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Contents

Conflict Approaches of Effective Project Manager in the Upstream Sector of Indonesian Oil & Gas Industry
Adhi Cahyono and Yanki Hartijasti ____ **65**

Risk Perception and Economic Value Of Disaster Mitigation Case of Bantul Post Earthquake May 2006
Suryanto and Mudrajad Kuncoro ____ **81**

Students' Entrepreneurial Intentions by Using Theory of Planned Behavior: The Case in Indonesia
Rifelly Dewi Astuti and Fanny Martdianty ____ **100**

Entrepreneurial Inclination Among Business Students: A Malaysian Study
Yet-Mee Lim, Teck-Heang Lee and Boon-Liat Cheng ____ **113**

Characterization of Early and Late Adopters of ATM Card in Indian Banking Industry
Kamalpreet Kaur ____ **128**

RISK PERCEPTION AND ECONOMIC VALUE OF DISASTER MITIGATION

Case of Bantul Post Earthquake May 2006

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Abstract

This study aims to obtain empirical evidence of disaster mitigation in Bantul, Indonesia. The expected utility theory and impact of regional characteristics on individual perceptions was used to describe the disaster risk management process. The regional mapping based on hazard level was conducted by a Geographical Information System (GIS). Data used in this research were primary and secondary data. Primary data were obtained by distributing questionnaire to some respondents. Sample amounts used were 395 respondents. The research empirical contribution was to economic valuation method used towards safety and efforts to link regional characteristics, individual perception and also their willingness to conduct mitigation. The research practical contribution was to identify some key obstacles in disaster risk management. Based on multiple regression analysis, this study found that educational level, risk aversion degree, trust towards earthquake-resistant building, control ability, income level, classification of hazard area contributes to higher Willingness To Pay (WTP) for mitigation. It also found that perception towards central governmental roles variable did not affect to WTP for mitigation. However, the income levels of the communities in Bantul positively correspond to WTP for mitigation suggesting that the findings were consistent with the expected utility theory.

Keywords: Risk perception, economic valuation, disaster risk mitigation, Willingness to Pay, Indonesia.

Indonesia is situated geographically and geologically in three actively moving tectonic plates: (1) Eurasia plate in the north, (2) Indo Australia-Oceania plate in the south, and (3) Pacific plate in the east (BNPB, 2004; Murjaya, 2007). The constant motion of these three slabs would cause frequent earthquakes. Due to its severe consequences, the disaster risk of Earthquakes would be catastrophic even though the probability might be low. Thus anticipative actions must be done in order to mitigate the risk of this disaster. Since it is impossible to reduce the hazard level, therefore the feasible course of action would be to develop people's capacity to respond or to reduce the vulnerabilities to the disaster. The efforts to improve capacities and/or to reduce vulnerabilities would needed good cooperation between the government and the communities.

The government would not be able to solve disaster problems without involving the active participation of the communities. One major problem in risk management was the potential difference of perception and understanding among the communities. Empirical studies that had been conducted on the subject can be grouped into two different conclusions. The first group was Ozdemir (2000); Ozdemir and Kruze (2005); Fujimi and Tatano (2006); Li and Hsiu (2007), who found that communities tended to be unaware towards disasters. Being aware towards disaster meant that the communities considered current disaster risk. Meanwhile, the second group argued on the contrary (Schade, *et al*. 2001; Miller, *et al*. 2002; Kunreuther, 2006) that when communities attempts to reduce potential risk, they are willing to mitigate for losses in the future. These findings are consistent with the expected utility theory.

The often emerge problem was that the comprehension and awareness of communities to conduct disaster's mitigation are heterogeneous. Perception formed in each community was supposed to affect behavior of communities to perform disaster mitigation. This was a challenge that must be faced to implement disaster risk management both in the developed countries as well as in the developing countries like as Indonesia.

This study aims to offer comprehensive analysis to the investigation of the relationship between disaster risk perception and the mitigation behavior by combining the analysis with threat description level, vulnerability, and ability to mitigate disaster. Mitigation behavior examined specifically in this study is the Willingness to pay for the mitigation efforts. Communities who lived in vulnerable regions should have higher Willingness to pay (WTP) than those who lived in less vulnerable regions. WTP in this case means the willingness to spend more money to mitigate earthquake risk. In the case of Bantul regency, for example, WTP is willingness to strengthen of their physical house to withstand earthquakes.

There are three main factors why research was conducted in Bantul. *First*, even though it is only a hefty 6.2-magnitude quake, the shallow depth of 10 kilometers made the May 2006 Java earthquake one of the worst of the 21st century. *Second*, most of area in Bantul Regency is vulnerable to earthquake risk (part of rings of fire path). While the tremor and the two strong aftershocks were closest to the city of Yogyakarta, the worst damage was in the area of Bantul. An estimated 5,800 people died from the earthquake plus another 36,000 were injured. The property damage, believed to affect 135,000 homes, leaving 1.5 million people homeless. *Third*, earthquakes are the type of disaster which could be repeated and relatively hard to predict precisely when and where will it struck.

Therefore, this research is important to be conducted to elaborate: (1) mapping behavior of individual WTP mitigation; (2) appropriate role of government by incorporating WTP mitigation based on communities. Based on the explanations above, the research problem formulated was "to what extent regional characteristic and individu-

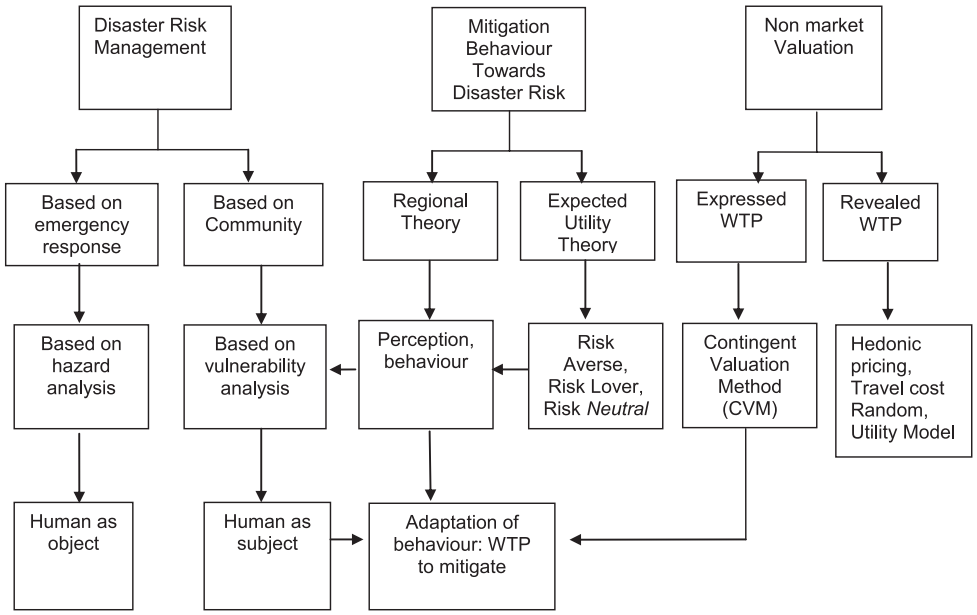


Figure 1. Underlying Theories

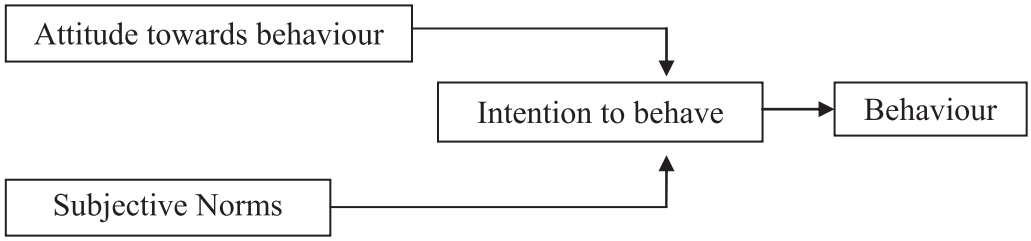
al's perception towards earthquake disaster affect mitigation behavior". Regional characteristics and mitigation behavior was reflected respectively by dummy variables and WTP of residence who became more secured from earthquake risk. This study aims to obtain empirical evidence of mitigation behavior in Bantul in accordance with the expected utility theory and affect of regional characteristic to individual perceptions towards earthquake disaster mitigation.

LITERATURE REVIEW

This research used three major theories, which is Disaster Risk Management Theory, Human Ecology Theory, and Non-Market Economic Valuation Theory. Figure 1 presented interrelationship amongst those theories underlying this research. The essence of Human Ecology Theory was on how human form relationship with their environment. Disaster Risk Management Theory consisted of how human efforts were necessary to minimize disadvantage risks caused by environment namely disaster case. While Non-Market Economic Valuation theory developed in the environmental economics subject, were efforts to give monetary value to environmental factors especially those with no market value.

