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## Do cultural factors alter the relationship between risk attitudes and economic welfare?

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Thailand Vietnam Socio Economic Panel

# Do cultural factors alter the relationship between risk attitudes and economic welfare?

Huong Dien Pham

Leibniz Universität Hannover

2017

TVSEP Working Paper

WP-003

The Thailand Vietnam Socio Economic Panel (TVSEP) is a long-term research project for data collection and scientific analysis funded by the Deutsche Forschungsgemeinschaft (DFG). The high quality panel data sets have been collected in rural areas of Thailand and Vietnam since 2007. The panels cover many important aspects of living standard measures, demography, geography, shocks, risks, expectations and behavioural traits of individuals. TVSEP data is available for scientific research purposes free of charge.

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# **Do Cultural Factors Alter the Relationship Between Risk Attitudes and Economic Welfare?**

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## **Abstract**

This paper analyzes how cultural factors shape risk attitudes and subsequently alter its relationship with economic welfare. The research sample is comprised by a three wave balanced panel data set of 588 ethnically diverse households collected between 2008 and 2013 in the Central Vietnam. Different ethnic groups are characterized by different languages, customs and beliefs that create the cultural diversity of the sample. Different approaches are used to examine the relationship between risk attitudes and economic welfare in the presence of the cultural diversity. First, a single-equation estimation method using a fixed effects model and a Hausman-Taylor model is employed to examine the unidirectional relationship. Second, a simultaneous equation estimation method using the Three Stage Least Squares model is applied to explore a bidirectional relationship between risk attitudes and economic welfare. Among the ethnic minorities, results indicate a negative association between willingness to take risks and economic welfare at low degree but a positive at the higher degree of risk-taking. For the ethnic majority, a positive and mutual relationship between risk attitudes and economic welfare is indicated. The ethnic majority is economically better-off than their minority counterparts are, whereas the minorities are economically homogenous but strongly diverse in risk attitudes and social factors. This study sheds light on the cultural heterogeneity in the individual risk attitudes as well as in shaping its relationship with economic welfare. Generally, it is suggested to consider sociocultural factors via risk-taking channel in socioeconomic policies that target ethnically or culturally diverse populations. Particularly, that implies a need to encourage the risk-taking strategies among the extremely risk-averse individuals, particularly who belong to the ethnic minorities.

**Keywords:** Ethnicity, Risk attitude, Economic welfare, Simultaneous equation model

**JEL:** C33, D81, I30, R20, Z19

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## 1. Introduction

Poverty or economic problems can lead to risk-averse decision-making (Haushofer & Fehr, 2014). In its turn, risk aversion can trap the poor into persistent poverty because their risk aversion prevents them from investing in high-risk and high-return opportunities (Mosley & Verschoor, 2005). However, the empirical evidence of the correlation between risk aversion and economic welfare remains mixed. Limited to the studies that were conducted in low-income countries, the results on the correlation between risk aversion and economic welfare are ranging from insignificant to significantly negative and positive (e.g., Binswanger, 1980; Liebenehm & Waibel, 2014; Tanaka, Camerer, & Nguyen, 2010; Vieider, Truong, Martinsson & Nam, 2014b; Yesuf & Bluffstone, 2009). Further empirical evidence of the relationship between risk attitudes and economic welfare remains highly demanded. Similarly, what are the driving factors of this relationship and how to address them need further investigation.

Firstly, we need to consider the consistency of the measures of risk attitudes that were used in previous studies. In fact, many studies to date applied experiments that are context-dependent and sensitive to the cognitive skills of the subjects and to the elicitation methods. Consequently, some of those studies are subject to a sceptical discussion on the consistency and reliability of their measures of risk attitudes (e.g., Cook, 2015; Chuang & Schechter, 2015; Filippin & Crosetto, 2016). Instead, this study employs a survey question to capture the general willingness to take risks that was validated by the risk experiments in different populations (Dohmen et al., 2011; Hardeweg, Menkhoff & Waibel, 2013). Vieider et al. (2015) compared students' responses to incentivized lottery choices and survey measures across 30 countries and found significant correlations within most countries and between countries. They suggest using survey measures for cultural comparisons on risk attitudes. Therefore, this study tests this survey-based measure to capture the general individual risk attitudes among an ethnically diverse population of rural Vietnam.

Recently, Vieider et al. (2016) was the first to examine the causal relationship between risk attitudes and economic welfare. However, by using different proxies of income such as land size and altitude, they could only reduce partly the endogeneity problem caused by measurement error. Hence, they tried to avoid a strongly interpretation of the causal effect. In fact, another cause of endogeneity that was suggested by Cardenas and Carpenter (2013) and Tanaka et al. (2010) has not considered so far. According to those researchers, the possible presence of reverse causality could explain why no significant correlation of the relationship between risk attitudes and income was found their studies. Therefore, this suggestion renders

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this study critically important to explore the mutual connection between risk attitudes and economic welfare.

Thirdly, the current study extends this body of literature by testing the assumption of a complex relationship in presence of cultural diversity. That is motivated by a suggestion from Bouchouicha and Vieider (2017) who indicated a “risk-income paradox” in the relationship between income and risk tolerance within and across countries. In particular, they found a negative when comparing between countries but a positive correlation when comparing within countries. A similar “paradox” in the relationship between risk-taking and economic welfare can be tested across ethnic groups, provided that risk-taking is driven by cultural factors.

This study investigates the relationship between risk preferences and economic wellbeing in presence of ethnic diversity. It aims to emphasize the importance of ethnicity to drive the variations of risk attitudes and economic wellbeing. Furthermore, it demonstrates how this ethnic diversity shapes the patterns of the relationship between risk attitudes and economic welfare. It expects to contribute to the emerging literature on the linkage among culture, risk attitude and economic development. Furthermore, this study introduces new approaches to examine the association between economic welfare and risk attitudes. As a result, it explains to some extent the mixed results of this relationship in empirical studies across cultures or countries. In addition, this study expects to shed light on the persistent poverty and economic gap among ethnically diverse populations.

A multiethnic sample of 588 individuals in a three-wave balanced panel collected from rural areas of Thua Thien Hue and Dak Lak provinces of Vietnam. The sample includes 13 ethnic minority groups that are proportional to their populations as well as well-presenting the ethnic minorities of Vietnam. Regarding ethnic diversity, Vietnam has 53 ethnic minority groups that contribute only 14 percent to the population, but account for almost half of the national poverty incidence (Kozel, 2014, p. 98). Studies documented the chronic poverty among the ethnic minorities and an increasing economic gap between the ethnic majority (Kinh) and the ethnic minorities despite the remarkable success in economic growth of the country (e.g., Fritzen, 2002; Kang & Imai, 2012). Different reasons are attributed to this gap such as the difference in endowments and the difference in returns of endowments, i.e. the structural effects (e.g., Imai, Gaiha, & Kang, 2011a; Van De Walle & Gunewardena, 2001). However, the absence of the relevance of cultural aspects in previous studies could contribute to understand why the efforts towards poverty alleviation are likely less effective among the

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ethnic minorities (World Bank, 2009, p.24). Indeed, the involvement of ethnic or cultural difference in attitudes and behaviors, including those towards risks, is empirically evidenced (Vieider et al., 2014a). Therefore, the linkage between culture and economics that was indicated in literature (Throsby, 2001) deserves further investigation, in particular, for the case of the ethnically diverse population of rural Vietnam.

To meet the objectives, first, the survey-based measure of risk attitude is validated by testing its correlations with individual and household characteristics and its predictive power towards the risky behaviors in a risk experiment. Second, the single-equation estimation using a fixed effects method and a correlated random effects method is applied to investigate the determinants of economic welfare. The patterns of the relationship between risk attitudes and economic welfare is particularly examined. In addition, the system-equation estimation using Three-Stage Least Squares method is employed to test a possible simultaneous dependency between risk attitudes and the economic welfare. Ethnic disaggregating analysis emphasizes the role of cultural factors in shaping risk attitudes and subsequently in driving the association between the individual risk attitudes and economic welfare.

The overall results indicate that ethnicity shapes risk attitudes and economic welfare, consequently influences their interdependency. Furthermore, the results provide insights into the mixed empirical results concerning this relationship across populations or cultures. First, this study indicates a non-linear relationship between risk attitudes and economic welfare when mixing ethnic groups that are culturally and socioeconomically diverse: that relationship is negative among the risk-averse and positive among the more risk-taking. Second, this study provides evidence of a mutual relationship between risk attitudes and economic welfare among the socially and culturally homogenous ethnic majority group.

The remainder of this paper is organized as follows. The conceptual framework and empirical evidence of the relationship between risk attitude, economic welfare and ethnicity are introduced in section 2. Section 3 presents the sample background and data descriptive statistics. Section 4 states the empirical strategies applied in this study. Finally, section 5 presents the empirical results and section 6 reports a summary and conclusions.

## **2. Relationship between risk attitudes, ethnicity and economic development**

This section introduces a conceptual framework and literature review of the linkage among risk attitudes, ethnicity and economic development with a focus on the developing countries. It indicates a connection between the theoretical framework and the existing empirical

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evidence of the relationship between risk attitudes and economic welfare and the need of further evidence. This study aims to bridge the linkage between risk attitudes and economic welfare to the linkage between ethnicity and economic development.

### ***2.1 Risk attitude and economic development***

Risk attitude is one of the elements in the endogenous growth model (e.g., Klasing, 2014; Doepke & Zilibotti, 2014). On the development pathway, risk-taking can be both a cause of and a consequence from the economic growth process. In other words, risk attitude is endogenous in the economic growth model at the same it can also have mutual interaction with economic development.

On the one hand, risk-taking can enhance the process of economic development. At the national level, significant differences in risk attitudes are found within and between countries (Guiso, L., & Paiella, 2008; Harrison, Lau, & Rutström, 2007). Similarly, Bouchouicha & Vieider (2017) suggest that the relationship between risk attitudes and economic welfare is positive or negative that depends on the economic growth levels. At the household level, risk-taking is found to be passed from parents to their children (Dohmen et al., 2011), at the same time, risk-taking drives entrepreneurship that leads to economic growth (Klasing, 2014). At the individual level, risk-taking influences the individual occupational choices (Bonin, Dohmen, Falk, Huffman, & Sunde, 2007). Accordingly, more risk-taking increases the probability that a person chooses to be self-employed (Caliendo, Fossen, & Kritikos, 2009; Cramer, Hartog, Jonker, & Van Praag, 2002). Similarly, risk-taking encourages the adoption to technologies among farmers (Liu & Huang, 2013).

On the other hand, risk aversion could be the result of the economically disadvantaged background. To be specific for the poor, there is an association between risk aversion and poverty in the way that risk aversion hinders the poverty reduction (e.g., Klasen et al., 2015; Günther & Maier, 2014). Indeed, the poor people tend to involve in risk-averse income smoothing strategies (Rosenzweig & Binswanger, 1992), similarly, they are prone to be risk-averse in using labor (Jayachandran, 2006) and more reluctant to adopt new agricultural technologies (Liu, 2013). Therefore, risk aversion is a key element to understanding the persistent poverty (Mosley & Verschoor, 2005). Similarly, it could be possible that risk aversion is relevant to the inequality that exists within a population in presence of a significant correlation between risk attitudes and economic outcomes.

Empirical studies that investigate the correlation between risk attitudes and economic development indicate mixed results (e.g., Binswanger, 1980; Liebenehm & Waibel, 2014;



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Tanaka et al., 2010; Vieider, Truong, Martinsson, & Nam, 2014b; Yesuf & Bluffstone, 2009). Some studies document no significant relationship between risk preferences and economic welfare, for instance, in the samples of rural populations in India and in Vietnam (Binswanger, 1980; Tanaka et al., 2010). To better understand these mixed results, the following concerns need deeper consideration.

