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THE WELFARE EFFECTS OF MICROFINANCE IN VIETNAM: EMPIRICAL RESULTS FROM A QUASI-EXPERIMENT SURVEY

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ABSTRACT

In this paper we analyse the effects of microfinance programs upon household welfare in Vietnam. Our analytical framework builds upon the rural household models of Singh *et al.* (1986) and Rosenzweig (1990). Data on 470 households across 25 villages was collected using a quasi-experiment survey approach to overcome self-selection bias. In our econometric analysis the welfare effects of microfinance are proxied using measures of household income and consumption. The empirical results indicate that participation in microfinance has a positive effect upon household welfare, with the size of the effect increasing at a decreasing rate as a household spends more time in the microfinance program.

Keywords: Microfinance, rural households, Vietnam, quasi-experiment survey, effectiveness, welfare.

1. INTRODUCTION

Microfinance refers to the provision of financial services to the poor. In the last thirty years, it has emerged from a grassroots movement to a global industry with about 70 million clients in 40 countries (Harris, 2005). In Vietnam, microfinance is also an important component of poverty reduction programs despite this it only started in the mid 1990s after the launch of the economics renovation policy. Improving the efficiency and effectiveness is the main challenge of microfinance in order to serve more clients on a sustainable basis. This has motivated us to conduct a study on the efficiency and effectiveness of the microfinance sector in Vietnam. The main objective of this research project is to provide policy applications and to improve the contribution of microfinance to poverty reduction. The efficiency analysis is conducted using the production frontier approach with data collected from the survey of microfinance programs. The result revealed that the main source of inefficiency of microfinance programs was due to their small operation scale. In order to be able to further develop for this sector, it is necessary to analyse the effectiveness of microfinance in poverty reduction.

This paper, which is a part of the above-mentioned research project, examines the effects of microfinance services on welfare of member households using econometrics techniques with the data collected from a quasi-experimental survey at the household level. The objective of such a survey design is to control for the self-selection issue. Our results revealed that access to microfinance created positive effects on the income and consumption level of its clients but this relationship was not statistically significant. In addition, the marginal effect of microfinance decreased over time. The paper includes five sections. After this introductory section, Section 2 discusses an analytical framework of household production and the main channel that microfinance can create effects to household welfare. Section 3 describes the sampling design of the household survey, choice of variables and descriptive statistics. Results and discussions from econometrics estimates are presented in Section 4, while some concluding remarks made in Section 5.

2. THE ANALYTICAL FRAMEWORK

This section presents a model that can be used to illustrate the relationship between access to microfinance and household welfare. The model includes a presentation on main components of a representative household and the main channels in which microfinance may affect key household economics indicators, such as income and consumption. The model is based on the general model of Singh *et al.* (1986), Rosenzweig (1990) and Taylor and Adelman (2003), while the effects of financial services on household economic wellbeing are based primarily on the models of Maldonado (2004) and McKernan (2002).

2.1 HOUSEHOLD PRODUCTION AND UTILITY FUNCTIONS

In agricultural household models, households play the roles of both producers (represent by a production function) and consumers (represent by a utility function), hence, effects of any intervention such as microfinance services, need to be examined through both these functions.

2.1.1 Production function

Let us consider a rural household that acts as both producer and consumer while remaining in contact with the outside economy by purchasing inputs, labour, capital; and selling outputs, services, labour and deposit savings. The production activities of the household at period *t* are conducted by using labour (L_t), capital (K_t), land (N_t), and other inputs including purchased and home inputs (X_t), to produce output (Q_t). All components of the household production can be affected by exogenous shocks ε_t (e.g., weather, pests), which are assumed to have a normal distribution and affect household production multiplicatively.

$$Q_t = f(L_t, K_t, N_t, X_t : \varepsilon_t) = f(L_t, K_t, N_t, X_t)\varepsilon_t \quad (1)$$

Although in rural Vietnam most households primarily use home labour, the labour market is normal and the use of hired labour is possible. The production function

(1) allows the transition of hired labour (L_{ht}) into the family production activities, and family labour into the local labour market during the off-season period.[1] The stock of family labour (proxied by workable hours of all labour in the family) may be influenced by some quality factors, such as health status (i.e., physical fitness, human capital, and social capital).[2] For example, households having good health and a skilled labour force are likely to have higher productivity. Likewise, households with well-connected networks of social relations (e.g., friends, clubs, and organisations) may have a chance to improve production through better information and other privileges shared among network members. The family labour stock (L_{ft}) includes time spent on production within the household (L_{Qt}), time spent on waged employment outside the household (L_{wt}), time for housework (L_{zt}),[3] and leisure time (L_{lt}).

$$\begin{aligned} L_{Qt} &= L_{ft} - L_{ht} \\ &= L_{ft} - (L_{wt} + L_{zt} + L_{lt}) \end{aligned} \tag{2}$$

The capital stock used in production may be divided into financial capital and physical capital. The physical capital stock is a function of the existing stock (depreciated) plus the value of investment in the past period. Therefore, the equation for physical capital stock is presented in (3), where δ is the depreciation rate and I_t is the investment level in period *t*.

$$K_{t+1} = (1-\delta)K_t + I_t \tag{3}$$

The financial capital of household includes cash in hand, savings and funds mobilised from external sources. With the availability of special financial services such as NGO microfinance programs (NMPs), eligible households may decide to join the program and demand an amount B_t to invest on indivisible projects.[4] The financial capital

[1] It is assumed that household and hired labour is perfectly substitutable, and hence, the same wage rate (w_t) is applied for labour in this model.
[2] These factors also affect hired labour but the household has no control over them.
[3] The amount of housework is expected to be related to some indicators of family composition, such as dependency ratio (i.e., households with more dependents would need more time for housework).
[4]The demand for funds includes external credit and internal mobilisation by changes in physical assets (e.g., sales of livestock, land), financial assets (e.g., withdrawal of savings), and hence, it partly reflects the livelihood strategy of rural households. However, evidence of exchanging physical capital and durables for

stock of households can include endowments, borrowed funds, savings and retained earnings. Therefore, the evolution of household financial capital stock (F_t) can be represented in equation (4), where r_t is the interest rate of financial stock from period t to period t+1; Π_t is the profit, E_t is the endowment, R_t is the remittance, C_t is the consumption, and I_t is the investment in period *t*.

$$F_{t+1} = (1+r_t)F_t + \prod_t + E_t + R_t + B_t - C_t - I_t \quad (4)$$

The profit of households is measured as the total revenue minus total costs. The total revenue consist of the revenues from production (i.e., the product of home output, Q_t, and its price, P_{Qt}); income from waged labour (i.e., the product of wage rate, w_t, and outside work hours, L_{wt}); and the earnings from savings and/or other financial assets (i.e., provided by the product of saving interest rate, r_{St}, and the saving volume, S_t). Total costs include spending on hired labour (i.e., the product of wage rate, w_t, and hired labour, L_{ht}); purchased inputs (i.e., a product of the input set, X_t, and its price, P_{Xt}); the rent and/or tax on production land (i.e., a product of land rental rate, a_t, and the area of net land exchange N_{nt});[5] and the cost of loans and/or other financial liabilities (i.e., proxied by the product of the loan interest rate r_{Bt} and the loan volume B_t).

$$\prod_t = (P_{Q_t}Q_t + r_{St}S_t + a_t N_{nt} + w_t L_{wt}) - (w_t L_{h_t} + X_t P_{Xt} + r_{Bt}B_t) \quad (5)$$

The market for productive land in Vietnam, where land is state owned, is still imperfect. The government assigns production land to households equally according to the size of households giving a Land-used Certificate (LUC), allowing households to have the right to that land for a particular period, such as 30-50 years. Households can rent or transfer the LUC only if they move to other areas, change occupation, or lack production ability, but there is no mention about the sale of land (The Government of

funds is rare in this study. Hence, in this model the demand for funds includes external credit only. For more details about demand for funds, see for example, Iqbal (2004).

[5] For simplicity, assume that rate for the rented-in and rented-out of land is the same, at a_t. The net land exchange is equal to the area allocated to households (N_{at}) minus any land rent out (N_{rot}) plus any land rent in (N_{rit}), in other word $N_{nt}=N_{at}-N_{rot}-N_{rit}$. When both land rented-in and land rented-out are present in a household, it is likely that household may swap land to make it more convenience for their production.

