The Determinants of Fishing Households' Income in the Coastal Plain Areas of Quang Nam Province

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Abstract: *This paper uses econometric models to estimate factors determining the fishing household's income in coastal plain areas of Quang Nam province. The estimation results indicate that the residential characteristics, characteristics* of *fisheries*, *characteristics* of *household's socioeconomic and demographics are the main factors having significant impacts on fishing household's income. In contrast, fisheries extension has no significant impact on the difference of income between fishing households. Based on the empirical results, some policy recommendations for improving the income of fishing households in coastal plain areas of Quang Nam province are proposed*.

Keywords: Econometrics, Income, Fishermen, Factors, Coastal Region, Fishing, Quang Nam

1. Introduction

Quang Nam, a coastal province in the key economic region of Central Vietnam, has many potentials and advantages in the development of marine economy. The provincial coastline stretches over 125 km, next to an exclusive economic zone of more than 40,000 km^2 where large fishing grounds with abundant marine resources, diverse in species and of high economic value are located. Despite the potentials for fishery and aquaculture development, Quang Nam still has many especially difficulty-stricken communes in coastal plain areas and islands. In particular, the current level of income of fishing households in these areas is still low and there is considerable income variation in the community of local fishermen. The paper investigates the factors determining the income of fishing households in the coastal plain areas of Quang Nam province based on the primary data collected under the provincial-level

scientific research project of Quang Nam province "Factors affecting income of and income-raising measures for fishing households in coastal plain areas of Quang Nam province", led by Hoang Hong Hiep, 2017. The survey was conducted with 588 fishing households in 12 communes/ wards in coastal plain areas in 6 districts of Quang Nam including Dien Duong commune (Dien Ban district); Cua Dai ward, Cam An ward (Hoi An city), Duy Hai commune (Duy Xuyen district); Binh Duong, Binh Minh, Binh Nam communes (Thang Binh district); Tam Thanh commune (Tam Ky city); Tam Hoa, Tam Tien, Tam Hai communes (Nui Thanh district). In particular, the sampling units in Thang Binh and Nui Thanh districts account for over 60% of the sample size. In general, the sample is quite large and representative.

2. Estimation Model

Based on the analytical framework of Olale and Henson (2012, 2013), Garoma et al. (2013), Al Jabri et al. (2013), Hoang Hong Hiep (2016), we propose the model of factors determining the income of fishing households in coastal plain areas of Quang Nam province as follows:

$Y_i = \alpha_0 + \beta_1 Regions_i + \beta_2$ Characteristics of $fisheries_i + \beta_3$ Socioeconomic and $Demographics_{it} + \beta_3$ Fisheries Extension $+ \varepsilon_i$ (1)

In which: εi= model residuals; i = fishing household i; i = 1,2,..., 588.

Dependent variable (Y) indicates the total income of a fishing household, measured by two scales: (i) the total income of a fishing household in one year; (ii) Per capita income of a fishing household in one year.

Independent variables:

Regions: These are dummy variables that reflect the characteristics of fishing households in different districts. As the sample covers 6 districts of Quang Nam province, we use up to 5 dummy variables in the model to control for income differentials among fishing households due to the characteristics of the residence areas.

Characteristics of fisheries: these variables reflect the specific characteristics of fishery activities of fishermen that directly affect the income of fishing households. The main fishery characteristics are: capacity of fishing vessels, fishery technology and equipment, fishing grounds, education level and experience of captains, consumption markets, diversification of income.

Socio-economic and Demographics: these variables reflect the demographic and socio-economic characteristics of fishing households. These attributes include: number of household members, number of dependent members, age of the fishermen, education level of fishermen, number of fishery workers in the household, experience of fishermen and captains, love for profession, the ownership of fishing vessels.

Fisheries Extension: these reflect the mechanisms and policies of the State to support fishermen in fisheries development and income generation, measured by the variables such as: role of fisheries extension work, fuel support, participation in cooperative groups or local fisheries unions.

