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Households' vulnerability from trade in Vietnam

Emiliano Magrini [a], Pierluigi Montalbano [b,c,*], L. Alan Winters [c,d,e,f]

[a] Agricultural Development Economics Division, Food and Agriculture Organization of the United Nations, Rome, Italy
[b] Department of Economics and Social Sciences, Sapienza University of Rome, Italy
[c] Department of Economics, University of Sussex, United Kingdom
[d] Centre for Economic Policy Research, London, United Kingdom
[e] Institute for the Study of Labor, Germany
[f] Global Development Network, India

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ABSTRACT

This paper assesses vulnerability from trade in Vietnam by presenting an extended version of Ligon and Schechter's (2003) Vulnerability as low Expected Utility (VEU) measure. It uses the Vietnam Household Living Standard Surveys (VHLSS) panel data covering the period 2002–06. The empirical results show that risk-induced vulnerability and heterogeneity in trade exposure matter in determining household overall vulnerability and that this is not linked to the actual manifestation of shocks. Although it does not represent, by any means, an argument against free trade, this work is relevant for policymaking since it contributes to deepen our knowledge on the subtle links between trade openness and vulnerability and informs us about suitable instruments to accompany it.

1. Introduction

Vietnam is seen as the success story of trade liberalisation. Over the first ten years after the adoption of the "Doi Moi" (renovation), a combination of stabilization, liberalisation and structural reforms, the annual average growth rate of Vietnam's merchandise exports boomed at 25 per cent (1986–1996), and it fell only to 18.5 per cent in the subsequent decade (1996–2006). An extensive empirical literature highlights the importance of this trade surge on the Vietnamese economy, identifying the positive correlations between trade liberalisation, growth and poverty reduction (Irvin, 1997; Fritzen, 2002; Jenkins, 2004; Nadvi et al., 2004; van de Walle & Cratty, 2004; Jensen & Tarp, 2005; Nguyen & Ezaki, 2005; Fujii & Roland-Holst, 2008; Niimi, Dutta, & Winters, 2007; Abbott, Bentzen, & Tarp, 2009; Heo & Doanh, 2009; Coello, Fall, & Suwa-Eisenmann, 2010; Hoang, Pham, & Ulubaşoğlu, 2016).[1]

The growth of average income is obviously hugely important to economic welfare, but even for an individual household it is not the only thing that matters. A key unanswered question is thus: did trade liberalization magnify households' exposure to risk, offsetting some of the benefits of the increase in average income, or even raising vulnerability to poverty? This topic, which essentially entails moving the discussion of trade liberalization beyond

[1] Critics highlight the relatively high concentration of poor households near the poverty line during the 1990s as a likely explanation for the pro-poor nature of growth in Vietnam. They also highlight the persistence of a high poverty gap in rural areas, in the Northern Mountain and the inland Central Highland regions as well as increased inequality throughout the country, resulting in an extensive urban-rural division, with the richest 20 per cent of the population living in urban areas (Heo and Doanh, 2009). Furthermore, trade openness seems to have promoted a distributional impact within the rice sector too, further penalizing the poorer small net producers (Coello et al., 2010). Last but not least, 80 per cent of the poor are still living (and working) in rural areas.

* Corresponding author at: Department of Economics and Social Sciences, Sapienza University of Rome, P.le A. Moro, 5, 00185 Rome, Italy and Department of Economics, University of Sussex, Jubilee Building, Falmer, Brighton BN1 9SN, United Kingdom.

E-mail addresses: Emiliano.Magrini@fao.org (E. Magrini), pierluigi.montalbano@uniroma1.it, p.montalbano@sussex.ac.uk (P. Montalbano), l.a.winters@sussex.ac.uk (L.A. Winters).

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the first moment of incomes to include the second, is currently hotly debated; it is also at the heart of the global trade negotiations on special safeguard mechanisms to protect farmers from excessive price volatility. Despite the importance of households' vulnerability in a multidisciplinary perspective and the strong policy imperative of targeting people at risk of future poverty, the empirical evidence about vulnerability from trade is mixed, scattered in separate fields of analysis and does not reach a common stance (Montalbano, 2011). This results from both the lack of suitable panel data and the complexity of the task of assessing ex-ante risks (Klasen & Waibel, 2016). A seminal account of risk and trade liberalization is Newbery and Stiglitz (1984), which shows that trade may actually be welfare decreasing in the absence of insurance. More recently, Allen and Atkin (2016) demonstrates how falling trade costs can affect farmers' revenue volatility and thus their crop allocation in a portfolio choice framework where returns are determined in general equilibrium in a many-location, many-good Ricardian trade model with flexible trade costs. In this paper, we focus on Vietnam where notwithstanding the impressive fall of poverty after Doi Moi, some scholars have argued that poor Vietnamese households remain more vulnerable to market risks that come with trade openness (Guha-Khasnobis, Acharya, & Davis, 2007) and to international price shocks (Jensen & Tarp, 2005).

Our aim is to shed light on this issue by looking at the innermost source of vulnerability induced by trade, which is neither directly observable nor linked to the actual manifestation of shocks. We show that trade exposure and its related risks matter in determining household vulnerability even in the absence of actual negative shocks. This because risk averse people react to the existence of risk (e.g., the possibility of the disruption of their livelihoods arising from trade reforms) by modifying their behavior independently of whether they actually experience such shocks or not (e.g., by undertaking precautionary saving and reducing current consumption). To assess vulnerability from trade we use a workable empirical identification strategy which focuses on the presence of heterogeneity in vulnerability scores across clusters of households classified by trade exposure, which, in turn, implies heterogeneity in their risk exposure and/or their mitigating strategies. Specifically, we present two innovations. First, an extended version of Ligon and Schechter's (2003) measure of Vulnerability as low Expected Utility (VEU) which can isolate the component of risk-exposure associated with trade openness (i.e., risks that are not fully shared across trade-related industries) and identify the ex-ante effects of risk from the ex-post effects of shocks. Second, we provide an empirical application of the proposed "extended measure" by exploiting the Vietnam Household Living Standard Surveys (VHLSS) panel data for the period 2002–06.

Obviously our precise results are conditional on the sample we have used, but we believe that our findings offer generalizable insights. Our sample period is not unrepresentative: it comes after *Doi Moi* but before the WTO accession in January 2007 and the food price spikes of the 2007–08 period,[2] and the price fluctuations it contains were relatively low from a long-run perspective (see Table A.1 in Appendix A). On the other hand, the availability of panel data at the household level provides a golden opportunity to test our hypothesis, because it allows us to control for time invariant confounders and additional noise, something that is not possible to replicate in any other period in Vietnam.[3]

Our results show that trade exposure and its related risks matter in determining household overall vulnerability. Notwithstanding that each household is subject to trade risk, by controlling for a full set of household and trade fixed effects, we demonstrate the presence of heterogeneity across households clustered in different industry groups defined by trade exposure. These differences could reflect either or both of differences in the nature of foreign and domestic risks and differences in mitigating strategies. We note that vulnerabilities could spill over from one cluster of households (industries) to another – for example via community effects – but these work against our identification strategy and would serve to reduce observed heterogeneities. Thus the fact that we do observe such heterogeneities suggests strongly that they do actually exist.

The empirical evidence that there may be trade-induced vulnerabilities has strong policy implications. Although it does not represent, by any means, an argument against free trade, it does deepen our knowledge of the welfare effects of trade reform and inform us about suitable instruments to accompany it. In this respect, we believe that governments should invest more on helping vulnerable households to carry out ex-ante progressive choices and take full advantage of the trade reforms through the support of targeted packages such as favoring savings, ensuring that credit markets serve the poor and developing tailor-made insurance schemes, especially for farmers involved in tradable crops. At the same time, we suggest investing fewer resources on ex-post price stabilization policies because these distort market functioning and cannot eliminate the vulnerability that occurs even when fluctuations are relatively weak.

The paper is organized as follows: Section 2 presents the conceptual framework on trade and vulnerability to poverty; Section 3 provides the details on our measure of vulnerability; Section 4 presents the empirical model; Section 5 provides details on data; Section 6 presents the empirical results; Section 7 some robustness checks; Section 8 concludes.

