ỨNG DỤNG MÔ HÌNH HỒI QUY BINARY LOGISTIC
TRONG PHÂN TÍCH GIẢM NGHÈO Ở THÀNH PHỐ HỘI AN
APPLICATION OF BINARY LOGISTIC REGRESSION
TO ANALYZING HOIAN'S POVERTY

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Abstract - Bài viết chủ yếu phân tích kết quả giảm nghèo và đánh giá tác động của các yếu tố đến tình trạng nghèoở thành phố Hội An bằng việc sử dụng phương pháp định lượng với mô hình hồi quy Binary Logistic. Kết quả cho thấy tỷ lệ hộ nghèo, đặc biệt là khoảng cách nghèo, độ trầm trọng của nghèo ở thành phố Hội An đã có sự giảm đi mạnh mẽ trong giai đoạn 2010 – 2012. Phân tích định lượng còn cho thấy các nhân tố làm tăng xác suất nghèo chủ yếu là do số người sống phụ thuộc cao hoặc tình trạng sức khỏe kém, nhiều bệnh tật. Ngoài ra xác suất nghèo tăng còn do lao động chính làm trong các ngành nông nghiệp, trình độ học vấn thấp, số lao động trong hộ còn ít và khả năng tiếp cận với nguồn vốn tín dụng chưa cao.

Key words - binary logistic; tỷ lệ nghèo; Hội An, xác suất nghèo; tác động biên

Tóm tắt - This paper is to analyse the poverty reduction results, clarify some basic factors and their impacts on poverty probability in Hoi An city by using quantitative methods:the model of Binary Logistic regression. The results show that the poverty rate, especially the poverty gap and poverty severity in Hoi An strongly declined in the 2010-2012 survey period. Quantitative analysis also reveals the factors that increase probability of being poor is mainly due to high number of people living dependently in households, poor health status with many illnesses. In addition, the rise in probability of poverty in Hoi An is also caused by almost main labourers working in the agricultural sector, low education levels, low numbers of labourers in households and difficulty in the accessibility of credit capital.

Từ khóa - binary logistic; poverty rate; Hoian; poverty probability; marginal impact

1. Introduction

Hoi An is known as one of the most famous tourist cities in Vietnam. People's life is improved markedly thanks to the implementation of governmental poverty reduction programs. However, this city which consists of the inner-city, rural areas, sandy areas, coastal areas, offshore islands with different favorable and difficult characteristics might lead to the big gap of standards of living among communes and wards.

This paper is to analyse poverty reduction performance in Hoian City, and firgure out some basic factors that impact poverty probability in view of making contributions to poverty reduction and sustainable development for the locality.

2. Methodology

2.1. Poverty Measurement

The definition of poverty is not unique, and therefore no method can be perfectly used to measure it. The concept from the World Bank (2004) is said to be the most currently complete: " Poverty concludes not only material destitution (to be measured by a suitable concept of income or consumption), but also the lack of education and health." From this, someone may think poverty is no money then still holds true but not enough. Poverty is also due to the lack of health, nutrition, education, safety, confidence in life, social relations, equal rights, or lacking the opportunity to develop, vulnerability and helplessness in face of changes around them.

There are two methods used to measure poverty: (1) Directly measured by assessing whether households have enjoyed standards such as: clean water, sufficient food, medical examination, education and other standards. (2)

Indirectly determined by calculating the financial resources that households need to purchase goods and services (the household's income or spending is normally used in this case)

In this article, household's income criteria are used as ways to determine poor households. Accordingly, from 2010 to 2012, households whose average income levels from 500,000 VND/person/month or less are classified to be poor.

2.2. Data Construction Method

Data used for this study was gathered from direct surveys with 280 votes according to the stratified and random sample selection method. The survey was conducted during the period from February to March 2013, with 112 poor households and 168 non-poor households in Hoian City. After collecting, 20 cases of incomplete information excluded to get a more accurate model. Therefore, the model has 260 samples, of which there are 155 non-poor households and 105 poor households.