Table 1: Measurement and description of variables

Variables	Description	Variable attribute	Measurement	Expected sign
Independent variables	Log (total income of fishing households)	LnTongTN	million dong/year	
	Log (per capita income of fishing households)	LnTNBQ_Nguoi	million dong/year	
"Regions" variables	Dien Ban	Dienban	1: Dien Ban; 0: otherwise	(+/-)
	Hoi An	Hoian	1: Hoi An; 0: otherwise	(+/-)
	Duy Xuyen	Duyxuyen	1: Duy Xuyen; 0: otherwise	(+/-)
	Thang Binh	Thangbinh	1: Thang Binh; 0: otherwise	(+/-)
	Tam Ky	Tamky	1: Tam Ky; 0: otherwise	(+/-)
	Nui Thanh	Nuithanh	1: Nui Thanh; 0: otherwise	(+/-)
"Characteristics of fisheries" variables	Log (capacity of vessels)	LnCongsuat	CV	(+/-)
	Level of catching and preserving technology	Congnghe	Likert scale 5 levels with: (1) very outdated and level (5) modern	(+)
	Fishfinder	Tamngu	1: in use; 0: not in use	(+/-)
	Fishing ground 1	Venbo	1: inshore fishing; 0: otherwise	(+/-)
	Fishing ground 2	Vunglong	1: nearshore fishing; 0: otherwise	(+/-)
	Fishing ground 3	Vungkhoi	1: offshore fishing; 0: otherwise	(+/-)
	Marine product consumption market	ThitruongTT	1: sale to logistics support vessels on the spot; 0: otherwise	(+/-)
	Education level of captains	HocvanTT	The highest school grade completed	(+)
	Years of experience of captains	KinhnghiemTT	The number of years	(+/-)
	Seine fishing	Luoivay	1: yes ; 0: otherwise	
	Gillnetting	Luoire	1: yes ; 0: otherwise	

"Demographics and socio-economic characteristics" variables	Number of household members	Nhankhau	The number of people	(+/-)
	Number of dependent household members	Phuthuoc	The number of people	(-)
	Age of fishermen	Tuoi	Age	(+)
	Education level of the head of household	HocvanND	The highest school grade completed	(+)
	Years of fisheries experience	KinhnghiemND	The number of years	(+)
	Love for profession	Yeunghe	5-point Likert scale with: (1) do not love the job and (5) love the job very much	(+)
	Ownership of the fishing vessels	Chutau	1: Owner; 0: Crew member	(+)
	Total number of fishermen of the household	LaodongNN	The number of fishermen	(+)
	Income diversification status of households	DadanghoaTN	1: having income from non-fisheries activities; 0: having income from fisheries only	(+/-)
"Fisheries extension" variables	Fisheries extension: Measured by 3 observation variables: The role of local fishery extension workers, the role of extension work, the role of local fisheries associations	Khuyenngu	Likert scale with 5 levels: (1) not good and (5) very good; Cronbach's alpha testing is used to test the scale.	(+)
	Participation in cooperative groups or/and associations	Hoptac	1: participating; 0: not participating	(+)
	Fuel support	HotroNL	1: receiving fuel support; 0: not receiving fuel support	(+)

3. Methodology, procedure and estimation results

First, we tested the variance inflation factors (VIF) according to Kennedy (2008) to test the multi-collinearity between independent variables of the estimation models. The test result shows that multi-collinearity between the explanatory variables do not exist in the model. Then, we continued to Breusch-Pagan/Cook-Weisberg test (Greene, 2000) to test Heteroscedasticity. The results of the tests presented in Table 2 show that the models violate the heteroscedasticity assumption, which allows us to estimate using the ordinary least squares method (OLS) with heteroscedasticity adjustment in the model. The regression results by the OLS method are presented in Table 2 which estimates the determinants of the income of fishing households in coastal plain areas of Quang Nam province as follows:

Table 2: Estimation results of factors affecting the income of fishing households in coastal barrier island areas of Quang Nam province(*)

