1. RESEARCH BACKGROUND AND QUESTIONS

Background and research questions

In the last decades, the world has faced an increase in the frequency and severity of natural disasters IPCC (2007). Natural disasters cause physical and social-economic damages (Lindell and Prater, 2003), which can be exposed through direct, indirect, and secondary effects (Pelling et al., 2002; Benson, 1997; Haen and Hemrich, 2006). The physical impacts of natural disasters include casualties (fatalities, injuries, epidemics, poor sanitation, inadequate shelter, impaired public safety) and property damages. According to Harris (2010), natural disasters caused 100,000 lives annually in the world. Guha-Sapir et al. (2004) find the world average damage is about US$ 67 billion per year and the economic cost related to natural disaster has increased 14-fold since the 1950s.

The impacts of natural disasters differ for different nations, regions, communities and individuals due to the differences in their exposures and vulnerabilities to natural disasters (Clark, et al. 1998). There is a consensus that the disasters cause more human losses in developing countries than the developed ones (Ludwig et al., 2007; Haen and Hemrich, 2006), and the poor are likely to suffer most from natural disasters (Ludwig et al., 2007; Haen and Hemrich, 2006; Kaplan, 2010). Although more than 60% of total damages caused by disasters occurred in high-income countries, the estimated damages as a share of GDP are significantly greater in less developed and small countries (Okuyama and Sahin, 2009). Studies of Guha-Sapir (2011), Gaiha et al. (2010), Ludwig et al. (2007), Toya and Skidmore (2005), Sawada (2006) also find that while the level of damages due to natural disasters is much higher in developed countries, the impact of disasters tends to be higher in less developed countries.
The impact of natural disasters on households depends on the level of resilience of households and communities to the natural disasters. Basically, resilience is defined as capacity of households to absorb and mitigate damage or loss caused by natural disasters (Holling, 1973; Perrings, 2001). The resilience refers to the ability to recover from disasters and the ability to withstand disasters (Rose, 2004; Briguglio et al., 2009). According to Rose (2004), resilience can take place at the three levels: micro level such as households and individual firms, medium level such as sectors and groups, and macro level with all individual units.

Poor households are more vulnerable to natural shocks in both response and recovery phases, both in developing and industrialized nations (see for example, Peacock et al., 1997; Fothergill and Peek, 2004; Wisner, et al. 2004; Krueger and Perri, 2010). The economic resilience depends on a large number of factors including macro and micro economic stability, social development and good governance (Briguglio et al. 2009). Assets, livelihood strategy, public transfers, and credit are important sources for households to increase resilience to shocks (Bruneau et al., 2003; Davies, 2013).

This study has two main objectives. The first objective is to measure the effect of natural disasters on household welfare and poverty in rural Vietnam. The second objective is to examine whether a number of household and commune characteristics can strengthen the resilience of households to natural disasters in Vietnam. The study aims to answer the following research questions:

- To what extent do natural disasters affect household welfare and poverty in rural Vietnam?
- Which household characteristics can mitigate household welfare loss caused by natural disasters and strengthen resilience of households to natural disasters in rural Vietnam? The household characteristics considered in this study include household assets, education, non-farm employment, transfers and access to credit.
- Which commune characteristics can mitigate household welfare loss caused by natural disasters and strengthen resilience of households to natural disasters in rural Vietnam? The commune characteristics considered in this study include infrastructure, urbanization and non-farm employment opportunities of communes.
Policy relevance

The study focuses on the effect of natural disaster to households in Vietnam for several reasons. Firstly, located in the Southeast Asia, Vietnam experiences a range of natural disasters including tropical storms, floods and droughts. UNISDR (2009) ranks Vietnam fourth in the global in terms of the absolute number of people exposed to floods, tenth to high winds from tropical cyclones, and sixteenth to droughts. Secondly, natural disasters occur throughout the country without very large events enable results applicable to average disasters (Noy and Vu, 2010). Thirdly, there are large surveys on households in Vietnam, which allows for the analysis of household welfare, resilience and natural disasters. More specifically, we will use the Vietnam Household Living Standard Surveys in 2002, 2004, 2006, 2008 and 2010 in this study. The VHLSSs contain panel data on household welfare and natural disasters in rural Vietnam.

