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The Big Five model in rural Southeast Asia: Validation, stability, and its role in household income*

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Abstract

Objective: We investigate the applicability of the Big Five model in rural Southeast Asia and thereby challenge recent concerns about the validity of the model in developing countries.

Method: We use a novel data set on personality traits from rural Thailand and Vietnam ($N = 3811$ individuals). In our analysis, we (i) assess the factor structure of the data, (ii) test the internal consistency of the items, (iii) compare the traits across two consecutive survey waves, and (iv) employ regressions to demonstrate the economic relevance of the traits.

Results: The results demonstrate a five-factor structure that fits the Big Five model. We observe changes in personality traits over time but Cohen's *d* coefficients only range between 0.06 and 0.21. The average rank-order stability, measured by the test–retest correlation of the Big Five between the two consecutive waves, lies at 0.21. Individual changes in personality traits over time relate to experienced shocks and appear to be largely independent of age, gender, and education. We further find that openness and emotional stability positively correlate with rural incomes.

Conclusions: While there is skepticism, pertaining to the use of personality trait models in developing countries, our study demonstrates that their importance and usage cannot be rejected.

KEYWORDS

Big Five model, income determination, personality traits, Southeast Asia, TVSEP

1 | INTRODUCTION

The measurement of personality is a complex endeavor since context and sub-group characteristics can hamper the applicability of existing models. The standard measurement model of personality is the Big Five model by Costa and McCrae (1992) that defines personality along the five dimensions of openness, conscientiousness,

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extraversion, agreeableness, and emotional stability. This model has been widely used in the fields of psychology, economics, biomedical, and social sciences. Subsequently, personality traits have been found to be important predictors for decision-making and behavioral and economic outcomes.

The typology and measurement of this model were initially developed and tested mainly in industrialized countries, such as the United States, Canada, Germany, or Britain, among highly educated samples. Thus, these studies represent only a small fraction of the world's population. Therefore, it is not self-evident that the structure of this model and related implications regarding the connection between personality and behavioral as well as economic outcomes are universally applicable.

Research on the validity and comparison of personality measures across cultures shows that the Big Five model can be applied across cultures. For example, Thalmayer and Saucier (2014) use data from the World Views survey covering 33 countries to analyze cross-cultural differences in relation to the Big Five. However, the data from the World Views survey is limited to highly educated populations, in this case, students. Similarly, Benet-Martínez and John (1998) compare samples of US and Spanish college students with bilingual working-class Hispanics residing in the US. While the latter attempts to target a lower educated sample, the interviewed individuals migrated to the United States and speak Spanish and English well enough to answer both questionnaires. Even though they might not be college students, this still means they have a relatively high level of education.

The literature relating personality to economic outcomes in developing and emerging countries is scarce and mainly highlights problems of capturing personality in different contexts. For instance, Gurven et al. (2013) analyze data from a largely illiterate, indigenous society in Bolivia. They find only two personality factors instead of the usual five and show that personality structures can vary across societies. Studies by Schmitt et al. (2007), Ludeke and Larsen (2017), and Laajaj et al. (2019) provide aggregate insights on poverty from large multi-country assessments. The results reveal issues such as lack of internal consistency, wrong factor loadings, and measurement errors.

Highly educated populations differ from the remaining population in terms of their personality (Cooper et al., 2010) as well as socio-economic characteristics (Lupton, 2019). Therefore, in addition to comparing data for the subgroup of highly educated individuals, it is important to understand, if the personality measures also hold within and across cultures for a diverse population sample. More detailed lexical studies (e.g., Ashton et al., 2004; De Raad et al., 2014; Saucier et al., 2014; Thalmayer et al., 2020) on personality, however, show that not all traits are ubiquitous across cultures. Saucier et al. (2014) compare the concept of personality across nine different languages. Their results suggest that not all factors of personality are paramount across different cultures. Recently, Thalmayer et al. (2020) addressed this concern by analyzing the personality structure among herding societies in East and West Africa. While the analysis with regards to the measure of personality is comprehensive, it does not include aspects related to the stability over time. In addition, the studies do not cover any related economic outcomes. However, only few recent studies are using data that covers lesser-educated rural populations in developing or emerging countries (e.g., Gurven et al., 2013; Ludeke & Larsen, 2017).

Studies on the stability of personality traits and change of personality show that average levels of personality change across a person's lifespan (Kotov et al., 2010; Ozer & Benet-Martínez, 2006; Roberts et al., 2006). While some studies find personality traits to be somewhat stable in the short run, that is, for a time horizon of a few weeks or months (e.g., Gösling et al., 2003), results for longitudinal data are not as conclusive. A study by Costa and McCrea (1988) finds that personality traits change in younger adults and are mostly stable after the age of 30. However, Roberts and DelVecchio (2000) find an increase in trait stability until the age of 50. In addition, shocks and certain life events in particular can lead to a change in a person's personality traits (Cobb-Clark & Schurer, 2012; Soto et al., 2011). A study by Soto et al. (2011) with longitudinal data from the U.S. shows that shocks as well as changes in demographic factors can alter individual personality over time. Schäfer (2016), using longitudinal data from Germany, shows fairly large variations over a time horizon of 4 years. The experience of shocks explains only a small part of this variation. However, an analysis using long-term data from the Australian HILDA database demonstrates that personality traits are stable for working-age individuals over a 4-year time period and that individual changes are generally not related to shock experience (Cobb-Clark & Schurer, 2012).

Against this background, we analyze the validity of the Big Five model in a rural emerging country setting. Specifically, we explore the following research questions: (1) Does the Big Five structure typically found in richer countries among highly educated samples hold among relatively poorer and lower educated individuals in rural Southeast Asia; (2) Are the survey measures internally valid?; (3) Are personality traits stable over a 2-year time horizon? (4) What is the relation between personality traits and income?

Our sample comprises a set of poor rural households in Thailand and Vietnam. To date, there are only few data sets

available from developing and emerging countries, such as the data from the Skills Measurement Program (STEP) by the World Bank.[1] These data sets, like the STEP data, focus mostly on urban areas. However, in order to increase our understanding of the relationship between personality and its interaction with labor market requirements, reductions in inequality and poverty, it is vital to cover rural areas as well. In the context of low- and middle-income countries, the rural areas and their populations differ both in terms of the labor market conditions and the demographics. Labor markets in rural areas are characterized as labor intensive, credit constrained, and probe to greater earnings instability and misallocation of labor in the agricultural sectors (Banerjee & Duflo, 2007; Campbell, 2011; Campbell & Ahmed, 2012; Gollin et al., 2014). In addition, the population in rural areas in Thailand and Vietnam differs from its urban counterpart. While working-age adults migrate to the cities, the elderly, adults involved in agriculture or care-taking activities, and children stay back (Amare & Hohfeld, 2016; Nguyen et al., 2015). Results from previously conducted studies on personality in rural areas like Gurven et al. (2013) or across emerging countries like Laajaj et al. (2019) show that our understanding of personality might not hold across populations and cultures. Therefore, it is vital to deepen our understanding of how far the generally accepted personality model of the Big Five holds in various sub-contexts.

