utilizing survey data from the main grain-producing areas of the three northeastern provinces, this study employed the Mvprobit model to analyze the factors and pathways influencing farmers' contract stability, focusing on information cost, negotiation cost, and execution cost. The key findings of this study indicate that farmers' behaviors related to service renewal and long-term cooperation align with transaction cost theory. Transaction costs significantly affect the stability of the contract relationship between farmers and agricultural productive services, with information costs having the highest impact, followed by negotiation costs and execution costs. Information costs and execution costs hinder the stability of farmers' agricultural productive service contract relationships, while negotiation costs promote it. Additionally, service satisfaction positively influences the stability of farmers' agricultural productive service contract relationships. At the same time, service satisfaction plays a crucial role in moderating transaction costs and enhancing the stability of farmers' agricultural service contracts. By improving farmers' satisfaction with services, the negative impact of transaction costs can be mitigated, fostering a more stable relationship between farmers and service providers. Additionally, factors such as land topography, aging, and risk significantly influence the stability of farmers' contractual relationships. Specifically, flat land terrain and lower transaction risks increase the likelihood of farmers renewing agricultural service contracts. Moreover, lower natural risks and aging degrees lead to a preference for long-term cooperation. Comparing different types of agricultural service contracts, farmers with a high aging degree are more inclined to renew contracts for full-service custody services, as these services cater more comprehensively to aging farmers. Variables like risky natural disasters and service object awareness have a greater impact on long-term cooperation willingness for certain services but less effect on full-service managed services.

Based on the aforementioned findings, this study can provide the following policy recommendations. Firstly, it is recommended to reduce transaction costs associated with the contract process in order to enhance the stability of contracts between farmers and agricultural productive services. APS organizations can categorize themselves based on the number of farmers in their service area and appoint farmer liaison officers to facilitate communication and coordination between farmers and APS organizations, thereby mitigating farmers' information asymmetry and reducing information search costs. Moreover, agricultural productive service organizations, particularly those offering full-service custody services, should consider implementing reasonable installment payment methods for service fees to alleviate the economic burden on some farmers and foster a more stable relationship between farmers and agricultural productive service contracts. Additionally, full-service custody service organizations should streamline the process from appointment scheduling to service delivery for farmers, ensuring the efficient allocation of time and resources. Furthermore, proactive communication with farmers and the regular monitoring of agricultural production conditions are essential to reduce farmers' monitoring and implementation costs, ultimately fostering the development of long-term cooperative relationships between farmers and agricultural productive services.

Second, enhancing the quality of agricultural productive services and improving farmers' service satisfaction is essential. Research indicates that farmers' satisfaction with APS plays a significant role in fostering stable contracts and regulating transaction

costs. Therefore, it is imperative for agricultural production service providers to prioritize service satisfaction. This can be achieved through several specific strategies. Firstly, technical services in agricultural production must be standardized, gradually leading to the overall standardization of agricultural productive services. Secondly, efforts should be made to cultivate farmers' awareness and loyalty toward agricultural productive services, along with providing regular professional training to enhance their engagement. Lastly, organizing activities to strengthen the relationship between farmers and service providers, such as greeting them warmly and offering small gifts during holidays, can be beneficial.

Third, the government should actively promote formal contract templates and improve the standardization of APS contracts. The study found that, while verbal agreements may save farmers costs in the short term during transactions, establishing a long-term and stable relationship between farmers and service providers requires the use of formal contracts to provide legal protection. Informal contracts are inadequate in preventing opportunistic behaviors and associated risks. In practice, the government has achieved suitable results in encouraging farmers to form cooperatives or cooperative alliances. Through the internal management of cooperatives, transaction costs are reduced, the mutual assistance of agricultural productive services between members is promoted, and long-term and stable cooperative relations are reached. At the same time, the government supports enterprises to develop digital platforms. For example, ADMS, a digital management platform independently developed by Wanying Company, can record the whole process of agricultural productive services by remotely sensing the characteristics of land plots and uploading service information in a timely manner, enhance the online communication between agricultural production service subjects and farmers, and reduce transaction costs, thereby promoting the stability of the contract relationship between farmers and agricultural productive services. Therefore, the government should promote formal contracts and enhance contract standardization. Contracts can be tailored to regional characteristics, ensuring transparency so as to mitigate opportunistic behavior resulting from information asymmetry. This approach can incentivize APS organizations to optimize management models, innovate technical methods, enhance service capabilities, increase agricultural production efficiency, and establish a mutually beneficial relationship with farmer groups.

Author Contributions: Conceptualization, H.L.; methodology, Y.X. and Z.W.; software, Z.C. and H.L.; validation, H.L. and Y.X.; formal analysis, Y.X. and Z.C.; investigation, Z.W. and Z.C.; resources, H.L.; data curation, Y.X.; writing—original draft preparation, Y.X. and Z.C.; writing—review and editing, H.L.; supervision, H.L.; project administration, H.L.; funding acquisition, H.L. and Y.X. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the National Natural Science Foundation of China (72103143, 72074153 and 72373101), the National Key R&D Program Project (2023YFD15011018 and 2022YFD190 1601-1), the Liaoning Province Philosophy and Social Science Young Talents Training subject commission (2022lslqnrcwtkt-51), the Liaoning Province Scientific Research Funding Program (LJKR0239), and the Liaoning Provincial Social Science Planning Fund Project (L22AGL017).

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Informed consent was obtained from all individual participants included in the study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author. The data are not publicly available due to privacy restrictions.

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

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