The Determinants of Poverty and Vulnerability in Small-scale Fisheries Communities in Vietnam

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Department of Economics

Faculty of Social Sciences, University of Ottawa

Submitted by Rui Yang (7273951)

To Gordon Betcherman

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Abstract

For the last two decades, Vietnam has achieved impressive progress in reducing the poverty rate, which is recognized as a major issue that has aroused the interest of researchers and policy-makers. Among all the various methods for detecting the determinants of poverty, the probit model is the most widely used one. The aim of this analysis is to find out the determinants of the poverty status at the household-level.

Detailed data from fishing communities in Vietnam has been used, and the conclusion that household structure, human capital and primary activities are main factors, has been drawn. Beside, a measurement of a vulnerability index is induced to further analyze the poverty problem. The analysis of vulnerability shows that whether one household is vulnerable to poverty depends on their primary activities to gain income and their location and the households with high vulnerability have an evenly possibility to be poor and non-poor, but those with relatively lower vulnerability are highly possible to be better off.

KEYWORDS: Probit model, Vulnerability index, Poverty, Small-scale fisheries

Introduction

One of the most visible characteristics of underdevelopment is poverty. By effectively taking away the rights to live in good health, to obtain adequate nutrition and to have access to education, poverty also destroys the expectations and hopes for the future as well (Ray, 1998). Therefore, poverty is also one serious problem facing the world. This problem is much more serious in developing countries rather than developed countries. For example, until 2011, there were still nearly 50 percent of people in Sub-Saharan Africa spending less than $1.25 per day, while the number in North America is under 5 percent[1].

Aiming to reduce the population in poverty, the poverty reduction strategies have been conducted. In order to improve the effectiveness of the policies, the determinants of poverty are needed.

Vietnam has made impressive progress in economic growth and poverty reduction in the 1990s and 2000s. Various former researches have provided a rich analysis about

[1] World Bank “http://data.worldbank.org/topic/poverty”

the determinants of poverty in the Vietnamese case. Besides, as Vietnam is a leading country in terms of the production of fisheries and aquaculture, the influence of fisheries on poverty should be taken into consideration when detecting the factors causing poverty and vulnerability.

The data used in this research is from the "Vietnam Fisheries Transition Survey", which provides information about 599 households in fishing villages in 3 districts (Phu Vang district, Tran Van Thoi district and Dam Doi district). The regression model is the probit model, with dummy variable of whether the household is poor or not being the dependent variable. After analyzing the determinants of poverty, the vulnerability index is introduced and the discussion about the difference between poverty and vulnerability is conducted.

There might be at least two reasons to focus on the determinants of poverty and vulnerability in small-scale fisheries communities. Firstly, this research provides a detailed analysis about the people making a living in the fisheries. Secondly, the discussion about the determinants of poverty and vulnerability also provides implications to the policy-makers.

The rest of the paper is organized as follows: the second part will be background information introducing the poverty in Vietnam; then the literature review will exhibit the previous research about the determinants of poverty and vulnerability; and the exhibition of methodology, data and some statistic characters will be the fourth part; the fifth part shows the empirical analysis; the final section will be the conclusion.

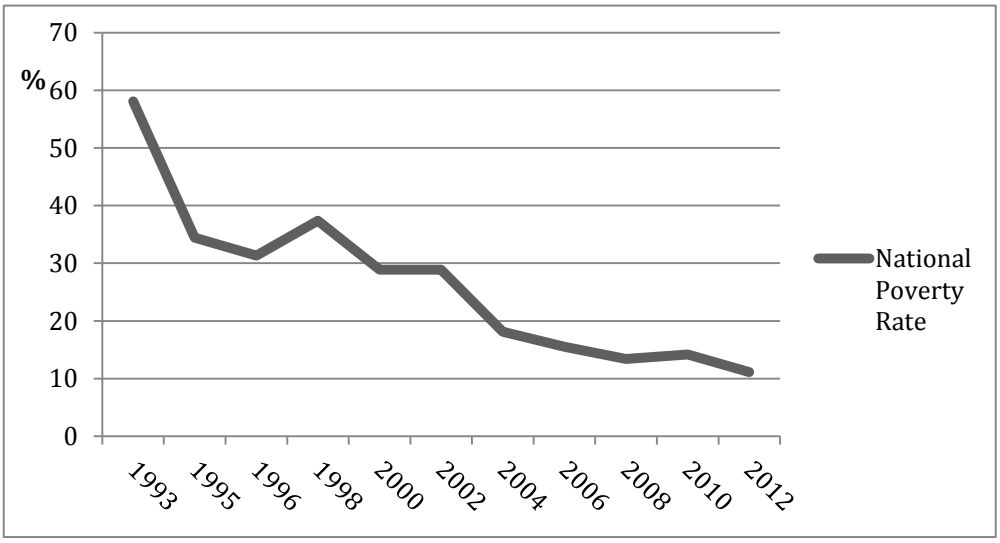
Background in Vietnam

1. Poverty in Vietnam—A Historical Perspective

In the past decades, Vietnam has achieved an impressive improvement in the field

of poverty reduction. The poverty rate[2] has fell from nearly 60 percent in early 1990s to 11.1 percent in 2012, which has translated to a dramatic change in the economic well-being of every Vietnamese.

Figure 1. National poverty rate in Vietnam form 1993 to 2012.



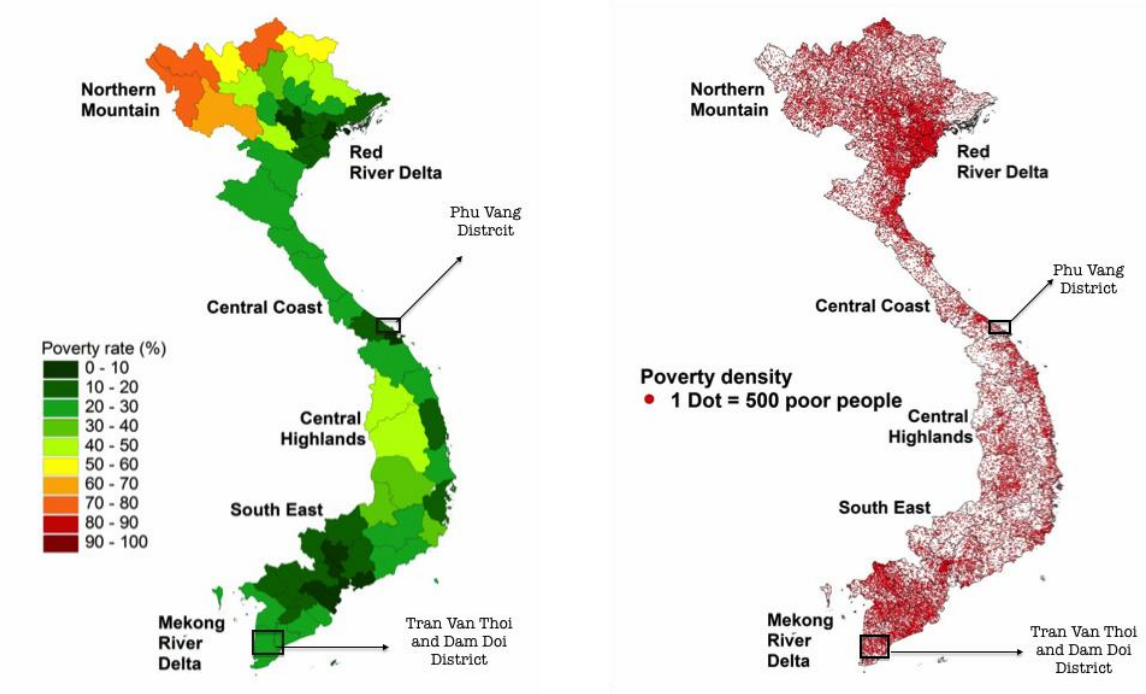
Source: General Statistics Office of Vietnam

However, concern has been raised as to the decreasing speed of the poverty reduction in recent years and the Vietnamese government has announced policies trying to effectively stimulate poverty reduction, which has been seen as being linked to better targeting. In response, the geographical map and small area estimations have been widely adopted to get a better understanding of the distribution of poverty.

Lanjouw, Marra and Nguyen (2013) analyzed the spatial distribution of poverty by province and district, based on the data form the 2009 Population and Housing Census and the 2010 Vietnam Household Living Standard Survey.

[2] The poverty rate here is headcount rate, headcount rate= $\frac{population\ of\ the\ poor}{total\ population}$

Figure 2. The poverty rate of province and the poverty density in 2009 (number of poor people)



Source: Lanjouw, Marra and Nguyen et al (2013)

Figure 2 shows the spatial distribution of poverty by using the headcount ratio by province and poverty density[3] in 2009. The mountainous Northern areas have the highest poverty rate and the poverty rate is the lowest in the Mekong and Red River Delta areas. Poverty density is much higher in the Mekong and Red River Delta areas than in other areas.

The districts involved in the "Vietnam Fisheries Transitions Survey" are Phu Vang district in the Central Coast area, Tran Van Thoi district and Dam Doi district in the Mekong River Delta area. Although the general poverty rates in Tran Van Thoi and Dam Doi districts are around 20-30%, there is a large number of people in poverty in the Mekong River Delta area as shown in Figure 2. Whereas, the poverty rate and amount of the poor population are both relatively low in Phu Vang district.

