Contents lists available at Science-Gate

International Journal of Advanced and Applied Sciences

Journal homepage: http://www.science-gate.com/IJAAS.html

# Impact of livestock and crop conversion support program on farm household income: A study in Chau Thanh A District

Quang Vang Dang [1], Quoc Duy Vuong [2, *]

[1]*Dean of Faculty of Economics, Ho Chi Minh University of Technology and Education, Ho Chi Minh City, Vietnam*
[2]*Department of Finance and Banking, School of Economics, Can Tho University, Can Tho City, Vietnam*

ARTICLE INFO

*Article history:*
Received 17 December 2023
Received in revised form
28 March 2024
Accepted 1 April 2024

*Keywords:*
Livestock and crop conversion support
Farm household income
Propensity score matching method
Probit regression model

ABSTRACT

This paper investigates the impact of a support program for livestock and crop conversion on the incomes of farm households in the Chau Thanh A district of Hau Giang province. It analyzes data from 250 farming households in the area using the propensity score matching (PSM) method. The study uses probit regression to identify three key factors that significantly affect a household's ability to benefit from the support program: the size of the land owned, as well as the age and gender of the household head. Additionally, the PSM analysis reveals that farm households participating in the support program earn significantly more income than those that do not, with an annual income difference of 159 million VND. These findings support earlier research on the subject. Based on these results, the authors suggest several strategies to encourage more farm households to join the livestock and crop conversion support program, which could help improve their incomes and overall quality of life.



## 1. Introduction

Recent studies indicate that as inflation rates rise, the savings rates of individuals tend to decrease while the capital required for investment in production sectors increases. This phenomenon can be attributed to the reduced purchasing power and increased economic uncertainty during periods of high inflation, which discourage savings and complicate investment planning.

Additionally, securing capital for rural financial markets presents complex challenges. It is imperative for governments, ministries, regulatory bodies, and financial institutions to devise concrete and effective strategies to address the shortage of capital in the economy, particularly in the agricultural and rural development sectors.

Chau Thanh A district, a rural area in Hau Giang province, exemplifies the necessity of focusing on agriculture, farmers, and rural life. Local authorities in Hau Giang have initiated a project known as "Project 1000," aimed at supporting livestock and crop production for farmers. Evaluating the impact of this project on local livelihoods requires a detailed analysis using specific economic indicators to measure the extent of farmers' participation and the project's effectiveness.

Although several studies in Vietnam and other countries have investigated the effect of participation in rural and agricultural support programs on household income, the results of these papers have not reached a consensus. The research of Sikwela and Mushunje (2013), Tran et al. (2023), Barslund and Tarp (2008), Wordofa and Sassi (2018), Bhuiya et al. (2016), and Allotey et al. (2019) provided evidence on the positive impact of participating in government's aid programs on the income of households, especially those in rural areas. In addition to improving household income and reducing poverty, these programs also help increase property values, education spending, and food spending for participants. However, these previous studies found different degrees of the influence of aid programs on households' income. Although many prior articles confirmed the positive influence of participation in support programs on households' income, some studies did not find any statistically significant effect of financial aid programs on the income of households, such as the study of Diagne et al. (2000).

This study explores the significant role of livestock and crop conversion support programs in influencing household income and examines the mixed results from prior research. It specifically

* Corresponding Author.
Email Address: vqduy@ctu.edu.vn (Q. V. Dang)
https://doi.org/10.21833/ijaas.2024.04.011
Corresponding author's ORCID profile:
https://orcid.org/0000-0002-6870-4106

investigates the factors that affect farm households' ability to secure capital through these programs and assesses how participation impacts their income. The results of this research will offer practical insights for governments, local authorities, and farm households, providing empirical evidence to guide decisions on developing further aid programs. Additionally, the findings will help farm households decide whether to participate in agricultural support programs (Moahid and Maharjan, 2020).

## 2. Literature review

Research exploring the influence of agricultural programs on household income has garnered significant interest globally. One study by Wordofa and Sassi (2018) focused on the impact of farmers' training centers on household farm income in Eastern Ethiopia, analyzing data from a survey of 2,449 households in Haramaya district conducted in 2013. This research found that the training center significantly boosted the income of farm households, suggesting the need to enhance crop production and develop livestock production. It also recommended that stakeholders in agricultural innovation collaborate to improve market dynamics for farmers engaged in both stable and seasonal food production.

