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The Impact of the 2016 Agricultural Subsidy Reform on Rural Household Farm Labor Supply: Evidence from China

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Abstract

This study uses nationally representative micro-panel data from the China Household Finance Survey (CHFS) and employs an Intensity DID approach to evaluate the impact of China's 2016 agricultural subsidy reform on rural household farm labor supply. Following the reform, the number of household members aged 16–65 whose primary occupation was farming increased in areas with a higher agricultural share. The estimated effect is statistically significant among households with more educated household heads and those in non-major grain-producing regions.

Keywords

Agricultural Subsidy Reform; Rural Household Farm Labor Supply; Intensity Difference-in-Differences; China.

1. Introduction

The Three Agricultural Subsidies policy introduced by China in 2004 is one of the country's most crucial agricultural support policies. The main policy objectives of the three agricultural subsidies are to stabilize grain production and raise farmers' incomes. In the initial stage of policy implementation, the Three Agricultural Subsidies indeed stabilized grain output and boosted farmers' income levels. However, since the subsidies were distributed mainly based on the land area contracted under the second-round land contracting rather than the actual cultivated area of farmers, some farmers could still receive corresponding subsidies even if they subcontracted their farmland or left it uncultivated, while genuine land operators who actually farmed the land failed to obtain subsidy support.

In response to the above situation, the Ministry of Finance and the Ministry of Agriculture and Rural Affairs carried out the reform of the Three Agricultural Subsidies in 2015, selecting some counties and cities in five provinces including Anhui, Shandong, Zhejiang, Hunan and Hunan as pilot regions. The reform integrated the original three agricultural subsidies into the Agricultural Support and Protection Subsidy, shifting the policy objectives to cultivated land fertility protection and promoting appropriately scaled grain production and operation. The reform clearly stipulated that farmland whose usage had been changed or left uncultivated for more than one year would not be eligible for subsidies. Meanwhile, new business entities that reached a certain scale of grain production and operation were provided with subsidies for appropriately scaled operation.

In 2016, the reform of the Three Agricultural Subsidies was rolled out nationwide. It is not difficult for us to find that the post-reform Agricultural Support and Protection Subsidy closely ties subsidy eligibility to agricultural production behaviors. This reform enables farmers who actually cultivate land to receive corresponding subsidies. It may also alter the relative returns between agricultural operations and non-agricultural employment, so rural households may reallocate their labor between the agricultural and non-agricultural sectors. In addition, differences in the degree of agricultural dependence across regions lead to varying degrees of impact from this reform, which provides us with an experimental opportunity to evaluate how

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the reform affects rural households' labor allocation between agricultural and non-agricultural sectors.

Most existing studies on agricultural subsidy reform have examined its impacts on grain output, agricultural productivity and household income. The labor allocation of rural households plays a central role in agricultural production. However, few literatures have discussed the relationship between this agricultural subsidy reform and the distribution of rural household labor across agricultural and non-agricultural sectors.

The pilot period of this agricultural subsidy reform was relatively short, making it difficult to accurately identify its policy effects. The reform was rolled out nationwide merely one year later. A conventional Difference-in-Differences model requires clear control groups and treatment groups, so it is obviously infeasible to adopt the traditional DID model to evaluate the effects of this reform. This study adopts an Intensity Difference-in-Differences model and uses the pre-reform share of agricultural output value at the prefecture-city level as an intensity variable to measure the varying degrees of reform impact across different prefecture-level cities. The results show that the number of labor allocated by households to the agricultural sector rises along with the increase in the agricultural output share of the prefecture-level city where the household is located. The policy effect is more pronounced among households with more educated household heads and in non-major grain-producing regions.

This study mainly makes marginal contributions in the following two aspects. First, most existing literature evaluates the policy effects of agricultural subsidy reform from the perspectives of agricultural production and rural household income, while few studies focus on the impacts of this reform on rural household labor allocation. This study adopts nationally representative micro household data to enrich the literature concerning agricultural subsidy reform and rural household labor supply. Second, within the framework of the Intensity Difference-in-Differences model, this study takes the regional share of agricultural output value as the intensity variable to measure the disparities in reform impacts across regions and identifies the policy effects in nationally representative regions. It also provides a feasible analytical framework for evaluating other nationwide agricultural reforms in subsequent research.

