Essays on Trade Openness and Vulnerability to Poverty

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Thesis submitted for the examination of Doctor of Philosophy

University of Sussex, UK

June 2016

Acknowledgements:

This work is dedicated to my family and especially to Silvia, my companion both in work and daily life.

Main main debt is to L. Alan Winters for his invaluable support and guidance.

A special thank goes to Umberto Triulzi who encouraged and supported me in undertaking this new challenge. I am also grateful to ZhenKun Wang, Andy McKay, the PhD students and all the members of the Department of Economics at the University of Sussex that kindly supported me during the entire research program.

I would like also to thank all the participants in the following Seminars and Conferences where previous versions of various bits of this work have been presented: The DIAL International Conference held in Paris, 30th June - 1st July , 2011; The Departmental Seminar held in Falmer (UK), Department of Economics, University of Sussex, 7th March 2012; The Scottish Economic Society annual Conference held in Perth, 16th-18th April, 2012; The 53th Italian Economic Society Annual Conference, Universita' della Basilicata, Matera (Italy), 19th October 2012.

The usual disclaimers apply.

SUMMARY

This thesis focuses on the welfare costs of exposure to risk linked to openness to international trade. This is a prominent issue in international debate, whereas it is largely ignored by trade literature, both theoretical and empirical. Trade theory is mainly focused on the first moment of the above relationship, which is actually insufficient for welfare purposes when people are risk averse. Empirical evidence is mixed, scattered in separate fields of analysis, and does not reach a common stance. As a result, current literature fails to make a full assessment of the net welfare impact of an opening-up process.

This work contributes to the above debate by proposing:

- A comprehensive review of the literature on the "destabilising effects" of openness to international trade;
- An empirical test on the significance and relevance of "precautionary saving" behaviour under risk, estimated from cross-country data;
- A conceptualisation of vulnerability to poverty induced by trade openness;
- A comprehensive analysis of vulnerability to poverty induced by trade liberalisation in Vietnam under Doi Moi,[1] by exploiting the available household living standard surveys for the period 1992-2008;
- An extended version of Ligon and Schechter's (2003) measure of Vulnerability as low Expected Utility;
- An empirical application of the adjusted VEU measure to "trade-induced vulnerability" using VHLSS panel data (2002-06)

The work is divided into four essays as follows:

1. Review of the literature and conceptualisation (and misconceptions) of "trade-induced vulnerability to poverty" (Essay 1);
2. A cross-country empirical test in the long-run behaviour of consumption under risk (Essay 2);
3. A cross-sectional empirical test of trade-induced vulnerability in Vietnam under *Doi Moi* (period 1992-2008) (Essay 3);
4. A panel empirical test of trade-induced vulnerability in Vietnam in the period 2002-06 (Essay 4).

[1] "Doi Moi" (renovation) was a comprehensive process of reforms undertaken from the early 1990s by Vietnam characterised by a combination of liberalisation, stabilisation and structural reforms.

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Introduction

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In principle, trade can alter risk exposure in two ways: by changing the riskiness of existing activities, for instance, by altering the weight of foreign compared with 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 et al., 2001).

According to the theory of precautionary saving (Kimball, 1990; Caballero, 1990; Deaton, 1992; Caroll 2001a; Caroll & Kimball, 2008), risk-averse people react to risk by modifying their behaviour, and more specifically, by undertaking additional 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 which implies permanent negative effects on welfare. This is particularly true for people characterised 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 et al., 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 is implicitly done by current vulnerability measures. As a result, current vulnerability measures tend to underestimate the overall impact of risk on consumption, leading to biased (downward) estimates of the overall effect of risk on welfare.

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- An extended version of Ligon and Schechter's (2003) measure of Vulnerability as low Expected Utility;
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The added value of this work is twofold:

- it detects the relevance of precautionary saving under risk at both cross-country and household levels;
- it proposes a novel empirical approach to looking at trade-induced vulnerability by separating the *ex-ante* effects of risk from the *ex-post* effects of shocks.

The presentation of the overall work is divided into four essays as follows:

1. Review of the literature and conceptualisation (and misconceptions) of "trade-induced vulnerability" (Essay 1);
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[2] *Doi Moi* (renovation) was a comprehensive process of reforms undertaken from the early 1990s by Vietnam characterised by a combination of liberalisation, stabilisation and structural reforms.

4. A panel empirical test of trade-induced vulnerability in Vietnam in the period 2002-06 (Essay 4).

The first challenge to undertake was to bridge trade openness and vulnerability to poverty which are traditionally seen as separate topics by the specialised literature. While the debate over trade openness and its measurement has been extensively investigated since Krueger's (1978) seminal work, vulnerability assessment is still at the "let a hundred flowers bloom" stage, as stated by Hoddinott and Quisumbing (2003). On the trade side, this work relies on the operational definition of "openness in practice", regardless of whether or not this depends mainly on deliberate policies (for a clear distinction between the two concepts, see McCulloch et al., 2001). Furthermore, it does not distinguish, at this stage, between the various sources of economic fluctuation linked to trade openness (price fluctuations, exchange rate volatility, policy mismanagement, etc.). The added value of this piece of work is to complement the literature that emphasises the risk side of trade reform and its impact on households' optimal portfolios, especially for the poor (Winters, 2002; Winters et al., 2004) with the literature on vulnerability to poverty able to measure the net welfare cost under risk. Since the most popular vulnerability measures based on expected values of the common Foster-Greer-Thorbecke (FGT) class of decomposable poverty measures (the so-called Vulnerability as Expected Poverty - VEP measures) are based on a weak theoretical background (Chaudhuri, 2001, 2003; Chaudhuri & al., 2002; Christiaensen & Boisvert, 2000; Christiaensen Subbarao, 2001; Gunther Harttgen, 2009; Pritchett et al., 2000), Ligon and Schechter's (2003) Vulnerability as low Expected Utility (VEU) measure has been taken as the main empirical reference of vulnerability induced by trade openness. It is micro founded, empirically based and presents some clear advantages over other groups of micro-founded vulnerability measures, e.g., the class of Vulnerability measures looking at the Threat of Poverty (VTP) (Calvo and Dercon, 2013; Povel, 2015, Chaudhuri & al., 2002; Kamanou & Morduch, 2004; Pritchett & al., 2000; Dutta et al., 2011; Gunther & Maier, 2008).

A key distinction to bear in mind in this work is between risk and shock. Current measures of vulnerability to poverty show a structural inability to provide separate assessments of the *ex-ante* impacts on welfare of both risk and risk-mitigating strategies from the *ex-post* impacts of shocks and their related coping strategies. Thus, they fail to properly address vulnerability. For instance, a household adopting *ex-ante* a complete self-insurance mechanism at the cost of lower mean consumption would be registered as being unaffected by risk, producing a structural underestimation of the risk component of vulnerability with a parallel overestimation of its poverty component, leading to biased outcomes (Elbers and Gunning, 2003). These authors also show that much of the effect on household expected consumption reflects *ex-ante* risk. This is particularly important in trade analysis where the risk component, as above noted, is virtually absent in the current debate on the net welfare impacts of trade reforms, theoretical and applied.[3]

The issue of properly addressing the impact of *ex-ante* risk on vulnerability has been generally performed by deriving simulation-based estimates of vulnerability grounded on structural dynamic models of household consumption and saving, modelled as the outcome of intertemporal optimisation under uncertainty (see, among others, Elbers and Gunning, 2003; Elbers et al., 2007; Elbers et al., 2009; Carter and Ikegami, 2009). Since we lack general agreement on what the right dynamic model is for any given economic environment in which vulnerable households actually live, the current work follows the strand of the literature that argues that it is more fruitful to derive empirically-based analyses of vulnerability, focusing on Euler-type restrictions on the evolution of the household consumption over time. Specifically, since households do their best to smooth consumption over dates and states of the world, this literature claims that the Euler restrictions can be exploited to estimate "*ex-ante*" measures of vulnerability even in the absence of a fully specified dynamic model (Ligon, 2011). Consumption smoothing behaviour is also consistent with the standard hypothesis of the stationarity of consumption over time and states that characterises current applied vulnerability measures, even when the distribution of individual income is not stationary. Looking primarily at consumption behaviour also looks reasonable for the following reasons: i) it is consistent with the standard empirical literature that looks at consumption as a more reliable indicator of individual welfare than income; ii) it is consistent with the specific situation of poorer households, which traditionally have few assets and are credit constrained with important knock-on effects on their ability to smooth consumption (McCulloch et al., 2001) and, iii) it acknowledges that consumption choices actually engender a further set of behavioural changes that are likely to produce effects on household welfare such as: smoothing asset/income; self-insurance; risk-sharing arrangements; diversification, multiple occupations, migration, etc. (Morduch, 1994; Rosenzweig and Wolpin, 1993; Townsend, 1994; 1995, Carter and Barret, 2006; Zimmerman and Carter, 2003). However, this

[3]The only reference to vulnerability in trade policy is related to the *ex-post* status of developing countries in terms of remoteness (in the case of Small Island Development States, SIDS), and lack of diversification of exports (for the eligibility to the GSP+ schema of the European Union). Additional details can be found in Winters & Martins (2004); Briguglio, 1995; Briguglio et al., 2009; Briguglio & Galea (2003); Guillamont, 2009 and 2010).

choice stands on the implicit assumption that consumption behaviour is the key behavioural variable in explaining household choices under risk.

This work contains a conceptual part and a set of empirical applications: since panel data are ideal for testing the theory of consumption but scarce at the micro level, a first cross-country empirical exercise was carried out to test the relevance and significance of the "extra-saving" hypothesis in response to macro-fluctuations in income. Then, two empirical assessments of trade-induced vulnerability were carried out at the household level. The latter are focused on Vietnam and take advantage of the available household living standard surveys covering the period 1992-2008.

The choice of Vietnam as the primary case study for the household level empirical analysis is not casual. The reason is threefold: i) since the early 1990s, Vietnam undertook a vast process of reforms, namely the *Doi Moi* (renovation), a combination of liberalisation, stabilisation and structural reforms, that determined a sudden opening up to international market of a previous planned economy; ii) empirical analyses consistently highlight the increased importance of international trade on Vietnamese economy as well as the positive empirical correlation between trade liberalisation and poverty reduction; iii) we can benefit from a collection of six household living standard surveys for the full period 1992-2008. The challenge was to complement the existing empirical evidence on the relationship between trade openness and poverty in Vietnam under *Doi Moi* with a parallel empirical analysis of the relationship between trade openness and vulnerability to poverty. Following on from Winters (2002) who provides an overall picture of the transmission channels between trade and poverty, this work assesses vulnerability induced by trade by relying on a workable empirical identification strategy which focuses on the presence of behavioural heterogeneity in consumption across households clustered by industries characterised by different degrees of trade exposure. The assumption is that the presence of heterogeneity in vulnerability scores across clusters of households classified by trade exposure strongly suggests heterogeneity in their risk exposure and/or mitigating strategy with significant policy implications.

As already noted, the thesis is divided into four essays.

The first essay presents a comprehensive review of the literature on the destabilising effects of trade openness, drawing together studies in different fields. It also provides a conceptualisation (and discusses the most common misconceptions) of vulnerability induced by trade openness and the main lines of direction for research on the link between trade openness and vulnerability to poverty. It highlights, on the one hand, the extent of the very informative work currently available on the topic and, on the other hand, the urgent need for more focused work on the implications of trade openness in terms of vulnerability. This piece of work first introduces the separate concepts of economic fluctuations, risk and uncertainty and their actual implications for welfare in developing countries, and then investigates the possible channels of transmission between trade openness and economic instability.

The second essay is a comprehensive empirical test of the significance and relevance of consumption smoothing under permanent risk. It presents conservative (i.e., lower bound) estimates of the relation between permanent risk and consumption smoothing based on a long (pre-crisis) cross-country panel setting (1950-2008). It proposes both LSDV and system GMM estimates of an ARDL model of consumption behaviour under risk based on the maximisation of the expected value of a time-separable CARA utility function over an infinite horizon (see Blanchard and Fischer (1989), Caballero (1990 and 1991), Weil (1990), Guiso et al., (1992) among others). As suggested by Carroll and Samwick (1997), Reis (2009) and Krebs et al. (2010), the permanent component of *ex-ante* income risk was filtered out as a measure of permanent risk. The reason is twofold: i) to let the transitory component of income risk absorb the measurement errors, leading to unbiased estimates of *ex-ante* risk; ii) to acknowledge that the more persistent the effect of the stochastic component of income is, the larger its impacts via the standard precautionary savings channel are assumed to be since permanent effects cannot easily be insured by smoothing consumption (for a thorough analysis of the issue of persistence, see Reis, 2009). While it focuses only on aggregate risks and rests on the implicit assumption that incomes are perfectly pooled across individuals (i.e., a representative agent hypothesis), it goes beyond averages and controls for country heterogeneity also providing estimates by income deciles. The main innovation to the existing literature in this first empirical exercise lies in proposing a way to look empirically at the cost of volatility on welfare that is alternative to using compensation parameters of household preference for stability (see, for instance, Lucas, 1987, 2003 and Reis, 2009). More specifically, this essay focuses on the impact of risk on current and future consumption possibilities (and welfare) which implies relative changes in portfolio allocation between risky capital and safe assets (Loayza et al., 2007; Reis, 2009; Cherif and Hasanov, 2012).

The third essay presents - to the best of my knowledge - the first comprehensive analysis of vulnerability to poverty induced by trade liberalisation in Vietnam under *Doi Moi* for the entire period 1992-2008, by exploiting all the available household living standard surveys. First of all, it presents an empirical assessment of Vulnerability to Poverty (VEP) induced by trade openness. Thus, acknowledging the structural limitations of VEP in further decomposing its risk-induced component, it also presents "upper bound" estimates on the relative importance of the various determinants of consumption behaviour under risk, by distinguishing the relative influence of *ex-ante* and *ex-post* factors. Finally, by clustering households by trade-related industries, it also presents some informative analyses across trade clusters of the heterogeneity in their stochastic component of income innovation (i.e., the component of income variation unexplained by observables). The striking feature of this first empirical exercise lies in highlighting the non-decreasing importance of the share of the vulnerability component of consumption behaviour linked to the stochastic determinants and/or ex-post shocks - an issue traditionally overlooked by the empirical literature in the field. Moreover, these estimates show that risk exposure varies systematically with the trade exposure of surveyed households.

The fourth essay proposes an extended version of Ligon and Schechter's (2003) VEU measure of vulnerability that is able to control for trade-related heterogeneity in households' exposure to shocks. Moreover, it also overcomes the common weakness of currently available measures of vulnerability, i.e., the inability to decompose the *ex-ante* impact of risk and its correlated risk-mitigating strategies from the *ex-post* ones. To provide an empirical application of this extended VEU measure, the essay focuses on VHLSS panel data (2002-06) and follows three methodological steps: first, following Ligon's (2006) approach, the VEU measure was further decomposed by filtering out a trade-related risk component from the aggregate component of risk premium able to capture any systematic variation in the expected level of log consumption across households classified by trade clusters. More specifically, it is argued that, because of heterogeneity in trade exposure between tradable and non-tradable industries, global risks do not affect households homogeneously and the residuals show up a systematic correlation across households clustered in industries characterised by the same degree of trade exposure. Second, as suggested by several authors (Elbers and Gunning 2003, Elbers et al. 2007, Elbers et al. 2009, Carter and Ikegami, 2009), with regard to the assumption that households correctly perceive the distribution of risk they face even when they actually do not experience any shock, the idiosyncratic component of the VEU measure is further decomposed by filtering out an idiosyncratic *ex-ante* component of risk. This lets us separate the cost of risk due to the *ex-ante* change in consumption behaviour from the other components of the risk premium and so give a distinct value to the costs of mitigation strategies compared with *ex-post* coping ones. Third, once again, the persistent component of *ex-ante* risk is further filtered out. This makes the extended version of VEU fully consistent with the theoretical and empirical prediction that a rational consumer safeguards against future bad shocks by reducing current consumption and over-accumulating saving in safe (unproductive) assets (Caballero 1990, Deaton 1992, Caroll 2001a). To test the significance of the separate impacts of the *ex-ante* permanent risk on both non-random consumption and on the risk premium, the correlates between permanent risk and the various components of trade-induced vulnerability are also presented. Finally, to control for the presence of heterogeneity in vulnerability scores by trade-related sectors, the VEU outcomes and the various components of the risk premia are calculated for cohorts of households defined by the degree of trade exposure of the industry from which they earn their main incomes.

Chapter 1

Essay 1 - Review of the literature, conceptualisation (and misconceptions) of trade-induced vulnerability to poverty

This essay introduces the reader to the welfare costs of exposure to shocks and uncertainty linked to trade openness - a prominent issue in international debate. It presents, first, a comprehensive review of the literature on the "destabilizing effects" of trade openness, drawing together studies in different fields. It thus provides a conceptualisation of trade-induced vulnerability and the promising lines of reasoning for future research on the link between trade and vulnerability.

Keywords: vulnerability, trade openness, volatility, crisis transmission, developing countries.

JEL: F10; F40; I32; E17, D60, O10

1.1 Introduction

According to theory, international trade improves resource allocation, lowers prices for consumers and leads to a more efficient production. An open trade regime also encourages the integration of the economy into the global system and imports of modern technology, which results in productivity improvements. Accordingly, international organizations advocate policy reforms centred on trade liberalization to foster growth and welfare.

However, a key issue remains unanswered: does trade openness magnify exposure to foreign shocks raising uncertainty and, eventually, producing long term effects on partner countries welfare? This topic is currently hotly debated by practitioners, whereas it is largely ignored by trade literature. Trade theory does not provide a full understanding of the links between trade openness, shocks and uncertainty. Empirical evidence is mixed, scattered in separate fields of analysis and does not reach a common stance. A number of attempts have been carried out recently to investigate more carefully this issue both at the aggregate (Montalbano & al., 2006, 2008; Guillaumont, 2009, 2010; Naude & al., 2009a),[1] and at the households level (Winters, 2002; Winters & al., 2004). However, these pioneer works lack consistency in terms of conceptualisation and methods.

This work aims at contributing to the above debate by providing a comprehensive conceptualisation of "trade-induced vulnerability" and some directions for future research on this topic at different levels of investigations (macro, micro and meso).

A first challenge is to bridge two relevant issues, traditionally seen as separate topics: trade openness and vulnerability. While the debate around trade openness and its measurement has been extensively investigated since Krueger (1978) seminal work, vulnerability assessment is still at the "let a hundred flowers bloom" stage, as stated by Hoddinott and Quisumbing (2003) and there are several misconceptions related to its analysis. The main focus of this work is the vulnerability analysis of the effects of trade openness on partner countries. Specifically, this essay addresses the issue of whether or not, and eventually under which conditions, trade openness leads to increasing exposure to external shocks and/or raising uncertainty about the future on certain actors and/or specific social groups. The debate around trade openness remains indeed an important part of the story but it does not represent the main contribution of this piece of work. This essay

[1] It is worth mentioning that the issue of aggregate vulnerability discussed here must be kept separated from the issue of Small Islands Developing States (SIDS) and Fragile States. SIDS are States characterized by a natural and/or endogenous inability to face external shocks (for additional details on SIDS see Montalbano & Triulzi, 2009; UNU-WIDER, 2008; Briguglio 1995; Atkins & Mazzi, 1999; Easterly & Kraay, 2000; Briguglio & Galea, 2003; Winters & Martins, 2004; Witter & al., 2002; Briguglio & al., 2009). Fragile States are countries where government does not deliver core functions to the majority of its people, including the poor. A number of post-conflict states fall into this category (UNU-WIDER 2008).

builds on McCulloch & al.'s (2001) operational view that the relative openness of countries depends largely on the extent to which international trade determines local prices, regardless of whether or not this depends mainly on deliberate policies.[2]

This essay is structured as follows. Section 2 surveys the existing literature on the likely destabilizing effects of trade openness. Section 3 reviews the current theoretical and applied literature on vulnerability, presenting an overall conceptualisation of the phenomenon as well as some of the most common misconceptions. Section 4 proposes a first conceptualisation of the trade and vulnerability link and some directions for future research. Section 5 concludes.

1.2 Is Trade Openness "destabilising" for developing countries?

Most empirical work establishes a consistent and significant positive correlation between trade liberalization, growth and poverty reduction (Edwards, 1993; Frankel & Romer, 1999; Sachs & Warner, 1995; Dollar & Kraay, 2002, 2004; Cline, 2004; Winters, 2004). The drawbacks to trade openness are acknowledged basically in terms of short and medium run adjustment costs. The pervasive effects of trade openness on poverty and inequality, even in the long run, are acknowledged as well (McCulloch & al., 2001; Lundberg & Squire, 2003; Winters & al., 2004; Goldberg & Pavcnik 2004). An issue largely ignored by the above literature concerns the analysis of possible destabilizing effects of trade openness. The hypothesis of a direct link between developing countries' instability and trade openness has several roots: i) the apparent asymmetry between the process of increasing specialisation and the presence of random, undiversifiable shocks in the export markets of open economies (Razin & Rose, 1992; Koren & Tenreyro, 2007); ii) the tendency of commodity prices which are at the core of the specialisation process in developing countries to be more volatile than those of manufacture goods (Malik & Temple, 2009); iii) the possible inconsistency between the shocks prevailing in open markets and traditional coping mechanisms and local market structures (Dercon, 2001); iv) the occurrence of boombust cycles of investment induced by trade openness in countries characterized by inadequate infrastructures and shortages of skilled labour (Razin & al. 2003); v) the role of trade liberalization in altering households' optimal portfolios, cou-

[2]For a comprehensive list of standard measures of trade openness, see McCulloch & al. (2001).

pled with greater variability in new portfolio options (Winters & al., 2004); and vi) higher risk of policy mismanagement in response to an entirely new set of incentives induced by trade openness in contexts where political institutions are weak (Gavin & Hausmann, 1996; Rodrik, 1999, Acemoglu & al., 2003, Fatás & Mihov, 2003, 2005).

Given the heterogeneity of the situations above, it is worth making explicit here: first, what is meant with "economic instability", second, why should we care; third, what are its link with trade openness.

a. Economic instability and its long term impact on developing countries

Economic instability refers, generally speaking, to a situation of excessive fluctuations of economic variables: a phenomenon which is indeed increasing over time for a high fraction of low and middle income countries (Agenor & al., 2000; Kose & al., 2003; Wolf 2005; Loayza & al., 2007). Fluctuation is usually measured by the volatility of economic variables, proxied by the standard deviation of the first differences of observed time series (Aizeman & Pinto, 2005, Wolf, 2005).[3] It reflects, empirically, the amount of uncertainty and risk of the economic variable, where risk is normally proxied by the predictable component of variability and uncertainty by its "unpredictable component". A workable difference between risks and uncertainty has been highlighted by Knights (1921) classic work: while risk permits one to assign probabilities to the different outcomes, uncertainty normally refers to situations where several outcomes are associated with an event, but the assignment of probabilities to these outcomes may not be possible (the so called "knightian uncertainty"). In this respect, empirical volatility can be considered more as an allied to risk in that it provides a concrete measure of the possible variation or movement of economic variables (Aizenman & Pinto, 2005). On the other hand, it has been highlighted that the volatility of economic variables is seldom predictable and, hence, total observed volatility may overestimate risk (Dehn, 2000; Aizenman & Pinto, 2005).[4] Several applied methods have been thus put in place by the literature to extract the

[3]This means to assume implicitly that series have a constant trend (equal to the mean). Following the RBC literature, using business cycle filters, trend can be allowed to follow a richer, time and country dependent process, by applying the so-called "output gap" measure (Hnatkovska and Loayza, 2005).

[4]Dehn (2000), disentangling commodity prices *ex post* shocks and total volatility, demonstrates that failure to account for "predictable" changes leads to considerable overstatements of actual uncertainty. This result holds for nine definitions of uncertainty from the "simple unconditional standard deviation" to "Garchs conditional standard deviation of one step ahead forecast error dummying out all shocks".

"unpredictable component" (i.e. uncertainty) from "pure risk" and sample variability (e.g., Hnatkovska & Loayza, 2005; Wolf, 2005; Demir, 2009).

It is from Lucas' (1987) seminal work onwards that economists have dealt with the macro analysis of the "cost of fluctuations". According to Lucas' calculations, these costs account little in terms of welfare. This contributed to divert much of the previous attention on the issue as well as in favouring growth centred policies with respect to economic stabilization ones. However, Lucas (1987)' results are not compatible with a number of stylized facts, e.g., the so called "equity premium puzzle" (Mehra & Prescott, 1985).[5] Moreover, as Aizenman & Marion (1999) highlight, while risks do not necessarily do,[6] "knightian uncertainty" produces pervasive long term effects, since agents are more reluctant to embark on new activities. Finally, from the work of Ramey & Ramey (1995) onwards,[7] empirical cross-country studies have consistently found a negative relation between volatility, long-run growth and welfare, especially in developing economies (Aizenman & Marion, 1999; Fatas, 2000; Pallage & Robe, 2003; Kose & al. 2003: Wolf, 2005; Hnatkovska & Loayza, 2005; Demir, 2009). As Loayza & al., 2007 highlight, two are the main reasons we should care about volatility in developing countries: i) the substantial welfare loss of deviating from a smooth path of consumption, in case of consumption volatility; ii) the indirect welfare loss in terms of future consumption, in case of a negative impact of volatility on growth. Loayza & al., (2007) underline as well that developing countries not only face more volatility than industrial countries but suffer larger volatility effects, because of the intrinsic instability of the developing process (mainly linked to the weakness of their financial systems and the main characteristics of their specialisation process of production); the concrete risk of policy mismanagement (e.g., as in the case of pro-cyclical and/or erratic fiscal and monetary policies), and the presence of weaker mitigating and coping mechanisms.

b. Economic instability and trade openness: a survey of the literature

[5] The "Equity Premium Puzzle", highlighted by Mehra and Prescott (1985) comes from the observation of higher return on equity stocks compared to government bonds. This highlight the presence of a sort of "risk premium" on equity stocks versus government bonds, i.e. individuals manifest clear risk aversion which is not compatible with standard economic models.

[6] Even when it happens and downward shocks (crises and/or "sudden stops") occur, one is still dealing with short term episodes than could (but could not as well) produce pervasive and long term effects.

