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# Risk attitude and economic welfare: A panel analysis on a multiethnic population in rural Viet Nam

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## ABSTRACT

The relationship between economic welfare and general risk attitude is examined using a three-wave data set collected from 588 ethnically diverse households in Central Vietnam. Ethnic minorities account for about 30 % of the sample and include twelve different ethnic groups. Multivariate analysis is applied with single equation and equation-system estimating approaches. The results confirm that the ethnic majority (Kinh) are wealthier while willingly taking more risk, roughly one point higher on the 11-point Likert scale, compared to the ethnic minority. Risk attitudes and economic welfare are determined differently between the two groups, as minorities are more vulnerable to their socio-demographic characteristics, resources, and locations, which are more beneficial to the Kinh. Stronger risk-taking is positively associated with a better economic well-being among the ethnic majority, whereas this association is not found among extremely risk-averse ethnic minority. Findings of this study suggest that development policies should offer different treatments tailored to specific needs based on socio-demographic and cultural backgrounds including attitudes toward risks.

## 1. Introduction

The attitude toward risk is one of the crucial elements in decision-making. [Binswanger \(1980\)](#) observed a tendency toward risk aversion among poor farmers in India. But this author did not find a significant effect of risk aversion on poverty directly. Instead, he concluded that limited access to credit plays a role in the poor decision-making of the farmers. Later, [Mosley and Verschoor \(2005\)](#) used “vicious circle of poverty” to describe the situation in which risk averse decision-making in precarious conditions trapped the poor in perpetual poverty. As such, risk aversion is both causing and being caused by chronic poverty. From a psychological view, [Haushofer and Fehr \(2014\)](#) found that both being poor and living with economic constraints leads people to make risk-averse decisions. These authors reported experimental evidence to show the negative effects of poverty on the decision-making of the poor. Similarly, from a social perspective, the concept of “culture of poverty” for the first time introduced by Lewis in 1960 s went through a long-time debate on its existence ([Leacock, 1971](#)). Nevertheless, it was acclaimed to reconsider in practice by many researchers (e.g., [Cohen, 2010](#); [Small, Harding, & Lamont, 2010](#); [Cuthrell, Stapleton, & Ledford, 2009](#)). However, the question is how risk aversion and economic welfare among the poor are truly related remains unclear. This study to some extent revisits all the above-mentioned issues by investigating the relationship between risk attitudes and economics welfare with the aim to bring insights into understanding of the poor and beyond.

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The mechanism of the interaction between risk attitudes and economic welfare is complex. Basically, risk attitude influences economic welfare by impacting decision making in which risk taking tends to encourage high risk high return decisions hence improving economic welfare (e.g., Iyer, Bozzola, Hirsch, Meraner, & Finger, 2020; Ambali, 2019). The relationship between risk attitudes and economic welfare can be mutual. Risk attitude depends on economic conditions and similarly on social factors (Rieger, Wang, & Hens, 2011). However, risk aversion's link to economic welfare has been found to be mixed in previous empirical studies: many studies provide evidence that wealthier people are prone to take more risks, whereas, many other studies document that wealth associates with risk aversion positively (e.g., Liu & Huang, 2013; Liebenehm & Waibel, 2014; Vieider et al., 2018; Yesuf & Bluffstone, 2009; Rieger, Wang & Hens, 2015), including a study conducted on a sample of Vietnamese farmers (Vieider, Truong, Martinsson & Nam, 2013). Some researchers suggest that a deeper consideration of the data and empirical methods are needed to understand the link between risk attitude and economic welfare (Binswanger, 1980; Tanaka, Camerer, & Nguyen, 2010). This study tries to provide further understanding about those mixed empirical results in the following distinctive ways. Firstly, the measurement of risk attitudes has been prone to controversy in the literature; therefore, the mixed results across studies may be due to the various methods of risk attitude elicitation that have been used. Many studies applied incentivized risk experiments to elicit risk preferences, while those experiments were claimed to be context-specific and sensitive to cognitive ability of the subjects (e.g., Chuang & Schechter, 2015). Furthermore, some experiments reveal their weaknesses in capturing risk attitudes and are less consistent when compared to a survey question (Lönnqvist, Verkasalo, Walkowitz, & Wichardt, 2015). Secondly, the relationship between risk aversion and economic welfare in previous studies was primarily analyzed using a unidirectional method. Some studies suggested a mutual interaction between risk attitudes and economic welfare (Cardenas & Carpenter, 2013; Tanaka et al., 2010) that remains. To fill this gap, this study examines the relationship between risk attitude and economic welfare by using both unidirectional and bidirectional approaches using an experimentally validated survey measure of risk attitudes.

The individual general risk attitude was measured by the self-reported willingness to take risks using a survey question first introduced by Dohmen et al. (2011) based on the German Socio-Economic Panel (SOEP): "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)." The intrinsic individual risk attitudes measured by the survey question correlated with other personality traits (Lönnqvist et al., 2015). The survey question was validated by risk experiments (Dohmen et al., 2011; Hardeweg, Menkhoff, & Waibel, 2013) that powerfully elicit 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). In this study, we test the validity of this survey question among different cultures since cultural factors can shape risk attitudes (Vieider et al., 2015). Additionally, Vieider et al. (2015) confirmed the validity of this survey question method measure and to compare risk attitudes across 30 countries with different cultures. Furthermore, by using an ethnically diverse sample, this study searched for evidence of cultural influences in the diversity of risk attitudes and their relationship with economic welfare.

A research sample includes rural households and household decision makers of two provinces of Central and Central Highlands of Vietnam, namely Thua Thien Hue (Hue) and Dak Lak. This research sample represents well the ethnic diversity of the country in rural and poor areas. That provides an ideal illustration of the poverty and ethnic gap in Vietnam. Indeed, Vietnam earned impressive success in poverty reduction and urbanization but inequality problems such as urban-rural gap and ethnic disparity persist (e.g., Cuong, Truong, & Van Der Weide, 2010; Lanjouw, Marra, & Nguyen, 2017). It is observed that the ethnic minorities benefited from government support less than the ethnic majority in the same areas (Cuong, Tung, & Westbrook, 2015). The disadvantaged ethnic minorities have their own traditions found more likely deviating from the assumption of "homo economicus" (Montalvo & Reynal-Querol, 2005; Nguyen, 2012). A question is whether risk attitude can explain to some extent the situation mentioned above.