2. Trade and vulnerability to poverty: The conceptual framework

The seminal paper of Newbery and Stiglitz (1984), about the negative welfare impacts of trade in the absence of insurance has been followed by a systematic exploration of the links between macro-economic volatility and trade (see, inter alia, Easterly et al., 2001; di Giovanni & Levchenko, 2009; Karabay & McLaren, 2010; Lee, 2014). However, the above analyses generally overlooked the possible impacts of the liberalization process on households' exposure to risk (Montalbano, 2011). A relevant exception in this respect is Allen and Atkin (2016) who explore – both analytically and quantitatively – the second moment effects of trade on Indian farmers using forty years of agricultural micro-data. They demonstrate that when households are risk averse and financial markets incomplete – as is the often case in developing countries – the interaction between trade and volatility may have important welfare implications.

According to the theory (Kimball, 1990; Caballero, 1990; Deaton, 1992; Carroll, 2001; Carroll & Kimball, 2008), risk-averse

[2] Völker, Tongruksawattana, Schmidt and Waibel (2016) analyze the impact of the 2008 food price crisis on vulnerability to poverty of rural households in Thailand and Vietnam. The authors find that Vietnamese households in remote locations with poor market access actually increased their vulnerability to poverty in 2008 mainly because of households' need to purchase higher prices rice and their limited ability to adjust their agricultural portfolio. They apply a methodology based on a mathematical risk programming approach applied to two typical agricultural households in Thailand and Vietnam.

[3] The VHLSS collected information of 29,530 households in 2002; 9188 in 2004; 9189 in 2006. These surveys were conducted by the General Statistics Office (GSO) of Viet Nam with technical assistance from the World Bank. VHLSSs are conducted every two years. The latest survey was released in 2014. Unfortunately, no panel data are available between the VHLSS 2006 and the VHLSS 2008. Moreover, the VHLSSs for 2010 and 2012 used a new sample frame (from the 2009 Population and Housing Census).

people react to risk by modifying their behavior. Specifically, by undertaking additional (precautionary) saving and reducing current consumption. This implies a smooth path of consumption that is lower than if the same average income were available with certainty and thus produces permanent negative effects on household welfare. This is particularly true for people characterized by a poor ability to take advantage of the positive opportunities linked to trade reforms and weak mitigating strategies. In the midst of trade reform, they carry out extra/unproductive saving and follow conservative choices shying away from profitable but risky investments (Winters, McCulloch, & McKay, 2004). This is the innermost source of vulnerability induced by trade. It is neither directly observable nor linked to the actual manifestation of shocks. Moreover, it also implies that mean consumption reflects the negative impact of risks. Thus, mean consumption cannot be used as a riskless counterfactual. As a result, current vulnerability measures tend to underestimate the overall impact of risk on consumption, leading to downward biased estimates of the overall effect of risk on welfare (Elbers & Gunning, 2003).

In principle, trade can magnify risks in two ways: by changing the riskiness of existing activities, for instance by altering the weight of foreign relative to domestic shocks faced by the economy; or by changing the emphasis among the different activities households engage in such as, for example, switching from subsistence food crops to cash crops (McCulloch, Winters, & Cirera, 2001) or to crops with less volatile yields (Allen & Atkin, 2016). In this latter case, reductions in trade costs reduce the elasticity of local prices to local quantities thereby raising revenue volatility for farmers causing them to move into crops with higher mean (a first moment effect) and less risky yields (a second moment effect). Hence, trade openness could alter households' optimal portfolios, so that their current ones become sub-optimal *ex-ante*.[4] This is especially the case with the poor, because of their poor ability to take advantage of the positive opportunities created by trade reforms, their weak capabilities to insure themselves against adverse impacts and, possibly, the lack of information about the risks associated with the new activities induced by openness (Winters et al., 2004). This, together with the presence of risky assets (Elbers, Gunning, & Kinsey, 2007) may explain *ex-ante* their unwillingness to pursue high average returns linked to the different activities opened up by trade reforms, and eventually the possibility of falling into poverty traps (Carter & Barret, 2006; Dercon & Christiaensen, 2011). None of this depends on the magnitude or the nature of foreign risks and/or their channels of transmission to household welfare, nor on any correlations between domestic and foreign risks.

The poor might also be less able to protect themselves against the adverse effects of a new set of man-made foreign shocks and incentives. This is because traditional mechanisms might not work as well as in the pre-liberalization scenario, hampering people's standard management strategies (Dercon, 2001). Trade openness can also affect governments' ability to adopt price stabilization policies and/or contribute to the elimination of institutions or policies aimed at smoothing domestic prices (Winters, 2002; Winters et al., 2004). In all the above cases, trade openness can have an impact on households' optimal portfolios and, eventually, lead to net welfare effects less positive than expected in the long run (Winters, 2002; Winters et al., 2004; Calvo & Dercon, 2007).

It follows that any measure of vulnerability which is not able to take adequately into account trade exposure and the effect of the *ex-ante* change in behavior induced by trade liberalization may be missing an important component of the welfare analysis.

[4] This is different from the fact that, *ex post*, a household may actually lose out from an unlucky realization. Increases in observed poverty can be consistent with *ex ante* improvements in welfare if households trade higher mean incomes for higher variances (Winters et al., 2004).

3. Measuring vulnerability from trade

To isolate the trade risk component of vulnerability, we propose an extended version of Ligon and Schechter's (2003) measure of Vulnerability as low Expected Utility (VEU). It overcomes the weak theoretical background of the most popular vulnerability measures based on expected values of the common Foster-Greer-Thorbecke (FGT) class of decomposable poverty measures (Chaudhuri, Jalan, & Suryahadi, 2002; Kamanou & Morduch, 2004; Pritchett et al., 2000; Gunther & Harttgen, 2009)[5] and presents some clear advantages with respect to other micro founded classes of vulnerability measures looking at the threat of poverty (Calvo, 2008; Dutta, Foster, & Mishra, 2011; Calvo & Dercon, 2013; Povel, 2015).[6]

According to the VEU approach, the vulnerability of household i (Vi) is measured by Eq. (1).

$$V_i = [U_i(z) - U_i(Ec_i)] + [U_i(Ec_i) - EU_i(c_i)] \tag{1}$$

where U_i is a weakly concave, strictly increasing function and the first bracketed term (i.e. the difference in utility at z compared to the utility of households' expected consumption) involves no random variables. The second bracketed term, according to the ordinal measures of risk proposed by Rothschild and Stiglitz (1970), measures vulnerability to risk.[7] This risk component can be further decomposed into covariate and idiosyncratic components. Let $(Ec_i|x_t)$ be the expected value of consumption conditional on a vector of covariant variables x_t, then we can rewrite the VEU measure as follows:

$$V_i = [U_i(z) - U_i(Ec_i)] + [U_i(Ec_i) - EU_i(Ec_i|x_t)] + [EU_i(Ec_i|x_t) - EU_i(c_i)] \tag{2}$$

where the first bracketed component is again vulnerability to poverty, but the second and third components break down vulnerability to risk into two sub-components: vulnerability to covariate risks and vulnerability to idiosyncratic risks.

To assess vulnerability from trade, following on Ligon (2006), we further decompose the risk component of the VEU measure filtering out a "meso (trade-related) risk" from "aggregate risk" and "idiosyncratic risk" (and likely measurement error), as follows:

$$\begin{aligned} V_i = {} & [U_i(z) - U_i(Ec_{it})] + && [\text{poverty}] \\ & [U_i(Ec_{it}) - EU_i(Ec_{it}|\mu_k)] + && [\text{trade related risk}] \\ & [EU_i(Ec_{it}|\mu_k) - EU_i(Ec_{it}|\mu_k,\mu_t)] + && [\text{aggregate risk}] \\ & [EU_i(Ec_{it}|\mu_k,\mu_t) - EU_i(Ec_{it}|\mu_k,\mu_t,x_{it})] + && [\text{idiosyncratic risk}] \\ & EU_i(Ec_{it}|\mu_k,\mu_t,x_{it}) - EU_i(c_{it})] && [\text{unexplained risk and measurement error}] \end{aligned} \tag{3}$$

where μ_k represents a risk term which varies across k clusters of households characterized by heterogeneity in their exposure to trade openness and μ_t is an aggregate risk term, common to all households, which may vary over dates and (aggregate) states. The fourth sub-component in Eq. (3) contains the remaining idiosyncratic risk, i.e., any systematic deviation by households from the

[5] For a survey of the main methods applied in vulnerability analysis please refer to Montalbano (2011).