First, measurement of risk attitudes has been prone to controversy in the literature. Various methods of risk attitude elicitation have been used along the line might be a reason for the mixed results across studies. Many studies applied various incentivized risk experiments to elicit risk preferences. However, these experiments are context-specific and sensitive to the subjects' cognitive ability. Therefore, many of them are subject to skeptical discussions about their reliability to measure risk attitudes (e.g., Cook, 2015; Chuang & Schechter, 2015). Similarly, experiments reveal some weaknesses in capturing risk attitudes, such as that they turn less consistent under tests when compared with a survey question (Lönnqvist, Verkasalo, Walkowitz, & Wichardt, 2015). In contrast, the intrinsic individual risk attitudes measured by the survey question is correlated with other personality's traits (Lönnqvist et al., 2015). This question was validated by risk experiments (Dohmen et al., 2011; Hardeweg et al., 2013) to powerfully elicit the general risk attitudes in different populations. In particular, the simplicity of a survey question is preferable to an experimental method in the context of developing countries (Chuang & Schechter, 2015). It could be interesting to test the capacity of this survey question among different cultures because cultural factors can shape risk attitudes (Vieider et al., 2015).

Second, conceptually, risk attitudes and economic welfare are mutually related. This interaction causes reverse effect that challenges the unidirectional empirical method that is used to understand the relationship between risk attitudes and economic wellbeing. To date, empirical evidence of this reverse causation is lacking because most of previous studies limited their analysis to the correlation rather than a causal relationship. In some cases, that was due to the data limitations as well as the purposes of the estimation analyses in those studies. Some studies suggested that this uncontrolled reverse causality might explain why they did not find a significant correlation between the economic wellbeing (i.e. income) and risk preferences (e.g., Tanaka et al., 2010; Cardenas & Carpenter, 2013). Because this suggestion has been not considered, it renders this study critically important to explore whether or not there exists a mutual relationship between risk attitudes and economic welfare.

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## ***2.2 Ethnicity and economic development***

Ethnic diversity can lead to economic growth but only under the condition of the well-developed markets to encourage trade across boundaries between ethnic groups (Montalvo & Reynal-Querol, 2017). However, the ethnic diversity can hinder the economic growth once this cooperation among different ethnicities breaks down (Churchill, 2017b). For instance, a significant association between ethnic fractionalization and the decreasing financial performance of microfinance institutions was documented (Churchill, 2017a). Consequently, ethnic diversity has both negative and positive effects on the economic development. In which, the negative effect is strongly related with the situation of undeveloped economies and imperfect markets. These negative effects can be either indirectly or directly rooted from the ethnic diversity.

First, ethnic diversity could have negative impact on social network, trust, and social capital, consequently on economic development (e.g., Alesina & Zhuravskaya, 2011; Dincer, 2011). Indeed, higher ethnic diversity is found to be associated with lower trust (Beugelsdijk & Klasing, 2016). The difference in cultures or behaviors could obstruct the cooperation across ethnic groups (e.g., Miguel & Gugerty, 2005; Alesina & Zhuravskaya, 2011; Dincer, 2011). Consequently, mistrust can lead to stereotypes that prevent certain groups from accessing to business opportunities and financial institutions (Fafchamps, 1996). Moreover, ethnic diversity is associated with the poor institutional system and public goods that eventually cause poverty (Miguel, 2006) especially among the disadvantaged groups, i.e. the ethnic minorities. Hence, ethnic diversity is detrimental to the economic circumstances of these groups, particularly, without the presence of well-functioning markets. Similarly, the diversity could be relevant to the inequality across ethnic groups.

Second, ethnic diversity could have a directly negative effect on economic development. For example, Churchill, Okai, and Posso (2016) stated that there is an association between the ethnic diversity and persistent poverty due to a hierarchical structure in which the superior role belongs to the ethnic majority. Hence, there exists persistent poverty among ethnic minorities in some countries because of the disadvantages that have lasted for a long time such as having fewer opportunities and facing discrimination (Epprecht, Müller & Minot, 2011; Gustafsson & Sai, 2009). Stereotypes and social exclusion due to ethnic identity can be one of the causes of poverty and inequality (e.g., Maass, Roasbianca & Kiesner, 2005; Hoff & Pandey, 2006; Porter & Craig, 2004).

Regarding the ethnic diversity among the rural population of Vietnam, many studies documented the persistent ethnic economic gap (e.g., Imai et al., 2011a; Kang & Imai, 2012; Van De Walle & Gunewardena, 2001). Some of these studies attribute this gap to the difference in endowment or to the returns to endowment across groups. However, literature lacks of evidence of the role that the relationship between risk attitudes and economic welfare plays in the ethnic gap in Vietnam. The positive association between risk-taking and economic development that is witnessed across countries (e.g., Gloede et al., 2015; Hopland, Matsen, & Strøm, 2016; Vieider et al., 2016) supports the expectation for the linkage between risk attitudes to economic welfare in the ethnically diverse population of Vietnam.

### ***2.3 Cultural factors and risk attitudes***

Cultural diversity and ethnic diversity are “two sides of the same coin” and the empirical evidence shows that ethnicity predicts cultural factors (Desmet, Ortuño-Ortín, & Wacziarg, 2017). Accordingly, ethnicity is expected to be related to human attitudes including that towards risks. For instance, culture influences risk-taking in health issues among adolescents (Christopherson & Jordan-Marsh, 2004). Similarly, culture impacts risk-taking of the corporate managers (Li, Griffin, Yue, & Zhao, 2013). Furthermore, culture or considerably similar to ethnicity is represented by languages, social networks, and cultural heritage that result from social norms and social identity of the people within an ethnic group. Among them, languages influence cognitive skills, the spread of technologies, and education, resulting in the social recognition and reputation. Consequently, they influence preferences and behaviors, including that towards risks (i.e. in economic decision-making) (Hoff & Stiglitz, 2016). Nevertheless, the evidence of the relationship between ethnicity and risk attitudes in the existing literature is limited.

### **3. Sample background and descriptive statistics**

The data used in this study are apart from the long-term project: “Thailand Vietnam Socio Economic Panel”, funded by the German Research Foundation (see [www.tvsep.de](http://www.tvsep.de)). The project collected data from approximately 4000 households in six provinces of Thailand and Vietnam starting in 2007. This study uses data from three survey waves conducted in 2008, 2010, and 2013 in two provinces of Central Vietnam, namely Thua Thien Hue (Hue) and Dak Lak. The data are restricted to those respondents who remain household decision makers resulting in a sample of 588 individuals in a three-wave balanced panel.

Vietnam is a multiethnic country with 53 ethnic minority groups making up 15 percent of the population and one ethnic majority, namely Kinh. A strong diversity among those ethnic minority groups is recognized in terms of languages, customs, beliefs and other social aspects (Hoàng Anh Tuấn, 2013, March 11). The socioeconomic gaps between the majority (i.e. Kinh) and ethnic minorities are profound among Vietnamese populations (e.g., World Bank, 2009; Baulch, 2011; Kozel, 2014; Cuong, Tung & Westbrook, 2015). Some studies found that the difference in returns to endowments or the structural effects are more important to explain the ethnic gaps in comparison to the difference in endowment (e.g., Imai, Gaiha & Kang, 2011a; Van De Walle & Gunewardena, 2001). Similarly, ethnic minorities in Vietnam are facing both “hidden and overt discrimination” as documented by some studies (e.g., Baulch, 2011, p.15). For instance, hidden discrimination in terms of stereotypes, such as “ethnic minorities do not know how to make a living, how to use credit effectively, how to use technology or raise livestock, they do not consume and have low intellectual levels” (World Bank, 2009).

Concerning ethnic diversity of the research sample, the minorities account for approximately 30 percent of the population, this proportion is slightly smaller in Hue. The largest minority group in Dak Lak province is Ede with 13 percent, while the Paco constitute the largest minority group in Hue province with 6 percent. Each of the other twenty minority groups in both provinces accounts for about 3 percent or less. Ethnic minorities in these provinces are representatives of their populations as well as the ethnic minorities of Vietnam.

The left panel of Table 1 demonstrates the differences and statistic tests between the ethnic majority and the ethnic minorities. The results confirm the ethnic disparities in Vietnam (e.g., Baulch, 2011; Kozel, 2014; Cuong, Tung, & Westbrook, 2015; World Bank, 2009). The ethnic majority have 58 percent higher in consumption expenditure and about 80 percent higher in income. Also, only 16 percent of the majority suffers from poverty while it is about 54 percent of the minorities (see notes of Table 1 for definition of poverty).

Furthermore, the minorities are left behind regarding many different aspects of living standards. The ethnic minorities have less official education that is captured by the number of schooling years. They have fewer opportunities to migrate out of their province to probably search for jobs or study. They are more dependent on agriculture and therefore experience more agricultural shocks<sup>1</sup>. Similarly, they are less likely involved in nonfarm self-employed

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<sup>1</sup> The variables shocks are calculated by counting numbers of shocks experienced by the household over the last one year. These shocks are categorized according to their impacts into socio-demographic shocks, agricultural shocks and economic shocks.

activities to diversify their income sources. They tend to live in larger size families with more dependent members. The ethnic minorities are living in smaller and less valued houses with fewer rooms and they change their shelters more often. They are more often located in the mountainous areas with lower quality of water and transportation as well as farther away from the district center.

All aforementioned gaps between minority and Kinh households persist over the years, despite of the improvements in living standards within each group. That could be a reason for that the ethnic minorities self-report to be less optimistic about their future well-being and less willing to take risks than the ethnic majority.

**Table 1: Descriptive statistics**

| Variable  | (1)                 |                     |                    | (2)              |                                  |                    |
|---|---------------------|---------------------|--------------------|------------------|----------------------------------|--------------------|
|   | Minorities<br>(522) | Majority<br>(1,242) | Statistic<br>test# | Ede<br>(n = 222) | Other<br>minorities<br>(n = 300) | Statistic<br>test# |
| <i>Economic status</i>                                |                     |                     |                    |                  |                                  |                    |
| Consumption <sup>a</sup> (PPP USD)                    | 3.73                | 5.90                | -15.90***          | 3.96             | 3.56                             | 2.01**             |
| Poverty (%) <sup>h</sup>                              | 54                  | 16                  | 263.19***          | 52               | 56                               | 0.77               |
| Wealth <sup>c</sup> (PPP USD)                         | 445.23              | 936.66              | -12.06***          | 497.77           | 406.35                           | 1.13               |
| Income <sup>b</sup> (PPP USD)                         | 3.14                | 5.64                | -11.40***          | 3.12             | 3.15                             | 0.76               |
| <i>Individual characteristics</i>                     |                     |                     |                    |                  |                                  |                    |
| WTR   | 3.70                | 4.65                | 48.66***           | 2.95             | 4.25                             | 40.85***           |
| Age   | 42.93               | 50.14               | -10.70***          | 43.36            | 42.60                            | 0.96               |
| Female (%)  | 33                  | 43                  | 16.79***           | 26               | 38                               | 8.80***            |
| Married (%)   | 87                  | 83                  | 4.84**             | 88               | 86                               | 0.25               |
| Self-employed (%)                                     | 5                   | 23                  | 81.33***           | 4                | 6                                | 0.99               |
| No religion (%)                                       | 74                  | 80                  | 6.63**             | 49               | 93                               | 133.51***          |
| Health impairment (%)                                 | 25                  | 22                  | 1.02               | 28               | 22                               | 3.11*              |
| Optimism <sup>f</sup>                                 | 0.37                | 0.46                | 9.24*              | 0.32             | 0.42                             | 3.23               |
| Membership <sup>d</sup> (%)                           | 61                  | 68                  | 8.31***            | 42               | 75                               | 58.54***           |
| Education (years)                                     | 5.00                | 6.16                | -5.85***           | 4.46             | 5.41                             | -2.77***           |
| <i>Household characteristics</i>                      |                     |                     |                    |                  |                                  |                    |
| Household size <sup>e</sup>                           | 5.03                | 4.04                | 8.97***            | 0.10             | 0.12                             | 4.04***            |
| Household dependency ratio                            | 0.38                | 0.38                | 2.02**             | 5.48             | 4.70                             | 0.04               |
| Non-farm land (ha)                                    | 0.89                | 0.60                | 8.71***            | 0.37             | 0.38                             | -1.25              |
| Crop land (ha)  | 0.63                | 0.26                | 8.75***            | 0.72             | 1.01                             | -2.88***           |
| Member average age (years)                            | 27.66               | 35.85               | -11.72***          | 26.39            | 28.61                            | -2.33**            |
| Member average education                              | 4.78                | 6.86                | -12.69***          | 4.16             | 5.24                             | -4.23***           |
| Migrating members <sup>e</sup>                        | 0.08                | 0.35                | -7.52***           | 0.07             | 0.09                             | -1.25              |
| Literate members <sup>e</sup>                         | 3.70                | 4.07                | -4.62***           | 3.83             | 3.61                             | 0.82               |
| Self-employed members <sup>e</sup>                    | 0.11                | 0.55                | -12.61***          | 0.06             | 0.14                             | -2.59***           |
| <i>Experience with shocks</i>                         |                     |                     |                    |                  |                                  |                    |
| Economic shocks <sup>e</sup>                          | 0.27                | 0.24                | 0.76               | 0.26             | 0.28                             | -1.05              |
| Agricultural shocks <sup>e</sup>                      | 1.08                | 0.63                | 9.28***            | 0.87             | 1.24                             | -3.92***           |
| Socio-demographic shocks <sup>e</sup>                 | 0.49                | 0.44                | 1.39               | 0.58             | 0.42                             | 2.36**             |
| <i>Infrastructure (village level characteristics)</i> |                     |                     |                    |                  |                                  |                    |
| Distance to district town (km)                        | 15.54               | 12.80               | 1.79*              | 16.24            | 15.02                            | 1.74*              |
| Water quality (scale)                                 | 3.79                | 3.10                | 165.61***          | 3.93             | 3.69                             | 93.51***           |
| Stability (years)                                     | 8.49                | 12.15               | -7.59***           | 8.67             | 8.36                             | 1.90*              |
| Road quality (scale)                                  | 2.57                | 2.99                | 68.13***           | 2.00             | 3.00                             | 167.96***          |