In short, this study is expected to contribute to the current literature in several ways. First, to our best knowledge, it is the first time to use the risk-welfare channel (i.e., risk attitudes drive economic decisions hence resulting in economic outcomes) to estimate the impact of ethnicity on economic welfare. Second, the simultaneous interaction between risk attitude and economic welfare is the first time to be examined. Hence, third, insights into the ethnic gap in Vietnam by disaggregating the ethnic effect are provided. Ethnic diversity impacts community economic development (Maass, Roasbianca, & Kiesner, 2005) and social exclusion due to ethnic identity, among other factors, causes poverty and inequality (e.g., Hoff & Pandey, 2006; Porter & Craig, 2004). Therefore, this study sought to shed light on the persistent ethnic economic gap in Vietnam presented in previous studies (e.g., Imai et al., 2011a; Kang & Imai, 2012; Van de Walle & Gunewardena, 2001) from the risk-welfare channel.

Technically, we explore the determinants of risk attitude and economic welfare using single-equation estimation approach. Special attention was paid to the ethnic gaps in economic status and how they relate to the willingness to take risks among ethnic groups. To address the mutual relationship between risk attitude and economic welfare, the three-stage least squares regression (3SLS) was applied. This approach is expected to circumvent the simultaneous interaction between risk aversion and economic welfare that was missing in previous studies.

The remainder of this paper is organized as follows. Section 2 describes the research sample and presents descriptive statistics of the data. Section 3 introduces the empirical strategies of this study. Section 4 shows the empirical results. Finally, Section 5 summarizes the results and concludes the paper.

## 2. Data and background

Kinh is the largest ethnic group in Vietnam, hereby called the ethnic majority, accounts for almost 90 % of the population. The rest is comprised by 53 small-sized ethnic groups, hereby called the ethnic minority. These groups are characterized by different cultures and languages and locating mostly in mountainous and remote areas across the country. However, they are highly found in the

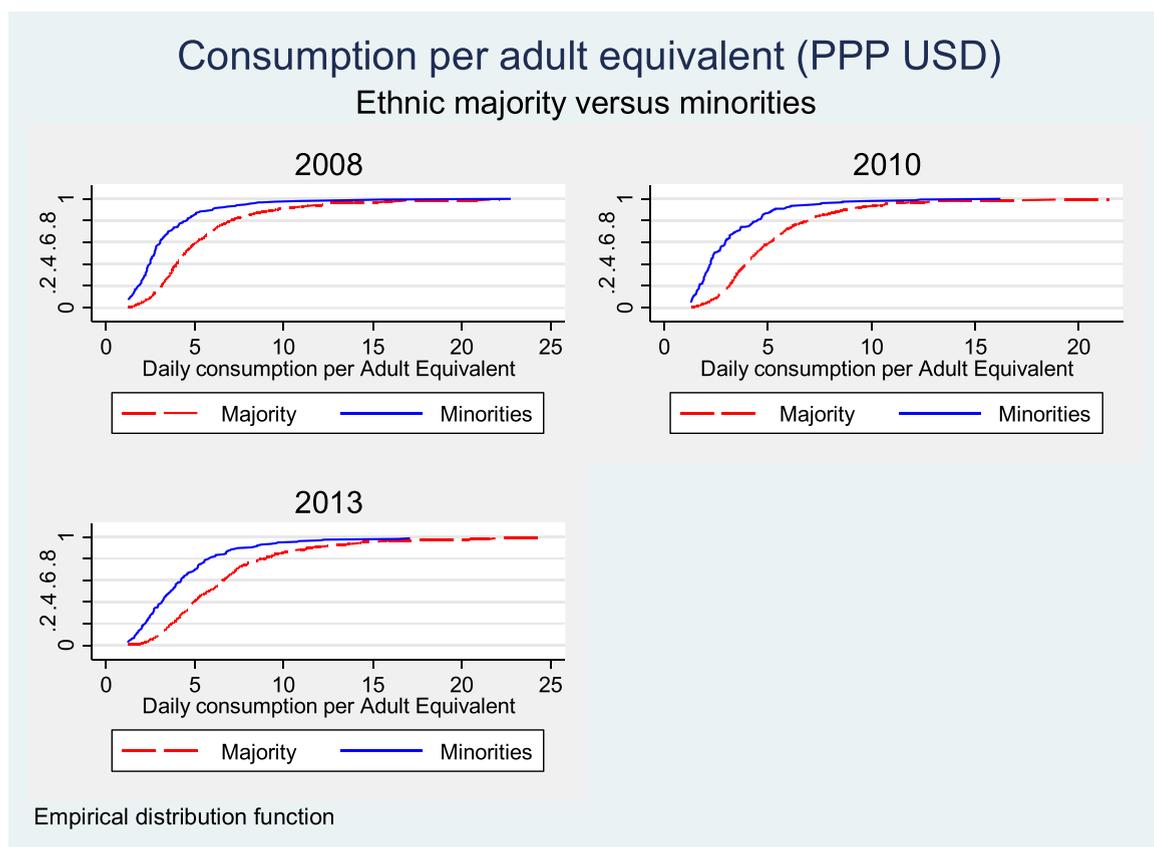
**Table 1**  
Descriptive statistics.

Variable	Minorities (522)	(1) Majority (1242)	Statistic test#	(2) Ede (n = 222)	Other minorities (n = 300)	Statistic test#
	Mean	Mean		Mean		
<i>Economic status</i>						
Consumption <sup>a</sup> (PPP US Dollar)	3.73	5.90	-15.90 ***	3.96	3.56	2.01 **
Poverty (%) <sup>b</sup>	54	16	263.19 ***	52	56	0.77
Wealth <sup>c</sup> (PPP US Dollar)	445.23	936.66	-12.06 ***	497.77	406.35	1.13
Income <sup>b</sup> (PPP US Dollar)	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) <sup>i</sup>	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) <sup>i</sup>	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  $AE = 1 + 0.7 * (\text{adults}-1) + 0.5 * \text{children}$ . <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 US Dollar), 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. <sup>i</sup>scale with the quality decreasing from 1 to 5. # 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; the calculations are the author's own.

mountainous Northern, the Central and the Central Highlands. Data used in this study are part of the long-term panel project, "Thailand Vietnam Socio-Economic Panel," funded by the German Research Foundation (see [www.TVSEP.de](http://www.TVSEP.de)). For the present study, we used the data by household survey conducted in 2008, 2010, and 2013 in two provinces that belong to Central Vietnam, namely Thua Thien Hue (Hue) and to Central Highlands, namely Dak Lak. The research sample is well-represented for the ethnic diversity and the poverty of rural areas in Vietnam. These two provinces are also the focus of many other studies that address the ethnic gap and poverty in Vietnam.