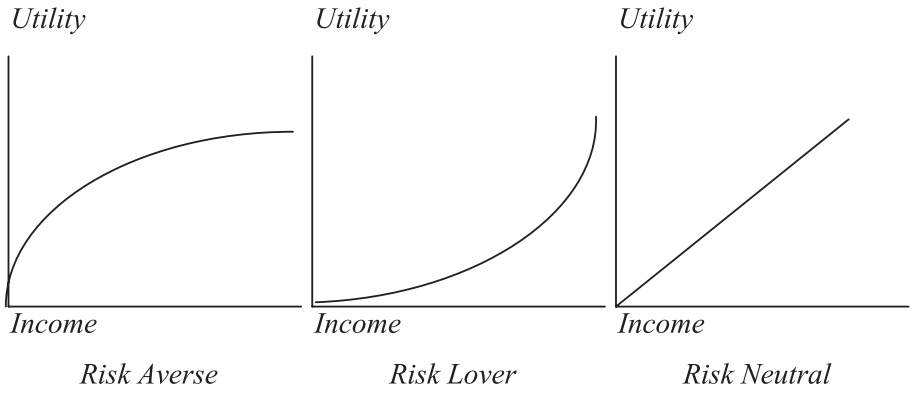
Disaster Risk Management

Disaster risk management concept is often resembled with disaster reduction. However, not only disaster reduction, disaster risk management also includes prevention concepts and preparations for disasters (Kohler, *et al*. 2000; Aufrett, 2003). Total risk reduction is basically applying prudent principles in each *disaster risk management* actions. Disaster risk management is an activity that covered disaster planning and mitigation aspect before, during, and after a disaster took place. Disaster risk management aimed to develop "safety culture" and created "disaster resistant community".



Source: Ajzen & Fishbein in Azwar (2003)

Figure 2. Reasoned Action Theory



Source: Pyndick & Rubinfeld (2001)

Figure 3. Individual Preference towards Risk

Disaster risk is basically emerged due to some factors. The factors must be available in the same time. According to Sadisun (2004), disaster risk is an interaction between disaster threat, vulnerability, and mitigation ability towards disasters. Mathematically, it could be formulated as:

$$\text{Disaster Risk} = \frac{(\text{Hazard x Vulnerability})}{\text{Mitigation Ability}} \quad (1)$$

Human Ecology: Perception, Attitude, Behavior Relationships

Azwar (2003) stated that attitude was not only a mental but also physical response. Azwar (2003) further divided attitude into two approaches, the first one is the three component combination approaches (affective, cognitive, and attitude). The second approach emerged due to dissatisfaction to inconsistent explanation among the three component relationships namely cognitive, affective, and attitude in forming attitude. The approach followers limited their attitude concept only in affective aspect. Attitude is an affect or positive or negative evaluation towards an object.

Theory of Reasoned Action developed by Ajzen and Fishbein in Azwar (2003) stated that human intentions were affected by two things namely attitude towards behavior (a personal aspect), and subjective norms (individual perception to behave the attitude or not). According to Harvey & Smith in Ritohardoyo (2006), perception is classified

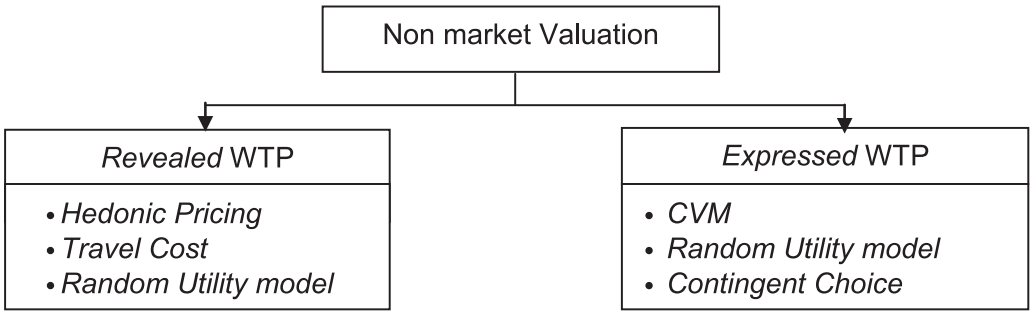


Figure 3. Non-market Economic Valuation

into two were personal perception and social perception. Personal perception of one impression forming process is based on investigation or reasoning towards one thing that had affected the physical as well as psychological aspects. Community's social perception is an action based on investigation or reasoning, either through direct interaction through mass media as well as through other communities toward one case.

Based on Figure 2, perception and environmental relationship is perception that affected human attitude order towards environment. If one's perception towards environment had a positive value, then it has the ability to affect the perceiver either physically or psychologically so that, in turn, it could give the perceiver the motivation towards its environment.

Individual Mitigation Attitude

Individual mitigation attitude is an attitude about efforts that must be conducted by an individual when he or she is in an uncertain condition. Mitigation is an effort to reduce disaster risk that potentially suffered by individuals as explained previously. The economic model most often used to explain the decision making in uncertain condition is the Expected Utility Theory. The theory stated that expected utility are the average of outcomes weighted by measured probabilities in all event possibilities (Pindyck & Rubinfield, 2001). The Expected Utility Theory developed by von Neumann Morgensten (1954) in Dixit (1990), mathematical equation by von Neumann-Morgenstern:

$$EU=\Sigma PiU(Yi) \quad (2)$$

Where:
Pi = probabilities 1, remark 1>0
Yi = economic gain (such as income, wealth, and profit)

Preference towards Risk

Individual preferences in facing risk could be classified into three groups, (1) risk lover, (2) risk neutral, and (3) risk averse group. Risk lover has preference to uncertainty over certainty, risk neutral places equal preference between uncertainty and certainty, while risk averse preferred certainty over uncertainty.

Economic Valuation

Total economic value of natural resource and environment could be valued by some valuation method. According to Hufscmidt, et al. (1992), outlined economic advantage valua-

tion method (environmental cost) of natural resources and environment is basically could be divided into two large groups based on market-oriented approach and non-market approach or survey-oriented.

Relationship Risk Perception and WTP Model

Model that linked risk perception variables and WTP is developed by Ehrlich & Becker (1972) and then adapted by Ozdemir (2000). The model was developed in order to explain individual mitigation behavior (willingness to pay for safety) in the hazard area, especially a low probability high impacts disaster. Ehrlich & Becker (1972) classified behavior mitigation were self-insurance, self-protection, and insurance market. Insurance itself is defined as risk reducer and self-protection is probability reducer due to catastrophic risk. Insurance itself is a mitigation form, especially when someone is not risk affected, but it could affect to consequences due to the risk.

Previous Empirical Studies

Previous research associated to natural disaster insurance demand has been conducted among others by: Grace, *et al.* (2002), Kunreuther (2006), and Li & Hsiu (2007). Li & Hsiu (2007) analyzed factors that effected towards insurance demand in Taiwan. What made this different was that their research introduced spatial variables as explaining variables beside net income variables and governmental subsidy. An analysis tool used was spatial econometrics and panel regression. Research result showed that governmental subsidy loan affected negatively towards earthquake insurance demand, while net income variables and spatial variables were positively harmonious affected to the hypothesis.

Research conducted by Grace, et al. (2002) analyzed insurance demand to housings where insurance protection covered risk towards catastrophic natural disaster. The research showed a consistent result in two sample regions, demand for insurance with added protection towards catastrophic natural disasters were actually more elastic compared to demand for insurance without additional protection towards catastrophic natural disaster risk. The research showed that there was an insurance premium cost increase that would decrease the demand for insurance.

Kunreuther (2006) yielded a different conclusion compared with the research conducted by Grace, *et al.* (2002), especially related to willingness to pay extra for additional protection. Kunreuther (2006) presented an empirical fact which suggested that the magnitude of flood disaster cost was due to poorly conducted disaster mitigation efforts and the lack of insurance both for themselves and their homes.

Research result conducted by Schade, *et al*. (2001) showed that in low probably disaster risk area, it was more important to investigate Willingness to pay than the estimated subjective probability where there was an ambiguity in that estimation. According to Schade, *et al.* (2001), anxiety was an important thing to explain a phenomenon why some people were willing to spend their money for protection while others were not.

Nyman (2001) mentioned that insurance demand was a demand towards a certainty fitted to the expected utility theory. However, in previous researches individuals was known to actually prefer uncertain disadvantages than certain disadvantages. Based on the gap between expected utility theory and the findings mentioned above, it can be concluded that insurance demand was influenced by an expected consideration to obtain bigger compensation if there was a claim.