Notes: <sup>a</sup> Daily consumption per adult equivalent (AE): Organization for Economic Cooperation and Development adult equivalents AE = 1 + 0.7\*(adults-1) + 0.5\*children. <sup>b</sup> Daily income per capita. <sup>c</sup> Total asset value (wealth) per capita. <sup>d</sup> Be member of a social or political organization. <sup>e</sup> Counted numbers. <sup>f</sup> Scale from -2 to 2. <sup>g</sup> WTR: willingness to take risks. <sup>h</sup> A new poverty line was constructed using a cost-of-basic-needs approach and calculated based on the updated poverty line proposed by the General Statistical Office – World Bank (GSO-WB) in 2010 (expenditure per person per month of 653,000 VND, equivalently 22,600VND/day, PPP equals to 3.09 USD), which is substantially higher than the original GSO-WB poverty line. The increase reflects improvements in the quality of the food reference basket, the Food Energy Intake method (fewer calories from rice, more consumption of proteins, vegetables, and fats) and a higher allocation for basic nonfood spending, including housing and durables. # Prtest (test for the same proportion between two groups) is used for dummy variables Chi-square test for categorical variables and nonparametric two sample test (Mann-Whitney test) for other variables. Significance levels: \* p<0.1, \*\* p<0.05, \*\*\* p<0.01.

Source: TVSEP Survey 2008, 2010 and 2013 in Hue and Dak Lak, own calculations.

The Vietnamese government has taken a lot of effort to support ethnic minorities. Indeed, there is a considerable reduction in poverty headcount ratio of 23 percent from 2008 to 2013 among the ethnic minorities. This could benefit from the government's supporting project (Cuong, et al., 2015). However, the persistent ethnic gap, despite of the efforts to support

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ethnic minorities, suggests reconsidering the interventions that targeted the ethnic minorities but ignored their cultural differences. Indeed, policy interventions have been designed according to the dominant group's standards rather than cultural-specific strategies (Baulch et al., 2007). Therefore, the ethnic minority groups who share similar socioeconomic and cultural backgrounds with the majority achieved better economic improvement, while other groups who remained strongly attached to their own values obtained less progress (Baulch et al., 2007).

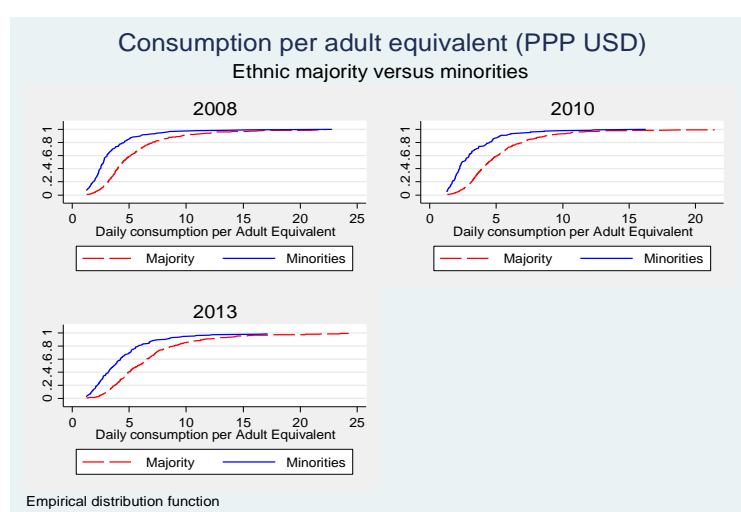
Since socio-cultural factors influence human attitudes and behaviors (Hoff & Stiglitz, 2016), the difference in risk attitudes across ethnic groups is no surprise. More specifically, an average member of the ethnic majority reports almost 1 point higher on the 11-point Likert scale of the willingness to take risks in comparison with an average member of the ethnic minority. The process of adopting standards from the ethnic majority could be affected by the willingness rather than the capacity to do this. That leads to the linkage between the cultural factors and socioeconomic gaps between the ethnic majority and their ethnic minority counterparts. For instance, some studies found that socio-cultural factors influence behaviors towards risks in health among Vietnamese (Rheinländer et al., 2010). Consequently, the horizontal inequality has been recognized as a cause of unsuccessful programs in health care and education and biased treatments towards the ethnic minorities (e.g., Tran & Walter, 2010; Målvist et al., 2013).

To explore further the ethnic heterogeneity in the sample background, this study compares Ede who is the largest ethnic minority group with about above 40 percent of the ethnic minority's population to the other ethnic minorities (Table 1, panel 2). Similar statistics tests are calculated for the gaps between Ede and the rest of the ethnic minorities including 12 different groups. Despite the similarity in most of the variables representing living conditions, significant differences are found in some social and cultural aspects between Ede and other ethnic minorities as follows. First, on average, Ede people show stronger risk aversion, about 1.3 points lower on the 11-point Likert scale, whereas, they are significantly indifferent in almost all economic indicators. This is a crucial point to support the first hypothesis that there might be a more complex than a linear relationship between risk attitudes and economic welfare if we pool all ethnic groups together. Second, Ede people report themselves to be more religious at the same time less willing to take risks. That is in line with some studies which find that more religious people tend to be more risk-averse (e.g., Noussair et al., 2013; Nielsen et al., 2017). Third, Ede people are found to have slightly less official education and

to be much less likely to be involved in social or political organizations in comparison to other ethnic minorities.

Choosing a good proxy for economic welfare is crucial to examine its relationship with risk attitude without bias. To illustrate, Vieider et al. (2014b) found a strong correlation with income but no correlation with wealth. Proxies might be different from each other due to their own characteristics (i.e. long-term or short-term) as well as due to the collection process. These differences might be involved in the mixed results in empirical studies to date. For instance, consumption expenditure seems to be more precise in developing countries because it could capture long-term economic welfare of households (Haughton & Khandker, 2009). In addition, consumption expenditure presents as a better measure in comparison to income because income could be underreported, such as households might not be willing to report true information of income if it is illegal (Parvathi & Nguyen, 2018).

The changes between 2008 and 2013 in household consumption expenditure within and between the ethnic majority and the minorities are reported in Figure 1. The gap between two groups is captured by the distance between two cumulative distribution functions: the continuous line represents the minorities and the dashed line represents the majority. The majority is economically better-off in all years. In addition, the gap in daily consumption per adult equivalent between Kinh and ethnic minorities increased on average from 2.13 to 2.26 USD (purchasing power parity) (Appendix, Table A1). This increasing gap is in line with inefficient poverty reduction among the minority groups (e.g., Baulch, Pham, & Reilly, 2012; World Bank, 2009, p. 24).



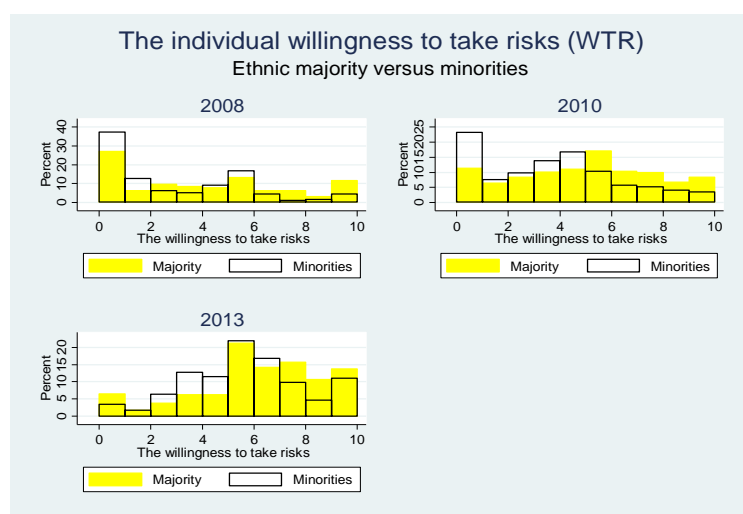
**Figure 1: Economic gap between the ethnic majority and minorities**

Source: TVSEP Survey 2008, 2010 and 2013 in Hue and Dak Lak, own calculations



Risk attitude is measured by the self-assessed willingness to take risks (WTR), a survey-based question using an 11-point Likert scale. The survey question reads, “Are you generally a person who is fully prepared to take risks, or do you try to avoid taking risks? Please choose a number on a scale from zero (unwilling to take risks) to ten (fully prepared to take risks)”. This simple survey question is sufficiently validated by risk experiments in different countries (e.g., Dohmen et al., 2011; Hardeweg, Menkhoff & Waibel, 2013) to reveal individual attitudes towards real-life risky decisions. Furthermore, this measure is less noisy than an incentivized measure under tests (e.g., Lönnqvist, Verkasalo, Walkowitz & Wichardt, 2015).

Similarly, the overlapping histograms of WTR of the Kinh majority and the ethnic minorities are presented in Figure 2. The changes in WTR between 2008 and 2013 and the gap between the majority and the ethnic minorities are presented. There is a relatively stronger willingness to take risks among the ethnic majority in comparison with the ethnic minorities. The gap is about 1 point on average over time on the 11-Likert scale and it is strongly statistically significant. This gap of roughly one point remains in spite of changes in risk-taking within each group over the years.



**Figure 2: The general willingness to take risks (WTR)**

Source: TVSEP Survey 2008, 2010 and 2013 in Hue and Dak Lak

In sum, Figure 1 and Figure 2 demonstrate the tendency for changes in household consumption expenditure and WTR, respectively, over the years with visible persistent differences between the ethnic majority and ethnic minorities. The overall descriptive results confirm an economic gap and the difference in risk attitudes between ethnic majority and minorities. The concurrent changes in risk attitudes and economic welfare over time allow us to expect some relationship between them. The following section introduces the strategy used

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to test our hypotheses.