Due to the attrition rate over the years and change in the self-reported household decision-maker (i.e. identical decision-maker over time), the final sample comprised 588 individuals in a three-wave balanced panel. Concerning ethnic diversity of the research sample, minorities account for roughly 30 % of the population with a slightly smaller percentage of minorities in Hue. Ede, the largest minority group in Dak Lak province, makes up 13 % of the province population; Paco is the largest minority group in Hue province at 6 %. Each of the other twelve minority groups accounts for about 3 % or less of the population (Fig. A1, appendix). The subsample of ethnic



**Fig. 1.** Economic gap between the ethnic majority and minorities.  
Source: TVSEP Survey 2008, 2010 and 2013 in Hue and Dak Lak, own calculations.

minority in the two provinces is well-representative of the ethnic minority in Vietnam. Although some of the groups have their own spoken languages, the official language used in schools and on administrative documents is Vietnamese. Risk attitude is measured by the self-assessed willingness to take risks using an 11-Point Likert scale as noted above. This survey question was two-way translated from English into Vietnamese and vice versa. When the question was read to the respondents, they were asked whether they understood. They started their answer only after confirming that they understood the question.

The descriptive statistics summarized in [Table 1](#) confirm the ethnic disparities in Vietnam (e.g., [World Bank, 2009](#); [Baulch, 2011](#); [Kozel, 2014](#)). Minorities are left behind in all indicators of human development including education, and health. They are more agriculturally dependent and less involved in non-farm self-employed activities; consequently, they experience more agricultural shocks. They tend to live in larger size households with more dependent members. They are more often located in areas with lower water quality and poorer transportation systems and are farther away from the district center. Therefore, they are less likely to migrate out of their province, mainly due to lack of income. All aforementioned disparities between minority and Kinh households have persisted over many years, despite improvements in living standards within each group ([Cuong et al., 2015](#)). Within this study, economic welfare is defined as economic status of a subject (i.e., household, individual) measured at any point in time that can be presented in different indicators which are reported in [Table 1](#). They are daily consumption per adult equivalent, daily income (self-reported) per capita, wealth (self-reported total assets) per capita and poverty line. By all indicators, the gap between the ethnic majority and the ethnic minorities is apparent.

[Fig. 1](#) illustrates the changes in economic welfare proxied by consumption expenditure within ethnic groups and compares Kinh and ethnic minorities over the period between 2008 and 2013. Improvement is recognized within each group. By overlaying histograms, the difference between the two groups over the years between 2008 and 2013 is compared: red for the Kinh group and blue for the minority group. Overall, an average Kinh household has a higher consumption expenditure per adult equivalent than its ethnic minority counterpart. In addition, the gap increased between 2008 and 2013, which seems to be in line with inefficient poverty reduction among the minority groups (e.g., [Baulch, Pham & Reilly, 2012](#); [World Bank, 2009](#)).

With a similar approach applied in [Fig. 1](#), the comparisons between the Kinh majority and ethnic minorities are presented in [Fig. 2](#). For our purposes, it is important to note the changes in willingness to take risks (WTR) over the years between 2008 and 2013 and the gap between the Kinh majority and ethnic minorities. Kinh individuals reported a relatively stronger willingness to take risks than ethnic minorities. This gap remains over the years regardless of the roughly one-point higher increase in risk-taking within each group