2 | MATERIALS AND METHOD

2.1 | Data

This study uses different data sets to analyze the validity and stability of the Big Five measure of personality traits for individuals in rural Southeast Asia (see Hardeweg et al., 2013). The main data are individual-level data from the Thailand and Vietnam Socio Economic Panel (TVSEP). Additionally, we use U.S. data from a community survey (see Goldberg, 1999) as a reference point for the TVSEP data.

2.1.1 | TVSEP data

The TVSEP is a panel survey that has been carried out since 2007 and regularly administers surveys among rural households in Thailand and Vietnam. Until now, eight waves have been conducted. The data were collected in three rural provinces in each country. In Thailand, these are the provinces of Buriram, Nakhon Panom and Ubon Ratchathani, and in Vietnam the data are gathered in the provinces of Thua Thien Hue, Ha Tinh, and Dak Lak. Figure A1 in the Appendix exhibits an overview of the survey region. The survey covers some 4400 households in 440 villages. The household sample in each province was randomly drawn based on a stratification process considering the heterogeneous agro-ecological conditions within the regions. Please refer to Hardeweg et al. (2013) for a detailed review of the sampling strategy.

In both countries, an almost identical household survey is applied. It consists of nine sections covering individual information on household members (e.g., age, education, health, and employment) as well as household-level information (such as household income, housing conditions, and experienced shocks). The TVSEP survey is carried-out via in-person interviews conducted by enumerators, who record answers electronically on a tablet.

In the 2017 TVSEP survey, an additional module comprising a personality inventory was included. These questions allow to study personality traits and their consequences on a large sample of individuals living in rural Thailand and Vietnam, and, to relate them to a rich set of socio-economic variables. The survey questions included in the TVSEP are based on the Big Five personality inventory questions, which are frequently used in micro surveys such as the German Socio Economic Panel (SOEP), the British Household Panel Survey (BHPS), the Household Income and Labor Dynamics in Australia (HILDA) survey or the U.S. micro surveys. The questions of personality traits were translated from the English version of the 15-item inventory scale. The translation was cross-checked with the available Vietnamese version of the Skills Measurement Program (STEP) questions developed by the World Bank.[2] For Thailand, there was no STEP survey available at the time of the survey design. The translated questions were pilot tested with English and Vietnamese or Thai speaking students prior to the survey and during the enumerator training in the field in both Vietnam and Thailand.

In the respective TVSEP questionnaire section, respondents are asked how much they agree with different statements about themselves. They rank their answers on a Likert scale ranging from 1 to 7, where 1 means "Does not apply to me at all" and 7 means "Applies to me perfectly" (see Figure A2 in the Appendix). Respondents are presented with 15 survey questions in total. Each factor is captured by three questions. Table A1 in the Appendix provides an overview of survey questions for each personality trait. The response rate to the personality questions is very high (99.95%), with only one missing case in Vietnam.

For the purpose of this study, we utilize data from 3811 individual respondents - 1913 Thai and 1898 Vietnamese, who answered the subsection on personality traits.[3] Table 1 provides some descriptive statistics for our sample.

TABLE 1 Descriptive statistics main sample.

Variable	Sample mean
Age (in years)	55
Gender (1 = female)	0.61
Married (1 = married)	0.78
Education (years of schooling)	6
Literacy (1 = literate)	0.93
Ethnicity (1 = Ethnic majority)	0. 88

Note: Calculations with TVSEP 2017 data. $N = 3811$. Table displays mean values for respective variables.

Respondents are on average 55 years old, 61% are female and 78% are married. They have an average education of 6 years and most respondents can read and write. The majority of respondents belongs to the ethnic majority of the respective country.

2.1.2 | Additional TVSEP data for stability testing

In Section 3.3, we test the stability of the data over time and compare TVSEP data from the years 2017 and 2019, waves 7 and 8, respectively. In 2019, data were collected in Thailand only. Therefore, comparison data for Vietnam are not available. The questions and answering scales are identical to the 2017 questionnaire and the survey again obtained a very high response for the personality trait questions, that is, only one missing case. The data set includes data on personality traits for all three Thai provinces. We identify 1105 households with the same respondent in 2017 and 2019. While the same households are interviewed for every TVSEP wave, the respondent within the household may vary over time, for example, if the household head is not available his or her spouse might answer the survey. We only include cases, where the respondent was the same in both years and therefore obtain a lower sample size. This reduced sample is used only in this specific section. Throughout the rest of the paper, we use the full data set from wave 7 (2017) for both countries.

2.1.3 | U.S. data

We test the external validity of our data set in Section 3.1. Therefore, we use a data set from the United States as a benchmark and compare the 2017 TVSEP data to this sample. The U.S. data display a high validity in terms of the Big Five model (Soto & John, 2009). They stem from a self-administered survey of 642 adults. The sample is balanced gender-wise and includes individuals from different ages. The data are frequently used as a benchmark in other studies (see e.g., Goldberg, 1999; Laajaj et al., 2019).

2.2 | Data approach

Items in all data sets are corrected for acquiescence bias prior to the analysis. Acquiescence is a common survey bias, where the respondent agrees or disagrees with a question irrespective of the content (Ferrando et al., 2004). For instance, in the TVSEP questionnaire, the questions "Do you see yourself as someone who does tasks efficiently?" and "Do you see yourself as someone who tends to be lazy?", capture conscientiousness. The second question is coded reversely. If an individual strongly agrees to both these questions, this contradiction indicates acquiescence bias (AB). This systematic error can affect the mean levels in item responding, factor structure and hence the overall validity of personality questionnaires (Danner et al., 2015; Rammstedt et al., 2017). Typically, to produce AB-corrected factors at least one of the questions measuring each factor is required to be reversed. The TVSEP questionnaire, as most short versions of the BFI, does not contain reversed questions for openness and agreeableness. Therefore, we estimate a correction for these items based on those items for which a reversed question is available. This method is also used in other scientific studies, and we specifically follow the instruction from Laajaj et al. (2019) to calculate our AB-corrected factors.