[7] At the aggregate level, volatility has been for a long time confined in standard cycle theory, mainly concerned in the decomposition of economic growth into cyclical and trend components. Thus, it has been long considered as a second-order issue in developing studies - but of primary interest in industrial countries concerned with smoothing the fluctuations of their business cycles.

The phenomena of "trade-induced" instability have been traditionally seen as terms-of-trade shocks (Rodrick, 1998). However, open economies show, overall, greater output volatility and, in some cases, greater consumption volatility too (Hnatkovska & Loayza, 2005; Loayza & al., 2007). Winters (2002) provides a first analysis of the conditions under which foreign shocks can have specific impacts on households in developing countries, via the main transmission channels of trade openness: when foreign shocks are greater than domestic ones (e.g. when world markets are more variable than local ones); when trade liberalization affects governments' ability to operate price stabilization policies; when trade reforms change the emphasis among the different activities engaged by households (e.g. in the case of farmers, switching from subsistence to cash crops). He concludes that international trade has a priori ambiguous implications for macro stability.

To investigate more in depth this issue, it is useful to gather current applied literature on the "destabilizing effects" of trade openness into two main strands: empirical analyses that emphasize the role of trade openness as a key determinant of aggregate volatility (Easterly & al., 1993; Mendoza, 1995; Gavin & Hausmann, 1996; Prasad & Gable, 1998; Rodrik, 1998; Kose, 2002; Kose & Yi, 2001, 2006; Wolf, 2004; Kose & al., 2005); and empirical analyses that look at trade openness as a complementary, real aspect in currency crises (Milesi-Ferretti & Razin, 1998, 2000). In this latter case, trade openness has been seen both as a means to trigger "sudden stops" (Cavallo & Frankel, 2008), or as a vehicle to spread out crises, especially in regional contexts (Glick & Rose, 1999; Easterly & Kraay, 2000; Forbes, 2002).

In both cases, empirical results are mixed. While some studies find that an increase in the degree of trade openness leads to higher volatility on a wider set of outcome variables (aggregate income, consumption, employment, salaries and prices), especially in developing countries (Karras & Song, 1996; Easterly & al., 2001; Kose & al., 2003; Di Giovanni & Levchenko, 2009; Raddatz, 2006; Loayza & Raddatz, 2007; Krishna & Levchenko, 2009; Haddad & al., 2010), others find no significant relationship between an increased degree of trade interdependence and domestic macroeconomic volatility (Calderon & al., 2005; Kose & Yi, 2006; Cavallo, 2007) or just a temporary relationship (Santos-Paulino, 2010). A separate but related issue is the role of international trade as a key determinant of business cycle transmission across countries (Anderson & al., 1999; Canova & Dellas, 1993; Clark & van Wincoop, 2001; Otto & al., 2001; Calderon & al., 2005; Calderon & al., 2007; Baxter & Kouparitsas, 2005; Imbs, 2004; Kose & Yi, 2001, 2006). This is consistent, theoretically, with the international "Real Business Cycle" (RBC) approach as it embodies demand and supply side spill-over channels (Stadler, 1994). However, Kose & Yi (2001, 2006), who try to match RBC and the co-movements in their empirical findings, are not able to explain its magnitude, and suggest the existence of a "tradeco-movement puzzle".[8]

In the second strand of the literature, the role of trade openness in fostering macroeconomic crises is also hotly debated. The basic argument for a positive role of trade openness in reducing exposure to foreign shocks is that a high trade/GDP ratio helps to adjust to a cut-off in international financing. Rose (2005) provides empirical explanations for the above case, arguing that countries with higher trade/GDP ratios are less likely to default because investors are less likely to pull out, and that higher ratios of trade to GDP allow countries to cope with a cut-off of capital inflow and a smaller percentage increase in exports. Cavallo & Frankel (2008) show that trade openness makes countries less vulnerable to both severe sudden stops and currency crashes, and show that this relationship is even stronger when correcting for the endogeneity of trade, using "gravity estimates".[9] On the other hand, the basic argument for a pervasive role of trade openness in increasing exposure to external shocks, is grounded in the idea that a weakening export performance can trigger a sudden stop in capital flows. Furthermore, Eichengreen & Rose (1999), Glick & Rose (1999) and Forbes (2002) demonstrate empirically the role of "trade linkages" in spreading crises in regions.[10] The central point here is that currency crises spread along the lines of trade linkages and, since trade patterns are strongly negatively affected by distance, - no matter who is the first victim of a speculative attack, or what factors are behind it - there is strong evidence that currency crises tend to spread regionally because of trade linkages. Forbes (2002), following Corsetti & al. (2000) and Wincoop & Yi (2000), decomposes the trade linkages of crises into three parts: i) a "competitiveness effect", linked to changes in relative prices

[8] This new "economic puzzle" has been argued by Kose & Yi (2006) to highlight the inability of standard international business cycles models to explain the empirical findings related to the fact that pairs of countries with stronger international trade linkages tend to have more coordinated business cycles.

[9] Guidotti & al. (2004) provide evidence that economies that trade more, recover more quickly from output contractions that usually accompany "sudden stops". Calvo & al. (2004) and Edwards (2004) find that openness to trade is associated with fewer "sudden stops". Martin & Rey (2006), using a general equilibrium model, show that emerging markets are more prone to financial crises unless openness in their financial accounting is counteracted by similar degrees of openness in trade.

[10] The rationale for this evidence is that, in the presence of nominal rigidities, currency devaluation gives the country a temporary boost in terms of competitiveness, leaving its trade competitors likely to be the next to be attacked.

that could hamper international competitiveness; ii) an "income effect", i.e. reduction in the demand for imports induced by the income reduction following a crisis; iii) a "cheap import effect", which, by contrast, is a positive supply shock connected to a reduction in import prices by trading partners forced to devaluate.[11] She highlights also the key role of countries different responses to the initial crisis in determining the prevalence of each effect: e.g., the competitiveness effect is larger in the face of a currency devaluation, while the income effect is mainly linked to a rise in interest rates.

The first impression generated by the above survey is to conclude that applied literature on trade and instability is unstable too. My point here is that the analyses above are not sufficient to have a final say on the issue and that a more rigorous "trade-induced vulnerability to poverty" analysis is needed. The surveyed empirical works use, in fact, numerous different methods and empirical instruments, and studies are separated across widely different fields of investigation which often do not communicate.[12] In addition, most of these investigations are backward looking and mainly targeted at issues not directly linked to vulnerability. Moreover, they are overwhelmingly focused on "output volatility" while there is little investigation on "consumption volatility" and on the relationships between the two.

Before drawing the key directions of research on trade and vulnerability in section 4, it is useful to provide a clear cut conceptualisation of vulnerability and its measurement as well as to highlight the most common misconceptions.

[11] Analysing data on trade flows for a sample of countries that experienced a crisis in the 1990s, Forbes (2002) suggests that competitiveness and income effects are negative, significant and quantitatively relevant, while the positive cheap import effect remains weak.

[12] Regarding the trade and volatility link, e.g., extensive use of panel data is made to measure the external exposure of a worldwide sample of countries by the sensitivity of first and second moments of economic growth (average rate and standard deviation) to openness and financial shocks (Kose & al., 2003; Hnatkovska & Loayza, 2005; Wolf, 2005; Calderon & al., 2005). Semi-structural VAR (Vector AutoRegressive Models) are applied to panel data in order to isolate and standardize shocks; estimate their impact on GDP and examine whether and to what extent this impact depends on domestic conditions (Loayza & Raddatz, 2007; Santos-Paolino 2010). Malik & Temple (2006), in their effort to explain differences in output volatility across developing countries, used instead a Bayesian method to highlight explanatory variables that are robust across a wide range of specifications. Another interesting exercise to measure variability is proposed in Valenzuela (2006), which attempts to assess whether, in a context of volatile commodity markets, it is possible to discern the effects of trade liberalization on poverty using an innovative application of a stochastic framework in combination with the Global CGE model and a micro-household simulation. An extensive use of Probit models is applied to measure the probability of a sudden stop (Cavallo & Frankel, 2008; Calvo & al., 2003, Frankel & Rose, 1996, Frankel & Wei , 2004, Glick & Rose 1999).

1.3 Vulnerability: Conceptualisation, measurement and common misconceptions

As Hoddinott & Quisumbing (2003) underline, vulnerability means different things to different people. It is a complex phenomenon, not easily determined by one measurable dimension. It can be rightly compared to a picture in a newspaper. Looked at from a distance, it may seem clear and relatively sharp. However, viewed close up, it appears blurred and grainy and loses its sharpness. Likewise, there is a wide consensus on what vulnerability means in general terms; but, when we attempt to analyse it in detail, the concept tends to blur and become subsumed in the haze of the multifarious situations of vulnerability, giving only context-specific interpretations. As a result, a proliferation of methodologies, terminology and approaches to vulnerability analysis have been applied within a broad range of topics (e.g. food security, natural disasters, conflict prevention, economic fragility, etc.). Scholars, research centres, multilateral and bilateral organizations and agencies have developed their own definitions and methods to analyse vulnerability.[13] It is notable that not all these definitions include the same key elements and they also use slightly different terminology. Hence, practitioners from different disciplines use different meanings and concepts of vulnerability, which tend to be theoretically strong and empirically weak, or vice versa (Alwang & al., 2001).

a. The concept of vulnerability

An attempt to provide a comprehensive definition of vulnerability has been carried out by the World Bank, in its "Social Risk Management" (SRM) approach (Holzmann, 2001; Holzmann & Jorgensen, 2001; Heitzmann & al., 2001).[14] The SRM approach is partly an extension of the literature on poverty dynamics, where the traditional distinction between chronic and transient poverty is enhanced by a forward-looking approach. According to this approach (see Heitzmann & al., 2001), the three basic components of vulnerability analysis are the following:

[13] For an extensive analysis of the methods and tools in international organization, see Montalbano & Triulzi (2002).

[14] The aim of the Social Risk Management approach is to embed social protection programs into an integrated approach to poverty reduction. To this extent, the SRM framework is considered as a safety net in times of crisis and hardship, but more importantly a springboard to assist the poor to escape poverty and vulnerability prior to the occurrence of a shock (World Bank, 2000).

- a thorough analysis of risks (i.e. the exogenous side): risks have different nature. Moreover, they can be characterised by a known or unknown probability distribution, by different magnitude (size and spread), history, frequency, correlation, duration, timing and severity. Finally, they may be idiosyncratic (i.e. specific to the household and its members, e.g. illness or job loss), or covariate (i.e. experienced simultaneously, regionally or nationally, e.g. inflation, recession, and terms-of-trade volatility);

- an assessment of the degree of resilience and/or responsiveness (i.e. the endogenous side): Households can respond to or manage risks in several ways, using formal and informal risk managing, mitigating and coping tools. Risk management involves *ex-ante* and *ex-post* actions. Risk mitigation includes formal and informal responses to expected losses such as self-insurance (e.g. precautionary savings), building social networks, and formal insurance based on expansion of the risk pool. Risk coping activities are *ex post* responses and involve activities to deal with actual losses such as selling assets, removing children from school, migration of selected family members, taking temporary employment. The availability of coping mechanisms has to be coupled with the degree of "adaptability" or "resilience" of different households.

- a benchmark: it means a socially accepted minimum norm for each outcome under which households is said to be vulnerable to future loss.[15]

Another prominent approach to vulnerability is the "Sustainable Livelihood Vulnerability" (SLV) adopted by many international development agencies, such as UNDP, and with slight differences in terminologies and methods also by DFID, IDS, Oxfam, CARE, to produce project appraisals and reviews (see Carney &. al., 1999). The SLV approach is linked to Sens seminal "capabilities approach" which stresses what people can do or be, based on their entitlements. Accordingly, SLV assesses vulnerability as the likelihood that people's livelihoods deteriorate over time, and analyses the dynamics and characteristics of the population's reaction strategies in various political and socio-economic contexts (Barrientos, 2007; UNDP, 1999 & 2000; Singh & Gilman, 1999). It incorporates an evaluation of sensitivity to negative shocks ("livelihood sensitivity") as well as the endogenous ability to respond and recover ("livelihood resilience").[16]

[15] Standard analyses generally use a poverty line to assess vulnerability to poverty.

[16] Efforts have been made to combine the "sustainable livelihood" approach and "en-

b. The measurement of vulnerability

Different approaches to vulnerability lead to different methods of estimation. While SLV adopts a more holistic approach and looks at the capacity of social communities to recover from disasters, monetary analyses of vulnerability typically express welfare in terms of consumption and focus on consumption variability as proxy for economic instability, acknowledging that consumption of an optimizing household changes only in response to unexpected changes in income (Dynan, 1993).

While the earliest efforts attempt to measure vulnerability simply as the negative impact on household's consumption from exposure to a set of observed risks - the so called VER (vulnerability exposure to risk) approach (Glewwe & Hall, 1998; Amin & al., 1999, Dercon & Krishnan, 2000) later efforts measure vulnerability as loss in "expected welfare", variously defined, in an uncertain environment (Chaudhuri, 2001, 2003; Ligon & Schechter, 2003; Calvo & Dercon, 2007a).

A first taxonomy of the main methods applied in vulnerability analysis has been provided by Hoddinott & Quisumbing (2003). A slight update to this identifies three main typologies of vulnerability measures: VEP-Vulnerability as Expected Poverty (Christiaensen & Boisvert, 2000; Christiaensen & Subbarao, 2005; Chaudhuri, 2001, 2003; Chaudhuri & al., 2002; Pritchett & al., 2000; Gunther & Harttgen, 2009); VEU - Vulnerability as Low Expected Utility (Ligon & Schechter 2003, 2004); VTP - Vulnerability as Threat of Future Poverty (Calvo & Dercon, 2003, 2005, 2007a,b). Each of these vulnerability method presents its own virtues and weaknesses (details about these methods and their pros and cons are reported in the Appendix). VEP method is the most commonly applied. The reason is twofold: it is more easily interpretable than utility-based measures since it provides results in terms of expected values of the common FGT class of decomposable poverty measure (Foster & al., 1984); it permits one to assess vulnerability using a single round of cross-sectional data, which is a strong assumption

vironmental vulnerability", where vulnerability is the exposure of individuals or social groups to a reduction in livelihood linked to environmental change (Dinar & al., 1998, Ahmed & Lipton, 1999). Following this approach, methodologies to provide insights into the expected negative impacts of climate change have been developed. However, we should remember the distinction between "socio-economic vulnerability" and "ecological fragility or environmental vulnerability" (Guillamont, 2009). While socio-economic vulnerability can be induced also by natural factors (see, e.g., the undeniably negative impact of earthquakes, typhoons and floods on the sustainability of economic growth), we need to acknowledge that an entire set of issues, such as biodiversity, pollution and global warming, remain exclusively outside this subject and form a separate and specific area of analysis, i.e. "ecological fragility".

but particularly convenient in the absence of panel data, as it is the case for most developing countries. However, it holds, among others, on two additional strong assumptions: i) the variance of log consumption of otherwise equal households is not the same for all households and captures the impact of covariate and idiosyncratic shocks[17] ii) this variance can be explained with observable household and community characteristics. One of the main weakness of the VEP method lies in its somewhat perverse policy implication that is the fact that increasing variance one would reduce the vulnerability of those with mean consumption below the poverty line. VEU is more rigorous in terms of theoretical background but less suitable to be easily transformed into policy prescriptions. It measures vulnerability as the difference between the expected utility of consumption and a minimum acceptable level of utility derived from a certainty-equivalent level of consumption. It helps to disentangle "vulnerability to poverty" from "vulnerability to risk" (i.e., high volatility in consumption). However, it remains sensitive to the choice of the form of the utility function and changes in welfare above the poverty line. Lastly, VTP actually benefits of a rich "axiomatic approach" but pays for it through a limited empirical applicability and the need of lengthy households panels. VTP sees vulnerability as a combination of poverty (measured as failure to reach a minimum outcome) and risk (measured as dispersion over different states of the world), emphasising the sensitivity to risk of the vulnerability measure. It also avoids vulnerability to depend from outcome changes above the poverty line (the so called focus axiom).

Ligon & Schechter (2004), using a set of Monte Carlo experiments to explore the performance of different estimators and vulnerability measures, find that each of the three approaches perform best in different environments. More specifically, when the environment is stationary and consumption expenditures are measured without error, VEP is the best estimator. If the vulnerability measure is risk-sensitive[18] and consumption is measured with error, then VEU and VTP estimators generally perform best. Finally, if the distribution of consumption is non-stationary, a modification of the Chaudhuri (2001) estimator applied to panel data in differences proposed by Pritchett & al. (2000) performs best.

[17]As Kamanou & Morduch (2002) and Hoddinott & Quisumbing (2003) point out, a strong homogeneity assumption must be made in order to interpret results of vulnerability, namely that all households observed in the cross-section receive draws from the same distribution of consumption changes. In practice, while one can refine this measure by disaggregating by region, by income group, etc., the assumption of homogeneity still has to be made.

[18]According to Ligon & Schechter (2004) a vulnerability measure is "risk sensitive" if it increases when risk increases.

In conclusion, we still lack a single, generally agreed, method to measure vulnerability as well as a common approach to look at uncertainty as a source of distress. Moreover, the above methods focus all on households, no matter what the typology (from handmade macroeconomic policy to natural disasters, e.g. rainfall, etc.) and nature (covariate and idiosyncratic) of the observable shocks. Furthermore, they all make reference to a poverty line (in terms of consumption, income or utils) as a benchmark, narrowing, generally speaking, the assessment of vulnerability into vulnerability to poverty.

c. The most common misconceptions about vulnerability

Notwithstanding the amount of analytical and empirical work on vulnerability, its analysis is still affected by several misconceptions.

I) Vulnerability vs poverty

First, most analyses liken vulnerability to poverty. Although closely related - they can be seen as two sides of the same coin - these two concepts are different. The first obvious remark is that observed poverty status of a household is the *ex-post* realisation of a state, whereas vulnerability is its *ex-ante* probability (Chaudhuri & al., 2002). However, it is worth underlying they both focus on poverty dynamics with a different lens. While, in fact, standard poverty assessments deal with the evidence of the temporary nature of poverty (Baulch & Hoddinott, 2000)[19] trying to separate transient and chronic poverty and providing information on "how often" a household is poor; vulnerability analyses that deal with it distinguish between those who have low expected mean consumption (i.e. low endowment) and those who have high volatility of consumption (i.e. high uninsured income fluctuations), provides additional information on the sources of poverty. Thus, vulnerability analysis, by disentangling those who are considered as vulnerable because of an estimated expected mean consumption below a minimum accepted benchmark from those who have an estimated expected mean above the benchmark but a high estimated variance in consumption provides an answer also to the key question of "why the poor are poor" (Chaudhuri & Datt, 2001, Gunther & Harttgen, 2009). It follows that the characteristics of the vulnerable differ significantly from those of the poor. Hence, targeting only the latter will exclude a significant group of households that are at risk of a

[19]Comparing 13 panel studies of developing countries in Latin America, Africa, Asia and Russia, Baulch & Hoddinot (2000) show there is a surprisingly large percentage of temporarily poor households (from a low of 20% to a high of 66%) in relation to the percentage of chronically poor (10% on average, but never more than 25%) for each region.

decline in living standards as well. In other words, the distinction between poverty and vulnerability remains key for economic policy.

A separate but related issue concerns the degree of vulnerability of the poor. The widespread idea is that the poor will be among the most vulnerable people (World Bank, 2000; Calvo & Dercon, 2007a). Empirical analyses show however that shocks occur everywhere along the income distribution and affect poor and non-poor alike (Tesliuc and Lindert, 2004).[20] Moreover, the poor can show a higher degree of resilience even if they rely on coping strategies that could damage their growth prospects (Jalan & Ravaillon, 1999, Zimmerman & Carter, 2003; Carter & Barrett, 2006; Carter & al., 2007). It follows thus another key difference between resilience and responsiveness it is worth bearing in mind.

II) Resilience vs responsiveness

Another common misconception in vulnerability analysis concerns precisely the distinction between “resilience” or “adaptability” and “responsiveness” or “coping capacity”. Notwithstanding their obvious interconnection, they are different concepts and cannot be considered as a single one. The term “resilience” refers to “the capacity of a system, community or society potentially exposed to hazards to adapt, by resisting or changing in order to reach and maintain an acceptable level of functioning and structure” (UN/ISDR, 2004). “Responsiveness”, on the other hand, measures the availability of policy tools and institutions to cope with, mitigate or avoid the negative effects of external shocks. In the first case, we are dealing with a structural phenomenon given by the complex of individual actions undertaken collectively mainly by private agents, to cope with, mitigate or avoid the negative effects of external shocks. These actions will depend strongly on assets, and levels of education and health and open the way to new conceptual developments - for instance, in the recent debate on adaptation to climate change. In the second case, we are dealing with policies and institutions capable of strengthening or reducing a country’s ability to cope and/or recover from negative shocks. This distinction has been enhanced at the macro level, by separating the issue of “structural vulnerability” which results from endogenous factors that are independent of a country’s current political will, from the issue of “policy vulnerability” which is linked to a country’s political choices or, even more clearly, from the issue of “state fragility” which relates to countries characterized by very low policy-capability scores (Naude & al., 2009a,b; Guillamont, 2009, 2010). A similar distinction is been in the

[20] The largest relative differences in the incidence of shocks seem to occur across location characteristics, such as the region or area of residence.

"sustainable livelihood" approach, between "coping strategies", defined as short-term responses to specific shocks, and "adaptive strategies", or those that entail longer-term changes in behaviour as a result of shocks or stress. Note that, a greater capacity to cope usually builds resilience, and vice-versa.

III) Vulnerability vs ex post welfare loss

Furthermore, it should be acknowledged that experiencing an *ex-post* welfare loss is neither necessary nor sufficient for the classification of vulnerable. Vulnerability is an *ex-ante* condition that only potentially may lead to negative outcomes. Therefore, vulnerability cannot be directly observed, but only predicted (Chaudhuri & al., 2001). Vulnerability measures cannot rely only on observable data (e.g, vulnerability does not depend on, say, what consumption expenditures are actually realized, but rather on what they might be, Ligon & Schechter, 2004). The estimation problem in vulnerability analysis generally involves two steps: first, making consumption predictions; second, summarizing their welfare consequences (Ligon & Schechter, 2004). The first step normally implies the use of past realizations of consumption expenditures to estimate the probability of possible future consumption outcomes. This may be relatively easy if the environment is assumed to be stationary (probabilities remain the same across time). However, environments are not stationary in reality, and the probabilities associated with different consumption realizations vary over time (Ligon & Schechter, 2004).

As a matter of fact, vulnerability needs both a factual analysis (i.e. a forward looking measure from the observed facts) and a counterfactual (i.e. another measure for a different world). For instance, the counterfactual for vulnerability measures based on consumption expenditure is the unobservable level of consumption that would have prevailed in the absence of shocks and/or uncertainty (Alwang & al., 2001). This is the most problematic issue in vulnerability analysis. As many empirical studies show, to figure out a counterfactual is intrinsically challenging because individuals cannot easily or accurately quantify the extent/cost of welfare losses from shocks (Tesliuc & Lindert, 2004). Hence, one should rely on indirect estimation methods. A number of methods have been applied so far, from simple augmented specifications of a typical consumption regression with shock dummies (Datt & Hoogeveen, 2000), to an extensive application of the Oaxaca decomposition (Oaxaca, 1973)[21] or the use of non-parametric density estimations (Di Nardo

[21]The Oaxaca (1973) decomposition provides separate consumption estimations for a sample of households with and without shocks, and a way of partitioning the gap into a part attributable to differences in measured characteristics and a part attributable to the "treatment". This approach helps to explain the average differences between the two

& al., 1996).[22]

Finally, as illustrated previously, without any benchmark, the term vulnerability is too imprecise to be practically useful. A mere situation of risk exposure or a simple subjective feeling of vulnerability are not sufficient for policy targeting. Hence, vulnerability should be defined in terms of the potential to fall below a socially accepted minimums and its measurement should include a cut-off or benchmark (Alwang & al., 2001). At the household level, monetary vulnerability measures assess vulnerability *strictu sensu*, as the risk of falling below a poverty line. Similarly, the sustainable livelihood literature defines vulnerability with respect to a minimum livelihood level. With a macro level view Naude et al. (2009) adopt a broader definition of vulnerability as the risk that a "system" will be adversely affected by a shock (encompassing a broad range of welfare measures, benchmarks and shocks).

1.4 Trade-induced vulnerability to poverty: directions for future research

Keeping in mind concepts, misconceptions and methods of vulnerability analyses is of great help to foster current debate on the destabilizing effects of trade openness. This permit, in particular, to draw the main elements of a thorough analysis of "trade-induced vulnerability to poverty" as well as to derive a sound research agenda on the topic.

A number of considerations support the hypothesis of a trade and vulnerability link: Dercon (2001) underlines the role of openness as a vehicle for an entirely new set of shocks and incentives able to put traditional mechanisms under pressure and hamper people's standard management strategies; Winters (2002) and Winters & al. (2004) suggest that trade openness could alter households' optimal portfolios, so that their current portfolios become suboptimal, especially for the poor, because of their poor ability to bear new risks, and weak capabilities to insure themselves against adverse impacts; Ligon (2006) and Calvo & Dercon (2007a) infer that households' welfare can be negatively affected by uncertainty over future change induced by, among

groups, but is not very helpful for understanding the distributional consequences of shocks.

[22] Di Nardo & al. (1996) provide an extension of the Oaxaca decomposition by estimating the distribution of consumption that would have prevailed if all households were spared the negative impact of shocks, giving more weight to those households who are more likely to be under-represented. This distribution is compared with the actual distribution of consumption, and for each bin of the distribution the impact of the shock is determined as the difference between the current and the counterfactual density. For more details, see Tesliuc & Lindert (2004).

other things, reductions in barriers to trade.