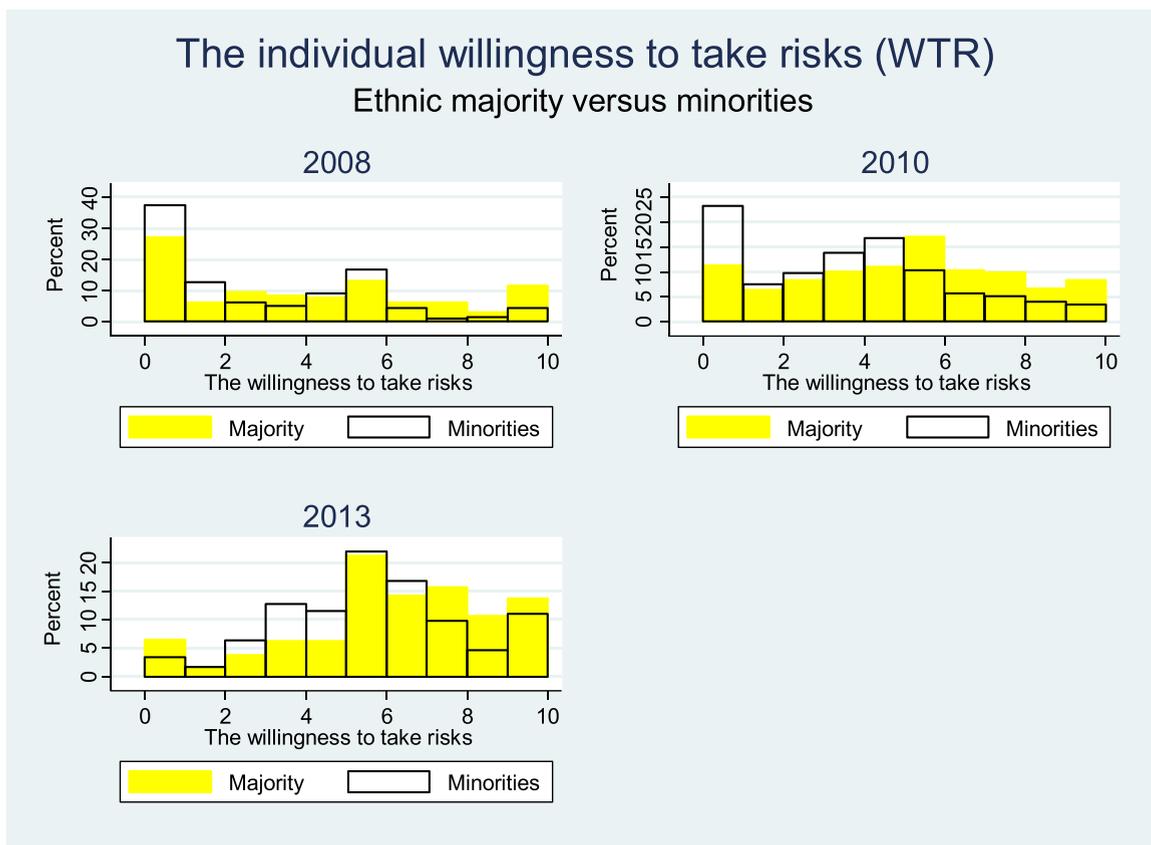


Fig. 2. The general willingness to take risks (WTR).  
Source: TVSEP Survey 2008, 2010 and 2013 in Hue and Dak Lak, own calculations.

each year.

In sum, Figs. 1 and 2 demonstrate the tendencies for changes in household consumption expenditure and WTR, respectively, over the years with visible and persistent differences between the ethnic majority and minorities. The overall descriptive results confirm an economic gap and a difference in risk attitudes between the ethnic majority and minorities. However, when looking at the minority alone, it is found that although they are almost insignificantly different in economic status, they are considerably different in willingness to take risks but similar consumption per adult equivalent that is shown in Fig. A2 in Appendix.

### 3. Empirical strategy

The research objectives were met by using both single-equation and system-equation methods. First, WTR was measured by a survey question estimated based on individual and household characteristics to test the validity of this survey question by common determinants suggested in literature. Second, the proxy power of consumption per adult equivalent was challenged by examining the ordinary explanatory factors of economic welfare. Third, the system-equation estimation was applied to test a mutual relationship between risk attitude and economic welfare. By disaggregating ethnicity, the ethnic dimension of the two will be addressed.

#### 3.1. Estimating the surveyed-based measure of risk attitudes

In this section, the survey-based measure of risk attitudes is examined by expected determinants suggested in literature and previous studies. The willingness to take risks (WTR) is individual attitude of the household decision maker. (E) presents the general economic status of his household. On purpose, self-reported market price of the house is chosen since it has more advantages over other indicators of economic welfare including consumption, income, and assets. House is treated as a stable and long-term asset of a household used to proxy economic status.<sup>1</sup> It is used to avoid any simultaneous interaction between risk attitudes and economic welfare if that exists and cannot be controlled by this estimation method. Various regression methods which are suitable for the 11-

<sup>1</sup> Results of other proxies are available upon requests.

point Likert dependent variable are employed such as interval regression, ordered probit, and OLS regression.

Risk attitude is a personal trait that is empirically associated with personality factors (Lönnqvist et al., 2015) and that can be shaped by socioeconomic variables (Guiso & Paiella, 2008). The application of the survey question to the general willingness to take risks has been significantly correlated with its applications on different risk domains such as stock holdings, job choices, and smoking (Dohmen et al., 2011). Hardeweg et al. (2013) also point out that the general application of this question can predict risk behaviors among farmers in Thailand. In addition, this measure significantly correlates with an incentivized measure of risk attitude in cross-country comparison (Vieider et al., 2015), which 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:

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

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

The 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 welfare.  $Z_{1it}$  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.  $E_{it}$  is economic welfare proxied by self-reported house value. In addition, the geographic characteristics,  $G_j$ , were controlled at the village level ( $j$ ).

Based on previous studies, we expect to uncover some significant correlations between risk attitudes and the socio-demographic determinants, such as age, gender, education, and marital status (e.g., Dohmen et al., 2011; Gloede, Menkhoff, & Waibel, 2015; Liebenehm & Waibel, 2014; Miyata, 2003). Furthermore, we also expected to observe significant correlations between subjective opinions about health status and future welfare and risk attitudes (Dohmen et al., 2011; Hardeweg et al., 2013). Notably, we added the variable of religion because religious people are more likely to be risk-averse—this was found among a Dutch population by Nousseir, Trautmann, van de Kuilen, and Vellekoop (2013) and among Germans by Nielsen, Bech, Christensen, Kiil, and Hvidt (2017). Because shocks and other negative experiences interfere with risk attitudes, they tend to cause 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's town and a province dummy variable; these variables can represent accessibility to information that encourages the 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 provide channels for risk-sharing activities, can be related to household consumption expenditure and risk attitudes (Grimard, 1997).

### 3.2. Estimating economic welfare

This analysis examines the determinants of household economic welfare. Many independent variables were found to explain economic welfare from previous studies (e.g., Akerele & Adewuyi, 2011; Litchfield & McGregor, 2008; Mukherjee & Benson, 2003). To specify, individual and household characteristics such as the age and gender of the household decision-maker, endowment in education, land size, social capital, and experience with shocks determine a household's economic welfare (e.g., Epprecht, Müller, & Minot, 2011; Günther & Harttgen, 2009; Klasen, Lechtenfeld, & Povel, 2015). In addition, regional effects (e.g., coastal, mountainous, province) and location effects (e.g., distance to the district town, water quality, and length of time living in current house) have been found to have significant effects on the economic welfare of the Vietnamese population (Imai, Gaiha & Kang, 2011b).

In the estimation, economic welfare ( $W$ ) is proxied by the daily consumption per adult equivalent (in logarithm form).  $W$  of household  $i$  is regressed on the set of the individual characteristics of the household decision-maker ( $X_{2it}$ ) and the set of household characteristics ( $Z_{2it}$ ).  $V_j$  denotes geographic characteristics at the village level ( $j$ ). Among them, the individual  $WTR$  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  $t = 1, 2, 3$ .