[6] Differently to the these class of measures, VEU addresses vulnerability to risk only after aggregation across states has been performed (Calvo, 2008). It implicitly measures vulnerability net of the adoption of all the feasible precautionary saving and/or other insurance mechanisms whereby households can smooth away, even if not fully, variations in outcomes over states of the world. Second, VEU empirical applications overcome the need to approximate all possible states of the world, a somewhat heroic assumption of these class of measures using the short panel data currently available in developing countries.

[7] It is the "natural" counterpart, denominated in utils, of the "risk premium" the household would be willing to forego in order to eliminate the risk. It can be measured, starting from a (weakly) concave utility function, as the difference between the utility of consuming the expected consumption with certainty and the expected utility from consuming c_i.

predictions of complete markets, other than trade risk heterogeneity, where the last subcomponent is by construction unexplained risk and likely measurement errors. The rationale of this further decomposition is the following: with complete markets, household *i*'s consumption is supposed to vary over time only in response to aggregate shocks (i.e., common to all households). However, if trade exposure and/or risks themselves vary by trade categories we should observe households' heterogeneity in risk exposure by sector of occupation. A simple joint significance test of the latent terms (μ_k) in an equation describing households' consumption (Eq. (6)) will provide an appropriate empirical test for this (see Section 6).

4. Model specification

To compute household vulnerability by using our extended VEU measure we follow a three-step procedure. First, we choose the utility function. As in Ligon and Schechter (2003) we adopt the Constant Relative Risk Aversion (CRRA) utility function which takes the form:

$$U(c) = \begin{cases} \log(c) \;\; if \;\; \gamma = 1 \\ \frac{c^{1-\gamma}}{1-\gamma} \;\; otherwise \end{cases} \tag{4}$$

where γ measures household relative risk aversion (Arrow, 1971; Pratt, 1964), that is the degree of concavity of the utility function.

Second, we estimate both the unconditional and the conditional expectations of household *i*'s consumption included in our vulnerability measure. In the first case, we compute the unconditional expectation of consumption as follows: $Ec_{it} = 1/T\sum_{t=1}^{T} c_i$.[8] For the conditional expectation $E(c_{it}|\mu_k, \mu_t, x_{it})$, as in Ligon (2006), we assume that the expected consumption expenditure of household *i* can be estimated using a linear equation of conditional log consumption expenditure as follows:

$$c_{it} = \alpha + \theta_i + \mu_k + \mu_t + \omega_1 s^2_{\eta it} + \omega_2 s^2_{\varepsilon it} + \boldsymbol{\beta} X_{it} + \upsilon_{it} \tag{5}$$

where *c* is the logarithm of the real per capita consumption and α is a constant. θ, μ_k, μ_t, ω, *and* $\boldsymbol{\beta}$ are unknown parameters to be estimated: θ_i captures the influence of the fixed household characteristics on predicted consumption; μ_k is our latent variable of interest: it captures the influence of the (meso) trade-related fixed effects; μ_t captures the remaining effect of common changes in aggregates which are not captured by the meso component; ω_1 and ω_2 clean our measure of trade risks controlling for the remaining effect of all the other permanent ($s^2_{\eta it}$) and transitory ($s^2_{\varepsilon it}$) *ex-ante* risks other than those trade related; finally, $\boldsymbol{\beta}$ is a vector of parameters attached to a set of household characteristics (X_{it}) such as the age of the household's head (and its square), his/her sex, marital status, and level of education, the household size (and its square), the number of children, the geographical location as well as positive and negative income shocks.[9] Note that if the latent variables μ_k are jointly significant, then we can reject the null hypothesis of complete aggregate risk sharing across households clustered by trade-related industries.[10] The intuition behind all this is that this component of risk captures the presence of risk heterogeneity across industries clustered by trade exposure and represents a measure of the different nature of trade risks, and/or the correlated mitigating strategies, relative to the domestic ones. Consistently, if some risk is shared at the aggregate level, then estimates of μ_t will be significant too. The introduction of the ex-ante permanent and transitory risk components in our econometric specification has the important role of capturing their impact on mean consumption, via the standard precautionary savings channel. This is a substantial contribution to overcome the main weakness of the Ligon and Schechter's (2003) version of VEU which ignores the impact of income fluctuation on the first moment of the consumption distribution.

To derive parsimonious information on ex-ante risk from our data, we first exploit the longitudinal dimension of the panel and derive the variance of innovations in income. Following the previous empirical works (Carroll & Samwick, 1997, 1998; Hubbard, Skinner, & Zeldes, 1994; Gourinchas & Parker, 2002; Jalan & Ravallion, 2001; Meghir & Pistaferri, 2004; Storesletten, Telmer, & Amir, 2004) we estimate:

$$y_{ikt} = \varphi + \gamma X_{it} + \vartheta_i + \rho_k + \rho_t + u_{it} \tag{6}$$

where *y* is the logarithm of the real per capita income; *X* is the same set of covariates as in Eq. (5); ϑ_i, ρ_k, and ρ_t are household, trade sector and time fixed effects, respectively. We then use (6) to filter out the permanent component of ex-ante risk from the stochastic component of consumption. This leads to unbiased estimates of the ex-ante risk since the transitory component absorbs all measurement errors. Also the more persistent is the effect of the stochastic component of income, the larger are assumed to be its impacts (for a thorough analysis on this issue, see Reis, 2009). To this end, as in Carroll and Samwick (1997) and Krebs, Krishna, and Maloney (2010), we assume that the stochastic term (i.e., the unpredictable component) of our income equation (u_{it}) is the sum of two unobserved components, a permanent (η_{it}) and a transitory one (ε_{it}) that are both white noise and uncorrelated with each other at all leads and lags. Finally, under the assumption of absence of unpredictable growth, we assume the expected value of the variance of log difference of income of length *d* as:

$$E[r^2_{yid}] = 2\sigma^2_{\varepsilon} + d\sigma^2_{\eta} \tag{7}$$

where r^2_{yid} is the variance of log difference of income of length *d* for each household *i* in the sample and σ^2_{ε} and σ^2_{η} are, respectively, the variances of the permanent and transitory shocks to income. By using two r^2_{yid} of different lengths we disentangle the permanent and transitory components of the variance of income innovation for each household *i* as follows:

$$s^2_{\eta i} = r^2_{yid} - r^2_{yid-1} \quad \text{and} \quad s^2_{\varepsilon i} = \frac{r^2_{yid-1} - (d-1)s^2_{\eta i}}{2} \tag{8}$$

where $E(s^2_{\eta i}) = \sigma^2_{\eta}$ and $E(s^2_{\varepsilon i}) = \sigma^2_{\varepsilon}$.

Finally, consistently with the adoption of the CRRA utility function, we assume that poorer households are more responsive to changes in risk. To this end, we scale both components of income *ex-ante* risk by the ratio between current household's income and expected lifetime wealth (Banks, Blundell, & Brugiavini, 2001; Giles & Yoo, 2007). Our final proxy for ex-ante permanent risk for each household *i* at time t is thus the following:

$$s^2_{\eta it} = \pi_{it} s^2_{\eta i} \tag{9}$$

where $\pi_{it} = \left(\frac{Y_{it}}{W_{it}}\right)^2$, Y_{it} is household income and W_{it} is a measure of the expected wealth. We squared the scaling factor to be consistent with the literature that assumes that the poorer households are

[8] We assume here a stationary environment, which is indeed reasonable in our case considering the very short panel.

[9] In order to catch the individual contribution of the *m* sources of idiosyncratic risks, we orthogonalize the *m* variables x_{it} by using a Gram-Schmidt procedure and then rewrite the fourth line of Eq. (4) as follows:

$$\begin{aligned} &\left[EU_i(Ec_i|\mu_k,\mu_t) - EU_i(Ec_i|\mu_k,\mu_t,x_{it})\right] = \\ &\left[EU_i(Ec_i|\mu_k,\mu_t) - EU_i(Ec_i|\mu_k,\mu_t,x_{1it})\right] + \\ &\left[EU_i(Ec_i|\mu_k,\mu_t,x_{1it}) - EU_i(Ec_i|\mu_k,\mu_t,x_{2it})\right] + \\ &\cdots \\ &\left[EU_i(Ec_i|\mu_k,\mu_t,x_{(m-1)it}) - EU_i(Ec_i|\mu_k,\mu_t,x_{mit})\right]. \end{aligned}$$

[10] We are here excluding any shift in the degree of trade exposure across groups of sectors during the time span of the analysis, which is consistent with the short period of our panel data.

characterized by a higher degree of concavity of the utility function.[11] As well as its theoretical foundation, the scaling term has the additional advantage of transforming our "risk term" into a time variant idiosyncratic component as well as introducing explicit heterogeneity in households' responses to permanent risk and, hence, heterogeneity in expected mean consumption.