Findings from the studies can provide useful information for policy makers on the adverse effects of natural disasters on household welfare and poverty in rural Vietnam. If natural disasters result in large economic damages for households, the government should have stronger and more effective policies and programs to reduce the adverse effects of natural disasters in Vietnam. Findings from the household and community characteristics associated with the resilience of households to natural disasters can be useful inputs for policies to strengthen the resilience to natural disasters. For example, if we find that non-farm employment and access to credit can be important factors to mitigate the adverse effect of natural disasters, the government can consider policies and programs on non-farm employment and micro-credit for areas that are more likely to be exposed to natural disasters.

Contribution

The study is expected to have several contributions to the literature of environmental economics as well as development economics. Firstly, it proposes a simple estimation method to estimate the effect of natural disasters on poverty, and examine whether household and commune characteristics can strengthen households’ resilience to natural
disasters. Secondly, it provides empirical findings on the effect of natural disasters on household welfare and poverty in a developing country. There are only a few empirical studies which examine explicitly the effect of natural disasters on household welfare and poverty. Thirdly, it provides empirical findings on a number of household and commune characteristics that can strengthen the resilience of households to natural disasters in Vietnam.

2. LITERATURE REVIEW

There are few papers that examine the effect of natural disasters on households’ income and consumption. Baez and Santos (2008) estimate the impact of the two strong earthquakes in El Salvador on rural household income and poverty using panel data from the last two rounds of Basis El Salvador Rural Household Surveys between 1996 and 2002. His results indicate significant reduction (one third) in household income per capita caused by combined effects of both earthquakes and these effects are different for short, medium and long terms. Krueger and Perri (2010) investigate how households in Italia response to income shock. Employ the Italian Survey of household income and wealth (1987-2008) and waves of panel study of income dynamics (2004-2006) they find that income shocks affect all groups of households in Italy. Masozera et al. (2007) find the Hurricane Katrina causes severe damages to households in New Orleans and its neighborhoods, regardless of their income, advancement and other social factors.

Kurosaki (2010) investigates vulnerability of household consumption to natural disasters (floods, droughts, and pest attacks) in rural Pakistan, using two-period panel data surveyed in 2001 and 2004. His results show that depending upon the nature of disasters and the characteristics of households, the sensitivity of consumption changes to village-level shocks differs across regions and that land is effective in alleviating the ill-effects from disasters of different types.

The effects of disasters are differential at the country as well as at household levels (Kaplan, 2010; Cochrane, 1975; Noy, 2009). In addition, the vulnerability varies between income and occupational groups, between regions in the country (Benson, 1997). The Government and people are not indeed passive to suffer damages from natural disasters.
They set up long-terms and short-terms protecting measures for natural risk mitigations, such as dyke systems against flooding (Benson, 1997), irrigation systems versus droughts (Timothy et al. 2010), ex ante risk management and ex post risk-coping behaviors and self-insurance mechanisms against large-scale disasters (Sawada 2006).

Research on the effect of natural disasters on households in Vietnam is only in its early stages. Minot et al. (2006); Imai and Gaiha (2007), Timothy, et al. (2010) find income and expenditure of households in high exposed to natural disaster areas in Vietnam are much lower than the average. Timothy, et al. (2010) find riverine floods and hurricanes cause immediate welfare losses of 23 and 52 per cent, respectively. They also find natural disasters generate negative long term effects from the frequent exposure to disasters. Wainwright and Newman (2011) examine numerous strategies that rural household in Vietnam apply to get rid of consumption shortfalls caused by adverse income shocks. They conclude that the ability of households to deal with income shocks depend on their level of total liquid assets, income and wealth and poor households are more vulnerable to the shocks as they have less stock of liquid assets.

The literature of resilience to natural disasters tends to focus on the cross-countries study and macro-economic level (Rose, 2004; Canon, 2008; Briguglio et al., 2009). Resilience is mentioned as the ability of households to cope with natural disasters, including the ability to recover and withstand disasters (Holling, 1973; Perrings, 2001; Rose, 2004; Briguglio et al., 2009). Briguglio et al. (2009) and Davies (2013) discuss several determinants of resilience at the micro and macro levels. At the household level, assets, livelihood strategy, public transfers, and credit are important factors to strengthen resilience to shocks (Bruneau et al., 2003; Davies, 2013). Although there is a relatively large literature on vulnerability and resilience, there is limited empirical research if any on characteristics of households and communities that can strengthen resilience of households to natural disasters.