The rest of the paper is organized as follows.Section Two introduces the policy background and related literature. Section Three presents the research design. Section Four reports the empirical findings. Section Five concludes.

2. Institutional Background and Literature Review

2.1. Policy Background

The Three Agricultural Subsidies constitute one of the core policy instruments for the state to support agricultural development. The three agricultural subsidies refer respectively to the Direct Grain Subsidy for Grain Farmers, the Improved Seed Subsidy and the Comprehensive Agricultural Input Subsidy. The Direct Grain Subsidy disburses fiscal subsidies based on the actual grain planting area of rural households; the Improved Seed Subsidy guides farmers to adopt fine crop varieties through targeted subsidies; the Comprehensive Agricultural Input Subsidy provides partial compensation for farmers' expenses on purchasing agricultural materials such as chemical fertilizers, diesel oil, seeds and agricultural machinery. The Three Agricultural Subsidies aim to mobilize enthusiasm for grain production, boost grain output and raise farmers' incomes. In the initial stage of policy implementation, the Three Agricultural Subsidies played a vital role in promoting grain production and increasing farmers' income levels. However, various problems emerged as the policy was continuously implemented. In theory, the disbursement of the three subsidies should be carried out after verifying the planting area, yet the actual operation entails substantial administrative costs. Some village

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cadres reported that they had to conduct more than twenty rounds of verification on cultivated land areas to ensure accurate subsidy distribution. Therefore, subsidies are often issued based on the second-round contracted farmland area of households in practice. This distribution model allows some farmers to receive subsidies even if they do not engage in farming, which greatly weakens the incentive effect of the three subsidies on encouraging households to sustain grain production. Meanwhile, in order to comply with the World Trade Organization (WTO) rules concerning agricultural support, coupled with the practical demand for agricultural modernization, the reform of China's agricultural subsidy system has been further accelerated.

In 2015, the Ministry of Finance and the Ministry of Agriculture and Rural Affairs carried out pilot reforms of the Three Agricultural Subsidies in five provinces including Anhui, Shandong, Hunan, Sichuan and Zhejiang, and rolled out the reform nationwide in 2016. This reform unified and merged the original Three Agricultural Subsidies into the Agricultural Support and Protection Subsidy, shifting the policy objectives to cultivated land fertility protection and the promotion of appropriately scaled grain production. Funds for cultivated land fertility protection are designed to guide farmers to protect cultivated land, improve soil fertility and safeguard national food security. The subsidies are issued to farming households with contracted land rights. Farmers are not eligible for subsidies if their farmland is converted to non-grain uses such as livestock breeding, forestry and agricultural facilities, or left uncultivated for more than one year. Funds for promoting appropriately scaled grain production mainly support large-scale grain growers, family farms, farmers' professional cooperatives and agricultural socialized service organizations. Meanwhile, the policy encourages local governments to introduce diversified support measures tailored to local conditions, such as interest subsidies for agricultural loans and subsidies for the promotion of key agricultural technologies and supporting services, so as to cultivate various forms of appropriately scaled grain production.

Most of the post-reform subsidy funds are used for cultivated land protection, and the rest are allocated to appropriately scaled grain production. This also reflects that the reform focuses more on supporting actual agricultural production rather than simply providing universal income subsidies. This agricultural subsidy reform not only restructures the agricultural subsidy system but also alters the incentive conditions for rural households to engage in agricultural production and operation, raising the expected returns of agricultural production. This may encourage households to devote more family labor to agricultural production. Varying levels of agricultural development across regions result in differing degrees of policy impact from the agricultural subsidy reform. In regions with a high share of agricultural output value, households rely more heavily on agricultural production, and the agricultural subsidy reform may exert a more noticeable influence on agricultural production and operation activities.

2.2. Literature Review

Research on the economic effects of agricultural subsidies began earlier in developed countries, but the evidence remains mixed. Weber and Key (2012) argue that decoupled subsidies mainly provide income support and have little effect on farmers' production decisions. By comparison, Adams et al. (2001) and Chau and Gorter (2005) show that such payments may still influence agricultural production and labor input by reducing production risk, easing credit constraints, and improving farm liquidity.