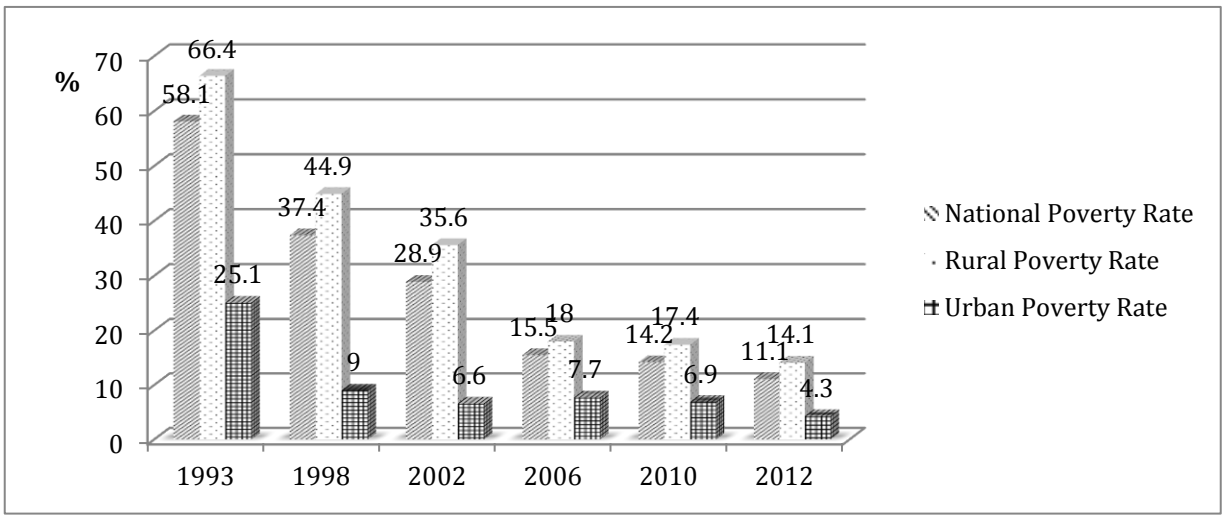
[3] Poverty density shows the population of the poor in one district, and here one dot in the figure 2 represents 500 poor people. Therefore, the more dots in one district, the more poor people in this district.

2. Characteristics of Poverty in Vietnam

2.1 Gap between the rural poverty rate and the urban poverty rate

Despite the impressive achievement of Vietnam in terms of poverty reduction, urban-rural poverty disparities are evident (World Bank 2011).

Figure 3. The national, urban and rural poverty rate of Vietnam (%) in 1993, 1998, 2002, 2006, 2010 and 2012.



Source: General Statistics Office of Vietnam

The figure exhibits that the gap between rural poverty rate and urban poverty rate has gradually narrowed. However, the rural poverty rates are still much larger than the urban poverty rates. In 2012, the rural poverty rate was almost four times as larger as the urban poverty rate.

Despite the gap between the rural and urban poverty rates, during the last two decades, the rural poverty rate has decreased nearly 80 percent, dropping to 14.1% in 2012.

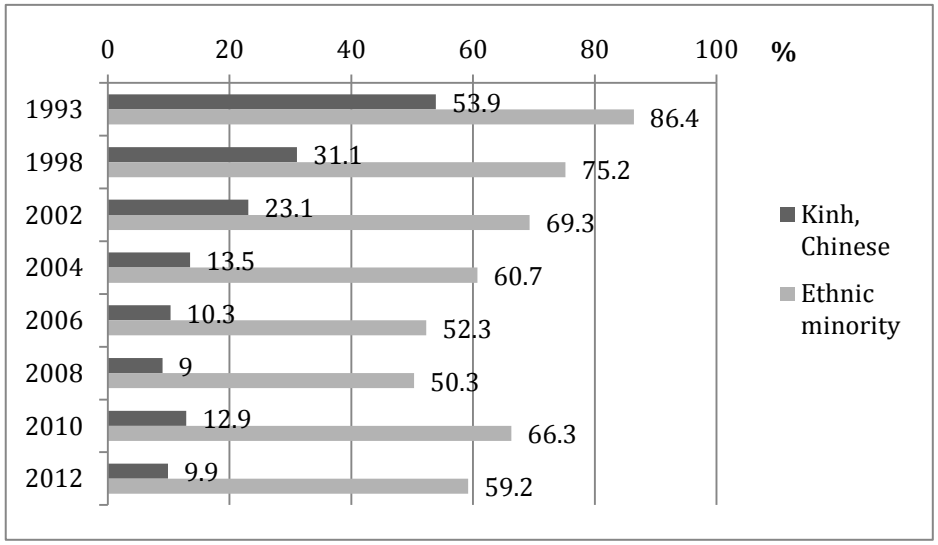
2.2 Ethnic Minority Groups are Vulnerable

Ethnic minority groups are the poorest people in Vietnam, and the poverty rates of ethnic minority groups are much higher than those of majority groups (see figure 4).

The major reason for this phenomenon is that most of the 53 ethnic groups in

Vietnam— except the Chinese and Kinh who are mostly urban-based – are located in the upland areas, which have the worst access to public services and lack basic infrastructure (Vietnam poverty analysis 2002).

Figure 4. Headcount rate of ethnic majority and minority in Vietnam



Source: Poverty and migration profile in 2012

3. Poverty Reduction Policies in Vietnam

Under the influence of the Doi Moi[4], or renovation policies, the economy in Vietnam has been liberalized both internally and externally, which largely transformed the economic structure in Vietnam and raised the household-level income, directly leading to the rapid reduction of poverty rate (World Bank, 2014).

Now, the government of Vietnam is still in the process of expanding the target to reduce poverty. Since 1999, this work has been undertaken jointly by the government, donor and non-government organization (NGO) members of the Poverty Task Force[5]

[4] Doi Moi is the economic reforms in Vietnam in 1986, with the goal of creating a "socialist-oriented market economy".

[5] The Poverty Task Force (PTF) is a Government-Donor-NGO forum for poverty analysis and strengthening the poverty focus of policy making and development planning in Vietnam

(PTF) to specify locally relevant versions of the International Development Targets and Millennium Development Goals[6] (MDG) 01(Vietnam Poverty Analysis 2002)

The latest specific polices to reduce poverty can be found in the Government Resolution No. 80/NQ-CP, dated May 19, 2011,which has as it`s targets that the average income per capita of poor households will increase 3.5 times; the rate of poor households will drop 2% a year, particularly 4% in poor districts and communes by poverty standards set for each period

The specific policies are as followings:

3.1 The poor's living conditions will be markedly improved, first of all in health, education, culture, daily-life water and housing; the poor will have increasing convenient access to basic social services;

3.2 Socio-economic infrastructure facilities in poor districts and communes and extremely disadvantaged villages and hamlets will receive concentrated and synchronous investment according to new-countryside standards, first of all essential infrastructure such as transport, electricity and daily-life water supply.

Literature Review

Previous empirical research analyzing the determinants of poverty tried to link the possibilities of being poor with such factors as education, disability, household structure, gender, ethnic and rural areas, etc. Haughton and Khandker (2008) argued that the infrastructure, good governance, economic, political and market stability all are important factors when analyzing the cause of poverty.

[6] The Millennium Development Goals (MDGs) are eight international development goals that were established following theMillennium Summit of the United Nations in 2000, following the adoption of the United Nations Millennium Declaration.

Aiming to understand the main determinants of poverty in Lao PRD, Andersson, Engvall and Kokko (2006) conducted an analysis based on a detailed household survey data and observed the conclusion that the household size, dependency ratio, education and access to agricultural inputs are all crucial factors explaining whether a household is poor.

Apart from the household and individual characteristics being influential factors of poverty, in Eritrea, the regional unemployment rate played a positive effect on the possibility of being poor, which illustrated that labor market policy would influence the poverty status of households (Fissuh and Harris, 1998). Thus the regional factors, such as the local development of one district, can dramatically affect the poverty status among the households in different districts. It is reasonable to take the location variables into consideration when analyzing the determinants of the poverty and the vulnerability.

By using the cross-sectional data drawn from 48 countries in Sub-Saharan Africa, the result from the research of Adeyemi, Ijaiya and Raheem (2009) suggested that inflation, the growth rate of population, the lack of safe water and the incidence of HIV/AIDS all have influenced the poverty headcount rate. This conclusion indicates that the macroeconomic factors would affect the poverty rate.

Particularly, though household structure, human capital, occupation are the most significant factors causing poverty, empirical analysis in Vietnam also scrutinized the influence of education, credit and ethnicity. Cloutier, Cockburn and Decalune (2008) found that education could influence the household income in many different ways, and by cutting the subsidy on education, household income would decrease, increasing the possibilities of being poor. Quach (2005) figured that access to credit is a significant positive factor in household poverty reduction, and this influence of the amount of borrowing is more evident in the poorer households than better-off ones. According to the research of Baulch, Chuyen, D.Haughton and J. Haughton (2002), the main determinants of poverty for the minority and Kinh-Hoa are different. The geographic and

cultural remoteness are the reasons that the ethnic minority group is on average poorer than the Kinh-Hoa group.