Another study conducted by Allotey et al. (2019) examined the effects of a fertilizer subsidy program on maize income in Northern Ghana. Utilizing the propensity score matching (PSM) method to analyze data from 400 respondents collected in 2019, the findings indicated that the majority of maize farmers joined the program due to the high poverty levels in the area. Participation in the program significantly increased the maize income of these farmers. The researchers recommended increasing investments and expanding the subsidy program to include other agricultural inputs like improved seeds, pesticides, and insecticides. These studies collectively highlight the potential of targeted agricultural interventions to enhance household incomes, underscoring the importance of continuous support and collaboration among key stakeholders in the sector.

In a study conducted by Nguyen and Pham (2015) in Vietnam, the effects of the Government's Program 135 on household income were analyzed in the Dong Thap Muoi area, Long An province. The research involved a survey of 360 households, which was evenly split between those who were beneficiaries of Program 135 and those who were not. The results indicated that households receiving support from the program experienced significant increases in income. Additionally, the study identified various factors influencing household income, including the education level, age, and gender of the household head, proximity to the nearest border gate, the average size of productive land, the labor force participation rate, and the involvement of family members in socio-political organizations.

The study by Uddin et al. (2015) examined the impact of rural development programs (RDP) on poverty alleviation in Bangladesh, which is notably the world's most densely populated country, with 71 percent of its population residing in rural areas. The research utilized data from 192 poor households and employed quantitative research methods to assess the outcomes. The findings suggest that RDPs, which focus on housing, agriculture, health, and education, have substantially enhanced the poverty conditions among the poor. This improvement was observed across various capabilities of the households, including economic, human, protective, and political capabilities.

The research by Gadisi et al. (2020) examined the effects of government support programs on household welfare in Limpopo province, South Africa. Using compensation variation (CV) and PSM methods, the study assessed how these programs influence household welfare. The results indicated that initiatives such as the Reconstruction and Development Program (RDP) support, social grants, and government-subsidized housing have a positive impact on the welfare of households in both low- and middle-income categories in the region. It was found that the welfare gains for low-income households were greater than those for middle-income households. Moreover, the study highlighted that asset ownership, such as televisions and motor vehicles—which incur maintenance costs, subscription fees, and other expenses—tends to reduce household welfare in these income groups. The conclusion drawn from the study suggests that sustaining and extending these programs could improve household welfare and living standards among non-beneficiary households.

Empirical research has identified several categories of factors that influence household income. These factors include:

- Household characteristics: These encompass age, gender, education level, occupation, experience, and the number and dependency status of family members. Such characteristics can significantly shape the economic dynamics within households.
- Socio-economic factors: Key indicators here include land area, employment within the locality, total assets, and overall income. These elements contribute to the financial foundation of households.
- Geographical factors: Factors like the distance to the nearest market center can affect a household's ability to engage economically with broader markets, impacting income potential.
- Microfinance factors: This includes the number of loans, interest rates, terms of credit, and participation in training courses, which can all influence a household's financial health and income-generating capabilities.

The studies further highlight that land productivity and area directly affect labor productivity, which in turn impacts household income. For instance, Uddin et al. (2015) noted the significance of these factors in their research. Additionally, capital investment is crucial; Alam and

Waheed (2006) found that a lack of investment capital leads to lower productivity, which negatively affects household income and savings. Contrarily, household size may reduce income, as shown by Akaakohol and Aye (2014), whereas positive impacts on income are associated with the age, education level, and experience of the household head, as Mesra (2018) identified.

These findings suggest a complex interplay of various elements that contribute to the economic status of households, underscoring the importance of multi-faceted approaches in addressing income disparities.

## 3. Research methods

### 3.1. Sample selection

Primary data for the study is gathered through direct interviews with farm households that have either participated or not participated in a specific project, using a specially designed questionnaire. The study employs a non-random sampling method to select households within the study area. The survey collects various types of information, including details about the household head, their participation in the project, and their views on the project's support programs.

To enable meaningful comparisons, the sample is carefully chosen to ensure that the groups of participants and non-participants have similar characteristics. Households are categorized into two groups: those that have participated in the project (referred to as the participating group) and those that have expressed interest but have not yet participated (referred to as the control group).

The selection process for the interviews uses a list of households from Project 1000, provided by the Department of Agriculture and Rural Development of Chau Thanh A district. To maintain the study's reliability, about 30% of the households participating in the project are surveyed, totaling data collection from 250 households across various communes in Chau Thanh A district, Hau Giang province.

The aim of the impact assessment is to evaluate how participation in the program affects household income. Each group of observations shows a range of income variations per household, thereby allowing the study to determine if differences in income variations between the two groups can be attributed to their participation in the program.