Since the U.S. data follow a different scale (i.e., the scale goes from 1 to 5) than the TVSEP data, we also standardize items from the 2017 TVSEP and the U.S. data for the principal component analysis in Section 3.1. The standardization is done after correcting for acquiescence bias.

To obtain the "traditional" Big Five traits, which we use in the analysis in Sections 3.1 and 3.4, we construct simple averages using the three questions for each respective trait.

2.3 | Methods

We use different methodologies to analyze the validity and stability of the Big Five and to generate insights into their role in household income, which are described in the following. The results in Section 3 are based on these described methods.

2.3.1 | External validity

In a first step, we assess the underlying structure of personality traits and the external validity of our survey

measures (Section 3.1). In particular, we (i) perform a Principal Component Analysis (PCA) and use a factor rotation against data from the United States to explore the underlying factor structure in our sample, (ii) analyze correlations between PCA factors and original Big Five factors, and (iii) compare averages for the resulting factors to other surveys.

First, we perform a PCA which uses the dependencies between the input variables to reduce the dimensionality and creates groups which are homogeneous within themselves and heterogeneous between each other (Backhaus et al., 2011). It is advantageous when data sets contain a large number of variables. We base the PCA on the 15 questions on personality traits administered to respondents in the household questionnaire (see Section 2). To conclude that the factor structure of the Big Five model can be applied to our sample, the PCA should produce five factors and the underlying 15 items should load on the expected factors based on the model by Costa and McCrae (1992) as shown in Figure A1. We therefore align the factor loadings with those in the U.S. data by means of Procrustes rotation.

The Procrustes rotation includes the following two rotation steps: (i) after the PCA of the target sample (in our case the U.S. data) an orthogonal rotation is performed to confirm the predetermined factor structure as much as possible, (ii) after the PCA in the application sample (in our case the Thai and Vietnamese data) the Procrustes rotation is applied meaning that the rotation is done in such a way as to maximize the similarity between the factor structure in the application toward the target data.

This rotation allows to retain the factor structure in our data that is closest to the factor structure apparent in the U.S. data. Since our aim is to assess the applicability of the Big Five model for the TVSEP survey as a whole, we report and interpret the results from the pooled sample. For results at the individual country level, please refer to Tables A3 and A4 in the Appendix. In addition to the PCA, we perform a Principal Axis Factor analysis (PAF) to rule out that this correlation-focused approach, which considers the shared covariance, yields different results. In order to check, whether the factor structure holds for different subgroups, the analysis is additionally carried out for different subgroups of the sample population: gender, age, and education. For gender, the sample is split into male and female population, for age into prime working age (25–50), middle-aged (51–65), and older age (66 and above), and into lower educated (education below the mean) and higher education (education above the mean).

Second, we calculate a simple form of the personality traits by taking the average across the three items per trait. Subsequently, we run a correlation analysis, to see how far these averages differ from the predicted factors produced from the PCA.

2.3.2 | Internal validity

In a second step, we calculate a series of psychometric indicators to document the internal validity and consistency of our survey measures (Section 3.2). These indicators include: (i) the within correlation that is the average correlation within the items belonging to one personality trait, (ii) the between correlation that is the average correlation between items of different personality traits, and (iii) the Cronbach's itemized alpha coefficient which tests for the internal consistency of scales across the survey questions and the personality traits.

A strictly positive correlation either in the within or the between correlation coefficient suggests that the indicator captures something that the tested items have in common rather than just noise. If the expected factor structure exists, the correlation within items belonging to one trait should be positive. Further, the correlation between items of different personality traits should be close to zero.

The Cronbach's itemized alpha coefficient (Cronbach, 1951) is one of the most widely used tests of internal consistency (Gösling et al., 2003). It tests the internal consistency of scales across the survey questions and across the five personality traits. The coefficient can take values between 0 and 1 and increases with higher correlation between the items of the same personality. We compute the psychometric indicators separately for Thailand and Vietnam as well as jointly for the whole database.

2.3.3 | Stability

In the third step (Section 3.3), we focus on assessing the stability of the traits over time. For this step, we use the reduced data set with 1105 observations from Thailand that includes data from two TVSEP waves (see Section 2.1). The first part of this analysis focuses on population indexes and uses various stability indicators. Ultimately, we run a multivariate regression to assess intra-individual consistency. In particular, we (i) calculate the rank-order consistency, (ii) analyze mean-level changes between the years by conducting a mean-level comparison across the two waves and analyzing changes in the distribution of the traits across waves, and (iii) analyze individual differences across time, that is, the intra-individual consistency.

First, rank-order consistency tests whether the relative placement of a person within a group is stable over time

(Roberts & DelVecchio, 2000). The rank-order consistency is typically assessed via the test–retest correlation. We follow this approach and provide results on the test–retest correlation for all five traits.

Second, we analyze mean-level changes and compare the means for the five traits across the two time periods. To analyze the statistical significance of the mean difference across the two waves, we perform a two-sided *t*-test and compute the reliable change index (RCI). The RCI is calculated as:

$$\frac{x_1 - x_2}{\sqrt{2 * \left(s * \sqrt{1 - rxx}\right)^2}} \quad (1)$$

where x_1 and x_2 denote the value of the variable means compared to each other, s is a measure of intrinsic variability of things being measured (standard deviation) and rxx is the reliability measure (in our case the Cronbach's alpha). The values are interpreted like standard z-scores, where values $>|1.96|$ are statistically significant. In addition, we calculate Cohen's d statistics to measure the size of the effect and analyze whether the differences are sub-group specific, for example, whether difference are more pronounced by gender, age, or education.

Additionally, we analyze whether any difference in the sample means reflects a change in the overall distribution of traits across waves, that is, we capture whether on average-specific traits increase or decrease over time (Cobb-Clark & Schurer, 2012; Coulacoglou & Saklofske, 2017; Specht et al., 2011). Therefore, we calculate the mean difference for various percentiles (as described in Formula 2 below, where p denotes the five personality traits) and visually analyze histograms of the five traits for the 2 survey years:

$$\delta^P = Trait^P_{2019} - Trait^P_{2017} \quad (2)$$

Fourth, we assess changes at the individual level, that is, changes in traits of each individual and analyze whether this change is related to a person's age, gender, or shock experience. We follow the approach by (Cobb-Clark & Schurer, 2012) and implement a simple OLS regression. The outcome variable represents the change in personality traits between 2017 and 2019. We take the difference between the two waves and construct a standardized measure that captures the change between the waves. Moreover, we construct domain-specific shock indicators, utilizing the TVSEP's comprehensive shock section from the 2019 wave. For the analysis, we classify all shocks that were reported in the 2019 wave to have happened between the two waves, that is, between 2017 and 2019, according to four domains: health, family, employment, and environment. The indicator takes the value of 1, if an individual has a shock experience >1 sample standard deviation. We run regressions for each of the five personality traits. The regression takes the following form:

$$Difference_t = \beta_0 + \beta_1 ShockDomain_i + X_i'\beta_2 + \varepsilon_i \quad (3)$$

where $Difference_i$ represents the difference between 2019 and 2017 by trait for individual i. $ShockDomain_i$ captures whether an individual experienced a shock by domain. The dummy variable equals one for individuals who have a shock experience >1 sample standard deviation. Finally, X_i is a vector of socio-economic control variables: age, education, gender, income, dummy indicating whether the respondent is married or not, dummy for whether the respondent is a farmer.