Vietnam, 1998). Therefore, land transactions are introduced in this model in the form of land rent-in and rent-out, although this may not be a common practice in rural Vietnam.

The input set of this model (X_t) is the combination of home inputs (e.g., manure and seeds) and purchased inputs (e.g., fertilizer and hybrid seeds). Traditionally, agricultural production does not need much in the way of purchased inputs, but with the development of new technologies, new inputs giving higher productivity became available, leading to same households making a switch from traditional inputs. Thus, the proportion of purchased inputs over home inputs can be used as a proxy for the production technology adopted by households.

The components of the production function (i.e., physical, financial, social and human capital) in a household are transferable during the production process. For example, the relative sizes of physical capital and financial capital can be determined by decisions such as liquidising physical capital into financial (e.g., selling machinery and livestock) or the accumulation of physical assets from financial assets (e.g., purchasing new equipment). Likewise, financial and physical capital can have a relationship with human capital through the consumption of food, education and health care services. For example, borrowers may invest a proportion of borrowed funds for production and use any remaining part to cover shortfalls in food consumption, which can result in the necessary level of nutrition needed for a productive labour force. The dynamics among these components may depend on factors such as the size and timeframe of the investment, household characteristics (e.g., demographical factors of household heads and other labourers in the household, number of dependents) and other unobservable characteristics of the household, such as risk attitude and entrepreneurial skills. We can describe the way in which households make decisions on optimal ways to develop physical capital, financial capital, social capital, and human capital and using a utility function, such as that described below.

2.1.2 Utility function

We assume that the main goal of households is to maximise the level of utility, resulting from the consumption (C_t) of home produced goods (Q_{ht}), market purchased goods (Q_{mt}), and leisure (L_{lt}). The consumption of goods and services, and the allocation of time for leisure are expected to be affected by a set of exogenous household characteristics θ_t (e.g., household size and dependency ratio). For example, households with small children may not be interested in choosing long distance travel as a leisure activity. In the microfinance programs under this study, certain components of the vector, θ_t, such as gender and wealth status, were set as the eligibility criteria for membership. Assuming that the timeframe in which the household operates is from period 0 to period T, the life-time utility of a household is the total of present-value instantaneous utility with functional form υ_t in each period, discounted by α and the expectation E_t conditional on the information available at time *t*, is presented in equation (6).

$$U = E_t \sum_{t=0}^{T} (1+\alpha)^{-t} \upsilon_t (C_t, L_{lt}; \theta_t) = E_t \sum_{t=0}^{T} (1+\alpha)^{-t} \upsilon_t (Q_{mt}, Q_{ht}, L_{lt}; \theta_t) \quad (6)$$

The level of consumption is decided by the total budget available for consumption. Particularly, the budget for households to purchase market goods and services and the value of leisure time[6] are determined by the marketed surplus[7], the value of the net labour exchange[8], the net value of land exchange (i.e., $a_t N_{n_t}$), endowment (E_t), remittances (R_t) and borrowing (B_t), and the input costs ($P_{xt}X_t$).

$$P_{m_t} Q_{m_t} = P_{Q_t} Q_{n_t} + w_t L_{nt} + a_t N_{n_t} + E_t + R_t + B_t - P_{X_t} X_t \quad (7)$$

[6] The value of time spent on leisure and housework is based on the concept of labour income as the value of the household labour stock (2005).

[7] It is assumed that all products of households are tradable, and hence the marketed surplus is represented by the product of surplus home produce (i.e., total output produced minus home consumption $Q_{nt} = Q_t - Q_{ht}$) and the price of home output P_{Qt}

[8] The net labour exchange is represented by home labour spent in wage employment minus the hired labour working in family production (i.e., $L_{nt} = L_{wt} - L_{ht}$).

The household aims to maximise utility by choosing the appropriate combination of consumption and leisure in (6), given the production technology in equation (1), the time constraint in equation (2) and the budget constraint in equation (7). These latter two constraints can be represented by evolution equations of two state variables, physical and financial capital stocks, presented in the following optimisation problem.

$$\underset{D_t=(L_{wt},L_{ht},L_{lt},Q_{ht},Q_{mt},B_t,S_t,I_t)}{Max} \mathrm{E_t}\sum_{t=0}^{T}(1+\alpha)^{-t}\upsilon_t(Q_{m_t},Q_{h_t},L_{lt};\theta_t)$$

Subject to:

$$\begin{aligned} &K_{t+1}=(1-\delta)K_t+I_t \\ &F_{t+1}=(1+r_t)F_t+\prod_t+E_t+R_t+B_t-C_t-I_t \\ &F_{t+1}\geq F_0>0; K_{t+1}\geq K_0>0 \end{aligned} \tag{8}$$

The notation D_t in the above problem, represents the set of decision choices of a household on production and consumption factors. Meanwhile, the first constraint reflects the evolution of physical capital stock in equation (3), the second constraint is obtained by inserting equation (5) into equation (4), representing the evolution of financial capital. The third constraint is a common restriction that a household leaves physical assets and financial stock for the next generation no less than their positive endowments. Other factors only need a non-negative restriction, allowing them to move in or out of the system (e.g., households may decide to use all labour into waged employment or transfer all productive land to others).

The value of the maximised utility from the above optimisation problem is represented by an indirect utility function V_t in equation (9), with K_{t+1} and F_{t+1} following evolution equations (3) and (4), respectively.

$$V_t(F_t,K_t)=\underset{F_t,K_t}{Max}\{U(Q_{ht},Q_{mt},L_{lt};\theta)+(1+\alpha)^{-1}E_tV_{t+1}(K_{t+1},F_{t+1})\} \tag{9}$$

The decisions regarding optimal levels of production variables (e.g., capital, labour, land, inputs) and consumption variables (e.g., goods and services, leisure) are

solved by deriving the first order conditions of this indirect utility function with respect to the variables of interest. For example, the optimal loan amount is solved by differentiating equation (9) with respect to external loan as follows.[9]

$$V_t'(B_t) = (1+\alpha)^{-1} E_t\{V_{t+1}'(F_{t+1})\} = 0 \tag{10}$$

The expression presented in equation (10) shows that the household will borrow until the discounted marginal benefit of the loan is zero, or equivalently when the loan interest rate equals the value of the marginal product of the loan. In practice, households may not be able to obtain the optimal amount of loan funds due to credit rationing,[10] and hence, they equate the shadow price of loans (i.e., roughly equal to the loan interest rate plus transaction costs to borrowers) with the value of its marginal product. Regardless of equating the exogenous loan interest rate (or the endogenous shadow price) to the value of the marginal product of the loan, households select the loan size which allows them to get as close as possible to the optimal path. Therefore, the decision on optimal (or close to optimal) amount of loans will be depicted in a reduced-form function of market prices (for both consumption and production variables) and inputs as:

$$B_t^* = B_t^*(P_{X_t}, P_{m_t}, P_{Q_t}, L_t, K_t, N_t, r_t \mid \theta_t; \varepsilon_t) \tag{11}$$

Substituting B_t^* into equations (1), (5), (7) and (6), we can see that there is a relationship between credit and household income and consumption.

Using the first order conditions for decision variables, we obtain a system of equations where each endogenous decision variable is a function of all exogenous variables (e.g., land, capital, prices), and hence, the household decisions can be solved

[9] The choice of other decisions on production and consumption variables will be made similarly but this study focuses on analysing the decision on the demand for the financial input.