Nyman's (2001) research was interesting because it concludes that insurance demand by individuals to be caused by certainty and not due to uncertainty. This conclusion was estimated to be suitable with cases in health insurance but may not be suitable with natural disaster insurance cases that are relatively catastrophic.

Simmons, *et al.* (2002) explored valuation of two kinds of measure for typhoon mitigation in Gulf Coast City. They used *hedonic price* method and concluded that individuals regarded that *self-insurance* as one of mitigation forms that were conducted whenever known that the individual is living in a hazard disaster region. This finding was similar with what Simmons & Kruse (2000) which compared housing price between houses with and without protection. The result was that the price of houses equipped with disaster protections was higher than houses without protections.

Morone & Ozdemir (2006) investigated protection attitudes towards disaster considered to be of low probability category but serious affect. The research method used was experimental design using linear regression analysis. The result was in line with previous researches that individuals tended to *risk averse* so that they wished to buy insurance as a mitigation form. This finding added insight to the economic valuation of the mitigation efforts by measuring mitigation attitude.

Ozdemir (2000) tried to investigate the relationship between perception towards risk and WTP to conduct mitigation using surveys. The result showed among others, perception significantly affects WTP, while risk *aversion* degree variable did not affect WTP. Prudent attitude was also positively influence WTP, as well as some demographic variable such as child possession. On the other hand, gender, age, and past experience did not affect WTP.

Chinn (2005) also conducted a research especially related to disaster characteristic by lottery experiment and by questionnaire survey. The finding also showed low interest to conduct mitigation especially to disaster insurance. People rejected to pay unfair premium cost. Contradictory to the findings of Ozdemir (2000), gender variable was found to be significant in influencing WTP for mitigation. These research further supported prospect theory instead of expected utility theory.

Onculer (2002) conducted a research similar to Browne & Hoit (2000), Chinn (2005), and Ozdemir & Kruse (2005). Onculer (2000) conducted a study on risk perception and WTP magnitude. Some variable investigated was perception towards risk, attitude towards coded buildings, experience roles, dynamic groups, and

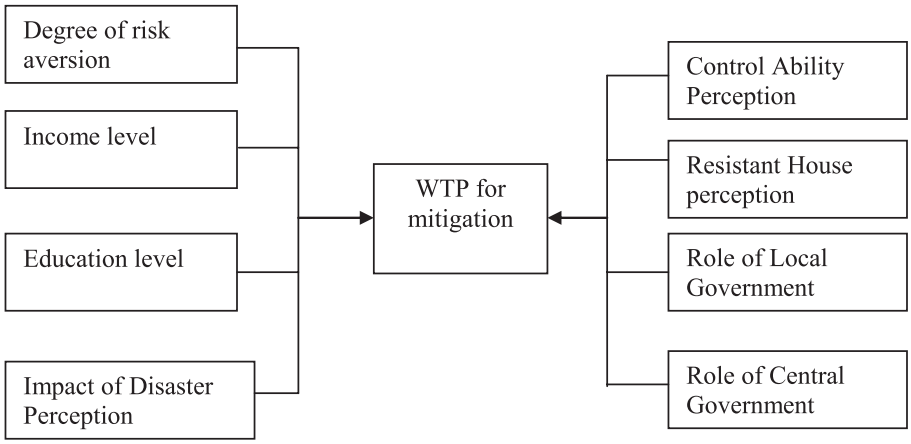
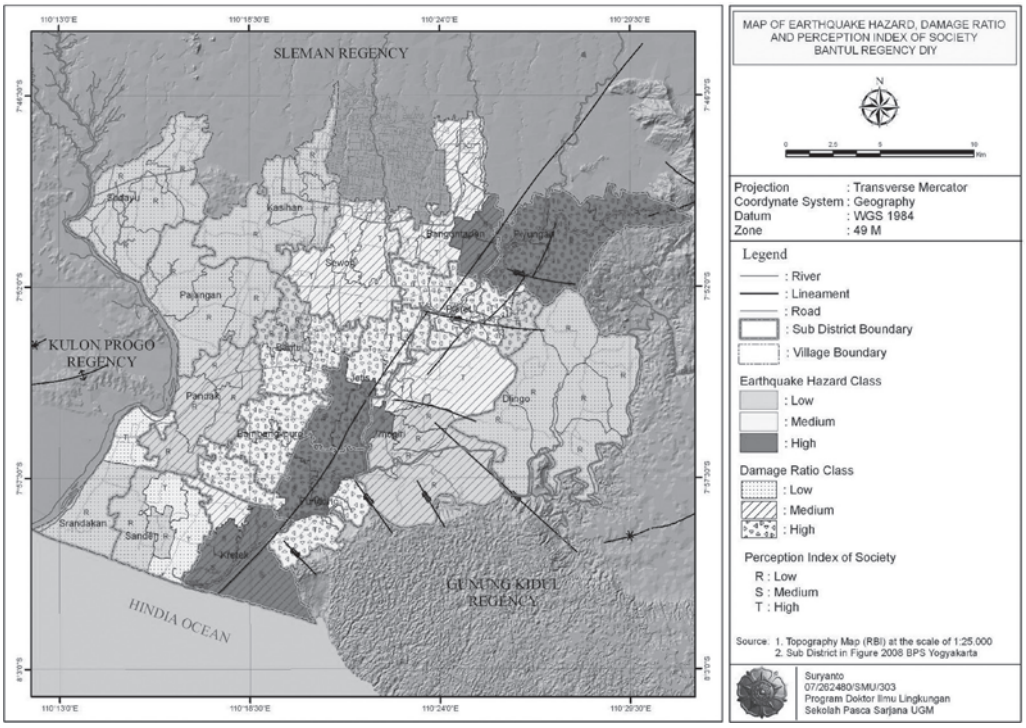


Figure 4. Research Framework



Description:
Damage ratio (the ratio of damage) is the ratio of the number of heavily damaged houses divided by the number of houses in a district. Amplification area is the area divided by the amount of shock when the earthquake struck.

Figure 5. Determine of Sample Area Based on Micro zoning Map and Damage Ratio

socio-economic factors, such as budget obstacles and social networks.

Onculer (2002) & Chinn (2005) researches complemented the findings of Ozdemir (2000) which aimed to explain individual attitude towards protection from an insurance company. However, an experimental method was viewed to be incapable to illustrate individual perception especially how natural disaster affect psychological experience.

Table 1. Operational Definition

Variables	Operational Definition
WTP	Willingness to pay for strengthening their house to be safer from the risk of earthquake disaster
RAVERS	Degree of risk aversion, attitudes toward risk, which can be categorized as risk lover, risk averse or neutral
IMPACT	Perceptions of the impact caused by the earthquake risk among the risks that threaten life in general. Investigation of this effect compared with other types of disasters, whether serious earthquake impact for the individual or not.
LOC_GOVT	Perceptions of the Role of Local Government in earthquake disaster mitigation efforts
EDUCATE	highest education level successfully attained by the head of household
CEN_GOVT	Perceptions of the central government's role in earthquake disaster mitigation efforts
LINCOME	Income level of respondents. This variable reflects disposable income the householder plus the income of other family members
TRUST	Trust respondent mitigation (earthquake-resistant housing and life insurance) are able to protect himself and his family from the risk of earthquakes
DUMMY	Different location of respondents, this variable was used to distinguish between respondents who lived in highly vulnerable areas, moderately vulnerable to disasters, and areas classified as less vulnerable to disaster.

Table 2. Data Description

Variable	Variable Description	Average	Deviation	Skewness
WTP	*Willingness to Pay* (rupiah)	13,238,462	14,701,765	1.667
Perceptions Variables				
IMPACT	Earthquake Impact	3.57	0.62	-1.883
TRUST	Trust to resistant house	2.85	0.60	-0.609
CONTROL	Control ability	2.32	0.68	0.051
LOC_GOVT	Role of local government	2.32	0.82	-0.351
CEN_GOVT	Role of central government	2.05	0.83	0.009
RAVERS	Degree of Risk Aversion	1.22	0.57	2.769
Economic Variable				
INCOME	Level of Income (IDR)	1,381,392	848,230	1.706
Social Variable				
EDUC	Education level	2.30	1.18	0.289
CHILD	Amount of children (under 10 years)	0.49	0.70	1.534
Dummy Variables				
DUMMY1	Highly hazard region	-	-	-
DUMMY2	Hazard region	-	-	-

Conceptual Framework

Discussion on disaster risk perception could not be separated from disaster risk analysis learning. Perception of communities towards disaster was affected by variables that could be described in disaster risk analysis. Disaster risk analysis covered disaster threat kind description, hazard level description, and people's ability level description to overcome. Figure 4 showed the relationship among research variables used. Prone (hazard) level zoning with damage ratio was used to determine research sample.