2.3.4 | Income analysis

In the final step (Section 3.4), we estimate the correlation between personality traits and income to test the relevance of these traits in our sample. We estimate the effects of the Big Five personality traits on log income per capita while controlling for individual and family characteristics.

First, we analyze the linear relationship between personality traits and income using data from the 2017 TVSEP sample. The income regression takes the following form:

$$\ln(I_{ir}) = \beta_0 + \beta_1 P_{ir} + \eta_1 IC_{ir} + \eta_2 FB_{ir} + \gamma_1 D_r + \mu_{ir} \quad (4)$$

where I_{ir} denotes the per capita income of individual i from district r. P_{ir} captures the effects of the five personality traits openness, conscientiousness, extraversion, agreeableness, and emotional stability. Control variables for individual characteristics (IC_{ir}), family background (FB_{ir}), and the district (D_r) are included.[4] We use bootstrapped standard errors clustered at the household level.

Second, as there may be concerns that evaluations at the mean level neglect heterogeneous effects across the income distribution (Koenker & Hallock, 2001; Yu & Lu, 2003). Studies show that estimation of heterogeneous effects of the Big Five personality along the income distribution can provide additional insights. For instance, Collischon (2020) finds that the importance of personality traits is higher for groups with higher earnings, whereas Eren and Ozbeklik (2013) and Nandi and Nicoletti (2014) find evidence for an opposite pattern. Therefore, we also execute a simultaneous-quartile regression which takes the following form:

$$Q(\ln(I_{ir}|\theta)) = \beta_0 + \beta_{1,\theta} P_{\mathrm{ir}} + \eta_{1,\theta} IC_{ir} + \eta_{2,\theta} FB_{ir} + \gamma_{1,\theta} D_r + \mu_{ir} \quad (5)$$

where θ denotes the θth conditional quantile of I_{ir}. We obtain and compare results for the 10th, 50th, and 90th percentiles to investigate heterogeneity along the income distribution. In addition, we control for same set of variables as described in Section 3. The results for the quartiles are computed simultaneously and take the variance–covariance matrix between the quartiles into account. Thus, the results can be compared across quartiles.

3 | RESULTS

3.1 | External validity

3.1.1 | Principal component analysis

We conduct a PCA to analyze the factor structure in our sample and test whether the proposed five-factor structure holds in the context of the TVSEP data. Factor loadings from the rotated and pooled PCA are shown in Table 2. Following Hair et al. (2009), only the factors with loadings >0.30, that is, meeting the minimum practical significance level, are interpreted. The results table as well as the Screeplot of Eigenvalues (see Figure A3) clearly show a five-factor structure for the rural TVSEP sample that is in line with the original Big Five model proposed by Costa and McCrae (1992). Almost all items load on the correct factor and the five factors are in congruence with the factors extracted for the U.S. data (see Table A2). Results from an additional PAF suggest that the same factors are retained as for the PCA (see Table A5). The values of the congruence coefficient suggest that overall the congruence between the factors retained from the target US data and retained from the TVSEP data is 0.86. For the individual factors, the congruence varies from 0.82 for factors 1 and 4 to 0.9 for factor 5. Hence, all five factors are replicated for the TVSEP data.

An exception is the item sociable that loads not only into the factor for extraversion, but also agreeableness. This indicates a small diversion from the original factors. However, minimal diversions in terms of factor loadings are not unusual. The five-factor structure also holds when we look at results by country. The five-factor structure is slightly more pronounced for Vietnam than for Thailand (Table 2).

3.1.2 | Analysis by subgroup

The PCA by subgroup reveals that the five-factor structure is not supported for all subgroups studied (see Table 3). While the factors openness, conscientiousness, and emotional stability can be confirmed for nearly all subgroups, extraversion, and agreeableness are not

TABLE 2 Rotated factor loadings TVSEP sample.

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
	Emotional stability	**Conscientiousness**	**Agreeableness**	**Extraversion**	**Openness**
New ideas	−0.047	0.255	−0.128	0.064	**0.495**
Artistic	0.222	−0.173	0.060	0.109	**0.454**
Active imagination	0.102	0.001	−0.037	−0.029	**0.625**
Work thoroughly	−0.029	**0.579**	−0.059	0.080	−0.038
Efficient	0.196	**0.491**	−0.102	0.079	0.023
Lazy (reversed)	0.094	**0.487**	0.168	−0.168	0.027
Talkative	0.017	0.001	−0.057	**0.480**	0.009
Sociable	0.054	−0.171	**0.302**	**0.347**	0.231
Reserved (reversed)	−0.244	0.094	−0.077	**0.668**	−0.057
Forgiving	0.023	0.044	**0.478**	0.171	−0.181
Kind	0.102	0.116	**0.446**	0.188	−0.107
Rude (reversed)	0.085	0.009	**0.599**	−0.171	0.129
Worries (reversed)	**0.547**	−0.176	−0.138	0.142	−0.108
Nervous (reversed)	**0.530**	0.000	−0.174	0.149	−0.146
Relaxed	**0.479**	0.082	0.026	−0.093	−0.075
Congruence coefficient	0.825	0.843	0.908	0.819	0.912

Note: Calculations with TVSEP 2017 data. Table displays results for the PCA with Procrustes rotation to the U.S. data. For the rotation, all data were corrected for acquiescence bias and standardized to ensure comparability. Values higher than 0.3 are highlighted in bold. Congruence coefficients were calculated against U.S. data from Table A2.

TABLE 3 PCA subgroup analysis.