#### **4. Empirical strategy**

The research objectives are approached by both single-equation and system-equation methods. In the first approach, the heterogeneities of the determinants of risk attitudes and economic welfare are explored with an emphasis on ethnicity. Furthermore, the first hypothesis of a non-linear relationship is tested. In the second approach, the system-equation estimation is applied to test the second hypothesis of a mutual relationship between risk attitude and economic welfare. By disaggregating ethnicity, the ethnic dimension in this relationship is uncovered to approach the final objective.

##### ***4.1 Estimation of risk attitudes***

In this section, the reliability of the self-assessed measure of risk attitudes is tested for its association with individual and household characteristics. Even though consumption expenditure is used as proxy of household economic welfare (E) in the entire study, in this analysis, to reduce the problem of endogenous consumption, self-reported market price of the house is used to control for economic status<sup>2</sup>. This variable represents a long-term stable asset of the household that is more likely endowment rather than economic status that changes over time. The analysis employs various regression methods, including interval regression, ordered probit, and OLS regression to check the robustness of the results.

Risk attitude is a personal trait, empirically found to be in association with personality factors (Lönnqvist et al., 2015). This trait can be shaped by socioeconomic variables (Guiso & Paiella, 2008). The application of this question to the general willingness to take risks is found to be significantly correlated with its applications on different risk domains such as stock holdings, job choices and smoking (Dohmen et al., 2011). These authors also pointed out that the general application of this question has the best ability to predict risky behaviors. In addition, this measure is significantly correlated with an incentivized measure of risk attitude when comparing between countries (Vieider et al., 2015). That implies that this survey-based measure can be applied and compared across cultures.

The multivariate correlates of the willingness to take risks (WTR) of an individual  $i$  at time  $t$  are estimated in the following specification:

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<sup>2</sup> This variable is found to strongly correlate with other indicators of economic welfare including consumption, income and assets. House is treated as a stable and long-term asset of a household.

$$WTR_{it} = \alpha_0 + \alpha_1 X_{1it} + \alpha_2 Z_{1it} + \alpha_3 G_j + \alpha_4 (E_{it}) + v_{it}, \quad (1)$$

where:  $\alpha_0, \alpha_1, \alpha_2, \alpha_3, \alpha_4$ , and  $\alpha_5$ : parameters or vectors of parameters are to be estimated,  $v_{it}$  is error term and  $t = 1, 2, 3$ .

A set of individual characteristics,  $X_{1it}$ , includes age, gender, marital status, ethnic identity, employment status, education and subjective attitudes, namely health impairment and attitude toward future wellbeing; and  $Z_{1it}$  is a set of household characteristics believed to be associated with individual risk attitudes, such as household size, dependency ratio, consumption, and experience with shocks. In addition, the geographic characteristics  $G_j$  are controlled at the village level (j).

From findings in previous studies, some correlations between risk attitudes and the socio-demographic determinants, such as age, gender, education, and marital status are expected (e.g., Dohmen et al., 2011; Liebenehm & Waibel, 2014; Gloede, Menkhoff & Waibel, 2015; Miyata, 2003). Furthermore, subjective opinions about health status and future wellbeing are expected to be significantly correlated with risk attitudes (Dohmen et al., 2011; Hardeweg et al., 2013). Similarly, variable of religion is added because more religious people are more likely risk-averse that is found among a Dutch population by Noussair et al. (2013) and among Germans by Nielsen et al. (2017). Shocks and other negative experiences interfere with risk attitudes, thereby causing changes in risk attitudes over time (e.g., Gloede et al., 2015; Liebenehm, 2018; Malmendier & Nagel, 2011). In addition, geographic effects are proxied by the household's distance to the district town and province dummy variable because these variables can represent accessibility to information that encourages capacity to take risks. In low-income communities, risk sharing among members within a group helps limit consumption risk. As a result, membership in socio-political organizations, which provides channels for risk-sharing activities, can be related to household consumption expenditure and risk attitudes (Grimard, 1997).

#### ***4.2 Estimation of economic welfare***

This analysis examines the determinants of household welfare. A large number of independent variables that were found to explain economic welfare are adopted from previous studies (e.g., Akerele & Adewuyi, 2011; Litchfield & McGregor, 2008; Mukherjee & Benson, 2003). In particular, individual and household characteristics such as age and gender of the household decision maker, endowment in education, land size, social capital, and experience

with shocks determine household's economic welfare (e.g., Epprecht, Müller & Minot, 2011; Günther & Harttgen, 2009; Klasen, Lechtenfeld & Povel, 2015). In addition, regional effects (coastal, mountainous, province), location effects (i.e. distance to the district town, water source, and length of time living in current house) have significant effects on the economic welfare of the Vietnamese population (Imai, Gaiha & Kang, 2011b).

For estimation, daily consumption per adult equivalent is converted to a logarithm. Then, economic welfare ( $W$ ) of household  $i$  is regressed on the set of individual characteristics of household decision maker ( $X_{2it}$ ), set of household characteristics ( $Z_{2it}$ ), where  $V_j$  denotes geographic characteristics at the village level ( $j$ ). Among them, the individual willingness to take risks (WTR) of the household decision-maker is expected to play a decisive role. The specification is illustrated below.

$$\log(W_{it}) = \beta_0 + \beta_1 X_{2it} + \beta_2 Z_{2it} + \beta_3 V_j + \beta_4 WTR_{it} + \mu_{it} \quad (2)$$

where:  $\beta_0, \beta_1, \beta_2, \beta_3$  and  $\beta_4$  parameters or vectors of parameters to be estimated,  $\mu_{it}$  is error term and  $t = 1, 2, 3$ .

Ethnic diversity is found to have effects on a community's economic development (Maass, Roasbianca & Kiesner, 2005). Social exclusion due to ethnic identity can be one of the causes of poverty and inequality (e.g., Hoff & Pandey, 2006; Porter & Craig, 2004). This research aims to shed light on the persistent ethnic economic gap in Vietnam from the risk-welfare channel (e.g., Imai et al., 2011a; Kang & Imai, 2012; Van De Walle & Gunewardena, 2001). Thereby, this work can contribute to those studies that find a positive association between risk-taking and economic development globally (e.g., Gloede et al., 2015; Hopland, Matsen & Strøm, 2016; Vieider et al., 2016). To some degree, the geographic and institutional effects are eliminated focus on other factors that explain ethnic gap in economic wellbeing within a region.

Random effects, fixed effects and OLS regressions are applied to panel data. The Hausman test's (Greene, 2012, p.421) results decide which model fits the best for the data. Nevertheless, fixed effects model might theoretically not be the best to approach the objective in observing the heterogeneity of economic welfare. Furthermore, to test the hypothesis of a non-linear relationship between risk attitude and economic welfare, a residual analysis is conducted to observe the shape of the relationship between WTR and the unexplained variation of economic welfare. In addition, to test the assumption that there is endogeneity in

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the relationship between risk attitudes and economic welfare, the Durbin-Wu-Hausman test (Davidson & MacKinnon, 1993, p.235–236) is applied.

### ***4.3 Simultaneous estimation of risk attitude and economic welfare***

The assumption on a conceptualized mutual relationship between risk attitudes and economic welfare needs empirical evidence. This assumption leads them to be endogenous, interdependent, and jointly determined. Hence, the assumption on exogeneity in the single-equation estimations is violated, thereby causing simultaneity bias. At the same time, the reciprocal interaction could also lead to the related unexplained variations of risk attitudes and economic welfare. These hypotheses are tested by applying a system of equations to estimate risk attitudes and economic welfare simultaneously using Three-Stage Least Squares (3SLS) estimation (Zellner & Theil, 1962). The equation system not only takes notice of the joint-endogeneity of the dependent variables but also accounts for the mutual interaction between two equations. The simultaneous estimation is expected to be an unbiased and efficient estimation and to have a twofold advantage in comparison with single-estimation method. First, the estimation allows for the endogeneity problem of two explained variables by assuming that the exogenous variables of the system are able to instrument the endogenous variables of the system. As a result, the system obtains the requirement of over identification. Second, the estimation can also consider the existing mutual interaction between two variables by allowing correlated error terms.

This analysis addresses the mutual relationship between risk attitudes and economic welfare by a system-equation estimation method. By emphasizing the ethnic impact, the study aims to shed light on the ‘risk-income paradox’ suggested by Bouchouicha & Vieider (2017) when analyzing the relationship between risk aversion and economic development within and between countries (i.e. cultures). Moreover, the attention is paid to the heterogeneity of determination of both risk attitudes and economic welfare. Significance of several time-invariant factors such as ethnicity and geographic features are expected.

Even though, this study does not aim to deal with all causes of endogeneity in the relationship between risk attitudes and economic welfare, it addresses the possibility of simultaneity bias that leads to the endogeneity problem. Even if a fixed effects model is applied, the regressors in the equation (2) can be correlated with a time constant error component, but they must be exogenous to the past, the present and future time variant errors. In such a way, the system-equation estimation is suggested to reduce this disadvantage of a fixed effects regression to address the endogeneity problem caused by simultaneity bias (i.e. the possibility of a

correlation between the regressor and the time-variant error). In addition, the mutual interaction between error terms of two equations allows for the possibility of a correlation between the regressor and the past and future time-variant error (i.e. the dynamic dimension of the relationship between endogenous variable and the regressor).

The simultaneous system is presented in its structural form as follows:

$$\begin{cases} \log(W_{it}) = \lambda_0 + \lambda_1 X_{2it} + \lambda_2 Z_{2it} + \lambda_3 V_j + \lambda_4 WTR_{it} + u_{1it} \\ WTR_{it} = \gamma_0 + \gamma_1 X_{1it} + \gamma_2 Z_{1it} + \gamma_3 G_j + \gamma_4 \log(W_{it}) + u_{2it} \end{cases} \quad (3)$$

Variables included in the systems have similar definitions as they have in equation (1) and equation (2).

Explanatory variables such as sets of  $X_1$ ,  $X_2$ ,  $Z_1$ ,  $Z_2$ ,  $V$  and  $G$  assumed to be exogenous (determined outside of the model). The system takes notes of the simultaneity of the variables of willingness to take risks (WTR) and economic welfare (W). They are interdependent and determined jointly.

Additionally, the system takes into account the mutual interaction between the equations. Therefore, for a given observation  $i$ , the errors of two equations are correlated:  $E(u_1 u_2 | X) = \delta_{12}$ , ( $\delta_{12} \neq 0$ ), but  $u_1$  and  $u_2$  are assumed to be homoscedastic and identically and independently distributed:  $E(u_1) = 0$  and  $E(u_2) = 0$ .

The estimation is executed in two steps: in the first step, the predicted outcomes of each dependent and (endogenous) variable are calculated in a linear regression on all exogenous variables of the system. The calculated values are required to instrument the endogenous variables of the system. In the second step, the predicted outcomes of endogenous variables are used instead of actual outcomes in the full specification. The error terms of two equations are allowed to be correlated because WTR and economic welfare might have reciprocal interaction within the system.

Three assumptions need to be fulfilled for a consistent and efficient estimation, when compared with the single-equation estimation method. First, two equations are assumed to be jointly dependent that proves the suitability of simultaneous estimation over the single-equation estimations is needed. Second, over-identification is required to assure the validity of the instruments (i.e. the exogenous variables) in the system to deal with the endogeneity bias. Third, the error terms,  $u_1$  and  $u_2$ , are homoscedastic and independently and identically distributed but correlated with each other in the system. To test the above assumptions, the

Breusch-Pagan LM Diagonal Covariance test to see whether the simultaneous equation presents more appropriate than the single equation estimation for undertaking the task. Second, the Hansen-Sargan test is to check if the equation system is over-identified to accept the null hypothesis that the exogenous variables of the system are qualified to instrument the endogeneity. The System Heteroscedasticity test is applied to test the presence of homoscedastic variance of each single equation and heteroscedastic covariance of the whole system.