Before the reform, China's Three Agricultural Subsidies program distributed payments based on contracted land area rather than actual cultivation. Most studies focused on how the subsidies affected agricultural production. Wang and Yang (2014) and Gao and Song (2017) report that the subsidies increased grain-sown area, grain output, and agricultural productivity. Zhong et al. (2008)， further show that part of the subsidy was capitalized into land rents,

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benefiting landowners instead of producers. The limited linkage between subsidy payments and actual farming activities weakened production incentives and constrained the role of subsidies in promoting land transfer and large-scale farming (Xu et al., 2020).As the mismatch between subsidy eligibility and actual production became increasingly apparent, later studies questioned the effectiveness of this design and argued that subsidy payments should be targeted at actual farm operators rather than contracted landholders (Ji et al., 2015; Xu et al., 2020; Leng et al., 2021).

The 2015–2016 reform marked a transition in China's agricultural subsidy system, shifting the policy focus from broad-based income support toward incentives for agricultural production. Recent studies have examined the effects of this reform on agricultural outcomes. Xu et al. (2022) and Ye et al. (2023) show that the reform improved grain production efficiency, while Xu et al. (2021) and Pengfei et al. (2023) find that it promoted farmland transfer to large-scale operators and expanded grain production scale. Meanwhile, the reallocation of subsidies toward actual farm operators also increased land rental prices (Liu et al., 2020; Yang et al., 2022), thereby affecting land transfer and agricultural production decisions. Previous studies have suggested that improvements in production efficiency, changes in land transfer, and the expansion of large-scale farming may all influence the demand for agricultural labor. However, because mechanization may substitute for labor while farm expansion may simultaneously increase labor demand, the overall effect of agricultural subsidy reform on rural household labor allocation remains theoretically ambiguous.

Overall, existing literature has conducted extensive research on the impacts of agricultural subsidy reform on grain production efficiency, land transfer, farm scale and household income. However, studies concerning the reform’s effect on the allocation of household labor between agricultural and non-agricultural sectors remain relatively scarce. In addition, as the agricultural subsidy reform was rolled out nationwide in 2016, the traditional Difference-in-Differences model struggles to construct reasonable treatment and control groups, so few studies have focused on policy effects under nationwide unified implementation. This study adopts the Intensity Difference-in-Differences model to identify the effect of the agricultural subsidy reform on rural households’ labor allocation across agricultural and non-agricultural sectors, and further conducts group tests to examine the heterogeneity of policy effects among households with household heads of different educational attainment, as well as between major grain-producing regions and non-major grain-producing regions.

3. Research Design

3.1. Data

This paper uses household-level data from the 2013, 2015, 2017, and 2019 waves of the China Household Finance Survey (CHFS), which are matched with prefecture-level data from the corresponding editions of the China City Statistical Yearbook. Conducted by the Survey and Research Center for China Household Finance at Southwestern University of Finance and Economics, the CHFS is a nationally representative household survey that collects comprehensive information on household demographics, employment, income, assets, and agricultural production. The survey contains information on household members' agricultural employment, land management, and agricultural inputs, allowing us to construct household-level measures of farm labor supply by aggregating individual agricultural employment.Prefecture-level data on agricultural value added and gross domestic product (GDP) are obtained from the China City Statistical Yearbook. These data are used to construct the treatment intensity measure, defined as the pre-reform share of agricultural value added in prefecture-level GDP.

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3.2. Variables

Dependent Variable. The dependent variable is Household Farm Labor (HFL), measured as the number of household members aged 16–65 whose primary occupation is farming. It reflects the allocation of household labor to agricultural production.

Key Independent Variables. The key explanatory variable is the interaction between the post-reform indicator (Post) and treatment intensity (Intensity). Post equals one in 2017 and 2019, after the nationwide implementation of the reform, and zero in 2013 and 2015. Intensity follows Li et al. (2022) and is measured by the average share of agricultural value added in prefecture-level GDP before the reform (2013–2015). It is calculated as the ratio of primary industry value added to prefecture-level GDP. Regions with a larger agricultural share are considered more exposed to the reform because agriculture plays a more important role in the local economy.