The output expected from the study was linked between attitude variable and individual perception towards disaster risk. The higher the disaster threat the higher the disaster risk. A regional hazard level was an illustration of physical disadvantage potentials life victims disadvantage potentials and social effect, and also secondary effect from earthquake disaster. The higher hazard level, higher risk of disaster.

The relationship between disaster's risk perception and WTP magnitude

could be explained by expected utility theory. Individuals were basically wished a maximum level utility. If the individual was faced with disadvantage risk potentials so that attitude to do was efforts to reduce the disadvantage risk. The attitude could be taken as an example was willing to earn money or income to build an earthquake resistant home and/or insure their lives. Inter variable relationship would be presented more completely in Figure 4.

RESEARCH METHOD

This research employed both secondary and primary data. Secondary data was necessary to know the damage ratio level documented in the archives, while primary data was collected by spreading questionnaires. Sampling technique was conducted using *multistage cluster sampling*. The research region was divided into main cluster namely: highly hazard, hazard, and less hazard regions as shown in Figure 5.

Data Description

Table 2 presented description about data analyzed. Respondent mitigation WTP average value was IDR13.283 millions with fairly high deviation standard value of IDR 14.702 millions. The result illustrated that respondent mitigation WTP value was varied or ranged between very wide the smallest and greatest WTP. Operational definition of the variable is shown in Table 1, while the value of other variables is shown in Table 2.

RESULTS AND DISCUSSION

Discussion on region characteristic effect, individual perception, and mitigation behavior of individual could be conducted after economic valuation to obtain mitigation economic value. Having mitigation economic valuation completed, next steps will be estimated perception variable effect, economic variables, and social variables. The estimated models must be through a series of examination to decide whether the model was good to represent.

A series of test needed was a classical assumption test that consisted of multicolinearity to view whether independent variables used in the research were inter-correlated. Heteroscedasticity test applied to examine whether its residual variant was homogenous, auto-correlation test examine whether there was correlation between t-period obstructing errors with *t*-1 period (time period before t), and normality test to examine whether the data used has normal distribution or not.

Test of Classical Assumptions

Multicolinearity

Based on multicolinearity test in Classical Assumption Test Appendix, it could be recognized that VIF (Value Inflation Factor) value from each independent variable were or less than 10. Classical assumption test results to obtain VIF value was shown in Table 3.

Heteroscedasticity

This was a test to view whether there was variance residual non similarity from one research to another (heteroscedasticity test) using Park method which proposed that *variance* (s2) was function of free variables that were stated in the following equations:

$$2i = \alpha\ Xi\beta \qquad (3)$$

Table 3. Regression of Log Linear Mitigation Behavior

Variables	Define of Variables	Model	
		Model 1 Full Model	Model 2 Best Model
CHILD	Amount of children under 10 years	0,026 (.408)	-
PROB	Perception of Disaster Probability	-0,068 (-1.068)	-
EDUC	Education level	0,053 (1.207)	0,050 (1.179)
IMPACT	Impact Perception	-0,073 (-1.496)	-0,073 (-1.491)
LOC_GOVT	Perception to local government role	-0,128 (-1.626)	-0,126 (-1.615)
RAVERS	Degree of Risk Averse	0,157)* (1.939)	0,174* (2.197)
TRUST	Perception to building earthquake resistant	0,243** (2.958)	0,243** (2.969)
CEN_GOVT	Perception to central government role	-0,129* (-1.805)	-0,139* (-1.968)
CONTROL	Perception of controllability	0,259** (3.672)	0,261** (3.721)
LNINCOME	Log of income level	0,301** (3.613)	0,291** (3.523)
DUMMY1	Dummy of highly vulnerable area	1,220** (9.781)	1,225** (9.906)
DUMMY2	Dummy of vulnerable area	0,336** (2.437)	0,318** (2.364)
Constant		10,526	10,522
R^2		0,382	0,379
Adjusted R^2		0,361	0,362
F statistic		18.413	21.994
Classic Assumption test	Heteroscedasticity	Hetero	-
	Multicolinearity	-	-

*significant at α=5% or 0, 05, ** significant at α=10% or 0, 1,
(...) = t statistic value
Source: Primary data processing

Based on regression result that was conducted between logarithm value from residual square with independent variable was known that there were none of independent variables that had t-count value higher than t-table (1.96) in trust level of 95% (α=0.05) or there was none of independent variables hat had a significant t-count such as seen in Table 3 so that it could be concluded that in this research estimation model there was no heteroscedasticity.

Autocorrelation

Test result in liner regression yielded d-count value of 1.663. The result could also be obtained by conducting manual calculation by formula (Gujarati, 1997):

$$\text{Count-d} = \frac{\sum \left(et - e_{t-1}\right)^2}{\sum e_t^2} \qquad (4)$$

Count DW value was 1.663 (Appendix 4.1.2. R square value and Durbin

Watson) compared with d-table value for k=10 and n=395 but in table that showed highest dl value for k=10 and n=200 was 1.665 and df value of 1.883. Auto correlation test if we used dl and du values, could be categorized auto correlation liberate model, but reminded auto correlation distraction only affected to time series so that auto correlation obstruction to cross section data could be denied (Ghozali, 2002).

Normality

A fourth classical assumption test was normality test was a test to view whether in regression model, dependent and independent variables had normal distribution or not. A good regression model had a normal data distribution or approached normal. Normality test was conducted by using graphic method was view normal ***probability*** *plot* that compared cumulative distribution from the actual data by cumulative distribution from normal distribution. Normal distribution would form a diagonal straight line.

Hypothesis Test

Regression analysis result recapitulation towards earthquake resistant homes WTP by *backward* analysis method could be known that model was estimated ranged from *full model*. Model with all independent variables were introduced in to the model then gradually would be dropped by a system to enter significant variables only. The best model could consider magnitude of adjusted R^2, statistical F value, and its classical assumption test. Model 1 or complete model and Model 2 or the best model was presented in Table 3.

Model 2 was chosen as the best model by consideration from classical assumption obstruction of heteroscedasticity and multicolinearity. Besides classical assumption test consideration, if compared with its Adjusted R^2 value so that model 2 was higher than other models (could be viewed in attachment). The high adjusted R^2 showed that the model was more fit than other models. Model 2 that was stated fit does not include the introduced children possession variables and probability perception variables.

Based on Table 3, results of the data analysis are: *First*, variable of income influenced to WTP was positively significant. The awareness living in disaster hazard region was estimated as WTP mitigation difference among the three research regions.

Second, degree of risk aversion showed positive and significant impact in developing WTP mitigation; Central governmental role variable toward disaster mitigation efforts were quite significantly influential. The variable of perceptions regarding the role of local government was rejected. The perception of most respondents in Bantul toward local government's role to disaster risk management tends to be negative. This finding represents that the most of people in Bantul tend to decrease their WTP mitigation if they believed that the government will always help if disaster strikes in the future.

Third, the perception of trust towards earthquake resistant house showed positive and significant effect at 95 percent confidence level. These findings could be meant that respondents

who believed that earthquake resistant houses were able to protect him and hence the family would be willing to pay more money for the improvement than individuals which does not believe it to be so.

Fourth, control ability variables also affected WTP mitigation positively and significantly. The control ability was also respondent perception towards earthquake disaster risk if hit them has known actions to do. Control ability variable was significant probably due to what most respondents have learned from earthquake event on 27 May 2006.

Fifth, hazard region dummy variables showed a significant result. Disaster mitigation economic valuation yielded Willingness to pay (WTP) amounted IDR 20.059 millions in a highly hazard region, which was higher than two other region categories of IDR 12.73 millions (hazard region) and amount IDR 7.711 millions (less hazard region). The magnitude difference proved that respondent living in high hazard area wish to improve their safety sense by building up their homes.

Sixth, children possession variables, educational level variables, probability perception variable, effect perception variables, and regional governmental role perception variables were found to be insignificant in affecting WTP for mitigation.

Variables of Impact and Education level were also found to be not significant in influencing WTP for mitigation, even though based on the description of the data shown in Table 2, most of respondents believed that the impact of earthquakes have high negative consequences. Education level also gives insignificant result to WTP for mitigation, which means that having higher formal education level does not necessarily mean higher WTP mitigation.

Local government role in implementing disaster risk management have not been able to increase community participation. Evaluation of the implementation Medium-Term Regional Development Planning (RPJMD) and Long-Term Regional Development Planning (RPJPD) are required especially in disaster risk management. In the future, the local government role should be to stimulate community participation to disaster risk management efforts.

The role of Central government to provide assistance to the community responded well as the responsibility of the government according to Law No. 24 of 2007, but this research showed it will be decreasing WTP mitigation. In Bantul case, WTP mitigation tends to decline because fund of reconstruction and rehabilitation in large part are used to the strengthening of the structure of earthquake-resistant housing. Moreover, community spending could be allocated for other use besides the rehabilitation and reconstruction because "mutual cooperation" among the people as a form of social capital.