## **5 Model results**

We estimate risk attitudes using equation (1) and economic welfare using equation (2); results are reported in this section. In section 5.1, the survey-based measure of risk attitudes is validated by its correlates with individual and household background variables as well as its predictive power towards risky behaviors in a risk experiment. The economic welfare is regressed in single-equation estimation with awareness of the endogeneity problem in section 5.2. Section 5.3 addresses the reciprocal relationship between risk attitude and economic welfare by applying the method of system equation estimation.

### ***5.1 Validity of the survey-based risk attitudes***

This section verifies our survey question to measure the general willingness to take risks by analyzing its correlation with individual and household background variables. The results in Table 2 confirm most of our expectations on the correlates of the individual willingness to take risks and agree with the results of previous studies. The results of different estimation methods are reported to evaluate the robustness. In particular, interval regression is reported in columns (1), (2) and (3) with different specifications. Results of the ordered probit regression are reported in column (4), and OLS regression presents in column (5); both regressions are applied with the similar specification as in column (3).

The results are highly qualitatively consistent across estimation methods. The correlates of risk attitudes confirm findings from previous studies. In particular, positive correlations are found from the variables of civil status (i.e. married), economic status, self-employment and education. These findings are in line with that of previous studies (e.g., Dohmen et al., 2011; Donkers, Melenberg, & Van Soest, 2001; Hardeweg et al., 2013; Miyata, 2003). In contrast, we find that living in a household with a large number of dependent members discourages risk-taking that is similar to findings of previous studies from different populations (e.g., Dohmen et al., 2011; Liebenehm & Waibel, 2014). Similarly, experience with socio-

demographic shocks reduces the individual willingness to take risks that is similar to the finding from Gloede et al. (2015). In addition, we find evidence of a strong and positive correlation between the optimism towards future wellbeing and risk-taking as found in other studies (e.g., Dohmen et al., 2011; Hardeweg et al., 2013).

Our analysis indicates the positive correlations of ethnicity and religion to highlight the influence of cultural factors on risk attitudes. However, the significance is declining when controlling more background variables. We particularly pay attention to the strongly and significantly positive correlation of education on risk attitudes. The correlation that remains consistently significant regardless of different specifications emphasizes the importance of education in shaping risk attitudes among the low-income and less-educated communities.

**Table 2: Multivariate correlates of the general willingness to take risks (WTR)**

|                                       | [1]<br>Intreg       | [2]<br>Intreg        | [3]<br>Intreg       | [4]<br>Oprobit      | [5]<br>OLS          |
|---------------------------------------|---------------------|----------------------|---------------------|---------------------|---------------------|
| Female                                | -0.016<br>[0.197]   | 0.015<br>[0.195]     | -0.042<br>[0.198]   | -0.018<br>[0.064]   | -0.051<br>[0.165]   |
| Age                                   | -0.007<br>[0.007]   | -0.009<br>[0.007]    | -0.001<br>[0.008]   | -0.000<br>[0.003]   | -0.001<br>[0.006]   |
| Married                               | 0.675**<br>[0.266]  | 0.558**<br>[0.267]   | 0.617**<br>[0.275]  | 0.201**<br>[0.089]  | 0.513**<br>[0.227]  |
| Ethnic identity                       | 0.696***<br>[0.190] | 0.566***<br>[0.192]  | 0.381*<br>[0.200]   | 0.135**<br>[0.065]  | 0.313*<br>[0.166]   |
| No religion                           | 0.586***<br>[0.198] | 0.489**<br>[0.196]   | 0.374*<br>[0.198]   | 0.118*<br>[0.064]   | 0.253<br>[0.164]    |
| Education                             | 0.132***<br>[0.022] | 0.125***<br>[0.022]  | 0.099***<br>[0.023] | 0.033***<br>[0.007] | 0.081***<br>[0.019] |
| House value♦                          |                     | 1.963***<br>[0.563]  | 1.312**<br>[0.580]  | 0.427**<br>[0.188]  | 1.276**<br>[0.471]  |
| Household size                        |                     |                      | -0.069<br>[0.049]   | -0.022<br>[0.016]   | -0.067*<br>[0.040]  |
| Dependency ratio                      |                     |                      | -0.473*<br>[0.268]  | -0.159*<br>[0.087]  | -0.425*<br>[0.221]  |
| Self-employed                         |                     |                      | 0.492**<br>[0.216]  | 0.161**<br>[0.070]  | 0.404**<br>[0.178]  |
| Membership                            |                     |                      | 0.282<br>[0.175]    | 0.091<br>[0.057]    | 0.205<br>[0.143]    |
| Impairment                            |                     |                      | -0.410**<br>[0.205] | -0.139**<br>[0.066] | -0.340**<br>[0.167] |
| Optimism                              |                     |                      | 0.659***<br>[0.127] | 0.218***<br>[0.041] | 0.597***<br>[0.103] |
| Constant                              | -0.407<br>[0.537]   | -4.259***<br>[1.212] | -2.874**<br>[1.250] |                     | -1.329<br>[1.022]   |
| Pseudo R <sup>2</sup> /R <sup>2</sup> | 0.044               | 0.048                | 0.060               | 0.061               | 0.248               |
| Observations                          | 1762                | 1746                 | 1696                | 1696                | 1696                |

Notes: Random effected regressions. The dependent variable is the self-reported willingness to take risks. ♦ self-reported market price of the house, in natural logarithm. 1-3: Interval regression estimates, 4: Ordered Probit estimates and 5: Pooled OLS estimates Standard errors in brackets, Control for time and province effects. Sample size changes across regressions due to missing values of some observations in some variables.

Source: TVSEP Survey 2008, 2010 and 2013 in Hue and Dak Lak, own calculations.



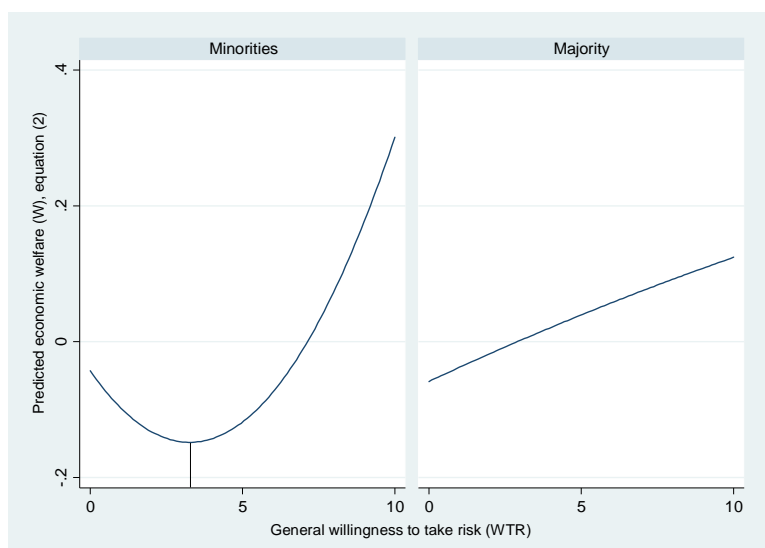
## *5.2 Determinants of economic welfare*

The analysis aims not only to explore the determinants of economic welfare, but also to test the first hypothesis on the non-linear relationship with WTR. The estimation of economic welfare using the specification from equation (2) is conducted<sup>3</sup>. First, Durbin-Wu-Hausman test (Davidson and MacKinnon, 1993, 235–236) significantly confirms endogeneity of the estimation. Second, the Hausman test (Greene, 2012, p.420) suggests the fixed effects model to be the most suitable rather than the random effects and the OLS regressions. However, some individual time-invariant variables are of interest of this study. While the random effects model is not recommended and fixed effects model eliminates the time invariant variables, a correlated random effects model, namely Hausman-Taylor model (Hausman and Taylor, 1981), is chosen. This model allows one or more variables to be correlated with the unobservable effects (Wooldridge, 2010), at the same time, it allows for analyzing the impact of some individual time invariant variables. Among other factors, ethnicity plays an important role in this study.

The results of fixed effects model show an insignificant coefficient of risk attitudes. The question is that whether there are different shapes of the relationship between risk attitudes and economic welfare witnessed by the culturally and socioeconomically diverse sample. Consequently, a “risk-income paradox” suggested by Bouchouicha and Vieider (2017) could exist in our research sample. To test the hypothesis on a non-linear relationship, first, an analysis of predicted values of economic welfare is conducted after a fixed effects regression of economic welfare using equation (2). The plot of the predicted economic welfare against WTR in Figure 3 demonstrates the non-linear relationship between the willingness to take risks and economic welfare among the ethnic minorities. It shows that among the risk-averse individuals who report their willingness to take risks roughly at 3.5 or lower on the 11-point Likert scale of, the more risk-averse, the better economic condition they have. In contrast, among the individuals who report their risk-taking from that point upwards, the more economically better-off, the less risk-averse they are. Interestingly, the association between risk-taking and economic welfare is positive among the majority group in a monotonic pattern. That suggests a linear relationship between risk attitudes and economic welfare among the ethnic majority group.

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<sup>3</sup> Due to the large number of independent variables, a test of multicollinearity (VIF test) is applied on equation 2. Results of the tested are reported in Appendix, Table A2



**Figure 3: Plot predicted economic welfare against risk attitudes**

Source: TVSEP Survey 2008, 2010 and 2013 in Hue and Dak Lak, own calculations

To quantify the non-linear pattern of the relationship between the risk attitudes and economic welfare, a quadratic term of WTR is added to the same regression models. The results are reported in Table 3 including the outcomes for the ethnic majority sample and for the minority sample<sup>4</sup>. Attention is especially paid to the significance of the coefficients of both original and quadratic forms of WTR among the ethnic minorities, whereas they are insignificant in the sample of the ethnic majority. Because the sample of the ethnic majority is homogenous regarding cultural and socioeconomic backgrounds, while that of the ethnic minorities including a large number of group (Figure A1, Appendix) are significantly diverse. The result seems to reflex the driving force of cultural factors in the patterns of the relationship between risk attitudes and economic welfare across cultural groups. It can be that this relationship can be positive in one or more groups but it could be negative in the other groups. For instance, Figure A2 (Appendix) shows that as largest groups among the ethnic minorities, Ede and Paco are insignificantly different in economic welfare from other groups, whereas Paco's respondents expressed stronger willingness to take risks and Ede's respondents expressed stronger risk aversion.

<sup>4</sup> The results of the full sample are skipped since they are dominated by the results of the ethnic majority groups due to its larger sample size.