### 3.3. Simultaneously estimating risk attitude and economic welfare

The conceptualized explanation of a mutual relationship between risk attitudes and economic welfare needs empirical evidence. If this mutuality exists, these two are endogenous, interdependent, and jointly determined. Hence, the hypothesis on exogeneity in the single-equation estimations is violated leading to simultaneity bias. At the same time, the reciprocal interaction could also lead to the related unexplained variations between risk attitudes and economic welfare. The above-described relation is challenged by estimating simultaneously risk attitudes and economic welfare using 3SLS (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 have a twofold advantage in comparison with the single-estimation method. First, the estimation allows for the endogeneity problem of two explained variables by assuming that the exogenous variables can instrument the endogenous variables of the system to obtain the requirement of over-identification. Second, the estimation can also consider the existing mutual interaction between two variables in case it fails to be observed by allowing correlated error terms.

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

	[1] Intreg	[2] Intreg	[3] Intreg	[4] Oprobit	[5] OLS
Female	-0.016 [0.197]	0.015 [0.195]	-0.042 [0.198]	-0.018 [0.064]	-0.051 [0.165]
Age	-0.007 [0.007]	-0.009 [0.007]	-0.001 [0.008]	-0.000 [0.003]	-0.001 [0.006]
Married	0.675 * * [0.266]	0.558 * * [0.267]	0.617 * * [0.275]	0.201 * * [0.089]	0.513 * * [0.227]
Ethnic majority (Kinh)	0.696 * * * [0.190]	0.566 * * * [0.192]	0.381 * * [0.200]	0.135 * * [0.065]	0.313 * * [0.166]
No religion	0.586 * * * [0.198]	0.489 * * [0.196]	0.374 * [0.198]	0.118 * [0.064]	0.253 [0.164]
Education	0.132 * * * [0.022]	0.125 * * * [0.022]	0.099 * * * [0.023]	0.033 * * * [0.007]	0.081 * * * [0.019]
House value◆		1.963 * * * [0.563]	1.312 * * [0.580]	0.427 * * [0.188]	1.276 * * * [0.471]
Household size			-0.069 [0.049]	-0.022 [0.016]	-0.067 * [0.040]
Dependency ratio			-0.473 * [0.268]	-0.159 * [0.087]	-0.425 * [0.221]
Self-employed			0.492 * * [0.216]	0.161 * * [0.070]	0.404 * * [0.178]
Membership			0.282 [0.175]	0.091 [0.057]	0.205 [0.143]
Impairment			-0.410 * * [0.205]	-0.139 * * [0.066]	-0.340 * * [0.167]
Optimism			0.659 * * * [0.127]	0.218 * * * [0.041]	0.597 * * * [0.103]
Constant	-0.407 [0.537]	-4.259 * * * [1.212]	-2.874 * * [1.250]		-1.329 [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, Cut points in Ordered Probit Model: cut1: 0.172(0.245); cut2: 0.448 \* (0.245); cut3: 0.741 \* \* \* (0.246); cut4: 1.058 \* \* \* (0.247); cut5: 1.377 \* \* \* (0.248); cut6: 1.895 \* \* \* (0.251); cut7: 2.230 \* \* \* (0.253); cut8: 2.580 \* \* \* (0.256); cut9: 2.885 \* \* \* (0.258); cut10: 2.990 \* \* \* (0.259). Significance levels: \* p < 0.1, \* \* p < 0.05, \* \* \* p < 0.01. 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, the calculations are the author’s own.

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 \(2019\)](#) when analyzing the relationship between risk aversion and economic development within and between countries (i.e., cultures). Moreover, attention is paid to the heterogeneity of the determination of both risk attitudes and economic welfare.

Although dealing with all causes of endogeneity in the relationship between risk attitudes and economic welfare might go beyond the scope of this study, it addresses the possibility of simultaneity bias that leads to the endogeneity problem. Even if a fixed-effects model is applied, the regressors in [Eq. \(2\)](#) can be correlated with a time constant error component, but they must be exogenous to past, 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 the 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 the 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 [Eq. \(1\)](#) and [Eq. \(2\)](#).

Explanatory variables such as sets of X<sub>1</sub>, X<sub>2</sub>, Z<sub>1</sub>, Z<sub>2</sub>, V, and G were assumed to be exogenous (determined outside of the model). The system considers the simultaneity of the variables of willingness to take risks (WTR) and economic welfare (W), which are interdependent and determined jointly.

Additionally, the system considers the mutual interaction between the equations. Therefore, for a given observation *i*, the errors of the 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  $E(u_2) = 0$ .

**Table 3**

Determinants of economic welfare (proxied by daily consumption per adult equivalent converted to natural logarithm).