CONCLUSION

Based on data analysis, our study could offer some important findings. *First*, mitigation behavior of communities in Bantul Regency is consistent with expected utility theory. They actually have willingness to mitigate to

reduce the disaster risk. Variable of income showed significant influence to WTP for mitigation. Marginal utility of income will decrease when income is rising.

The other variables which might affect WTP are the degree of rejection of risk mitigation, trust in the earthquake-resistant housing, the ability to control, perceptions of the role of central government, income level, and vulnerability regional differences. Variable levels of education, perceptions of the role of local governments, and the impact of natural disasters do not have a significant impact to WTP.

The difference of hazard level influenced to WTP mitigation, it means that behavior of mitigation dependent on where they lived. Communities who lived in prone region (high hazard) have higher WTP than communities who lived in safer area. Implications of these findings are: (1) there was willingness to reduce risk in the future and (2) that the government has to increase the community's degree of risk aversion.

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Appendix

Research Questionnaire

A. IDENTITY OF RESPONDENT

No	
Name	
Age	years
Occupy	
Address	
Impact to building house	Totally damage/heavy damage/damage/no damage (choose one)

Risk Perception and Economic Value_2

by Suryanto Suryanto

Submission date: 31-Jan-2020 09:24AM (UTC+0700)
Submission ID: 1249068587
File name: nd_Economic_Value_of_Disaster_Mitigation_potong-halaman-3-18.pdf (853.34K)
Word count: 5952
Character count: 33233

10

RISK PERCEPTION AND ECONOMIC VALUE OF DISASTER MITIGATION

Case of Bantul Post Earthquake May 2006

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Abstract

This study aims to obtain empirical evidence of disaster mitigation in Bantul, Indonesia. The expected utility theory and impact of regional characteristics on individual perceptions was used to describe the disaster risk management process. The regional mapping based on hazard level was conducted by a Geographical Information System (GIS). Data used in this research were primary and secondary data. Primary data were obtained by distributing questionnaire to some respondents. Sample amounts used were 395 respondents. The research empirical contribution was to economic valuation method used towards safety and efforts to link regional characteristics, individual perception and also their willingness to conduct mitigation. The research practical contribution was to identify some key obstacles in disaster risk management. Based on multiple regression analysis, this study found that educational level, risk aversion degree, trust towards earthquake-resistant building, control ability, income level, classification of hazard area contributes to higher Willingness To Pay (WTP) for mitigation. It also found that perception towards central governmental roles variable did not affect to WTP for mitigation. However, the income levels of the communities in Bantul positively correspond to WTP for mitigation suggesting that the findings were consistent with the expected utility theory.

Keywords: Risk perception, economic valuation, disaster risk mitigation, Willingness to Pay, Indonesia.

Indonesia is situated geographically and geologically in three actively moving tectonic plates: (1) Eurasia plate in the north, (2) Indo Australia-Oceania plate in the south, and (3) Pacific plate in the east (BNPB, 2004; Murjaya, 2007). The constant motion of these three slabs would cause frequent earthquakes. Due to its severe consequences, the disaster risk of Earthquakes would be catastrophic even though the probability might be low. Thus anticipative actions must be done in order to mitigate the risk of this disaster. Since it is impossible to reduce the hazard level, therefore the feasible course of action would be to develop people's capacity to respond or to reduce the vulnerabilities to the disaster. The efforts to improve capacities and/or to reduce vulnerabilities would needed good cooperation between the government and the communities.

The government would not be able to solve disaster problems without involving the active participation of the communities. One major problem in risk management was the potential difference of perception and understanding among the communities. Empirical studies that had been conducted on the subject can be grouped into two different conclusions. The first group was Ozdemir (2000); Ozdemir and Kruze (2005); Fujimi and Tatano (2006); Li and Hsiu (2007), who found that communities tended to be unaware towards disasters. Being aware towards disaster meant that the communities considered current disaster risk. Meanwhile, the second group argued on the contrary (Schade, *et al*. 2001; Miller, *et al*. 2002; Kunreuther, 2006) that when communities attempts to reduce potential risk, they are willing to mitigate for losses in the future. These findings are consistent with the expected utility theory.

The often emerge problem was that the comprehension and awareness of communities to conduct disaster's mitigation are heterogeneous. Perception formed in each community was supposed to affect behavior of communities to perform disaster mitigation. This as a challenge that must be faced to implement disaster risk management both in the developed countries as well as in the developing countries like as Indonesia.

This study aim to offer comprehensive analysis to the investigation of the relationship between disaster risk perception and the mitigation behavior by combining the analysis with threat description level, vulnerability, and ability to mitigate disaster. Mitigation behavior examined specifically in this study is the Willingness to pay for the mitigation efforts. Communities who lived in vulnerable regions should have higher Willingness to pay (WTP) than those who lived in less vulnerable regions. WTP in this case means the willingness to spend more money to mitigate earthquake risk. In the case of Bantul regency, for example, WTP is willingness to strengthen of their physical house to withstand earthquakes.

There are three main factors why research was conducted in Bantul. *First*, even though it is only a hefty 6.2-magnitude quake, the shallow depth of 10 kilometers made the May 2006 Java earthquake one of the worst of the 21st century. *Second*, most of area in Bantul Regency is vulnerable to earthquake risk (part of rings of fire path). While the tremor and the two strong aftershocks were closest to the city of Yogyakarta, the worst damage was in the area of Bantul. An estimated 5,800 people died from the earthquake plus another 36,000 were injured. The property damage, believed to affect 135,000 homes, leaving 1.5 million people homeless. *Third*, earthquakes are the type of disaster which could be repeated and relatively hard to predict precisely when and where will it struck.

Therefore, this research is important to be conducted to elaborate: (1) mapping behavior of individual WTP mitigation; (2) appropriate role of government by incorporating WTP mitigation based on communities. Based on the explanations above, the research problem formulated was "to what extent regional characteristic and individu-

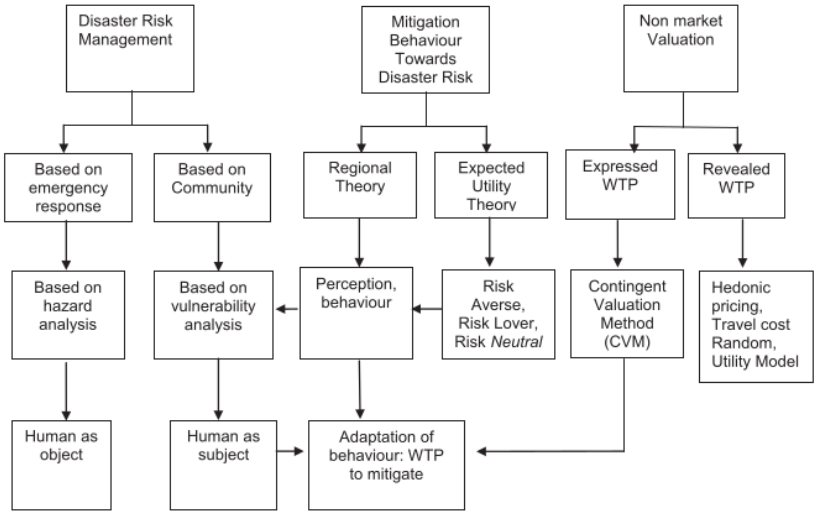


Figure 1. Underlying Theories

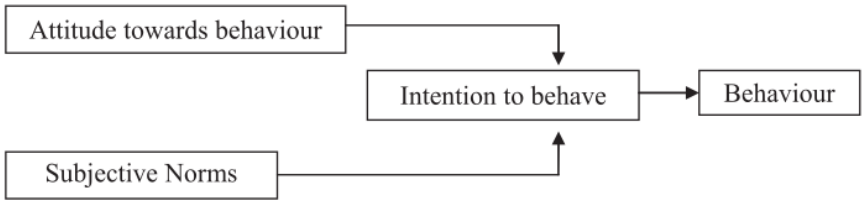
al's perception towards earthquake disaster affect mitigation behavior". Regional characteristics and mitigation behavior was reflected respectively by dummy variables and WTP of residence who became more secured from earthquake risk. This study aims to obtain empirical evidence of mitigation behavior in Bantul in accordance with the expected utility theory and affect of regional characteristic to individual perceptions towards earthquake disaster mitigation.

LITERATURE REVIEW

This research used three major theories, which is Disaster Risk Management Theory, Human Ecology Theory, and Non-Market Economic Valuation Theory. Figure 1 presented interrelationship amongst those theories underlying this research. The essence of Human Ecology Theory was on how human form relationship with their environment. Disaster Risk Management Theory consisted of how human efforts were necessary to minimize disadvantage risks caused by environment namely disaster case. While Non-Market Economic Valuation theory developed in the environmental economics subject, were efforts to give monetary value to environmental factors especially those with no market value.