A comprehensive investigation of this link requires not only the analysis, theoretically and empirically, of the main transmission channels by which trade openness could eventually turn into negative impacts in terms of welfare, but also an assessment of the degree of both resilience and responsiveness of partner countries. It requires as well the agreement of a socially accepted minimum standard or benchmark over which vulnerability is not an issue. The issue of the benchmark is key in a "trade-induced vulnerability" analysis. Approaches that condemn any shock that causes even one individual to suffer a reduction in income are not useful because, given the heterogeneity of households and the strongly redistributive nature of trade shocks, they will condemn virtually any policy intervention (Winters, 2002). Conversely, narrowing "trade-induced vulnerability" to essentially "vulnerability to poverty because of trade openness", as follows directly from current vulnerability analyses, not only embodies all the limits of standard poverty analyses, but does not take into account a broad range of welfare measures, benchmarks and shocks which turn indeed to be relevant in an open scenario.

To achieve a better understanding of the trade and vulnerability link and a sound method to measure it, I will suggest some refinements to the current literature on the "destabilizing effects" of trade openness and three promising directions for future research which are related to three levels of investigation: macro, micro and meso.

Concerning the refinement of current literature, it is possible to sum up three main weaknesses of applied literature on the "destabilising effects" of trade openness. First, the need to move from *ex post* assessments, based on aggregate volatility or crisis transmission, to *ex-ante* measures of the likelihood and magnitude of experiencing a reduction in well-being induced by trade openness. Second, the need to choose a suitable benchmark to distinguish actual vulnerability from normal variability. Third, the need of a counterfactual, since vulnerability is an *ex-ante* condition and it is not observable. At the micro level, since the data derived from household surveys are severely limited, there is also the need of a better accounting for the actual impacts of external shocks and specific evidence on "man-made" shocks, such as those that derive from the management of economic policies in a globalised world (Dercon, 2001).

Regarding the directions of future research, from a macro point of view the key challenge is to incorporate a forward looking lens to the standard macro literature on cross-country effects of trade openness; from a micro point of view the aim is to assess the welfare impact of covariate and idiosyncratic shocks induced by trade openness at household level; at the meso level, the objective is to derive useful insights and a more comprehensive picture of the vulnerability to trade phenomena by investigating the channels of transmission of external shocks at the subnational level. The first aspect of vulnerability highlights the pervasive and differentiated impact of covariate shocks that are of main interest for international economic policy. The second might help national policymakers to set priorities and calibrate domestic coping mechanisms and safety nets. The third sheds lights on the pervasive role of geography, regional, industry and competition polices.

a) Aggregate vulnerability from international trade

Substantive cross-country evidence claims that trade openness foster income growth and poverty alleviation among trading partners. As Bhagwati and Srinivasan (2002) clearly state "trade does seem to create, even sustain, higher growth", while Dollar and Kraay (2002; 2004) argue trade openness benefits the poor, given the positive association between overall growth and poor income growth. These results are consistent with trade theory: trade liberalisation, by eliminating price distortions, improves resource allocation, the import of modern technology and, hence, productivity improvements.

The need for a macro approach to vulnerability is grounded in the recognition that, in the current wave of global trade integration, external covariate macro shocks - the result of a perverse combination of international turmoil and economic policy mismanagement - are becoming increasingly and quantitatively important (World Bank, 2000; Eichengreen & Bordo, 2002).[23] As a result, efforts to measure vulnerability on the level of countries are increasing too (Gallopin, 2006; Montalbano & al., 2006, 2008; Guillaumont, 2009; Naude & al., 2009a, 2009b).

Following a broad definition of vulnerability as the likelihood that an economic system would undergo an outcome below a certain benchmark because of a "perturbation" (Naude & al., 2009b), and recalling Hnatkovska & Loayza's (2005) decomposition method to derive "extreme volatility" of consumption (i.e., large fluctuations above a specified band) as a proxy for "perturbation", Federici & Montalbano (2012) provide a first empirical cross-country test for vulnerability from trade openness. They investigate the long term relationship, in a large sample of countries, between the portion of "extreme volatility" of consumption linked to trade openness and the deviation of consumption growth from its expected path (derived, using business cycle filters, as a time and country dependent trend). The novelty of this

[23] Although some of these crises received considerable attention in the media (Mexico 1995, Southeast Asia 1997, Brazil and Russia 1998, and Argentina 2001), as World Bank (2000) points out, they represent merely the tip of the iceberg that is a much vaster and more complex phenomenon.

empirical exercise lies in its ability to add a forward looking lens to existing literature on the effects of volatility on consumption growth, a feasible notion of benchmark and a counterfactual, all essential elements of a vulnerability framework.

However, simple negative associations between trade openness, macroeconomic volatility and consumption growth are not a sufficient condition to derive robust conclusions on the vulnerability of partner countries. At the same time, we should acknowledge that growth may be higher or lower without uncertainty, but welfare will always be higher without (Reis, 2009). Hence, current empirical literature actually underestimates the cost of fluctuations. Additional efforts towards a more comprehensive aggregate vulnerability analysis are needed. This means, first of all, to reach consensus on a workable definition of "aggregate vulnerability"with the aim to limit the playing field of the analysis and avoid the most common misconceptions. Secondly, to provide a more comprehensive assessment, theoretically and empirically, of the permanent effects on welfare of risk, and its macro links with trade openness and global imbalances (Bordo, 2005; Caballero & Krishnamurthy, 2009; Claessens & al., 2010). The next essay represents a first step in this direction since it provides a comprehensive empirical test of the significance and relevance of consumption behaviour under permanent risk. It is theoretically grounded in a precautionary saving framework and empirically grounded in a wide (147 countries) and long cross-country panel setting for the pre-crisis period (1950-2008);

b) Household vulnerability from trade

A macro approach to vulnerability encompasses the limitations of standard cross-section analyses. Moreover, it focuses on aggregate variables and thus deals only with covariant macro shocks at country level (i.e. shocks affecting the variables on average), without taking account of the differences in observable household characteristics and income distributions. As already underlined, vulnerability assessments may differ across social groups within countries, while the relative income positions of households are likely to have important effects on their ability to access adequate tools and coping mechanisms, as underlined by a number of vulnerability analyses. Hence, aggregate vulnerability needs to be complemented by household investigations.

International trade affects the risks faced by households 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, and by changing the emphasis among the different activities they engage in, for instance, switching from subsistence food crop to cash crops (McCulloch &

al. 2001). However, if the above risks are taken knowingly it is not clear if they are welfare worsening, even if the variance increases (Winters, 2002).

Empirical evidence shows that poorer households may be less able than richer ones to protect themselves against the adverse effects of man-made external shocks or to take advantage of the positive opportunities created by policy reforms (Tesliuc & Lindert, 2004). This may explain the unwillingness of some households to pursue high average returns linked to the different activities opened up by trade reforms (see Morduch, 1994). Thus, they suffer the costs of trade reforms without reaping any compensating benefits in the form of higher average earnings. If this is the case, trade openness has pervasive effect on households' optimal portfolios with likely negative effects in the long run (Winters, 2002; Winters & al., 2004; Calvo & Dercon, 2007a).

This issue, though very relevant, has been largely overlooked by trade empirical literature. It implies the capacity to measure the cost and the probability of changes in households' behaviour induced by risk exposure linked to trade openness that generates uncertainty. This needs a factual and a counterfactual analysis alike. Counterfactual analysis should be able to measure the expected level of consumption expenditure in the absence of uncertainty, net of the mean effects generated by trade. From the point of view of the factual analysis, it means acknowledging that keeping "consumption smoothing" as a primary behavioural objective in the midst of trade reforms actually engenders a set of behavioural changes that can produce diversified effects on households' welfare: from "smoothing income" i.e. sacrifice expected profits for greater self-protection (Morduch, 1994) to the sale of assets (Rosenzweig & Wolpin, 1993) and/or risk-sharing (Townsend, 1994, 1995), to changes in many non-marketed investments, including human capital outcomes and life-cycle patterns of consumption expenditure and time allocation (Becker, 1965).[24] As Elbers & Gunning (2003) demonstrate, behavioural changes in response to ex-ante uncertainty/risk, even under consumption smoothing hy-

[24]Other strands of the literature underline the existence of constrained circumstances that may lead individuals to depart from consumption smoothing as well. The "dynamic asset-based approach to poverty" (Zimmerman & Carter, 2003; Carter & Barrett, 2006; Carter & al., 2007) highlights that poorer agents respond to shocks by smoothing productive assets, hence destabilizing consumption and thus possibly dipping to a poverty trap. Caroll (2001) observes the precautionary savings motive can generate a behaviour that is virtually indistinguishable from that generated by a liquidity constraints, by essentially inducing self-imposed reluctance to borrow. Lee & Sawada (2010) demonstrate that the introduction of a liquidity constraint in presence of precautionary savings might negatively affect the behaviour of the poor, by preventing them to raise the optimal amount of savings. This because the possibility of future binding constraints in a standard life cycle model with uncertainty, makes the households accumulate precautionary wealth in the attempt to insure themselves.

pothesis, may have substantial welfare costs. Moreover, the potential impact of risk exposure may be much greater than normally estimated by standard vulnerability measures which treat the mean expected consumption as the riskless counterfactual.

A useful attempt to provide an overall assessment of trade reforms on household welfare, was conducted by Niimi & al. (2007). Adopting Glewwe & al.'s (2002), Justino & Litchfield's (2004) and Winters' (2002) conceptual framework, Niimi & al. (2007) analyse the impact of the *Doi Moi* reform process in Vietnam through three channels: prices, employment and wages, and fiscal policies. They provide robust empirical evidence that trade reforms have actually contributed to reducing poverty in Vietnam.[25] However, they lack a forward looking approach. It means to investigate whether the process of opening up the Vietnamese economy has also had an identifiable impact on people's behaviour, and long term effects on their welfare, by increasing *ex-ante* their degree of uncertainty towards the future and/or their exposure to risk.

To this end, both the third and the fourth essays represents a step forward. They complement the existing poverty assessments of Vietnam opening up process by presenting workable ways of exploiting the available households' living standard surveys and present both VEP and (extended) VEU assessments from trade openness.

Vulnerability from trade: a meso approach

A meso approach of vulnerability from trade is required to compound the outcomes of cross-country vulnerability analyses with those at household level in "within country" approaches. The need to enrich vulnerability analysis with a "meso" perspective emanates from the consciousness that neither cross country nor household vulnerability assessments, although characterized by relevant virtues, can guarantee an holistic welfare analysis of the risks induced by trade liberalization. The "meso approach" of vulnerability is a totally new - and promising approach that attracts a growing interest among practitioners. Up to now, it is possible to identify basically two main strands of the literature devoted to the meso approach: the "vulnerability of subnational regions approach", which underlines the role of regional-level shocks as a source of covariate risk to households' income and stresses fragility in various domains, such as economic fragility, fragility of ecosystems and fragility related to governance and local institutions; and the "industry level volatility approach", which starts from the assumptions that the analysis of volatility

[25] They apply a multinomial logit (MNL) model to analyse the probability of being in a particular state, out of several unordered alternatives.

across industries and a closer look at the production sector are key to an deep investigation of the impact of shocks on poverty.

Frontrunners of the first strand of the literature, also called "vulnerability of place" (i.e. the vulnerability of people to fall into or remain in poverty owing to being at a particular place) are Naude et al., (2009b). They built a Local Vulnerability Index (LVI) across 354 magisterial districts in South Africa concluding that remoteness, dominance of primary (agricultural) production in a local economy, and low population densities are the dominant features of the most vulnerable sub-national districts. Also Gunther & Harttgen (2009), starting from the traditional VEP method and using a multilevel analysis (Goldstein, 1999), present a method to differentiate the relative importance of covariate shocks at "community level" (i.e. geographically clustered) with idiosyncratic shocks at household level.

Proponents of the "industry level approach" are Imbs (2004), di Giovanni & Levchenko (2009) and Krishna & Levchenko (2009). Imbs (2004) proposes a possible solution to the macro trade co-movement puzzle (see Kose & Yi, 2001, 2006), highlighting the role of intra-industry trade on business cycle synchronization. Di Giovanni & Levchenko (2009), using a broad, industry-level panel dataset of manufacturing production and trade (59 countries and 28 manufacturing sectors over a period of 30 years), highlight that more open the industries tend to be, *ceteris paribus*, the more volatile since they are more exposed to world supply and demand shocks. Krishna & Levchenko (2009) provide theoretical explanations of Koren & Tenreyro's (2007a) hypothesis that developing countries are more volatile because their production specialisations are in more volatile sectors. They find that less developed countries with low levels of human capital or with lower institutional ability, tend to specialise in less complex goods (i.e. that require fewer inputs for the production of one unit of the good), which are characterised by higher levels of output volatility. This last is a somewhat surprising feature. According to Leontief technology if all inputs are necessary, more inputs imply more risks. Their argument is that the volatility of a good that uses only a few inputs will be more affected by the shocks to each individual input, while production in a sector that uses numerous inputs will be less affected, on average, by shocks to any particular input (see also Koren & Tenreyro, 2007b). As it is apparent, we are still far from a comprehensive analysis of "meso vulnerability". However, also in this case, very useful, although still scattered, contributions are in place and provide a valuable starting point.

Notwithstanding a through analysis of "meso vulnerability" is outside the scope of this research work, the empirical evidence presented in both Essays 3 and 4 that trade-related risks are not fully shared across trade-related industries consistently highlights the relevance of this issue and the need of further investigations in this direction.

1.5 Conclusions

Whether - and eventually to what extent - trade openness imply long term welfare discounting for some countries or households by raising their uncertainty about the future and/or their risk exposure to external shocks is still uncertain. Hence, it warrants more careful investigation.

The literature review presented here highlights the amount and extent of the very informative work currently available on this topic and also the urgent need for more focused work on the implications of trade openness in terms of vulnerability. The added value of the present work is to get a comprehensive conceptualisation of vulnerability, its methods and misconceptions, and to highlight three directions for future research in "trade-induced vulnerability" within three levels of analysis: macro, micro and meso. Improving our capacity to assess the vulnerability hazard of different trade reform options, at different levels of analysis, has evident policy implications. Evaluation of the impact of covariate shocks induced by trade openness is of major interest to international economic policy; assessment of trade-related idiosyncratic shocks will help national policymakers to set priorities and calibrate domestic coping mechanisms and safety nets; the "meso" analysis sheds lights on the economic geography and socio-political determinants of "trade-induced vulnerability" as well as on the role of industrial and competition polices.

Appendix 1A - Short summary of the most common vulnerability measures

This appendix provides a short summary on the main available methods to measure monetary vulnerability as well as of their pros and cons.

VEP-Vulnerability as Expected Poverty (Christiaensen & Boisvert, 2000; Christiaensen & Subbarao, 2005; Chaudhuri, 2001, 2003; Chaudhuri & al., 2002; Pritchett & al., 2000).

This is the most controversial but commonly applied method. It assesses vulnerability simply as the expected value of the standard FGT class of decomposable poverty measures (Foster & al., 1984) as follows:

$$V_{\alpha,ht} = F(z) \int_0^z \left(max \left\{ 0, \frac{z - c_{h,t+1}}{z} \right\} \right)^\alpha \frac{f(c_{h,t+1})}{F(z)} dc_{h,t+1} \qquad \text{(1A-1)}$$

where c_h is household's consumption; z is the standard poverty line; $F(.)$ and $f(.)$ indicate, respectively, the cumulative distribution and the density function of consumption at time $t+1$[26]. Eq.1A-1 measures the probability of households to fall below the poverty line, i.e. $F(z)$, multiplied by a conditional probability-weighted function of the shortfall below this poverty line (Christiaensen & Boisvert, 2000). The parameter α sets the degree of sensitivity of the vulnerability measure to the distance from the poverty line.[27] When $\alpha = 0$ VEP measure reduces to the probability that the household will experience poverty, i.e $V = F(z)$[28]. The distribution F is taken as given and reflects both the households' exposure to shocks (idiosyncratic or covariant) and its ability to cope with them.

[26]Eq. 1A-1 is obtained by multiplying the expected value of the poverty index by $F(z)/F(z)$. For more information on the derivation procedure of Eq.1A-1, see Christiaensen & Boisvert, 2000.

[27]To provide a measure of vulnerability more consistent with the measure of the severity of poverty, Kamanou & Morduch (2002) express vulnerability as expected changes in poverty rather than expected poverty per se. Specifically, they define vulnerability in a population as the difference between the expected value of a poverty measure in the future and its current value (i.e. only the first moment matters), attaching weights to the deviations between the welfare measure and its benchmark.

[28]The majority of works (Christiaensen and Boisvert, 2000; Pritchett et al., 2000; Chaudhuri and Datt, 2001; Chaudhuri et al., 2002) rely on this choice indeed, but there are also some VEP applications which look at the depth of the poverty ($\alpha = 1$) and at the spread of its distribution ($\alpha = 2$) (see, for example, Ravallion, 1988).

Empirically, on the assumption that consumption is log-normally distributed, setting the consumption poverty threshold, z and a threshold probability value above which a household is considered vulnerable, it is possible to estimate vulnerability to expected poverty as the probability at time t of a household with characteristics Xh to fall below the poverty line in the near future using the estimated expected mean ($\widehat{c}_h$) and variance ($\widehat{\sigma}_h^2$) of its log consumption, as follows:

$$V_{\alpha,ht} = Pr(lnc_{ht} < lnz|X_h t) = \Phi(\frac{lnz - ln\widehat{c}_h t}{\sqrt{\widehat{\sigma}_h^2 t}}) \tag{1A-2}$$

where Φ is the cumulative density of the standard normal distribution.

The main assumption of the VEP approach is that environment is stationary and the variance of the residuals in cross-sectional consumption regressions (i.e. the unexplained part of household consumption) is not simply a measurement error and is not equal across households. It rather captures the impact of both idiosyncratic and covariate shocks on consumption, that can be explained by a set of observable household characteristics. It follows from this assumption the main advantage of the VEP method: it can be used to assess vulnerability with a single round of cross-sectional data.

The drawbacks of the VEP method are essentially the lack of a solid theoretical background and the fact it relies on a set of strong assumptions, namely: cross-sectional variability proxies also inter-temporal variance in consumption (hence, it misses the impact of household-invariant but time-variant shocks); time series are stationary; the distribution of shocks to consumption is independent normal; households have increasing absolute risk aversion, (which contrasts to the empirical evidence on the risk preferences of the poor).[29] Furthermore, it displays a somewhat perverse feature relating to the measure of the welfare consequences of risks, since it implies a reduction of vulnerability by increasing the variability of consumption around the poverty line, which is in sharp contrast to the poor being risk averse (Hoddinott & Quisumbing, 2003).[30] Finally, the standard version of the approach is not able to differentiate between the impact of idiosyncratic shocks and

[29] VEP method does not deal with households' risk preferences, but this assumption follows directly from the VEP method as noticed by Ligon & Schechter (2004).

[30] To make this point Hoddinott & Quisumbing (2003) present the following example: consider two possible scenarios. In the first, a risk averse household is certain that expected consumption in period t+1 is just below the poverty line so that the probability of poverty (i.e. vulnerability) is 1. In the second, while mean expected consumption remains unchanged, there is a slight variability of consumption such that there is probability 0.5 that the household will have consumption just above the mean (and above the poverty line) and probability 0.5 that the household will have consumption slightly lower than the mean (and the poverty line). Moving from the first scenario to the second, makes

the impact of covariate shocks. Acknowledging the latter caveat, Sarris & Karfakis (2006) and Gunther & Harttgen (2009) present different methods to disentangle VEP measure assessing separately the impact of covariate shocks at the community level and the idiosyncratic ones at household level. More specifically, Gunther & Harttgen (2009) acknowledge the hierarchical structure of community and household variables by applying a multilevel analysis. Hence, they decompose the unexplained variance in households' consumption into a lower-level (i.e. household) and a higher-level (i.e. community) component. Gunther & Harttgen (2009) provide also a sound method to decompose vulnerability estimates into sources of vulnerability. They disentangle the set of vulnerable households into two sub-groups, namely: households with the estimated expected mean consumption below the poverty line (the poverty induced vulnerable) and households with estimated expected mean consumption above the poverty line but characterized by high estimated variance in consumption (the risk induced vulnerable).

VEU - Vulnerability as Low Expected Utility (Ligon & Schechter 2003, 2004).

The VEU model tries to counteract the weak theoretical background of the VEP class of measures by proposing a measure of vulnerability based on expected utility. The vulnerability of household h is thus measured as the difference between the utility derived from some level of certainty-equivalent consumption, zce (above which the household would not be considered vulnerable; something analogous to a poverty line), and the expected utility of consumption ($EU_h(c_h)$), as follows:

$$V_h = U_h(z_c e) - EU_h(c_h) \tag{1A-3}$$

where U_h is a weakly concave, strictly increasing function.

The VEU method too enables decomposition of vulnerability into two distinct components: vulnerability to poverty, that is, low expected consumption, and vulnerability to risk, that is, high volatility of consumption, as follows:

$$V_h = [U_h(z_c e) - U_h(E(c_h))] + [U_h(E(c_h)) - EU_h(c_h)] \tag{1A-4}$$

where the first bracketed term (i.e. the difference in utility at zce compared to the utility of households' expected consumption) is a measure of

the household worse off (being risk averse, it would prefer the certain consumption to the expected consumption). However, the second scenario will reduce vulnerability, from 1 to 0.5. The perverse result is that, using this measure, a policymaker seeking to reduce vulnerability should introduce new sources of risks.

vulnerability to poverty and involves no random variables, while the second term, according to the ordinal measures of risk proposed by Rothschild & Stiglitz (1970), measures vulnerability to risk.[31]. Moreover, with this method, different from VEP, the risk component can be further decomposed into covariate and idiosyncratic components. Let $E(c_h|x_t)$ be the expected value of consumption conditional on a vector of covariant variables x_t, then we can rewrite the VEU measure as follows:

$$V_h = [U_h(z_c e) - U_h(Ec_h)] + [U_h(E(c_h)) - E(c_h|x_t)] + [E(c_h|x_t) - EU_h(c_h)] \tag{1A-5}$$

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 avoid confusion between the measurement error and idiosyncratic risk, Ligon & Schechter (2003) further decompose their measure of idiosyncratic risk into risk that can be attributed to a set of distinct, observed, time varying characteristics.

The VEU measure of vulnerability raises three main and interrelated concerns too: firstly, the obvious circumstance that the choice of the particular functional form of the utility function directly affects the magnitude of the phenomenon[32]; secondly, the difficulty to transform VEU measures of vulnerability, in units of utility, into actual economic policy targets (Hoddinott & Quisumbing, 2003); thirdly, it is sensitive overall to *ex-ante* changes in welfare, even those above the poverty line that have no direct incidence on future poverty (Calvo & Dercon, 2007a).

VTP - Vulnerability as the Threat of Poverty (Calvo and Dercon, 2013; Povel, 2015, Chaudhuri et al., 2002; Kamanou & Morduch, 2004; Pritchett, Suryahadi, & Sumarto, 2000; Dutta et al., 2011; Gunther & Maier, 2008).

The VTP class of vulnerability measures tries to avoid some of weaknesses of both VEP and VEU methods. The main advantage of this group of measures is that vulnerability is associated to the extent that poverty cannot be safely ruled out as any of the possible future scenarios (Calvo, 2008).

[31] 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_h.

[32] Ligon and Schechter (2003) rely on the Constant Relative Risk Aversion (CRRA) form of the utility function.

Starting from the assumption that people suffer and are wary of the future if their knowledge of what it holds is uncertain, Calvo & Dercon (2007a) assess vulnerability as the *ex-ante* probability weighted average[s] of state-specific indices of deprivation and propose a set of axioms[33] to picture the desirable properties of a vulnerability measure able to endogenously combine poverty and risk measures.

If all the axioms are satisfied, the following vulnerability measure applies:

$$V_\alpha = 1 - E[x^\alpha] \tag{1A-6}$$

with $0 \leq \alpha \leq 1.0 \leq 1$ represents the rate of coverage of basic needs, which is derived, for each state of the world, as $x_i \equiv \widetilde{y}_i/z$ where $\widetilde{y}_i(y_i, z)$; y_i is the consumption level (after all consumption smoothing efforts have been deployed); z is the standard poverty line; and α represents risk sensitivity (as α increases to 1, household approaches risk-neutrality). It follows then, that people are vulnerable to the extent that poverty cannot be safely ruled out as a possible future scenario (Calvo, 2008) This means that general uncertainty not related to poverty in any state of the world does not enter in this measure of vulnerability. In this respect, the VTP measure overcomes VEP, which, according to this view, risks to overestimate vulnerability and VEU, since the vulnerability measure cannot be affected by outcome changes above the poverty line (i.e., the focus axiom).

Two main caveats apply to use of the VTP measure. Firstly, it follows from the definition above that for those facing no uncertainty with known $x_i = x* < 1$, for all i, $V_\alpha > 0$; that is, they must be considered vulnerable with certainty. In other words, being poor is the dominant threat in terms of vulnerability. However, there is no agreement on this reasoning in the literature. Moreover, there is also a risk of a spurious correlation between poverty and vulnerability since those households that suffer an income or wealth loss are likely to be at the lower end of the income distribution (Tesliuc & Lindert, 2004). Secondly, the empirical strategy of VTP implies the use of lengthy

[33] The set of axioms is the following: the focus axiom (i.e. the vulnerability measure cannot be affected by outcome changes above the poverty line); symmetry over states (i.e. the only relevant difference between two states of the world i and j is the difference in their outcomes and probabilities); continuity and differentiability (of the vulnerability function); scale invariance (i.e. vulnerability measure should not depend on the unit of the measure of outcomes); normalization (i.e. to impose boundaries for reasons of comparability); probability-dependent effect of outcomes (i.e. vulnerability is sensitive to the likelihood of that particular state of the world); probability transfer (i.e. if yi is greater than or at least equal to y_j, then vulnerability cannot increase as a result of a probability transfer from state j to state i); risk sensitivity (i.e. greater risk increases vulnerability); constant relative risk sensitivity (i.e. risk sensitivity remains constant if all state specific outcomes increase proportionally). Calvo and Dercon (2007).

panel data to retrieve predictions of the rate of coverage of basic needs and the distribution of random idiosyncratic shocks looming for households in the future in various states of the world (Calvo, 2008). This strategy is not exempt from critique. It is not only subject to mis-specifications and measurement errors, but assumes a time invariant discrete uniform distribution of shocks, which is indeed an assumption as strong as proxing inter-temporal variance with cross-sectional variability, as made by the VEP method. As a result, this generous effort of building an axiomatic approach to vulnerability lacks robust empirical analyses capable of providing a clear added value to standard VEP outcomes. It should be borne in mind, generally speaking, the existence of a trade off between more accurate vulnerability estimates and the vast amounts of data required on all possible states of the world.