We estimate the conditional expectation of the consumption expenditure (Eq. (5)) using a three-way fixed effects model. This allows us to quantify the different sub-components which are needed to calculate the extended vulnerability measure presented in Eq. (3). It is possible since the total number of fixed effects is still workable using a standard least square dummy variable (LSDV) estimator, which simply includes dummy variables for each household, trade sector and time period. Furthermore, our three-way fixed effects model allows wiping out time-invariant unobserved heterogeneity as well as mitigating likely omitted variable bias (unobservable factors such as household's preferences, abilities, and/or attitude towards risk that are likely correlated with the set of observable characteristics in Eq. (5). If this unobserved heterogeneity were not explicitly captured through those three fixed effects, it would be absorbed in the error term υ_{it}, causing correlation with the other covariates and producing biased and inconsistent coefficients. This is the reason why a random-effects model would not work in this framework.

At the same time, the three-way fixed effects model has some weaknesses we need to take into consideration. The first one is that it does not allow controlling for time-variant unobserved heterogeneity. However, this problem should not affect our estimates since the length of our panel is quite limited and thus it is reasonable assuming that – even if this heterogeneity exists – it does not evolve so quickly to bias our analysis in such a short time span. The second one relates to the fact that the trade fixed effects are identified only by those households that move across trade-related groups between periods. This is because the k fixed effects turn out to be zero for any household that does not change trade group over the period under observation (for more details see Andrews, Gill, Schank, & Upward, 2008). In particular, if the dataset contains a limited number of movers and/or there is unobserved heterogeneity between movers and non-movers which makes the mobility endogenous, the estimated fixed effects could be inconsistent. The former – i.e. limited mobility bias – is a problem only if the dataset contains a limited number of movers per number of trade sector and a high number of trade sectors without any mover. Fortunately, our dataset does not suffer from either problem.[12] Concerning the endogenous mobility, we address the issue of unobserved heterogeneity testing the mean differences between movers and non-movers in the dependent and independent variables as well as we compare the trade fixed effects obtained with the whole sample versus those obtained with only movers. As shown in Section 7, we do not find any evidence of endogenous mobility and therefore our preferred specification can be considered unbiased and consistent.

5. Data

We use panel data for the period 2002–2004–2006 coming from the Vietnam Household Living Standard Surveys (VHLSS). These are nationally representative surveys based on the Population and Housing Census 1999 and developed by the Vietnam General Statistic Office (GSO), jointly with the United Nations Development Program (UNDP) and the Swedish International Development Agency (SIDA) with World Bank's technical assistance. In each wave, two questionnaires have been filled up, a household questionnaire and a community questionnaire. The first one contains detailed information on household demographic characteristics, education, health and healthcare, income, expenditures, assets and durable goods and accommodation as well as participation in poverty reduction programs. The community questionnaire gathers information on the demographic, health, education and infrastructure of all rural communities. The VHLSS collected information from a sample of 29,530 households in 2002 of which 4476 were re-interviewed in 2004 and 2006 out of samples of 9188 in total in 2004 and 9189 in 2006. The numbers of surveyed communes are 2091 in 2002, 3063 in 2004 and 3065 in 2006. Taking into account some inconsistency in the GSO original panel we use here the McCaig (2009) revised version of VHLSS panel data.[13] Moreover, the following sample restrictions have been introduced to reduce the influence of unobservables and measurement errors. First, we dropped all the households that for which the household head changed during the panel period or the household head was not in the labor force during the entire period. Second, to reduce the influence of outliers (e.g., they are both source of measurement error and/or unusual households whose behavior is unlikely to be informative about the general one) we also dropped households with per capita income or consumption lower than the first percentile or higher than the last one. Finally, we keep only the households that have observations for all the panel period as well as real per capita income, consumption and assets different from zero. As result of these restrictions the sample decreases to a balanced panel of 988 households.

The variable used for consumption is the real per capita food and non-food expenditure in the past 12 months re-adjusted by price indexes for regions and months. Food expenditure includes information on both market purchases and consumption from home production of 58 items while the non-food expenditure collects information on 32 items Poverty lines are expressed in Vietnamese dongs as follows: 1,915,000 for 2002; 2,070,000 for 2004; 2,559,000 for 2006. Lastly, we convert all nominal variables into nationally representative January 2006 prices using three different set of deflators, as suggested by Benjamin, Brandt, and McCaig (2017). Considering that households within each survey are interviewed during different months, the first set are monthly deflators, which are needed to convert the income and consumption values to January prices of the respective year. Second, to take into consideration the differences in the cost of living across regions we use regional deflators.[14] Third, to link January prices of 2002 and 2004 to January 2006, we use the Consumer Price Index (CPI) indicators provided by the GSO, which are 1.279 for 2002 and 1.193 for 2004. Since the VHLSS does not include an overall measure of household per capita income, we construct one as follows (for additional information see also Benjamin et al., 2017). We aggregated income into six major categories: income from crops, income from agricultural sidelines, household business income, wage income, gifts and remittances, and other residuals sources of income. As already mentioned in the previous section, we also include a set

[11] According to Skinner (1988) and Guiso, Jappelli and Terlizzese (1992), the exponent of the scaling factor measures the sensitivity to the level of expected wealth exhibited by the reaction to uncertainty. If the exponent is more than zero, the effect of risk on consumption increases with the decline of household's resources and this decline is faster the higher is the value.

[12] In our dataset, 422 households out of 953 move at least once during the period under analysis (44.2%), and the ratio of movers per sector is equal to 52.75 (422/8). Andrews et al. (2008) and Andrews, Gill, Schank and Upward (2012) show that once this ratio is above 20/25, the limited mobility bias vanishes and the estimates converge towards the true ones. Moreover, since the number of trade sectors is so limited (i.e. 8), all our trade sectors contain at least one group of movers (see Table A.4 in the Appendix).

[13] As highlighted by McCaig (2009), the GSO original panel data 2002–06 are incorrect: of the 4476 households interviewed in 2004 that should have a matching household in 2002, 429 have proven to be mismatched (9.6%) and these matching errors in the 2002–2004 VHLSS panel contribute to mismatches in the entire 02–06 VHLSS panel.

[14] For the regional deflators, we use the indices provided by the GSO in the VHLSS. We also replicate the same exercise using the different set of regional deflators kindly provided (upon request) by Brian McCaig and the results do not change significantly.

of household's characteristics in the analysis directly taken form household module of the VHLSS such as the head age (and its square), his/her sex, marital status, and level of education, the household size (and its square), the number of children, and the geographical location. Table A.2 in the Appendix reports descriptive statistics of these covariates by trade categories.

It is generally agreed that VHLSS data can be considered to be of high quality and provide legitimate nationally representative household data based on stratified random samples. However, we cannot avoid all possible sources of measurement errors, although provided that they are random, have mean zero and apply to the dependent variable (as in our case) they will not cause estimation bias. On the other hand, as suggested by Nakata, Sawada and Tanaka (2009) measurement errors in retrospective expenditure seem to be systematically related to household size and so we include household size as one of the control variables in our regressions to try to mitigate the biases arising from measurement errors in consumption.