Recently, the concentration of poverty modeling has transferred to the dynamic model and vulnerability, which attempts to analyze the causal relationship between the poverty statuses today with the possibilities of being poor tomorrow and the causes of vulnerability. And ethnic, geographic location, human capital characteristics of household are three major factors believed to help general people increasing the possibilities to move out from poverty (Thang, Trung Dat and Phuong 2006).

Vulnerability is defined as the possibility that a household may experience poverty (Prowse 2003, Barrientos 2007). The two dimensions of vulnerability are exposure to risks and susceptibility (Béné 2008, Moser 1998). Therefore, the vulnerability to poverty is usually measured as the probability of future consumption or income less than the poverty line. Despite this clear idea of measuring vulnerability, the causes and analysis of vulnerability to poverty are less clear (Alwang, Siegel, and Jorgensen, 2001).

But it is not meaningless to attempt to understand the factors causing vulnerability. Dercon (2001) built up a framework analyzing the determinants of vulnerability. The basic idea is that the assets, such as land, labor, capital, belonging to households would generate income. The income of the household would increase the welfare of the household, mainly through consumption. Household would be influenced by risks. For example, the human capital would be depreciated if the person is disabled, the income would decrease if the bad weather reduced the output production, and the welfare would decline if the price level went up. Therefore, the vulnerability would not only be influenced by such factors as human capital, household structure and productivity, but also be affected by risks or shocks.

In Vietnam, specifically, Tmai, K.S, Gaiha, R and Kang, W (2011) concluded that family structure (such as the burden rate, the proportion of female family members and

the age of the household head, etc.), education level, location, access to infrastructure are all important factors affecting the vulnerability.

Although former studies argued that household structure (such as the number of children in one household, the dependency ratio, etc.), human capital and location are all crucial factors causing poverty and vulnerability in Vietnam, the influence of the primary activities of the household, has not been deeply analyzed. Moreover, the relationship between poverty and vulnerability is also a moot problem.

Especially, the fisheries (particularly in small-scale fisheries) is conventionally perceived to be intimately correlated with poverty (Béné, C. 2008).

Therefore, in order to find out the influence of fisheries as the primary activities on the poverty status of household, the determinants of poverty and vulnerability in small-scale fisheries transition communities are analyzed in this paper.

Data and Methodology

1. Definitions of Poverty

1.1. Basic definitions

The central concept of poverty problem is the poverty line, Debraj Ray (1998) defined the poverty line as: 'A critical threshold of income, consumption, or, more generally, access to goods and services below which individuals are declared to be poor.' Therefore, the definition of poor and non-poor would be really clear.

Poor: individuals whose income or consumption is below the poverty line.

Non-poor: individuals whose income or consumption is above the poverty line.

1.2. The Poverty line

The poverty line can be measured in two ways—absolute poverty line and relative poverty. The absolute poverty line is based on the basic level of nutritional requirement,

for instance, the general poverty line of Vietnam, conducted by the General Statistic office of Vietnam (stand out as GSO), is calculated as the consumption required to maintain 2100 calories per capita, taking non-food consumption into consideration.

There is another measurement of poverty line in Vietnam, and the poverty line of the Ministry of Labor Invalids and Social Affairs (MOLISA) based on the level of the economy, the growth rate and actual living standards of Vietnamese in specific regions (Tuan, 2008).

Contrarily, the relative poverty is measured as the percentage of the population with income less than some fixed proportion of median income, which is regarded as a measurement of income inequality.

1.3. Poverty line chosen for analysis of poverty in Vietnam

In 2012[7], the poverty line from GSO and MOLISA are:

The GSO general poverty line: 530 thousand VND per month for rural area and 660 thousand VND per month for urban area.

The MOLISA poverty line: 400 thousand VND per month for rural area and 500 thousand VND per month for urban area.

The GSO poverty line is used in this analysis, since the methodology GSO used is internationally accepted. Particularly, it is transparent what the GSO poverty line is measuring, specifically, the poverty line of GSO is estimated by the minimum level of expenditure required to satisfy basic nutritional (2100 calories per capita per day) and other needs (such as clothing, housing, etc)(Vietnam Poverty Analysis 2002).

Moreover, there is one major disadvantage about the poverty line of the MOLIS that cannot be neglected. This measurement system of the MOLISA include the different poverty lines among different provinces and different districts, and the data collection is various in terms of guidelines and enumerators across different provinces, all of which makes the poverty line of MOLISA being normally lower than the local perception,

[7] The data from "Vietnam Fisheries Transitions Survey" is about 2012, therefore, in here, I takes the poverty line in 2012 to make comparison.

hence, missing out many the poor (Tuan, 2008).

Thus, the GSO poverty line is used in this paper.

2. Methodology

In terms of poverty modeling, there have been rigorous attempts trying to link the poverty incidence or consumption with its determinants. One of the most popular methods to detect the determinants of poverty is the binary choice model. The binary choice model is a model with a zero-one dummy variable being the dependent variable, including the linear probability model, the probit model and the logit model.

The merits of the binary choice model are obvious. Not only can the heterogeneity between different groups (i.e. the poor and the non-poor, or households in different districts) be captured with weak tests, the effect of independent variables can also vary among different groups (Fissuh and Harris, 2004).

In the aim of avoiding the drawbacks in the usage of probit or logistic model, some researchers turned to other models. For example, there are a large number of researchers using a linear regression model with the logarithm of consumption or income being the dependent variable. Such methodology can be found in the research of Justino, Litchfield and Pham (2008), which paid special attention to the influence of agriculture and access to infrastructure on the household poverty incidence in Vietnam.

However, compared to the model that use logarithm of consumption or income as the dependent variable, the probit model provides clear result about poverty status. Moreover, the heterogeneity problem with probit model can be tested and improved.

To understand the determinants of being poor, the method used is probit model, assuming the residuals εi would have a standard normal distribution. The specific models here are:

$$P(y=1|Xi)=\phi(Xi`\beta)$$

$$P(y=0|Xi)=1-\phi(Xi`\beta)$$

Where $\phi(\cdot)$is the cumulative distribution function of standard normal distribution, Xi is a vector of explanatory variables, βdenotes a vector of parameters. Dependent variable $yi = \begin{cases} 1, & monthly\ income - poverty\ line < 0 \\ 0, & monthly\ income - poverty\ line \geq 0 \end{cases}$.

Maximum likelihood estimators of β are consistent and asymptotically efficient and asymptotically normal under correct assumption of residuals.

To analyze the determinants of the vulnerability index, the ordinal least square regression model is also used. The regression equation is:

$$y = X\beta + \varepsilon$$

Where y represents the dependent variable, the vulnerability index in this case, X denotes $1 \times p$ column of the explanatory variables and β is the $p \times 1$ vector of the unknown parameters, ε indicates the residuals.

3. Data

In this paper, the data from the "Vietnam Fisheries Transitions Survey[8]" has been used to pursue the research objectives. This data gathers the information from survey questionnaires, which were carried out in two provinces, three districts, and twelve communes (with one to eight villages per commune). The questions on the questionnaire are separated into nine sections, including household information; employment and earnings; other sources of income; fishing; aquaculture; assets and housing; loans; risks and coping; and perceptions.

"The survey field work was carried out by Vietnamese surveyors affiliated with the Phu Vang University of Agriculture and Camau Agricultural Extension Centre between November 2012 and March 2013. Once the survey villages had been selected, 599 households were surveyed through neighbourhood-stratified random sampling.

[8] Melissa Marschke and Gordon Betcherman conducted the "Vietnam Fisheries Transition Survey", Melissa Marschke is an associate professor at the School of International Development and Global Studies at the University of Ottawa and Gordon Betcherman is a Professor in the School of International Development and Global Studies at the University of Ottawa.

Questionnaires were administered through face-to-face interviews, usually with the household head. On average, the survey took 1 hour to complete. Data was inputted and initially edited by staff of Phu Vang University with final editing and analysis undertaken at the School of International Development at the University of Ottawa."[9]

One of the most distinct characteristics of the data, is that it provides information about the primary activities, such as aquaculture, fisheries, wages/salaries, and self-employed.

However, the data also has its drawbacks. The most serious problem is the dependent variable. Expenditure or consumption is believed to be a better choice to analyze the poverty problem. For the most part, poverty lines are set according to the minimum consumption level to obtain enough nutrition.

But in this survey data, it only contains income data rather than information about household consumption. As the alternative method, income data has been widely used by many researchers as the indicator of poverty. As a result, the analysis is based on monthly income, and the income poverty line from the General Statistics Office of Vietnam (also as GSO) is used to be compatible with the income data.

4. Statistical Characteristics

The main focus of the "Vietnam Fisheries Transition Survey" is on the influence of the primary activity, which is defined to be the predominate source of household income. Therefore, this paper includes an analysis of the influence the primaries have on poverty.

Table 1, Poverty index among each primaries and districts

[9] J. Rebecca Taves. 2014. Assessing vulnerability in households and communities involved in fisheries sector activities, Master Thesis, University of Ottawa, 16P.