**Table 3: Determinants of economic welfare**

| VARIABLES                   | Majority (Obs = 1,045) |                        | Minorities (Obs = 500) |                      |
|-----------------------------|------------------------|------------------------|------------------------|----------------------|
|                             | FE                     | HTAYLOR                | FE                     | HTAYLOR              |
| Age                         | 0.072***<br>[0.027]    | 0.034**<br>[0.016]     | 0.097**<br>[0.039]     | 0.027<br>[0.025]     |
| Age square                  | -0.001**<br>[0.0003]   | -0.0004***<br>[0.0002] | -0.0004<br>[0.0004]    | -0.0002<br>[0.0003]  |
| Married                     | -0.003<br>[0.115]      | 0.130*<br>[0.069]      | 0.336***<br>[0.127]    | 0.251***<br>[0.095]  |
| Self-employed               | -0.097<br>[0.064]      | -0.065<br>[0.050]      | 0.245<br>[0.189]       | 0.159<br>[0.158]     |
| WTR♦                        | 0.005<br>[0.014]       | 0.001<br>[0.013]       | -0.062***<br>[0.023]   | -0.057***<br>[0.021] |
| WTR square                  | -0.001<br>[0.001]      | -0.0001<br>[0.001]     | 0.006**<br>[0.003]     | 0.006***<br>[0.002]  |
| Impairment                  | 0.016<br>[0.037]       | -0.013<br>[0.031]      | -0.029<br>[0.058]      | -0.053<br>[0.049]    |
| Membership                  | 0.003<br>[0.034]       | 0.011<br>[0.028]       | -0.052<br>[0.059]      | -0.020<br>[0.049]    |
| Education (decision maker)† | 0.067*<br>[0.036]      | 0.065**<br>[0.028]     | 0.013<br>[0.088]       | 0.116*<br>[0.068]    |
| Household size              | -0.132***<br>[0.021]   | -0.116***<br>[0.016]   | -0.148***<br>[0.029]   | -0.105***<br>[0.021] |
| Dependency ratio            | 0.135**<br>[0.066]     | 0.179***<br>[0.052]    | 0.378**<br>[0.155]     | 0.347***<br>[0.124]  |
| Nonfarm land [log]          | -0.001<br>[0.003]      | 0.006***<br>[0.002]    | -0.005<br>[0.004]      | 0.004<br>[0.003]     |
| Average member age          | 0.008**<br>[0.003]     | 0.007***<br>[0.002]    | -0.008<br>[0.006]      | -0.002<br>[0.004]    |
| Average member education    | 0.027***<br>[0.007]    | 0.037***<br>[0.005]    | 0.024<br>[0.015]       | 0.052***<br>[0.012]  |
| Migrating members           | -0.027<br>[0.022]      | -0.028<br>[0.018]      | -0.131*<br>[0.076]     | -0.143**<br>[0.064]  |
| Literacy                    | 0.032*<br>[0.019]      | 0.015<br>[0.014]       | -0.007<br>[0.028]      | -0.007<br>[0.022]    |
| Self-employed members       | 0.054<br>[0.034]       | 0.080***<br>[0.027]    | -0.155<br>[0.137]      | -0.011<br>[0.111]    |
| Distance to town            | -0.003<br>[0.003]      | -0.002<br>[0.002]      | 0.001<br>[0.004]       | -0.002<br>[0.002]    |
| Water quality               | -0.053***<br>[0.013]   | -0.052***<br>[0.011]   | 0.0003<br>[0.022]      | -0.002<br>[0.018]    |
| Economic shocks             | 0.034<br>[0.025]       | 0.047**<br>[0.022]     | 0.045<br>[0.040]       | 0.023<br>[0.034]     |
| Agricultural shocks         | -0.018<br>[0.018]      | -0.032**<br>[0.015]    | 0.004<br>[0.026]       | -0.026<br>[0.021]    |
| Socio.demo.shocks           | 0.028<br>[0.020]       | 0.019<br>[0.017]       | 0.018<br>[0.033]       | 0.009<br>[0.028]     |
| Stability                   | -0.0003<br>[0.002]     | 0.001<br>[0.001]       | -0.009**<br>[0.005]    | -0.005<br>[0.004]    |
| Road quality                | -0.047**<br>[0.019]    | -0.045***<br>[0.017]   | 0.047<br>[0.045]       | 0.054<br>[0.039]     |
| R <sup>2</sup> within       | 0.343                  |                        | 0.323                  |                      |
| R <sup>2</sup> overall      | 0.121                  |                        | 0.038                  |                      |

Notes: Hausman test prefers Fixed Effects, the Hausman-Taylor model assumes endogeneity of (♦) WTR (the willingness to take risks). †: household decision maker has number of schooling years higher than 12. Robust standard errors are in brackets. Control for province, regional and time effects. Other control variables have insignificant coefficients including: health impairment, membership, gender, province, regional variables and time. Significance levels: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.  
Source: TVSEP Survey 2008, 2010 and 2013 in Hue and Dak Lak, own calculations.

In the results of the ethnic majority group, the coefficients of the variables that explain significantly economic welfare have similar magnitude compared between the fixed effects model and the Hausman-Taylor model. In particular, the following variables significantly determine household's economic welfare. Age of the decision maker has inverted U-shape

association to economic welfare. As such, too old or too young household decision makers tend to be related with worse economic condition of the household. Furthermore, a household is better-off if it has a household decision maker who obtains education that is higher than 12 years of the official schooling years, although the coefficient is only weakly significant. Household size has a negative effect, but number of dependent members has a positive effect on household economic welfare. There is a positive effect of the variable of member average age (i.e. average age of the full sample is 50 years old) on household consumption expenditure. Undoubtedly, the average education of the households' members has positive impact on household's welfare. In addition, some significant effects are found from marital status, number of self-employed members, economic shocks and agricultural shocks. However, these effects are only present in the Hausman-Taylor model.

In comparison to the results of the ethnic majority, those of the ethnic minorities show some difference in the effects of some variables. Such as, the variable of age and its quadratic form turn insignificant in the analysis of the minorities. Better infrastructure proxied by the water supply and road quality<sup>5</sup> significantly increases economic welfare of the ethnic majority but not for that of the minorities. The number of migrating members has a negative and weakly significant effect on economic welfare of the ethnic minorities but no significant effect on that of the majority. There are divergent factors to explain economic welfare when comparing between the ethnic majority and the ethnic minorities. This finding is in line with previous studies (Imai et al., 2011a; Van De Walle & Gunewardena, 2001) that found different economic returns with the same characteristics between the majority and the minorities.

In sum, the findings confirm that there is diversity in the relationship between risk attitudes and economic welfare among a mixed sample of ethnic minorities. In particular, this connection is negative among the extremely risk-averse but turns positive among the more risk-taking. That is similar to Bouchouicha and Vieider (2017) who found difference in the direction of the association between income and risk tolerance across cultures (i.e. countries). In contrast, among the homogenous ethnic majority group, no significant coefficient of risk attitudes is found. To respond, in the next step, this study aims to examine a suggestion from Tanaka et al. (2010) and Cardenas and Carpenter (2013) that there might be simultaneous relation between risk attitudes and economic welfare. If this simultaneity exists, it challenges the results of single-equation estimation.

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<sup>5</sup> These variables are measured by decreasing scales

### 5.3 Simultaneous equations estimation of risk attitudes and economic welfare

If there is a mutual interaction between risk attitudes and economic welfare, the strict assumption on the exogeneity of the regressors in a static fixed effects regression (Table 3) is violated. That causes a correlation between risk attitudes and the error terms of the estimate of economic welfare in a single-equation method. Therefore, this section is going to test a possibility of existing reverse causation between risk attitudes and economic welfare.

We estimate simultaneously economic welfare and the risk attitudes using the system of equations (3a,b) under the 3SLS regression. The results of the full sample are presented in Table 3.4. The tests of assumptions on a consistent and efficient estimation using 3SLS are positive (details of the tests reported in Table A2 (Appendix)). In particular, in comparison with the single-equation estimations, the signs of these coefficients remain consistent, whereas the magnitudes significantly change. Indeed, taking note of the endogeneity caused by the mutual relation between the WTR and economic welfare considerably changes the coefficients of several variables.

The results indicate that a stronger willingness to take risks is associated with higher economic welfare, i.e. the wealthier an individual is, the more willing to take risks it is. *Ceteris paribus*, an increase in WTR by one point on the 11-point Likert scale is associated with approximately 9% increase in economic welfare. Similarly, one percent increase in consumption expenditure goes along with a 0.7 point increase in the willingness to take risks on the 11-Point Likert scale. The degree of the effect from risk taking on economic welfare is stronger than that of economic welfare on risk-taking. The coefficient of ethnicity in correlation with the economic welfare confirms the ethnic economic gap. *Ceteris paribus*, an ethnic majority household's consumption expenditure per adult equivalent is about 23 percent higher than that of an ethnic minority counterpart.

**Table 4: 3SLS estimates of economic welfare and risk attitudes**

| Variables                               | Economic Welfare (1) |           | WTR (2)      |           |
|---|----------------------|-----------|--------------|-----------|
|   | Coefficients         | Std. Err. | Coefficients | Std. Err. |
| Willingness to take risks (WTR)         | 0.090***             | 0.027     |              |           |
| Daily consumption per adult equivalent# |                      |           | 0.745**      | 0.378     |
| Age                                     | 0.027***             | 0.009     | 0.004        | 0.050     |
| Age square                              | -0.0003***           | 0.0001    | -0.00003     | 0.0005    |
| Female                                  | -0.005               | 0.031     | -0.102       | 0.165     |
| Married                                 | 0.115**              | 0.046     | 0.411*       | 0.247     |
| Majority (Kinh)                         | 0.211***             | 0.035     | 0.220        | 0.203     |
| No religion                             |                      |           | 0.297**      | 0.147     |
| Self-employed                           | -0.009               | 0.047     | 0.294        | 0.207     |
| Health impairment                       | -0.066**             | 0.033     | -0.216       | 0.178     |
| Member of a social or political org.    | -0.013               | 0.028     | 0.142        | 0.149     |
| Education <sup>a</sup>                  | 0.069***             | 0.024     | 0.051***     | 0.020     |
| Household size                          | -0.078***            | 0.011     | 0.027        | 0.057     |
| Dependency ratio                        | 0.229***             | 0.051     | -0.544**     | 0.266     |
| Optimistic about future wellbeing       |                      |           | 0.571***     | 0.107     |
| Nonfarm land (log of value)             | 0.008***             | 0.002     |              |           |
| Average age of members                  | 0.005***             | 0.001     |              |           |
| Average education of members            | 0.038***             | 0.005     |              |           |
| Migrating members                       | -0.015               | 0.018     |              |           |
| Literate members                        | 0.002                | 0.011     |              |           |
| Self-employed <sup>b</sup>              | 0.120***             | 0.025     |              |           |
| Economic shocks                         | 0.061***             | 0.024     | 0.129        | 0.129     |
| Agricultural shocks                     | -0.055***            | 0.015     | 0.162**      | 0.082     |
| Socio-demographic shocks                | 0.031*               | 0.018     | -0.162*      | 0.095     |
| Stability                               | 0.001                | 0.001     |              |           |
| Distance to town                        | -0.0005              | 0.001     | -0.009       | 0.006     |
| Water quality (decreasing scale)        | -0.029***            | 0.009     |              |           |
| Road quality (decreasing scale)         | -0.005               | 0.017     |              |           |
| Coastal                                 | 0.129***             | 0.037     |              |           |
| Mountainous                             | 0.016                | 0.029     |              |           |
| Hue                                     | -0.418***            | 0.050     | 1.671***     | 0.174     |
| Constant                                | 0.452**              | 0.228     | 0.168        | 1.160     |
| Observations                            | 1499                 |           | 1499         |           |
| R <sup>2</sup>                          | 0.403                |           | 0.266        |           |

Notes: The Three Stage Least Squares estimation (3SLS). #: Log base ten. <sup>a</sup>: (1): if household decision maker has higher education than high school, (2): number of schooling years of the household representative. <sup>b</sup>: (1): number of self-employed members in household, (2): if the household representative is self-employed. Control for province and time fixed effects. Significance levels: \* p<0.1, \*\* p<0.05, \*\*\* p<0.01.

Source: TVSEP Survey 2008, 2010 and 2013 in Hue and Dak Lak, own calculations.

However, there is no significant ethnic difference in the willingness to take risks in this analysis. This implies that the economic gap between the two groups could probably absorb the difference in risk attitudes. The ethnicity can play a role in shaping the relationship between risk attitudes and the economic gap between the majority and the minorities. Therefore, when controlling for the relationship between risk attitudes and economic welfare, the significant difference only remains in the economic welfare but not in the risk attitudes. Some ethnic dimension of this relationship can be discovered by analyzing two groups separately. Nevertheless, provided that among the ethnic minorities, the relationship between risk attitudes and economic welfare has a non-linear shape, the results of this pooled sample

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could be subject to some bias. To consider that, an ethnic disaggregating analysis is necessary with emphasize on the ethnic majority group.

#### ***5.4 Ethnic disaggregating simultaneous equations estimations***

This section deals with separate analyses of the ethnic majority and the ethnic minorities using a similar technique that was applied in previous section to the full sample. Purpose of this analysis is to generate insights into the difference in the relationship between risk attitudes and economic welfare within groups.