3. METHODOLOGY

3.1. Data source
This study will rely on Vietnam Household Living Standard Surveys (VHLSS) in 2002, 2004, 2006, 2008 and 2010. The VHLSSs were conducted by the General Statistics Office of Vietnam (GSO) with technical assistances from the World Bank. The surveys contain household and commune data. Data on households include basic demography, employment and labor force participation, education, health, income, expenditure, housing, fixed assets and durable goods, participation of households in poverty alleviation programs. Commune data include demography and general situation of communes, general economic conditions and aid programs, non-farm employment, agriculture production, local infrastructure and transportation, education, health, and social affairs. The commune data contain information on natural disasters happening in communes in previous years. Commune data can be merged with household data. Each of the VHLSSs covers 9,189 households. The data are representative for urban/rural and eight geographic regions. It is helpful that the surveys contain panel data of around 4,200 households between two consecutive surveys.

3.2. Estimation methods

Effects on natural disasters on household welfare

The main method used in this study will be econometric regressions. This section presents briefly the estimation method. We assume a household welfare indicator is a function of characteristics of households and communities as follows (Glewwe, 1991):

$$\ln(Y_{ijt}) = \beta_0 + X_{ijt}\beta_1 + C_{jt}\beta_2 + D_{jt}\beta_3 + X_{ijt}G_{jt}\beta_4 + C_{jt}G_{jt}\beta_5 + G_{jt}\beta_6 + u_{ijt} + \epsilon_{ijt},$$  

(1)

where $Y_{ijt}$ is a welfare indicator of household $i$ in commune $j$ in the year $t$; $X_{ijt}$ is a vector of characteristics of households such as demographical variables and assets; $C_{jt}$ is a vector of characteristics of communities such as infrastructure and population; $D_{jt}$ is the variable of natural disasters in commune $j$ in year $t$; $G_{jt}$ is the dummy variable of years.

We use two indicators of household welfare including income and consumption of households. We use similar specifications as equation (1) for different dependent variables.

The effect of natural disaster on households is measured by parameters $\beta_3$, $\beta_4$ and $\beta_5$. The equation (1) includes interactions between the natural disasters and variables of
communes and households. It allows the effect of natural disasters to vary across different households. To measure the partial effect (PE) of the natural disasters on households’ outcomes (i.e., per capita income and consumption), we can take the partial derivative of the outcome with respect to the natural disaster variable as follows:

\[
PE_{ijt} = \frac{\partial Y_{ijt}}{\partial D_{jt}} = \frac{\partial e^{\beta_0 + X_{ijt}\beta_4 + C_j\beta_5 + D_j\beta_4 + \epsilon_{ijt}}}{\partial D_{jt}} = (\beta_3 + X_{ijt}\beta_4 + C_j\beta_5)Y_{ijt}.
\]  

(2)

Model (1) allows for the heterogeneous effect of natural disasters, since the partial effect varies across households. We can estimate the Average Partial Effect (APE) – a popular parameter in econometrics (Wooldridge, 2010) - at time \( t \) by taking the expectation of \( \text{APE}_{ij} \) across households:

\[
APE_t = E(\text{APE}_{ij}) = E[(\beta_3 + X_{ijt}\beta_4 + C_j\beta_5)Y_{ijt}].
\]  

(3)

APE is the average change in the dependent variable (per capita income or expenditure of households) due to the natural disasters. Since the disaster variable is the dummy variable, the APE can be called the Average Treatment Effect in the literature of impact evaluation (Wooldridge, 2010). The estimator of APE in equation (3) is expressed as follows:

\[
APE_t = \frac{1}{n_t} \sum_{i,j} \text{APE}_{ijt} = \frac{1}{n_t} \sum_{i,j} (\beta_3 + X_{ijt}\beta_4 + C_j\beta_5)Y_{ijt}.
\]  

(4)

Where \( n_t \) is the number of sampled households at time \( t \), \( \hat{\beta}_3, \hat{\beta}_4 \) and \( \hat{\beta}_5 \) are estimates from equation (1).

A problem is estimating the effect of natural disasters is the endogeneity of natural disasters. Thus, in this study we use the fixed-effect regression to eliminate unobserved time-invariant variables (variable \( u_y \) in the equation (1)) that can cause endogeneity bias. It is expected that the endogeneity bias will be negligible after the elimination of unobserved time-invariant variables and the control of observed variables. In addition, the natural shocks are expected more exogenous than social economic shocks.

The traditional method to deal with endogeneity is instrumental variable regression. However, finding absolutely exogenous instrumental variables for the natural disaster
variable is difficult. In addition to fixed-effects regression, we can use internal instruments for the natural disaster variable using a widely-used Generalised Method of Moments (GMM) which is developed by Holtz-Eakin, Newey, and Rosen (1988), and Arellano and Bond (1991). The GMM-type instruments for the natural disaster variable are higher order lags of the natural disaster variable. There are available tests on the validation of the instruments (overidentification and correlation tests).