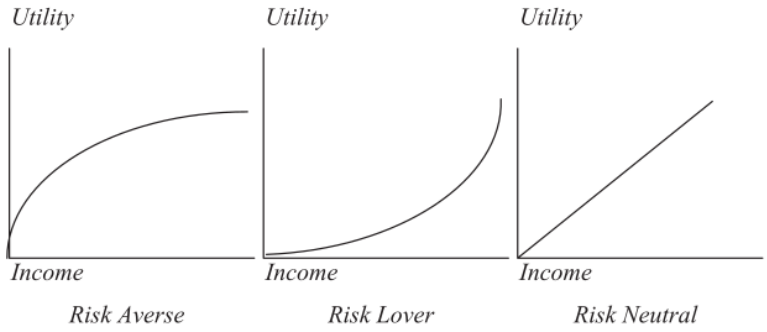
Disaster Risk Management

Disaster risk management concept is often resembled with disaster reduction. However, not only disaster reduction, disaster risk management also includes prevention concepts and preparations for disasters (Kohler, *et al*. 2000; Aufrett, 2003). Total risk reduction is basically applying prudent principles in each *disaster risk management* actions. Disaster risk management is an activity that covered disaster planning and mitigation aspect before, during, and after a disaster took place. Disaster risk management aimed to develop "safety culture" and created "disaster resistant community".



Source: Ajzen & Fishbein in Azwar (2003)

Figure 2. Reasoned Action Theory



Source: Pyndick & Rubinfeld (2001)

Figure 3. Individual Preference towards Risk

Disaster risk is basically emerged due to some factors. The factors must be available in the same time. According to Sadisun (2004), disaster risk is an interaction between disaster threat, vulnerability, and mitigation ability towards disasters. Mathematically, it could be formulated as:

$$\text{Disaster Risk} = \frac{(\text{Hazard x Vulnerability})}{\text{Mitigation Ability}} \quad (1)$$

Human Ecology: Perception, Attitude, Behavior Relationships

Azwar (2003) stated that attitude was not only a mental but also physical response. Azwar (2003) further divided attitude into two approaches, the first one is the three component combination approaches (affective, cognitive, and attitude). The second approach emerged due to dissatisfaction to inconsistent explanation among the three component relationships namely cognitive, affective, and attitude in forming attitude. The approach followers limited their attitude concept only in affective aspect. Attitude is an affect or positive or negative evaluation towards an object.

Theory of Reasoned Action developed by Ajzen and Fishbein in Azwar (2003) stated that human intentions were affected by two things namely attitude towards behavior (a personal aspect), and subjective norms (individual perception to behave the attitude or not). According to Harvey & Smith in Rito-hardoyo (2006), perception is classified

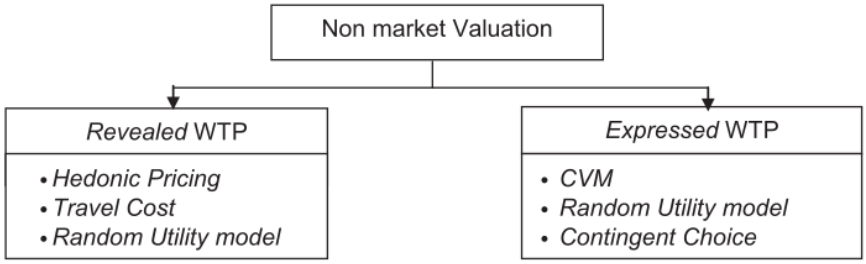


Figure 3. Non-market Economic Valuation

into two were personal perception and social perception. Personal perception of one impression forming process is based on investigation or reasoning towards one thing that had affected the physical as well as psychological aspects. Community's social perception is an action based on investigation or reasoning, either through direct interaction through mass media as well as through other communities toward one case.

Based on Figure 2, perception and environmental relationship is perception that affected human attitude order towards environment. If one's perception towards environment had a positive value, then it has the ability to affect the perceiver either physically or psychologically so that, in turn, it could give the perceiver the motivation towards its environment.

Individual Mitigation Attitude

Individual mitigation attitude is an attitude about efforts that must be conducted by an individual when he or she is in an uncertain condition. Mitigation is an effort to reduce disaster risk that potentially suffered by individuals as explained previously. The economic model most often used to explain the decision making in uncertain condition is the Expected Utility Theory. The theory stated that expected utility are the average of outcomes weighted by measured probabilities in all event possibilities (Pindyck & Rubinfield, 2001). The Expected Utility Theory developed by von Neumann Morgensten (1954) in Dixit (1990), mathematical equation by von Neumann-Morgenstern:

$$EU=\Sigma PiU(Yi) \quad (2)$$

Where:
Pi = probabilities 1, remark 1>0
Yi = economic gain (such as income, wealth, and profit)

Preference towards Risk

Individual preferences in facing risk could be classified into three groups, (1) risk lover, (2) risk neutral, and (3) risk averse group. Risk lover has preference to uncertainty over certainty, risk neutral places equal preference between uncertainty and certainty, while risk averse preferred certainty over uncertainty.

Economic Valuation

Total economic value of natural resource and environment could be valued by some valuation method. According to Hufscmidt, et al. (1992), outlined economic advantage valua-

tion method (environmental cost) of natural resources and environment is basically could be divided into two large groups based on market-oriented approach and non-market approach or survey-oriented.

Relationship Risk Perception and WTP Model

Model that linked risk perception variables and WTP is developed by Ehrlich & Becker (1972) and then adapted by Ozdemir (2000). The model was developed in order to explain individual mitigation behavior (willingness to pay for safety) in the hazard area, especially a low probability high impacts disaster. Ehrlich & Becker (1972) classified behavior mitigation were self-insurance, self-protection, and insurance market. Insurance itself is defined as risk reducer and self-protection is probability reducer due to catastrophic risk. Insurance itself is a mitigation form, especially when someone is not risk affected, but it could affect to consequences due to the risk.

Previous Empirical Studies

Previous research associated to natural disaster insurance demand has been conducted among others by: Grace, *et al*. (2002), Kunreuther (2006), and Li & Hsiu (2007). Li & Hsiu (2007) analyzed factors that effected towards insurance demand in Taiwan. What made this different was that their research introduced spatial variables as explaining variables beside net income variables and governmental subsidy. An analysis tool used was spatial econometrics and panel regression. Research result showed that governmental subsidy loan affected negatively towards earthquake insurance demand, while net income variables and spatial variables were positively harmonious affected to the hypothesis.

Research conducted by Grace, et al. (2002) analyzed insurance demand to housings where insurance protection covered risk towards catastrophic natural disaster. The research showed a consistent result in two sample regions, demand for insurance with added protection towards catastrophic natural disasters were actually more elastic compared to demand for insurance without additional protection towards catastrophic natural disaster risk. The research showed that there was an insurance premium cost increase that would decrease the demand for insurance.

Kunreuther (2006) yielded a different conclusion compared with the research conducted by Grace, *et al*. (2002), especially related to willingness to pay extra for additional protection. Kunreuther (2006) presented an empirical fact which suggested that the magnitude of flood disaster cost was due to poorly conducted disaster mitigation efforts and the lack of insurance both for themselves and their homes.

Research result conducted by Schade, *et al*. (2001) showed that in low probably disaster risk area, it was more important to investigate Willingness to pay than the estimated subjective probability where there was an ambiguity in that estimation. According to Schade, *et al.* (2001), anxiety was an important thing to explain a phenomenon why some people were willing to spend their money for protection while others were not.

Nyman (2001) mentioned that insurance demand was a demand towards a certainty fitted to the expected utility theory. However, in previous researches individuals was known to actually prefer uncertain disadvantages than certain disadvantages. Based on the gap between expected utility theory and the findings mentioned above, it can be concluded that insurance demand was influenced by an expected consideration to obtain bigger compensation if there was a claim.

Nyman's (2001) research was interesting because it concludes that insurance demand by individuals to be caused by certainty and not due to uncertainty. This conclusion was estimated to be suitable with cases in health insurance but may not be suitable with natural disaster insurance cases that are relatively catastrophic.

Simmons, *et al.* (2002) explored valuation of two kinds of measure for typhoon mitigation in Gulf Coast City. They used *hedonic price* method and concluded that individuals regarded that *self-insurance* as one of mitigation forms that were conducted whenever known that the individual is living in a hazard disaster region. This finding was similar with what Simmons & Kruse (2004) which compared housing price between houses with and without protection. The result was that the price of houses equipped with disaster protections was higher than houses without protections.