Chapter 2

Essay 2 - Aggregate risk and consumption behaviour: the empirical evidence in the long run

This essay sheds light on the impact of aggregate (permanent) risk on consumption behaviour. Unlike previous works, the present analysis: i) is theoretically grounded in a precautionary saving framework; ii) is empirically grounded in a wide (147 countries) and long cross-country panel setting for the pre-crisis period (1950-2008); iii) controls for country heterogeneity and also includes the poorest countries in the world. By presenting conservative (i.e., lower bound) estimates, our main conclusion is to highlight a significant association, on average and *ceteris paribus*, between aggregate permanent risk, "extra saving" and consumption. Although consumption fluctuations are seen as the optimal response to risk, this implies a lower smooth path of consumption than the risk-free counterfactual, with permanent negative effects on welfare. This relationship holds in the long run, increases over time and is widespread across the entire income distribution. However, our results empirically confirm Lucas's (1987) intuition regarding the low value of stabilisation policies.

Keywords: consumption, volatility, risk, precautionary saving, welfare, developing countries.

JEL: E21, F40, C82, O10, O57

2.1 Background, aims and caveats

This work contributes to the empirical debate on the impact of macroeconomic fluctuations on welfare by empirically assessing the impact of aggregate (permanent) risk on consumption behaviour. The global crisis of 2008-09 has raised additional concerns about the welfare effect of macroeconomic shocks on public and private saving (Mody et al., 2012; Aizenman and Noy, 2013), especially in developing contexts (Prasad, 2013). While the empirical debate from Ramey and Ramey (1995) onwards has largely focused on the causal impact of macro volatility on long run growth (highlighting a negative relationship for developing countries), we believe that the empirical assessment of the impact of macro-economic fluctuations on welfare needs additional, more careful investigation (Loayza et al., 2007; Reis, 2009).

Since panel data are ideal for testing the theory of consumption but scarce at the micro level, we present conservative (i.e., lower bound) estimates of the relevance and significance of household "extra-saving" under the precautionary saving hypothesis (Caroll, 2001a; Kimball, 1990; Caballero, 1990, Deaton, 1992) based on a long and wide cross-country panel setting (147 countries) for the pre-crisis period (1950-2008). To go beyond averages and control for country heterogeneity, we provide estimates by income deciles as well.

Our main conclusion is that, on average and *ceteris paribus*, a lower consumption smoothing path is significantly associated with permanent risk, producing aggregate "extra saving" and hampering consumption prospects. This relationship holds in the long run and is widespread across the income distribution. However, albeit by reference to conservative estimates, we cannot refute Lucas's (1987) intuition regarding the low value of stabilisation policies.

As in other similar studies, the aim is not, at this stage, to distinguish between the various sources of macroeconomic fluctuations (productivity or monetary shocks; pure business cycles; long run uncertainty; policy mismanagement, etc.)[1], nor to address the issue of the portfolio choices beneath consumption behaviour,[2] but rather to highlight empirically the presence of a

[1]Parker and Preston (2005) underline four proximate causes of fluctuations in aggregate consumption growth: new information, real interest rate, consumption preference, and risk.

[2]In this respect, our results should be assumed to be conditional to asset prices. While direct estimates of precautionary wealth may be advisable to let data speak in a much less filtered way (Carroll, 2001b; Carroll and Samwick, 1997), data on wealth cannot be estimated reliably and in a comparable way across countries. Furthermore, it is not yet clear how to translate estimates on wealth into a set of behavioural parameters (Carroll and Kimball, 2008)

robust relationship between aggregate permanent risk, consumption smoothing and "extra-saving" by looking at its magnitude; short-run versus long run dynamics and robustness to countries' heterogeneity. It is also worth noting that our focus is not, at this stage, to determine clear-cut attribution but to present lower bound estimates on the likely change in consumption behaviour in countries characterised by significant aggregate fluctuation as well as to assess possible traces of "extra-saving" in poor countries. Since income and consumption fluctuations are growing over time (and cannot be considered only as a negative spill-over of the global crisis) this is a relevant issue for policymaking.

The empirical strategy is grounded on the theory of precautionary saving and looks at the impacts of permanent risk on consumption behaviour. According to the precautionary saving literature, consumption adjustments (e.g., reducing current consumption and encouraging additional/extra saving) are seen as optimal responses to meaningful uncertainty in future income (Caroll, 2001a; Kimball, 1990; Caballero, 1990, Deaton, 1992). The literature on precautionary saving is mainly focused on individuals in a closed economy setting. Surprisingly little attention has been devoted to its aggregate counterpart in a global framework (significant exceptions are Ghosh and Ostry, 1995 and 1997; Krussell and Smith, 1998; Carroll, 2000 and, more recently, Mody et al., 2012; Cherif and Hasanov, 2012; Baiardi et al., 2013). Our contribution is an effort to bridge this gap and give additional insights into the impact of aggregate risk on countries' welfare.

A number of caveats must be taken when performing this empirical task. The main drawback is represented by the implicit assumption that there is a representative agent (i.e., no individual differences). While convenient - it permits the adoption of an invariant felicity function and reduces the problem of measurement error - it implies that incomes are perfectly pooled across individuals (i.e., full domestic risk sharing) and, hence, limits the analysis to aggregate risk only.[3] In this respect, our empirical results can be seen as a conservative estimate of the phenomenon under analysis since the direc-

[3]The usual concern is that the representative consumer model reduces the relevance of precautionary saving (Carroll, 2000). The representative agent story can be even more misleading in the presence of borrowing restrictions that could alter uniformity across individuals. However, as Krussel and Smith (1998), Heaton and Lucas (1996) and Constantinides and Duffie (1996) argue, household heterogeneity arises mostly from idiosyncratic transitory shocks which are easy to insure with only a modest amount of saving (Gourinchas, 2000). Conversely, in a world full of uncertainty, the precautionary demand for saving is likely to be strengthened if access to credit is limited when it is most required (Deaton, 1992; Lee and Sawada, 2010). Moreover, several recent studies controlling for incomplete risk sharing and heterogeneous agents find only modest effects on welfare estimates with respect to Lucas's benchmark (Lucas, 2003; Krussel et al., 2012; Krebs, 2003)

tion of distortion of our aggregate estimates is likely to reduce the impact of volatility rather than emphasise it (the average variability of the individual is greater than the variability of individuals whose behaviour is being averaged). The same consideration applies for another theoretical prediction: the presence of full international risk sharing (i.e., perfect consumption smoothing across countries and states of nature) in the hypothesis of complete markets (Obstfeld and Rogoff, 1996).[4]

Lastly, consumption smoothing is not the only behavioural mechanism to respond to risk and uncertainty. For instance, prudent households under risk may well decide to reduce their health care and school expenditure, contributing in this way to a permanent reduction in income and welfare. However, consumption behaviour is undeniably one of the most relevant household choices under risk. Since saving-ratios tend to be pro-cyclical (rising in boom times and falling in times of crisis), consumption should be assumed, in a macroeconomic perspective, to be protected against business-cycle fluctuations (Deaton, 1992). Violation of this assumption reveals that people react to risk by modifying their consumption behaviour, specifically by reducing current consumption and encouraging additional/extra saving. This implies a lower smooth path of consumption than a risk-free counterfactual with permanent negative effects on welfare. This could arise for various reasons. Risk exposure could generate behaviour that is virtually indistinguishable from that generated by a liquidity constraint by inducing self-imposed reluctance to borrow (Caroll, 2001a). Alternatively, liquidity constraints could make people accumulate precautionary wealth in an attempt to insure themselves (Lee & Sawada, 2010).[5] Consumption smoothing also engenders a set of behavioural changes apt to produce likely effects on household welfare such as smoothing asset/income; self-insurance, risk-sharing arrangements, diversification, migration, etc. (Morduch, 1994; Rosenzweig & Wolpin, 1993; Townsend, 1994, 1995; Zimmerman and Carter 2003).

The work is organised as follows: Section 2 briefly summarises the literature; Section 3 presents the empirical model; Section 4 shows the cross-country estimates and Section 5 concludes.

[4]In this framework, the only type of risk reflected by consumption is due to aggregate uncertainty over world output (i.e., systemic risk). However, also in this case, the empirical literature has systematically rejected the null hypothesis of complete risk sharing, acknowledging a much larger degree of risk sharing within countries than cross-countries (Crucini and Hess, 2000; Kose et al., 2003, 2007, 2009 and 2011; Asdrubali and Kim, 2008; Broner and Ventura, 2011, Pierucci and Ventura, 2012).

[5]Madsen and McAleer (2000) provide some support for the uncertainty hypothesis, using panel data for 22 OECD countries.

2.2 Why should we care about macro-volatility? A review of the literature

The phenomenon of macro volatility has been confined to standard cycle theory for a long time and was mainly concerned with the decomposition of economic growth into cyclical and trend components. Thus, it has long been considered a second-order issue in studies on developing countries, but of primary interest in industrial countries concerned with smoothing the fluctuations of their business cycles. Moreover, according to the influential Lucas (1987) study, the cost of fluctuations is supposed to be of little account in terms of welfare. The fraction of consumption forgone for a reduction in its variability is approximated by the reduction in the squared coefficient of variation multiplied by half the coefficient of relative risk-aversion. Hence, the value of so-called "economic stabilisation" policies is supposed to be low. However, Lucas (1988) observed that, in the long term, fluctuations in rates of growth are likely to be more substantial in less developed countries, suggesting a link between a country's level of economic development and its volatility. Recent empirical evidence questions Lucas's (1987) results. While Lucas conveniently assumed consumption shocks to be serially uncorrelated, Reis (2009) points out that Lucas's estimates are downward-biased, since he belittled the role of "persistence" as a crucial determinant of the cost of fluctuation.

This weakness is supposed to be more serious in the context of developing countries (Calderon and Fuentes, 2010). From the work of Ramey and Ramey (1995) onwards empirical cross-country studies have consistently found that volatility exerts a significant negative impact on long-run growth. Moreover, they show that it severely affects developing economies' welfare (Fatas, 2000; Pallage and Robe, 2003; Wolf, 2005; Aizenman and Pinto, 2005; Loayza et al., 2007) and that consumption volatility increases compared with income volatility (Kose et al., 2003). More recently, Malik and Temple (2009) argue that volatility should be assumed as "endemic" in the developing world. They show that the median standard deviation of annual growth rates in low-income countries has been more than three times that of OECD member countries over a period of 40 years (1960-99). The World Bank, in its volatility handbook, also claimed that, in the developing world, "good times do not offset the negative impact of bad times" and shocks tend to have permanent negative effects (Aizenman and Pinto, 2005). According to a number of scholars, such asymmetry is reinforced by internal factors such as incomplete markets, inefficient taxation, pro-cyclical fiscal policy and especially, weak financial market institutions (Easterly et al., 2001; Denizer et al., 2002; Ferreira da Silva, 2002; Bekaert et al., 2005). Other factors include political insecurity, macroeconomic instability and institutional weaknesses – all phenomena that largely affect developing countries (Alesina et al., 1999; Judson and Orphanides, 1999; Gavin and Hausmann, 1996; Raddatz 2006; Servén, 1997; Agénor et al., 2000; Fatás and Mihov 2005; Acemoglu et al., 2003; Rodrik, 1998 and 1999). Volatility, in this context, is seen as a proxy of "uncertainty", likely to lead firms either to under-invest or to invest in the "wrong" projects (Caballero, 1991; Bertola and Caballero 1994; Serven, 1997; Aizenman and Marion, 1999) and households to abandon a smooth path of consumption. This behaviour is enhanced by conditions of risk aversion, incomplete markets, lumpiness and the irreversibility associated with the investment process (Hnatkovska and Loyaza, 2005). More recently, the literature has also investigated the plausibility of an overall negative effect of cyclical fluctuations on long-term growth (Fatas, 2000; Blackburn and Pelloni, 2004 and 2005), overcoming the standard distinction between the two issues.

Loayza & al. (2007) highlight two main reasons why we should care about macroeconomic fluctuation: i) the substantial welfare loss of deviating from a smooth path of consumption; ii) the indirect welfare loss in terms of future consumption, in the case of a negative impact of volatility on growth. They also argue that these phenomena are emphasised in developing countries which not only face more volatility than industrial countries, but suffer larger volatility effects, because of the intrinsic instability of the process of development (mainly linked to the weakness of their financial systems and the main characteristics of their specialisation process of production); the concrete risk of policy mismanagement (e.g., as in the case of pro-cyclical and/or erratic fiscal and monetary policies) and the presence of weaker mitigating and coping mechanisms.

More recently, additional empirical cross-country evidence (Mody et al., 2012 and Cherif and Hasanov, 2012) shows how heightened uncertainty has increased precautionary saving in safe assets, leading countries into a "volatility trap". Likewise, Carriére-Swallow and Céspedes (2013) highlight the presence of strong heterogeneity in the impact of uncertainty on countries' welfare with emerging markets suffering a much more severe and persistent fall in investment than the other countries in the sample.

The empirical framework adopted in this essay aims to explore the first direct channel of the impact of macroeconomic fluctuations highlighted by Loayza et al. (2007). In this respect, this work differs from the strand of the literature that looks primarily at the second (indirect) channel (Ramey and Ramey, 1995, Fatas, 2000; Pallage and Robe, 2003; Wolf, 2005; Aizenman and Pinto, 2005; Loayza et al., 2007). It also differs from the one that looks directly at the observed aggregate consumption to calculate the gains from eliminating fluctuations in consumption using compensation parameters of household preference for stability (Lucas, 1987, 2003; Reis, 2009). In other words, this Essay focuses on the impact of ex-ante risk on current and future consumption possibilities which implies relative changes in portfolio allocation between risky capital and safe assets.Taking advantage of the long panel data available for aggregate variables, it exploits Euler restrictions to estimate the ex-ante impact of income risk even in the absence of a fully specified dynamic model.

2.3 Macro-volatility and consumption smoothing: the empirical model

To assess the cost of fluctuations on consumption behaviour the obvious theoretical reference is the theory of ”precautionary saving” (Caroll, 2001; Kimball, 1990; Caballero, 1990, Deaton, 1992). According to this strand of the literature, if the marginal utility of consumption function is convex, the consumer follows prudent behaviour.[6] This means that an individual pays attention not only to the mean of the future income (as implicitly assumed by the standard permanent consumption model) but also to its variability. Although the qualitative and quantitative aspects of the theory of precautionary saving (whose basic intuition dates back to Keynes) are now well established, less agreement exists about the strength of the precautionary motive (Carroll and Kimball, 2008) and little attention has been devoted to its aggregate counterpart. Furthermore, the impact of the precautionary motive in developing contexts remains somewhat ambiguous and calls for additional empirical investigation. Deaton (1992) - the first to provide evidence of the cost of precautionary saving on household welfare in developing contexts - highlights a positive effect of risk/uncertainty on saving and growth. Conversely, Hahn (1970), Dercon (2005), Elbers et al. (2009) and Gunning (2010) show how the introduction of risky assets produces, under a series

[6] Although often confused, precaution and risk aversion are not exactly the same thing (Carroll and Kimball, 2008). While prudence represents the “intensity” of the precautionary saving motive, risk aversion determines the price one is willing to pay to eliminate uncertainty. Practically speaking, the degree of precaution is the degree of convexity of the marginal utility function, whereas risk aversion is controlled by the degree of concavity of the utility function. Hence, while precaution depends on the third derivative of the utility function, risk aversion depends on the second derivative and one can be inferred from the other only for very special functions, e.g. if utility is exponential, then absolute prudence coincides with absolute risk aversion (Kimball, 1990).

of specific circumstances, negative effects of risk and uncertainty on saving decisions.

Our cross-country comparison adds a long-term perspective (not available at the micro level) to look at the impact of permanent risks on labour income. Furthermore, it could help in assessing whether and to what extent, on average and *ceteris paribus*, aggregate precautionary saving behaviour in developing countries is statistically different from that in more developed contexts.

The standard approach to testing the impact of income risk on causing representative agents to deviate from consumption smoothing is to assume that agents maximise the expected value of the following time-separable Constant Absolute Risk Aversion (CARA) utility function[7] over an infinite horizon (see Blanchard and Fischer (1989), Caballero (1990 and 1991), Weil (1990), Guiso et al., (1992) among others)[8]:

$$\max E_t \left[\sum_{t=0}^{\infty} \beta^t e^{-\rho c_t} \right] \tag{1}$$

where β is a subjective discount rate of consumption (time preference) and ρ is the degree of absolute risk aversion. Eq. (1) is subject to a standard budget constraint $w_{t+1} = Rw_t + y_{t+1} - c_{t+1}$ where $R = (1 + r)$ is the interest factor (assumed to be constant); w is individual wealth (w_t is given) and y_t is the consumer's idiosyncratic income. For now let's assume that the latter exhibits a random-walk deviation from an exogenously growing measure of permanent income: $y_{t+1} = \widehat{y_t} + \psi_{t+1}$.[9] In the simplified case where $R\beta = 1$ and if income shocks are normally distributed, the solution of the system is the following (see Appendix A):

[7]Notwithstanding the fact that the adoption of the Constant Relative Risk Aversion (CRRA) isoelastic utility function is standard in models of precautionary saving (Carroll et al., 1992; Carroll and Samwick, 1997 & 1998; Deaton 1992; Zeldes 1989, Skinner 1988), with a stochastic income process it does not allow a closed form solution. To assess the cost of fluctuations in income, therefore, the only solution left is to apply a negative exponential utility function with Constant Absolute Risk Aversion (CARA) which allows for a closed form solution for the consumption function. The CARA utility function is the following: $U(C) = -\frac{1}{\rho}e^{-\rho C}$ where ρ is the coefficient of absolute risk aversion ($\rho = -\frac{U''}{U'} > 0$). CARA application also has its drawbacks since it implies that the degree of risk aversion is constant (i.e., independent of the level of individual resources) and it does not rule out negative consumption, especially early in life, if assets are low and income innovations are variable (Deaton, 1992).

[8]The hypothesis of infinite time horizon is standard in macroeconomics and reasonable when the focus is on households and not on individuals.

[9]In appendix 2B, we further decompose this measure of permanent income to assess separately the permanent and transitory stochastic components.

$$c_t = w_t \frac{R-1}{R} + \widehat{y}_t - (R-1)\frac{\frac{1}{2}\rho}{(1-R)^2}\sigma_\psi^2 \tag{2}$$

Eq. (2) adds to the certainty equivalent consumption a negative term on the right hand side that is precautionary saving. It is evident from the fact that it equals zero if there is no risk $\sigma_\psi^2 = 0$ or no precautionary motive $\rho = 0$.[10] Note that, according to this model, the effect of risk on consumption does not depend on the level of permanent income or the level of wealth.

Eq. (2) assumes that consumption tracks permanent income in the long run (which is reasonable in an aggregate framework thanks to the turnover of generations, Deaton, 1992). However, consumption also shows sensitivity to transitory income in the short-run and consumers take some time to adjust their consumption to long-run equilibrium.[11] It means technically that consumption and total income are co-integrated.[12]

To control for this and provide a full account of the separate (short-term and long-term) components of the consumption function as well as the adjustment mechanism that links short-term and long-term consumption-income equilibria, we apply an autoregressive distributed lag (ARDL) (1,1) version of our consumption model, as follows:[13]

$$c_t = \beta_0 + \beta_1 y_t + \beta_2 y_{t-1} + \beta_3 c_{t-1} + u_t \tag{3}$$

[10] Because of the use of exponential utility in this exercise, the degree of absolute risk aversion is assumed to be equal to the degree of absolute prudence.

[11] Probably linked to imperfect information and the correlated small individual mistakes in consumption choices.

[12] Indeed, Fisher-type tests do not exclude "unit-root" problems even when cross-sectional averages and linear time trends are taken explicitly into account. Following up the Im–Pesaran–Shin (IPS) approach, the Fisher test performs a unit-root test on each panel series separately, then combines the p-values to obtain an overall test of whether the panel series contains a unit root. The starting point for the test is a set of Dickey–Fuller regressions of the form: $\Delta Y_{it} = \phi_i Y_{it-1} + Z_{it}\gamma_i + \varepsilon_{it}$ where ϕ_i is panel-specific. The null hypothesis is $H_0 : \phi_i = 0$ for all i versus the alternative $H_a : \phi_i < 0$. $Z_{it}\gamma_i$ represent panel-specific means (fixed effects) and linear time trends that describes the process by which the series is generated. Our test uses Newey–West standard errors (i.e., based on heteroskedasticity- and autocorrelation-consistent covariance matrix estimator) to account for serial correlation.

[13] The generic form of the Autoregressive Distributed Lags-ARDL (p,q) process applied to consumption function is the following:

$$c_t = \alpha_0 + \alpha_1 y_t + \alpha_2 y_{t-1} + ... + \alpha_p y_{t-p} + \gamma_1 c_{t-1} + ... + \gamma_q c_{t-q} + u_t$$

Our aim is to reach a version of this ARDL process with white noise errors and the minimum number of lags.

From Eq.(3) we can derive the steady state equation:[14]

$$c^* = \frac{\beta_0}{(1-\beta_3)} + \frac{\beta_1+\beta_2}{(1-\beta_3)}Y^* \tag{4}$$

where $\beta = \frac{\beta_1+\beta_2}{(1-\beta_3)}$ is the long-term marginal propensity to consume.

If we subtract c_{t-1} from both sides Eq.(3) and take into account the steady state (long-term) equilibrium by acknowledging from Eq.4 that $\beta_2 = \beta(1-\beta_3) - \beta_1$ we get:[15]

$$c_t - c_{t-1} = \beta_0 + \beta_1(y_t - y_{t-1}) - (1-\beta_3)[c_{t-1} - \beta y_{t-1}] + u_t \tag{5}$$

where $[c_{t-1} - \beta y_{t-1}]$ is the error correction mechanism (Hendry, 1995; Hamilton, 1994); β is the long-term parameter; β_1 is the short-term parameter (attached to variables in differences) and $(1-\beta_3)$ is the speed of the adjustment process from short-term to long-term equilibrium (the EC term).

Eq. (5) can be estimated without constraints as follows:

$$\Delta c_t = \beta_0 + \beta_1 \Delta y_t - (1-\beta_3)c_{t-1} + \beta(1-\beta_3)y_{t-1} + u_t \tag{6}$$

where Δ is the first difference operator.

From Eq. (6) we derive the following empirical model:

$$\Delta c_t = \delta_0 + \delta_1 \Delta y_t + \delta_2 c_{t-1} + \delta_3 y_{t-1} + u_t \tag{7}$$

where:
$\delta_0 = \beta_0$ [the constant]
$\delta_1 = \beta_1 = c$ [the short-run propensity of consumption]
$\delta_2 = -(1-\beta_3) =$ [i.e. the EC term]
$\delta_3 = \beta(1-\beta_3)$ [where β is the long-term propensity of consumption]

By applying an Error Correction Model (ECM), this framework is able to link both the short-term and long-term components of the consumption function in a way that is consistent with the standard stylised facts on consumption (i.e., consumption proportional to permanent income in the long run and to current income in the short run). The consistency of this model with permanent consumption theory is generally acknowledged by the empirical condition that the sum of δ_2 and δ_3 approximate statistically to zero (i.e., $\beta = 1$).

[14]Steady state is non-stochastic $[E_t(u_t) = 0]$ and variables are supposed to be in equilibrium at a constant level as follows:
$c_t = c_{t-1} = C^*$ and $y_t = y_{t-1} = y^*$

[15]For details, please refer to Appendix 2C

While in equilibrium certainty equivalence holds by definition, according to Eq. (2), under the log normality assumption[16], precautionary saving is proportional to the variance of income shocks. Hence, the precautionary saving version of Eq. (7) is the following:

$$\Delta c_{it} = \delta_0 + \delta_1 \Delta y_{it} + \delta_2 c_{it-1} + \delta_3 y_{it-1} + \delta_4 \sigma_{id}^2 + u_{it} \tag{8}$$

where $\delta_4 = -(R-1)\frac{\frac{1}{2}\rho}{(1-R)^2}$. It is worth noting that Δc_{it} has been derived by subtracting c_{t-1} from both sides of Eq.(3) and hence here it does not represent the consumption slope. As standard in this literature in this paper we only refer to labour income (i.e., excluding capital income). This lets us treat income as outside the agents' control and assess the consumption consequences of unanticipated shocks (whereas capital income depends at least partially on assets and portfolio choices of households).

2.4 The empirical strategy and cross-country estimates

2.4.1 The empirical strategy

To estimate Eq.(8) we need to handle the classical dynamic panel bias (Nickell, 1981) i.e., the presence of a positive correlation between the lagged dependent variable and the error.[17] Since our panel is balanced, we first apply the Least Square Dummy Variable (LSDV) estimator.[18] Notwithstanding that the residuals of the ARDL specification are not expected to show any systematic component,[19] we repeat the estimation by using the Arellano-Bover/Blundell-Bond system generalised method of moments (SGMM) estimator (Arellano and Bover 1995; Blundell and Bond 1998).[20] The motivation

[16]Traditional models assume the log normality of consumption from the log normality of permanent income. Battistin et al. (2009) demonstrate empirically that the distribution of consumption expenditures across households is closer to log normal than the distribution of income.

[17]By construction, unobserved panel-level fixed effects are correlated with the lagged dependent variable

[18]Note that it could argued that the dynamic panel bias is actually not a major issue for our full sample estimates since $T \geq 30$ (Roodman, 2009).

[19]As expected, Fisher type tests now reject the presence of a "unit-root" problem.