Control Variables. The empirical model controls for household demographic characteristics, including the number of household members aged 70 and above, the number of children under 16, and household size. All specifications include household and year fixed effects to account for time-invariant household characteristics and common year shocks.

3.3. Summary Statistics

Table 1 reports summary statistics for the variables used in the analysis. The sample contains 24,631 household-year observations. Rural households have an average of 1.49 members primarily engaged in farming, although the number ranges from 0 to 11, revealing substantial differences in household farm labor allocation. The treatment intensity measure averages 0.137, with a standard deviation of 0.083, indicating considerable variation in the pre-reform share of agricultural value added across prefectures. This regional variation provides the identifying variation for the Intensity DID approach.

The average age of the household head is 53.53 years, while the household head has completed 7.22 years of schooling on average. The average household consists of 3.45 members, including 0.74 children under the age of 16 and 0.23 members aged 70 or above. These statistics indicate substantial heterogeneity in household demographic characteristics. Overall, the variables exhibit sufficient variation to support the subsequent empirical analysis.

Table 1. Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Household Farm Labor (HFL)	24,631	1.489	1.035	0	11
Post	24,631	0.489	0.500	0	1
Intensity	24,631	0.137	0.083	0.003	0.576
Age of Household Head	24,629	53.53	10.57	3	117
Household Head's Years of Schooling	24,609	7.224	3.279	0	19
Household Size	24,631	3.447	1.679	1	18
Number of Children	24,631	0.742	0.977	0	10
Number of Elderly Members	24,631	0.228	0.508	0	5

3.4. Identification Strategy

Because the 2016 reform of the Three Agricultural Subsidies program was implemented nationwide, all rural households were exposed to the policy after its implementation. Consequently, the conventional Difference-in-Differences (DID) framework, which relies on a clear distinction between treated and untreated units, is not directly applicable. Following the identification strategy of continuous treatment intensity designs, this paper exploits regional

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variation in policy exposure rather than the conventional treatment–control group comparison to identify the causal effect of the agricultural subsidy reform.

Although the reform was implemented uniformly across the country, the intensity of policy exposure differed substantially across regions. In regions where agriculture accounted for a larger share of the local economy, agricultural production activities were more concentrated, the coverage of agricultural subsidies was broader, and agricultural producers were more dependent on subsidy policies. Consequently, the reform was expected to generate stronger incentive effects in these regions. In contrast, regions with a smaller agricultural sector were expected to experience weaker policy effects. Accordingly, this paper uses the pre-reform share of agricultural value added in prefecture-level gross domestic product (GDP) as a measure of policy treatment intensity, thereby capturing the extent to which different regions were exposed to the reform.

Based on this identification strategy, the following Intensity Difference-in-Differences (Intensity DID) model is estimated:

$$\boldsymbol{HFL_{ijt} = \alpha + \beta(Post_t \times Intensity_{jt}) + X_{ijt} + \mu_i + \tau_t + \varepsilon_{ijt}}$$

where HFL_{ijt} denotes the number of household members primarily engaged in farming in household i, located in prefecture-level city j, in year t. $Post_t$ is a post-reform indicator that equals one for the post-reform period (2017 and 2019) and zero for the pre-reform period (2013 and 2015). $Intensity_{jt}$ measures regional policy exposure and is defined as the average pre-reform share of agricultural value added in prefecture-level gross domestic product (GDP) over 2013 and 2015. $X_{ijt}$is a vector of household-level control variables, including the number of household members aged 70 or above, the number of children under the age of 16, and household size. μ_i and τ_t denote household fixed effects and year fixed effects, respectively, while ε_{ijt} represents the idiosyncratic error term.

The coefficient of primary interest is β, which reflects how the effect of the agricultural subsidy reform varies with regional treatment intensity. A positive estimate implies that the estimated effect of the reform increases with regional treatment intensity.

4. Empirical Results

4.1. Baseline Results

Table 2. Baseline Regression Results

	(1)	(2)
	HFL	HFL
Post×Intensity	0.443**	0.506***
	(0.205)	(0.192)
Controls	No	Yes
Household Fe	Yes	Yes
Year Fe	Yes	Yes
Observations	24,631	24,631

Notes: Standard errors clustered at the county level are reported in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 2 presents the baseline estimation results for the effect of the agricultural subsidy reform on rural household farm labor supply. Columns (1) and (2) both include household and year

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fixed effects, while Column (2) further controls for household characteristics. The estimated coefficient on Post × Intensity is positive and statistically significant in both specifications. After household characteristics are included, the estimated coefficient increases from 0.443 to 0.506 and remains statistically significant at the 1% level.