	Emotional stability	Conscientiousness	Agree ableness	Extra version	Openness	Congruency coefficient	*N*
Male	Yes	Yes	Yes	–	Yes	0.806	1438
Female	Yes	–	Yes	Yes	Yes	0.753	2279
Age 25–35	Yes	–	Yes	–	–	0.520	142
Age 36–45	Yes	Yes	Yes	Yes	Yes	0.796	561
Age 46–55	Yes	Yes	Yes	Yes	Yes	0.812	1062
Age 56–65	–	Yes	–	–	Yes	0.529	933
Age 66 +	Yes		–	–	Yes	0.524	886
No formal education	Yes	Yes	Yes	Yes	Yes	0.842	200
Primary education	Yes	Yes	Yes	Yes	Yes	0.899	2045
Lower secondary education	Yes	Yes	Yes	Yes	Yes	0.821	869
Upper secondary education	–	Yes	–	Yes	Yes	0.555	406
Tertiary education	Yes	Yes	Yes	Yes	Yes	0.754	197

Note: Calculations with TVSEP 2017 data. Yes = factor loadings as expected. The congruence coefficients were calculated based on the data from Table A2.

TABLE 4 Psychometric indicators.

	No. of items	No. of observations	Within correlation	Between correlation	Cronbach's alpha*
All	15	3811	0.27	0.087	0.53
Thailand	15	1913	0.26	0.103	0.51
Vietnam	15	1898	0.27	0.082	0.52

Note: Calculations with TVSEP 2017 data. Table displays the results of the psychometric indicators. The * indicates values that are the average for the five character traits.

always clear in all subgroups. In particular, the factor agreeableness is not found among the male survey population and conscientiousness is not found among the female survey population. In both sub-groups only a four-factor structure prevails. In addition, the factor structure is also less pronounced for individuals ages 25 to 35 and individuals above 55 years. However, given the small sample sizes for some sub-groups, especially individuals aged 25–35, individuals without formal education, and individuals with higher education, results are likely not representative.

3.1.3 | Correlations between PCA factors and socio-economic characteristics

We dig further into concerns that the concept of the Big Five model holds better in higher-educated samples. Our previous analysis already revealed a strong five-factor structure for our rural relatively lower educated sample and among different education levels. However, we look at correlations between socio-economic variables and the resulting factors as shown in Table A6. We observe a low correlation between education levels and all five factors. We are therefore reassured that the Big Five model can be applied in the context of our rural Thai and Vietnamese sample with comparatively low education levels. To facilitate future analysis, we also assess the similarity between the factors obtained from the PCA and the Big Five (see Table A7). The results suggest a high correlation between the factors from the PCA and the Big Five created as averages based on the underlying questions.

3.2 | Internal consistency

3.2.1 | Within and between correlation

Table 4 provides the results for the within and between correlations. The results show that the within correlation is strictly positive and varies between 26% and 27%. The between correlation is significantly lower and ranges between 8% and 10%.

TABLE 5 Analyses of mean-level changes comparison of sample means and mean-level change.

	Panel A—Mean differences					Panel B—Distribution of difference				
	(1) Mean 2017	(2) Mean 2019	(3) Mean difference	(4) RCI	(5) Cohen's *d*	(7) Min	(8) 25th	(9) 50th	(10) 75th	(11) Max
Openness	4.21	3.96	−0.24***	−0.16	0.21	−5.71	−1.21	−0.27	0.75	6.23
Conscientiousness	5.54	5.44	−0.11**	−0.09	0.11	−4.79	−0.92	−0.08	0.67	4.10
Extraversion	4.38	4.26	−0.12**	−0.09	0.11	−4.73	−1.00	−0.10	0.73	4.04
Agreeableness	5.65	5.50	−0.16***	−0.13	0.17	−4.08	−0.98	−0.15	0.63	4.35
Emotional stability	4.82	4.74	−0.07	−0.06	0.06	−6.35	−0.96	−0.02	0.83	4.25

Note: Calculations with TVSEP data from 2017 and 2019. $N = 1105$. Panel A—First three columns show results for the sample means. ** and *** denote significance at the 5% and 1% levels. Column 3 displays results from the two-sided *t*-tests that compares the means from 2017 with those in 2019. This value also represents the mean level change. Column 4 displays the Reliable Change Indicator (RCI). In this indicator the standard error, which is usually used in a *t*-test, is replaced by the difference in the standard error of measurement. In this case the Cronbach's alpha is used as the measure of reliability of the variance measure. Values > |1.96| can be interpreted as capturing actual change. Column 5 displays results Cohen's *d* between 2017 and 2019. Panel B—Columns 6–11 show detailed results for the mean-level change.

3.2.2 | Cronbach's alpha

The overall results of the Cronbach's alpha coefficient for each factor are displayed in Table 4. The average reliability for the five factors for the whole sample is 0.53. The values per country are slightly lower. Table A9 in the Appendix displays detailed results per trait. The factors conscientiousness, agreeableness, and emotional stability display higher values of internal consistency, while the values for openness and extraversion are slightly lower.

3.3 | Stability

3.3.1 | Rank-order stability and mean-level change

Results for the rank-order stability are provided in Table A10. The average test–retest correlation across the traits lies at 0.21. Emotional stability has the highest correlation between waves with a value of 0.24, while openness has the lowest (0.16). The test–retest correlations are lower compared to other existing studies such as Zhang et al., 2022, McCrae et al., 2011 and Gösling et al., 2003. We attribute this to the time interval of 2 years between the test and retest in our study as well as the lower education-level of the sample.

Table 5 shows results for the mean-level change across the 2 years. The table is divided into two parts. Panel A (columns 1–5) shows results for the differences in means between the 2 years and Panel B (columns 6–11) shows the distribution of the differences. Results for the comparison of means across the 2 years, reveal a decrease in mean values between 2017 and 2019 for all traits (see column 3). The results indicate that while the differences in means are statistically significant according to the *t*-test, the differences are not significant when calculating the RCI (column 4). Additionally, Cohen's *d* (column 5) shows that the difference is negligible as it is equal to 0.2 (openness) or close to 0.1 standard deviation (conscientiousness, extraversion, agreeableness, emotional stability).

Panel B (columns 6–11) shows the changes along the distribution. We see that changes in specific personality traits are not normally distributed, that is, the median is not zero but in the range of −0.27 (openness) and −0.02 (emotional stability). All factors are less pronounced in 2019.

To analyze whether the changes are systematic in nature, we include superimposed histograms in the appendix (see Figures A4–A8). The graphs show that the distribution of the five factors differs across the 2 years. For some traits, respondents choose on average less extreme values, that is, conscientiousness and agreeableness. However, overall, there is no clear pattern visible with respect to changes in the distribution.

TABLE 6 Intra-individual consistency.