Geography	Primary activity	Average monthly income (thousand VND)	Poverty headcount ratio (%)[10]	Poverty gap index (%)[11]
All geography	All sectors	2,938	17.53	5.59
All geography	Fishing as primary activity - near-shore	1,945	21.26	4.13
All geography	Fishing as primary activity - off-shore	13,600	1.49	0.38
All geography	Aquaculture as primary activity - extensive	1,191	21.90	7.44
All geography	Aquaculture as primary activity - intensive	2,663	8.70	3.30
All geography	Other as primary activity	1,551	18.12	7.27
Dam Doi	All sectors	1,612	25.45	9.38
Dam Doi	Fishing as primary activity - near-shore	563	73.33	16.96
Dam Doi	Fishing as primary activity - off-shore	2,750	5.26	1.33
Dam Doi	Aquaculture as primary activity - extensive	1,137	28.57	10.52
Dam Doi	Aquaculture as primary activity - intensive	2,549	11.76	4.47
Dam Doi	Other as primary activity	1,596	24.00	10.95
Tran van Thoi	All sectors	6,634	10.06	3.86
Tran van Thoi	Fishing as primary activity - near-shore	4,804	0.00	0.00
Tran van Thoi	Fishing as primary activity - off-shore	20,200	0.00	0.00
Tran van Thoi	Aquaculture as primary activity - extensive	1,221	31.11	11.74
Tran van Thoi	Aquaculture as primary activity - intensive	2,986	0.00	0.00
Tran van Thoi	Other as primary activity	1,831	8.70	3.55
Phu Vang	All sectors	1,089	15.50	2.97
Phu Vang	Fishing as primary activity - near-shore	964	20.51	3.47
Phu Vang	Fishing as primary activity - off-shore	1,299	0.00	0.00
Phu Vang	Aquaculture as primary activity - extensive	1,223	11.36	2.56
Phu Vang	Aquaculture as primary activity - intensive	.	.	.
Phu Vang	Other as primary activity	971	17.86	3.51

Source: the "Vietnam Fisheries Transition Survey" data

It is found that the poverty problem is much more serious in households whose income is mainly from extensive aquaculture, since the poverty headcount rate and poverty gap index of households with the extensive aquaculture as primary activity are

[10] Poverty headcount ratio=$\frac{amount\ of\ the\ poor}{total\ population}$

[11] Poverty gap index=$\frac{1}{N}\sum_q \frac{(povert\ line - monthly\ income)}{poverty\ line}$, where N is total population, q is the amount of the poor whose monthly income is below poverty line. Poverty gap index estimates the depth of poverty, considering how far the poor are from the poverty line.

larger than that of households with other primary activities. The poverty headcounts ratio of households in the Dam Doi district appears to be the largest one, compared with poverty headcount ratios in other districts.

However, as opposed to households in the Dam Doi district with extensive aquaculture as primary activity, the households depending on near-shore fishery in the same district seems to live in a severe poverty with over half of the population being poor and with relatively low average monthly income.

In summary, the districts and primary activities seem to make a huge difference on the poverty problem, which will be discussed in detail later.

5. Variables

Based on the theoretical and empirical evidence, household characteristics, human capital, geographical factors are thought to be main determinants of household-level poverty in Vietnam. Using the data from VHLSS[12] 2002, Imai, Gaiha and Kang (2010) analyzed the poverty in Vietnam with a probit model, and argued that the age of the household head, share of female members, dependency burden, the highest education level of the household, total land area and location are all significant determinants of whether a household is poor or not.

5.1 Dependent Variables

The explained variable "pr2012" is defined as 1 if the monthly income per capita is below the poverty line, in this case, 530,000 VND, and 0 if the monthly income per capita is over the poverty line.

5.2 Household Characteristics

The first factor considered is the age of the household head, with dummy variables "age3554" and "age55" denoting whether the age of the head[13] of the household is aged

[12] VHLSS stands for the Vietnam Household Living Standard Survey, which is an ongoing longitudinal survey of the Vietnamese population that has been conducted in several waves.

[13] In the survey data, there is no question asking about the age of household head, instead there is information about the age of people who got the questionnaire. Since nearly 80 percent of the people who was surveyed are

between 35 and 54, or over 55. There is an omitted variable representing the households whose head is younger than 35.

There is expected to be a nonlinear relationship between the age of the household head and the possibilities of the household being poor, the household head between 35 years old and 54 years old are considered to be the most productive. Therefore, "age3554" is expected to be a negative influence on the "pr2012". Whereas, the coefficient of "age55" is expected to be positive, due to the decreasing working ability of older household head, which would increase the probability of falling down into poverty.

Taking the gender of household head into consideration, the dummy variable "hhg" equals 1 if the head of household is female. Compared with having a male household head, the households with a female head are widely thought to obtain relatively lower income, which would increase the possibility of being poor, and this idea can be consistent with the work of Nguyen, Le Dang, Vu Hoang and Nguyen (2006).

The last of the variables of household characteristics describes information about household structure. With variable "numb_child" denoting the number of children under 18 in one family and variable "prop_me" capturing the proportion of male members over total amount of members in one household, the coefficients of them are expected, respectively, to be positive and negative. Since increasing the number of children in household would need extra time on children caring, which would lead to the reduction of working time of the adults in the household and the contraction of the income. Compared with the female, the male is believed to have a greater possibility to get a higher income, showing a bigger contribution of the male to the household income. Thus, the proportion of males in the household would have a negative effect on the possibility of being poor.

5.3 Human Capital

The human capital variables provides information about the education level of the

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the head of household, it is reasonable to use that data to represent the age of household head.

household head. As an ordinal variable, "headedu" would be 0 if the head of household never attend school, and be 9 if the head of household has a doctoral diploma.

As one of the most widely accepted thoughts, the investment in human capital has a positive effect on the household income. Therefore "headedu" is expected to be a negative influence on the poverty. With a higher education level of the head of the household, the household would have a lower probability to be poor. However, due to the decreasing marginal effect education had on income, the coefficient of "headedu2" will be positive.

5.4 Geographical Factors

As it is showed from table1, the poverty rates of different districts are different. Considering both poverty headcount rate and poverty gap ratio, the dummy variable "dis01", being 1 if the household living in the Dam Doi district, is expected to have a positive coefficient.

What is more, "dis02" is the dummy variable, equaling to 1 if the household is in Tran van Thoi district. There is an omitted variable representing the households living in Phu Vang district. From table 1, households in Tran van Thoi district and Phu Vang district are richer than the households in Dam Doi district, showing no obvious relationship between living in Tran van Thoi and Phu Vang district and poverty. The expectation of "dis02" would be no significant influence.

5.5 Primary Activities

Primaries are represented by four dummy variables, "primary01", "primary02", "primary03" and "primary04".

Primary01=1, if the main primary of household is near-shore fisheries;

Primary02=1, if the main primary of household is off-shore fisheries;

Primary03=1, if the main primary of household is extensive aquaculture;

Primary04=1, if the main primary of household is intensive aquaculture;

There is one more omitted variable, denoting the household whose primary activities are neither fisheries, nor aquaculture, such primary activities as farming, self-employment

and salary work, etc.

Since the households with off-shore fisheries and intensive aquaculture are relatively less poor than others, the “primary02” and “primary04” are expected to have a negative effect on the possibility of being poor. The “primary01” and “primary03” are not expected to be significant factors.

The following table summaries the variables discussed above.

Table 2, the definition and expectation influence of variables.

Variables	Definition	Expectation influence on possibility of being poor
pr2012	equals to 1 if the household monthly income is lower than rural poverty line, otherwise equals to 0.	-
vulnarbility	vulnerability index calculated by the Bene equation	-
age3554	equasl to 1 if the age of household head is between 35 and 54, otherwise, equals to 0.	negative
age55	equasl to 1 if the age of household head is larger than 55, otherwise, equals to 0	positive
hhg	equals to 1 if the head of household is female, otherwise, equals to 0	positive
headedu	ordinal variable showing the highest level of education achieved by head of household,	negative
headedu2	the square of headed	positive
numb_child	the total amount of members who is younger than 18	positive
prop_me	the proportion of male members in one household	negative
primary01	equals to 1 if the primary activity is near-shore fishing, otherwise, equals to 0	Not significant
primary02	equals to 1 if the primary activity is off-shore fishing, otherwise, equals to 0	negative
primary03	equals to 1 if the primary activity is extensive aquaculture, otherwise, equals to 0	Not significant
primary04	equals to 1 if the primary activity is intensive aquaculture, otherwise, equals to 0	negative
dis01	equals to 1 if the location of household is in Dam Doi district, otherwise, equals to 0	positive
dis02	equals to 1 if the location of household is in Tran van Thoi district, otherwise, equals to 0	Not significant

Empirical Results and Analysis

Taking the binary dummy variable of poverty as the dependent variable of the probit model, the results of this probit model are given in the Table 3. The first column shows the coefficients, and the marginal effects of each variable are given in the third columns.