### 3.2. Estimation method

#### 3.2.1. Probit regression model

To analyze the factors affecting the ability of farm households to participate in the livestock and crop support program in Chau Thanh A District, the study uses a binary probit regression model. The original analytical model can be written as follows:

$$y_i^* = x_i\beta + v_i \quad (1)$$

where, $y_i^*$ is a hidden variable, reflecting the ability of farm households to participate in the livestock and crop support program in Chau Thanh A district; $x_i$ is the vector of explanatory variables, which are factors affecting the ability of farm households to participate in the project in Chau Thanh A district; $v_i$ is a random error representing explanatory variables that are unobservable but have an effect on $y_i^*$; $\beta$ are the estimated coefficients of the regression model.

Since $y_i^*$ is not observable, it is not possible to estimate the coefficients $\beta$ through a linear regression model. In this case, a logit or probit probabilistic model is often used to overcome the limitations of a linear regression model. Accordingly, the unobservable dependent variable $y_i^*$ is declared through the observable dependent variable $y_i$ as follows:

$$y_i = \begin{cases} 1, households\ that\ participate\ in\ the\ project\ 1000, if\ y_i^* > 0 \\ 0, households\ that\ do\ not\ participate\ in\ the\ project\ 1000, if\ y_i^* \le 0 \end{cases} \quad (2)$$

As the observable dependent variable $y_i$ is a binary variable, and if $v_i$, which is an independent random error, is assumed to follow the normal distribution, the probability that a household accesses formal credit can be expressed through the formula (Wooldridge, 2002):

$$Pr(y_i = 1|x) = Pr(y_i^* > 0|x) = Pr(x_i\beta + v_i > 0) = Pr(v_i > -x_i\beta) = Pr(v_i \le x_i\beta) = \varphi_i(x_i\beta) \quad (3)$$

where, $\varphi_i(.)$ is the cumulative normal distribution (cdf); $\theta_i(.)$ is the density function of the normal distribution (pdf). Therefore, the marginal effect of the explanatory variable $x_{ik}$ is calculated through the formula as follows:

$$\partial\varphi_i(.)/\partial x_{ik} = \theta_i(.)\beta_k \quad (4)$$

The model presented above is the basic form of the probit model and is often used in analyzing the factors affecting the household's ability to access resources. Estimating the coefficients $\beta$ from this model is quite easy with the method of maximum likelihood estimation (MLE). However, it is quite difficult to directly use the estimated coefficients $\beta$ to explain the significance of the model. Hence, the study uses the marginal effect to explain the significance of the model in lieu of the estimated coefficients $\beta$ (Wooldridge, 2002).

Table 1 summarizes the characteristics of the variables in the probit research model and the

expected signs about the impact of the independent variables on the dependent variable.

### 3.2.2. PSM method

PSM constructs a statistical comparison group based on a probability model of participation in intervention $T$ depending on observed characteristics $X$, or propensity score $P(X)=Pr(T=1|X)$. Necessary assumptions for the identification of the program effect are conditional independence and the presence of common support. These assumptions are detailed as follows.

Assumption of conditional independence: This assumption states that given a set of observable covariates $X$ that are not influenced by treatment, potential outcomes $Y$ are independent of treatment assignment $T$. If $Y_i^T$ represent outcomes for participants and $Y_i^C$ represent outcomes for nonparticipants, conditional independence implies

$$(Y_i^T, Y_i^C) \perp T_i | X_i \quad (5)$$

## 4. Research results

### 4.1. Characteristics of surveyed farm households

Table 2 presents the descriptive statistical outcomes for the variables, categorized by two groups: participants and non-participants of the credit support program.

**Table 1:** Description of variables in binary probit regression model

| Variable | Measurement method | Expected signs |
|---|---|---|
| Participation in credit support program (CREDIT) | Dummy variable, 1 = Household participates in credit support program, 0 = Otherwise | |
| Gender (GENDER) | Dummy variable, 1 = Male-headed household, 0 = Female-headed household | + |
| Educational level (EDU) | The highest level of education of household head | + |
| Age (AGE) | Age of household head (years old) | + |
| Dependents (DEPENDENT) | Number of dependents in household (person) | - |
| Agricultural training (TRAINING) | Dummy variable, 1 = Household participates in agricultural training courses, 0 = Otherwise | + |
| Land size (FARM) | Total land owned by household (m2) | + |
| Total assets (ASSET) | Total value of assets owned by household (million VND) | + |
| Total production costs (COST) | Total costs of production (million VND) | - |