Models Variables	(1) LnTongTN	(2) LnTongTN	(3) LnTNBQ	(4) LnTNBQ
LnCongsuat	0.114***	0.117***	0.119***	0.122***
	(0.003)	(0.003)	(0.005)	(0.004)
Congnghe	0.0397	0.0469	0.0433	0.0509
	(0.362)	(0.295)	(0.352)	(0.286)
Luoivay	-0.0828	-0.131*	-0.0955	-0.145*
	(0.262)	(0.078)	(0.223)	(0.066)
Luoire	0.200	0.228	0.158	0.187
	(0.261)	(0.209)	(0.417)	(0.341)
Chupmuc	-0.287***	-0.295***	-0.301***	-0.307***
	(0.006)	(0.006)	(0.009)	(0.009)
Vungkhoi	0.0478	0.0259	0.0478	0.0227
	(0.588)	(0.771)	(0.604)	(0.807)
Venbo	-0.288***	-0.311***	-0.261**	-0.285**
	(0.006)	(0.003)	(0.023)	(0.014)
HocvanTT	-0.00560	-0.00530	-0.00677	-0.00617
	(0.763)	(0.777)	(0.744)	(0.770)
KinhnghiemTT	-0.00150	-0.00158	0.000445	0.000410
	(0.707)	(0.691)	(0.915)	(0.921)
ThitruongTT	0.290***	0.277***	0.332***	0.318***
	(0.005)	(0.009)	(0.002)	(0.006)
	0.0619	0.0496	0.207***	0.196***
	(0.417)	(0.519)	(0.002)	(0.003)
Nhankhau	0.209***	0.212***		
	(0.000)	(0.000)		
HocvanND	0.0141	0.0122	0.0262	0.0240
	(0.438)	(0.517)	(0.181)	(0.240)

(*) Pvalue is noted in parentheses. * pvalue < 0.1, ** pvalue < 0.05, *** pvalue < 0.01.

Tuoi	-0.00877**	-0.00827*	-0.00517	-0.00455
	(0.050)	(0.068)	(0.280)	(0.354)
Phuthuoc	-0.176***	-0.183***	-0.0205	-0.0257
	(0.001)	(0.000)	(0.347)	(0.251)
LaodongNN	0.123	0.132*	0.211***	0.222***
	(0.113)	(0.098)	(0.004)	(0.003)
KinhnghiemND	0.00902*	0.00747	0.00852	0.00675
	(0.071)	(0.148)	(0.115)	(0.219)
Chutau	0.559***	0.594***	0.524***	0.561***
	(0.000)	(0.000)	(0.000)	(0.000)
Yeunghe	0.122***	0.133***	0.155***	0.167***
	(0.001)	(0.000)	(0.000)	(0.000)
Khuyenngu	0.0235	0.0102	0.0418	0.0278
	(0.552)	(0.793)	(0.316)	(0.497)
Hoptac	0.129*	0.118	0.147*	0.137*
	(0.079)	(0.111)	(0.067)	(0.092)
HotroNL	0.136	0.109	0.144	0.116
	(0.220)	(0.330)	(0.214)	(0.321)
HoiAn	0.210	0.345***	0.289**	0.427***
	(0.105)	(0.006)	(0.025)	(0.001)
DuyXuyen	-0.168*	0.0750	-0.200*	0.0424
	(0.092)	(0.390)	(0.060)	(0.658)
DienBan	0.00664	0.214*	0.0859	0.291**
	(0.956)	(0.078)	(0.531)	(0.039)
ThangBinh	-0.320***		-0.324***	
	(0.000)		(0.000)	
NuiThanh		0.159*		0.149*
		(0.062)		(0.083)
Hằng số	2.879***	2.657***	2.820***	2.593***
	(0.000)	(0.000)	(0.000)	(0.000)
N	588	588	588	588
R^2	0.508	0.492	0.429	0.413
Breusch-Pagan/ Cook-Weisberg Test	(0.0846)	(0.0256)	(0.0258)	(0.0092)

- *"Regions":*

Estimates show that the average income of fishing households in coastal plain areas in Nui Thanh district and Hoi An city is statistically significantly higher than the average income of fishing households in the remaining districts. This aligns with the fact that Nui Thanh district and Hoi An city have large fishing ports adjoining the estuary and large fleets of fishing vessels operating mainly in nearshore and offshore areas, especially in Tam Hai island commune and Cua Dai commune which have large offshore fleets and long experience in offshore fishing. In contrast, the average income of fisheries households in the coastal plain areas of Thang Binh district is statistically significantly lower

(at the significance level of 1%) than the average income of fishing households in the remaining districts. This is in line with the field visit observation that most fishermen in coastal plain areas of Thang Binh district practice fisheries in inshore areas in small boats with capacity of less than 24CV. Therefore, the income from fisheries is usually low.