[20]The Arellano-Bover/Blundell-Bond SGMM estimator augments the Arellano and Bond (1991) GMM estimator built on Holtz-Eakin et al. (1988) by including lagged level as well as lagged difference in a system of two equations (the original and the transformed ones). The first difference transformation is applied here since our panel is strongly balanced (Roodman, 2009).

for using the SGMM estimator instead of the GMM one is the recognition that lags are likely to be weak instruments in the context of the Arellano and Bond (1991) GMM estimator if consumption is expected to be persistent.[21]

Moreover, since risk/volatility effects are also supposed to be persistent (Reis, 2009) and to control for the likely correlation between permanent risk and errors determined by replacing expected values with observed means, we present additional SGMM estimates where risk is assumed as a predetermined variable.[22] Thus, we use lagged values of risk/volatility as instruments only for the period in which they are supposed to be unrelated to the error term (i.e., lags higher than three for the first difference equation).[23] Furthermore, we control for the possible spatial cross-sectional dependence of panel data.[24] Moreover, even if observed variables are in real terms and first differencing removes any time invariant components of the model, we

[21]When the time series are persistent and the number of time series observations is small, the first-differenced GMM estimator is poorly behaved. The reason is that, under these conditions, lagged levels of the variables are only weak instruments for subsequent first-differences (Bond et al., 2001). The system estimator exploits an assumption regarding the initial conditions to obtain moment conditions that remain informative even for persistent series, and it has been shown to perform well in simulations. Specifically, the system GMM estimator combines the standard set of equations in first-differences with suitably lagged levels as instruments, with an additional set of equations in levels with suitably lagged first-differences as instruments. Although variables in levels are necessarily correlated with country-specific effects, it assumes that variables in first-differences are not correlated with the country-specific effects used as instruments in the level equations. The validity of these additional instruments can be tested by using the standard tests of over-identifying restrictions. Practically speaking, instead of transforming the regressors to expunge the fixed effects, it transforms the instruments to make them exogenous to fixed effects. This is valid assuming that changes in any instrumenting variable are uncorrelated with observed country fixed effects (i.e., countries are not too far from steady states, in the sense that deviations from long-run means are not systematically related to fixed effects). It is worth noting that assuming the opposite (i.e., first-differences correlated with country-specific effects) would result in implausible long-run implications (Bond et al., 2001).

[22]This means we allow the error term at time t to have some feedback on the subsequent realisations of the risk/volatility term at time t. More formally, $E(vol_{is}\varepsilon_{it}) = 0$ for $s \leq t$ and $E(vol_{is}\varepsilon_{it}) \neq 0$ for $s > t$. vol is volatility.

[23]The STATA command xtabond2 has been applied to run the SGMM estimates, whereas the more flexible STATA command xtdpd has been applied for running the additional SGMM estimates with risk/volatility as predetermined variables.

[24]The assumption that the disturbances of a panel model are cross-sectionally independent is often inappropriate (so called "pure heteroscedasticity"). Provided that the unobservable common factors are uncorrelated with the explanatory variables, the coefficient estimates from standard panel estimators are still consistent (but inefficient). However, the standard error estimates of commonly applied covariance matrix estimation techniques are biased and hence statistical inference that is based on such standard errors is invalid (see Driscoll and Kraay, 1998; Hoechle, 2007).

include time dummies to remove any residual time variant component that can impact consumption behaviour other than volatility and observables. This makes the assumption that there is no correlation across countries in the idiosyncratic disturbances more likely.

With regard to our proxy for risk, in line with the classical literature in the field (Guiso et al., 1992; Hubbard et al., 1994; Carroll and Samwick, 1997; Gourinchas and Parker, 2002; Meghir and Pistaferri, 2004; Storesletten et al., 2004; Krebs et al., 2010; Reis, 2009) we filtered out the permanent component of income innovation for each country i in the sample (for more details, see Appendix B). The assumption is that the ability to smooth consumption changes according to the degree of shock persistence, with likely deviations from the consumption smoothing of permanent risk (which is assumed to be fully persistent) being larger than that for transitory ones. This reinforces our aim to make conservative estimates since the relevance and significance of transitory income shocks in causing deviations from consumption smoothing are not addressed here.

Fig. 1 provides a glance into the long-run relationship between volatility of per capita consumption growth and per capita GDP across our sample of 147 countries in the period 1950-2008 (the full list of countries included in the sample, divided into deciles for different decades, is provided in Tables 2D-1 and 2D-2 in Appendix 2D).

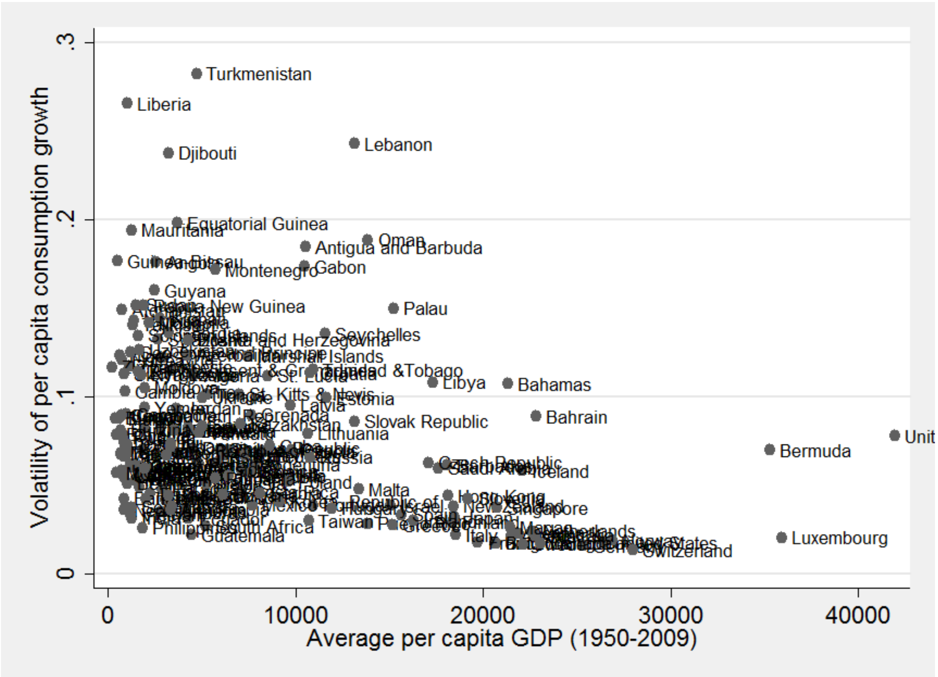
The figure highlights the well-known evidence of strong heterogeneity in consumption volatility according to the income levels of the countries in the sample. Specifically, richer countries show a lower degree of consumption volatility, than poorer ones. This leads us to investigate whether differences in countries' income levels actually produce diversified effects both in their short-term and long-term consumption dynamics as well as in their precautionary saving behaviour. A workable way to look at this source of countries' heterogeneity is to provide consumption estimates by income deciles.[25]

2.4.2 Data

We provide estimates for a panel of 147 countries in a long-term pre-crisis period (1950-2008). Data come from the PWT 7.0 database which is the most widely used source for cross-country comparisons (Johnson et al., 2013). They have been extensively used in various fields of economics including growth, development and international trade. Data in the PWT are measured at purchasing power parity and have covered a large number of

[25]This means we rely on mean group estimators of the parameters, i.e., not imposing that both short-term and long-term parameters are the same across groups. See Pesaran and Smith, 1995.

Figure 1: Volatility and per capita GDP in the long run



countries from all regions for more than 50 years. The ultimate objective of the PWT is to adjust national estimates of GDP by valuing output at common international (purchasing power parity [PPP]) prices so that the resulting PPP-adjusted estimates of GDP are comparable across countries. This allows researchers to make real quantity comparisons both across countries and over time. As a matter of fact, roughly two-thirds of all cross-country empirical work is based on the PWT. Second place is held by the World Bank's World Development Indicators (WDI) which were originally based on the PWT, but have subsequently diverged. The IMFs World Economic Outlook (WEO) dataset comes a distant third (Johnson et al., 2013). Recently, the PWT methodology came under some criticism. Ponomareva & Katayama (2010) were among the first to argue that outcomes from the PWT could be version-dependent. They noted that in case of "classical" measurement errors, where the growth rate is the LHS variable, measurement error results only in inefficiency (it is captured by the random error term of the regression). However, Johnson et al. (2013) highlighted that this variability across alternative versions of the PWT stems, in fact, only in part from random changes to underlying national income accounts data.

It also seems to be systematically related (inversely) to the size of a country and to the distance of the data from the benchmark data. Hence, when the PPP-adjusted GDP appears as an independent variable (in level or growth) in the regression estimation, measurement errors actually produce biased results. Although challenging, Johnson et al. (2013) demonstrate that this further source of bias could be corrected econometrically. Carrying out careful robustness checks, they argue that the use of a good instrumentation strategy helps to overcome these additional sources of measurement errors in the PWT. Moreover, they demonstrate that while studies that use annual data are less robust, low frequency data remain more robust. All things considered, the use of SGMM technique appears to be the best strategy to adopt also for this purpose, provided that proof of instrument validity is supplied using the appropriate tests (see the following sub-section). Also, assuming that low frequency data are more robust, as a further robustness check for the validity of the estimates, the consistency of annual empirical outcomes with those obtained by averaging data on 3-year spans will be tested as well.[26]

Specifically, we make use of the following variables: the per capita consumption share of real gross domestic product to derive our proxy of real per capita consumption and the PPP Converted GDP Laspeyres per worker at 2005 constant prices to derive our proxy of real labour income (Table 2D-3 in Appendix 2D provides some descriptive statistics). All variables are in 2005 international dollars per person. According to the PWT, workers' definition includes all status categories of persons in employment, not only employees, including paid family workers, employers, own-account workers, members of producers' cooperatives, contributing family workers and workers not classifiable by status. The choice to use GDP per worker is driven by the fact that national labour income is likely to be misreported especially where there are high rates of informality, unemployment and short-term work, and that the income of self-employed workers is not directly observable. Moreover, in most developing countries, the assumption that the self-employed earn the same average wage as employees would be misleading since the share of employees in the total number of persons engaged (employees + self-employed) is below 50 percent (Inklaar & Timmer, 2013). On top of that, there is a clear lack of consistency across methods used by national accounts and labour surveys in different countries. Of course, this choice rests on the assumption that real wages should track labour productivity in the long run. The use of the SGMM technique helps to control for potential sources of unobserved

[26]Note that lower frequency exercises would not be compatible with our empirical analysis. They would smooth excessively the data and would cause a dramatic reduction in the number of observations.

heterogeneity also linked to this assumption.[27]

2.4.3 Cross-country estimates

Table 1 shows the outcomes of the panel estimates of Eq.(8) for the full sample. In the first three columns, it reports the certainty equivalence (CE) version of our consumption model (the baseline model) whereas the rest of the table presents the outcomes of the precautionary saving model (for the sake of brevity, proxies of permanent risk computed for $d = 5$ and $d = 10$ years backwards are reported in the main table). For each model, the table reports in the first column the result of the Least Square Dummy Variable (LSDV) specification and in the second and third columns, respectively, the outcomes of the one step (SGMM) and two step (2SGMM) system GMM estimates. A further empirical exercise with permanent risk as predetermined variable is reported in the last two columns (denoted as PSGMM and P2SGMM, respectively, where P stands for pre-determined).

As can be seen in the table, all coefficients are significant and show the expected signs in all panel estimates. As expected, the LSDV coefficients look downward biased than the system GMM ones, whereas the two step GMM estimates are supposed to be more robust due to the expected persistence of consumption and income[28]. The consistency of the GMM estimates cannot be taken for granted and depends strictly on the validity of the moment conditions used.[29] To test this validity, we adopt the Hansen J Test which

[27]It is worth noting that the new PWT 8.1 (released in 2015) also provides for the first time estimates for the share of labour income in GDP. These are based on a strong set of assumptions related to comparability across time and space as well as on the decomposition of mixed total income earned by self-employed workers. Unfortunately, this new release is not directly comparable with the previous one (it prepares the ground for a new generation of the PWT managed by the University of Groningen). Moreover, it does not provide separate estimates for private, government and investment shares of consumption. While in fact the previous release, and specifically its consumption component, was primarily intended to measure the standard of living across countries, the new generation is meant primarily to measure the productive capacity of an economy (for more details, see Feenstra et al., 2015).

[28]While naive OLS regressions of the lagged dependent variable are supposed to be positively correlated with the error, biasing its coefficient estimate upward, the opposite is supposed to happen with the LSDV specification. As a matter of fact, the evidence that LSDV coefficients should be considered downward biased with regard to alternative specifications (including GMM) is included by Roodman (2003) in the checks to perform when using System or Difference GMM. The fact that the two sets of coefficients could converge using the two estimation techniques is excluded.

[29]Unfortunately, as Roodman (2009) clearly states, there appears to be little guidance from the literature on how many instruments is “too many”. Adopting prudent behaviour, we used the *collapse* option to reduce the proliferation of instruments and always checked

Table 1: Certainty Equivalence and Precautionary Saving ARDL model of per capita consumption under permanent risk full panel (dependent variable: first diff. of annual pc consumption)

	CE			permrisk (d=5)					permrisk (d=10)				
	LSDV	SGMM	2SGMM	LSDV	SGMM	2SGMM	PSGMM	P2SGMM	LSDV	SGMM	2SGMM	PSGMM	P2SGMM
diff. pc gdp worker (log)	0.669***	0.761***	0.815***	0.674***	0.721***	0.716***	0.719***	0.714***	0.701***	0.713***	0.715***	0.706***	0.719***
	(0.0445)	(0.0965)	(0.0997)	(13.25)	(13.59)	(13.93)	(13.16)	(13.36)	(10.70)	(9.65)	(10.52)	(9.59)	(10.23)
lagged pc cons. (log)	-0.116***	-0.370***	-0.477***	-0.149***	-0.342**	-0.402**	-0.322***	-0.325***	-0.186***	-0.335**	-0.345***	-0.266***	-0.291***
	(0.0147)	(0.142)	(0.144)	(-9.20)	(-2.21)	(-2.20)	(-2.90)	(-2.65)	(-7.28)	(-2.59)	(-2.63)	(-3.38)	(-3.38)
lagged pc gdp worker (log)	0.0951***	0.332***	0.422***	0.116***	0.318**	0.375**	0.300***	0.306***	0.141***	0.318**	0.323***	0.252***	0.276***
	(0.0145)	(0.124)	(0.124)	(7.13)	(2.22)	(2.22)	(2.90)	(2.68)	(5.89)	(2.58)	(2.64)	(3.37)	(3.37)
permanent risk (d=5)				-0.0396	-0.821	-0.821+	-0.775**	-0.637*					
				(-0.37)	(-1.24)	(-1.47)	(-2.07)	(-1.78)					
permanent risk (d=10)									-0.681**	-2.710*	-2.812*	-0.868***	-2.551***
									(-2.24)	(-1.82)	(-1.68)	(-2.59)	(-2.71)
cons	0.0333	-2.599	-3.788**	0.0854+	-0.205+	-0.268*	-0.190*	-0.242*	0.139**	-0.211*	-0.165*	-0.168**	-0.176**
	(0.0397)	(2.352)	(1.789)	(1.60)	(-1.47)	(-1.90)	(-1.74)	(-1.95)	(2.22)	(-1.89)	(-1.92)	(-2.24)	(-2.19)
long-term cons.prop ($-[\delta_3/\delta_2]$)	*0.82*	*0.90*	*0.88*	*0.78*	*0.93*	*0.93*	*0.93*	*0.94*	*0.76*	*0.95*	*0.94*	*0.95*	*0.95*
Nr. Obs.	7,990	7,990	7,990	5987	5987	5987	5987	5987	4295	4295	4295	4295	4295
Fe year	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
FE country	yes	no	no	yes	no	no	no	no	yes	no	no	no	no
R^2	0.364			0.396					0.415				
AB test (AR^2)		0.340	0.204		0.173	0.258	0.194	0.253		0.387	0.366	0.379	0.389
Nr. Instr.		119	119		109	109	151	151		99	99	126	126
Hansen Test		0.318	0.318		0.206	0.206	0.269	0.269		0.454	0.454	0.195	0.195

t-statistics in parentheses. + p$\leq$ 0.15; $*p \leq 0.10$; $**\,p \leq 0.05$; $***p \leq 0.01$

is robust to heteroskedasticity.[30] It actually rejects the null hypothesis of over-identifying restrictions. Furthermore, the Arellano-Bond test for serial correlation in the first-differenced errors at orders higher than one strongly supports the hypothesis of no serial correlation in the first-differenced errors for all our system GMM empirical exercises.[31]

When looking at the coefficients of the certainty equivalence model, it is worth noting that the long-term propensity to consume out of income is less than one for each of the reported model specifications[32]. It denotes a relatively high sensitivity of consumption to current income and reveals signs of possible violations of the consumption smoothing hypothesis. The consistency of our empirical estimates with permanent consumption theory actually increases when we control for permanent risks (in the main sections of the table we report for the sake of brevity, only permanent risk computed at the most statistically significant time horizons i.e., $d = 5$ and $d = 10$). This consistency means that the consumption smoothing hypothesis seems to hold net of precautionary saving. In other words, our average "representative household" shows risk-averse behaviour and the supposed violation of consumption smoothing highlighted by the certainty equivalence model becomes perfectly rational once we take into account the role of the overall risk that is perceived to be permanent (as highlighted by the significant coefficients for ex-ante risk and the corresponding increase of the long-term propensity to consume out of income). The highly significant negative relationship between permanent risk and per capita consumption, on average and *ceteris paribus*, is thus the main feature of our empirical estimates. This empirical evidence is fully consistent with the theory of precautionary saving and reveals the presence of extra-saving in response to aggregate risk (i.e., when incomes are perfectly pooled across individuals). If this is the case, standard

the validity of the test for subsets of instruments via the difference-in-Hansen test.

[30]The most common Sargan test has an asymptotic chi-squared distribution only for a homoskedastic error term. It tends to over-reject with heteroskedasticity.

[31]The presence of autocorrelation in the idiosyncratic disturbance term would render some lags invalid as instruments. Of course, full disturbance is presumed to be autocorrelated because it contains fixed effects. Hence, rejecting the null hypothesis of first-order serial correlation in the first-differenced errors does not imply model misspecification because the first-differenced errors are serially correlated even if the idiosyncratic errors are independent and identically distributed (and the GMM estimation procedure is specifically designed to eliminate this source of trouble). It is only rejection of the null hypothesis of no serial correlation in the first-differenced errors at an order greater than one which implies model misspecification. In fact, if some instruments are endogenous to the error term in differences, they become potentially invalid instruments after all (Roodman, 2009).

[32]Note that the long-term propensity to consume can be computed as $-[\delta_3/\delta_2]$, where δ_3 is the coefficient of the lagged per capita income and δ_2 the coefficient of the lagged per capita consumption.

certainty equivalence models are actually severely affected by an omitted variable bias. This result, especially in the case of permanent risk computed using a decade as a time horizon, is robust to the various specifications of our empirical model, including the one step and two step system GMM and also when we control for permanent risk to be a predetermined variable in our empirical specification (see the PSGMM and P2SGMM outcomes in the last two columns of both the permanent risk sections in Table 1).

For sensitivity purposes, in Table 2D-4 in Appendix 2D we present the estimated coefficients for permanent risk computed at various time horizons: from $d = 5$ to $d = 15$ (In Table 2D-4 for the sake of brevity, the parameters of the CE components have been not reported since they do not show any significant changes compared with the previous estimates). It turns out that our estimates are robust to permanent risk computed only at some specific fixed time horizons (e.g. $d = 5$ and $d = 10$ or not far from them) and that the magnitude (in the case of $d = 6$ also the sign) of the relationship is not stable across the different time horizons. Both the high significance of the negative relationship between permanent risk and per capita consumption at fixed time horizons (specifically with $d = 10$) and the instability of the same relationship at the other time horizons provides robust empirical evidence in all our estimates and for different econometric specifications. A possible interpretation of this (and food for thought for further analyses) is that it is probably consistent with the average attitude when people look at risk and/or with the standard design of the available risk-mitigating mechanisms. In other words, it seems to hold a strong tendency of computing the optimal consumption under risk looking at the past performance of income risk at some fixed time horizons (especially for $d = 10$) rather than in the continuum. This interpretation would be consistent with our empirical evidence but calls for further investigation.

To give some insights into the evolution of the model over time, we break down the panel by decades too.[33] This also helps to get additional insights into the evolution of the model over time. Table 2 shows these further empirical outcomes. Here for the sake of brevity, the estimated coefficients by decade of the main variables of Eq. (8) are reported only for the CE version of the model, whereas only the coefficients of the various proxies of permanent risk (for $d = 5$ and $d = 10$ and for risk assumed as a predetermined variable which is reported as *permanent risk pred.* in the table) are reported for the corresponding precautionary saving specification of the same model. Also in

[33] Going backwards from the last available observation, we set up the following decades: decade 1 (1960-1969); decade 2 (1970-1979); decade 3 (1980-1989); decade 4 (1990-1999); decade 5 (2000-2008). Results for decade 1950-1959 are not available since we cannot observe consumption volatility for d previous periods.

this case, with the exception of the first decade, the LSDV coefficients appear to be downward biased than the system GMM ones. Regarding the negative relationship between permanent risk and per capita consumption highlighted for the full period, it turns out to be more significant in the last decade (from 2000 onwards). This looks consistent with the more recent literature that underlines how the relevance and significance of the negative incidence of aggregate risk/macrofluctuations are actually rising in recent years, on average and *ceteris paribus*.

Acknowledging that lower frequency data are likely to be more robust (see sub-section 2.4.2), as a robustness check for the validity of the estimates, we carry out the same estimates also averaging data over 3-year spans. Unfortunately, this dramatically reduces the number of observations (from about 6,000 to about 2,000 and below 1,500 if we compare the estimates with permanent risk with $d = 10$) and smooths the data reducing the relevance of consumption smoothing. As a matter of fact, the coefficients of lagged consumption and lagged income (whose ratio determines the long-term propensity to consume) are weakly significant in the SGMM specification even in the certainty equivalent specification (columns 2 and 3). Moreover, averages tend to smooth the risk component too. Notwithstanding the above caveats, Table 2D-6 in Appendix 2D shows that the negative relationship between consumption and permanent risk still holds, even if it turns out to be only weakly significant with permanent risk computed over a 10-year time span (when we are actually using less than 1,500 observations.)

As stated by the theory of precautionary saving, income and past consumption levels are sufficient statistics to absorb the most important factors for current consumption (see Appendix 2A) and there are no hints in the theory that suggest heterogeneity in country paths of adjustment to their respective steady state consumption other than via income. On the other hand, we should admit that a number of possible country time variant characteristics may matter as well in our empirical analysis (e.g. consumption distribution; the size of the government sector, etc.). Unfortunately, these statistics are not provided by the PWT and neither are they easily obtainable from other data sources. However, to get some feeling for the relevance of such heterogeneous factors in driving consumption convergence, as a further robustness check, we also run the model by adding a full set of country-specific trends. This is not possible for system GMM estimates since instrument proliferation soon becomes an issue (the instrument count grows extremely large relative to the sample size) but we can run the test using LSDV. As in the main estimates, we should acknowledge these further outcomes as probably being downward biased than the true parameters. Table 2D-7 in Appendix 2D reports the estimated coefficients with country-specific trends. As can be

Table 2: Certainty Equivalence and Precautionary Saving ARDL model of per capita consumption under permanent risk by decades (dependent variable: first diff. of annual pc consumption)

	1960-69			1970-79			1980-89			1990-99			2000-08		
	LSDV	SGMM	2SGMM	LSDV	SGMM	2SGMM	LSDV	SGMM	2SGMM	LSDV	SGMM	2SGMM	LSDV	SGMM	2SGMM
diff. pc gdp worker (log)	0.675***	0.527***	0.560***	0.597***	0.582***	0.613***	0.670***	0.704***	0.719***	0.818***	0.836***	0.850***	0.680***	0.720***	0.684***
	(5.75)	(4.10)	(5.77)	(7.11)	(6.29)	(6.51)	(14.80)	(10.18)	(10.70)	(10.40)	(10.83)	(10.65)	(6.00)	(5.91)	(6.48)
lagged pc cons. (log)	-0.402***	-0.0776	-0.0855	-0.394***	-0.339	-0.354	-0.451***	-0.333**	-0.393***	-0.470***	-0.356**	-0.365**	-0.393***	-0.250***	-0.259***
	(-11.79)	(-1.34)	(-1.13)	(-8.18)	(-1.03)	(-0.96)	(-6.82)	(-2.41)	(-2.94)	(-8.90)	(-2.08)	(-1.98)	(-6.49)	(-2.98)	(-2.90)
lagged pc gdp worker (log)	0.401***	0.0728	0.0805	0.338***	0.293	0.314	0.324***	0.299**	0.356***	0.349***	0.330**	0.340*	0.275***	0.230***	0.242***
	(6.01)	(1.42)	(1.20)	(5.75)	(1.03)	(0.98)	(5.05)	(2.41)	(2.94)	(6.28)	(2.06)	(1.96)	(5.26)	(2.99)	(2.91)
cons	-0.438	-0.0581**	-0.0625**	-0.0819	-0.0481	-0.103	0.388	-0.128	-0.157*	0.275	-0.223+	-0.219+	0.469+	-0.0990*	-0.122**
	(-0.68)	(-2.18)	(-1.98)	(-0.32)	(-0.39)	(-1.04)	(1.26)	(-1.20)	(-1.72)	(1.10)	(-1.62)	(-1.61)	(1.64)	(-1.72)	(-2.05)
long-term cons.prop $(-[\delta_3/\delta_2])$	*1.00*	*0.94*	*0.94*	*0.86*	*0.86*	*0.89*	*0.72*	*0.90*	*0.91*	*0.74*	*0.93*	*0.94*	*0.70*	*0.92*	*0.93*
Nr. Obs.	1089	1089	1089	1406	1406	1406	1531	1531	1531	1743	1743	1743	1640	1640	1640
Fe year	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
FE country	yes	no	no	yes	no	no	yes	no	no	yes	no	no	yes	no	no
R^2	0.472			0.490			0.476			0.560			0.432		
AB test (AR^2)		0.086	0.140		0.767	0.684		0.864	0.883		0.317	0.341		0.229	0.242
Nr. Instr.		39	39		59	59		73	73		93	93		112	112
Hansen Test		0.165	0.165		0.245	0.245		0.598	0.598		0.196	0.196		0.716	0.716
permanent risk (d=5)	0.701	2.135	1.092	-0.938+	-0.861	-0.473	0.178	-1.483	-1.773	0.0407	-0.252	0.0664	-0.142	-0.0506	-0.0840
	(1.29)	(1.02)	(0.62)	(-1.54)	(-0.73)	(-0.38)	(0.47)	(-0.83)	(-1.11)	(0.29)	(-0.47)	(0.12)	(-0.83)	(-0.08)	(-0.13)
permanent risk pred (d=5)		-4.148*	-3.193+		0.222	0.0364		-2.489	-2.694		-1.008	-1.035		-1.868**	-1.880
		(-1.78)	(-1.62)		(0.18)	(0.03)		(-1.06)	(-0.99)		(-1.13)	(-1.15)		(-2.37)	(-0.67)
permanent risk (d=10)				1.138	1.881	2.197	0.00986	-0.523	-0.0773	-1.015*	0.112	-0.248	-0.996*	-2.115*	-2.103*
				(0.98)	(1.10)	(1.18)	(0.02)	(-0.74)	(-0.12)	(-1.72)	(0.06)	(-0.23)	(-1.82)	(-1.94)	(-1.82)
permanent risk pred (d=10)					1.881	2.197		-0.435	0.0219		-1.435*	0.146		-1.055***	-2.121**
					(1.10)	(1.18)		(-0.60)	(0.03)		(-1.67)	(0.11)		(-2.63)	(-2.31)

t-statistics in parentheses. + p$\leq$ 0.15; $*p \leq 0.10$; $**\,p \leq 0.05$; $***p \leq 0.01$

seen in the table, while the estimates turn out to be more robust and the coefficients for income risk decrease slightly in magnitude and significance, the negative relationship still holds.