Morone & Ozdemir (2006) investigated protection attitudes towards disaster considered to be of low probability category but serious affect. The research method used was experimental design using linear regression analysis. The result was in line with previous researches that individuals tended to *risk averse* so that they wished to buy insurance as a mitigation form. This finding added insight to the economic valuation of the mitigation efforts by measuring mitigation attitude.

Ozdemir (2000) tried to investigate the relationship between perception towards risk and WTP to conduct mitigation using surveys. The result showed among others, perception significantly affects WTP, while risk *aversion* degree variable did not affect WTP. Prudent attitude was also positively influence WTP, as well as some demographic variable such as child possession. On the other hand, gender, age, and past experience did not affect WTP.

Chinn (2005) also conducted a research especially related to disaster characteristic by lottery experiment and by questionnaire survey. The finding also showed low interest to conduct mitigation especially to disaster insurance. People rejected to pay unfair premium cost. Contradictory to the findings of Ozdemir (2000), gender variable was found to be significant in influencing WTP for mitigation. These research further supported prospect theory instead of expected utility theory.

Onculer (2002) conducted a research similar to Browne & Hoit (2000), Chinn (2005), and Ozdemir & Kruse (2005). Onculer (2000) conducted a study on risk perception and WTP magnitude. Some variable investigated was perception towards risk, attitude towards coded buildings, experience roles, dynamic groups, and

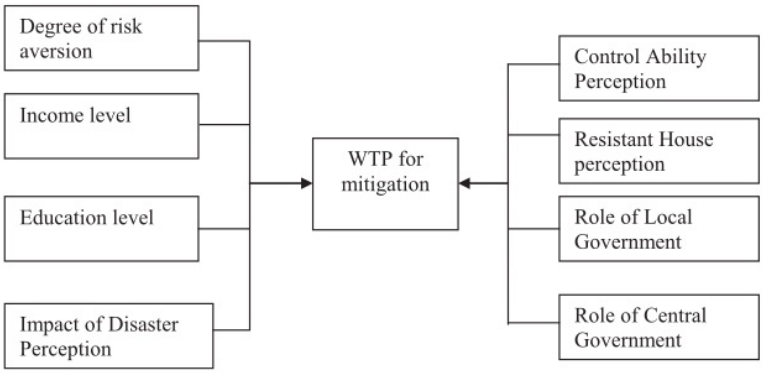
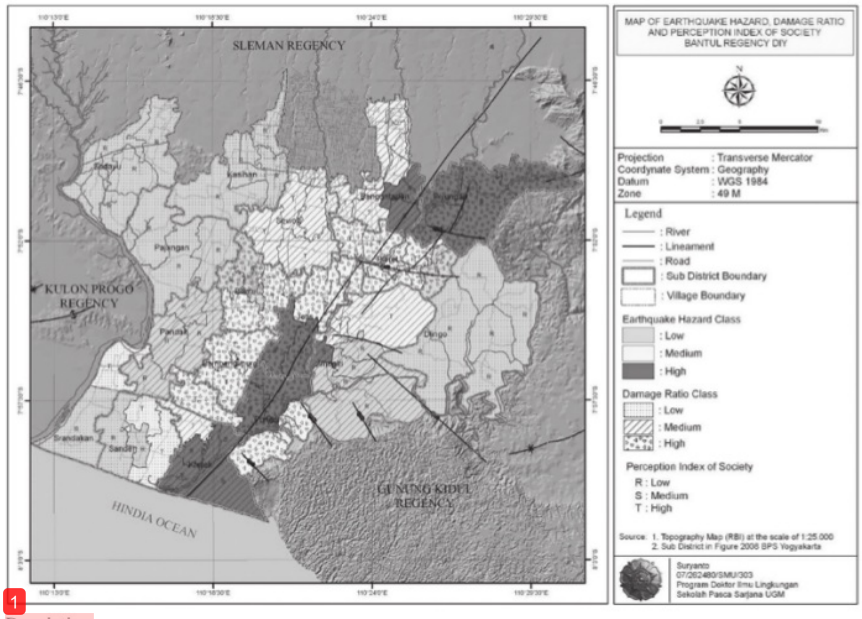


Figure 4. Research Framework



Description:
Damage ratio (the ratio of damage) is the ratio of the number of heavily damaged houses divided by the number of houses in a district. Amplification area is the area divided by the amount of shock when the earthquake struck.

Figure 5. Determine of Sample Area Based on Micro zoning Map and Damage Ratio

socio-economic factors, such as budget obstacles and social networks.

Onculer (2002) & Chinn (2005) researches complemented the findings of Ozdemir (2000) which aimed to explain individual attitude towards protection from an insurance company. However, an experimental method was viewed to be incapable to illustrate individual perception especially how natural disaster affect psychological experience.

Table 1. Operational Definition

Variables	Operational Definition
WTP	Willingness to pay for strengthening their house to be safer from the risk of earthquake disaster
RAVERS	Degree of risk aversion, attitudes toward risk, which can be categorized as risk lover, risk averse or neutral
IMPACT	Perceptions of the impact caused by the earthquake risk among the risks that threaten life in general. Investigation of this effect compared with other types of disasters, whether serious earthquake impact for the individual or not.
LOC_GOVT	Perceptions of the Role of Local Government in earthquake disaster mitigation efforts
EDUCATE	highest education level successfully attained by the head of household
CEN_GOVT	Perceptions of the central government's role in earthquake disaster mitigation efforts
LINCOME	Income level of respondents. This variable reflects disposable income the householder plus the income of other family members
TRUST	Trust respondent mitigation (earthquake-resistant housing and life insurance) are able to protect himself and his family from the risk of earthquakes
DUMMY	Different location of respondents, this variable was used to distinguish between respondents who lived in highly vulnerable areas, moderately vulnerable to disasters, and areas classified as less vulnerable to disaster.

Table 2. Data Description

Variable	Variable Description	Average	Deviation	Skewness
WTP	*Willingness to Pay* (rupiah)	13,238,462	14,701,765	1.667
Perceptions Variables				
IMPACT	Earthquake Impact	3.57	0.62	-1.883
TRUST	Trust to resistant house	2.85	0.60	-0.609
CONTROL	Control ability	2.32	0.68	0.051
LOC_GOVT	Role of local government	2.32	0.82	-0.351
CEN_GOVT	Role of central government	2.05	0.83	0.009
RAVERS	Degree of Risk Aversion	1.22	0.57	2.769
Economic Variable				
INCOME	Level of Income (IDR)	1,381,392	848,230	1.706
Social Variable				
EDUC	Education level	2.30	1.18	0.289
CHILD	Amount of children (under 10 years)	0.49	0.70	1.534
Dummy Variables				
DUMMY1	Highly hazard region	-	-	-
DUMMY2	Hazard region	-	-	-

Conceptual Framework

Discussion on disaster risk perception could not be separated from disaster risk analysis learning. Perception of communities towards disaster was affected by variables that could be described in disaster risk analysis. Disaster risk analysis covered disaster threat kind description, hazard level description, and people's ability level description to overcome. Figure 4 showed the relationship among research variables used. Prone (hazard) level zoning with damage ratio was used to determine research sample.

The output expected from the study was linked between attitude variable and individual perception towards disaster risk. The higher the disaster threat the higher the disaster risk. A regional hazard level was an illustration of physical disadvantage potentials life victims disadvantage potentials and social effect, and also secondary effect from earthquake disaster. The higher hazard level, higher risk of disaster.

The relationship between disaster's risk perception and WTP magnitude

could be explained by expected utility theory. Individuals were basically wished a maximum level utility. If the individual was faced with disadvantage risk potentials so that attitude to do was efforts to reduce the disadvantage risk. The attitude could be taken as an example was willing to earn money or income to build an earthquake resistant home and/or insure their lives. Inter variable relationship would be presented more completely in Figure 4.

RESEARCH METHOD

This research employed both secondary and primary data. Secondary data was necessary to know the damage ratio level documented in the archives, while primary data was collected by spreading questionnaires. Sampling technique was conducted using *multistage cluster sampling*. The research region was divided into main cluster namely: highly hazard, hazard, and less hazard regions as shown in Figure 5.

Data Description

Table 2 presented description about data analyzed. Respondent mitigation WTP average value was IDR13.283 millions with fairly high deviation standard value of IDR 14.702 millions. The result illustrated that respondent mitigation WTP value was varied or ranged between very wide the smallest and greatest WTP. Operational definition of the variable is shown in Table 1, while the value of other variables is shown in Table 2.

RESULTS AND DISCUSSION

Discussion on region characteristic effect, individual perception, and mitigation behavior of individual could be conducted after economic valuation to obtain mitigation economic value. Having mitigation economic valuation completed, next steps will be estimated perception variable effect, economic variables, and social variables. The estimated models must be through a series of examination to decide whether the model was good to represent.