Table 3, Probit Model Results

pr2012	Coef.	Std. Err.	Marginal Effect	Std. Err.
age3554	-0.4675866	0.1731781***	-0.1082768	0.0426505***
age55	-0.7250538	0.2055801***	-0.1678972	0.0508313***
hhg	-0.3852836	0.2628129	-0.0892183	0.0614074
headedu	-0.2112451	0.0738129***	-0.048917	0.0113168***
headedu2	0.0000021	0.0000007***	4.89E-07	1.60E-07***
numb_child	0.0695072	0.0523995	0.0160955	0.0121621
prop_me	-0.7843738	0.3439888**	-0.1816337	0.0861492**
primary01	0.0750632	0.1850358	0.017382	0.0432228
primary02	-1.469658	0.4503738***	-0.3403218	0.1073936***
primary03	0.0709805	0.1526052	0.0164366	0.0354504
primary04	-0.7302227	0.3068281**	-0.1690942	0.0748085**
dis01	0.6793669	0.1670007***	0.1573177	0.0341444***
dis02	-0.0655297	0.1808155	-0.0151744	0.0418489
Log-likelihood	-247.72136[14]	-415.19516[15]	-	-

Note: *** represents being significant at 1%, ** represents being significant at 5%

Table 3 presents the probit model results, but before deeply analyzing the effect each independent variable has, it is reasonable to test the heteroscedasticity and multi-collnerailty in the data.

1. Test

1.1 Heteroscedasticity

[14] -247.72136 is the log-likelihood value of the probit model with all variabls.
[15] -415.19516 is the log-likelihood value of the probit model with no variable.

It is one major problem of the probit model that it always not possible to test heteroscedasticity. There are two forms of heteroscedasiticy: the first one is that the residuals are heteroskedastic, and in this case, the maximum likelihood estimator of the βs is inconsistent, which implies that the log-likelihood function needs to be modified to fix the problem. The second one is that heteroscedasiticy still exists in the model even if there is no heteroscedasticity problem in the residuals.

In fact, the first form of heteroscedasiticy is common in probit model, therefore the test here is to test whether there is heteroscedasiticy in the equation yi*=Xiβ+εi.

Using White`s test, the result in table 4 shows that the residual is not heteroskedastic, meaning that there is no heteroscedasticy problem in the probit model.

Table 4, Test result for heteroskedasticity

White`s test for H_0:homoskedasticity
against H_1: heteroskedasticity
chi2(74)=218.18
Prob>chi2=0.00

1.2 Multi-collinearity

When choosing the explanatory variables, the multi-collinearity problem needs to be considered. The covariances between the variables are shown in table 5.

From this table, the biggest absolute correlation coefficient is 0.74, between "age3554" and "age55". Since the "age3554" and "age55" are both dummy variables on age of the household head, for the households with "age3554" equal to 1, the "age55" would definitely be 0. Therefore, the covariance between "age3554" and "age55" being high is not a problem.

The covariances between variables are not large, meaning that there is no multi-collinearity problem in the variables.

Table 5, Covariance matrix table of each variable.

Variables	age3554	age55	hhg	headedu	numb_child	prop_me	primary01	primary02	primary03	primary04	dis01	dis02
age3554	1.00											
age55	-0.74	1.00										
hhg	0.04	0.01	1.00									
headedu	0.02	-0.03	0.03	1.00								
numb_child	-0.01	-0.03	-0.02	-0.01	1.00							
prop_me	-0.03	-0.03	-0.02	-0.01	0.56	1.00						
primary01	0.07	-0.09	-0.04	0.02	-0.03	-0.03	1.00					
primary02	0.00	-0.05	-0.03	-0.04	-0.02	-0.02	-0.18	1.00				
primary03	0.01	0.08	-0.01	-0.05	-0.04	-0.04	-0.38	-0.26	1.00			
primary04	-0.03	0.01	-0.03	-0.03	-0.02	-0.02	-0.15	-0.10	-0.21	1.00		
dis01	0.02	0.02	0.18	0.25	0.03	-0.07	-0.27	-0.06	0.00	0.22	1.00	
dis02	-0.04	-0.11	-0.11	0.13	-0.20	0.01	-0.04	0.25	-0.14	-0.02	-0.50	1.00

2. Probit Model Result

2.1 Goodness of fit

In the probit model, the most commonly reported measure of goodness of fit is McFadden`s likelihood ratio index. The McFadden $R^2 = 1 - \frac{-247.72136.}{-415.19516} = 0.4034.$

As an analog to the R^2 in the ordinary least square regression model, the value of this measure has to between one and zero. When the McFadden R^2 equals to 1, the probit model is a "perfect fit"; and when this measure is 0, then the model does not fit. The bigger the McFadden R^2 is, the better the model fits the data.

Thus, the probit model fits this cross-sectional data well. Other measurement of the goodness of fit is discussed in the Appendix.

2.2 Analysis of the explanatory variables

From table 2, it can be concluded that the "age3554", "headedu", "prop_me" "primary02" and "primary04" all have positive effect on the possibilities of being poor, and are significant, which is completely the same as the former expectation. However, contrary to expectation, the "age55" has a negative effect on probability of being poor, meaning that if the head of household is beyond 55 years old, there is a higher possibility for this household to be non-poor.

Therefore, more attention should be paid to the "age55" and its unexpected effect on the probability of being poor. There are three possible explanations:

The first explanation is experience, which means that when the head of the household is getting older, at the same time, they would have important experience that is helping them to gain more income. The age of head in household can be regarded as a proxy of experience, but there is no such experience information as work year in the survey data, which means that the relationship between age and experience cannot be tested here.

Another explanatory is the relationship between the age of household head and the

number of workers in one family. It is possible that when the head of household is relatively older, there are more working people in the household, for example, the multigenerational households.

The last one tries to link the age of head in household with productivity. When the head of household is older, their working time is longer and would be able to purchase more assets, land and boats to increase the productivity. Here as the productivity assets and total land area being the indicator of productivity, the relationship between age of head in household and productivity of household as a whole are analyzed.

Table 6, Statistical characteristics among different age groups

Age group	Average amount of working people [16]in one family	Average Productivity Assets[17]	Average total land area[18]
Below 35	2.78481	1.962025	12531.63
Between 35 and 54	2.95935	2.078591	14983.36
Beyond 55	3.496689	2.125828	18774.71
Total	3.071786	2.075125	15615.76

Table 6 shows that the amount of working people and the total land area of the households with an older head is bigger than that of household with a younger head. But this cannot support the relationship between age and other factors.

Aiming to prove the existence of such relationship, regressions of amount of working people and total land area being dependent variables are conducted.

[16] Working people here means the people who can work, assuming between 20 years old and 64 years old.
[17] Amount of productivity assets means the total amount of productivity assets belonging to one family, regardless of the kind of assets. Productivity assets are boat, car, phone and pump.
[18] Total land area is the sum of resident, agricultural, aquaculture and forestry land area, representing the productivity of the household.

Table 7, Regression[19] results of models with wp20, productivity assets and tot_land being the dependent variables.

	wp20		pro_assets		tot_land	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
age35	2.07835	0.1524747***	1.92008	0.124757***	9741.944	1769.925***
age3554	2.860889	0.0769571***	2.38309	0.06297***	14534.55	893.3171***
age55	3.514286	0.124417 ***	2.56429	0.1018***	18842.94	1444.235***
R-square	0.8057		0.7243		0.4483	
F-test	824.03		784.22		161.40	

Note: *** represents being significant at 1% level.

As it is shown in the table 6, the coefficient of "age35","age55" and "age3554" are both positive and the marginal effect of "age55" is bigger than the marginal effect of "age3554" and the marginal effect of "age35", meaning that increasing age would enlarge the amount of working people in one household and would also increase the total land area and the amount of the productivity assets, which supports the second and last explanatory.

Therefore, when the head of household is growing older, the amount of workable members in one household would increase, and the total land area would also rise, showing an increasing productivity power within the household.

Among all the significant variables causing poverty, the "dis01" has the biggest marginal effects on the possibility of being poor, which means that living in Dam Doi district would increase the probability of falling into poverty by 15.73%. Thus further analysis should be focus on adding regional factors, such as the regional unemployment rate, the fishing market development, the infrastructure development, etc, into the analysis of the determinants of poverty. Due to the lack of the necessary data, such analysis is not discussed in this paper.

Moreover, the marginal effect of "age55" is bigger than that of "age3554", meaning

[19] The regression model here is $y = age35\beta1 + age3554\beta2 + age35\beta3 + \varepsilon$, and this equation is the same for all those three models. The explanatory variables are "age35" "age3554" and"age55", y represents the dependent variable, will be the amount of workable people in one household ("wp20"), the total amount of productivity assets belonging to one family ("pro_assets") and the total area of the land in a household ("tot_land").

that having an older head of household would benefit the household more than having a younger household head. The marginal effect of age actually is increasing, but not decreasing.

The Vulnerability Analysis

1. Vulnerability Index

Generally, the vulnerability can be measured as the possibility of future consumption or income being smaller than the poverty line. For example, with the usage of Indonesian data from 1998 to 1999, Chaudhuri, Jalan and Surgahadi (2002) measured the vulnerability [20]as:

$$\widehat{Vh} = Pr(InCh < InZ|Xh) = \Phi(\frac{InZ - Xhb}{\sqrt{Xh\hat{\theta}}})$$

The households are divided into 3 groups: "highly vulnerable" for whom $\widehat{Vh}$>0.5; "relatively vulnerable" for whom 0.22<$\widehat{Vh}$<0.5, and 0.22 is the poverty headcount ratio; "not vulnerable" for whom $\widehat{Vh}$>0.22.