To control for the presence of heterogeneity in the conditional distribution of per capita consumption according to countries' income, we run the same estimates by also clustering countries by income deciles. Since the estimates by deciles introduce a truncation of the dependent variable that can yield potentially biased estimates, we need to control for this source of sample selectivity (or non-random) bias.[34] In this case, we are perfectly aware of the selection process that governs this sample selectivity bias and we can solve the problem by applying a Heckman two-step procedure. This requires us to run a selection equation prior to the main equation which determines, for each income decile, whether the dependent variable is observed (the selection mechanism). This selection equation is a probit equation which includes all the relevant exogenous variables of the main equation plus the value of the per capita real income as the identifying variable, i.e., the variable that determines the selection process into income deciles.[35] The selection equation estimates are then used to construct proxies of the inverse of the "Mills ratio" term[36]. This term is then included in the main equation regressions where only the truncated dependent variable is considered to derive the so-called "selection coefficient" (θ). This coefficient represents the product of the correlation coefficient between the error in the selection equation and the error in the main equation, and the standard error of the main equation. Thus a simple t-test of whether $H_0 : \theta = 0$ is a workable test for sample selectivity bias.

Table 3 shows the empirical outcomes of the estimates by income deciles. Note that here for the sake of brevity (to avoid having too many columns for each decile), for the estimates with permanent risk as predetermined variable we report only the estimated coefficients of the permanent risk (named as "permanent risk pred") at the end of the table. As expected, the selectivity bias cannot be ruled out with high probability in most cases (as witnessed by the strong significance of the estimated coefficients of the inverse Mills ratios). It is worth noting beforehand that the precision of the estimated coefficients is dependent on the density of the points at each decile. In this light, we should

[34]This is something that is different from the standard censored Tobit model since we only observe the complete regression model after the selection process into income deciles has actually occurred.

[35]In this case, the Panel Probit technique with country fixed effects is assumed to be unbiased since T is large and n not small. For more details, see Wooldridge (2002).

[36]It is defined as $\lambda_i = \frac{\phi[x_i^{'}\beta]}{\Phi[x_i^{'}\beta]}$. For more details, see Wooldridge (2002).

Table 3: Certainty Equivalence and Precautionary Saving ARDL model of per capita consumption under permanent risk by deciles, full period (dependent variable: first diff. of annual pc consumption)

by deciles (full period)	decile 1		decile 2		decile 3		decile 4		decile 5		decile 6		decile 7		decile 8		decile 9		decile 10	
	LSDV	SGMM	LSDV	SGMM	LSDV	SGMM	LSDV	SGMM	LSDV	SGMM	LSDV	SGMM	LSDV	SGMM	LSDV	SGMM	LSDV	SGMM	LSDV	SGMM
diff. pc gdp worker (log)	0.523***	0.707***	3.153***	3.223***	-0.142***	-0.164***	0.389***	0.390***	2.090***	2.095***	-8.595***	-8.829***	3.107***	3.106***	5.169***	5.241***	-0.419+	-1.430+	0.253	0.332
	(4.84)	(3.02)	(40.23)	(25.25)	(-10.39)	(-10.10)	(179.88)	(110.34)	(4689.52)	(709.23)	(-150.29)	(-167.52)	(9387.08)	(3934.63)	(55.45)	(69.18)	(-1.55)	(-1.71)	(1.52)	(0.82)
lagged pc cons. (log)	-0.172***	-0.338**	-1.142***	-1.161***	-1.881***	-1.916***	-3.106***	-3.097***	-2.103***	-2.105***	-5.048***	-5.157***	-1.173***	-1.173***	0.0779***	0.0901***	-1.536***	-2.879**	-0.292***	-0.218*
	(-7.84)	(-2.85)	(-43.44)	(-27.98)	(-142.44)	(-108.03)	(-2077.09)	(-339.72)	(-8870.56)	(-982.33)	(-192.60)	(-217.05)	(-6900.96)	(-4514.83)	(6.67)	(3.89)	(-3.57)	(-2.63)	(-4.92)	(-1.90)
lagged pc gdp worker (log)	0.0988**	0.373*	4.815***	4.928***	0.0394***	0.0670+	1.311***	1.308***	1.689***	1.692***	-3.970***	-4.080***	4.588***	4.587***	4.193***	4.257***	-0.389***	-0.914*	-1.284**	-1.123
	(2.60)	(2.03)	(28.31)	(16.46)	(7.93)	(1.59)	(424.63)	(306.17)	(6460.12)	(813.64)	(-156.15)	(-141.47)	(7389.72)	(2642.35)	(48.54)	(67.40)	(-3.18)	(-1.93)	(-2.60)	(-1.01)
invmills	0.00515	-0.0165	-3.552***	-3.632***	2.571***	2.552***	5.253***	5.240***	3.951***	3.957***	-31.47***	-32.28***	4.797***	4.795***	5.055***	5.149***	-1.257***	-2.493**	-0.187**	-0.157
	(1.42)	(-0.40)	(-28.08)	(-16.18)	(256.21)	(50.33)	(868.59)	(285.52)	(2257.79)	(857.24)	(-164.83)	(-170.78)	(6453.43)	(2547.57)	(47.49)	(71.36)	(-3.50)	(-2.38)	(-2.50)	(-0.94)
cons	0.401*	-0.650	-17.96***	-19.44***	4.364***	3.737***	-11.89***	-11.88***	-29.22***	-29.28***	200.4***	205.5***	-96.04***	-96.02***	-61.85***	-62.94***	22.02***	43.31**	18.60**	15.84
	(2.04)	(-0.54)	(-24.44)	(-8.95)	(65.61)	(4.09)	(-481.65)	(-259.01)	(-2202.75)	(-874.55)	(168.94)	(172.70)	(-6532.24)	(-3563.41)	(-47.66)	(-59.52)	(3.49)	(2.43)	(2.87)	(1.11)
Nr. Obs.	956	956	849	849	869	869	818	818	838	838	795	795	676	676	761	761	1053	1053	375	375
Fe year	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
FE country	yes	no	yes	no	yes	no	yes	no	yes	no	yes	no	yes	no	yes	no	yes	no	yes	no
R^2	0.412		0.970		0.993		0.999		1.000		0.997		1.000		0.978		0.661		0.439	
AB test (AR^2)		0.994		0.423		0.530		0.835		0.321		0.420		0.470		0.159		0.316		0.671
Nr. Instr.		117		117		117		117		117		118		118		119		119		119
Hansen Test		1.000		1.000		1.000		1.000		1.000		1.000		1.000		1.000		1.000		1.000
permanent risk (d=5)	0.0306	0.0435	0.0361	0.0782	0.0175	-0.285*	0.00369	0.0768**	-0.00714***	-0.00739***	-0.0153	-0.0246+	-0.00130+	-0.00230	-0.0140*	-0.0117	0.173	-0.934	-0.0720	-0.437
	(0.11)	(0.16)	(1.06)	(0.88)	(0.69)	(-1.77)	(0.29)	(2.26)	(-18.85)	(-3.31)	(-1.14)	(-1.73)	(-1.54)	(-0.93)	(-1.75)	(-0.97)	(0.63)	(-1.05)	(-0.18)	(-0.62)
permanent risk pred (d=5)		0.0345		0.102		-0.0374		0.0284		-0.00731***		-0.0123		-0.00111		-0.00918		-0.372		1.368***
		(0.16)		(1.30)		(-0.36)		(1.02)		(-9.57)		(-0.46)		(-0.50)		(-1.20)		(-0.56)		(3.07)
permanent risk (d=10)	-0.331	0.276	-0.406***	-0.615***	0.0457	0.182	-0.0122	-0.0114	0.00820+	0.00938	-0.0203	-0.0140	0.00142*	0.00106*	-0.0244	0.0326	-0.0500	1.215*	-0.196	-0.697***
	(-0.35)	(0.25)	(-6.78)	(-4.68)	(1.09)	(1.29)	(-0.66)	(-0.50)	(1.63)	(1.19)	(-1.15)	(-1.01)	(2.11)	(1.67)	(-0.80)	(0.86)	(-0.35)	(1.96)	(-1.09)	(-3.88)
permanent risk pred (d=10)		0.281		-0.603***		0.165		-0.0225		0.00632		-0.0163**		0.000911		0.00633		1.040*		-0.503**
		(0.28)		(-5.67)		(1.16)		(-0.97)		(0.73)		(-2.15)		(0.84)		(0.24)		(1.94)		(-2.45)

t-statistics in parentheses. + p$\leq$ 0.15; $*p \leq 0.10$; $**p \leq 0.05$; $***p \leq 0.01$

handle these estimates with care as suggested by a perfect Hansen statistic of 1.000 as well as the apparent absence of selectivity bias for the two extreme deciles. On the other hand, the hypothesis of no serial correlation in the first-differenced errors is not close to being rejected in any of the empirical exercises by deciles.[37] The most interesting feature of this further empirical exercise is that precautionary saving behaviour is confirmed, on average and *ceteris paribus*, and this phenomenon is widespread, with some exceptions, across the entire income distribution, poorest deciles included (even if this is not significant for the poorest one).

For sensitivity purposes and to avoid the likely selection bias due to countries' past performances, we report in Table 2D-8 additional estimates by deciles in which countries have been classified according to their income in the first decade of the observed time span (1960-69). This avoids the bias to classify countries as relatively poor and/or relatively rich according to their actual performance during the observed time span rather than their actual economic situation at the beginning of the observed period. This correction is particular relevant for countries that have followed a strong evolutionary path, e.g. China. The empirical outcomes for these new estimates by income deciles do not substantially differ from the previous ones. Precautionary saving behaviour is still confirmed and it is still widespread across the income distribution, including the poorer countries in the world which actually show, on average and *ceteris paribus*, a significant phenomenon of 'extra-saving" associated with aggregate risk.

To summarise, our empirical long-run cross-country panel exercise shows substantial evidence of a robust negative relationship between permanent risk and per capita consumption. This empirical evidence is widespread across the entire income distribution. However, it is robust for risk computed over specific time horizons and for more recent decades. This empirical evidence is, on the one hand, consistent with the theory that sees consumption fluctuations as optimal responses to risk. On the other hand, it is also consistent with the common concern over a likely "precautionary-investment"/'volatility trap" effect which has been highlighted in the most recent models of consumption under uncertainty (Reis, 2009; Cherif and Hasanov, 2012). This is probably linked to a change in portfolio allocation between risky capital and safe assets with risk-averse agents shying away from risky investment and, possibly, also causes indirect welfare cost by hampering future consumption possibilities (Loayza et al., 2007). In this respect, this empirical evidence implies a per-

[37] As specified above, the likely absence of serial correlation in the first-differenced errors at an order greater than one is the most common test for the validity of instruments since if some instruments are endogenous to the error term in differences they become potentially invalid (Roodman, 2009).

manent lower smooth path of consumption with permanent negative effects on welfare.

As underlined in Section 2, there is also a debate on the relative magnitude of the welfare cost of risk. In this respect, this work is innovative with regard to the existing literature by proposing a way to look empirically at the cost of volatility on welfare other than via the usual compensation parameters of household preference for stability (see, for instance, Lucas, 1987, 2003 and Reis, 2009). By focusing on the impact of risk on consumption behaviour and the implied changes in portfolio allocation between risky capital and safe assets, we can provide useful insights into the welfare cost of risk. Specifically, we can derive a relative measure of the net contribution of risk on consumption behaviour, on average and *ceteris paribus*, by standardising the variables and derive standardised coefficients. The estimated standardised coefficients of Eq.(8) are reported in Table 2D-5 (for the sake of brevity, only the full sample estimates are reported).[38] The relative lower magnitude of the estimated standardised coefficients for permanent risk compared with all the other consumption determinants shows that, in line with the Lucas (1987, 2003) computation, the cost of fluctuations should be perceived to be low in terms of welfare. Its impact in terms of consumption volatility has been approximately equal to half of the overall impact of a change in the short-run propensity to consume.[39]

2.5 Conclusion

Unlike previous work on the cost of macro volatility, we perform an empirical strategy grounded on the theory of precautionary saving in a long-run pre-crisis period (1950-2009) and wide cross-country setting (147 countries).

Our empirical model estimates a significant negative relationship, on average and *ceteris paribus*, between permanent risk and per capita consumption. This empirical evidence is widespread across the entire income distribution. However, it is robust for risk computed over specific time horizons and for more recent decades.

This conclusion is, on the one hand, consistent with the theory that sees consumption fluctuations as optimal responses to risk. On the other hand, it

[38] Note that the estimates based on standardised variables do not include the constant term. This is because each standardised variable has a mean of 0 and hence $cons = \widehat{\mu}_Y - b_1 * \widehat{\mu}_{x_1} - b_2 * \widehat{\mu}_{x_2} = 0$

[39] The impact of standardised coefficients on the dependent variable is assessed as its change in terms of standard deviation induced by a change of one standard deviation of the independent variable.

is also consistent with a likely “precautionary-investment”/‘volatility trap” effect that, in turn, implies a permanent lower smooth path of consumption with permanent negative effects on welfare. Our empirical results are consistent with the previous empirical literature and suggest the need to be aware of a likely omitted variable bias in performing certainty equivalent analyses, i.e., not controlling for the precautionary saving component. However, they cannot refute Lucas’s (1987, 2003) view that the cost of fluctuations should be perceived to be low in terms of welfare implications.

Our empirical evidence provides new insights into the long-standing debate over the costs of fluctuations. It shows that countries - including poorer ones - hold ”extra saving”, in a long-run perspective, because of economic fluctuations. This phenomenon is neither transitory nor specific to the current “crisis period”, even if it is increasing over time.

Appendix 2A - Consumption with Constant Absolute Risk Aversion (CARA) Utility

Blanchard and Fischer (1989), Caballero (1990 and 1991), Weil (1990), Guiso et al., (1992), Caroll (2013) among others, assume that agents maximise the expected value of the following time-separable Constant Absolute Risk Aversion (CARA) utility function.

$$\max E_t \left[\sum_{t=0}^{\infty} \beta^t e^{-\rho c_t} \right] \tag{2A-1}$$

where β is a subjective discount rate of consumption (time preference) and ρ is the degree of absolute risk aversion.[40] Eq. (2A-1) is subject to the following standard budget constraint:

$$w_{t+1} = Rw_t + y_{t+1} - c_{t+1} \tag{2A-2}$$

where $R = (1 + r)$ is the interest factor (assumed to be constant); w is individual wealth (w_t is given) and y_t is the consumer's idiosyncratic income. This latter exhibits a random-walk deviation from an exogenously growing measure of permanent income:

$$y_{t+1} = \widehat{y}_t + \psi_{t+1} \tag{2A-3}$$

In the perfect foresight version of the model (where $\psi_t = 0 \; \forall t$), the Euler equation is:

$$e^{-\rho c_t} = R\beta e^{-\rho c_{t+1}} \tag{2A-4}$$

$$1 = R\beta e^{-\rho(c_{t+1} - c_t)} \tag{2A-5}$$

$$R\beta = e^{\rho(c_{t+1} - c_t)} \tag{2A-6}$$

Taking logs:

$$\rho(c_{t+1} - c_t) = \ln(R\beta) \tag{2A-7}$$

$$c_{t+1} = c_t + \ln(R\beta)^{\frac{1}{\rho}} \tag{2A-8}$$

[40] Because of the use of exponential utility in this exercise the degree of absolute risk aversion is assumed to be equal to the degree of absolute prudence.

Starting from Eq.2A-8 let now assume a stochastic environment with permanent income shocks distributed normally, i.e., $\psi_t \sim N(0, \sigma_\psi^2)$. For the sake of simplicity let us assume also $R\beta = 1$. Eq. 2A-8 becomes:[41]

$$c_{t+1} = c_t + \frac{1}{2}\rho\sigma_\psi^2 + \epsilon_{t+1} \tag{2A-9}$$

Since the intertemporal budget constraint must hold in every state of the world the expected present discount value of consumption must equal current wealth plus the expectation of the present discount value of income as follows:

$$E_t[PV_t(c)] = w_t + E_t[PV_t(y)] \tag{2A-10}$$

where PV is the present discount value. Thus we first derive the present discount value of consumption as follows:

$$PV_t(c) = c_t + \frac{(c_t + \frac{1}{2}\rho\sigma_\psi^2 + \epsilon_{t+1})}{R} + \frac{(c_t + \frac{1}{2}\rho\sigma_\psi^2 + \epsilon_{t+1} + \frac{1}{2}\rho\sigma_\psi^2 + \epsilon_{t+2})}{R^2} + ... \tag{2A-11}$$

and its expected value as follows:

$$E_t[PV_t(c)] = c_t + \frac{c_t}{R} + \frac{c_t}{R^2} + ... + \frac{\frac{1}{2}\rho\sigma_\psi^2}{R} + \frac{2\frac{1}{2}\rho\sigma_\psi^2}{R^2} + \frac{3\frac{1}{2}\rho\sigma_\psi^2}{R^3} + ... =$$

$$=\mathrm{c}_t(1 + R^{-1} + R^{-2} + ...) + \tfrac{1}{2}\rho\sigma_\psi^2 \sum_{j=1}^{\infty} \tfrac{j}{r^j}$$

(2A-12)

Since if $R > 1$ then $\sum_{j=0}^{\infty} \frac{j}{r^j} = \left(\frac{R}{(R-1)^2}\right)$, the expectation of the infinite horizon present discount value of consumption becomes:

$$E_t[PV_t(c)] = c_t \left(\frac{1}{1 - \frac{1}{R}}\right) + \left(\frac{\frac{1}{2}\rho\sigma_\psi^2 R}{(1-R)^2}\right) \tag{2A-13}$$

Then we derive the present discount value of income as follows:

$$PV_t(y) = \widehat{y}_t + \frac{(\widehat{y}_t + \psi_{t+1})}{R} + \frac{(\widehat{y}_t + \psi_{t+1} + \psi_{t+2})}{R^2} + ... \tag{2A-14}$$

[41] Please note that the inter-temporal substitution of consumption (the last term in Eq. 2A-8) takes here the form of additive changes in the level of consumption (while in CRRA is a multiplicative term of the growth rate of consumption).

and its expected value as follows:

$$E_t[PV_t(y)] = \widehat{y}_t \sum_{j=0}^{\infty} R^{-j} = \widehat{y}_t \left(\frac{1}{1 - \frac{1}{R}} \right) \tag{2A-15}$$

And derive Eq.2A-16 as follows:

$$c_t \left(\frac{1}{1 - \frac{1}{R}} \right) = w_t + \widehat{y}_t \left(\frac{1}{1 - \frac{1}{R}} \right) - \left(\frac{\frac{1}{2}\rho\sigma_\psi^2 R}{(1-R)^2} \right) \tag{2A-16}$$

Re-arranging we finally got:

$$c_t = w_t \frac{R-1}{R} + \widehat{y}_t - (R-1)\frac{\frac{1}{2}\rho}{(1-R)^2}\sigma_\psi^2 \tag{2A-17}$$

Appendix 2B - Decomposition of observed volatility in income innovations

Carroll and Samwick (1997) propose a simple method for decomposing the volatility of income innovations into a transitory and a permanent component. First, they assume that the log of permanent income follows the process below:

$$\widehat{y}_t = g_t + \widehat{y}_{t-1} + \eta_t \tag{2B-1}$$

where g_t represents growth due to predictable components (m) as follows: $g_t = m_t - m_{t-1}$, and η_t is a shock to permanent income. If we remove the predictable component of income growth as follows: $\widetilde{y}_t = \widehat{y}_t - m_t$ and $\widetilde{y}_{t-1} = \widehat{y}_{t-1} - m_{t-1}$, we can rewrite:

$$\widetilde{y}_t = \widetilde{y}_{t-1} + \eta_t \tag{2B-2}$$

Second, they assume that the log of current income is given by $\widetilde{y}_t$ plus a transitory error term:

$$y_t = \widetilde{y}_t + \epsilon_t \tag{2B-3}$$

On the assumption that both η_t and ϵ_t are white noise and uncorrelated with each other at all leads and lags, we can derive the d-year income difference as follows:

$$y_{t+d} - y_t = \widetilde{y}_{t+d} - \widetilde{y}_t + \epsilon_{t+d} - \epsilon_t \tag{2B-4}$$

Substituting Eq.2B-2 into Eq.2B-4 recursively yields:

$$y_{t+d} - y_t = \eta_{t+1} + \eta_{t+2} + ... + \eta_{t+d} + \epsilon_{t+d} - \epsilon_t \tag{2B-5}$$

Hence, the d-year second moment is

$$var(\upsilon_{yd}) = d\sigma_\eta^2 + 2\sigma_\epsilon^2 \tag{2B-6}$$

where σ_η^2 and σ_ϵ^2 are, respectively, the variances of the permanent and transitory shocks to income.

To apply this decomposition method to our analysis, on the assumption of no individual specific growth rates for income other than those predictable, we compute the variance of υ_{yd} for each country i as follows:

$$var(\upsilon_{yid}) = \upsilon_{yid}^2 \tag{2B-7}$$

We then use two υ^2_{yid} of different lengths to estimate the permanent component of the variance of income innovation for each i as follows:

$$s^2_{\eta_i} = \upsilon^2_{yid} - \upsilon^2_{yid-1} \tag{2B-8}$$

To get also a measure of $s^2_{\epsilon_i}$ it is sufficient to acknowledge that:

$$s^2_{\eta_i} = ds^2_{\eta_i} + 2s^2_{\epsilon_i} - \upsilon^2_{yid-1} \tag{2B-9}$$

and finally yield $s^2_{\epsilon_i}$ as follows:

$$s^2_{\epsilon_i} = \frac{\upsilon^2_{yid-1} - (d-1)s_{\eta^2_i}}{2} \tag{2B-10}$$

where $E(s^2_{p_i}) = \sigma^2_p$ and $E(s^2_{e_i}) = \sigma^2_\epsilon$ and σ^2_p and σ^2_ϵ are the variances of the permanent and transitory shocks to income, respectively.