As regards the measure for expected wealth in the denominator of the scaling factor, it is widely recognized that living standards are determined by a multitude of factors. In a popular work, Filmer and Prichett (2001) suggest that asset indices are as reliable as conventionally measured consumption expenditure as proxy of household living standards. Following this approach, to soften the risk of endogeneity, as a measure of expected wealth we use the linear combination of the principal component factors of a sub-set of housing characteristics and land physical availability, as in Povel (2015).[15]

To group households according to the trade openness of their sector of specialization, since the VHLSS survey do not relate production and external trade, we acknowledge here the work done by Coello et al. (2010). They matched the ISIC code of any sector with the SITC classification used in trade data and classified sectors as follows: export manufactured goods; import competing manufactured goods; non traded services; agriculture. A further breakdown of the agricultural sector is also provided, as follows: rice (considered apart because of its special status); main export agricultural products, other export agricultural products, import-competing crops and subsistence crops. This provides us with eight trade-related production sectors (see Table A.3 in the Appendix for details about the surveyed industries included in each sector).[16]

6. Empirical results

Table 1 reports the estimated coefficients of Eq. (5). The signs of the coefficients on age of the head of household and its square confirm the well-known concave age-consumption profile. Not surprisingly, we find that the higher the size of the household, the lower the level of per-capita consumption. The same is true for the number of children. The sex of the household head and his/her marital status turn out to be not significant.

The education variables behave as expected – higher levels of education correspond to higher levels of consumption – even if the estimated coefficients are not significant. As expected, the ex-ante permanent component of risk is significantly and negatively correlated with household consumption (the transitory component is also significant but unreliable since we know that, by construction, it absorbs all measurement errors, see Section 4). This shows the consistency of our empirical exercise with the theoretical prediction of precautionary saving behavior under risk. In other words, our consumption estimates confirm that Vietnamese households register, generally speaking, a lower path of consumption because of ex-ante risk (as a function of mitigating strategies) even when they do not experience any shock. Finally, the significance of the trade-related fixed effects (specifically, in the case of main export and import-competing crops) confirms the intuition of the presence of a significant systematic variation in household consumption patterns by trade-related clusters of farmers. The significance of the aggregate year fixed effects shows that some time variant shocks are shared at the macro level too.

Based on the consumption estimates of Eq. (5), Table 2 shows overall vulnerability, in utils, as well as the relative weights of its poverty and risk components (Eq. (3)). To do that, we normalize consumption with respect to the poverty lines available for each period, so that for poor households, the consumption is below 1. Total vulnerability (Column 1) is the sum of poverty (Column 2) and risk-induced (Column 3) components.

From Column 4 to Column 8, we report the decomposition of the risk-induced component as proposed in Eq. (4). The fourth column shows the meso (trade-related) component of overall risk-induced vulnerability while the fifth column filters out the component of truly covariate shocks. The sixth column isolates the component of

Table 1
Panel regression on household consumption (period 2002–06).

		Full Sample	
		Coeff	t-stat
Risk components	Permanent	−1.78e−13***	4.23e−14
	Transitory	8.37e−14***	1.99e−14
Household Characteristics	Age (household head)	0.0322***	0.00899
	Age^2 (household head)	−0.000311***	0.0000830
	Size	−0.148***	0.0264
	Size^2	0.00613***	0.00223
	No of children	−0.0418***	0.0149
	Married (household head, married = 1)	−0.0343	0.0558
	Sex (household head, male = 1)	−0.0238	0.0645
	Prim educ (yes = 1)	0.0307	0.0363
	Low secondary educ (yes = 1)	0.0651	0.0447
	Upper secondary educ (yes = 1)	0.0248	0.0654
	Tech/voc edu (yes = 1)	0.0713	0.0556
	Univers. Edu (yes = 1)	0.0889	0.108
	Geographical loc (urban = 1)	0.0172	0.0760
	Pos. income shocks	2.988***	0.424
	Neg. income shocks	2.229***	0.441
Trade Fixed Effects	Exporting industries	−0.00458	0.0552
	Import-competing industries	−0.0180	0.0391
	Rice	−0.0330	0.0250
	Main export crops	−0.106**	0.0513
	Other export crops	−0.0461	0.0431
	Import-competing crops	−0.0948**	0.0457
	Non-traded food	−0.0176	0.0765
	Constant	8.076***	0.358
	Household fixed effects	Yes	Yes
	Time effects	Yes	Yes
	Observations	2341	
	Adjusted R2	0.833	

Note: *p < .1, **p < 0.05, ***p < 0.01.
Non-farm non-traded activities and year 2002 are, respectively, the benchmark for trade and time effects.

[15] The household characteristics used in the principal component analysis are the following: house type (temporary house; semi-permanent house; house with a shared kitchen or bath/toilet; houses with a private kitchen or bath/toilet; villas); house property (yes or not); living area (in squared meters) and land decile (of the total agricultural land area). To improve the interpretability of the retained factors we applied the standard orthogonal varimax rotation (Kaiser, 1958). We have this freedom to re-express the factors because of the inherently indeterminate nature of the factor model (e.g., if z1 and z2 are two factors, then z1 + z2 and z1 − z2 are equally valid solutions). The orthogonal rotated factor loadings are every bit as good as the original loadings.

[16] To group the households we used here the characteristics of the head of the family. We have also performed the same exercise according to the occupation status and sector of activity of the majority of household members. The outcomes do not change significantly.

Table 2
Vulnerability decomposition in utils (period 2000–2006).

	Vulnerability decomposition			Total Risk decomposition				
	Total Vuln	Poverty Induced	Total Risk	Trade Risk	Aggr. risk	Ex-ante id. risk	Ex-post id. risk	Unexpl. risk
Exporting industries	0.238	0.158	0.080	−0.024	0.164	0.0001	0.075	−0.135
Import-competing industries	0.320	0.220	0.100	−0.019	−0.010	0.0000	0.185	−0.056
Non-traded industries	0.162	0.101	0.061	−0.010	0.092	0.0003	0.045	−0.066
Rice	0.358	0.275	0.083	0.020	0.180	0.0011	−0.106	−0.010
Main export crops	0.355	0.208	0.147	0.014	0.075	0.0004	0.103	−0.046
Other export crops	0.471	0.402	0.069	0.028	0.243	0.0008	0.026	−0.229
Import-competing crops	0.382	0.307	0.074	0.021	0.180	0.0006	−0.065	−0.062
Non-traded crops	0.368	0.239	0.130	−0.006	0.576	0.0022	1.073	−1.513
Overall	0.346	0.261	0.085	0.016	0.167	0.0009	−0.058	−0.039

Source: Authors' calculations.

vulnerability due to the remaining ex-ante permanent risk (i.e., other than the trade-related one). The seventh column refers to the ex-post idiosyncratic components of risk. The last one is the residual unexplained sub-component. Our results show that – once we control for all these risk components – the households producing main and other export crops as well as those producing import-competing crops are those more exposed to trade risk. This confirms our intuition that trade-related risks matter in determining household vulnerability, specifically for those farmers particularly exposed to international competition. In line with the literature (Lucas, 2003; Reis, 2009), we also find that the overall loss due to permanent risk is very small, but nonetheless statistically significant.

7. Sensitivity and robustness checks

Because of the importance of the trade-fixed effects in the calculation of our extended VEU measure, we need to rule out the risk of endogenous mobility between sectors (see Section 4). As already mentioned, this is because only those households that move across trade-related groups drive the identification of the fixed effects (Table A.4 reports the percentages of movers by trade categories). If the mobility were driven by specific observed and/or unobserved factors, imputing the same trade-related fixed effect to movers and non-movers would lead to a biased vulnerability measure. Thus, as robustness check, we control that there are no systematic differences between moving and not-moving households. We start looking at differences in the consumption expenditure since wealthier households may be more prone to move to trade sectors that are less exposed to risk or with better average performances. The kernel densities in Fig. A.1 in Appendix show that the two groups have an almost identical log consumption distribution. This is confirmed in Table A.5 that tests the mean differences of the log consumption between movers and non-movers reporting that it is not statistically different from zero. Table A.5 also reports the t-tests for other household characteristics to control if some of them could be correlated with both the consumption expenditure and the choice of moving across sectors. Except for the level of lower secondary education of the household head, we do not find any evidence of significant mean differences between groups.

As a further robustness check on the validity of our estimates, we re-estimate our model using only the sub-sample of movers (Table A.6 in the Appendix) to control if there is unobserved heterogeneity between the two groups which results in different trade-related fixed effects. As plotted in Fig. A.2 in Appendix, we see that actually the fixed effects obtained with the whole sample are almost identical to those obtained with the sub-sample of movers and hence confirming that our setting in unlikely to be subject to endogenous mobility.