	Openness	Conscientiousness	Extraversion	Agreeableness	Emotional stability
Shocks	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Health (>1 Std)	−0.110	0.024	0.115	0.104	0.054
	(0.101)	(0.101)	(0.101)	(0.101)	(0.101)
Family (>1 Std)	0.133	0.063	0.106	0.141	−0.165
	(0.098)	(0.098)	(0.097)	(0.098)	(0.098)
Employment (>1 Std)	−0.044	−0.063	−0.169**	−0.098	−0.023
	(0.080)	(0.079)	(0.079)	(0.080)	(0.080)
Environment (>1 Std)	0.020	−0.186***	0.062	−0.098	−0.001
	(0.066)	(0.066)	(0.066)	(0.066)	(0.066)
Observations	1105	1105	1105	1105	1105

Note: Results for five OLS regressions with individual-level TVSEP 2017 and 2019 data, run separately for each factor. ** and *** denote significance at the 5% and 1% levels. Additional controls: gender, age, education, marital status, being a farmer, and income. Sample includes Thai respondents only because the 2019 survey wave was carried out exclusively in Thailand. The full results are reported in the Appendix in Table A14.

3.3.2 | Mean comparison for specific subgroups

To understand the sources of the differences in means across the 2 years mentioned above (Table 5, Panel A, columns 1–3), we compare sample means of personality traits in the 2 years by various socio-demographic variables. Results for the subgroup specific population mean comparison are displayed in Tables A11–A13. The two sided *t*-test shows that means for females, less educated individuals, and individuals above 66 years of age differ significantly. While these differences are statistically significant, the RCI indicates that the magnitude of the changes are not relevant.

This is supported by results from the Kolmogorov–Smirnov test which suggest that the distribution of mean-level changes are not systematic (refer to Table A14). The results are not significant across age groups. In case of gender, the only exception is agreeableness, where females have higher changes in mean values than males. For education, we note a significant difference in distribution of changes for openness as less educated individuals show lower changes in mean values. The findings are on average in line with Cobb-Clark and Schurer (2012).[5] Overall, the results suggest that the changes in personality traits between 2017 and 2019 are independent of age, gender, and education.

3.3.3 | Intra-individual consistency

Table 6 provides results from the OLS regressions, which analyze the intra-individual consistency in the presence of shocks (shocks related to health, family, employment, and environment) across the two waves for each trait. Overall, the results show some significant effects of adverse life events on individual changes in personality traits. Environmental and employment-related shocks are associated with changes in conscientiousness and extraversion. Individuals who experience one or more adverse events in these domains are less conscientious (−0.186 std.) and less extraverted (−0.169 std.). However, shock experience does not explain differences for all personality traits. In particular, differences in openness, agreeableness, and emotional stability do not relate to shock experience.

In terms of other control variables (see Table A14), we see that education does not play an important role in intra-individual consistency, that is, on average education does not affect changes in personality traits for all traits except agreeableness. This result is in line with the findings from the Kolmogorov–Smirnov test, which we described above.

3.4 | Personality and income

Table 7 presents the results for both the OLS and the simultaneous quartile regression. The ordinary least squares results (model 1) show that higher scores in openness and emotional stability are positively associated with income. For individuals who score one point higher on openness or emotional stability per capita income is about 2.6% and 4.6% higher, respectively. In contrast, conscientiousness, extraversion, and agreeableness are not related to income.

From the set of control variables, individual, and family background variables matter. In terms of individual characteristics, education is particularly important. One additional year of education increases the per capita

TABLE 7 Log income regression.

	OLS	10th Percentile	50th Percentile	90th Percentile
Variables	**(1)**	**(2)**	**(3)**	**(4)**
Openness	0.026**	−0.003	0.026	0.062***
	(0.013)	(0.025)	(0.017)	(0.022)
Conscientiousness	0.004	0.038	0.014	0.001
	(0.017)	(0.034)	(0.020)	(0.029)
Extraversion	0.017	−0.016	0.028	0.058***
	(0.014)	(0.029)	(0.016)	(0.022)
Agreeableness	−0.009	0.026	0.006	−0.066**
	(0.017)	(0.034)	(0.021)	(0.032)
Emotional stability	0.046***	0.041	0.036**	0.075***
	(0.014)	(0.025)	(0.016)	(0.022)
Age	0.050***	0.033**	0.046***	0.070***
	(0.007)	(0.014)	(0.008)	(0.011)
Age^2	−0.000***	−0.000**	−0.000***	−0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
Gender (1 = female)	−0.018	0.001	−0.030	−0.042
	(0.033)	(0.060)	(0.036)	(0.055)
Education (in years)	0.061***	0.061***	0.055***	0.063***
	(0.005)	(0.010)	(0.006)	(0.008)
Religious	−0.056	−0.022	−0.051	−0.056
	(0.042)	(0.091)	(0.057)	(0.070)
Ethnicity	0.383***	0.391***	0.369***	0.378***
	(0.057)	(0.133)	(0.083)	(0.097)
Married (1 = married)	0.079*	0.157**	0.093*	−0.011
	(0.043)	(0.072)	(0.049)	(0.069)
Household size	−0.095***	−0.106***	−0.087***	−0.104***
	(0.009)	(0.020)	(0.011)	(0.013)
Farmer	−0.071**	0.056	−0.075	−0.124
	(0.035)	(0.073)	(0.044)	(0.066)
Constant	8.733***	7.819***	8.799***	9.166***
	(0.267)	(0.575)	(0.289)	(0.406)
Observations	3744	3744	3744	3744
R^2	0.257	–	–	–

Note: Calculations with TVSEP 2017 data. ** and *** denote significance at the 5% and 1% levels. Bootstrapped standard errors with 400 repetitions and clustered at household level are in parentheses. The regression controls for district fixed effects. The number of observations is lower than in the original sample, due to missing values in the income variable.

income by 6.1%. In terms of magnitude, we observe that education plays a larger role compared to the Big Five personality traits when looking at overall income levels. In terms of family background, ethnicity, and household size matter. On the one hand, belonging to the ethnic majority is positively correlated with income. On the other hand, household size is negatively related to income.

With regard to differences across the income distribution, the results suggest that the effect of the Big Five personality traits differs along the distribution (columns 2–4). In the 10th percentile, none of the traits is relevant for income. Education, ethnicity, and household size, however, display similar effects in terms of sign, significance, and magnitude compared to the OLS. In contrast, openness, and emotional stability show significant and positive effects on income for those at the 90th percentile. In addition, agreeableness has a negative effect on income in the 90th percentile. This shows that the effect

TABLE 8 Comparison between TVSEP and other surveys.