**Effects on natural disasters on poverty**

To estimate the effect of natural disasters on poverty of households, we can use logit or probit regressions in which the dependent variable is the poverty status of households. However, there are no available fixed-effects probit estimators due to a so-called incidental parameter problem in maximum likelihood methods (Greene, 2004). A fixed-effects logit estimator can be used, but it is not efficient since it drops observations with fixed values of the dependent variable. To estimate the effect of natural disasters on poverty, we can use the probability of being poor as follows (Hentschel et al. 2000; Elbers et al. 2002, 2003):

\[
E[P_{ijt} \mid Y_{ijt}, \sigma^2] = \Phi \left[ \frac{\ln z - \ln Y_{ijt}}{\sigma_{ijt}} \right], \quad (5)
\]

where \( P_{ijt} \) is probability of being poor; \( Y_{ijt} \) is consumption; \( z \) is poverty line; \( \Phi \) is the cumulative standard normal function; \( \sigma_{ijt} \) is the standard deviation of error terms in equation (1). The effect of \( D_{jt} \) on the poverty probability is the partial derivative of the poverty probability with respect to \( D_{jt} \) as follows:

\[
\frac{\partial E[P_{ijt} \mid X_{ijt}, D_{jt}, C_{jt}]}{\partial D_{jt}} = -\phi \left[ \frac{\ln z - \ln(Y_{ijt})}{\sigma_{ijt}} \right] \frac{\partial \ln(Y_{ijt})}{\partial D_{jt}} \\
= -\left( \beta_3 + X_{ijt} \beta_4 + C_{jt} \beta_5 \right) \Phi \left[ \frac{\ln z - \ln(Y_{ijt})}{\sigma_{ijt}} \right], \quad (6)
\]

where \( \phi \) is the probability density function of the standard normal distribution. The average partial effect (APE) of the natural disaster variable on poverty rate can be estimated as follows:
\[ APE_p = -\frac{1}{n} \sum_{i=1}^{n} \left( \beta_3 + X_{ij} \beta_4 + H_p \beta_5 \right) \left( \frac{\ln z - \ln(Y_{ij})}{\sigma_{ij}} \right), \]  

where \( n \) is the number of households in the sample. The standard errors of the average partial effect estimators can be calculated using non-parametric bootstrap with 500 replications (Deaton, 1997).

**Resilience to natural disasters**

As mentioned, the equation (1) includes interactions between the natural disaster variable and variables of communes and households. It allows the effect of natural disasters to vary across different households. Households who are more resilient to natural disasters are less likely to be affected by natural disasters. Important explanatory variables that are interacted with the natural disaster variable are household and commune assets. In this study, the following variables will be interacted with the natural disaster variable:

- **Household variables:**
  - Land and durables: to examine whether households with large lands and durables such as motorbikes are more resilient to natural shocks.
  - Human assets including education and non-farm employment: to examine whether households with higher education and non-farm employment activities are more resilient to natural shocks.
  - Social assets: transfers and access to credit: to test the hypothesis that households who have better access to credit, public transfers and remittances might be more likely to recover from natural shocks and more resilient from the natural shocks.

- **The commune variables:**
  - Local infrastructures including irrigation, market and rural roads: to test hypothesis that households who are living in communities with better infrastructure are more resilient to the natural shocks.
  - Social variables including urbanization, non-farm business and the distance to the nearest town: to examine whether households living in better-off areas
with more non-farm opportunities are more likely to recover from the natural disasters.

4. REFERENCES


Kurosaki T., (2010), ‘Vulnerability of Household Consumption to Natural Disasters in Rural Pakistan’


5. STUDY TEAM

Brief CVs

Education


Employment

- Researcher, Faculty of Trade and International Economics, National Economics University, Vietnam.

Publication


Education

• 2004 – 2008: Bachelor Degree in Sociology, University of Social Sciences and Humanities, Vietnam, National University, Hanoi.

• 2009 – 2011: Master Degree in Development Economics, University of Social Sciences and Humanities, Vietnam, National University, Hanoi.

Employment

• Lecturer assistant, University of Social Sciences and Humanities, Vietnam National University, Hanoi.