Also, for sensitivity purposes, Table A.7 presents the vulnerability estimates for different specification of the CRRA utility function derived for different levels of the risk aversion parameter ($\gamma = 1; 2; 3$).[17] As expected, if we increase our risk aversion parameter, the vulnerability estimates also increase in magnitude, but the relative pattern across its components does not change For instance, as we move from gamma = 1 to gamma = 3, "risk-induced" vulnerability almost triples its weight (from 13% to 34% of total vulnerability).

We also provide new estimates of vulnerability by changing the set of household characteristics used in the principal component analysis to compute the expected wealth in the denominator of the scaling factor that multiplies the proxies of permanent and transitory risks. In this case, we extend the number of variables including also information on the ownership of durables assets (motorized transport, color TV, refrigerator), housing quality (electricity, type of toilet, drinking water, cooking gas) and ownership of breeding cattle. As Table A.8 shows, the vulnerability estimates are still consistent with those reported in Table 2, and the categories more exposed to trade risk are still those producing main and other export crops as well as those producing import-competing crops.

Finally, we acknowledge that in VEU the order of the decomposition drives the empirical results. We can thus alternatively look at the aggregate/covariate risk as a residual risk term after controlling for trade groups' deviations from risk sharing or rather assume deviations from risk sharing by trade categories as a residual subcomponent of the VEU overall risk component. Note however that, in choosing the order of the decomposition, we are just attempting to provide alternative possible distributions across sub-components of the VEU overall risk which remains invariant. Table A.9 in Appendix reports the VEU decomposition by reversing the order of the decomposition of the VEU overall risk between aggregate/covariate risk and risk by trade groups (i.e., assuming deviations from risk sharing by trade categories to be a residual subcomponent of the VEU overall risk component). Also in this case, the risk-sharing deviations by trade categories are still positive for farm tradable crops, in line with the statistical significance of the fixed effects by trade categories. It means that, even though the exact weight of the trade related sub-component depends from the order of the decomposition (which ultimately reflects different conceptual views), a trade meso component of risk should be included in the VEU measure in any case.

8. Conclusions and policy recommendations

This paper addresses the important issue of vulnerability from trade, which is at the heart of the global trade negotiations on

[17] However, we do not expect our results to be very sensitive to the actual choice of γ since in this exercise we are more interested in investigating the relative importance of the various vulnerability components than its overall magnitude. While in fact the estimates of total vulnerability, poverty and risk are all sensitive to one's choice of the shape of the utility function (i.e., the γ parameter), the relative magnitudes of the different components are less sensitive as greater concavity reflects greater welfare losses associated with all the components (Ligon and Schechter, 2003).

special safeguard mechanisms to protect farmers from excessive price volatility. It focuses on Vietnam and takes advantage of the Vietnam Household Living Standard Surveys (VHLSS) panel data available for the period 2002–2004–2006. The added value of this exercise lies in proposing an extended version of the VEU measure of vulnerability able to address more appropriately the presence of trade-related heterogeneity in households' exposure to risk and to overcome the most common weaknesses of current available measures of vulnerability. More specifically, we present a method to decompose the impact on vulnerability of the ex-ante risk and its correlated risk mitigating strategies from the ex-post ones and to look separately at the relationship between ex-ante risk, trade-related risk, aggregate risk and mean consumption.

Our empirical results show a number of useful insights for policymaking. First, we demonstrate that the risk-induced component of vulnerability consistently matters in determining households' overall vulnerability even in a context of decreasing poverty and that this is not linked to the actual manifestation of shocks. Second, we show the presence of a relative inability, on average, to share risks across households involved in different trade-related clusters, specifically in the case of farm households. This confirms our intuition that trade-related risks (i.e., risks that are not fully shared across trade-related industries) matter in determining household overall vulnerability. Our empirical evidence highlights that households engaged in farm activities more exposed to international competition may warrant support.

The policy implications of these results are important for governments interested in increasing the net benefits of trade reform and protecting the most vulnerable households. Interventions to absorb trade-related risks usually consist of putting in place measures to stabilize domestic prices and/or increasing the offer of risk management instruments such as savings, credit and insurance (Loyaza et al., 2007). Stabilization mechanisms operate by introducing trade restrictions or creating public marketing boards that directly interfere with the market fundamentals. In some cases, these interventions have proved to be viable options to offset extreme short-run fluctuations and emergency crises of hunger and food insecurity. For example, Asian governments – including Vietnam – invested a lot in stabilizing domestic rice prices during periods of excessive fluctuation caused by thin and unstable international markets with the primary objective to buffer their consumers and farmers (Dawe & Timmer, 2012). However, there are several arguments to question the use of such measures, especially to tackle trade-related risk in the medium and long runs. Indeed, they are destabilizing for the markets, difficult to implement, extremely costly for the public budgets, and not targeted on the vulnerable. For the sake of this paper, it is even more important to stress that they are not effective because vulnerability from trade is an ex-ante condition and – as we have just proved – occurs even in absence of strong fluctuations. On the contrary, we believe that a more fruitful approach would be for those who are vulnerable to trade to learn how to carry out progressive choices and take full advantage of the trade reforms. This process can take the form of supporting self-insurance via savings (through micro-financial instruments), assisting income risk management by providing access to credit, sustaining community-based risk-sharing and pushing public and private institutions to develop new insurance products targeted on vulnerable farmers most involved in tradable goods production. However, even for this set of interventions caution is required, since targeting may turn out to be complicated to implement and it can generate rent-seeking behavior.

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Appendix A

See Figs. A1 and A2 and Tables A1–A9.

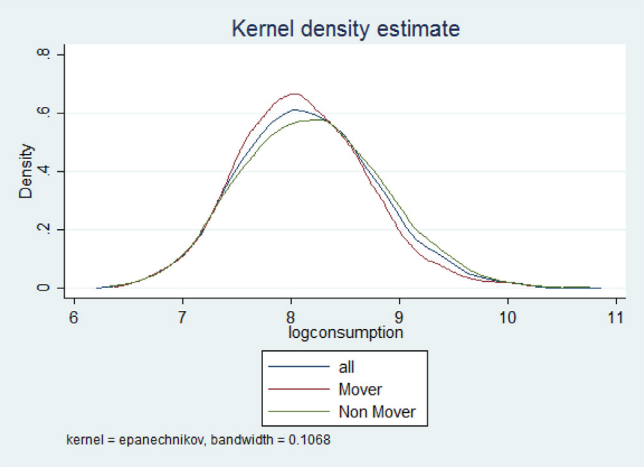

Fig. A1. Kernel density of log-consumption between moving and not-moving households.

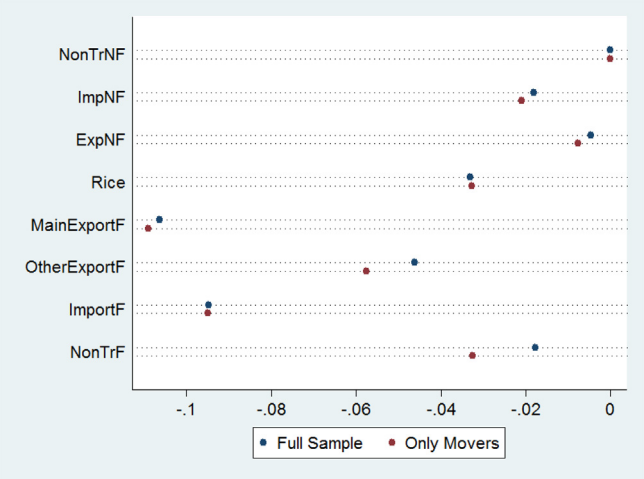

Fig. A2. Trade fixed effects estimates.

Table A1
Commodity price volatility 1992–2016.

Time period	All	Food	Agriculture	Minerals
1982–1986	0.0253	0.0318	0.0269	0.0271
1987–1991	0.0286	0.0324	0.0177	0.0512
1992–1996	0.0252	0.0271	0.0346	0.0388
1997–2001	0.0223	0.0273	0.0219	0.0296
2002–2006	0.0257	0.0286	0.0254	0.0414
2007–2011	0.0417	0.0438	0.0509	0.0716
2012–2016	0.018	0.0228	0.0254	0.0391
Average	0.0265	0.0303	0.029	0.0424

Source: UNCTAD. Volatility is defined as standard deviation of monthly changes in logged commodity price indices.

Table A2
Descriptive statistics by trade categories.