4.2. Parallel Trend Test

The Difference-in-Differences model requires the identification assumption of pre-reform parallel trends, which is also required for the Intensity Difference-in-Differences model. The pre-reform parallel trend assumption requires that samples share identical trends before the policy is implemented, meaning the estimated coefficients for pre-policy years should be statistically insignificant. Taking 2015 as the reference year, this study adopts an event-study specification to test the pre-reform parallel trends. Figure 1 presents the dynamic estimated coefficients together with their 90% confidence intervals.

Figure 1 shows that the 90% confidence interval of the estimated coefficient for 2013 crosses the zero line, indicating that regions with different policy exposure intensities share identical trends in the amount of household labor allocated to the agricultural sector, which verifies the validity of the pre-reform parallel trends assumption. After the reform, the estimated coefficients for 2017 and 2019 are both significantly positive. The figure demonstrates that the agricultural subsidy reform increases the volume of household labor assigned to agricultural production as the regional share of agricultural output value rises.

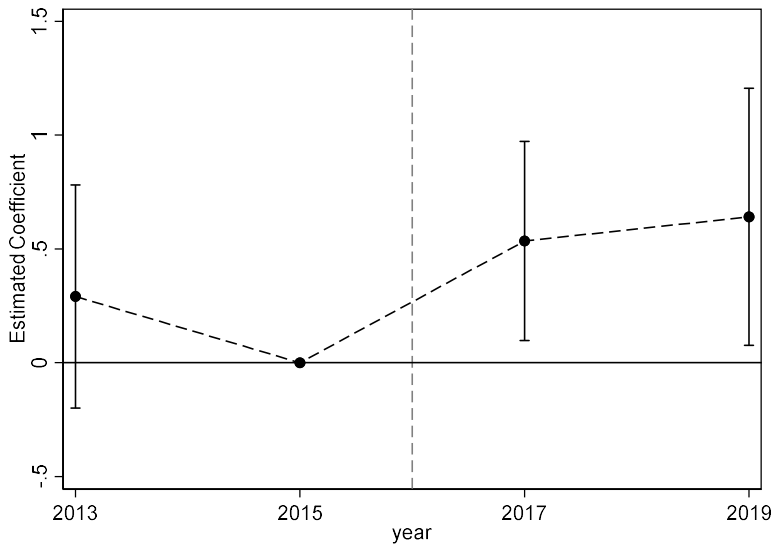

Figure 1. Event-Study Estimates

Notes: The figure reports the estimated coefficients and 90% confidence intervals from the event-study specification, using 2015 as the reference year. The vertical dashed line marks the implementation of the 2016 agricultural subsidy reform.

4.3. Robustness Checks

4.3.1. Alternative Measure of Treatment Intensity

In the baseline regression, we adopt the average of the prefecture-level agricultural output value shares in 2013 and 2015 as the treatment intensity. However, as mentioned earlier, five provinces launched pilot agricultural subsidy reforms in 2015. The pilot reform likely exerted impacts on local agricultural output value shares, which may bias the baseline intensity variable constructed based on such data. Accordingly, we only use the prefecture-level agricultural output value share in 2013 as the intensity variable for further regression. Table 3 presents the corresponding estimation results

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As shown in Table 3, after controlling for household and time fixed effects, the coefficient of the interaction term is significantly positive whether control variables are included or not. The estimated results are consistent with the baseline regression results, which shows that the agricultural subsidy reform still significantly raises the amount of household labor allocated to the agricultural sector after replacing the indicator of intensity variable, and the results are robust.

Table 3. Robustness Check: Alternative Measure of Treatment Intensity

	(1)	(2)
	HFL	HFL
Post×Intensity2	0.480**	0.495**
	(0.211)	(0.193)
Controls	No	Yes
Household Fe	Yes	Yes
Year Fe	Yes	Yes
Observations	23443	23443

Notes: Standard errors clustered at the county level are reported in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively..

