Asian Journal of Social Science and Management Technology
ISSN: 2313-7410
Volume 2 Issue 3, May-June, 2020
Available at www.ajssmt.com

Analyses the Impacts of Natural Disasters on Income Per Capita in Mekong Delta River

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ABSTRACT : The paper shows the relationship between natural disasters and income per capita at Mekong Delta river. Fixed Effects Model (FEM) was used to analyze panel data of 13 provinces from 2012 to 2018. The results show that natural disasters reduce 5.3% of per capita income for the province affected by natural disasters. In addition, other factors such as infrastructure, trade and provincial competitiveness index (PCI) also have a positive impact on per capita income. From the research results, some policy implications are proposed to minimize the negative impact of natural disasters on per capita income in Vietnam.

1. INTRODUCTION

Currently the whole world is facing climate change. Due to global warming, natural disasters tend to occur more frequently (Cavallo & Noy, 2011; World Bank, 2010). Vietnam is one of the countries severely affected by natural disasters, especially typhoons and floods. When natural disasters occur, policy makers must take specific measures to reduce the impact of natural disasters on death toll and the economy. In order to have good policies, policymakers first need to know which economic variables affected by natural disasters? However, there are not many researches which analyze the impact of natural disasters on economic variables in Vietnam. This thesis aims to study the effects of natural disasters on income per capita, especially the detailed analysis for the Mekong Delta.

2. LITERATURE REVIEW

In Thailand, Paxson (1992) used the regression method with panel data of households from 1975 to 1986 to study the impact of rain and flood on household income. Research results show that rain and flood have a negative effect on income in the short term. Similarly, in Philippine, Datt & Hoogeween (2003) studied the impact of the El Nino phenomenon on per capita income with household survey data in 1998 including 38,710 households. The analysis results indicate El Nino phenomenon reduces the income per capita in Philippines by 7% to 9%.

In the US, Masozera et al. (2007) used geographic information systems (GIS) to analyze the impact of Hurricane Katrina on the personal income in New Orleans. Research results show that Hurricane Katrina has a negative impact on the income of New Orleans people. Similarly, Coffman & Noy (2011) analyzed the impact of Typhoon Iniki on the Hawaiian Islands after 17 years of natural disaster. The result illustrates Iniki typhoon decreasing personal income as well as reducing the population and employment of the islanders. Recently, Karim (2018) studied the impact of floods on the income and expenditure of people in Bangladesh. The author used household survey data in 2000, 2005 and 2010. The research team has found strong evidence of negative impacts on farmers' income and agricultural expenditure. In Vietnam, Vu & Im (2014) used the GMM method

to analyze panel data of 63 provinces and cities of Vietnam from 2002 to 2011. The author has studied the relationship between natural disasters and household income, investment in housing and internal trade. Research results show that natural disasters do not affect per capita income, but affect positively housing investment and internal trade activities in Vietnam. Contrary to the above results, Arouri et al. (2015) confirmed that natural disasters have a negative impact on household income and expenditure in Vietnam. The both studies used the Vietnam Household Living Standard Survey (VHLSS). Income of households affected by natural disasters is estimated to decrease by 2-7%.

In summary, most foreign studies confirmed that natural disasters have a negative impact on income, expenditure and poverty of households. In Vietnam, the research results are not consistent as well as the number of studies is limited. Therefore, this paper aims to provide more empirical evidence on the impact of natural disasters on per capita income and poverty rates in Vietnam.

3. RESEARCH METHOD AND MODEL

In order to identify the formal research model in this case, the authors refer the factors affecting household income on empirical studies. According to Arouri et al (2015); Bui Anh Tuan et al. (2014), education and health care have a positive impact on people's income because a person with an intellectual and good health will have a high working more efficiently than others, so they can earn higher income. Therefore, in this study, the author chooses education and health care as two control variables that affect household income and poverty in Vietnam.

According to the research of Arouri et al (2015); Chakamera & Alagidede (2017), infrastructure is one of the factors that have a positive impact on economic growth and income of people in Asian and African countries. Good infrastructure will encourage to invest businesses, thereby creating more jobs and increasing people's incomes. Therefore, in this study, the author selects infrastructure as the control variable for income.
In addition to education, health care and infrastructure, Noy & Vu (2010) also affirmed that trade is a factor which has a positive impact on people's income. For provinces with good commercial activities, the income of people from trade and services will increase. Increased income will also lead to a reduction in local poverty rates. Therefore, in this study, the author chooses trade as a control variable for the research model.

Finally, according to Phan Huu Viet (2013), Vietnam's provincial competitiveness index (PCI) has a positive impact on the performance of businesses. As businesses perform better, they need more inputs such as land and labor. These factors can contribute to increasing the income of the households. Therefore, in this study, the author proposes to use the PCI index as an independent variable affecting the income and poverty rates of households in Vietnam. Summary of the factors just analyzed, the author proposes a research model as follows.