[10] In this study rationing refers to quantity-rationing since NMPs set the limit for loan size, which progressively increases with the seniority of members. For other types of credit rationing, see, for example, Maldonado (2004).

econometrically by reduced-form equations for the variables of interest such as financial input.[11]

2.2 ESTIMATING THE EFFECTS OF MICROFINANCE

As mentioned previously, there is a relationship between the decisions regarding the financial inputs and various indicators of household economic wellbeing, such as income and consumption. The effects of microfinance, therefore, can be estimated by comparing the outcomes of households with and without microfinance access, classified by the eligibility criteria θ_t[12] as in equation (12), where V^P_t and V^N_t represent the indirect utility of participating and non-participating households, respectively. The effects of microfinance can be measured by comparing the outcomes of participants and non-participants. That is, effects=V^P_t - V^N_t, where:

$$\begin{aligned} V_t^P &= V_t(B_t, K_t, L_t, N_t, P_{X_t}, P_{Q_t}, P_{m_t} \mid \varepsilon_t; \theta_t = 1) \\ V_t^N &= V_t(B_t, K_t, L_t, N_t, P_{X_t}, P_{Q_t}, P_{m_t} \mid \varepsilon_t; \theta_t = 0) \end{aligned} \tag{12}$$

The linkages and components of microfinance presented in the model above suggest that financial inputs (proxied by access to microfinance) can affect household economic wellbeing. Microfinance services can create effects on household economic indicators through four main channels, namely financial capital, physical capital, human capital and social capital. Other important determinants of household utility may include household size and composition, endowments, remittances, production technology and market prices.[13]

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[11] Another approach to solving for the household decision variables involves using optimisation models (i.e., maximise household objective function subject to a set of constraints). For more details about options to solve rural household models, see for example, Kuiper (1990).

[12] It is possible that some eligible households may choose not to participate in microfinance but the practical evidence among NMPs in this study indicated that very few households belong to this group.

[13] Fore more details discussions on the main pathways in which microfinance influences household welfare, see, for example, Marr (2002).

3. THE HOUSEHOLD SURVEY AND DATA

3.1 THE HOUSEHOLD SURVEY

The household survey in this study was conducted using a quasi-experimental approach, in which we sampled both eligible and ineligible groups of households from member villages and non-member villages that meet the selection criteria of microfinance programs. In order to make relevant control-treatment groups, villages and households were selected according to eligibility criteria, which are a set of observable characteristics.

The survey consists of two steps. In the first step we identified the pool of members and member-to-be villages by asking NMPs that planned to expand their operations and have been in operation for at least three years. Therefore, the primary sampling units (PSUs) are villages with microfinance and those eligible but have not yet received microfinance services. In the second stage, we constructed lists of eligible and ineligible households (i.e., strata) in each village, then households were sampled randomly from those lists (see Table 1).

Table 1: The Sampling Frame for the Household Survey

Villages that **meet** the selection criteria of microfinance programs (poor villages and lack of access to financial services)			
Have received microfinance services (Member or treatment villages)		**Have not received** microfinance services (Non-member or control villages)	
Eligible Households (Group 1)	Ineligible Households (Group 2)	Eligible Households (Group 3)	Ineligible Households (Group 4)

The household survey also applied a choice-based sampling technique (i.e., eligible households were over-sampled), which allows one to gain reliable data with least costs spent on data collection (Lancaster and Imbens, 1991; Imbens, 1992). With the available information on population of eligible and ineligible households, the conversion

to full population is straightforward using the sampling weight, which is the inverse of the probability of being sampled in each stratum (i.e., group).

3.2 CHOICE OF VARIABLES

The choice of variables selected for effectiveness analysis is summarised in Table 2. As can be seen, the welfare indicators focus on direct and expected household outcomes, namely income and consumption. The effects of the contribution of microfinance to household welfare will be identified by examining the relationship between the duration in microfinance and amount of loans received, after controlling for characteristics of households and villages.

Table 2: List of variables

Welfare Indicators • Household income • Income per person • Income per adult equivalent • Household consumption • Consumption per person • Consumption per adult equivalent	**Household characteristics** • Age of household head • Sex of household head • Household size • Number of labour • Dependent ratio • Education of labour (average education level of persons in the labour age) • Capital stock • Arable land • Shocks encountered
Microfinance Intervention • Eligibility criteria • Loans from microfinance • Months in microfinance	**Village characteristics** • Casual wage • Price of rice • Availability of grid electricity • Availability of paved road • Distance to township

3.2.1 Welfare indicators (Y_{ij})

As the ultimate goal of microfinance is to improve the livelihood of the economically active poor, the effects of microfinance should be measured by changes in the welfare of clients. Many variables can be used to measure a change in welfare, such

as income and consumption (proxies for economic wellbeing); education and health spending (proxies for human capital); and spending on social events (a proxy for social capital). The effects of microfinance analysed in this paper focus on economic indicators, including income and consumption per adult equivalent. In addition, the study examined microfinance effects on poverty reduction and some detailed welfare measure such as education level and health status.

3.2.2 Household Characteristics (X_{ij})

Household characteristics considered here include the dependency ratio, number of labourers, arable land, average education level of labourer, and age of household head. The dependency ratio is defined as the number of people outside the working age range divided by the number of people aged within that range (16-60 years). It is expected that households with a higher dependency ratio would have more difficulty improving their living standard. The number of labourers represents the production capacity since most production activities in rural areas are labour intensive. It is expected that a household with more available labour would be able to generate higher income, *ceteris paribus*.

The average education level of labour in a household is a proxy for the ability to learn and apply technologies in production. It is expected that households with a more educated labour force have the ability to generate a higher income and/or consumption level. Unlike previous studies, which selected only the education level of household heads, we argued that the education level of other members in the labour age may also affect household production.

The next variable is productive land, which also represents the capacity of households since most households surveyed were farmers. It is expected that households with more production land, *ceteris paribus*, would have a higher output volume and higher income. However, in rural Vietnam land was allocated by the government equally to individuals while the market for production land does not legally exist. Hence, the

average land variable may not be a significant determinant to household welfare as one would expect.

The age of the household head is selected as one household characteristic that may affect the performance of the household's economic wellbeing. Particularly, age of the household head and income or consumption may have a quadratic relationship (i.e., income generated by household heads and their family increase to a peak as their career develops then declines when they get to retirement age), hence the age of the household head should be squared. However, this argument may not hold strongly in rural Vietnam because it does not take into account the fact that parents often live in the same house with their children when they retire (i.e., their children will often be household heads) so that income from their children can keep the average household consumption smoothed. Therefore, we did not use the quadratic form of this variable as household heads will be concentrated in the labour age.

The household capital stock is also an important determinant of economic outcomes. It is expected that households with higher capital stock, especially non-residential capital stock, will be able to generate higher income. The main issue with capital stock measurement in rural households is the lack of proper accounting records, making it difficult for one to value the current capital stock of households. We proximate capital stock by consulting opinions of villager leaders and group of households on the value of key capital items, such as threshing machines and bullocks.

Shocks (e.g., illness, burglary, fire and loss of crops) could create considerable impacts on household income and consumption. Particularly, shocks can reduce current income, forcing a household to switch on a modest consumption level, which may lead to loss of productivity (e.g., due to poor health), and hence, reduced future income. Therefore, a shock dummy variable is recorded by asking if households have experienced any kind of shock within the 12 months prior to the survey period.

3.2.3 Village characteristics

The village characteristics that are likely to influence household welfare include the availability of electricity, road quality and the distance to a township. The available of electricity influence the ability of villages to apply labour saving techniques in production and in life. Likewise, road conditions have a great influence on the ability of households to trade with the outside world. It is expected that both electricity and road conditions have positive influences on income and consumption. The distance to a township is selected to capture the influence of location on household welfare. It is expected that villages located closer to a township will have easier access to a market place, and off-farm job opportunities (e.g., the proximity to a township can promote the production and welfare of households by making it easier to sell non-subsistence products, and to buy productive inputs), and hence, lead to higher income and consumption.

Prices of inputs and outputs may also influence the economic performance of households. In this study, the price of rice, which is the primary product of most rural households and a staple food in Vietnam, is selected. The wage rate for casual labour, which is a typical form of labour needed in rural Vietnam, is also selected. The effect of the rice price and casual labour wages on household income and consumption is not clear. If households sell rice and/or work as hired labour, then a rise in the prices will have a positive effect upon household income. Meanwhile, if households need to purchase rice and hire labour then a rise in prices would have a negative effect on household income.

3.2.4 Eligibility and treatment variables

The eligibility dummy variable (i.e., equals one for eligible households and zero otherwise), is a function of the unobservable characteristics that permits households to join microfinance programs, is expected to have a negative sign because microfinance targets poor households.