**Table 2:** Cross-tab comparison of the variables used in the regression model

| Variable | Group | Number of observations | Mean | Standard deviation |
|---|---|---|---|---|
| Gender (GENDER) | Participants | 167 | 0.7904 | 0.4082 |
| | Non-participants | 83 | 0.8795 | 0.3275 |
| Educational level (EDU) | Participants | 167 | 2.6826 | 1.0065 |
| | Non-participants | 83 | 2.8433 | 1.1527 |
| Age (AGE) | Participants | 167 | 49.0400 | 5.3280 |
| | Non-participants | 83 | 47.3600 | 5.8028 |
| Dependents (DEPENDENT) | Participants | 167 | 1.5209 | 0.7099 |
| | Non-participants | 83 | 1.4819 | 0.6692 |
| Agricultural training (TRAINING) | Participants | 167 | 0.6443 | 0.4771 |
| | Non-participants | 83 | 0.6932 | 0.4638 |
| Land size (FARM) | Participants | 167 | 6,207.1856 | 1,851.3938 |
| | Non-participants | 83 | 7,079.5181 | 2,013.4765 |
| Total assets (ASSET) | Participants | 167 | 208.2634 | 73.5746 |
| | Non-participants | 83 | 203.3734 | 73.3231 |
| Total production costs (COST) | Participants | 167 | 138.6228 | 56.9031 |
| | Non-participants | 83 | 156.4458 | 57.4113 |

Table 2 displays the characteristics of households involved in a support program versus those not participating. Among the 83 non-participants, 88% are headed by males, whereas among the 167 participants, 79% are male-headed households. In both groups, the majority of household heads have completed secondary education. There are no significant differences between the participating and non-participating groups in terms of the age of household heads or the number of dependents. Both groups show a high interest in participating in agricultural training courses. Furthermore, the difference in total assets between the two groups is minimal. The average land size for non-participants is about 7080 square meters (0.708 hectares), compared to 6207 square meters (0.6207 hectares) for participants. There is, however, a notable difference in total production costs between the two groups, with participants spending approximately 139 million VND and non-participants spending about 156 million VND.

### 4.2. Determinants of access to the livestock and crop conversion support program

Table 3 presents the estimation results using the probit regression model. The results from Table 3 show that gender, age, and land size have a considerable influence on the ability of farm households to access capital from the livestock and crop conversion support program in Chau Thanh A district, Hau Giang province. The impacts of these variables on participation in credit support program can be explained as follows:

- Firstly, it can be seen from Table 3 that the gender of the household head is statistically significant in explaining the household's ability to access loans from the livestock and crop conversion support

program with the negative estimated coefficient (β1=-0.4511) at the significance level of 10%. In rural settings, the male household head typically assumes the role of the primary decision-maker regarding family business plans, which often affords him greater access to formal credit. This access can lead to enhanced opportunities for increasing household income through capital utilization. However, recent findings indicate a shift towards recognizing the increasing role of women in society and their growing involvement in financial decisions, echoing trends highlighted in the study by Xiong and Niu (2010). This shift suggests a broadening of attention towards gender equity in economic opportunities.

- Secondly, as expected, age is statistically significant at the significance level of 5% and has a positive impact on the ability of farm households to access capital from the livestock and crop conversion support program in the research area (β3=0.0312). This result is similar to the study of Gadisi et al. (2020). The survey in the study area indicates that the heads of households are typically middle-aged or older, as younger individuals often seek non-agricultural employment. This trend leaves older individuals more engaged in agricultural activities. Consequently, when these older household heads require financing, they frequently seek capital support from local entities such as associations and unions.
- Last but not least, based on the regression results in Table 3, land size has a negative relationship with credit accessibility from the livestock and crop conversion support program of farm households with the negative estimated coefficient (β6=-0.0001) at the significance level of 5%. In fact, households own residential land, agricultural land, and other types of land. When farming households make loan requests at commercial banks, these households often use their own land as collateral assets to guarantee the loan. The results of this study are contrary to the original expectations and research results of previous studies such as Gadisi et al. (2020) and Uddin et al. (2015).

This study did not observe significant effects of factors such as educational level, number of dependents, agricultural training, total assets, and total production costs on farm households' ability to access capital from the livestock and crop conversion support program in the study area. The lack of statistical significance in these variables might be attributed to the fact that most of the households involved are primarily engaged in farming, which could complicate their access to government-supported programs.