A series of test needed was a classical assumption test that consisted of multicolinearity to view whether independent variables used in the research were inter-correlated. Heteroscedasticity test applied to examine whether its residual variant was homogenous, auto-correlation test examine whether there was correlation between t-period obstructing errors with *t*-1 period (time period before t), and normality test to examine whether the data used has normal distribution or not.

Test of Classical Assumptions

Multicolinearity

Based on multicolinearity test in Classical Assumption Test Appendix, it could be recognized that VIF (Value Inflation Factor) value from each independent variable were or less than 10. Classical assumption test results to obtain VIF value was shown in Table 3.

Heteroscedasticity

This was a test to view whether there was variance residual non similarity from one research to another (heteroscedasticity test) using Park method which proposed that *variance* (s2) was function of free variables that were stated in the following equations:

$$2i = \alpha\ Xi\beta \qquad (3)$$

Table 3. Regression of Log Linear Mitigation Behavior

Variables	Define of Variables	Model	
		Model 1 Full Model	Model 2 Best Model
CHILD	Amount of children under 10 years	0,026 (.408)	-
PROB	Perception of Disaster Probability	-0,068 (-1.068)	-
EDUC	Education level	0,053 (1.207)	0,050 (1.179)
IMPACT	Impact Perception	-0,073 (-1.496)	-0,073 (-1.491)
LOC_GOVT	Perception to local government role	-0,128 (-1.626)	-0,126 (-1.615)
RAVERS	Degree of Risk Averse	0,157)* (1.939)	0,174* (2.197)
TRUST	Perception to building earthquake resistant	0,243** (2.958)	0,243** (2.969)
CEN_GOVT	Perception to central government role	-0,129* (-1.805)	-0,139* (-1.968)
CONTROL	Perception of controllability	0,259** (3.672)	0,261** (3.721)
LNINCOME	Log of income level	0,301** (3.613)	0,291** (3.523)
DUMMY1	Dummy of highly vulnerable area	1,220** (9.781)	1,225** (9.906)
DUMMY2	Dummy of vulnerable area	0,336** (2.437)	0,318** (2.364)
Constant		10,526	10,522
R^2		0,382	0,379
Adjusted R^2		0,361	0,362
F statistic		18.413	21.994
Classic Assumption test	Heteroscedasticity	Hetero	-
	Multicolinearity	-	-

*significant at α=5% or 0, 05, ** significant at α=10% or 0, 1,
(...) = t statistic value
Source: Primary data processing

Based on regression result that was conducted between logarithm value from residual square with independent variable was known that there were none of independent variables that had t-count value higher than t-table (1.96) in trust level of 95% (α=0.05) or there was none of independent variables hat had a significant t-count such as seen in Table 3 so that it could be concluded that in this research estimation model there was no heteroscedasticity.

Autocorrelation

Test result in liner regression yielded d-count value of 1.663. The result could also be obtained by conducting manual calculation by formula (Gujarati, 1997):

$$\text{Count-d} = \frac{\sum (et - e_{t-1})^2}{\sum e_t^2} \quad (4)$$

Count DW value was 1.663 (Appendix 4.1.2. R square value and Durbin

Watson) compared with d-table value for k=10 and n=395 but in table that showed highest dl value for k=10 and n=200 was 1.665 and df value of 1.883. Auto correlation test if we used dl and du values, could be categorized auto correlation liberate model, but reminded auto correlation distraction only affected to time series so that auto correlation obstruction to cross section data could be denied (Ghozali, 2002).

Normality

A fourth classical assumption test was normality test was a test to view whether in regression model, dependent and independent variables had normal distribution or not. A good regression model had a normal data distribution or approached normal. Normality test was conducted by using graphic method was view normal ***probability*** *plot* that compared cumulative distribution from the actual data by cumulative distribution from normal distribution. Normal distribution would form a diagonal straight line.

Hypothesis Test

Regression analysis result recapitulation towards earthquake resistant homes WTP by *backward* analysis method could be known that model was estimated ranged from *full model*. Model with all independent variables were introduced in to the model then gradually would be dropped by a system to enter significant variables only. The best model could consider magnitude of adjusted R^2, statistical F value, and its classical assumption test. Model 1 or complete model and Model 2 or the best model was presented in Table 3.

Model 2 was chosen as the best model by consideration from classical assumption obstruction of heteroscedasticity and multicolinearity. Besides classical assumption test consideration, if compared with its Adjusted R^2 value so that model 2 was higher than other models (could be viewed in attachment). The high adjusted R^2 showed that the model was more fit than other models. Model 2 that was stated fit does not include the introduced children possession variables and probability perception variables.

Based on Table 3, results of the data analysis are: *First*, variable of income influenced to WTP was positively significant. The awareness living in disaster hazard region was estimated as WTP mitigation difference among the three research regions.

Second, degree of risk aversion showed positive and significant impact in developing WTP mitigation; Central governmental role variable toward disaster mitigation efforts were quite significantly influential. The variable of perceptions regarding the role of local government was rejected. The perception of most respondents in Bantul toward local government's role to disaster risk management tends to be negative. This finding represents that the most of people in Bantul tend to decrease their WTP mitigation if they believed that the government will always help if disaster strikes in the future.

Third, the perception of trust towards earthquake resistant house showed positive and significant effect at 95 percent confidence level. These findings could be meant that respondents

who believed that earthquake resistant houses were able to protect him and hence the family would be willing to pay more money for the improvement than individuals which does not believe it to be so.

Fourth, control ability variables also affected WTP mitigation positively and significantly. The control ability was also respondent perception towards earthquake disaster risk if hit them has known actions to do. Control ability variable was significant probably due to what most respondents have learned from earthquake event on 27 May 2006.

Fifth, hazard region dummy variables showed a significant result. Disaster mitigation economic valuation yielded Willingness to pay (WTP) amounted IDR 20.059 millions in a highly hazard region, which was higher than two other region categories of IDR 12.73 millions (hazard region) and amount IDR 7.711 millions (less hazard region). The magnitude difference proved that respondent living in high hazard area wish to improve their safety sense by building up their homes.

Sixth, children possession variables, educational level variables, probability perception variable, effect perception variables, and regional governmental role perception variables were found to be insignificant in affecting WTP for mitigation.

Variables of Impact and Education level were also found to be not significant in influencing WTP for mitigation, even though based on the description of the data shown in Table 2, most of respondents believed that the impact of earthquakes have high negative consequences. Education level also gives insignificant result to WTP for mitigation, which means that having higher formal education level does not necessarily mean higher WTP mitigation.

Local government role in implementing disaster risk management have not been able to increase community participation. Evaluation of the implementation Medium-Term Regional Development Planning (RPJMD) and Long-Term Regional Development Planning (RPJPD) are required especially in disaster risk management. In the future, the local government role should be to stimulate community participation to disaster risk management efforts.

The role of Central government to provide assistance to the community responded well as the responsibility of the government according to Law No. 24 of 2007, but this research showed it will be decreasing WTP mitigation. In Bantul case, WTP mitigation tends to decline because fund of reconstruction and rehabilitation in large part are used to the strengthening of the structure of earthquake-resistant housing. Moreover, community spending could be allocated for other use besides the rehabilitation and reconstruction because "mutual cooperation" among the people as a form of social capital.

CONCLUSION

Based on data analysis, our study could offer some important findings. *First*, mitigation behavior of communities in Bantul Regency is consistent with expected utility theory. They actually have willingness to mitigate to

reduce the disaster risk. Variable of income showed significant influence to WTP for mitigation. Marginal utility of income will decrease when income is rising.

The other variables which might affect WTP are the degree of rejection of risk mitigation, trust in the earthquake-resistant housing, the ability to control, perceptions of the role of central government, income level, and vulnerability regional differences. Variable levels of education, perceptions of the role of local governments, and the impact of natural disasters do not have a significant impact to WTP.

The difference of hazard level influenced to WTP mitigation, it means that behavior of mitigation dependent on where they lived. Communities who lived in prone region (high hazard) have higher WTP than communities who lived in safer area. Implications of these findings are: (1) there was willingness to reduce risk in the future and (2) that the government has to increase the community's degree of risk aversion.

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Appendix

Research Questionnaire

A. IDENTITY OF RESPONDENT

No	
Name	
Age	years
Occupy	
Address	
Impact to building house	Totally damage/heavy damage/damage/no damage (choose one)

Risk Perception and Economic Value_2

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PAGE 1

PAGE 2

PAGE 3

PAGE 4

PAGE 5

PAGE 6

PAGE 7

PAGE 8

PAGE 9

PAGE 10

PAGE 11

PAGE 12

PAGE 13

PAGE 14

PAGE 15

PAGE 16

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