But due to the lack of dynamic consumption information, in this paper, the equation conducted by Christophe Béné (2008) is used:

$$V\_ig = \text{CV\_g} \times \text{Pov\_i} \times DEP\_ig \times \frac{1}{[A\_i \times (1 - DEP\_ig) + 1]}$$

Where,

V_ig represents the index of vulnerability;

CV_g is the coefficient variance of income of household i in the same group g;

$Pov\_i = \sqrt{PL/I\_i}$, I_i is monthly income per capita for household i, PL stands for

[20] The consumption model are $InCh = Xhb + \varepsilon$, and the error term $\varepsilon \sim N(0, Xh\theta)$, Z represents the poverty line, Ch represents the consumption per capita and Xh denotes the explanatory variables. $\Phi(\cdot)$ is the cumulative distribution function of standard normal distribution.

the poverty line (in this case, the poverty line is 530 thousand VND per capita), and the square root here is for the assumption of the decreasing marginal positive effect poverty gap has on household`s vulnerability;

DEP_ig is the proportion of income from the household i`s primary activity over the total income;

A_i is the number of total activities household i engaged in;

$[A\_i \times (1 - DEP\_ig) + 1]$ is the effect of diversification, which reflects the fact that households would engage in different business activities in order to reduce the negative effect of such shocks as weather, market fluctuations and environment.

One obvious benefit in using this vulnerability index is that it can be measured with cross-sectional data and does not need longitudinal data.

2. Analysis of the Vulnerability Index

The statistical characteristics of the vulnerability index calculated from the data are that the mean of vulnerability is 0.27 and standard deviation is 0.32. The vulnerability index of nearly half of the people is below 0.17, which means that the distribution of vulnerability index is right-skewed with median being less than mean. The higher the vulnerability index is, the more vulnerable the household is.

The most important characteristics of this vulnerability index is that the larger the vulnerability index is, the more likely people are to be poor, since there shows a negative relationship between vulnerability index and monthly income, which is shown in the Figure A1 in appendix.

There are some special households, whose vulnerability indices are much larger than the average vulnerability index, which should be paid more attention.

From the calculation equation of the vulnerability index, it can be concluded that the special cases are those whose monthly income are far lower than the average level, which leading to these big vulnerability indices. Moreover, it can also be found that

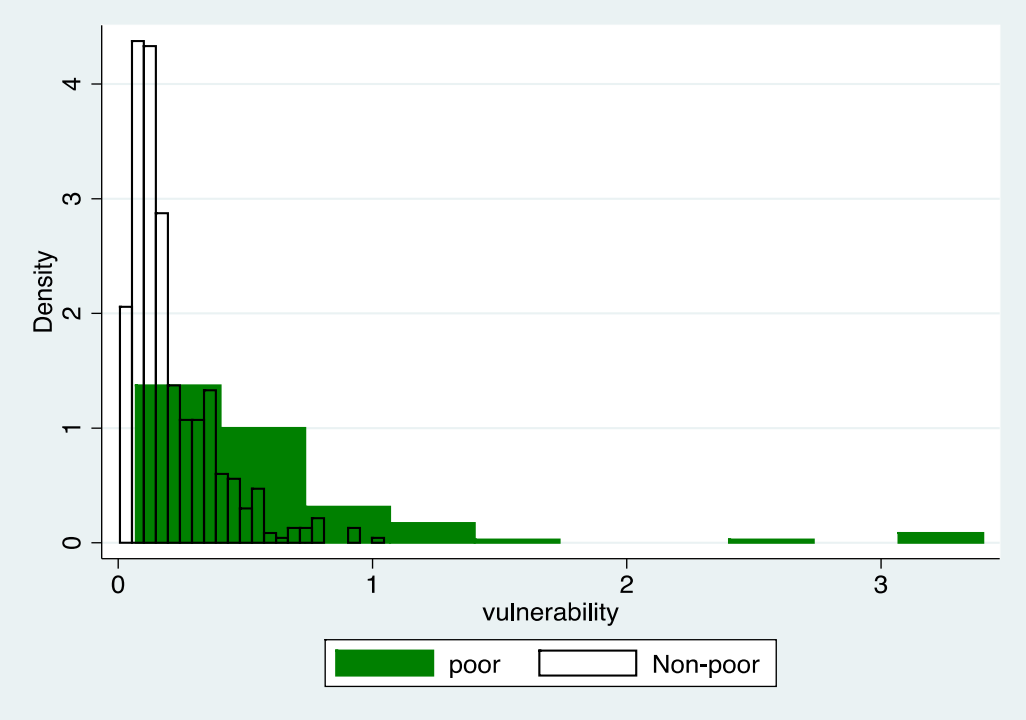
those four households with extraordinary vulnerability index are the same household with the lowest monthly income.

Since income is one part of the calculation equation of the vulnerability index, it seems natural to have such a negative relationship between income and the vulnerability index.

Therefore, the households with low monthly income are highly likely to be vulnerable, showing some comparability between the vulnerability index and the poverty rate, which is also supported by the statistical characteristics between the poor and the non-poor.

1.1 The poor vs. the non-poor

Figure 5, Histogram[21] graph of the poor and the non-poor



Source: the "Vietnam Fisheries Transition Survey" project

[21] Density here means the possibility density, the probability of falling within a particular range is given by the area of each bar between the lowest and greatest values of the range.

From the figure 5, we can see that the range of the vulnerability index varies largely between the poor and the non-poor, the vulnerability index for the non-poor seems smaller than the index of vulnerability for the poor, which means that there is a higher possibility for the poor to be poor again than the income of the non-poor drop below the poverty line.

Table 9, The mean of the vulnerability index for the poor and non-poor.

pr2012	N(slno)	mean(vulnerability)
0	494	0.2046762
1	105	0.5747669
Total	599	0.2695502

Source: "Vietnam Fisheries Transition Survey" data

Table 9 reports that the average vulnerability index of the poor group is higher than the average index of the non-poor, conveying the positive relationship between vulnerability and poverty.

But there are still some questions to be answered: Is the vulnerability index exactly the same as the poverty rate? What is the meaning of coming up with this vulnerability index and what can this vulnerability index tell more than simple poverty?

1.2 Differences between Vulnerability and Poverty

Since the definition of the vulnerability index is to capture the possibility of being poor in the future, a line to distinguish between the "highly vulnerable" and the "non vulnerable" is needed. The threshold used in this paper is the following.

With the plausible assumption that the amount of households in poverty and the amount of households who are vulnerable are same, the vulnerability line is the vulnerability index that makes the proportion of household, whose vulnerability is larger than the line, is same as the poverty headcount ratio. That is, although the households who are poor and the households who are vulnerable may be different, the percentage of poor households and vulnerable households are the same.

$$\frac{amount\ of\ household\ who\ are\ poor}{all\ households} = \frac{amount\ of\ household\ who\ are\ vulnerable}{all\ households}$$

Specifically, there are 105 households defined to be poor. Therefore, the vulnerability index line distinguishes between the vulnerable and the not vulnerable should be the index of the 105th household on a descending order.

In this case the vulnerability line is 0.42.

Thus, the data can be separated into 4 groups: "poor" & "vulnerable", "poor" & "not vulnerable", "non-poor" & "vulnerable" and "non-poor" & "not vulnerable" .

Table 10, the number of household in different groups

	Non-poor (pr2012=0)	Poor (pr2012=1)	Total
Vulnerable (vulnerability>0.4231994)	52	53	105
Not Vulnerable (vulnerability≤0.4231994)	442	52	499
Total	494	105	599

Source: the "Vietnam Fisheries Transition Survey" project

Therefore, nearly half of the households who are poor are actually not vulnerable, which means that there is a higher than average possibility that they will escape from poverty. On the other hand, there are a lot of households who are defined to be non-poor, but they have a relatively higher probability to be poor in the next period.

From Table 10, it can be concluded that the households who are not vulnerable have a much higher possibility to be non-poor than the possibility to be poor. On the other hand, the possibility of being poor and non-poor, for the households who are vulnerable, are similar.

3. Vulnerability Index Regression

To get a better understanding of the vulnerability, some OLS regressions are conducted. The reason why the OLS regressions, instead of the probit model, are used is that compared with the probit model, the OLS regression models can better fit the data. Furthermore, the OLS regressions can provide more information about the vulnerability index, compared with classifying households into the vulnerable group and the not vulnerable group.