2.3. Empirical Model

The model chosen to reflect determinants of poverty is Binary Logistic. The application of the Binary Logistic model to analysing poverty are increasingly popular in current economic studies. Studies on the incidence of poverty in Nepal (Joshi et al, 2012) or Denbel District in Ethiopia (Shibru et al, 2013) are some of these examples. Most of previous papers on Hoian's poverty used multiple linear regression models with dependent variables of quantitative as income or expenditure of the poor. The goal of this article is to study the correlation between one or more risk factors and incidences of poverty. Binary Logistic regression model is considered to be the most appropriate when dependent variable is dichotomous

variable as in our case.

In this paper, dependent variable, a qualitative variable, is determined as the status of households (poor/not poor). The dependent variable receiving two values 1 if it happens and 0 if it does not happen.

The model takes the form:

$$Ln(\frac{P(Y=1)}{P(Y=0)}) = \beta_0 + \beta_1 X_i + \varepsilon \qquad (1)$$

Y represents poor status of Hoian's households, measured by two values 1 and 0 (If households are not poor, they are encrypted 0, if households are poor, they are encrypted 1). X_i is an independent variable, ε is random error of population regression function. The parameters of this model reveal independent variable's effect on the probability of falling into poor condition of Hoian's households. This model results can be used to suggest policies of poverty reduction and improve household's income.

3. Results

3.1. Poverty Performance in Hoian

3.1.1. Poverty Rate

Hoian's effort to reduce poverty in the period 2010-2012 achieved much success with the poverty rate continuously decreased (Figure 1). In 2012, this number is only 2.15 % with the total 451 poor households. Hoian is also a low poverty rate-ranking city if compared to upper 10% of the whole country.

3.1.2. Poverty Gap and Poverty Severity

Poverty rate cannot completely reflect poverty reality. To measure poverty depth, the indicator of poverty gap (PG) *(the distance between the average income of the poor and the poverty line)* and the poverty severity (PS) *(is defined as the average of the square relative poverty gap of the poor. It takes inequality among the poor into account)* need to be used. The calculation of these two indicators was formed by Foster, Greer and Thorbecke (1984).

$$PG = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{z-y_i}{z}\right) \qquad (2)$$

$$PS = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{z-y_i}{z}\right)^2 \qquad (3)$$

In which n: number of households

q: households below poverty line.

y_i: average income

z: povety line.

Applied to data sets with 773, 599 and 451 poor households through the years 2010, 2011 and 2012, it is shown that Hoian's poverty gap decreased over the years. This demonstrates that the proportion of poor people close to the poverty line increases, the depth of poverty also falls (firgue 1). Poverty severity degrades fast showing that the unequal levels are also diminishing, even in particular group of poor households. These indicators represent a relatively optimistic signal in reducing poverty in the years to come.
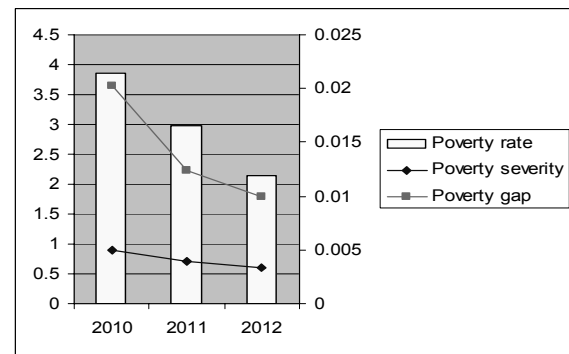

Firgue 1. *Poverty rate, poverty gap and poverty severity of Hoi An*
Source: Department of labor, invalids and Social in Hoi An and author's calculation

3.1.3. Poverty rate and GDP per capita:

The figure of GDP per capita growth and poverty rate in Hoian show us the relatively tight relationship between economic growth and poverty reduction, which is reflected in the indicator "1% increases in GDP per capita growth and percentage point reduction in poverty rate". According to the results, 1% increases in GDP per capita growth has helped reduce the poverty rate up to 0.079 and 0.073 percentage in 2011 and 2012 (Firgue 2) as compared with the previous year.