- *Characteristics of fisheries*

The coefficient of vessel capacity variable is positive, as expected, and is statistically significant at 1%. This shows that the capacity of fishing vessels has a significant impact on the income of fishing households, whereby fishermen on large vessels with high capacity will have high income. The fishing grounds of fishermen are divided into three types: offshore, nearshore, and inshore. Estimates show that fishing households engaged in inshore fishing have significantly lower income compared to offshore and nearshore fishing at 1% significance level. In contrast, the average income of fishing households engaged in offshore fishing do not differ significantly from those of nearshore and inshore fishing. Therefore, the effectiveness of offshore fishing of the fishermen in coastal plain areas of Quang Nam province is rather low due to the limited experience in offshore fishing. Thus, facilitating the shift from inshore fishing to offshore fishing with the appropriate scale should be identified as a focus in the coming time to improve the income of fishing households towards sustainability.

Unexpectedly, the coefficients of fishery equipment and technology level variables do not reach a statistical significance level of 10%. This means that there is little difference in the level of fishing technology employed by the fishermen in the coastal plain areas of Quang Nam province. Most of the fishing households rely on experience rather than modern fishing technology. In practice, the use of ordinary, obsolete fishfinders can result in low net fishing productivity, which makes the income from this mode of fishing lower than other modes. This is further demonstrated by the negative coefficients of the dummy variables of seine fishing, which shows that the income of seine fishing households is statistically significantly lower than that of households employing other fishing methods. This is a fact to be noted in the implementation of fisheries modernization policy for coastal plain areas in the coming time.

Estimation results also show that the consumption market for marine catch has a significant impact on the average income of fishing households. Accordingly, fishing households selling marine catch to purchasing logistics vessels on the spot will have a significantly higher income compared to those selling to markets on land. The policy implication is that Quang Nam province needs to put mechanisms in place to develop a logistics service fleet to improve the efficiency of fishing activities, especially offshore fishing.

Thus, characteristics of fisheries have a decisive impact on the income of fishing households in coastal plain areas in Quang Nam province. In other words, there is very high level of dependence on fisheries for income generation of this community.

- *Demographics and socio-economic characteristics*

Estimates show that the number of household members have a positive effect on the income of fishing households at

a statistical significance level of 1%. Similarly, the number of fishery workers in the household also has a positive effect on the household income. That still holds true at a significant level of 1% for models (3) and (4) by eliminating the effect of demographic variables in the model. In contrast, as expected, the coefficient of the variable of dependent members (members not generating income) is negative and that still holds true at a statistically significant level of 1% in both (3) and (4) models. This means that the number of dependent members has a negative impact on the income level of fishing households. In particular, as expected, income diversification has an effect on household income growth at a statistical significance level of 1% in both (3) and (4) models. The policy implication is that raising the income of fishing households from non-fishery activities is the direction to be encouraged in the future.

Estimated results also show that the age of fishermen correlated negatively with household income at 10% statistically significant level in model (1) and 5% in model (2). Thus, the higher the age of the household head, the lower the household income. This is in line with the fact that the inshore fishermen in the coastal plain areas are mostly elderly people. Young and middle-aged people are gradually taking the key role in improving fishing efficiency for the community through the development of nearshore and offshore fishing fleets.

Unexpectedly, the education level of household heads and the education level of captains do not have a statistically significant effect on household income. This allows us to replace the education level of household heads variable with the captains' educational level variable. Meanwhile, experience in fisheries has a significant effect on household income at 10% significant level in model (1). It is implied that the income of fishing households in the coastal plain areas is not heavily influenced by experience. This is an especially noteworthy point that needs to be considered thoroughly in formulating policy to increase community income by encouraging young fishermen to engage in offshore fishing. Particularly, fishermen's love of profession has a positive effect on household income at the statistically significant level of 1%. The implication is that love of profession is an important driving force in improving the efficiency of fishing activities, contributing significantly to the increase in fisheries-derived income of fishing households.