Trait	Thailand (TVSEP)	Vietnam (TVSEP)	Germany (SOEP)	Australia (HILDA)	United States
Openness	4.60	4.04	4.49	4.24	5.38
	(1.26)	(1.37)	(1.17)	(1.05)	(1.10)
Conscientiousness	5.66	5.79	5.93	5.15	5.73
	(1.01)	(0.89)	(0.87)	(1.01)	(1.02)
Extraversion	4.48	4.55	4.82	4.40	4.53
	(1.05)	(1.09)	(1.13)	(1.09)	(1.34)
Agreeableness	5.76	5.89	5.35	5.40	5.76
	(0.96)	(0.89)	(0.97)	(0.89)	(1.06)
Emotional stability	4.69	3.59	4.16	5.20	4.67
	(1.12)	(1.08)	(1.21)	(1.05)	(1.46)

Note: Thailand and Vietnam means are calculated by authors based on TVSEP 2017 data ($N_{TH} = 1913$, $N_{VN} = 1898$). German SOEP means are taken from Schäfer (2016) ($N = 17{,}028$). Australian HILDA means are taken from Cobb-Clark and Schurer (2012) ($N = 6104$). The U.S. data are the same that we use before and were rescaled to fit a scale that is comparable to the other data sets ($N = 642$).

of personality traits is most pronounced at the top of the income distribution. However, conscientiousness is not significant for income at any point along the distribution. Thus, we conclude that while the Big Five is important for income in our sample, there are differential effects along the income distribution. Across the distribution, however, education clearly has a larger effect on income compared to personality traits. Finally, the importance of personality traits increases across the income distribution.

4 | DISCUSSION

4.1 | External validity

The results from our PCA analysis are in contrast to the results from a study by Laajaj et al. (2019). In their multi-country analysis, they highlight doubts regarding the applicability of the Big Five model in the larger World Bank STEP survey. They find substantial problems with factor loadings in their urban sample, especially in the case of conscientiousness. We do not find such issues with respect to the factor conscientiousness or the other factors, and rather observe a clear five-factor structure with only one minor alteration for the factor agreeableness. Therefore, we conclude that the Big Five model can be applied for our overall sample from rural Southeast Asia.

However, the analysis of the sub-groups shows that for the male and female sub-group only four factors are found. Similarly, the sub-sample analysis for younger adults (25–35 years old) and elderly (above 55 years) does not reveal a five-factor structure. For individuals with secondary or tertiary education the five-factor structure can also not be confirmed. Yet, the sample size for these groups is rather small and therefore the resulting factor structure might be misleading. The main reasons why this sample is not representative of sub-groups are: (i) the sampling was performed at the household level and the main aim of the survey was to target poor rural households—therefore no stratification at any sub-group level was performed; (ii) the survey, including the section on personality traits, is only administered to one respondent within the household, that is, the household head or his/her spouse in most cases - with heads of households typically being middle-aged adults, and therefore, younger adults and elderly are underrepresented in the sample; (iii) the sampling did not take the education status of the household or the surveyed individual into account when performing the sampling—given that poor rural households were the target, upper secondary or higher education degrees are comparatively rare in this population. Therefore, the sample is not suited to perform a dedicated and meaningful sub-group analysis. However, we wanted to explore, if any differences with regards to sub-groups are visible, despite the limitations.

The data appears to be suitable to study personality traits for the overall sample. However, given the scope of the data collection and the representation of different sub-groups within the sample, it is not well suited to perform a sub-sample analysis that goes into very detailed age groups or separating individuals by educational degree.

4.1.1 | Comparison with other surveys

In an additional exercise, we compare mean values from our data set with data collected under various surveys in industrialized countries, namely—the German Socio-Economic

Panel (SOEP), the Australian Household Income and Labor Dynamics in Australia (HILDA), and the U.S. data mentioned in Section 2. This provides perspective on the distribution of traits in different country contexts.[6]

Table 8 shows considerable heterogeneity across countries. For instance, mean values for agreeableness are slightly higher for Thailand and Vietnam compared to their Western counterparts. Schmitt et al. (2007) also report similar findings for Southeast Asians.

Additionally, the rural population in Thailand reports one of the highest levels of openness, after the American sample. Germans are more conscientious than all other country samples. On average, rural Thais and Vietnamese tend to be less extroverted and score highest on agreeableness, when compared to samples from industrialized countries. With respect to emotional stability, we see that the Vietnamese score lowest on average, with Thais scoring just between Germans and Australians.

4.2 | Internal consistency

Ludeke and Larsen (2017) analyze Big Five data from the World Value Survey and highlight severe problems in terms of the within the correlation of factors for samples from "non-WEIRD" countries. Negative within correlations are observed as frequently as positive, which results in within correlations being clustered around zero. We do not observe this in our data set and find only strictly positive within correlations. However, we acknowledge that other studies using data from developing countries such as Laajaj et al. (2019) report higher within correlations. Still, the between correlation in our data shows very little correlation across items belonging to different factors.

Results for Cronbach's Alpha are similar to that of other Big Five surveys using the short version of 15 questions. Dehne and Schupp (2007), for example, validate Big Five data from the German Socio Economic Panel (SOEP) and observe Alpha values between 0.51 and 0.66. Laajaj et al. (2019) examine data from the World Bank STEP survey, which also includes data for Vietnam. The values for the acquiescence bias-corrected factors for Vietnam range between 0.30 and 0.51.

Having assessed the between and within correlation as well as the Cronbach's Alpha, the data appear to be internally valid for the purpose of this study.

4.3 | Stability

Given that the TVSEP has collected data on personality traits in two consecutive waves (2017 and 2019) in Thailand, we test the stability of personality in our data set to allow for better understanding of the structure of the Big Five data. Thereby, we also contribute to existing empirical evidence on the stability of the Big Five in large long-term household panels, and the stability of the Big Five in developing and emerging countries within a rural sample.

The results on stability over time suggest, that the personality traits in our sample are fairly stable. However, the differences in mean values are slightly higher than values observed in studies from industrialized countries (Almlund et al., 2011; Cobb-Clark & Schurer, 2012).

The analysis of intra-individual consistency reveals that intra-individual consistency is not solely driven by shocks or other observables and can only partly be explained by these variables. This is in line with a study by Schäfer (2016), who analyses longitudinal data from Germany and finds similar results in terms of intra-individual consistency. Given that the time horizon between the TVSEP waves is 2 years, other unobserved factors or even measurement errors might explain the gap. However, we cannot establish any causal explanation.

4.4 | Personality and income

Personality traits have been identified as important predictors of income in the literature (Nyhus & Pons, 2005; Piatek & Pinger, 2010; Wells et al., 2016). However, evidence using data from developing countries has been lacking, with some exceptions (Attanasio et al., 2015; Bühler et al., 2020; Gertler et al., 2014; Laajaj et al., 2019).