**Table 3:** Estimated results of the probit regression model

| Variable | Coefficient | SE |
|---|---|---|
| Gender (GENDER) | -0.4511* | 0.2356 |
| Educational level (EDU) | -0.0549 | 0.0797 |
| Age (AGE) | 0.0312** | 0.0151 |
| Dependents (DEPENDENT) | 0.0153 | 0.1243 |
| Agricultural training (TRAINING) | -0.0691 | 0.1820 |
| Land size (FARM) | -0.0001** | 0.00004 |
| Total assets (ASSET) | 0.0002 | 0.0011 |
| Total production costs (COST) | -0.0008 | 0.0017 |
| Constant | 0.2888 | 0.8932 |
| Number of observations | 250 | |
| Loglikelihood | -149.219 | |
| LR Chi2(8) | 19.23 | |
| Prob > chi2 | 0.0137 | |
| Pseudo R2 | 0.0605 | |

** and * indicate statistical significance at the 5% and 10% levels, respectively

### 4.3. The impact of access to the livestock and crop conversion on household performance

The estimation results from the probit model shown in Table 3 identify three variables—gender, age, and land size—as significant influencers on the ability of farm households to access capital from the livestock and crop conversion support program. The findings from this model also set the groundwork for further analysis using PSM, ensuring that the comparison methods applied in subsequent steps are robust. Additionally, the impact of accessing capital from this support program on household income is analyzed using the PSM method. Table 4 outlines the results of this impact assessment, detailing how access to capital influences the income levels of the farm households in the study area.

**Table 4:** Results of the impact assessment of access to capital from the support program on households' income

| Assessment method | | Borrowing households (household) | Non-borrowing households (household) | Income difference (million VND/year) | Standard error | t value |
|---|---|---|---|---|---|---|
| | | | **Mean comparison** | | | |
| PSM | Central | 167 | 83 | 159.226 | - | - |
| | Interval | 167 | 83 | 159.366 | 8.710 | 18.297 |
| | Stratified | 167 | 83 | 158.321 | 8.360 | 19.060 |

Applying the PSM method, the propensity scores of individuals based on the set of characteristics (independent variables) are estimated. Households whose probability is outside the probability range are eliminated. Households are matched according to the stratified probability matching method, central matching method, and interval matching method. Then, the comparison results of each pair of

individuals above are used to calculate the average treatment effect (ATE). The ATE value is the difference in income between the group of borrowing households and the group of non-borrowing households.

According to the results in Table 4, the comparison results by using the stratified probability matching method show that the difference in income between the group of 167 borrowing households and the group of 83 non-borrowing households is 158.321 million VND/year at the significance level of 1%. For the central matching method and the interval matching method, the disparities are 159.226 million VND/year and 159.366 million VND/year, respectively. Thus, it can be concluded that farm households who borrow capital from the livestock and crop conversion support program use their loans effectively, contributing to increasing the households' income. Therefore, the capital from the support program has a positive effect on the income of farm households. In other words, participation in the livestock and crop conversion support program has contributed to stabilizing and increasing the income of farm households in Chau Thanh A district, Hau Giang province.

## 5. Conclusions

This study evaluates the impact of the livestock and crop conversion support program (Project 1000) on farm household incomes in Chau Thanh A district, Hau Giang province. Utilizing data from 250 farm households, the research employs a probit regression model to identify key factors that influence these households' ability to access capital from the program. Additionally, the study uses the PSM method to assess the program's impact on household income.

Key findings from the survey of 250 households indicate that 167 households have successfully accessed credit through the program, which they use to enhance their farming and livestock operations. The support program has been effective in providing access to necessary capital and has continually improved its operations to meet its objectives, including helping households increase income and improve living standards.

The probit regression results reveal that gender, age, and land size significantly affect the ability to access capital, with gender and land size negatively impacting access, while age shows a positive effect. However, factors such as education level, number of dependents, agricultural training, total assets, and total production costs did not show a significant impact on access to capital.

Furthermore, PSM analysis shows a significant difference in income between households that borrowed and those that did not, with a difference of approximately 159 million VND/year at a 1% significance level, underscoring the positive impact of the support program on household income.

Despite these findings, the study acknowledges limitations such as the small sample size and the geographical focus restricted to one district. It also does not delve into the reasons why some households opt not to participate in the program.

Based on these results, the study recommends several measures to enhance the efficiency of capital use within the program. These include the development of loan insurance products, more agricultural training courses, regular assessments of farm households' borrowing needs, and collaborations between the Farmer's Union, local government bodies, enterprises, and insurance companies to provide comprehensive support to participating households. These efforts aim to bolster the program's effectiveness in increasing farm household incomes and fulfilling broader social responsibilities.

## Compliance with ethical standards

## Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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