Appendix 2C - The derivation of the unconstrained version of the ECM

Starting from the ARDL (1,1) version of the consumption model:

$$c_t = \beta_0 + \beta_1 y_t + \beta_2 y_{t-1} + \beta_3 c_{t-1} + u_t \tag{2C-1}$$

We subtract c_{t-1} on both sides and take into account of the steady state equilibrium by acknowledging that $\beta_2 = \beta(1-\beta_3) - \beta_1$ as follows:

$$c_t - c_{t-1} = \beta_0 + \beta_1 y_t + [\beta(1-\beta_3) - \beta_1] y_{t-1} + \beta_3 c_{t-1} - c_{t-1} + u_t \tag{2C-2}$$

$$\Delta c_t = \beta_0 + \beta_1 y_t + \beta(1-\beta_3) y_{t-1} - \beta_1 y_{t-1} - (1-\beta_3) c_{t-1} + u_t \tag{2C-3}$$

$$\Delta c_t = \beta_0 + \beta_1 (y_t - y_{t-1}) + \beta(1-\beta_3) y_{t-1} - (1-\beta_3) c_{t-1} + u_t \tag{2C-4}$$

$$\Delta c_t = \beta_0 + \beta_1 \Delta y_t - (1-\beta_3) c_{t-1} + \beta(1-\beta_3) y_{t-1} + u_t \tag{2C-5}$$

Appendix 2D - Tables

Table 2D-1: List of countries by deciles (decade 1960-69)

Decade 1960_1969									
dec1	dec2	dec3	dec4	dec5	dec6	dec7	dec8	dec9	dec10
Zimbabwe	Equatorial Guinea	Niger	Comoros	Malaysia	Dominican Republic	El Salvador	Iran	Barbados	New Zealand
Burundi	Nepal	Chad	Congo, Dem. Rep.	Haiti	Colombia	Chile	Jamaica	Finland	Canada
Guinea-Bissau	Ghana	Madagascar	Kenya	Tunisia	Panama	Seychelles	Gabon	Italy	Sweden
China Version 1	Indonesia	Mauritania	Papua New Guinea	Syria	Ecuador	Cyprus	Argentina	France	United States
Mozambique	Uganda	Sri Lanka	Morocco	Paraguay	Bolivia	South Africa	Venezuela	Belgium	Luxembourg
Malawi	Botswana	Pakistan	Egypt	Fiji	Namibia	Peru	Puerto Rico	Austria	Switzerland
Ethiopia	China Version 2	Gambia, The	Cote d'Ivoire	Zambia	Brazil	Uruguay	Trinidad &Tobago	Iceland	
Mali	Rwanda	Congo, Republic of	Thailand	Korea, Republic of	Jordan	Singapore	Ireland	United Kingdom	
Lesotho	India	Guinea	Cameroon	Romania	Nicaragua	Hong Kong	Greece	Norway	
Burkina Faso	Bangladesh	Cape Verde	Nigeria	Mauritius	Guatemala	Portugal	Japan	Denmark	
Tanzania	Sierra Leone	Togo	Senegal	Honduras	Algeria	Mexico	Spain	Netherlands	
	Benin	Central African Republic	Philippines	Taiwan	Turkey	Costa Rica	Israel	Australia	

Table 2D-2: List of countries by deciles (decade 2000-09)

Decade 2000-2009									
dec1	dec2	dec3	dec4	dec5	dec6	dec7	dec8	dec9	dec10
Zimbabwe	Tanzania	Tajikistan	Angola	Albania	South Africa	Cuba	Slovak Republic	Taiwan	United States
Congo, Dem. Rep.	Comoros	Nigeria	Honduras	Dominica	Thailand	Argentina	Hungary	Spain	Singapore
Burundi	Uganda	Cameroon	Swaziland	China Version 1	Tonga	Costa Rica	Libya	Italy	Bermuda
Liberia	Ghana	Uzbekistan	Sri Lanka	China Version 2	Marshall Islands	Lebanon	Cyprus	France	Kuwait
Somalia	Gambia, The	Sudan	Indonesia	Turkmenistan	Brazil	Gabon	Saudi Arabia	Japan	United Arab Emirates
Niger	Chad	Laos	Micronesia, Fed. Sts.	Tunisia	Panama	Malaysia	Oman	Finland	Norway
Ethiopia	Nepal	Kyrgyzstan	Bolivia	Azerbaijan	Serbia	Chile	Czech Republic	Germany	Brunei
Malawi	Timor-Leste	Djibouti	Paraguay	Vanuatu	Dominican Republic	Mexico	Portugal	Hong Kong	Luxembourg
Central African Republic	Kenya	Pakistan	Guyana	St.Vincent & Grenadines	Mauritius	St. Lucia	Malta	United Kingdom	Qatar
Mozambique	Bangladesh	Nicaragua	Bhutan	Bosnia and Herzegovina	Venezuela	Latvia	Seychelles	Belgium	
Guinea-Bissau	Benin	Moldova	Kiribati	Ecuador	Suriname	Russia	Trinidad &Tobago	Sweden	
Afghanistan	Lesotho	Congo, Republic of	Syria	Algeria	Kazakhstan	Grenada	Korea, Republic of	Denmark	
Eritrea	Zambia	Vietnam	Georgia	Ukraine	Belize	St. Kitts & Nevis	Bahrain	Ireland	
Sierra Leone	Sao Tome and Principe	Papua New Guinea	Iraq	Guatemala	Bulgaria	Lithuania	Slovenia	Canada	
Madagascar	Cote d'Ivoire	Yemen	Maldives	Peru	Uruguay	Croatia	Barbados	Austria	
Togo	Haiti	India	Namibia	El Salvador	Jamaica	Poland	Israel	Netherlands	
Rwanda	Senegal	Philippines	Jordan	Montenegro	Iran	Palau	Greece	Macao	
Guinea	Mauritania	Mongolia	Armenia	Samoa	Botswana	Equatorial Guinea	Puerto Rico	Australia	
Burkina Faso	Solomon Islands	Cape Verde	Egypt	Colombia	Belarus	Estonia	New Zealand	Iceland	
Mali	Cambodia	Morocco	Fiji	Macedonia	Turkey	Antigua and Barbuda	Bahamas	Switzerland	

Table 2D-3: Main descriptive statistics of the variables used in the empirical analysis

Variable	Obs	Mean	Std. Dev.	Min	Max	Variable	Obs	Mean	Std. Dev.	Min	Max
All sample											
gdp worker	8059	18984.9	22793.31	320.2335	313082.8	pc cons.	8059	4983.916	5745.357	107.4675	42741.04
1960-69											
gdp worker	1128	11704.1	12260.59	420.9939	57920.37	pc cons.	1128	3020.333	3331.097	107.4675	15272.57
1970-79											
gdp worker	1580	17871.85	25031.07	681.4249	313082.8	pc cons.	1580	3967.613	4399.34	158.3371	19655.31
1980-89											
gdp worker	1614	19648.43	23378.98	711.808	271261.9	pc cons.	1614	4931.654	5338.43	128.0619	24775.35
1990-99											
gdp worker	1842	20903.86	22664.84	396.7094	128604.1	pc cons.	1842	5634.676	6124.661	112.7644	38989.38
2000-08											
gdp worker	1895	25154.58	27027.87	320.2335	213682.1	pc cons.	1895	7010.444	7559.901	120.4792	42741.04
percentiles											
	10%	25%	50%	75%	90%		10%	25%	50%	75%	90%
gdp worker	1712.68	3320.23	10573.5	25993.3	50280.5	pc cons.	585.534	967.983	2630.41	6615.99	13857.6

Source: PWT 7.0. All variables are in 2005 International dollar per person.

Table 2D-4: CE and PS ARDL models under permanent risk (dependent variable: first diff. of annual pc consumption): sensitivity tests for permanent risk at different time horizons

	LSDV	SGMM	2SGMM	PSGMM	P2SGMM
permanent risk (d=5)	-0.0396	-0.821	-0.821+	-0.775**	-0.637*
	(-0.37)	(-1.24)	(-1.47)	(-2.07)	(-1.78)
permanent risk (d=6)	0.327**	1.511+	1.247	0.397**	0.422
	(1.99)	(1.62)	(1.14)	(2.14)	(0.49)
permanent risk (d=7)	0.0847	1.016	1.156+	0.0157	0.402
	(0.93)	(1.37)	(1.65)	(0.12)	(0.63)
permanent risk (d=8)	-0.212	-1.278	-1.592+	-0.185	-0.924
	(-0.58)	(-1.44)	(-1.60)	(-0.47)	(-1.09)
permanent risk (d=9)	-0.304	0.394	0.730	-0.332	0.635
	(-1.05)	(0.41)	(0.67)	(-1.06)	(0.89)
permanent risk (d=10)	-0.681**	-2.710*	-2.812*	-0.868***	-2.551***
	(-2.24)	(-1.82)	(-1.68)	(-2.59)	(-2.71)
permanent risk (d=11)	-0.0308	-0.123**	-0.134**	-0.0281	-0.0685
	(-1.38)	(-2.08)	(-2.59)	(-1.38)	(-0.82)
permanent risk (d=12)	-0.0371**	-0.0551	-0.0582	-0.0344*	-0.0538
	(-2.02)	(-1.28)	(-1.25)	(-1.84)	(-1.25)
permanent risk (d=13)	-0.0252	0.118	0.0834	-0.00886	0.107
	(-0.97)	(0.81)	(0.71)	(-0.30)	(0.89)
permanent risk (d=14)	-0.0375+	0.0828	0.128	-0.0311	-0.00309
	(-1.45)	(0.54)	(1.12)	(-0.97)	(-0.03)
permanent risk (d=15)	-0.0397+	0.00338	-0.0170	-0.0323	-0.0329
	(-1.45)	(0.02)	(-0.11)	(-1.01)	(-0.31)

Table 2D-5: Certainty Equivalence and Precautionary Saving ARDL model of per capita consumption under permanent risk - *Standardised beta coefficients* (dependent variable: first diff. of annual pc consumption)

	CE			permrisk (d=5)					permrisk (d=10)				
	LSDV	SGMM	2SGMM	LSDV	SGMM	2SGMM	PSGMM	P2SGMM	LSDV	SGMM	2SGMM	PSGMM	P2SGMM
diff. pc gdp worker (log)	0.538***	0.612***	0.655***	0.546***	0.583***	0.580***	0.548***	0.578***	0.540***	0.549***	0.551***	0.544***	0.555***
	(15.04)	(7.88)	(8.17)	(13.25)	(13.59)	(13.93)	(11.43)	(13.36)	(10.70)	(9.65)	(10.52)	(9.59)	(10.23)
lagged pc cons. (log)	-1.506***	-4.805***	-6.188***	-2.069***	-4.746**	-5.570**	-7.863***	-4.504***	-2.722***	-4.898**	-5.043***	-3.883***	-4.260***
	(-7.92)	(-2.61)	(-3.31)	(-9.20)	(-2.21)	(-2.20)	(-6.11)	(-2.65)	(-7.28)	(-2.59)	(-2.63)	(-3.38)	(-3.38)
lagged pc gdp worker (log)	1.301***	4.543***	5.771***	1.676***	4.576**	5.393**	5.646***	4.406***	2.107***	4.747**	4.826***	3.769***	4.125***
	(6.58)	(2.67)	(3.39)	(7.13)	(2.22)	(2.22)	(5.03)	(2.68)	(5.89)	(2.58)	(2.64)	(3.37)	(3.37)
permanent risk (d=5)				-0.006	-0.124	-0.124+	-0.116**	-0.096*					
				(-0.37)	(-1.24)	(-1.47)	(-2.07)	(-1.78)					
permanent risk (d=10)									-0.063**	-0.252*	-0.261*	-0.241**	-0.237***
									(-2.24)	(-1.82)	(-1.68)	(-2.50)	(-2.71)
Nr. Obs.	7990	7990	7990	5987	5987	5987	5987	5987	4295	4295	4295	4295	4295
Fe year	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
FE country	yes	no	no	yes	no	no	no	no	yes	no	no	no	no
R^2	0.364			0.396					0.415				
AB test (AR^2)		0.340	0.204		0.173	0.258	0.194	0.253		0.387	0.366	0.379	0.389
Nr. Instr.		119	119		109	109	151	151		99	99	126	126
Hansen Test		0.318	0.318		0.206	0.206	0.269	0.269		0.454	0.454	0.195	0.195

t-statistics in parentheses. + p$\leq$ 0.15; $*p \leq 0.10$; $**p \leq 0.05$; $***p \leq 0.01$

Table 2D-6: LSDV estimates of CE and PS ARDL models under permanent risk (dependent variable: first diff. of annual pc consumption) (3-year averages)

	CE			permrisk (d=5)			permrisk (d=10)		
	LSDV	SGMM	2SGMM	LSDV	SGMM	2SGMM	LSDV	SGMM	2SGMM
diff. pc gdp worker (log)	0.691***	0.723***	0.724***	0.671***	0.694***	0.694***	0.678***	0.718***	0.746***
	(0.0490)	(0.0552)	(0.0550)	(0.0526)	(0.0672)	(0.0672)	(0.0670)	(0.0668)	(0.0698)
lagged pc cons. (log)	-0.209***	-0.0460	-0.0528	-0.259***	-0.0227	-0.0227	-0.324***	0.00956	0.106
	(0.0282)	(0.115)	(0.117)	(0.0342)	(0.169)	(0.169)	(0.0465)	(0.191)	(0.125)
lagged pc gdp worker (log)	0.172***	0.0492	0.0552	0.211***	0.0301	0.0301	0.256***	-0.00209	-0.0930
	(0.0272)	(0.103)	(0.104)	(0.0310)	(0.154)	(0.154)	(0.0404)	(0.178)	(0.117)
permanent risk (d=5)				-1.107**	-0.922**	-0.922**			
				(0.453)	(0.400)	(0.400)			
permanent risk (d=10)							-2.291+	-2.646+	-2.104
							(1.462)	(1.691)	(1.945)
cons	0.0337	-0.0746	-0.0972+	0.0755	-0.0832	-0.0832	0.187*	-0.0403	0.0283
	(0.0840)	(0.0529)	(0.0601)	(0.102)	(0.108)	(0.108)	(0.104)	(0.141)	(0.0915)
Nr. Obs.	2480	2480	2480	2057	2057	2057	1483	1483	1483
Fe year	yes	yes	yes	yes	yes	yes	yes	yes	yes
FE country	yes	no	no	yes	no	no	yes	no	no
R^2	0.521			0.538			0.581		
AB test (AR2)		0.293	0.293		0.541	0.541		0.690	0.496
Nr. Instr.		19	19		20	20		20	20
Hansen Test		0.318	0.318		0.206	0.206		0.340	0.340

t-statistics in parentheses. + p$\leq$ 0.15; $*p \leq 0.10$; $**\, p \leq 0.05$; $***p \leq 0.01$

Table 2D-7: LSDV estimates of CE and PS ARDL models under permanent risk (dependent variable: first diff. of annual pc consumption) with *country-specific trends*

	CE	permrisk (d=5)	permrisk (d=10)	1960-69	1970-79	1980-89	1990-99	2000-09	1970-79	1980-89	1990-99	2000-08
diff. pc gdp worker (log)	0.672***	0.684***	0.710***	0.719***	0.475***	0.714***	0.838***	0.646***	0.492***	0.683***	0.800***	0.647***
	(0.0463)	(0.0342)	(0.0465)	(0.0686)	(0.0566)	(0.0388)	(0.0964)	(0.126)	(0.0740)	(0.0619)	(0.103)	(0.129)
lagged pc cons. (log)	-0.248***	-0.299***	-0.375***	-0.980***	-0.701***	-0.770***	-0.657***	-0.738***	-0.784***	-0.716***	-0.767***	-0.700***
	(0.0212)	(0.0258)	(0.0426)	(0.101)	(0.0730)	(0.0717)	(0.116)	(0.0829)	(0.105)	(0.0611)	(0.127)	(0.0808)
lagged pc gdp worker (log)	0.182***	0.223***	0.294***	0.859***	0.422***	0.530***	0.516***	0.440***	0.602***	0.487***	0.653***	0.428***
	(0.0178)	(0.0212)	(0.0362)	(0.112)	(0.0662)	(0.0627)	(0.130)	(0.125)	(0.0893)	(0.0775)	(0.128)	(0.126)
permanent risk (d=5)		-0.107		0.844*	-0.935**	0.0193	0.177	-0.286+				
		(0.116)		(0.438)	(0.436)	(0.255)	(0.275)	(0.190)				
permanent risk (d=10)			-0.515*						1.548**	-0.206	-0.572+	-1.306***
			(0.293)						(0.716)	(0.511)	(0.389)	(0.446)
cons	-0.822+	-4.262*	-14.57**	215.9***	-15.25	25.56***	5.852	-76.67***	-78.83***	-9.113	6.748	-63.06**
	(0.505)	(2.421)	(5.803)	(79.66)	(12.86)	(7.745)	(12.43)	(23.46)	(20.12)	(9.950)	(10.58)	(24.70)
Nr. Obs.	7990	5987	4295	511	1046	1373	1514	1543	511	1046	1372	1366
Fe year	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
FE country	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
country*year	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
R^2	0.417	0.453	0.489	0.742	0.629	0.665	0.636	0.617	0.697	0.646	0.688	0.622

t-statistics in parentheses. + p$\leq$ 0.15; $*p \leq 0.10; **p \leq 0.05; ***p \leq 0.01$

Table 2D-8: Certainty Equivalence and Precautionary Saving ARDL model of per capita consumption under permanent risk by deciles, first decade only (dependent variable: first diff. of annual pc consumption)

by deciles (first decade)	decile 1		decile 2		decile 3		decile 4		decile 5		decile 6		decile 7		decile 8		decile 9		decile 10	
	LSDV	SGMM	LSDV	SGMM	LSDV	SGMM	LSDV	SGMM	LSDV	SGMM	LSDV	SGMM	LSDV	SGMM	LSDV	SGMM	LSDV	SGMM	LSDV	SGMM
diff. pc gdp worker (log)	1.936***	2.081***	10.43***	10.13***	-1.671***	-1.667***	-2.389***	-2.480***	-0.0645***	-0.0644***	0.527***	0.527***	4.151***	4.150***	2.058***	2.058***	5.261***	5.236***	-1.312***	-1.307***
	(13.83)	(10.78)	(123.03)	(60.59)	(-668.19)	(-535.22)	(-39.86)	(-38.80)	(-804.52)	(-350.08)	(11984.66)	(11125.47)	(13717.26)	(15615.93)	(3252.85)	(3423.59)	(924.20)	(374.36)	(-512.54)	(-634.81)
lagged pc cons. (log)	1.526***	1.297***	-25.69***	-24.98***	-2.333***	-2.332***	-1.306***	-1.332***	-3.007***	-3.007***	-1.228***	-1.228***	0.207***	0.206***	-1.910***	-1.910***	4.401***	4.366***	-5.042***	-5.032***
	(7.66)	(3.44)	(-109.20)	(-56.88)	(-3875.86)	(-779.25)	(-62.64)	(-113.34)	(-23505.47)	(-10297.16)	(-34266.43)	(-11391.62)	(1659.45)	(1033.79)	(-2035.81)	(-6647.20)	(859.50)	(300.76)	(-1155.99)	(-1194.79)
lagged pc gdp worker (log)	-0.0823**	0.228+	-24.30***	-23.56***	-0.836***	-0.833***	-3.109***	-3.190***	2.062***	2.062***	1.412***	1.412***	2.448***	2.448***	2.886***	2.887***	-1.783***	-1.767***	2.130***	2.126***
	(-2.14)	(1.50)	(-107.99)	(-56.23)	(-373.02)	(-537.38)	(-38.99)	(-33.42)	(23016.99)	(9330.60)	(30970.80)	(11245.72)	(16806.42)	(7680.08)	(2241.68)	(6664.67)	(-634.38)	(-213.52)	(1658.85)	(988.80)
invmills	-15.72***	-16.34***	96.66***	93.80***	4.840***	4.832***	6.903***	7.077***	12.51***	12.51***	4.612***	4.612***	14.12***	14.12***	2.222***	2.221***	3.139***	3.122***	-4.086***	-4.077***
	(-8.58)	(-5.37)	(108.61)	(56.12)	(1035.85)	(936.45)	(52.30)	(54.55)	(14576.28)	(7922.65)	(11211.47)	(19883.27)	(9730.98)	(10104.61)	(2967.32)	(3371.79)	(838.15)	(364.68)	(-794.71)	(-806.06)
cons	-2.907***	-0.905	-543.9***	-528.8***	-17.44***	-17.55***	3.641***	3.708***	-120.8***	-120.8***	-48.19***	-48.19***	-213.3***	-213.3***	-34.11***	-34.11***	-47.29***	-47.00***	61.87***	61.72***
	(-6.21)	(-0.09)	(-108.61)	(-57.63)	(-863.59)	(-77.02)	(20.90)	(16.78)	(-15064.86)	(-6784.42)	(-11880.78)	(-19094.02)	(-9965.49)	(-10091.37)	(-2729.59)	(-4260.57)	(-926.19)	(-372.82)	(812.21)	(939.87)
Nr. Obs.	2454	2454	610	610	597	597	646	646	632	632	671	671	659	659	671	671	697	697	353	353
Fe year	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
FE country	yes	no	yes	no	yes	no	yes	no	yes	no	yes	no	yes	no	yes	no	yes	no	yes	no
R^2	0.739		0.991		1.000		0.980		1.000		1.000		1.000		1.000		1.000		1.000	
AB test (AR^2)		0.787		0.405		0.095		0.581		0.280		0.602		0.415		0.839		0.084		0.644
Nr. Instr.		115		117		117		117		117		118		119		119		119		119
Hansen Test		1.000		1.000		1.000		1.000		1.000		1.000		1.000		1.000		1.000		1.000
permanent risk (d=5)	0.105	-0.290	-0.264***	-0.336***	-0.198	-1.862	0.417***	0.391*	0.107	1.844	0.0411	0.0223	-0.134	-0.577	-0.481***	-0.884+	0.0550	0.315	-0.212	-0.509+
	(0.74)	(-0.00)	(-3.77)	(-4.30)	(-0.69)	(-1.12)	(4.90)	(1.87)	(0.53)	(1.44)	(0.68)	(0.15)	(-0.94)	(-1.44)	(-4.28)	(-1.76)	(0.40)	(1.06)	(-0.97)	(-1.90)
permanent risk pred (d=5)		0.122		-0.254***		-1.576+		0.368***		1.461		-0.0903		-0.531		-0.597***		0.224		-0.628*
		(0.44)		(-5.34)		(-1.60)		(3.39)		(1.52)		(-0.48)		(-1.52)		(-7.89)		(0.78)		(-2.08)
permanent risk (d=10)	-0.243+	-0.284	0.361	-0.288	-0.171	0.308	0.339	-1.233***	-0.132	-1.351+	0.0230	-0.371	0.183*	0.315***	-0.341	-0.728*	-0.0679	0.0975	-0.169	-0.653**
	(-1.49)	(-0.34)	(0.66)	(-0.60)	(-1.03)	(0.47)	(1.11)	(-3.31)	(-0.29)	(-1.69)	(0.39)	(-1.45)	(1.82)	(2.88)	(-1.29)	(-2.03)	(-1.21)	(1.11)	(-1.01)	(-3.97)
permanent risk pred (d=10)		-0.00432+		-0.0163***		0.00906		0.0116**		-0.0258		0.00270*		-0.00622		-0.00959		-0.00196		-0.0200**
		(-1.51)		(-3.79)		(0.88)		(2.19)		(-1.05)		(1.71)		(-0.55)		(-1.24)		(-0.90)		(-2.93)

t-statistics in parentheses. + p$\leq$ 0.15; $*p \leq 0.10$; $**\ p \leq 0.05$; $***p \leq 0.01$

Chapter 3

Essay 3 - Trade openness and vulnerability to poverty in Vietnam under *Doi Moi*

This Essay follows up the existing poverty assessments of trade liberalisation in Vietnam under *Doi Moi*. It looks specifically at the relationship between trade liberalisation and vulnerability to poverty. To this end, it first applies, a VEP framework to six recent living standard surveys in Vietnam (covering the period 1992-2008) to assess the presence of heterogeneity of vulnerability to poverty across industries clustered by different degrees of "trade exposure" and their evolution over time. Second, it assesses the relative influence of *ex-ante* versus *ex-post* factors on consumption levels and variability, overall and by trading industries. The following results are obtained: i) a downward trend in vulnerability to poverty in Vietnam together with an increased share of its stochastic (risk) determinant; ii) a relative increase of the percentage of vulnerable people in the relatively higher "trade-exposed" groups of industries; iii) the higher relevance of the *ex-ante* stochastic (risk) component in the higher "trade-exposed" group of industries. The above results are key for policymaking. They highlight a link between trade openness and risk-induced vulnerability as well as the need to target vulnerability to poverty even in a trade liberalisation scenario characterised by decreasing poverty.

Keywords: trade openness, vulnerability, poverty, risk, consumption behaviour, Vietnam.

JEL: F14, O12, D12, C31

3.1 Introduction

Following the so-called “Asian option” of transition, from the early 1990s Vietnam adopted the *Doi Moi* (renovation) process, a combination of liberalisation, stabilisation and structural reforms. Within the liberalisation component, Vietnam experienced two main waves of trade liberalisation, one in the 1990s and a second in the 2000s (Coello at al., 2010). The first wave lasted from the initial opening of the country until approximately 2001 and foresaw the total abolition of trade licences and the removal of most quantitative restrictions (Than, 2005). The second wave - still in place - includes the full involvement of the country in the world network of reciprocal trade agreements (both multilateral, see the WTO accession in January 2007, and bilateral, see the agreements signed with the USA in 2001 as well as the FTA negotiations launched with the EU in 2012).

An extensive empirical investigation on trade liberalisation and poverty dynamics in Vietnam has been carried out to date (Irvin, 1997; Liu, 2001; Fritzen, 2002; Jenkins, 2004; Nadvi et al., 2004; van de Walle and Cratty, 2004; Jensen and Tarp, 2005; Nguyen and Ezaki, 2005; Fujii and Roland-Holst, 2007; Niimi et al., 2007; Abbott et al., 2009 ; Heo and Doanh, 2009; Coello et al., 2010). Empirical analyses consistently highlight the increased importance of international trade in the Vietnamese economy as well as the positive correlation between trade liberalisation, growth and poverty reduction.[1]

However, the above analyses have focused mainly on the first sub-period, when the process of liberalisation was still restricted and subject to trade licences. Moreover, they do not provide any clue to the relationship between openness and vulnerability to poverty. This is because they generally overlook the possible impact of the opening-up process on households’ exposure to risk as well the role of trade openness as one of the possible channels of risk.

Following on from the existing debate on vulnerability induced by trade openness (see Essay 1), this work aims to overcome the above knowledge gaps, starting with a preliminary and workable step: assessing the presence

[1]Critics also 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 penalising 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.

of heterogeneity in households' vulnerability according to the relative degree of trade exposure of their sector of employment. Of course, the presence of significant differences in vulnerability patterns by trading sector does not provide information on the nature of the foreign risks and/or their channels of transmission to household welfare which is outside the scope of this empirical exercise. Moreover, because of the lack of panel data, our analysis is not able to directly control for cross-sectional household heterogeneity or for measurement error and their evolution over time. The problem is that the cross-sectional variation in vulnerability to poverty across the various trade-exposed sectors can actually be driven by a number of factors other than risk (e.g., differences in household characteristics across sectors due to self-selection) that are unobservable to the researcher.

Acknowledging the above empirical constraints, the added value of this analysis lies in taking advantage of the full set of available rounds of household surveys in Vietnam to give a careful interpretation of the cross-sectional evidence of the relationship between household vulnerability and trade openness in "trade-related" industries. Specifically, it is argued that the assessment of an increasing negative relationship between the stochastic component of income and consumption in the case of households involved in the more exposed trading sectors can only reasonably be interpreted as related to risk. Conversely, supposing that the above relationship is not due to risk - but to households' unobservable heterogeneity - it would imply a partial revision of the assumed benefits from trade openness, which is worth investigating too.

The contribution of this paper is twofold: using six living standard surveys in Vietnam (covering the period 1992-2008), we first assess the percentage and the evolution of vulnerable people across the different sectors of the economy organised according to their relative degree of trade exposure; second, we provide an assessment of how much of the households' consumption variation (which is at the core of vulnerability analysis) can be explained by its stochastic *ex-ante* component, namely the variance of income within trade-exposed defined groups, as well as by actual income shocks, defined as the component of income variation unexplained by observables.

Our results are the following: a downward trend in vulnerability to poverty in Vietnam together with an increased share of its stochastic (risk) determinant; a relative increase in the percentage of vulnerable people in the relatively more trade-exposed sectors; iii) the non-decreasing relevance (both in terms of net mean contribution on expected average and variance of household consumption) of the *ex-ante* stochastic (risk) component in the higher "trade-exposed" groups of industries. The above results are key for policymaking. They highlight a link between trade openness and risk-induced vulnerability as well as the need to target vulnerability to poverty even in a trade liberalisation scenario characterised by decreasing poverty.