Variable	Exporting industries			Import-competing industries			Non traded non food			Rice		
	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
Income – Real PC (dongs)	98	10170.52	31512.73	110	8635.61	6810.55	549	8342.43	7907.23	1138	5691.47	4965.25
Consumption – Real PC (dongs)	98	3965.80	2166.41	110	4766.76	3010.91	549	4891.99	3084.55	1138	3231.16	1916.06
Age hh head	98	44.35	9.48	110	44.18	9.93	549	43.16	9.66	1138	46.20	10.24
Household size	98	4.84	1.59	110	4.44	1.52	549	4.43	1.34	1138	4.87	1.87
No of children	98	1.41	1.15	110	1.16	0.98	549	1.12	0.99	1138	1.26	1.29
Married hh head (yes = 1)	98	0.94	0.24	110	0.92	0.28	549	0.92	0.27	1138	0.89	0.31
Household head sex (male = 1)	98	0.90	0.30	110	0.84	0.37	549	0.85	0.36	1138	0.85	0.36
Prim educ (yes = 1)	98	0.33	0.47	110	0.22	0.41	549	0.23	0.42	1138	0.25	0.44
Low secondary educ (yes = 1)	98	0.27	0.44	110	0.40	0.49	549	0.38	0.49	1138	0.36	0.48
Upper secondary educ (yes = 1)	98	0.04	0.20	110	0.06	0.25	549	0.09	0.28	1138	0.07	0.25
Tech/voc edu (yes = 1)	98	0.05	0.22	110	0.12	0.32	549	0.15	0.36	1138	0.05	0.21
Univers. Edu (yes = 1)	98	0.00	0.00	110	0.05	0.23	549	0.05	0.21	1138	0.00	0.07
Geographical loc (urban = 1)	98	0.15	0.36	110	0.19	0.39	549	0.26	0.44	1138	0.04	0.19
Variable	Main export crops			Other export crops			Import-competing crops			Non-traded food		
	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
Income – Real PC (dongs)	195	7487.78	6300.18	99	5243.90	4885.85	139	5791.81	5605.04	42	7092.52	3794.10
Consumption – Real PC (dongs)	195	4037.54	2820.95	99	3101.61	1721.26	139	3105.19	2125.41	42	4642.70	3730.84
Age hh head	195	44.16	9.81	99	45.65	10.42	139	42.56	11.47	42	46.36	10.96
Household size	195	5.17	1.78	99	4.80	1.78	139	4.53	1.81	42	4.33	1.03
No of children	195	1.59	1.24	99	1.46	1.49	139	1.23	1.29	42	0.67	0.90
Married hh head (yes = 1)	195	0.86	0.35	99	0.80	0.40	139	0.84	0.37	42	0.90	0.30
Household head sex (male = 1)	195	0.88	0.33	99	0.84	0.37	139	0.80	0.40	42	0.88	0.33
Prim educ (yes = 1)	195	0.36	0.48	99	0.30	0.46	139	0.27	0.45	42	0.33	0.48
Low secondary educ (yes = 1)	195	0.27	0.45	99	0.31	0.47	139	0.31	0.46	42	0.38	0.49
Upper secondary educ (yes = 1)	195	0.03	0.17	99	0.02	0.14	139	0.03	0.17	42	0.07	0.26
Tech/voc edu (yes = 1)	195	0.03	0.16	99	0.07	0.26	139	0.06	0.23	42	0.02	0.15
Univers. Edu (yes = 1)	195	0.01	0.10	99	0.00	0.00	139	0.00	0.00	42	0.02	0.15
Geographical loc (urban = 1)	195	0.09	0.29	99	0.02	0.14	139	0.17	0.38	42	0.02	0.15

Table A3
Industries classification by trade-related sectors.

Non-farm activities	Exporting industries	Fishing, aquaculture; Mining of coal and lignite; extraction of peat; Extraction of crude petroleum and natural gas; Wearing apparel, dressing and dyeing of fur; Footwear; Wood and of products of wood and cork; Office, accounting and computing machinery
	Import-competing industries	Forestry, logging and related service activities; Mining of uranium and thorium ores; Food products and beverages; Tobacco products; Textiles; Tanning and dressing of leather; luggage; Paper and paper products; Coke, refined petroleum products and nuclear fuel; Chemicals and chemical products; Rubber and plastics products; Other non-metallic mineral products; Basic metals; Fabricated metal products; Machinery and equipment; Electrical machinery and apparatus; Radio, television and communication equipment; Medical, precision and optical instruments; Motor vehicles, trailers; Furniture; manufacturing n.e.c.;
	Non-traded	Recycling; Electricity, gas, steam and hot water supply; Collection, purification and distribution of water; Construction; Sale, maintenance and repair of motor vehicles; Wholesale trade and commission trade; Retail trade, repair; Hotels and restaurants; Land transport, transport via pipelines; Water transport; Air transport; Supporting and auxiliary transport activities; Post and telecommunications; Financial intermediation; Insurance and pension funding; Activities auxiliary to financial intermediation; Real estate activities; Renting of machinery and equipment; Computer and related activities; Research and development; Other business activities; Public administration and defence; Education Health and social work; Sewage and refuse disposal, sanitation; Activities of membership organizations n.e.c.; Recreational, cultural and sporting activities; Other service activities Private households as employers; Extraterritorial organizations and bodies;
Farm Activities	Main Exports	Black pepper; Cashew, coffee Rubber, tea
	Other Exports	Bananas; Cassava manioc; Coconut; Cotton; Cabbage, cauliflower; Mango, Papaya; Peanuts; Pineapple; Sesame seeds; Soy beans; Specialty rice; Sweet potatoes
	Rice	
	Import-competing	Apples; grapes; Fresh vegetables; Indian Corn; Jackfruit, durian; Jute; ramie; Mulberry; Oranges, limes; Other leafy greens; Plums, potatoes; Sugar cane; Tobacco; Tomatoes
	Non-traded	Custard apple; Litchi, logan, rambutan; Sapodilla; Water morning glory

Source: Coello et al. (2010).

Table A4
Percentage Movers by trade categories.

Trade category	Percentage movers
Export Industries	58.39%
Import-competing Industries	65.77%
Non-traded Non-Food	41.32%
Rice	36.43%
Main Export Crops	37.50%
Other Export Crops	81.74%
Import-competing Crops	70.97%
Non-Traded Food	51.02%
Total	44.28%

Table A5
Mean differences between movers and non-movers.

	Non-Mover	Mover	t-stat	p-value
Log(Consumption)	7.835	7.812	0.683	0.495
Age hh head	43.367	42.365	1.531	0.126
Hh size	4.917	4.784	1.251	0.211
No Children	1.448	1.481	−0.431	0.666
Married hh head	0.891	0.912	−1.115	0.265
Hh head sex	0.859	0.855	0.145	0.885
Prim educ	0.245	0.277	−1.129	0.259
Low Sec educ	0.326	0.396	−2.231	0.026
Upper Sec educ	0.085	0.066	1.074	0.283
Tech/Voc educ	0.051	0.045	0.419	0.675
Univ educ	0.017	0.014	0.339	0.734
Geographical Loc	0.145	0.109	1.670	0.095

Table A6
Panel regression on household consumption using only movers (period 2002–06).

		Only Movers	
		Coeff	t-stat
Risk components	Permanent	−1.31e−13	1.38e−13
	Transitory	7.48e−14***	2.01e−14
Household Characteristics	Age (household head)	0.0308	0.0207
	Age^2 (household head)	−0.000304	0.000209
	Size	−0.202***	0.0456
	Size^2	0.0110***	0.00425
	No of children	−0.0438**	0.0210
	Married (household head, married = 1)	−0.0317	0.0731
	Sex (household head, male = 1)	−0.0840	0.0888
	Prim educ (yes = 1)	0.000674	0.0640
	Low secondary educ (yes = 1)	0.0789	0.0704
	Upper secondary educ (yes = 1)	−0.0225	0.0989
	Tech/voc edu (yes = 1)	0.0890	0.0873
	Univers. Edu (yes = 1)	−0.0847	0.138
	Geographical loc (urban = 1)	0.0401	0.136
	Pos. income shocks	2.870***	0.609
	Neg. income shocks	3.045***	0.581
Trade Fixed Effects	Exporting industries	−0.00757	0.0540
	Import-competing industries	−0.0209	0.0396
	Rice	−0.0328	0.0250
	Main export crops	−0.109**	0.0513
	Other export crops	−0.0575	0.0435
	Import-competing crops	−0.0950**	0.0470
	Non-traded food	−0.0324	0.0763
	Constant	7.713***	0.533
	Household fixed effects	Yes	Yes
	Year fixed effects	Yes	Yes
	Observations	1043	
	Adjusted R2	0.835	

Note: *p < .1, **p < 0.05, ***p < 0.01.
Non-farm non-traded activities and year 2002 are, respectively, the benchmark for trade related and time effects.