Table 11, OLS regression result of vulnerability index

	regression 1		regression 2	
Vulnerability	Coef.	Std. Err.	Coef.	Std. Err.
pr2012	0.3700907	0.0314179***	-	-
age3554	-	-	-0.0337192	0.0341525
age55	-	-	-0.0343155	0.0387399
Hhg	-	-	-0.0066072	0.0511912
Headed	-	-	-0.0162921	0.0128247
headedu2	-	-	-8.87E-12	1.16E-11
numb_child	-	-	0.0117834	0.0104163
prop_me	-	-	0.04733	0.0648361
primary01	-	-	0.1155131	0.0371871***
primary02	-	-	0.0392657	0.0451583
primary03	-	-	0.2809127	0.0315165***
primary04	-	-	0.0682508	0.0510991
dis01	-	-	0.2549152	0.0330629***
dis02	-	-	0.1651657	0.0334947***
Constant	0.2046762	0.013154***	-	-
R-square	0.1886		0.4988	
F-test	138.76		44.85	

Note: *** denotes significance at 1% level

In the first regression model, there is only one explanatory variable—"pr2012", with the aim of analyzing the relationship between vulnerability and poverty. Even though "pr2012" being significant and positively affecting vulnerability in the model, the R-square is relatively low, with only 0.1886, which represents a low level of goodness of fit. The conclusion therefore is that, despite being significant, the variable "pr2012"

cannot completely explain the vulnerability index, which leads to the second regression model.

The rationale behind the second regression model is to detect the differences between vulnerability and poverty, by modeling vulnerability and poverty with the same independent variables.

From the results table, it is clear that all variables are not significant for vulnerability, except primary and district dummy variables, denoting that rather than the household structure, human capital, it is primary activities and locations that really affect the vulnerability level of households.

Moreover, the “primary01”, “primary03”, “dis01” and “dis02” all show up a positive influence on the vulnerability index, which accords with the statistical characteristic of the vulnerability index (see table 11).

There is only one variable that is significant at these two models, which is “dis01” being positively influential on the vulnerability index and poverty status.

The only factors that significantly affect the vulnerability index are primary activities and the places where the household lives, which means that, poverty reduction policy cannot reduce the vulnerability index, cannot reduce the possibility that households would be poor in future.

Therefore, further research should analyze why factors like primary activities and location are significantly influential on both poverty and vulnerability index. Is it the price level of some specific fish species or the production of some specific fish species that letting the households doing off-shore fishing and intensive aquaculture are richer than others? Is it lack of infrastructure or less-developed labor market that letting the households living in Dam Doi district have a relatively low income?

Conclusion

The analysis of poverty status with the data form the small fishing households in Vietnam shows that the household structure, human capital, education, location and primary activities all play significant roles in determining whether a household is poor or not. The people in these small-scale fisheries communities are those who depend mainly on the fisheries and aquaculture as their main income source.

Such targeted analysis would provide implications to the poverty reduction strategy about the determinants of poverty and vulnerability in the small-scale fisheries communities.

The poverty reduction strategy should be targeted to the households who are vulnerable and poor, since those households are not only poor at present, they also have a relatively higher likely to be poor in the future. Moreover, the significant determinants that have relatively larger marginal effect should be taken into consideration when making the policy decisions. Last but not least, special attention should be paid to the local development of the Dam Doi district, since living in this district not only increase the possibility of falling to poverty in the future, but also increase the probability of being poor.

Same as the previous research, the proportion of males in the household, age of head in household, education level of the household head all have a positive influence on the possibility of the household to be poor. What is more, such primary activities as off-shore fishing and intensive aquaculture, decrease the probability of being poor. Besides, living in the Dam Doi province positively affects whether the household is poor.

With the additional analysis on vulnerability index, it can be concluded that although the poor have a higher possibility to be vulnerable, it does not mean that all the vulnerable households are those who are poor.

Contrary to the determinants of poverty, the main determinants of the vulnerability index are the activities that households do for living and the places where the households live, which is the biggest differences between the poverty rate and vulnerability index.

Therefore, when deciding policies to reduce the poverty, it is necessary to consider the vulnerability index and more attention should be paid to find out whether the poverty status is transient. More factors, such as regional factors, and fisheries market development, should be considered when analyzing further why and how primary activities and locations influence both the poverty status and vulnerability index.

References

1. Adeyemi,SL, Ijaiya GT, Raheem,UA. (2009). Determinants of Poverty in Sub-Saharan Africa. African Research Review, vol 3. No.2.
2. Alwang, J, Siegel, P. and Jorgensen, S. (2001). Vulnerability: A View from Different Disciplines. Social Protection Discussion Paper No. 0115, Social Protection Unit, Human Development Network, World Bank, Washington, DC.
3. Andersson, M & Engvall, A & Kokko, A. (2006). Determinants Of Poverty In Lao Pdr. EIJS Working Paper Series 223, The European Institute of Japanese Studies.
4. Ashok Parikh & Kunal Sen (2006). Probit with heteroscedasticity: an application to Indian poverty analysis, Applied Economics Letters, 13:11, 699-707.
5. Barrientos, A. (2007). Does vulnerability create poverty traps? Chornic Poverty Research Centre Working Paper No. 76. May 2007.
6. Baulch, B & Truong T.K.C & Haughton, D & Haughton, J, (2002). Ethnic minority development in Vietnam : a socioeconomic perspective. Policy Research Working Paper Series 2836, The World Bank.
7. Béné, C. (2008). ASSESSING VULNERABILITY TO POVERTY IN FISHING COMMUNITIES*. 2008 Vietnam Proceedings
8. Bradshaw,T.(2006). Theories of Poverty and Anti-Poverty Programs in Community Development. RPRC Working Paper No. 06-05, February 2006.
9. Burgess, S & Propper, C. (1998). An economic model of household income

dynamics, with an application to poverty dynamics among American women. LSE Research Online Documents on Economics 6525, London School of Economics and Political Science, LSE Library.
10. Centre for International Economics, Canberra and Sydney (2002). Vietnam Poverty Analysis. Prepared for AusAID.
11. Chaudhuri, S., J. Jalan, et al. (2002). "Assessing household vulnerability to poverty from cross sectional data: a methodology and estimates from Indonesia." Department of economics discussion Paper No. 0102-52. University of Columbia.
12. Christiaensen, L. and Subbarao, K. (2004) Toward an understanding of household vulnerability in rural Kenya. World Bank Policy Research Working Paper 3326, Washington DC: World Bank.
13. Dercon, Stefan. 2001. "Assessing Vulnerability to Poverty." Paper prepared for the UK Department for International Development. Department of Economics, Oxford University.
14. Devereux, S. (2001) Can social safety nets reduce chronic poverty? Paper presented at the Birmingham University's Research Seminar on Chronic Poverty, School of Public Policy. 6 February, Birmingham.
15. Fisher, M. (2005). Association On the Empirical Finding of a Higher Risk of Poverty in Rural Areas: Is Rural Residence Endogenous to Poverty? Western Agricultural Economics Association. Vol. 30, No. 2, August 2005.
16. Fissuh, E & Harris, M. (2004). Determinants of Poverty in Eritrea: A Household Level Analysis. Econometric Society 2004 Australasian Meeting 364, Econometric Society.
17. Gans, H. (1995). The war against the poor. New York, NY: Basic Book.
18. Ghazouani,S & Goaied, M (2001). The Determinants of Urban and Rural Poverty in Tunisia. No 126, Working Papers from Economic Research Forum, 2001-09
19. General Statistics Office of Vietnam http://www.gso.gov.vn/default_en.aspx?tabid=474&idmid=3&ItemID=15194
20. Haughton, J. and. Khandker, S.R.(2008) Handbook on Poverty and Inequality, 232-235, published in 2008.
21. James, C. (2006). The place of Lester Ward among sociological classical. Journal of Classical Sociology. 6 (1), 5-21.
22. Justino, P , Litchfirld, J and Pham, H.T. (2008). Poverty dynamics during trade reform: evidence from rural Vietnam. Review of Income and Wealth Series 54, Number 2, June 2008.
23. Katsushi S. Imai , Raghav Gaiha & Woojin Kang (2011) Vulnerability and poverty dynamics in Vietnam,Applied Economics, 43:25, 3603-3618
24. Lewis,O (1998).The Culture of Poverty. Society, January/February 1998, Volume 35, Issue 2, pp 7-9.
25. Lanjouw, P. Marra, M. and Nguyen, C. (2013). Vietnam's Evolving Poverty Map: Patterns and Implications for Policy. Policy Research Working Paper 6355, The