Results of the above-described analysis are reported in Table 5 and in Table A4 (Appendix) separately for the ethnic majority and the ethnic minorities, respectively. The overall results indicate a large difference between the majority and minorities. The variations of risk attitudes and economic welfare remain well-explained among the ethnic majority; whereas there are fewer significant factors in the economic welfare and risk attitudes the minority group. Probably, mixing different ethnic groups who have different cultures and practices might increase the individual unobserved heterogeneity.

As expected, the significant association between risk attitudes and economic welfare is significant among the majority while it is insignificant among the ethnic minorities. These results reconfirm a positive relationship between risk attitudes and economic welfare among the culturally homogenous ethnic majority. One point increase on the 11-Point Likert scale of in the willingness to take risks associates with roughly 7% increase of consumption. The effects of both risk attitudes and economic welfare on each other reduces in comparison with the results of the full sample in Table 4 Especially, the coefficient of economic welfare in the regression of risk attitudes turns statistically insignificant. This implies the method of simultaneous equations is not a proper method to observe the relationship between risk attitudes and economic welfare among the ethnic minorities. Unfortunately, due to limited sample size, further break-downs could not be applied to see the difference across the ethnic minority groups.

**Table 5: 3SLS estimates of economic welfare and risk attitudes, ethnic majority**

| Variables                               | Economic Welfare (1) |           | WTR (2)      |           |
|---|----------------------|-----------|--------------|-----------|
|   | Coefficients         | Std. Err. | Coefficients | Std. Err. |
| Willingness to take risks (WTR)         | 0.067***             | 0.024     | -            | -         |
| Daily consumption per adult equivalent# | -                    | -         | 0.566        | 0.489     |
| Age                                     | 0.034***             | 0.011     | -0.050       | 0.070     |
| Age square                              | -0.0004***           | 0.0001    | 0.001        | 0.001     |
| Female                                  | 0.025                | 0.034     | -0.284       | 0.202     |
| Married                                 | 0.148***             | 0.054     | 0.472        | 0.334     |
| No religion                             |                      |           | 0.438**      | 0.204     |
| Self-employed                           | -0.036               | 0.047     | 0.329        | 0.227     |
| Health impairment                       | -0.036               | 0.038     | -0.301       | 0.223     |
| Member of a social or political org.    | 0.012                | 0.031     | 0.102        | 0.186     |
| Education <sup>a</sup>                  | 0.052**              | 0.025     | 0.062**      | 0.026     |
| Household size                          | -0.094***            | 0.016     | 0.013        | 0.082     |
| Dependency ratio                        | 0.230***             | 0.055     | -0.816***    | 0.314     |
| Optimistic about future wellbeing       |                      |           | 0.747***     | 0.136     |
| Nonfarm land (log of value)             | 0.007***             | 0.002     |              |           |
| Average age of members                  | 0.006***             | 0.002     |              |           |
| Average education of members            | 0.034***             | 0.006     |              |           |
| Migrating members                       | -0.013               | 0.018     |              |           |
| Literate members                        | 0.007                | 0.014     |              |           |
| Self-employed <sup>b</sup>              | 0.125***             | 0.025     |              |           |
| Economic shocks                         | 0.080***             | 0.027     | 0.089        | 0.168     |
| Agricultural shocks                     | -0.041**             | 0.018     | 0.137        | 0.109     |
| Socio-demographic shocks                | 0.008                | 0.020     | 0.014        | 0.119     |
| Constant                                | 0.652**              | 0.306     | 1.710        | 1.752     |
| R <sup>2</sup>                          | 0.370                |           | 0.243        |           |
| Observations                            | 1013                 |           | 1013         |           |

Notes: The Three Stage Least Squares estimates (3SLS). #: Log base ten.<sup>a</sup> (1) & (3): if household decision maker has higher education than high school, (2) & (4): number of schooling years of the household representative. <sup>b</sup>: (1) & (3): number of self-employed members in household, (2) & (4): if the household representative is self-employed. Control for village level characteristics, province and time effects. Significance levels: \* p<0.1, \*\* p<0.05, \*\*\* p<0.01. Source: TVSEP Survey 2008, 2010 and 2013 in Hue and Dak Lak, own calculations.

Similar to the results of single-equation estimation in section 4.2, the results of the simultaneous equations estimation document divergent determinants of risk attitudes and economic welfare. First, to some extent this difference reveals the structural variation in economic welfare between the majority and the ethnic minorities as shown in other studies (e.g., Imai, Gaiha, & Kang, 2011a; Van De Walle & Gunewardena, 2001). However, because of the switch in direction of the relationship between risk attitudes and economic welfare that is not controlled for the results could be biased. The results of the ethnic minority group are reported in the Table A3 in Appendix for reference only. In addition, adding the quadratic term of WTR (Table A4) demonstrates a positive significant correlation but the assumption of over-identification does not hold, consequently the results are biased.

To sum up, a significant effect of the willingness to take risk on economic welfare is found when allowing a bidirectional relationship between the WTR and economic welfare when analyzing the group of ethnic majority. That explains why the single equation estimation method in section 4.2 could not find a significant explanation of risk attitudes towards



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economic welfare because the reverse causation that exists in this relationship was not controlled for. The insignificant correlation between risk attitudes and economic welfare in the group of the ethnic minorities confirms a non-linear pattern of this relationship when considering ethnic minorities and the majority jointly. Furthermore, largely different determinants of the economic welfare and the WTR found between the majority and ethnic minorities seem to be consistent in comparison between the single equation method and the simultaneous equations method.

## **6. Conclusions**

This study examines the relationship between the risk attitudes and economic welfare in the presence of high ethnic diversity among rural farmers in Vietnam. First, the measure of general willingness to take risks is empirically validated for its reliability and applicability. Second, different approaches are used to explore the complexity of the relationship between the risk attitudes and economic welfare among a strongly heterogeneous population. Ethnic disaggregation aims to compare between two ethnic groups, namely the ethnic majority and the ethnic minorities.

The survey-based measure of risk attitudes could sufficiently measure risk attitudes in the presence of the ethnic diversity. The overall results indicate that cultural factors characterized by ethnicity do shape a large variation of risk attitudes and economic welfare. The results demonstrate an ethnic gap in economic welfare such that the ethnic majority is wealthier in terms of different economic indicators. Additionally, they express stronger willingness to take risks than the ethnic minorities. Diversity is even found among the ethnic minorities. For instance, the largest ethnic minority group, Ede, reported significantly weaker willingness to take risks in comparison to other ethnic minorities, while their economic welfare is similar to other minority groups.

Results explain to some extent the mixed empirical results concerning this relationship in previous empirical studies by indicating that ethnicity alters the interdependency between risk attitudes and economic welfare. First, the results for the ethnic minorities indicate a switch from a negative to a positive relationship between risk attitudes and economic welfare when the willingness to take risk reaches to roughly 3.5 points on the 11-point Likert scale. This finding confirms the mixed results on the relationship between risk attitudes and economic welfare when comparing across countries or cultures in which risk attitudes significantly diverges. Second, this study provides evidence of a positive and mutual relationship between

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risk attitudes and economic welfare among the socially and culturally homogenous and ethnic majority group. However, only the effect of risk attitudes on economic welfare is statistically significant. Particularly, one point increase in the willingness to take risk scale associates with about 7% increase in economic welfare. This finding is in line with a conventional negative linkage between risk aversion and economic welfare among the poor in developing countries. Additionally, this mutual interrelationship challenges the consistency of the results from the single-equation estimation method applied elsewhere in literature.

Between the two ethnic groups, divergent determinants of economic welfare and the individual willingness to take risks are documented. That probably relates to the diverse determinants of inequality across ethnic groups in Vietnam. For instance, while minorities are more vulnerable to risks due to their socio-demographic characteristics, resources such as non-farm land and non-farm self-employment are prominently beneficial to the ethnic majority. Additionally, some difference between Ede (i.e. the largest minority group) and other ethnic minorities suggests further diversity within the group of ethnic minorities. This implies a need to consider simultaneously the ethnic heterogeneity and risk aversion in socioeconomic policy making to enhance economic development and poverty alleviation in such ethnically diverse populations. For instance, among the extremely risk-averse ethnic minority individuals, interventions to improve economic welfare can be only effective conditional on encouraging their risk-taking. This study should be replicated for other ethnically diverse populations to assess the role of risk aversion in economic development in multicultural populations with recognized inequality. Finally, the correlated error terms in the system-equation analysis suggests a dynamic relationship between risk attitudes and economic welfare that leaves room for future studies.

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## APPENDIX

**Table A1: Descriptive statistics**

| Variable   | 2008   |         | 2010   |         | 2013    |         |
|--|--------|---------|--------|---------|---------|---------|
|  | Mean   | SD      | Mean   | SD      | Mean    | SD      |
| <i>Economic welfare</i>                            |        |         |        |         |         |         |
| Consumption <sup>a</sup> (PPP USD)                 | 4.93   | 3.75    | 4.71   | 3.35    | 6.14    | 4.34    |
| Income <sup>b</sup> (PPP USD)                      | 5.24   | 7.70    | 4.11   | 4.90    | 5.36    | 6.95    |
| Wealth <sup>c</sup> (PPP USD)                      | 687.60 | 1044.41 | 641.45 | 1007.08 | 1044.66 | 2293.04 |
| <i>Individual characteristics</i>                  |        |         |        |         |         |         |
| WTRg   | 3.39   | 3.20    | 4.14   | 2.83    | 5.58    | 2.57    |
| Age (years)  | 45.67  | 12.36   | 47.67  | 12.36   | 50.67   | 12.36   |
| Female (%)   | 40     |         |        |         |         |         |
| Ethnic majority (%)                                | 70     |         |        |         |         |         |
| Married (%)  | 85     |         |        |         |         |         |
| Self – employed (%)                                | 16     | 37      | 18     | 38      | 20      | 40      |
| No religion (%)                                    | 78     |         |        |         |         |         |
| Health impairment (%)                              | 18     | 38      | 22     | 41      | 29      | 46      |
| Optimism <sup>f</sup>                              | 0.45   | 0.64    | 0.43   | 0.64    | 0.41    | 0.67    |
| Membership <sup>d</sup> (%)                        | 67     | 47      | 65     | 48      | 67      | 47      |
| Education (years)                                  | 5.82   |         |        |         |         |         |
| <i>Household characteristics</i>                   |        |         |        |         |         |         |
| Household size <sup>e</sup>                        | 4.50   | 1.89    | 4.39   | 1.77    | 4.10    | 1.75    |
| Household dependency ratio                         | 0.37   | 0.25    | 0.37   | 0.30    | 0.39    | 0.38    |
| Non-farm land (ha)                                 | 0.69   | 1.65    | 0.80   | 2.52    | 0.57    | 2.77    |
| Crop land (ha)                                     | 0.35   | 0.57    | 0.31   | 0.50    | 0.45    | 2.58    |
| Member average age (years)                         | 31.03  | 13.67   | 32.80  | 13.59   | 36.47   | 14.67   |
| Member average edu. (years)                        | 6.49   | 4.84    | 5.83   | 2.80    | 6.42    | 3.00    |
| Migrating members <sup>e</sup>                     | 0.24   | 0.67    | 0.36   | 0.79    | 0.21    | 0.63    |
| Literate members <sup>e</sup>                      | 3.82   | 2.00    | 4.19   | 2.01    | 3.88    | 1.72    |
| Self-employed members <sup>e</sup>                 | 0.36   | 0.66    | 0.45   | 0.75    | 0.44    | 0.74    |
| <i>Shocks</i>                                      |        |         |        |         |         |         |
| Economic shocks <sup>e</sup>                       | 0.14   | 0.38    | 0.38   | 0.67    | 0.42    | 0.65    |
| Agricultural shocks <sup>e</sup>                   | 1.22   | 0.93    | 1.22   | 0.93    | 0.54    | 0.62    |
| Socio-demographic shocks <sup>e</sup>              | 0.50   | 0.75    | 0.63   | 0.80    | 0.64    | 0.76    |
| <i>Geographic (village levels) characteristics</i> |        |         |        |         |         |         |
| Distance to district town (km)                     | 14.68  | 11.70   | 13.69  | 10.86   | 12.48   | 9.39    |
| Water quality (decreasing scale)                   | 3.44   | 1.38    | 3.26   | 1.38    | 3.22    | 1.53    |
| Stability (years)                                  | 10.26  | 9.11    | 10.36  | 7.79    | 12.57   | 10.59   |
| Road quality (decreasing scale)                    | 2.79   | 0.97    | 2.93   | 1.05    | 2.86    | 0.91    |
| Coastal  | 0.18   |         |        |         |         |         |
| Mountainous  | 0.49   |         |        |         |         |         |

Notes: <sup>a</sup> Daily consumption per adult equivalent (AE): Organization for Economic Cooperation and Development adult equivalents  $AE = 1 + 0.7*(adults-1) + 0.5*children$ . <sup>b</sup> Daily income per capita. <sup>c</sup> Total asset value (wealth) per capita. <sup>d</sup> Be member of a social or political organization. <sup>e</sup> Counted numbers. <sup>f</sup> Scale from -2 to 2. <sup>g</sup> WTR: willingness to take risks. Source: TVSEP Survey 2008, 2010 and 2013 in Hue and Dak Lak, own calculations.