The choices of possible treatment variables include the amount of funds loaned and the duration of member participation in microfinance. The coefficient of the amount of loan received from microfinance measures effects per VND lent to households. One may argue that households also receive credit from other sources but money is fungible (i.e., one cannot recognise the contribution from microfinance loans and loans from other sources to household welfare), so total household loans should be used. This is a reasonable argument but one may face difficulty differentiating control and treatment groups as loans outside microfinance of all groups are very similar, especially in treatment villages. Apart from credit NMPs provide other financial services such as savings and other development activities such as literacy and health care, hence, using total loans will implicitly assume that there is no other effect from other integrated services. In addition, there are some practical difficulties in using loan volume. The outstanding loan is not perfectly relevant as it does not reflect the progressive lending policy of NMPs (i.e., due to high demand for fund and limited resources of donors and/or governments). Meanwhile, the cumulative volume of loans was difficult to obtain because rural households often did not keep neat financial records of previous years. Therefore, this study used the duration (i.e., number of months) that households are microfinance members as a treatment variable since it is easier to collect and reflect the progressive nature of microfinance effects.

3.3 DESCRIPTIVE STATISTICS

The means of the main variables show that some household characteristics are similar between the four groups. For example, the household heads surveyed share the characteristics of being approximately 40 years of age, completed secondary junior school (i.e., grade 7), having a family of five persons with two persons in the labour force. Other variables revealed that the majority of households owned their houses (the few exceptions are people who live in the houses of their parents); around two-thirds of

households own at least one television set (TV) and one-third own at least one motorcycle[14].

It is shown that all four groups use loans from external sources for their financial needs, whether or not they participated in microfinance programs. This suggests that this demand is a basic need of poor households. In addition, the amount of loans borrowed among the four groups was not differed significantly. The mean values of selected welfare indicators such as income and consumption are as expected, that eligible groups are poorer than those of ineligible groups. However, these indicators suggest that microfinance members are generally better off than non- members.

The means of main household welfare indicators also suggest that access to microfinance may create positive effects for its clients. For example, income and consumption of eligible households in member villages (i.e., Group 1) is respectively 18.8 and 16.56 percent higher than the relevant households in non-member villages (i.e., Group 3). The relative figures for income and consumption per adult equivalent are 13.53 and 13.86 percent. Since the total loans (from microfinance and other sources) of member households is 25.3 percent higher than that of non-member households, one may suggest that elasticity of microfinance to household welfare is small.

Some dummy variables, representing the characteristics of households (i.e., sex of household head, ownership of houses, and household accessories) are similar among the four groups. The only exception is the ownership of a TV, which differed among all four groups as well as between eligible and ineligible households. One possible reason for this difference may due to the lack of control for the quality of TV, and hence, the proportion of TV ownership does not reflect the differences in wealth of different groups.

[14] Rental property is almost a missing market in rural Vietnam because it is relatively cheap and easy to construct a rural shelter while land was allocated by the government. TVs and other housing accessories did not count for quality (e.g., TVs and motorcycles may be old and of cheap brands), hence, the households were not as “rich” as one may think.

Table 3: Means of main variables from the household survey

Variables	*Unit/Description*	*Total (n=471)*		*Group1 (n=237)*		*Group 2 (n=41)*		*Group 3 (n=164)*		*Group 4 (n=29)*	
		Mean	*Std.*	*Mean*	*Std.*	*Mean*	*Std.*	*Mean*	*Std.*	*Mean*	*Std.*
Age	Years	40.66	8.82	40.21	8.09	39.88	8.84	41.60	10.00	40.10	7.30
Education level	Years	7.13	1.89	7.19	1.77	7.24	1.85	6.96	2.08	7.38	1.76
Education of labour	Years	7.12	1.57	7.18	1.49	7.29	1.35	6.95	1.73	7.47	1.61
Household size	Persons	4.73	1.45	4.86	1.44	4.54	1.47	4.61	1.50	4.66	1.29
Number of labour	Persons	2.36	0.94	2.38	0.93	2.20	0.84	2.40	1.02	2.17	0.60
Dependent ratio	Dependents/labour	1.18	0.80	1.22	0.83	1.25	0.84	1.08	0.78	1.23	0.68
Land per capita	M^2/person	1200	481	1214	286	762	258	1270	625	1298	728
Number of loans	Loans	1.44	1.32	1.76	1.22	1.12	1.05	1.07	1.35	1.31	1.65
Total borrowing	VND'000	2888	3663	3163	3529	2246	2443	2525	3867	3603	4703
Household income	VND'000/year	13922	11057	14491	10298	18206	17818	12198	10125	12952	7749
Income per capita	VND'000/year	3070	2444	3071	2142	4326	4497	2780	2143	2931	1778
Income per adult equivalent	VND'000/year	4226	3327	4272	2995	5942	6262	3763	2708	4042	2423
Household consumption	VND'000/year	10817	7585	10847	5793	15746	12151	9306	8114	12159	6156
Consumption per capita	VND'000/year	2405	1589	2342	1276	3697	2985	2096	1271	2836	1815
Consumption per adult equivalent	VND'000/year	3307	2144	3244	1719	5086	4157	2849	1640	3901	2385
Household net income	VND'000/year	3104	8365	3645	9296	2460	10322	2893	6326	793	7224
Dummy variables											
Sex	1=male; 0=female	0.38	0.48	0.34	0.48	0.32	0.47	0.41	0.49	0.52	0.51
Profession	1=farmer; 0=others	0.94	0.23	0.94	0.24	0.90	0.3	0.95	0.22	1.00	0.00
Owned a house	1=yes, 0=no	0.95	0.22	0.95	0.21	0.98	0.16	0.93	0.25	1.00	0.00
Owned a TV	1=yes, 0=no	0.68	0.47	0.73	0.45	0.78	0.42	0.62	0.49	0.55	0.51
Owned a motorcycle	1=yes, 0=no	0.34	0.47	0.30	0.46	0.41	0.5	0.36	0.48	0.41	0.50

Note: Group 1=Eligible households in member villages; Group 2= Ineligible households in member villages; Group 3=Eligible in non-member villages; Group 4=Ineligible households in non-member villages.

The characteristics of the four groups of households surveyed were tested using the analysis of variance (ANOVA) for continuous variables. Since some variables such as income and consumption are highly skewed, the Kruskal-Wallis test for the differences in the median was also conducted for comparison. Some household characteristics such as sex and ownership of houses and household accessories are represented by dummy variables, and hence, the average value of these variables will be in the range between zero and one. Therefore, a test for differences between proportional variables among more than two groups was conducted (Table 4).

Table 4: Test for the equality of household characteristics (p-values)

Variables	*All groups are equal*		*Group1=Group3*		*Group 2=Group4*	
	Mean[i]	*Median*[ii]	*Mean*[i]	*Median*[ii]	*Mean*[i]	*Median*[ii]
Age	0.40	0.57	0.12	0.23	0.92	0.62
Education level	0.54	0.58	0.24	0.28	0.77	0.46
Education of labour	0.24	0.38	0.15	0.23	0.65	0.41
Household size	0.27	0.27	0.08	0.11	0.74	0.39
Number of labour	0.42	0.62	0.90	0.81	0.92	0.68
Dependent ratio	0.29	0.25	*0.07	*0.07	0.91	0.91
Land per capita	0.81	***0.00	0.86	***0.00	0.47	**0.04
Loans in 2003	***0.00	***0.00	***0.00	***0.00	0.55	0.89
Total borrowing	0.15	***0.00	0.09	***0.00	0.13	0.58
Household income	***0.01	***0.01	**0.04	***0.00	**0.05	0.32
Income per capita	***0.00	**0.03	0.24	***0.01	**0.02	0.39
Income per adult equivalent	***0.00	**0.02	0.13	***0.01	**0.02	0.46
Household consumption	***0.00	***0.00	**0.04	***0.00	**0.05	0.29
Consumption per capita	***0.00	***0.00	0.11	***0.01	**0.02	0.11
Consumption per adult equivalent	***0.00	***0.00	*0.06	***0.00	**0.02	0.12
Household net income	0.31	0.14	0.38	0.52	0.41	0.26
Dummy variables	*Proportion*[iii]					
Sex	0.15		0.14		0.09	
Profession	0.35		0.66		0.08	
Owned a house	0.36		0.37		0.40	
Owned a TV	**0.03		**0.03		**0.04	
Owned a motorcycle	0.24		0.16		0.99	

Note: Group 1=Eligible households in treatment villages; Group 2= Ineligible households in treatment villages; Group 3=Eligible in control villages; Group 4=Ineligible households in control villages. ***, **, and * indicates that the null hypothesis is rejected at 99 percent, 95 percent and 90 percent levels, respectively.