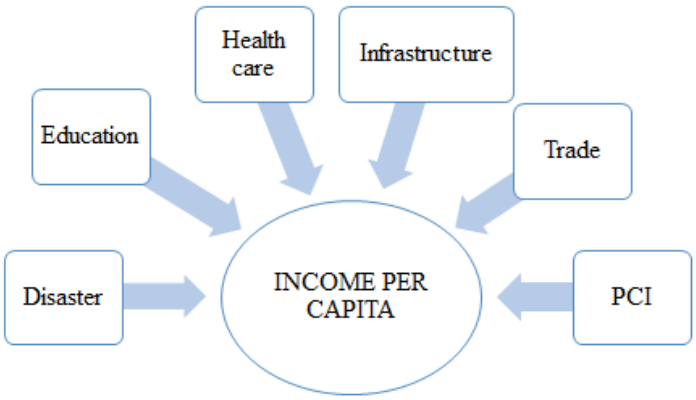

Fig 1: Research model

(Source: Authors' summary)

This study used panel data of 13 provinces and cities in the Mekong Delta region that collected during 2012-2018. The research data is divided into two main groups: data on economic variables and data on natural disasters. Data on economic variables collected systematically from the General Statistics Office. However, data on natural disasters is not systematically statistical, the author must gather from the individual events published on the DMC (2019). Each event recorded what kind of natural disasters, when and what provinces had affected. On this website, the data is only published from 2012 to the present. Combining economic data and disaster data, we have panel data of 13 provinces and cities of Vietnam for 2012, 2014, 2016 and 2018.

To analyze panel data, we can use the regression model Pool OLS, Fixed Effects Model (FEM) or Random Effects Model (REM). The OLS pool is not suitable in this case because we can not assume the characteristics of the 13 provinces that are the same and the provincial income is constant over time. Therefore, in this study, the author will consider two models FEM and REM in data analysis. To consider which model is more appropriate, the author used the Hausman test (1978) for the variables used. Testing results show that P_value of test is less than 5%. This result proves that the FEM model is more suitable for data analysis, so the author will use the FEM model to study the impact of natural disasters on income in Vietnam. The details of the panel data regression equation are as follows:

$$Y_{it} = \beta_{1t} + \beta_2 DISASTER_{it} + \beta_3 EDU_{it} + \beta_4 DOCTOR_{it} + \beta_5 INFRr_{it} + \beta_6 TRADE_{it} + \beta_7 PCI_{it} + u_{it}$$

In which, i receive values from 1 to 13 and t receive values 2012, 2014, 2016 and 2018. β1 to β7 are the regression coefficients and errors of the model are denoted uit. In the above equation, Yit is a dependent variable including income per capita (INCOME). DISASTERit is an independent variable representing natural disasters, this variable is a dummy variable, receiving value 1 if the province affected by natural disasters in the last two years. EDUit represents education, this variable is measured by the proportion of people over 15 years of age who are literate. DOCTERit represents health care, measured by the total number of doctors, nurses, and midwives in the province. INFRit represents infrastructure, which is measured by the total number of goods transported per capita in the province. TRADEit is an independent variable representing the province's trade activity, measured by the retail sales of goods and services per capita of that province. Finally, the PCIit represents the provincial competitiveness index, measured on a scale of 100.

4. RESULTS

To quantify the impact of natural disasters on per capita income in the Mekong Delta region, the author uses Eview software to analyze the fixed effects regression model (FEM). Regression results are shown in the following table.

Table 1: Regression results

Variable	Log (income per capita)			
	Coefficient	Standard error	t-statistics	P-value
(C)	8.8424	2.5559	3.4596	0.0015
DISASTER	-0.0532	0.0270	-1.9705	0.0572
EDU	-0.1331	0.0846	-1.5745	0.1249
DOCTOR	-0.0662	0.0647	-1.0235	0.3135
INFR	0.1995	0.0234	8.5321	0.0000
TRADE	0.0645	0.0268	2.40788140	0.0218
PCI	0.0364	0.0071	5.1288	0.0000
R^2	0.8814			
F-statistic	13.6319			
Observations	52			

Source: Authors' analysis

Next, the regression model needs testing to limit some defects of the model. First, the model is tested by Fisher to ensure that the model is suitable. Fisher test results show that the above model is suitable for significance levels below 1% and R2 values above 80%. A Jarque-Bera test is performed to ensure that the residuals of the regression follow the normal distribution. The test results show that the P_value of model is greater than 5%, this confirms that the regression residuals of the model follow the standard distribution. Finally, the author performed multi collinearity testing by calculating the variance inflation factor (VIF) of all independent variables of the model. The test results show that all VIF coefficients of the independent variables are smaller than 2. From the above results, we can confirm that the above model is not multi-collinear.

After making some tests on the defects of the model, we can deduce the regression results of the model as follows: natural disasters have a negative impact on per capita income in the Mekong Delta and regression coefficients for natural disaster variables have statistical significance below 5.7%. More specifically, provinces affected by natural disasters saw a decrease in per capita income of 5.3% compared to provinces not affected by natural disasters.

5. CONCLUSION

The paper analyzes the impact of natural disasters on per capita income in Mekong Delta region by Fixed Effects Model (FEM) with panel data of 13 provinces from 2012-2018. If a natural disaster occurs in a province, the per capita income of that province will decrease by 5.3%. In addition to the main factor as natural disasters, other factors such as infrastructure, trade and CPI have a positive impact on per capita income in the Mekong Delta region.

Natural disasters can be considered as an exogenous. So if we want to limit the negative impact of natural disasters on incomes, we can influence other factors such as improving provincial competitiveness index, investing more in education, health care, trade and infrastructure. The impact on these independent variables can attract more external investment resources, thereby creating jobs and income for people. The detailed implementation of the above solutions to promote the effect is outside the scope of this paper, so the author does not analyze in detail for the above solutions.

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How to cite this article: ***Nguyen Khac Hieu, Analyses the Impacts of Natural Disasters on Income Per Capita in Mekong Delta River, Asian. Jour. Social. Scie. Mgmt. Tech. 2(3): 25-29, 2020.***