VARIABLES	Majority (Obs = 1045)		Minorities (Obs = 500)	
	FE	HTAYLOR	FE	HTAYLOR
Age	0.072 *** [0.027]	0.034 ** [0.016]	0.097 ** [0.039]	0.027 [0.025]
Age square	-0.001 ** [0.0003]	-0.0004 *** [0.0002]	-0.0004 [0.0004]	-0.0002 [0.0003]
Married	-0.003 [0.115]	0.130 * [0.069]	0.336 *** [0.127]	0.251 *** [0.095]
Self-employed	-0.097 [0.064]	-0.065 [0.050]	0.245 [0.189]	0.159 [0.158]
WTR◆	0.005 [0.014]	0.001 [0.013]	-0.062 *** [0.023]	-0.057 *** [0.021]
WTR square	-0.001 [0.001]	-0.0001 [0.001]	0.006 ** [0.003]	0.006 *** [0.002]
Impairment	0.016 [0.037]	-0.013 [0.031]	-0.029 [0.058]	-0.053 [0.049]
Membership	0.003 [0.034]	0.011 [0.028]	-0.052 [0.059]	-0.020 [0.049]
Education (decision maker)†	0.067 * [0.036]	0.065 ** [0.028]	0.013 [0.088]	0.116 * [0.068]
Household size	-0.132 *** [0.021]	-0.116 *** [0.016]	-0.148 *** [0.029]	-0.105 *** [0.021]
Dependency ratio	0.135 ** [0.066]	0.179 *** [0.052]	0.378 ** [0.155]	0.347 *** [0.124]
Non-farm land [log]	-0.001 [0.003]	0.006 *** [0.002]	-0.005 [0.004]	0.004 [0.003]
Average member age	0.008 ** [0.003]	0.007 *** [0.002]	-0.008 [0.006]	-0.002 [0.004]
Average member education	0.027 *** [0.007]	0.037 *** [0.005]	0.024 [0.015]	0.052 *** [0.012]
Migrating members	-0.027 [0.022]	-0.028 [0.018]	-0.131 * [0.076]	-0.143 ** [0.064]
Literacy	0.032 * [0.019]	0.015 [0.014]	-0.007 [0.028]	-0.007 [0.022]
Self-employed members	0.054 [0.034]	0.080 *** [0.027]	-0.155 [0.137]	-0.011 [0.111]
Distance to town	-0.003 [0.003]	-0.002 [0.002]	0.001 [0.004]	-0.002 [0.002]
Water quality	-0.053 *** [0.013]	-0.052 *** [0.011]	0.0003 [0.022]	-0.002 [0.018]
Economic shocks	0.034 [0.025]	0.047 ** [0.022]	0.045 [0.040]	0.023 [0.034]
Agricultural shocks	-0.018 [0.018]	-0.032 ** [0.015]	0.004 [0.026]	-0.026 [0.021]
Socio. and demo. shocks	0.028 [0.020]	0.019 [0.017]	0.018 [0.033]	0.009 [0.028]
Stability	-0.0003 [0.002]	0.001 [0.001]	-0.009 ** [0.005]	-0.005 [0.004]
Road quality	-0.047 ** [0.019]	-0.045 *** [0.017]	0.047 [0.045]	0.054 [0.039]
Constant	-0.165 [0.705]	-57.108 *** [12.540]	-1.756 * [0.914]	-96.247 *** [22.514]
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, the calculations are the author's own.

The estimation was executed in two steps: in the first step, the predicted outcomes of each dependent and endogenous variable were calculated in a linear regression on all exogenous variables of the system. The calculated values were required to instrument the endogenous variables of the system. In the second step, the predicted outcomes of endogenous variables were used instead of actual outcomes in the full specification. The error terms of the two equations were correlated because it was possible that WTR and W reciprocally interacted within the system.

Three criteria need to be fulfilled for a consistent and efficient estimation when compared with the single-equation estimation method. First, the two equations are assumed to be jointly dependent, which proves the suitability of simultaneous estimation over the

single-equation estimation 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.

#### 4. Model results

We estimate risk attitude using Eq. (1) and economic welfare using Eq. (2); results are reported in Section 4.1. We focus on the ethnic gaps and the possible bias caused by endogeneity in Section 4.2, which aims to address this issue by applying the method of system equation estimation.

##### 4.1. Multivariate correlates of risk attitude

The results in Table 2 confirm most of our expectations on the correlates of the individual WTR aligning themselves with that of previous studies (in the parentheses). To specify, we found positive correlates of marital status (being married) and education (e.g., Dohmen et al., 2011; Donkers, Melenberg, & Van Soest, 2001; Hardeweg et al., 2013; Miyata, 2003). We also found that living in a household with a higher proportion of dependent members discourages risk-taking (Dohmen et al., 2011; Liebenehm & Waibel, 2014). Moreover, we observed that experience with socio-demographic shocks reduce the willingness to take risks (Gloede et al., 2015), while being optimistic about future welfare increases risk-taking (Dohmen et al., 2011; Hardeweg et al., 2013). In addition, we found that distance to the district's town is negatively correlated and being a member of a social or political organization is positively correlated with the willingness to take risks that suggests some significant relationship between social capital and risk attitude. Additionally, some time and geographic differences present.

More attention is paid to the coefficient of the ethnic variable (Kinh). Kinh people are more willing to take risks than their minority counterparts. However, we noted that this significance level becomes weaker when counting for more variables of household characteristics and personal attitudes toward health status (health impairment) and future welfare (optimism). A small change was found in the positive coefficient of house value, but the significance level remains relatively stable. One may think that these changes might be caused by the mediation of other factors such as education and consumption. We tested the interactions among ethnicity, education, and consumption but those interaction terms appeared insignificant.<sup>2</sup> We need to notice that, in this analysis, house value is used to represent the economic status of the household instead of consumption. As explained earlier in this study, if the interdependence between risk attitude and economic welfare exists, in this unidirectional regression method we might ignore the endogeneity bias. Since house value can present the economic status of the household but it is unlikely dependent on risk attitude of the household decision maker in short run. Not to mention that houses in rural areas of Vietnam are often inherited assets from generation to generation. Therefore, house value is suitable to be used in this analysis. In the bidirectional regression analysis, we will use the consumption per adult equivalent as a proxy to investigate the interaction between risk attitude and economic welfare.

##### 4.2. Determinants of economic welfare

The aim of Table 3 is to examine the validity of the proxy of household economic welfare, proxied by consumption per adult equivalent. It results basically confirm important significance from some determining variables, separately for ethnic majority (Kinh) and minority. The estimation of economic welfare using the specification from Eq. (2) is conducted using different regression models.<sup>3</sup>

In the results, in the sample of the ethnic majority (Kinh), we observed significant effects of several variables that explain economic welfare as expected. In particular, the following variables play important role in the Kinh household 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. However, the higher average age of the all household members is better for the household economic welfare. 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, equivalent to high school level. In addition, bigger household size disadvantages the household economic welfare, but the ratio between number of dependent members with total number of members increases the economic welfare proxied by consumption per adult equivalent. The average education of household members has positive impact on household economic welfare.

Also in Table 3, when comparing the results of the ethnic majority (Kinh) with those of the ethnic minorities, difference is found in the effects of some variables. Such as, the variable of age and its quadratic form turn insignificant in the analysis of the minorities.

<sup>2</sup> Result is available upon request

<sup>3</sup> Due to the large number of independent variables, a test of multicollinearity (VIF test) is applied on Eq. (2). Results of the tested are available upon request. 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 analyzing the impact of some individual time invariant variables.

**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 <sup>#</sup>			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
Ethnic 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 well-being			0.571 * **	0.107
Non-farm 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	-0.029 * **	0.009		
Road quality	-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	
R2	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, the calculations are the author's own.