[i] ANOVA test is used to compare group means.

[ii] the Kruskal-Wallis tested is also conducted to compare group medians.

[iii] Proportion test for categorical variables (i.e., sex, profession, owned a house, owned a TV, owned a motorcycle).

Test statistics showed that there is no significant difference among four groups of households in main characteristics, including sex, age, and education level of household heads, household size, number of labour, dependency ratio, ownership of house and major household accessories. However, there is a statistically significant difference among four groups in terms of land per capita. For example, eligible households in member villages own 1,214 m^2 per person while the figure of ineligible households is 762 m^2 per person. One possible reason is that the non-member group in treatment villages includes some households with spouses who have off-farm employment, such as village school teachers, therefore, they were not allocated as much production land as other households.

The mean of the total household loans borrowed from all sources in 2003 are not statistically different among the four groups. However, the median test suggests that the total loans of households differ significantly, and such differences focus only on eligible households in member villages and those in non-member villages (i.e., Group 1 and Group 3). Since the skewness test suggests that the distribution of total loans was not normal, the Kruskal-Wallis test could be more relevant. The results of the median test on the total loan suggest that: a) microfinance has some contribution to the differences in household borrowing, and b) the sample of control groups (i.e., Group 2 and Group 4) are comparable.

Although in member villages eligible households were able to borrow more than ineligible households (i.e., from sources other than microfinance), in non-member villages ineligible households could mobilise much more credit compared to eligible households. One may argue that the availability of microfinance services improves the creditworthiness of members because it was observed that they were able to mobilise credit from other sources similarly to ineligible households in the same village.[15]

[15] The average loans from all sources of the two groups in the treatment villages were 3.163 and 2.246 million VND, respectively. Given the average amount of loans from microfinance is 0.767 million VND, it can be said that loans of these two groups mobilised outside microfinance programs were similar.

The test of the null hypothesis that mean/median or proportion of household characteristics and economic performance of the eligible groups (i.e., group 1 and group 3) and ineligible groups (i.e., group 2 and group 4) in the control and treatment villages are equal, also indicates that most characteristics of the two groups were not significantly different, except for the number of loans. This partly reflects the purpose-designed products of microfinance programs (i.e., small loans with many instalments to ensure ease of repayment and to screen out the rich). Household income and consumption levels of the two groups do differ at a 95 percent significant level, with the means of the economic indicators showing that member households were better-off than their non-member counterparts. The test statistics also suggest that the specially designed survey may reach the aim of providing a relevant comparison since most observable household characteristics in the control and treatment groups are similar.

The income and consumption data show a skewed distribution due to the presence of several rich households in the sample. This suggests that the Kruskal-Wallis test is more relevant when comparing the values of these variables among the four groups. The skewness of these variables also suggests that heterokedasticity may affect linear regressions. However, it is unlikely that the relationship between household outcomes and microfinance access has a linear relationship. One possible non-linear relationship of microfinance and household outcomes could be in the log form, reflecting diminishing returns of economic outcomes. The convenience of the logarithm transformation is that log-normal is one of the distributions that fits income data well (Singh and Maddala, 1976). In this study, the logarithm of income and consumption resembles normal distributions, and therefore, the heterokedasticity issue may not appear if the logarithm of income and consumption is used.

4. ECONOMETRICS ANALYSIS

4.1 SPECIFICATION OF ECONOMETRIC MODEL

One of the concerns with using the logarithmic functional form with our data is the presence of zero values for many variables such as duration in microfinance and

amount of loans. Traditional treatments, such as using an arbitrarily small number to replace zero values, violate the independence of measurement unit in regression analysis. In addition, in the case where zero values represented a significant proportion of the sample as in this study (i.e., all non-member households have zero values in microfinance participation), the above approach would lead to biased estimations of the parameters. Battese (1997) proposed a clever treatment with dummy variables so that the efficient estimation can be obtained without any bias. Applying this treatment to the data in our study, the effects of microfinance to household welfare can be measured in a reduced form equation as follows:

$$\ln Y_{ij} = \beta_0 + \beta_1 E_{ij} + \beta_2 D_{ij} + \beta_3 \ln T_{ij}^* + \beta_4 (\ln T_{ij}^*)^2 + \beta_5 X_{ij}^* + \beta_6 V_j^* + \mu_{ij} \qquad (13)$$

Where:

- lnY_{ij} is the log of household welfare indicators such as income or consumption;
- E_{ij} is the eligibility dummy variable, equal to one for eligible households (in both the control and treatment villages) and zero for ineligible households;
- D_{ij} is the dummy variable that takes the value of one for non-members, zero otherwise;
- $T_{ij}^* = \max(T_{ij}, D_{ij})$, where T_{ij} is the treatment variable (i.e., number of months in microfinance), and D_{ij}=1 if T_{ij}=0 and zero otherwise;
- $X_{ij}^* = \ln X_{ij}$ if $X_{ij}>0$ and $X_{ij}^*=0$ otherwise, where X_{ij} is a vector of household characteristics such as age, sex, education and labour;
- $V_j^* = \ln V_j$ if $V_{ij}>0$, and $V_j^*= 0$ otherwise, where V_j is a vector of village characteristics such as prices and infrastructure conditions;
- μ_{ij} is the idiosyncratic error term; and
- β_1, β_2, β_3, β_4 and β_5 are the parameters to be estimated.

In the above equation, parameter β_1 measures differences between eligible and ineligible households while β_2 measures differences between members and non-members. Parameter β_3 and β_4 measures the effects of microfinance upon its clients while parameters β_5 and β_6 represent the relationships between selected household and village characteristics and the selected welfare indicator.

The use of the eligibility variable E_{ij} and the results of basic tests suggest that the self-selection issue would be mitigated. Because most other observable characteristics were controlled, the parameter β_1 of the eligibility variable E_{ij} in equation (13) would capture unobservable characteristics that made eligible households decide to join microfinance programs. In addition, the ANOVA, Kruskal-Wallis and Chi-squared proportion tests show that the main characteristics of eligible households in the control and treatment villages were not statistically different. Since the control and treatment villages are neighbours, it is possible that the unobservable characteristics of these households are similar. In addition, observations in the field revealed very few households who were eligible but had not yet joined the microfinance program. Therefore, we expect that self-selection may not be a significant issue in this case.

4.1.1 Test for endogeneity and model specification

4.1.1.1 Endogeneity test

As mentioned previously, there is an endogeneity issue when analysing the effects of microfinance. The determinants of microfinance participation such as age, education level and asset level also determine the household welfare. The test for the endogeneity of microfinance participation is conducted by the Wu-Hausman test using the artificial regression approach. The advantage of this test is that it can avoid the popular non-positive definite problems associated with finite sample data (Baum *et al.*, 2003).

The test results for all household welfare indicators only ranged from 0.04 to 0.48, suggesting the null hypothesis (i.e., access to microfinance is exogenous) could not be rejected (see Table 5). The test results confirmed that the quasi-experimental survey has eliminated the self-selection issues since participation in microfinance is only available for eligible households. The exogeneity of access to microfinance services means that it is possible to use standard regressions (i.e., ordinary least squares, Tobit and Probit) in the effectiveness analysis.

Table 5: Test for endogeneity of participation in microfinance

Outcome variables	*Wu-Hausman test*	
	Test-statistics F(1,451)	*p-value*
Total income	0.040	0.841
Average income	0.040	0.841
Income per adult equivalent	0.044	0.833
Total expenditure	0.492	0.483
Average expenditure	0.492	0.483
Expenditure per adult equivalent	0.476	0.491

4.1.1.2 Model specification test

As mentioned previously, this study used a quasi-experimental survey approach to mitigate the possible biases in microfinance effect analysis due to the non-random program placement issue. Despite selecting relevant control and treatment villages with this specially designed survey, bias is only eliminated if the order in which eligible villages joint microfinance programs is random. If this is the case, the village characteristics specification of equation (13) can be estimated efficiently and consistently using ordinary least squares (OLS). If the order in which eligible villages receive microfinance services is not random, OLS may provide inconsistent estimates for equation (13) using village characteristics specification. The inconsistency is due to the possible correlation between the availability of microfinance (i.e., proxied by the treatment variable T_{ij} because almost all eligible households join microfinance programs) and the error term (μ_{ij}), which includes some unobservable village characteristics. If village V_j was replaced by a set of village dummy variables, representing a village fixed-effect model, it should capture all (observable and unobservable) characteristics within each village, leaving only random errors captured by μ_{ij}. Therefore, equation (13) will provide consistent estimates with the village-fixed effects specification, regardless of the order in which villages received microfinance services.