Table A7
Vulnerability decomposition in utils in Vietnam in the period 2002–06 for different levels of the risk aversion parameter.

	Vulnerability decomposition			Total Risk decomposition				
	Total Vuln	Poverty Induced	Total Risk	Trade Risk	Aggr. risk	Ex-ante id. risk	Ex-post id. risk	Unexpl. risk
gamma = 1								
Exporting industries	0.177	0.138	0.039	−0.021	0.108	−0.00002	−0.043	−0.005
Import-competing industries	0.237	0.192	0.045	−0.015	−0.041	0.00000	0.088	0.013
Non-traded industries	0.135	0.105	0.031	−0.009	0.040	0.00001	0.033	−0.033
Rice	0.275	0.241	0.034	0.015	0.065	0.00003	0.049	−0.095
Main export crops	0.284	0.229	0.055	0.011	0.017	0.00001	0.014	0.014
Other export crops	0.342	0.311	0.031	0.018	0.073	0.00001	−0.055	−0.055
Import-competing crops	0.282	0.249	0.033	0.015	0.054	0.00000	0.006	−0.042
Non-traded crops	0.269	0.214	0.054	−0.005	0.383	0.00012	0.466	−0.790
Overall	0.266	0.230	0.036	0.011	0.060	0.00002	0.037	−0.073
gamma = 2								
Exporting industries	0.238	0.158	0.080	−0.024	0.164	0.0000	0.075	−0.135
Import-competing industries	0.320	0.220	0.100	−0.019	−0.010	0.0000	0.185	−0.056
Non-traded industries	0.162	0.101	0.061	−0.010	0.092	0.0000	0.045	−0.066
Rice	0.358	0.275	0.083	0.020	0.180	0.0001	−0.106	−0.010
Main export crops	0.355	0.208	0.147	0.014	0.075	0.0000	0.103	−0.046
Other export crops	0.471	0.402	0.069	0.028	0.243	0.0001	0.026	−0.229
Import-competing crops	0.382	0.307	0.074	0.021	0.180	0.0001	−0.065	−0.062
Non-traded crops	0.368	0.239	0.130	−0.006	0.576	0.0002	1.073	−1.513
Overall	0.346	0.261	0.085	0.016	0.167	0.0001	−0.058	−0.039
gamma = 3								
Exporting industries	0.249	0.128	0.121	−0.024	0.209	0.0000	0.439	−0.503
Import-competing industries	0.445	0.256	0.189	−0.023	0.041	0.0000	0.391	−0.222
Non-traded industries	0.189	0.083	0.106	−0.011	0.142	0.0001	0.077	−0.103
Rice	0.534	0.365	0.169	0.031	0.569	0.0005	7.713	−8.249
Main export crops	0.495	0.213	0.282	0.017	0.181	0.0001	0.312	−0.228
Other export crops	0.664	0.524	0.140	0.043	0.752	0.0004	0.962	−1.617
Import-competing crops	0.537	0.388	0.150	0.032	0.557	0.0003	0.891	−1.330
Non-traded crops	0.525	0.267	0.258	−0.007	0.876	0.0004	2.516	−3.127
Overall	0.495	0.327	0.168	0.024	0.489	0.0004	5.223	−5.614

Table A8
Vulnerability decomposition in utils in Vietnam in the period 2002–06 using a different scaling factor.

	Vulnerability decomposition			Total Risk decomposition				
	Total Vuln	Poverty Induced	Total Risk	Trade Risk	Aggr. risk	Ex-ante id. risk	Ex-post id. risk	Unexpl. risk
Exporting industries	0.238	0.165	0.072	0.007	0.086	−0.0007	0.202	−0.222
Import-competing industries	0.320	0.229	0.091	−0.014	0.093	−0.0009	0.161	−0.148
Non-traded industries	0.162	0.107	0.054	−0.012	0.072	−0.0007	0.002	−0.008
Rice	0.360	0.289	0.072	0.011	0.187	−0.0023	−0.203	0.079
Main export crops	0.355	0.217	0.138	0.035	0.120	−0.0013	0.234	−0.250
Other export crops	0.409	0.351	0.058	0.020	0.184	−0.0020	0.153	−0.298
Import-competing crops	0.382	0.319	0.063	0.017	0.173	−0.0018	0.017	−0.142
Non-traded crops	0.368	0.248	0.121	−0.005	0.100	−0.0009	0.320	−0.293
Overall	0.343	0.269	0.075	0.012	0.167	−0.0020	−0.099	−0.003

Table A9
Vulnerability decomposition in utils in Vietnam in the period 2002–06 computed reversing the order in Eq. (3).

	Vulnerability decomposition			Total Risk decomposition				
	Total Vuln	Poverty Induced	Total Risk	Trade Risk	Aggr. risk	Ex-ante id. risk	Ex-post id. risk	Unexpl. risk
gamma = 1								
Exporting industries	0.177	0.138	0.039	0.057	0.030	0.000	−0.04321	−0.005
Import-competing industries	0.237	0.192	0.045	−0.089	0.033	0.00000	0.088	0.013
Non-traded industries	0.135	0.105	0.031	0.003	0.028	0.00001	0.033	−0.033
Rice	0.275	0.241	0.034	0.037	0.043	0.00003	0.049	−0.095
Main export crops	0.284	0.229	0.055	−0.009	0.037	0.00001	0.014	0.014
Other export crops	0.342	0.311	0.031	0.043	0.048	0.00001	−0.005	−0.005
Import-competing crops	0.282	0.249	0.033	0.027	0.042	0.00000	0.006	−0.042
Non-traded crops	0.269	0.214	0.054	0.345	0.034	0.00012	0.466	−0.790
Overall	0.266	0.230	0.035	0.030	0.041	0.00002	0.037	−0.073

Table A9 (*continued*)

	Vulnerability decomposition			Total Risk decomposition				
	Total Vuln	Poverty Induced	Total Risk	Trade Risk	Aggr. risk	Ex-ante id. risk	Ex-post id. risk	Unexpl. risk
gamma = 2								
Exporting industries	0.238	0.158	0.080	0.064	0.076	0.0000	0.075	−0.134814
Import-competing industries	0.320	0.220	0.100	−0.118	0.090	0.0000	0.185	−0.056
Non-traded industries	0.162	0.101	0.061	0.015	0.067	0.0000	0.045	−0.066
Rice	0.358	0.275	0.083	0.050	0.149	0.0001	−0.106	−0.010
Main export crops	0.355	0.208	0.147	−0.006	0.096	0.0000	0.103	−0.046
Other export crops	0.471	0.402	0.069	0.094	0.177	0.0001	0.026	−0.229
Import-competing crops	0.382	0.307	0.074	0.060	0.142	0.0001	−0.065	−0.062
Non-traded crops	0.368	0.239	0.130	0.481	0.089	0.0002	1.073	−1.513
Overall	0.346	0.261	0.085	0.045	0.137	0.0001	−0.058	−0.039
gamma = 3								
Exporting industries	0.249	0.128	0.121	0.055	0.130	0.0000	0.439	−0.503
Import-competing industries	0.445	0.256	0.189	−0.170	0.189	0.0000	0.391	−0.221518
Non-traded industries	0.189	0.083	0.106	0.015	0.116	0.0001	0.077	−0.103
Rice	0.534	0.365	0.169	0.058	0.536	0.0005	7.713	−8.249
Main export crops	0.495	0.213	0.282	0.001	0.197	0.0001	0.312	−0.228
Other export crops	0.664	0.524	0.140	0.253	0.543	0.0004	0.962	−1.617
Import-competing crops	0.537	0.388	0.150	0.176	0.412	0.0003	0.891	−1.330
Non-traded crops	0.525	0.267	0.258	0.688	0.180	0.0004	2.516	−3.127
Overall	0.495	0.327	0.168	0.067	0.443	0.0004	5.223	−5.614

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