**Table A2: Tests after the Three Stages Least Squares regression**


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**\* Breusch-Pagan LM Diagonal Covariance Matrix Test (3sls)**  
Ho: Diagonal Disturbance Covariance Matrix (Independent Equations)  
Ho: Run OLS - Ha: Run 3SLS  
Lagrange Multiplier Test = 249.58454  
Degrees of Freedom = 1.0  
P-Value > Chi2(1) = 0.00000

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**\*Test for Over identification: H0: The system is just identified**  
Number of equations : 2  
Total number of exogenous variables in system : 32  
Number of estimated coefficients : 50  
Net of 1 linear constraints / dependencies  
Hansen-Sargan overidentification statistic : 17.349  
Under H0, distributed as Chi-sq(14), pval = 0.2381

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**\* System Heteroscedasticity Tests (3sls)**

\*\*\* Single Equation Heteroscedasticity Tests:  
Ho: Homoscedasticity - Ha: Heteroscedasticity

|             |               |       |    |   |      |   |        |   |                 |       |
|-------------|---------------|-------|----|---|------|---|--------|---|-----------------|-------|
| Eq. logcon: | Engle LM ARCH | Test: | E2 | = | E2_1 | = | 1.2264 | P | Value > Chi2(1) | 0.268 |
| Eq. logcon: | Hall-Pagan LM | Test: | E2 | = | Yh   | = | 0.11   | P | Value > Chi2(1) | 0.740 |
| Eq. logcon: | Hall-Pagan LM | Test: | E2 | = | Yh2  | = | 0.0168 | P | Value > Chi2(1) | 0.897 |
| Eq. logcon: | Hall-Pagan LM | Test: | E2 | = | LYh2 | = | 0.8469 | P | Value > Chi2(1) | 0.357 |
| Eq. wtr :   | Engle LM ARCH | Test: | E2 | = | E2_1 | = | 0.2958 | P | Value > Chi2(1) | 0.587 |
| Eq. wtr :   | Hall-Pagan LM | Test: | E2 | = | Yh   | = | 2.3559 | P | Value > Chi2(1) | 0.125 |
| Eq. wtr :   | Hall-Pagan LM | Test: | E2 | = | Yh2  | = | 2.0826 | P | Value > Chi2(1) | 0.149 |
| Eq. wtr :   | Hall-Pagan LM | Test: | E2 | = | LYh2 | = | 3.4185 | P | Value > Chi2(1) | 0.065 |

\*\*\* Overall System Heteroscedasticity Tests:  
Ho: No Overall System Heteroscedasticity

|                          |          |   |         |         |   |
|--------------------------|----------|---|---------|---------|---|
| Breusch-Pagan LM Test    | 242.507  | P | Value > | Chi2(1) | 0 |
| Likelihood Ratio LR Test | 270.965  | P | Value > | Chi2(1) | 0 |
| Wald Test                | 1178.800 | P | Value > | Chi2(1) | 0 |

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**Table A3: 3SLS estimates of economic welfare and risk attitudes, ethnic minorities**

| Variables                               | Economic Welfare (1) |           | WTR (2)      |           |
|---|----------------------|-----------|--------------|-----------|
|   | Coefficients         | Std. Err. | Coefficients | Std. Err. |
| Willingness to take risks (WTR)         | 0.119                | 0.089     | -            | -         |
| Daily consumption per adult equivalent# | -                    | -         | 0.642        | 0.525     |
| Age                                     | -0.017               | 0.021     | 0.136*       | 0.078     |
| Age square                              | 0.0002               | 0.0002    | -0.002*      | 0.001     |
| Female                                  | -0.112*              | 0.065     | 0.299        | 0.290     |
| Married                                 | 0.042                | 0.100     | 0.461        | 0.377     |
| No religion                             |                      |           | 0.368        | 0.263     |
| Self-employed                           | 0.037                | 0.194     | 0.519        | 0.551     |
| Health impairment                       | -0.124**             | 0.063     | -0.028       | 0.286     |
| Member of a social or political org.    | -0.045               | 0.059     | 0.229        | 0.253     |
| Education <sup>a</sup>                  | 0.151**              | 0.075     | 0.038        | 0.032     |
| Household size                          | -0.066***            | 0.021     | 0.026        | 0.075     |
| Dependency ratio                        | 0.222*               | 0.122     | -0.007       | 0.549     |
| Optimistic about future wellbeing       |                      |           | 0.302*       | 0.160     |
| Nonfarm land (log of value)             | 0.009**              | 0.004     |              |           |
| Average age of members                  | 0.0007               | 0.0028    |              |           |
| Average education of members            | 0.057***             | 0.011     |              |           |
| Migrating members                       | -0.013               | 0.115     |              |           |
| Literate members                        | -0.0061              | 0.0203    |              |           |
| Self-employed members <sup>b</sup>      | 0.179*               | 0.100     |              |           |
| Economic shocks                         | 0.023                | 0.052     | 0.290        | 0.199     |
| Agricultural shocks                     | -0.044               | 0.030     | 0.182        | 0.123     |
| Socio-demographic shocks                | 0.066                | 0.061     | -0.473***    | 0.155     |
| Hue                                     | -0.460***            | 0.107     | 1.127***     | 0.390     |
| Ede                                     | 0.103                | 0.069     | -0.141       | 0.299     |
| Paco                                    | -0.227***            | 0.088     | 0.430        | 0.391     |
| Constant                                | 1.098**              | 0.435     | -2.609       | 1.808     |
| R <sup>2</sup>                          | 0.270                |           | 0.303        |           |
| Observations                            | 486                  |           | 486          |           |

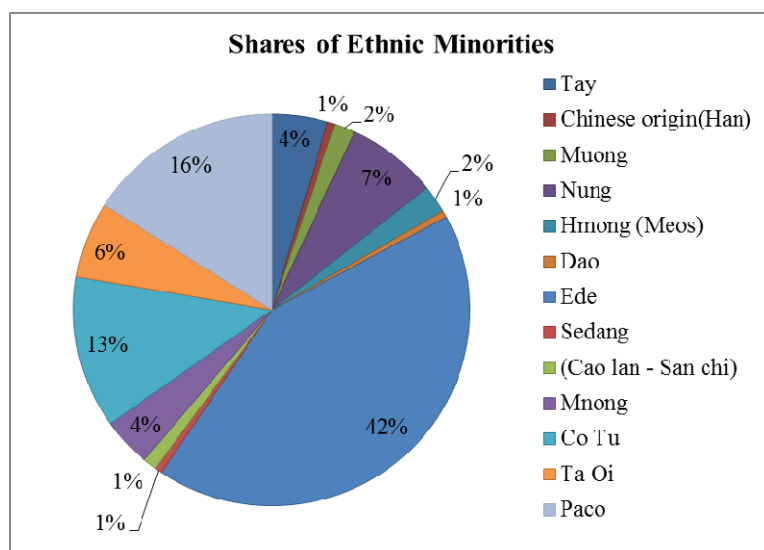
Notes: The Three Stage Least Squares estimates (3SLS). #: Log base ten.<sup>a</sup> (1) & (3): if household decision maker has higher education than high school, (2) & (4): number of schooling years of the household representative. <sup>b</sup>: (1) & (3): number of self-employed members in household, (2) & (4): if the household representative is self-employed. Control for village level characteristics and time effects. Significance levels: \* p<0.1, \*\* p<0.05, \*\*\* p<0.01.

Source: TVSEP Survey 2008, 2010 and 2013 in Hue and Dak Lak, own calculations.

**Table A4: Testing non-linear relationship in simultaneous equation, ethnic minorities**

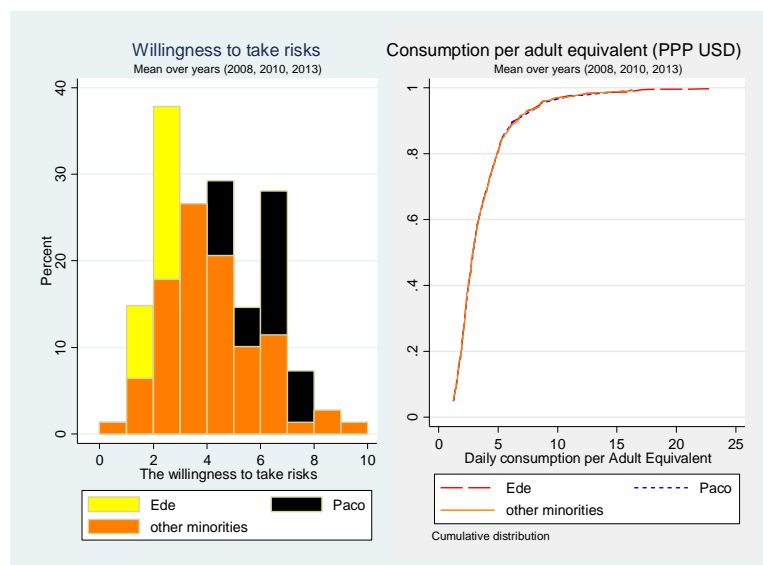
|   | Minorities       |           |                 |           |
|---|------------------|-----------|-----------------|-----------|
|   | Economic welfare |           | WTR             |           |
|   | coefficients     | Std. Err. | coefficients    | Std. Err. |
| Willingness to take risks (WTR)         | 0.334            | 0.394     |                 |           |
| WTR square                              | -0.018           | 0.039     |                 |           |
| Daily consumption per adult equivalent# |                  |           | <b>2.872***</b> | 0.555     |
| <i>Individual characteristics</i>       | <i>yes</i>       |           | <i>yes</i>      |           |
| <i>Household characteristics</i>        | <i>yes</i>       |           | <i>yes</i>      |           |
| Ede                                     | 0.155            | 0.146     | -0.304          | 0.337     |
| Paco                                    | -0.250**         | 0.107     | 0.734*          | 0.442     |
| R <sup>2</sup>                          | 0.121            |           | -0.104          |           |
| Observations                            |                  | 486       |                 |           |

Source: TVSEP Survey 2008, 2010 and 2013 in Hue and Dak Lak, own calculations.



**Figure A1: Share of ethnic minorities**

Notes: Ede is the largest minority group in Dak Lak and Paco is the largest minority group in Hue.  
Source: TVSEP Survey data waves 2008, 2010 and 2013 in Hue and Dak Lak.



**Figure A2: Risk attitudes and economic welfare across ethnic minority groups**

Notes: Ede is the largest minority group in Dak Lak and Paco is the largest minority group in Hue.  
Source: TVSEP Survey 2008, 2010 and 2013 in Hue and Dak Lak.