Publication

• Participation of women in social activities in Vietnam (in Vietnamese), Research Report.
Tasks in the proposed study

- Develop research plan
- Review the literature
- Process and analyse data
- Estimate the econometric models
- Write the report
- Guide the team member
- Present the findings and consult researchers and policy makers

- Collect documents in Vietnam
- Review the literature
- Clean and process data
- Estimate the econometric models
- Write the report
- Present the findings and consult researchers and policy makers
6. TENTATIVE BUDGET

The total cost of the research project is estimated at USD 9,750.

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<td>The second team member</td>
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7. REPORT CONTENT AND TIMELINE

The research report is structured as follows:

Abstract
1. Introduction
2. Literature review
3. Natural disaster, poverty and resilience in Vietnam
   3.1. Data set
   3.2. Descriptive analysis
4. Estimation methodology
5. Empirical results
6. Conclusion and policy implication
**Project is conducted for 5 months.**

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PROPOSAL SUMMARY

Research questions
The objective of this study is to examine to what extent natural disasters can affect household welfare and poverty, and which factors can increase resilience of households to natural disasters. The study aims to answer the following research questions:

- To what extent do natural disasters affect household welfare and poverty in rural Vietnam?
- Which household and commune factors can mitigate households’ welfare loss and strengthen resilience of households to natural disasters in Vietnam?

Scientific contribution
The study is expected to have several contributions to the literature of environmental economics and development economics. Firstly, it proposes a simple estimation method to estimate the effect of natural disasters on poverty, and examine whether household and commune characteristics can strengthen households’ resilience to natural disasters. Secondly, it provides empirical findings on the effect of natural disasters on household welfare and poverty in a developing country. Thirdly, it provides empirical findings on a number of household and commune characteristics that can strengthen the resilience of households to natural disasters in Vietnam.

Policy relevance
The effect of natural disasters on household welfare and which factors can strengthen households’ resilience to natural disasters have been long of great interest for both researchers as well as policy makers. Thus, empirical findings from this study can be useful for policy makers in designing policies and programs to mitigate the adverse effects of natural disasters and strengthen households’ resilience to natural disasters in Vietnam. Since Vietnam has a similar economic context and common geographical features as some Asian developing countries, such as the Philippines, Indonesia, Lao, and Cambodia, it is expected that the findings from the study might also be relevant for these countries.

Methodology
The study will use household fixed-effect regressions and the instrumental variable regressions to estimate the effect of natural disasters on household welfare and poverty, and subsequently examine the household and community characteristics that can strengthen resilience of households to natural disasters. Data are from the Vietnam Household Living Standard Surveys in 2004, 2006, 2008 and 2010.

Research team: ___ (Ph.D.); ___ (MA.)

Tentative budget: 9,750 USD
Regional Research Competition 2013
Toward a More Resilient Society

RESEARCH PROPOSAL

Project Title: Natural Disasters, Poverty and Resilience: Evidence from Rural Vietnam
Total Budget (USD): 9,750 USD
Project Duration (months): 5 months

RESEARCH TEAM

No. of Members: 2

Project Leader: __
Name: Nguyen Viet Cuong
Institution: National Economics University
Current Position: Researchers
Highest Educ. Attainment: Ph.D.
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Age: 37
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Fax (incl country+area codes): (844) 3869 3369

Members: __
Name: __
Institution: National University, Hanoi, Vietnam
Current Position: Assistant lecturer
Highest Educ. Attainment: Master
Nationality: Vietnam
Gender: Female
Age: 27
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E-mail: __
Phone (incl country+area codes): (844) 3858 3799
Mobile (incl country+area codes): (84) 913 306 497
Fax (incl country+area codes): (844) 3858 3821
April 26, 2013

From: Faculty of Trade Economics
National Economic University,
Giai Phong street, Hanoi, Vietnam

To: East Asian Development Network,
Philippine Institute for Development Studies,
Philippines
www.eadn.org

Re: Approval of the proposed study to EADN

Dear Sir/Madam,

[Name] is a research in our faculty. He has expressed his interest in a proposal entitled "Natural Disasters, Poverty and Resilience: Evidence from Vietnam" and would like to submit the proposal to the Regional Research Competition (RRC) with the theme: Toward a More Resilient Society. We are very happy to provide him with supports if he and the team can get the proposal approval from the Japan International Cooperation Agency (JICA), the Global Development Network (GDN) and East Asian Development Network (EADN).

Best regards,

[Signature]

Deputy Head of Faculty of Trade Economics
Ass. Prof. Dr. Tran Van Bao