- *Fisheries Extension*

According to the estimation results, the role of fisheries extension do not have significant effect on the income of fishing households. This can be understood that fisheries extension in the local area has not really contributed to improving the efficiency of fisheries activities, or possibly that fishermen still mostly rely on experience without fully realising the role of fisheries extension in marine product exploitation and preservation. Similarly, the fuel support variable also has no significant effect on the income difference between supported and non-supported fishing households. This is consistent with the fact that the majority of local fishing vessels operate in nearshore fishing grounds which are not eligible for fuel support. As expected, the variable of participation in cooperative group has a positive impact on household income at

10% significant level in models (1), (2) and (4). This implies that participation in fishery cooperative groups or associations actually helps fishing households improve their production efficiency by sharing fishing grounds, minimising fuel costs, cooperating in fishing,… This suggests that the local government should quickly ensure the substantive functioning of fisheries associations with the nuclear unit being cooperative groups in order to enhance fishing efficiency, contributing to improving income for fishing community in coastal plain areas.

4. Policy recommendations

Based on the above analysis, some policy recommendations are proposed to improve the income of fishing communities in coastal plain areas of Quang Nam province in the coming time as follows:

Firstly, to further promote the reasonable shift from inshore fishing to nearshore and offshore fishing in fisheries communities in coastal plain areas of Quang Nam province. This can help raising incomes for fishermen, minimising the depletion of resources in coastal areas, and contribute to protecting the national maritime sovereignty. In addition, the policy of shifting to offshore fishing for the communities in these areas should be designed in a way that is specialised, suitable for each fishing mode and fisheries community. Accordingly, Quang Nam province should focus on developing offshore fleets for fishing communities with long-standing tradition and practical experiences in offshore fishing, which are the areas with large fishing ports close to estuaries and smooth waterways like Hoi An city and Nui Thanh district. For other coastal plain areas, where fishing communities have long been accustomed to inshore fishing practice (Tam Ky, Thang Binh, Duy Xuyen), the provincial authority should put specific policies in place to encourage fishermen to gradually engage in nearshore and offshore fishing with medium-size vessels, avoiding the development of large fleets with high capacity vessels to operate in far fishing grounds given the limited experience of the community in offshore fishing. In addition, it is necessary to rapidly reform administrative procedures to enable eligible fishermen to easily access credit from central government programs (Decree 67) and funding support from the local government (Development Investment Fund, Fisheries Assistance Fund,...).

Secondly, to promote the modernisation of marine product exploitation and preservation technologies for offshore fishing fleets in order to increase the role of technology in improving the efficiency of fisheries. In particular, attention should be paid to promoting the leading role of local authorities in connecting fishermen and enterprises in the supply of modern machinery, equipment and technologies for marine product exploitation and preservation. The role of fisheries extension work in disseminating information and encouraging fishermen to adopt advanced, modern fishing and preservation equipment and technologies should be enhanced.

Thirdly, income diversification is an important strategy in improving income for fisheries communities in the coastal plain areas. Accordingly, it is necessary to review and adjust policies to support

fishermen to reduce poverty and increase income based on the combination of fishery and non-fishery livelihoods. Particularly, it is necessary to focus on raising non-fishery income for fisheries communities on the basis of exploiting the great potentials of the coastal plain areas of Quang Nam province for industrial and tourism development; there should be mechanisms to encourage enterprises to employ local workers, especially female workers in the fishing community.

Fourthly, to focus on effective implementation of family planning policy in the fishing community. Communication policy should focus on the dissemination of knowledge on family planning to young fishing households with low education levels, poor households and households replasing into poverty, thereby reducing the number of dependent members in fishing households. In addition, emphasis should be given to education development among fishing community.

Fifthly, to develop training activities to improve the capacity for captains, chief engineers of fishing vessels operating in nearshore and offshore areas, especially to grasp and competently use modern, advanced technology and equipment. In particular, incentive programs should be designed to encourage young, educated and capable fishermen to participate in building and mastering the operation of offshore fishing vessels.

Sixthly, to continue to establish and develop commune-level, district-level fisheries associations in coastal areas whose nuclear units are cooperative groups. In particular, it is necessary to quickly institutionalise the legal status of fisheries associations so that these associations have the legal entity as the representative body for fishermen recognised by law and therefore are capable of representing fishermen in matters related to fisheries ❑

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