Better infrastructure presented by the water supply and road quality<sup>4</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. Those findings are aligned with conclusions of previous studies (Imai et al., 2011a; Van De Walle & Gunewardena, 2001) which found different economic returns to similar characteristics between the majority (Kinh) and the minorities.

To sum up, the findings in Table 3 confirm the validity of the proxy of consumption per adult equivalent for household economic welfare. Furthermore, it also presents various determinants of economic welfare between the ethnic majority (Kinh) and the ethnic minority. Regarding the relationship between WTR and economic welfare, there are some signals of a complex relationship. In particular, among the ethnic minority, a inverted U-shape of WTR is presented. The relation is negative among the extremely risk-averse but turns positive among the more risk-taking among the ethnic minority households. 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 homogeneous 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 & 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.

#### 4.3. Simultaneous relationship between risk attitude and economic welfare

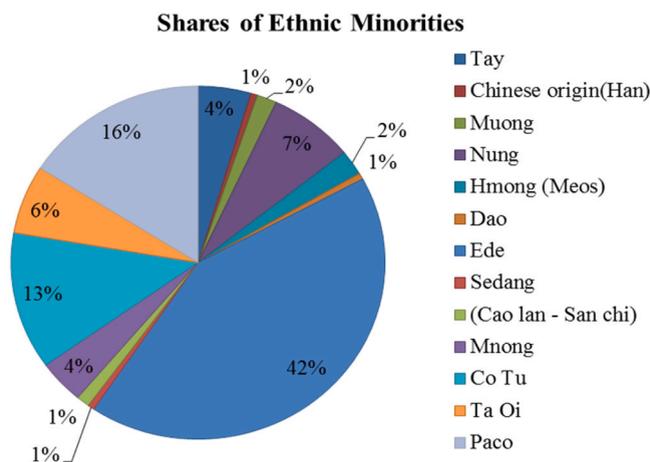
We simultaneously estimated economic welfare and risk attitude using Eq. (3) by applying the 3SLS regression for the full sample. Consumption indicator is proxy for economic welfare and risk attitude is measured by WTR (willingness to take risks). In the results

<sup>4</sup> These variables are measured by decreasing scales

**Table 5**  
3SLS estimates of economic welfare and risk attitudes, ethnic majority (Kinh).

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
Non-farm 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	

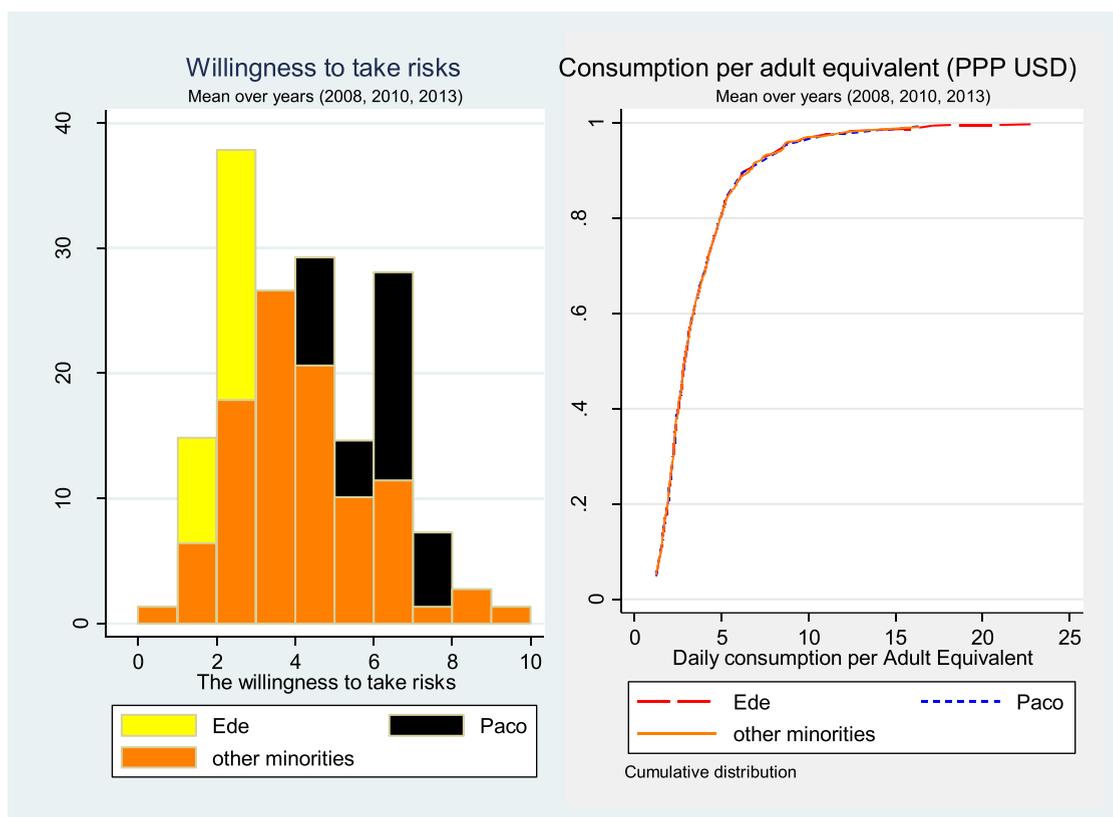
Notes: The Three Stage Least Squares estimates (3SLS). #: Log base ten.<sup>a</sup> (1) & (3): if household decision maker has higher education than high school, (2) & (4): number of schooling years of the household representative. <sup>b</sup>: (1) & (3): number of self-employed members in household, (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, the calculations are the author's own.



**Fig. 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 2008, 2010 and 2013 in Hue and Dak Lak, the calculations are the author's own.

presented in Table 4, almost all significant coefficients remain, compared with the single-equation estimations (Table 2 and Table 3). The directions of these coefficients stayed consistent; meanwhile, the magnitude changed significantly in comparison to the single-equation estimations. Indeed, taking note of the endogeneity caused by a mutual relationship between WTR and economic welfare influenced the coefficients of several variables considerably.