First, this indicator is positive showing that Hoian has carried out "growth to benefit the poor" policy over the past period.

Second, percentage-reduced point of the poverty rate in 2012 lower than in 2011 also reveals the fact that, in order to reduce 1 percentage point of poverty rate, the higher and higher growth of GDP per capita needs to be carried out, which means the "sensitivity" between economic growth and poverty reduction will decrease in the next year.

Year	GDP per capita growth (%)	Poverty rate(%)	1% increase in GDP per capita growth and percentage reduction in poverty rate.
2010	14.3	3.85	-
2011	10.9	2.98	0.079
2012	11.3	2.15	0.073

Firgue 2. *GDP per capita growth and poverty rate*
Source: Author's calculations

3.2. Descriptive Analysis from the Survey

3.2.1. Scale of Households

Survey results show a big difference in the scale of households. On average, the number of people in a non-poor family is 3.2; whereas, a poor family has 4.2. The highest number comes to a family with 8 people living in a house. Similarly, a big difference can be seen in the number of dependents. This number for non poor family is on average 1.3 which is less than the number of laborers (1.87), demonstrates the rate of dependency is low. On the contrary, those poor households have high rate of dependency. This number is on average 2.7 and nearly double the average number of laborers (1.44). point Mrs.

Vo Thi Tinh - Cam Kim township: "A day's Work was paid 120 thousand; while, men were paid 150 thousand. Women do not have enough strength to do the tilling, only the men do. I will go as a laborer working for loading cement, then receive 140 thousand per day, while men get 160 thousand." Source: Personal interviews

3.2.2. Householder's Education Level

Ranks of education level are encoded as 0: never go to school; 1: Primary school ;2: Lower secondary; 3: upper secondary; 4: intermediate; 5: colleges, universities.

Look at the chart we see this figure for non-poor householders is on average 2.29, much higher than the poor which is just 0.9. Most of them never go to school or just finish primary school. The men act as the mainstay of their family, but their low education not only affects income but also restricts decisions and their mistaken decisions can drive their family to more straitened circumstances.
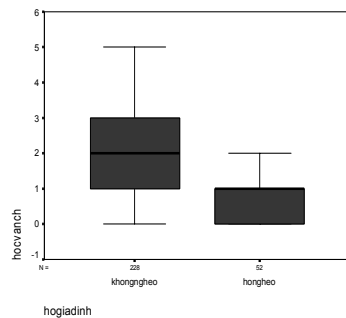

Figure 3. *Householder's Education Levels*
Source: SPSS analysis by author

3.2.3. Householder's Occupation

Occupation is classified in two types: agriculture and other sectors, including: construction industry, tourism and services. Investigation results show that the majority of poor householders mainly work in agriculture, only 21.27% of them are employed in other sectors. In contrast, most of non-poor householders work on other sectors with higher and more stable income, so the possibility of falling into poverty is lower.

3.2.4. The Accessibility of Resources

Over 90% of poor households have their own land to produce as their main occupation is doing farm work, 75% of them have means of production. Thus, poor households in Hoian have their land to produce but they are still into poor condition, this shows that the way people use land is not effective, as well as not knowing earning method so they waste this precious resource. 94% of investigated poor households have their own houses. However, nearly all of them are decayed, small areas and family members have to live cramped up. On average 2.8 people live in just one room while in non-poor houses, average1.6 people share one room.

3.2.5. Credit

The rate of credit accessibility is quite low with 28.8%. Not many poor households ask for loans although there are many sources, many projects to provide credit to the poor through the national program on poverty reduction, but still

a lot of poor people can not access to these credit sources.

When asking some households the reason for not taking loans, 32% responded that they have no specific business plans. Therefore, since most of the poor has not directed the work he will do with the loan, or even if they have, the practicability is not high evaluated, the credit institutions will refuse to lend. There are 27% of households are afraid of feeling indebted, 11% of households do not have collateral for loans, 11% of households being harassed by credit institutions, so they restrict accessibility of loan for the poor.