While our results are in line with other studies from developing countries (Laajaj et al., 2019), conscientiousness is usually an important factor in western educated sample populations. Given that we are analyzing data from rural emerging economies, we believe that this might be due to the specificities of rural labor markets. For a more detailed analysis of the role of non-cognitive skills for occupations and earnings see our related paper Bühler et al. (2020).

Our results further suggest that personality traits are more important for higher-income quartiles. This is in line with previous findings from western, educated samples, where returns to personality traits are higher for higher-wage groups (Collischon, 2020). In comparison to those results, however, personality traits are not significantly related to income for lower-income quartiles. Considering the composition of our sample, this seems reasonable as the majority of households in our sample are engaged in subsistence farming or agricultural production (Bühler et al., 2020). These households typically are among the lower- to medium-income households in our sample. In

agricultural production, returns from personality traits are different, compared to white collar jobs. For example, Qian et al. (2020) find that openness is important in determining the likelihood for smallholder farmers to participate in the land rental market. Personality traits also affect decisions regarding adoption of new crop or harvesting technology (Ali et al., 2017). However, weather, soil fertility, and market prices remain major factors in determining the income from farming and personality traits play only a marginal role.

4.5 | Limitations of the study

There are several limitations to this study. The limitations can be roughly divided into three groups: (i) related to the study set-up; (ii) related to the set-up of the personality section, and (iii) related to the statistical analysis.

Regarding the study set-up, there are two main limitations: First, the initial survey was not designed to include a section on personality traits. The subsection was only introduced in 2017. While data on households and individuals in the sample has been collected since 2007, information on personality traits is only available from 2017 onwards. Second, the initial sampling for this study was conducted at the household and not at the individual level. Questions on personality traits, however, are only administered to the respondent, that is, the household head or his/her spouse in most cases. Therefore, the sample of individuals who answered to the personality traits section is not representative of the overall sample population.

Regarding the set-up of the personality section, there are three limitations: First, given budget limitations and keeping a balance between the number of questions asked and the richness of the data set, only the 15 item-inventory scale was included in the survey. In order to test different types of models and to analyze personality in more depth, the full Big Five Inventory (BFI with 44 items would have been advantageous). However, evidence suggests a strong correlation between reduced and full versions of the BFI (Donnellan & Lucas, 2008). Second, the survey was administered by enumerators. Ideally, the Big Five Inventory is a self-administered survey. However, there are several reasons, why the survey as a whole was conducted by enumerators: (a) given the sample is composed of poor rural households not all respondents are literate enough to read complex questions (esp. true for questions related to income and agricultural production); (b) similarly, administering the survey via e-Mail or another online tool would equally not work with all respondents, since not everyone has an e-mail account or access to the internet; (c) drop-out rates of self-administered questionnaires are typically higher compared to surveys administered by enumerators; (d) administering the sub-survey on personality traits in different modes would have increased the complexity of data preparation and cleaning. Third, as the sampling was performed in 2007, individual characteristics that might have been interesting with regards to a sub-group analysis for personality were not taken into account.

Finally, there is one limitation related to the statistical analysis in this study. The results of the PCA relate to the U.S. data used. While this particular U.S. data set has been used as a comparison in other studies, it would have been interesting to compare our data to other data from Asia. However, we did not have access to such a data set.

5 | CONCLUSION

This paper analyses the applicability of the Big Five model outside the setting in which it was initially developed. We use a novel data set from rural Thailand and Vietnam on 3811 individuals where measures of personality traits were newly introduced in the survey in 2017. In order to answer our three research questions, we (i) analyze indicators of external and internal validity of the Big Five measures in the context of this new data set; (ii) examine the stability of the personality traits over time; (iii) address the economic relevance of personality traits by investigating their importance in relation to income.

The rotated PCA and the scree plot reveal a clear five-factor structure and establish the external validity of our data. Almost all groups of input variables load on the expected traits. We also find high correlations between the factors obtained from the PCA and the factors created using weighted averages of items according to the common Big Five structure. Further results from the internal consistency assessment (within correlation, between correlation, and Cronbach's alpha) confirm the validity of the measures.

We test the stability of the Big Five to get further insights into the structure of the data over time. The comparison of population means as well as intra-individual changes in personality traits over time indicate some differences. However, the analysis does not reveal subgroup-specific patterns. Further, intra-individual changes are partly driven by shocks experienced.

In a next step, we analyze the role of personality traits for rural households' income. Our regression results reveal a strong positive relation between the factors of openness and emotional stability, and income. Higher levels of openness and emotional stability are associated with higher income levels. Effects differ along the income distribution with no significant effects of personality traits

for the poorest and more significant effects for the richest 10% of households. Across the income distribution, the effect of education on income is higher compared to the effect from any trait. Therewith, our results highlight that the relevance of personality traits is context specific.

Overall, this paper provides insights into the applicability of the Big Five model outside of the original scope of the model, that is, in rural Southeast Asia. Thereby, we add valuable micro-level insights into the applicability and stability of the Big Five model. The analysis further demonstrates the context-specific nature of the relationship between personality traits and income. Since the majority of the world's poor are based in rural regions, our study highlights the need for more context specific studies from these countries to improve the understanding of the personality concept and its implications for behavioral and economic outcomes.

AUTHOR CONTRIBUTIONS

All authors contributed equally to the ideas of the paper, and to writing and editing it.

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ETHICS STATEMENT

This research uses data that were collected via a DFG-funded research project. The data collected within that project adhere to DFG ethics regulations.

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ENDNOTES

[1] The STEP survey targets adults in urban areas. The 15 items used in the STEP survey differ slightly from the 15 items we use. Our 15 items follow the items used in European household surveys.

[2] World Bank's Skills towards Employment and Productivity database, see https://step.worldbank.org/.

[3] The sample is slightly smaller than the original TVSEP sample due to survey attrition as well as non-responses. No other restrictions were applied to the sample.

[4] Individual characteristics: age, age^2, gender, marital status, years of education, being religious; Family background: household size, farmer (1 = household is engaged in farming), ethnicity (1 = household is a member of the major ethnic group).

[5] Cobb-Clark and Schurer (2012) find significant differences in distribution of mean-level change only in the case of agreeableness for females. In regard to age, they find very small differences in distribution of mean-level changes across conscientiousness and openness. They do not include education as a factor in this exercise.

[6] The SOEP and HILDA surveys use identical questions and scales to capture the Big Five. Therefore, a direct comparison is possible. In terms of the U.S. data, we adjusted the scale to fit the other scales, because it is originally scaled from 1 to 5 and the other surveys are measured on a 7-point Likert-scale.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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