One concern with the village fixed effect model is that it may be inconsistent with censored dependent variables unless it has a large number of observations per fixed effect unit. Particularly, the Monte Carlo evidence provided by Heckman (1999)

suggested that with eight observations or more per fixed-effect unit, the inconsistency issue would be insignificant. In this study, the number of observations in each village vaied from 15 to 20, which is ample for fixed village-effects models.

The Hausman-like specification test can be used to determine whether T_j and μ_{ij} are correlated. The test statistics, which have a χ^2 distribution, are calculated as $(\beta_{FE} - \beta_{VC})' (\Sigma_{FE} - \Sigma_{VC})^{-1} (\beta_{FE} - \beta_{VC})$,where β_{FE} and Σ_{FE} are the coefficients and subset of the covariance matrix of the fixed effect model; β_{VC} and Σ_{VC} are the matching set of coefficients and the respective subset of the covariance matrix of the village characteristics model. If the null hypothesis of no correlation between the error terms and the regressors is rejected, the fixed effect model is preferred.

Applying the original Hausman specification test to the data revealed that the difference of the covariance matrix of the two models is not positive definite, and hence, the test statistics are undefined. This issue is quite common in empirical research with finite samples, and could violate the assumption that one estimator is asymptotically efficient. This issue was overcome using the generalised Hausman test proposed by Weesie (1999) and extended by Creel (2004), who directly calculated the covariance matrix of the two alternative estimators using generalised method of moments with the combined moment conditions.[16] With the survey data, the generalised Hausman test is equivalent to the adjusted Wald test for the equality of common estimators between the village-fixed effects and the village characteristics models.[17] If the common parameters of the two models are similar, we can argue that the village characteristics models be preferred as it can examine other determinants of microfinance effectiveness such as prices, location and infrastructure. The test results revealed the null hypothesis (i.e., the common coefficients of two models are similar) was rejected for all household welfare

[16] More details, see Weesie (1999) and Creel (2004).

[17] In particular, the Wald statistics is adjusted as $(d-k+1)W/(kd) \sim$ F (k, d-k+1), where W is the standard Wald statistics, *d* is the total number of PSUs minus the number of strata; *k* is the dimension of the hypothesis test. In this study, we have 25 PSUs (i.e., villages) with two strata (i.e., eligible and ineligible households) in each village, hence the total PSUs is 50, and *d*=50-2=48. The dimension of the hypothesis *k*= 16, which equals the numbers of common coefficients of the two models. Therefore, the adjusted Wald test statistics is defined at F(16, 48-16+1)=F(16,33) (Korn and Graubard, 1990; Stata Corporation, 2003, p.97).

indicators (see Table 6). Therefore, the village fixed effects model is preferred because it has the ability to produce consistent estimates.

Table 6: The generalised Hausman specification test

Welfare indicators	*Test-statistics: F(16,33)*	*p-value*
Total income	2.460	0.014
Average income	2.460	0.014
Income per adult equivalent	2.450	0.014
Total expenditure	3.240	0.002
Average expenditure	3.240	0.002
Expenditure per adult equivalent	3.250	0.002

4.2 EFFECTS OF MICROFINANCE

This section presents the empirical results on the effects of microfinance on income and consumption of households, and poverty reduction.

4.2.1 Effects on household consumption and income

Effects of microfinance services on income and consumption per adult equivalent was analysed using village fixed-effect regressions, taking into account components of the survey design (i.e., sample weight, PSUs, strata). Regressions with survey data differ from standard regression in several ways. For example, sample weight was used to estimate parameters of interests so that the coefficients of survey estimates will be the same as those obtained from weighted least squares. However, the main difference between the survey regressions and standard regressions is the estimation of variances of the estimates. Regressions with survey data compute variance of the estimators using two main approaches, namely Taylor linearization (Huber, 1967; Kish, 1995), and through replication techniques such as balance repeated replications (Kish, 1969), balance half-sampling (McCarty, 1969), Jackknife (Krewski and Rao, 1981), and bootstrap (Rao and Wu, 1988). Comparison of alternative methods to calculate variances in survey analysis conducted by Kish and Frankel (1974) and Shao (1996) showed little difference. Therefore, we used the Taylor linearization approach because it is less

computational intensive and able to produce robust estimates using the sandwich variance method.

Microfinance effects on income and consumption per adult equivalent using village fixed effects model are presented in Table 7. It can be seen that the log of duration (i.e., number of months in microfinance) suggested that NMPs created positive effects on income and consumption of member households. Effect on income is larger than that on consumption, suggesting that most member households concentrated more on improving income than consumption. One reason for this is that most NMPs surveyed, encouraged loans for production rather than consumption. In addition, the regular practice of savings through compulsory accounts may make member households more cautious about increasing consumption.

Table 7: Effects of microfinance on income and consumption

Independent variables	*Income per adult equivalent*		*Consumption per adult equivalent*	
	Coef.	*t-ratio*	*Coef.*	*t-ratio*
Log of duration	0.185	0.241	0.072	0.080
Log of duration squared	-0.035	-0.329	-0.009	-0.071
Participating villages	0.241	1.243	0.281	1.332
Eligible households	-0.116	-1.324	***-0.455	-4.221
Log of dependency ratio	0.054	0.961	0.044	0.978
Log of household size	***-0.432	-3.811	***-0.513	-4.655
Log of land	***0.255	4.898	***0.162	5.104
Log of capital	***0.270	5.380	***0.132	2.455
Log of labour education	***0.366	2.898	***0.275	3.303
Log of age	***0.395	2.713	***0.405	4.324
Female-head households	*-0.134	-1.690	**-0.144	-2.187
Shock	-0.076	-0.880	0.036	0.619
No dependent dummy	0.202	0.805	0.110	0.468
No land dummy	***1.204	3.269	0.292	1.011
No duration dummy	0.229	0.168	0.078	0.047
Constant	1.430	0.907	**4.112	2.306
R-squared	0.544		0.631	

*Note: ***, **, and * represent 99, 95 and 90 percent significant level, respectively. Village dummies were dropped to reserve space. Variables with zero values are treated using the approach of Battese (1997) .*

The estimated coefficients, which represent elasticities in this log-log regression, suggest that a ten percent increase in microfinance duration lead to increase in income and consumption of 1.85 and 0.72 percent, respectively. Since the mean of duration in microfinance is 50 months, a 10 percent increase in duration (i.e., 5 months), lad to an increase of income per adult equivalent of 1.85%* 4,266 = VND 78,921 (about $US 5.0), while the relative figure on consumption per adult equivalent is 0.72%* 3,161=22,759 VND (about $US 1.5).[18]

The sign of log of duration squared is negative on both the income and consumption sides, suggesting that the marginal effect of microfinance decreases over time. For example, the marginal effect of income $\frac{\partial \ln Y}{\partial \ln t} * \frac{t}{Y} = 0.185 - 2 * 0.035 \ln t$, where *t* is the number of months in microfinance, and *Y* is income per adult equivalent. Since t and Y are positive, this suggests that when the duration in microfinance equals $e^{(0.185/2*0.035)}$=14 months, the marginal effect will be zero. One possible interpretation is that the contribution of microfinance services concentrates more on smoothing rather than increasing the income and consumption levels.

One reason for the modest contribution of microfinance is its relatively small size, compared to the total income or asset of household. The average loan size from microfinance programs is VND 700 thousand, accounting for only 5 percent of the average household income (i.e., VND 14.5 million) of member households. Therefore, significant contribution of microfinance to household income may be an ambitious expectation.