3.3. Empirical Analyses

Variables used in regression model includes: Number of dependent (DEP); number of labor (LAB); householder's education (EDU); Sex of householder (SEX); householder's occupation (OCC); Know how to do bussiness (KNOW); House possession (HOU); Land for production (LAND). The grounds for selecting these variables are on some earlier studies of poverty in different provinces and cities such as Khanh Hoa (Vo Van Dien, 2010); Mekong River Delta (Nguyen Quoc Nghi and Bui Van Trinh, 2011). In this model, the author added two new dummy variables: Loan condition (LOA) and Health condition (HEA) as these two indicators particularly impact poverty in Hoi An..

	B	S.E.	Wald	Sig.
DEP	11.226	4.223	7.065	.008
LAB	-2.634	1.269	4.310	.038
EDU	-4.285	1.844	5.399	.020
OCC	-6.206	2.842	4.768	.029
LOA	-4.352	1.750	6.184	.013
HEA	4.322	1.517	8.119	.004
Constant	1.605	2939.657	.000	1.000

Firgue 4. *Regression result*

After running the model, some variables such as SEX, KNOW, HOU, LAND have significant indicator sig.>0.05, thus these variables are not statistically significant, meaning they do not explain the significance of the regression model. After removing these variables out of the model,the new results of regression with the parameter characteristics as firgue 4.

The results of verifying the general match of the modelhave the sense to observe with Sig.=0.00, so it is safe to reject hypothesis Ho: βk=0, meaning that the model built match the data set. The value of -2LL is 27,815 which is not very high, so it presents a fairly good fit of the model.Independent variables used in regression includes:

The accuracy of its prediction model is also expressed by Classification Table. This Panel will compare the actual value and the predicted value for each expression and calculate the correct prediction rate of events. The results show that in 155 non poor households, the model predicted correctly 149 cases, so the correct rate is 96.1%. Similaly, in which 105 poor households, there are only 7 wrong predicted cases, the correct rate is 93.3%. The correct prediction rate of the whole model is 94.1%.

The sign of parameters reflects author's expectations. Accordingly, number of dependent and health condition are factors that highly influence probability of poverty. Of the factors that are likely to reduce the probability ofbeing poor, the occupation has strongest impact, meaning that ifhouseholder has not worked in the agricultural sector then theprobability of being poor can be lessened. Other factors such as number of labor, education level, loan condition also affect the ability to alleviate poverty.

Marginal impact analysis of each factor shows the great influence to probability of being poor of a household, particularly the number of the dependent andhealth condition (firgue 5). When other factors constant, with the probability of poverty, suppose 20% initially, if households bring up one more dependentthen the probability of poverty will increase up to 99.99%. If family members are chronically ill or sick, then the probability of poverty rise to 94.95%. If householders do not work in agricultural sectors then the probability of poverty can be reduced to only 0.0504%. If households are likely to take a loan or householders improve their education level then the probability is only about 0.3%. This figure for an additional worker is 1.7%.

	β	Change of poverty probability when independent variables change to a unit, with initial probability:			
		10%	20%	30%	40%
DEP	11.226	99.9880	99.9947	99.9969	99.9980
LAB	-2.634	0.7916	1.7636	2.9857	4.5686
EDU	-4.285	0.1529	0.3433	0.5871	0.9103
OCC	-6.206	0.0224	0.0504	0.0864	0.1344
LOA	-4.352	0.1430	0.3211	0.5493	0.8518
HEA	4.322	89.3245	94.9562	96.9946	98.0470

Firgue 5. *Marginal impacts of each factor to probability poverty*

4. Conclusions

Analyses indicating the depth and severity of poverty in Hoian tend to decrease. This study also proves that increase in Hoi An probability of poverty is mainly due to the number of dependents and health condition. Therefore, family planning policies as well aswhealth care policy for chronic diseases or illness subject to poor households will be a matter of paramount importance. Moreover, to achieve rapid and sustainable poverty reduction, it is essential to concentrate more on education, especially for poor students so that they can break out of the vicious cycle of their families' poverty. Resolution of employment and creditincentives for the poor should also be interested in.

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