4.3.2. Excluding Pilot Provinces

As mentioned above, the agricultural subsidy reform was piloted in five provinces in 2015, which implemented the policy one year in advance. We wonder whether our estimation results are significant merely due to the early policy rollout in pilot regions. To rule out this possibility, we exclude the samples of the five pilot provinces and conduct regressions using the remaining samples. The regression results are presented in Table 4. It can be observed that after dropping the pilot provinces, the coefficient of the interaction term remains significantly positive at the 1% statistical level, consistent with the baseline regression results. This further demonstrates that our significant findings are not driven by the policy pilots, and the baseline regression results are robust.

Table 4. Robustness Check: Excluding Pilot Province Samples

	(1)
	HFL
Post×Intensity	0.575***
	(0.209)
Controls	Yes
Household Fe	Yes
Year Fe	Yes
Observations	20170

Notes: Robust standard errors clustered at the county level are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

4.4. Heterogeneity Analysis

To explore whether the agricultural subsidy reform generates heterogeneous effects, we divide the samples for grouped regressions based on two dimensions: whether the household is located in a major grain-producing region and the educational attainment of the household head. In accordance with official standards, the following provinces are defined as major grain-

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producing regions: Hebei, Inner Mongolia, Liaoning, Jilin, Heilongjiang, Jiangsu, Anhui, Jiangxi, Shandong, Henan, Hubei, Hunan and Sichuan. All other provinces are categorized as non-major grain-producing regions. In addition, households are split into high-education and low-education groups according to whether the household head has received nine years of compulsory education. Table 5 reports the results of the heterogeneity regressions..

As shown in Table 5, the regression results indicate obvious regional heterogeneity in policy effects. For the sample of non-major grain-producing regions, the estimated coefficient of the interaction term is 0.998 and statistically significant at the 1% level. In major grain-producing regions, the coefficient of the interaction term is positive yet statistically insignificant. A plausible explanation is that the agricultural production systems in major grain-producing regions are relatively mature, making it difficult for agricultural subsidies to further boost households' agricultural labor input. By contrast, agricultural intensity in non-major grain-producing regions is relatively low, and the production incentives brought by the agricultural subsidy reform can effectively encourage rural households to allocate more labor to the agricultural sector.

Heterogeneous results also exist in terms of the educational attainment of household heads. For households with highly educated heads, the estimated coefficient of the interaction term is 0.471 and statistically significant at the 10% level. Although the coefficient of the interaction term is also positive for households with less educated heads, it is statistically insignificant. This result may arise because household heads with higher educational attainment can better comprehend changes in agricultural subsidy policies, respond to them, and adjust household labor allocation accordingly.

Table 5. Heterogeneity Analysis

	Major Grain-Producing Regions	Non-Major Grain-Producing Regions	High Education	Low Education
	HFL	HFL	HFL	HFL
Post×Intensity	0.081	0.998***	0.471*	0.105
	(0.187)	(0.297)	(0.257)	(0.197)
Controls	Yes	Yes	Yes	Yes
Household Fe	Yes	Yes	Yes	Yes
Year Fe	Yes	Yes	Yes	Yes
Observations	12456	12175	8680	8933

Notes: Robust standard errors clustered at the county level are reported in parentheses. Major Grain-Producing Regions are defined according to China's official classification. High Education is defined as a household head having completed at least nine years of schooling.. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

5. Conclusion

The results of this study show that the 2016 agricultural subsidy reform affects household labor allocation between agricultural and non-agricultural sectors. The reform increases the labor allocated by rural households to the agricultural sector as the agricultural output value of the local region rises. The above conclusions still hold after parallel trend tests and robustness tests. Heterogeneity analysis reveals that the positive policy effect is significant for rural households in non-major grain-producing regions and households with more educated heads. Overall, production-oriented agricultural subsidies can strengthen farmers' incentives to engage in agricultural production, yet policy effectiveness is constrained by regional agricultural endowments and household characteristics.The conclusions of this paper provide certain

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reference value for the formulation of agricultural support policies. Maintaining production-oriented subsidy incentives and taking regional differences and household heterogeneity into account helps improve the allocation efficiency of agricultural subsidy funds and facilitate the sustainable development of rural agriculture.

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