World Bank, Development Research Group, Poverty and Inequality Team, February 2013
26. Marie-Hélène Cloutier & John Cockburn & Bernard Decaluwé, 2008. "Education and Poverty in Vietnam: a Computable General Equilibrium Analysis," Cahiers de recherche 0804, CIRPEE.
27. Meyer, Bruce D., and James X. Sullivan. (2012). Identifying the Disadvantaged: Official Poverty, Consumption Poverty, and the New Supplemental Poverty Measure. Journal of Economic Perspectives, 26(3): 111-36.
28. Moser, C. (1998) The asset vulnerability framework: reassessing urban poverty reduction strategies, World Development, 26(1), pp. 1-19
29. Nguyen Thang, Le Dang Trung, Vu Hoang Dat and Nguyen Thu Phuong, "Poverty, Poverty Reduction and Poverty Dynamics in Vietnam", Background Paper for the Chronic Poverty Report 2008-09
30. Peter Lanjouw, Marleen Marra and Cuong Nguyen, Vietnam's Evolving Poverty Map: Patterns and Implications for Policy, Policy Research Working Paper 6355, The World Bank, Development Research Group, Poverty and Inequality Team, February 2013
31. Pham Anh Tuan. Viet Nam Country Case Study, Background Paper for the Chronic Poverty Report 2008-09
32. Prowse, M. (2003). Towards a clearer understanding of 'vulnerability' in relation to chronic poverty. CPRC Working Paper No 24 April 2003
33. Quach, M.H, (2005). Credit Rationing and Access to Finance for the Low Income Households - A Review and Extension of Literature, in: Access to Finance and Poverty Reduction – An Application to Rural Vietnam, Unpublished PhD Thesis, the University of Birmingham.
34. Rank, M. (2004). One nation underprivileged: Why American poverty affects us all. New York, NY: Oxford Press.
35. Ray, Debraj. Development Economics. Princeton University Press. Princeton, New Jersey. 1998.ISBN 0-691-01706-9. 249-256
36. Resolution on sustainable poverty reduction during 2011 – 2020 http://www.moj.gov.vn/vbpq/en/Lists/Vn%20bn%20php%20lut/View_Detail.aspx?ItemID=10737
37. Sher, J. P. (1977). School Based Community Development Corporations: A New Strategy for Education and Development in Rural America. in J. P. Sher (ed), Education in Rural America (pp. 291-346).
38. Soureshjani, M.H and Kimiagari, A.M. (2013). Calculating the best cut off point using logistic regression and neural network on credit scoring problem- A case study of a commercial bank. African Journal of Business Management. Vol. 7(16), pp. 1414-1421, 28 April, 2013
39. Thang, N, Trung, L.D. Dat, V.H. and Phuong, N.T. (2008). Poverty, Poverty Reduction and Poverty Dynamics in Vietnam. Background Paper for the Chronic Poverty Report 2008-09.

40. Tuan PA. 2008. Vietnam Country Case Study. Background Paper for the Chronic Poverty Report 2008-2009.
41. World Bank 2011. Poverty Reduction in Vietnam: Achievements and Challenges. Hanoi, March 2011.http://www.worldbank.org/en/news/feature/2013/01/24/poverty-reduction-in-vietnam-remarkable-progress-emerging-challenges
42. World Bank. 2014. *Well begun but not yet done : progress and emerging challenges for poverty reduction in Vietnam*. Washington, DC ; World Bank Group.

Appendix

Table A1, the result of classification statistics

	TRUE		
Classified	D	~D	Total
+	63	112	175
-	42	382	424
Total	105	494	599
Classified + if predicted Pr(D)>=0.25			
True D defined as pr2012!=0			
Sensitivity		Pr(+| D)	60.00%
Specificity		Pr(-|~D)	77.33%
Positive predictive value		Pr(D| +)	36.00%
Negative predicted value		Pr(~D| -)	90.09%
False + rate for true ~D		Pr(+|~D)	22.67%
False - rate for true D		Pr(-| D)	40.00%
False + rate for classified +		Pr(~D| +)	64.00%
False - rate for classified -		Pr(D| -)	9.91%
Correctly classified			74.29%

From the table, the total correctly classified rate is 74.29%, while 77.33% of non-poor is classified correctly, and there are 60.00% of the poor households being classified as the poor.

The cutoff point cannot equal to 0.5 when the proportion of 1s and 0s in the original data is not similar. And the 0.25 is the best cutoff point to minimize the estimation error.

Table A2, the best cut-off points

Cut off points	Specifity	Sensitivity	Sum	Correctly classified
0.01	100.00%	8.50%	108.50%	24.54%
0.1	88.57%	32.59%	121.16%	42.40%
0.15	75.24%	53.85%	129.09%	57.60%
0.2	66.67%	68.83%	135.50%	68.45%
0.25	60.00%	77.33%	137.33%**	74.29%
0.3	40.95%	86.84%	127.79%	78.80%
0.35	28.57%	92.31%	120.88%	81.14%
0.4	18.10%	94.53%	112.63%	81.14%
0.45	6.67%	97.98%	104.65%	81.97%

0.5	2.86%	98.58%	101.44%	81.80%
0.55	0.95%	99.60%	100.55%	82.30%
0.59	0.00%	100.00%	100.00%	82.47%

Note: **means the biggest sum value.

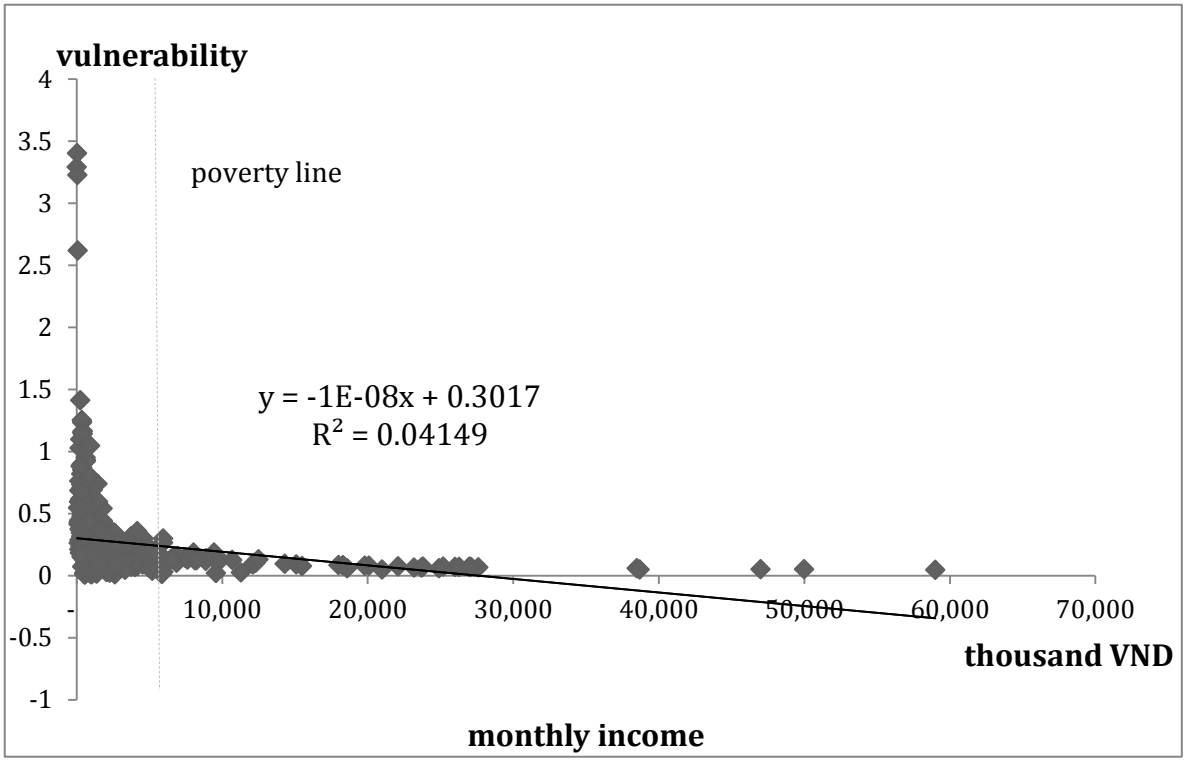
Specificity---the percentage of the poor are predicted to be poor, over the amount of poor households.

Sensitivity--the percentage of the non-poor predicted to be non-poor, over total non-poor households.

Sum—sum of sensitivity and specificity, choosing the cutoff points depends on maximizing the sum of sensitivity and specificity.

According to Soureshjani, M.H and Kimiagari, A.M (2012), the best cut-off point should the one that minimize the estimation error. Since when the cut-off points equal to 0.25, the sum of specificity and sensitivity is the biggest, which means that the estimation error is the least. The cut-off point should be 0.25.

Figure A1, the relationship between vulnerability index and monthly income



Source: The "Vietnam Fisheries Transition Survey" data

Table A3, Statistical characteristics of vulnerability index

Geography	Primary activity	Average vulnerability
All geography	All sectors	0.2695502
All geography	Fishing as primary activity - near-shore	0.1886696
All geography	Fishing as primary activity - off-shore	0.2029748
All geography	Aquaculture as primary activity - extensive	0.3973566
All geography	Aquaculture as primary activity - intensive	0.2749731
All geography	Other as primary activity	0.1866213
Dam Doi	All sectors	0.3546088
Dam Doi	Fishing as primary activity - near-shore	0.3976671
Dam Doi	Fishing as primary activity - off-shore	0.4833878
Dam Doi	Aquaculture as primary activity - extensive	0.488876
Dam Doi	Aquaculture as primary activity - intensive	0.292457
Dam Doi	Other as primary activity	0.203701
Tran van Thoi	All sectors	0.254288
Tran van Thoi	Fishing as primary activity - near-shore	0.1495283
Tran van Thoi	Fishing as primary activity - off-shore	0.0869606
Tran van Thoi	Aquaculture as primary activity - extensive	0.5725709
Tran van Thoi	Aquaculture as primary activity - intensive	0.2254355
Tran van Thoi	Other as primary activity	0.1806592
Phu Vang	All sectors	0.1896454
Phu Vang	Fishing as primary activity - near-shore	0.1655393
Phu Vang	Fishing as primary activity - off-shore	0.1270995
Phu Vang	Aquaculture as primary activity - extensive	0.2276789
Phu Vang	Aquaculture as primary activity - intensive	.
Phu Vang	Other as primary activity	0.150667

Source: The “Vietnam Fisheries Transition Survey” data