The results affirm a positive association between economic welfare (i.e., consumption per adult equivalent) and WTR. Ceteris paribus, stronger willingness to take risks improves economic conditions. The magnitude of this relationship (coefficient) is considerably stronger in comparison with the single-equation estimations (Table 3) at a higher significance level. An increase in WTR by 1 point improves economic welfare by 7%. This result suggests the direction of the causal relationship that stronger willingness to take



**Fig. 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, the calculations are the author's own.

risks strengthens economic welfare, but not the other way around.

The coefficient of ethnicity in correlation with economic welfare confirms the ethnic economic gap. A Kinh household's daily consumption per adult equivalent is almost 30% higher than its ethnic minority counterpart. This gap is relatively smaller than the one we found in the single-equation estimation (Table 4). However, there is no significant difference in WTR between the Kinh and ethnic minorities when endogeneity is accounted for, despite the observed difference in WTR between two groups (Table 2). The endogeneity between economic welfare and WTR might absorb the ethnic difference in WTR. Indeed, the observed variation in WTR between Kinh and minorities can be caused by the gap in economic welfare between the two groups. Altogether, this endogeneity could play some role in the ethnic gap. Therefore, some ethnic heterogeneity in this relationship can be expected when two groups are separately analyzed.

For an efficient and consistent simultaneous estimation, the Breusch-Pagan LM Diagonal Covariance test, the Hansen-Sargan test, and the System Heteroscedasticity tests were accounted for using standard test procedures. Firstly, 3SLS is obviously more appropriate than OLS estimation in doing the task (Lagrange Multiplier Test = 248.950). Secondly, the equation system is sufficiently over-identified to accept the null hypothesis that the exogenous variables of the system are qualified to instrument the endogeneity. Thirdly, the System Heteroscedasticity tests show the homoscedastic variance of each single equation and the heteroscedastic covariance of the system. Nevertheless, to assure the consistency of our estimation, we use bootstrap standard errors as suggested by (Cameron & Trivedi, 2009, p.166) that are close to robust standard errors. Compared with regressions without a bootstrap prefix, the results are fundamentally unchanged. Therefore, we report the results of the Three Stage Least Squares estimations with a bootstrap prefix (Tables 4 and 5).

Next, the two groups (Kinh and minorities) were separately analyzed with the same strategy applied to the full sample (Table 4). The results reported in Table 5 indicate a large-scale divergence between the two groups. The significant association between risk attitudes and economic welfare is rather strong among the Kinh, and conversely weak among the ethnic minorities. This difference suggests that WTR can trigger economic welfare among the Kinh; meanwhile, among ethnic minorities, risk attitudes depend on economic condition.

The results document divergent determinants of risk attitudes and economic welfare. First, this difference reveals to some extent the structural variation in economic welfare between the Kinh and ethnic minorities as shown in other studies (e.g., Imai, Gaiha & Kang, 2011a; Van de Walle & Gunewardena, 2001). The Kinh economically benefit from some socio-demographic characteristics. To specify, human capital such as the education of the household decision-maker improves the Kinh's economic welfare. Similarly, the

**Table A1**  
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 e.:<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.

self-employed activities of the members and non-farmland size positively predict their economic welfare. Furthermore, Kinh households benefit from their location and local infrastructure. In contrast, ethnic minorities are significantly vulnerable to socio-demographic characteristics. Female and unhealthy household decision-makers are significantly more likely found in less wealthy households. Secondly, concerning the determinants of WTR, we find that the WTR of the ethnic minorities is more vulnerable to socio-demographic shocks and their subjective attitudes. Moreover, their willingness to take risks significantly depends on economic circumstances as well as a significant time variant. Among the ethnic minority group, we do not find a significant relationship between the willingness to take risks and economic welfare (Table A1 in the Appendix). To sum up, a stronger positive association between WTR and economic welfare was found among the Kinh, but a rather weak association was found among ethnic minorities. Importantly, the direction of the causal relationship may differ between the two groups. Furthermore, there are largely divergent determinants of economic welfare and WTR between the Kinh and ethnic minorities.

## 5. Conclusions and policy implications

The present study examined the relationship between risk attitudes and economic welfare among ethnically diverse sample in rural areas in Thua Thien Hue and Dak Lak provinces in Central Vietnam. The risk attitude is measured by a experimentally validated survey question using the Eleven-point Likert scale and the consumption per adult equivalent proxies for the economic welfare. The author aims reveal how risk attitude and economic welfare are related and whether this relationship differentiates between the ethnic majority group (Kinh) and the ethnic minority including thirteen different ethnic identities. Both unidirectional and bidirectional regression approaches are used. Particularly, a simultaneous regression is employed to capture an interdependence between risk attitudes and economics welfare. The results show that the Kinh households are significantly wealthier. An average Kinh household has about 30% higher while being more willing to take risks than his minority counterpart. The major determinants of economic welfare confirm that the ethnic minority is less likely to benefit from their resources. At the same time, they are endowed with less resources so that it is understandable why their economic welfare is slowly being improved. In contrast, the living conditions are significantly beneficial to the ethnic majority. Launching an investigation of the relationship between the willingness to take risks and economic welfare, we suggest that the more willingness the ethnic majority give to take risks in decision-making, the better economic welfare they receive. This demonstrates that risky opportunities can help the Kinh households to improve their economic welfare. On the

contrary, it is not true for ethnic minority households because the impact of risk-taking on economic welfare is not linear and no mutual dependence between risk attitude and economic welfare is found. Especially for the extremely risk-averse ethnic minority, taking more risks seems to lead them to worse-off in welfare.

The above findings suggest several implications for policy makers. Development projects or social interventions can be applied to support the ethnic minorities should guide them to take good risks for better benefit as well as to avoid bad risks when needed. An insurance package against loss should be an ideal instrument in this case to ensure the poor minority to bravely make decisions involving risks. Additionally, assistance should be sent to the ethnic groups stemming from different cultures that deviate from the assumption of homo oeconomicus while doing business.

Further studies can apply the same methodology on other populations that share similarities or apply larger size of multiethnic samples to disaggregate into difference among ethnic minorities. Expected findings from these studies will contribute to both theory of the poor and to practice in rural development in multicultural populations.

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## Declaration of Competing Interest

I am hereby confirming that there is no conflict of interest in this research.

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## Appendix

See Figs. A1 and A2, Table A1.

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