The eligibility dummy variable has a positive sign while the sign of the participating village dummy is negative, suggesting that participating villages have a higher average income while eligible households have lower levels of income and consumption. Due to the dummy nature of these variables, they can be interpreted as the percentage of difference between the two groups separated by those dummies, after

[18] The mean of income and consumption per adult equivalent of member households is 4.3 and 3.2 VND million per year, respectively.

controlling for household characteristics. For example, the average log of income per adult equivalent in participating village is 24 percent higher than that of non-participating villages. Meanwhile, the log of income per adult equivalent of eligible households is, on average, 11.6 percent lower than that of ineligible households.

The magnitude of the eligibility dummy variable is larger (in absolute values) on the consumption side, suggesting that eligible households have more modest consumption bundles despite their income being not be too far behind other households. This finding supports the theory that the poor are more risk-adverse, and hence, eligible (i.e., poor) households in microfinance programs may apply a more modest consumption bundle to save some resources as a precaution. However, squeezing consumption too much may dampen future income due to a decrease of productivity (i.e., ill heath, malnourished) and lack of investment, making most of the poor trapped in the circle of poverty.

Income and consumption per adult equivalent was lower for households with a high dependency ratio and larger household size as the log of dependency ratio and household size have negative signs. Since the dependency ratio was defined as the ratio of dependents over labourers, households with a high dependency ratio may have relatively lower labour productivity as more time and resources are required to serve their dependents. Since the household size is positively correlated to the number of labourers, we dropped this variable to avoid mitigating the effects of colinearity, but household size can be used as a proxy to examine the contribution of labour.[19] Therefore, it was surprise that households with more labour have a lower income and consumption per adult equivalent. However, at the household level household size, and hence, labour have positive and significant contribution to income and consumption as expected. One possible reason for this behaviour may due to the diminishing marginal return to labour, hence, households with more labour can achieve a higher production level but the

[19] The correlation coefficient between labour and household size is 0.5 with a 99 percent significant level. We tried to include both variables and the result was that both were insignificant while it was significant when dropping one variable. We kept household size since it can be used as a proxy for household production scale, especially when some dependents are mobilised in production activities.

average output may decrease. In addition, agricultural production is highly seasonal, thus the average return may be lower for large families when it is difficult to find off-season employment.

The coefficient of production land is significantly and positively related to income and consumption, confirming that land is the primary input of rural households. Since most rural households are involved in agricultural production, it is reasonable that having more land could generate higher income and consumption. The magnitude of this variable is relatively high, and is only slightly less than that of physical capital but it still shows an inelastic response to income and consumption. In particular, a one percent increase in production land can lead to 0.26 percent increase in income and 0.16 percent increase in consumption per adult equivalent. One possible reason for the modest responses of the production inputs to income and consumption may be due to the lack of knowledge of how to exploit inputs effectively.

One important input for rural households was physical capital[20], which have positive and significant effects on per adult equivalent income and consumption. One possible reason is that physical capital is a production input, and hence, its contribution income more direct than that to consumption. Despite the magnitude of the physical capital was higher than that of production land, it remained quite inelastic as a one percent increase in physical capital lead to only a 0.27 percent increase in income per adult equivalent. One possible reason may be due to the relative small production scale of rural households in Vietnam, hence, machinery may be under utilised.

The two proxies for human capital, namely the average education of labour (representing knowledge), and age of household heads (representing experience) have a significant and positive contribution to income and consumption of households. The positive contribution of labour education suggested that households with a more educated labour force may have a higher capacity or ability to learn and apply new skills, which

[20] The physical capital in this study is measured by the estimated current value of production equipment (e.g., oxcart, tractor, threshing machine, and shed), livestock (e.g., bullock and sow), and transport means (e.g., motorcycles and bicycles). The evaluation of capital stock was conducted by counting capital stock items at the household survey and price information collected from the survey with village heads.

can lead to an improvement of income and consumption. The positive coefficient of the age variable is also explainable since the average age of a microfinance member in this study is 40, which is around the middle of the most productive age.

The dummy variable for female head households has negative and significant coefficients, which is as expected since those are often disadvantage households such as single mothers, widows, divorcees or households with males employed frequently in off-farm activities. Female headed-households often lack sufficient labour, an important input for most agricultural production activities.

The shock dummy variable is not significant although its signs (i.e., negative on income and positive on consumption) are as expected. Households suffering a shock within 12 months of the survey seem to have a reduction in income and an expansion in spending (although not significant and with a small magnitude). This suggests that the nature of most shocks resulted in a sudden increase of spending such as increasing medical bills due to sickness or reinvestment in failed projects. Although these shocks also lead to a reduction of income, its significant effects on income may take a little while to occur (i.e., this survey only covered income and consumption in 2003 while shocks in this year may lead to reduction of income in 2004). Another possible reason is that most households encountered minor shocks, which create insignificant impacts to income and consumption.

It is expected that the Battese (1997) dummy for households with no dependents received a positive sign since they have more labour with a possible higher productivity to generate more income, and hence, to enjoy a higher level of consumption. However, it is against our expectation as households with no production land have a higher income and consumption per adult equivalent. One possible reason is that households with no arable land did not participate in agricultural production but focused

on non-farm activities such as small trading and services, which often have a higher and more regular cash return than small-scale agricultural production[21].

The dummy for households that did not participate in microfinance programs was positive but it did not have much intuitive interpretation. In essence, it represents the average income and consumption of households in non-participating villages (both eligible and ineligible) together with ineligible households in member villages. Therefore, the result of the averaging is uncertain since ineligible households are often wealthier while eligible but not participating households are generally poorer.

We also examined effects of microfinance on main consumption items, including education, food, health care, entertainment and social affair (e.g., donation to charities and purchase gifts for weddings). The results showed that participating in microfinance increased spending for education, food, entertainment and social affairs but the spending on health care decreased.[22] Since health spending in this study referred mainly to the purchase of medications and payments for doctor visits, a decrease of this item could be interpreted as having better health. Although none of the relationship between access to microfinance and major consumption items was statistically significant, it still showed a positive picture that microfinance services may create desired effects on household welfare (see Table 8).

Other important determinants of these consumption items are household size, education of labour and the age of household heads. In particular, larger households seem to have higher spending on essential items such as food, education and health care but more restrictive on luxury items such as entertainment. The physical capital also provides an interesting interpretation in that the relatively richer households pay more attention to entertainment rather than education.

[21] To sketch the production scale of households in this study, recall that the arable land per person was only 1200 square meters, on average.

[22] These consumption items were only estimated at the household level because we know in advance that some items were only consumed by certain groups (i.e., education spending were often for children while social affairs spending are mainly for men) but the survey did not collect detailed information on gender by age groups.

Table 8: Microfinance Effects on main consumption items

Variables	*Education*	*Food*	*Health*	*Entertainment*	*Social affair*
Log of duration	1.927	0.648	-0.833	4.381	0.142
Log of duration squared	-0.178	-0.096	0.162	-0.604	-0.043
Eligible villages	***1.879	**-0.346	*1.115	***3.045	***2.469
Eligible households	0.137	***-0.436	***-0.932	-0.636	-0.461
Log of dependency ratio	***0.695	-0.006	0.231	*0.454	0.033
Log of household size	***2.127	***0.299	*0.860	-0.764	0.065
Log of capital	0.050	*0.068	0.224	**0.846	0.040
Log of labour education	***1.877	0.137	***0.869	-0.275	0.519
Log of land	*0.298	0.052	0.078	0.243	***0.369
Log of age	1.305	***0.383	-0.131	***1.697	***1.519
Gender	0.003	-0.037	**-0.921	-0.761	-0.385
Shock	-0.249	0.099	***1.096	0.331	-0.052
No dependent dummy	1.052	-0.011	1.517	1.548	0.335
No land dummy	0.690	0.203	0.381	-2.720	-0.034
No duration dummy	5.227	0.928	-1.597	7.782	-0.314
Constant	***-17.828	***4.719	-0.252	***-24.240	-4.619
R-squared	0.443	0.559	0.310	0.406	0.231

*Note: ***, **, and * represent 99, 95 and 90 percent significant level, respectively. Village dummy variables are not reported. Variables with zero values are treated using the approach of Battese (1997) .*

4.2.2 Effects on poverty reduction

The relationship between access to microfinance and incidence of poverty can provide additional useful information. Probit regressions are suitable for estimating effects of microfinance on the poverty status of households. In order to test for the sensitivity of findings with different choices of poverty lines, three measures of poverty, namely the national poverty line[23], the participatory wealth ranking (PWR)[24], and the international "one dollar a day" poverty line, are applied. It can be seen that the national

[23] At the time conducting this survey, the national poverty line was VND 100,000 per person per month for rural areas, which is about 20 US cents per person per day.

[24] This poverty line is measured in a relative sense with judgements from various criteria such as food sufficiency status, housing condition and amount of land. Generally, it may be a little bit higher than the national poverty line as NMPs tried to serve poor households ineligible for loans from the Vietnam Bank for the Poor (i.e., those under national poverty line).

poverty line covers the extreme poor, the PWR line is a little bit wider because it takes into account other aspects of poverty such as housing, and the international poverty line covers almost all households surveyed.

With the survey data pseudo likelihood estimators are used instead of true likelihood estimators, and therefore standard statistics like pseudo R-squared or likelihood ratio tests are no longer valid (Stata Corporation, 2003, p.28). In essence, the point estimate from the pseudo-likelihood estimators is a weighted log likelihood of the standard maximum likelihood approach. With survey data, the weighted likelihood is not the distribution of the sample, and hence, it is not the true likelihood.

Table 9: Microfinance and poverty incidence

Independent variables	*National poverty line (about $20 cents/day)*		*PWR poverty line*		*International poverty line ($1US/day)*	
	Coef.	*t-ratio*	*Coef.*	*t-ratio*	*Coef.*	*t-ratio*
Log of duration	-2.131	-1.062	*-3.615	-1.907	*5.264	1.711
Log of duration squared	0.359	1.160	*0.498	1.706	**-0.793	-1.965
Member villages	**-1.201	-2.053	-0.291	-0.298	-1.122	-0.117
Eligible households	0.305	0.897	**-0.691	-2.148	0.086	0.166
Log of dependency ratio	-0.157	-0.732	-0.038	-0.171	-0.205	-0.703
Log of household size	***1.018	2.339	-0.169	-0.506	***2.024	2.764
Log of land	*-0.363	-1.670	-0.030	-0.180	***-0.642	-3.244
Log of capital	***-0.426	-3.095	***-1.644	-6.743	***-1.662	-3.000
Log of labour education	***-1.199	-2.691	***-1.121	-3.030	-0.544	-0.997
Log of age	-0.554	-0.953	*-0.715	-1.842	-0.911	-1.112
Female-head households	*0.549	1.837	0.152	0.416	*0.982	1.660
Shock	0.120	0.382	0.182	0.791	0.226	0.546
No dependent dummy			-1.192	-1.196	-1.331	-1.020
No land dummy			-0.119	-0.086	***-3.510	-2.663
No duration dummy	-3.046	-0.909	***-7.796	-2.491	7.563	1.272
Constant	***12.738	2.376	***28.919	5.860	***22.726	5.598

*Note: The significant levels of the estimates are: ***, ** and * represent 99, 95 and 90 percent significant levels, respectively. Zero values are treated using Battese (1997)'s method. The dummy variables for zero values of the dependency ratio and arable land were dropped in the Probit regression with the national poverty line because of perfect multi-colinearity.*

Results of Probit estimates presented in Table 9 showed that the probability of a household being poor was reduced by length of the duration in microfinance when at the level of the national and the PWR poverty lines. In contrast, the probability for a household in the international poverty line increased significantly with the time in microfinance programs. A possible reason is that poor households (using the national or PWR poverty lines) may have improved their living conditions by accessing microfinance but the improvement still left them under the international poverty line. Therefore, the number of poor clients under the international poverty line increased significantly due to the raise in number of members in NMPs.

The log of duration squared of all three regressions suggested the expected behaviour that poverty reduction effects of microfinance services is decreasing over time while the rate that poor households shifted from local to international poverty lines was decreasing. Similar to the log of duration, this relationship was significant only when the PWR and international poverty line were used.

It is interesting that the dummy variables for member villages recorded an expected negative sign since poorer villages get a higher priority in receiving microfinance services. As expected, after receiving microfinance services the average poverty rate in member villages decreased. The negative and significant estimates on the eligible household dummy under the PWR poverty line is against the expectation as NMPs target poor households. This may be due to the subjective nature of the PWR poverty line, making it difficult to compare villages. Therefore, the average value of the PWR ranking across villages may not provide much intuitive interpretation. However, the national poverty line shows an expected behaviour that eligible households have a higher probability of being poor but this relationship is not significant.

The estimates for the dependency ratio and household size received counter intuitive signs. The negative sign of the dependency ratio suggests that those with a higher dependency ratio have less probability of being poor while households of larger size, which also mean having more labour, have a significantly higher chance of being poor unless evaluated by the PWR line. It is possible that small size households with workable dependents can organise their labour usage more efficiently, and hence, lower

the chance of being poor. Large household sizes, despite having more labour, may not be as efficient given the highly seasonal nature of agricultural activities and the shortage of off-farm employment opportunities in remote areas. In addition, the use of labour in rural households may be sub-optimal due to the difficulty of expanding the production scale by investing in new technologies or purchasing more land (e.g., poor households often lack sufficient capital for big investments while trading land is not a common practice in rural Vietnam).

Land and physical capital have strong and significant influences on the probability of being poor for households that are under all three poverty lines. However, the magnitude of physical capital is greater than that of production land, suggesting that having more land can be efficient in escaping extreme poverty but investing in physical capital is a better way to go above the higher-level poverty lines.

Other household characteristics such as education of labour, age and sex of household heads, and the exposure to shocks have expected influences on poverty reduction. The log of labour education suggested that households with a more educated labour force, *ceteris paribus*, can have a lower probability of being poor but this relationship was only significant at the national and PWR measures. The log of age of household heads suggests that households have less chance of being poor if they were headed by more mature persons but the significance was only at the PWR poverty line. The dummy variable for female-headed households also shows the expected positive sign for all three poverty measures as they are often disadvantage households. The shock dummy variable has a positive sign, although not significant, in all three measures of poverty. It is possible that shocks encountered by households surveyed, on average, are not big enough to create significant influences.

The Battese (1997)'s dummy variables for households with no dependent and no land suggested that these households have less chance of being poor under PWR and the international poverty line (it was dropped under the national poverty line because of perfect multi-colinearity). Despite the international poverty line being too high for many poor households to achieve, the significant lower probability of being poor under this line for households with no land may be possible. The reason for such a belief is that most of

the households with no productive land were involved in off-farm activities, which often generate much higher income than agricultural production. The dummy for non-participating households (i.e., duration is zero) suggest that they have a higher probability of being poor under international rather than the local poverty measures. However, this variable did not provide much intuitive interpretation since it is the average of the three groups that have not participated in microfinance programs.

5. CONCLUDING REMARKS

This paper has presented the analysis of the effects of microfinance on household welfare. An analytical framework was introduced to identify main factors that may influence microfinance effectiveness. Although there are still several ways to analyse microfinance effects, we choose the regression approach because it suited the time and resources and information available in this study. Particularly, we focus on analysing effects of microfinance to the household income and consumption. The analysis was conducted using a quasi-experimental survey, which aims to compare welfare of microfinance members with that of households of similar characteristics. The endogeneity test suggested that our quasi-experiment survey have made the access to microfinance exogenous, and hence, standard regression techniques can be applied. The generalised Hausman test, however, showed that the order in which eligible villages received microfinance may not be random, thus, a village fixed-effect model was preferable as it can provide consistent estimates regardless the order of receiving services.

The contribution of microfinance to household welfare was very modest. For example, a one percent increase in the duration of microfinance membership, *ceteris paribus*, leads to only 0.19 percent increase in income and 0.07 percent increase in consumption per adult equivalent. Perhaps, the small proportion of microfinance loans, compared with the total loans and total income of households, has constrained its contribution. A closer examination at main consumption items revealed that access to microfinance services has made the spending on education, food, and entertainment increase whilst payment for medications and doctors decreased.

There is also evidence that participating in microfinance has significantly contributed to the reduction of poverty using the national standard, which is about US 20 cents per person per day. However, a possible interpretation that poverty incidence increases with the duration of microfinance when the international poverty line is used although this finding is not statistically significant. One possible explanation for this behaviour was due to the modest contribution of microfinance to household income, it could not lift them over the international poverty line but it could be sufficient to help them get over the level of poverty under the national standard.

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