The paper is organised as follows: section 2 reviews the literature and presents the conceptual framework; section 3 provides details on the measurement of vulnerability to poverty; section 4 presents the empirical results and section 5 concludes.

3.2 Trade and vulnerability to poverty: literature review and conceptual framework

Notwithstanding differences in conceptual approaches and empirical methods, the literature on trade liberalisation and poverty dynamics in Vietnam has reached consensus on the following issues: price liberalisation has had a great impact on agricultural households and consumers since 1986 (Niimi et al., 2007) with poverty reduction figures for rice net producers better than for rice net consumers (Heo and Doanh, 2009); trade liberalisation has been beneficial to the poor thanks to the highly labour intensive structure of the Vietnamese exports;[2] the negative effects of trade liberalisation occurred mainly in coffee production (Ha and Shively, 2008).

However, a key issue remains unanswered: Has trade openness magnified households' exposure to risk and raised vulnerability to poverty? The topic is currently hotly debated by practitioners, whereas it is largely ignored by trade literature (see Essay 1). In principle, trade can magnify risks in two ways: by changing the riskiness of existing activities, for instance, by altering the weight of foreign compared with 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 et al., 2001). Hence, trade openness could alter households' optimal portfolios so that their current ones become sub-optimal *ex-ante*.[3] This is especially true for the poor, due to their poor ability to take advantage of the positive opportunities created by trade reforms, their weak capabilities to insure themselves from adverse impacts and, possibly, the lack of information on the risks associated with the new activities induced by openness (Winters

[2] Abbott et al. (2009) claim that the poverty impacts of trade reforms in Vietnam are even larger than those anticipated by existing model predictions, because of the intrinsic limitations of the most common applied methods and because they generally overlook the fact that institutional rather than tariff reforms have been the main driving factor behind recent development in Vietnam.

[3] Of course, *ex-post*, a household may lose out because of unlucky realisations. Hence, 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).

et al., 2004). Thus, they suffer the costs of trade reforms without reaping any compensating benefits in the form of higher average earnings (see Morduch, 1994). This, together with the presence of risky assets (Elbers et al., 2007) may explain *ex-ante* their unwillingness to pursue high average returns linked to the different activities opened up by trade reforms, resulting in poverty traps (Carter and Barret, 2006; Dercon and Christiaensen, 2011). Moreover, the poor can be less able to protect themselves from the adverse effects of a new set of man-made foreign shocks and incentives. This is because traditional mechanisms may not work as well as in the pre-liberalisation scenario, hampering people's standard management strategies (Dercon, 2001; Tesliuc and Lindert, 2004). Trade openness can also affect government ability to adopt price stabilisation 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 that are less positive than expected in the long run (Winters, 2002; Winters and al., 2004; Calvo and Dercon, 2007a).

This issue, though very relevant, has been largely overlooked by the empirical literature on trade because it implies the capacity to assess the counterfactual situation, i.e., the unobservable level of consumption that would have prevailed in the absence of risk, net of the mean effects generated by trade. Looking at consumption behaviour as a key behavioural tool in explaining households' choices under risk, in our analysis we assume that vulnerability passes through a deviation from a smooth path of consumption. In other words, we assume that the strategies households employ both to mitigate risks (that is, risk-induced *ex-ante* changing behaviour, Elbers and Gunning, 2007; Giles and Yoo, 2007; Jalan and Ravaillon, 2001) and cope with shocks (Coate and Ravallion, 1993; Udry, 1994; Townsend, 1994, 1995; Besley, 1995; Morduch, 2002) can be costly in the short run even if the overall impact in the long run is net beneficial (Ravallion 1988; Morduch 1994; Dercon, 2005). Moreover, we assume these costs to be diversified in terms of consumption behaviour, with the *ex-ante* risk-induced component of vulnerability considered a proper measure of vulnerability.

By decomposing vulnerability into its *ex-ante* and *ex-post* components, we test whether differences in the *ex-ante* component across groups can be associated with different degrees of trade exposure. While, in fact, incomes from non-traded sectors are mainly affected by domestic risks (for example, bad weather, crop failure, livestock diseases, etc.), people engaged in import- and export-related sectors are also supposed to face foreign markets risks (for example, international price fluctuations, exchange rate fluctuations, etc.). We do not really know whether or not domestic and foreign risks are positively or negatively correlated (the empirical evidence on this has been quite inconclusive, McCulloch et al., 2001). However, it is reasonable to expect a certain degree of risk heterogeneity associated with the heterogeneity of households' trade exposure. For instance, in the Vietnamese context, poor households in the midst of trade reform have two options in principle: i) rely, with regard to ongoing trade reforms, on conservative choices (for example, subsistence farming) as a main risk management strategy: this choice could help to insulate them from trade-related risks, but leaves them vulnerable to pre-liberalisation ones (for example, natural ones), possibly taking them into a cycle of poverty; ii) carry out progressive choices[4] (for example, moving to export crops), with an expected increase in mean income as well as in income variance. Thanks to this choice they could climb out of poverty, but remain vulnerable to both pre- and post-liberalisation risks. As a result, these two categories face different kinds of risks and are forced to apply different risk management strategies as well as to rely on different risk coping strategies when shocks occur. As a result, they will probably show different behavioural choices *ex-ante* and different welfare impacts *ex-post*.

3.3 Measuring trade-induced vulnerability

In this empirical exercise, we first apply the most common measure of vulnerability[5], i.e. the "Vulnerability to Expected Poverty" (VEP) method (Pritchett et al., 2000; Christiaensen and Subbarao, 2005; Chaudhuri and Datt 2001; Chaudhuri et al., 2002 and Chaudhuri 2003; Kamanou and Morduch, 2004; Gunther and Harttgen, 2009). The reason is twofold: i) it helps us derive a vulnerability measure using the single rounds of the available cross-sectional household data for the period 1992-2008; ii) it is consistent with existing poverty analyses since it provides results in terms of expected values of the common Foster-Greer-Thorbecke (FGT) class of decomposable poverty measures.

The VEP method looks at vulnerability as the probability that a household will fall into poverty in the near future.[6] To this end, it adapts the standard FGT index (Foster et al., 1984) to a stochastic environment and takes its expected value as follows:

[4]The term progressive is used here for ongoing trade reforms.

[5]A first taxonomy of the main methods applied in vulnerability analysis has been provided by Hoddinott and Quisumbing (2003). A slight update to this is provided in Appendix 1.5.

[6]Further details on the computation of this measure for different time horizons will be provided later on.

$$V_{\alpha,ht} = F(z) \int_0^z \left(max \left\{ 0, \frac{z - c_{h,k}}{z} \right\} \right)^\alpha \frac{f(c_{h,k})}{F(z)} dc_{h,k} \tag{1}$$

where c_h is household consumption; z is the standard poverty line; $F(.)$ and $f(.)$ indicate, respectively, the cumulative distribution and the density function of consumption at time k[7]. Since we rely on the headcount measurement of poverty ($\alpha = 0$), our VEP measure is reduced to the probability that the household will experience poverty, i.e $V = F(z)$.[8] The distribution F is taken as given and reflects both household exposure to shocks (idiosyncratic or covariant) and the ability to cope with them. More specifically, the VEP index measures "vulnerability to poverty" as the probability that household h will be poor, as follows:

$$V_{\alpha,ht} = Pr(lnc_{h,k} < lnz|X_{ht}) = \Phi(\frac{lnz - ln\widehat{c}_{h,k}}{\sqrt{\widehat{\sigma}^2_{h,k}}}) \tag{2}$$

where Φ is the cumulative function of the standard normal (see Appendix 1.5 in Essay 1 for additional details on the VEP measure) and k is the number of years in the future of the chosen time horizon.

The VEP method also provides a first decomposition between "poverty-induced" vulnerability and "risk-induced" vulnerability (Gunther and Harttgen, 2008). The first component refers to vulnerable households with estimated expected mean consumption below the poverty line (i.e., vulnerability is mainly driven by permanent low consumption prospects); the second refers to vulnerable households with estimated expected mean consumption above the poverty line, but high estimated variance of consumption (i.e., vulnerability is mainly driven by consumption volatility). However, VEP does not model risk explicitly, but assumes that the observed inter-household distribution of consumption at a point in time represents the future distribution of consumption across states of the nature for each household.

The VEP method suffers various shortcomings, some related to problems caused by the FGT measures of poverty and others specific to the stochastic nature of the analysis and underlying assumptions. The main shortcoming is given by the fact that it, generally speaking, overlooks the key role of the

[7] Eq. 1 is obtained by multiplying the expected value of the poverty index by $F(z)/F(z)$. For more information on the derivation procedure of Equation 1, see Christiaensen and Boisvert, 2000.

[8] The majority of works rely on this choice (Christiaensen and Boisvert, 2000; Pritchett et al., 2000; Chaudhuri and Datt, 2001; Chaudhuri et al., 2002), but there are also some VEP applications that look at the depth of poverty ($\alpha = 1$) and at the spread of its distribution ($\alpha = 2$) (see, for example, Ravallion, 1988).

behavioural response to risk. Practically speaking, a household that adopted complete self-insurance mechanisms at the cost of lower mean welfare would be registered as unaffected by risk, hence attributing its low level of welfare entirely to non-stochastic components of poverty. In other words, it produces a structural underestimation of the risk component of vulnerability with a parallel overestimation of its poverty component, leading to biased outcomes (Elbers and Gunning, 2003). Moreover, it does not provide any clue to distinguishing whether vulnerability is properly generated *ex-ante* (mainly linked to a lack of mitigating risk strategies) or *ex-post* (mainly associated with a lack of coping mechanisms).

To avoid this shortcoming and take into account the simple evidence that risk affects *ex-ante* households' savings decisions and thereby their consumption level, following on from Elbers et al. (2007), Elbers et al. (2009) and Carter and Ikegami (2009), we complement VEP outcomes with an empirical test on the relative importance of the various determinants of consumption behaviour under risk to infer the relative importance of the various components of vulnerability (non-stochastic, risk induced and shocks). Following Achen (1982), here we explore "importance" both in the sense of significant potential effects (i.e., the net mean contribution of each consumption behaviour's determinants) and in terms of dispersion effects (i.e., the net contribution to explaining the variance of consumption behaviour).

To this end, here we follow a consolidated literature that looks at the household's consumption in any period as determined by wealth, current income, uncertainty over future income as well as behavioural responses to cope with and manage risks (Deaton 1992; Browning and Lusardi, 1996; Chaudhuri, 2003; Dercon, 2005). We also follow the previous literature on poverty in Vietnam (Glewwe et al., 2002; Minot and Baulch, 2005; Niimi et al., 2007; Justino et al., 2008; Cuong et al., 2010; Nguyen and Winters, 2011) that assumes that all these factors are functions of a variety of observable household characteristics such as demographics, education and occupation, and depend on a set of characteristics related to the surrounding economic environment. To isolate the separate impact of the ex-ante permanent risk, we follow the same precautionary saving framework introduced in Essay 2 (Caroll, 2001; Kimball, 1990; Caballero, 1990; Deaton, 1992) and filter out the ex-ante permanent risk from possible measurement errors by applying the same decomposition method as Carroll and Samwick (1997). It is worth recalling here that this empirical exercise cannot be considered a proper exogenous test for the precautionary saving theory because of the lack of panel data. This is an unavoidable empirical constraint. Thus, we should assume the empirical outcomes of the risk channel as upper bounds of the true impacts (by the way, likely endogeneity in the other determinants of current consumption would actually soften the relevance of the risk channel thus lowering our upper bound reference). Furthermore, in the final part of the empirical analysis, we will demonstrate the likely inconsistency of the alternative hypotheses.

This follows the following simple linear econometric specification:[9]

$$c_{ht} = \alpha + \beta X_{ht} + \varphi V_t + \epsilon_{ht} \tag{3}$$

where c_{ht} is the log of per capita consumption of household h at time t; X_{ht} and V_t are two vectors of exogenous variables which control, respectively, for the household's and village's characteristics; ϵ_{ht} is the error term. While the non-random consumption is assumed to be simply equal to the predicted value of the Eq. 3, to estimate its stochastic component we need to identify an observable and exogenous proxy of risk. The most commonly applied method of extracting parsimonious information on risk from data is to calculate the variance of innovations to income. This is usually performed (Carroll and Samwick 1997, 1998; Hubbard et al, 1994; Gourinchas and Parker, 2002; Jalan and Ravallion, 2001; Meghir and Pistaferri, 2004; Storesletten et al., 2004) by calculating the variance of the residuals (μ_{ht}) of an income equation such as the following:

$$y_{ht} = \tau + \gamma Z_{ht} + \pi V_t + \mu_{ht} \tag{4}$$

where y_{ht} is the log of per capita income, Z is similar to X in Eq. 3 with the inclusion of the occupation characteristics[10], and V is the same set of commune characteristics as in Eq. 3. We also insert dummies for trade categories in the income regression. We believe in fact that it is more plausible to assume that households actually know which group they are in and hence that they make reference to their group average and not to the overall average income (i.e., they do not consider the inter-group differences in income as risk as implicitly assumed if we do not control for trade group dummies in the income regression). Moreover, in each round of observations, we compute the variance of the income innovations by "trade-related" groups as follows:

$$\sigma^2_{ygt} = \sum_{h=1}^{n} (\mu_{hgt} - \bar{\mu}_{gt})^2 / n \tag{5}$$

[9]Here we are implicitly assuming that consumption is log normally distributed. Browning and Lusardi (1996) provide an excellent survey of the empirical test on precautionary saving based on linear regression.

[10]The occupation characteristics are assumed to influence consumption behaviour only through income.

where μ_{hgt} indicates income innovation of household h in trading group g in round t of observations. Following Skinner (1988), Guiso et al. (1992), Blundell and Stoker (1999), Banks et al., (2001) and Giles and Yoo (2007), we further rescale it by a specific factor (π_{ht}) based on household expected wealth. In particular, consistent with the adoption of the CRRA utility function, we assume that poorer individuals are more responsive to changes in risk, scaling up the variance of income innovations by the square of the ratio between current household's income and expected lifetime wealth.[11] Our final proxy for income innovation is thus the following:

$$\sigma^2_{yht} = \pi_{ht}\sigma^2_{ygt} \tag{6}$$

where $\pi_{ht} = \left(\frac{y_{ht}}{\hat{w_{ht}}}\right)^2$ and $\hat{w_{ht}}$ is a measure of the expected wealth. As well as its theoretical foundation, the scaling term has the additional advantage of allowing us to obtain a risk measure that is specific to each household in the sample in each period, further differentiating risk exposure across the households belonging to the same trading group.

It is worth noting that, since the lack of panel data prevents us from exploiting the time dimension, here we are assuming the unexplained component of income in cross-section data in Eq. 4 to proximate stochastic innovation. While it is true that the unexplained component probably also contains non-stochastic unobservables as well as measurement error, it is not necessarily true for the variances of income innovations within sub-samples of households grouped according to their trade openness position. We will come back to this important caveat later on when looking at the empirical outcomes.

To provide a separate measure of the impact of idiosyncratic shocks on consumption in addition to the *ex-ante* impact of risk (the former influenced by the available coping mechanisms of the households, the latter by their mitigating strategies), we rely on objective measures based on income realisations. Considering that the self-reported measures of idiosyncratic shocks can be biased by subjective perceptions, we calculate the income shock variable using an objective measure such as the ratio between the household residual from Eq. 4 and the predicted level of log income, as follows:

[11] According to Skinner (1988) and Guiso et al (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 declines with the household's resources and the decline is faster the higher the value. Usually, the adopted value is two and this is why we use the square of that ratio.

$$\zeta_{yht} = \frac{\hat{\mu}_{ht}}{\hat{y}_{ht}} \tag{7}$$

In order to obtain true idiosyncratic shocks, we insert a series of provincial dummies into the Eq. 4 which allow us to "clean" the residual of its covariate component. Finally, we disentangle the positive (ζ_y^+) from the negative (ζ_y^-) shocks in order to consider the possibility that the households are credit constrained and thus unable to fully smooth their consumption in the event of negative shocks.

The last step is to exploit the proxies for risk and shock to retrieve our *ex-ante* and *ex-post* consumption counterfactuals, as follows:

$$c_{ht} = \alpha + \beta X_{ht} + \varphi V_t + \theta_1 \sigma^2_{yht} + \theta_2 \zeta_y^+ + \theta_3 \zeta_y^- + \epsilon_{ht} \tag{8}$$

3.4 The empirical analysis

Data

Because of the lack of panel data covering the entire period under analysis, our empirical exercise relies on cross-sectional data for the following years: 1992, 1998, 2002, 2004, 2006 and 2008. Data come from two different sets of Vietnamese household surveys (VLSS and VHLSS). The VLSS was undertaken in the period 1992/93 using a sample of 4,800 households, of which 4,000 were re-interviewed in 1997/98, out of a sample of 6,000 households in total. The VHLSS collected information from a new sample of 29,530 households in 2002; 9,188 in 2004; 9,189 in 2006 and 2008. Unfortunately, as reported by Pham and Reilly (2007) and Le and Booth (2010), the sampling frame for VHLSS differs substantially from that of VLSS: whereas VLSS used the 1989 Population Census, the VHLSS 2002 exploited the Population and Housing Census from 1999. As a result, while there are short panel samples from the last waves, no household was re-interviewed between the VLSS and the VHLSS and, generally speaking, a comparison between VLSS and VHLSS rounds is not possible.[12] It is generally agreed that VHLSS data can be considered to be of higher quality than VLSS and provide legitimate nationally representative household data based on stratified random samples. However, it has been demonstrated that households residing in VHLSS communes were on average better off in 1999 and are still better off in 2009

[12] As a matter of fact, we register a clear jump in the magnitude of our empirical estimates from VLSS to VHLSS rounds.

than the households living in non-VHLSS communes since durable goods such as televisions, motorbikes, phones, refrigerators and even computers are more widespread in the VHLSS-communes (for more details, see Hansen and Dang Le, 2013). If this is the case, it implies an overall downward bias of our subsequent estimates of "upper bound" vulnerability (our proxies of wealth in the denominator of the scaling factor tend to be overestimated) with no consequences in relative terms.

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 of 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 such as fabric, clothing, blankets, pillow, tailoring or laundry service, shoes, nylon sheeting, electrical equipment, etc. Poverty lines for computing vulnerability are expressed in Vietnamese dongs as follows: 1,160,000 for 1992; 1,790,000 for 1998; 1,915,000 for 2002; 2,070,000 for 2004; 2,559,000 for 2006; 3,360,000 for 2008.[13] The variable used for household real per capita income, has been derived by aggregating 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. Income from crops is net income (gross revenue minus current expenditures) from rice; other cereals, vegetables, and annual crops; industrial crops; fruit crops; and crop by-products such as straw, leaves, etc. Agricultural sidelines include livestock and other animal products, agricultural services, forestry services, hunting, trapping, and domesticating wild animals, and aquaculture. Household business income is net income from non-agriculture, non-forestry, and non-aquaculture businesses run by the household and includes the processing of agricultural, forestry and aquaculture products. Wage income includes salary or wage payments plus additional payments such as holiday contributions, social insurance payments, etc. for all jobs held by individuals during the past 12 months. Gifts and remittances include payments from both domestic and overseas sources. Finally, "other" residual sources of income include items such as government transfers and earned interest as well as rental income from land and housing. The income variable has been also re-adjusted by price indexes of regions and months.

We cannot avoid possible measurement errors for these key variables. However, when errors are mean zero random errors and the variable with er-

[13]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 provided by Brian McCaig and the results do not change significantly.

rors is used as a dependent variable, as in our case, it is well known that those errors will not cause estimation bias.[14] Furthermore, as suggested by Nakata et al. (2009), measurement errors in retrospective expenditure seem to be systematically related to household size. This suggests that the inclusion of household size as one of the control variables in our regressions contributes to mitigating biases arising from measurement errors in consumption.

The set of covariates used for our consumption estimates includes household characteristics (such as characteristics of the head of household, i.e., linear and quadratic age, marital status, sex, linear and quadratic terms of family size and number of children); education achievements (primary, secondary, upper secondary, technical/vocational, university) as well as village-level infrastructure characteristics (such as the presence of roads, water pipelines, public transports, urban/rural environment). We also include province dummies to control for spatial heterogeneity.

As regards the measure for expected wealth in the denominator of the scaling factor, while it is widely recognised that living standards are determined by a multitude of factors, consumption expenditure remains the most popular measure in low- and middle-income settings. As a matter of fact, previous empirical analyses that use scaling factors (Banks et al., 2001; Giles and Yoo, 2007) replace expected wealth in the denominator of the scaling factor with the observed level of consumption. However, the presence of period t consumption in the scaling term makes it likely that errors in the measurement of this term will be correlated with errors in the measurement of the dependent variable (Giles and Yoo, 2007). To this end, Banks et al., (2001) and Giles and Yoo (2007) use lagged observed consumption in the scaling term in their estimates (as we will do in Essay 4). Since in this exercise, we cannot rely on panel data, alternative strategies to avoid endogeneity bias in the estimates should be taken into account. In a popular work, Filmer and Prichett (2001) suggest that asset indices are as reliable as conventionally measured consumption expenditure as a proxy of household living standards. Following this approach, two alternative strategies are tested to proxy for wealth (the denominator) in the π term used in eq. 6. First, we use the current value in thousand dong of the households fixed assets and durable goods. VLSS and VHLSS collect the current value (at the time of interview) of about 59 goods not considered in the household expenditure plus the value of dwelling. Table 3A-2 in Appendix 3A provides the details on these assets and durable goods whereas Tables 3A-3 and 3A-4report the main descriptive statistics of the final variable overall and by

[14] In contrast, when errors are correlated with independent variables or involve a mean-reverting pattern, bias in estimation will arise (Gibson & Bonggeun, 2007).

trade groups. Since the adoption of a price index could determine spurious correlation with the LHS variable, which is deflated too, both income and assets in the scaling term are reported in current values.

Second, as an alternative strategy, to prevent any possible bias due to price influence and handle the vexing problem of choosing appropriate weights, similarly to what has been done by Povel (2015), we proxy the expected wealth in the denominator of the scaling factor using the linear combination of the principal component factors of a sub-set of housing characteristics and physical land availability. Unfortunately, this approach can only be used for the VHLSS dataset since in the case of the VLSS rounds, the use of this index dramatically reduces the number of observations because of the high number of missing values. Table 3C-2 in Appendix 3C reports the list of the housing characteristics used in the principal component analysis and some descriptive statistics. Table 3C-3 reports the set of linear coefficients (i.e., factor loadings) of the first two common factors (i.e., those factors with eigenvalues greater than one). To improve the interpretability of the retained factors we applied the standard orthogonal varimax rotation (Kaiser 1958). Rotating the factors means re-expressing them to maximise their differences (i.e., so that loadings on a few variables are as large as possible and loadings on the rest of the variables are as small as possible). We have this freedom to re-express the factors because of the inherent indeterminate nature of the factor model (e.g., if z_1 and z_2 are two factors, then $z_1 + z_2$ and $z_1 - z_2$ are equally valid solutions). The orthogonal rotated factor loadings are every bit as good as the original loadings. As a matter of fact, if we plot the rotated factor loadings, as in Fig. 3C-1, their interpretation appears to be straightforward: factor 1 gathers the housing characteristics whereas factor 2 focuses on property, land and area availability.

To group households according to the trade openness of their sector of specialisation, since VLSS and VHLSS surveys 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 agricultural sector is also provided, as follows: rice (considered separately because of its special status); main export agricultural products, other export agricultural products, import-competing crops and subsistence crops. This allows us to come up with eight trade-related production sectors (see Table A.1 for details on the surveyed industries included in each sector).[15] Table A.2 shows the main characteristics for each

[15]The classification of industries as net exporters or net importers is made according

production group across time in terms of mean consumption, income, assets and poverty levels.[16] It shows that the vast majority of sampled households is involved in rice production where mean income and consumption are significantly lower than in the other sectors (with the relevant exception of import-competing crops in 2008). Generally speaking, people involved in non-farm activities are on average richer than farmers. Among the non-farm activities, the highest mean income and consumption levels in almost all rounds of observations are registered in non-traded services followed by import-competing manufacturing. However, in 2008, both farm and non-farm exports actually increased their income and consumption levels. A relative lower incidence of poverty in non-farm sectors compared with the farm ones should also be noted as well as a relatively strong decrease of its incidence in non-traded farm activities (covering, however, a limited range of sectors and a small percentage of the total workforce). Generally speaking, the incidence of poverty seems to be structurally lower in non-farm activities than in farm ones with the relevant exception of farm main-exports and non-traded crops.

Vulnerability by trade-related sector in Vietnam

Table 1 adds new pieces of information to the standard picture of poverty and trade liberalisation in Vietnam under *Doi Moi*, by reporting the vulnerability rates (both the overall VEP rate and the risk-induced VEP subcomponent)for each round of household data alongside the poverty rates (both those computed from the survey and those reported by the Vietnam General Statistics Office, GSO). Following Chaudhuri (2003) in this empirical exercise we have considered a household vulnerable if its probability to register a consumption below the poverty line is higher than 0.50. Appendix 3B shows how vulnerability rates change along with changes in the probability thresholds and gives details of the VEP estimation procedure. It is worth noting that these are cross-sectional measures of vulnerability. They should be seen as "snapshots" of the expectation to be poor "in the near future". As common practice, in this exercise we consider households as vulnerable if they show a probability higher than 0.50 to fall into poverty at least once in the following two years.[17] It is worth noting that *ex-ante* vulnerability

to the average trade flows in 2002. For additional details on the procedure adopted, see Coello et al. (2010).

[16]To group the households, we used the characteristics of the head of the family. We 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.

[17]To make clear-cut computations on a specific number of years in the future, a common procedure is to compute vulnerability as one minus the probability of no episodes of poverty times the number of years of the chosen time horizon in the future (k), as follows:

and *ex-post* poverty should be viewed as different statistics: while we can compare their evolution over time, we cannot draw any cross comparisons between them.[18] At first sight, it is evident from Table 1 that there is a decreasing trend in both poverty and vulnerability rates. The percentage of vulnerable people decreased from around 56 per cent of the total population in 1992 to 8.3 per cent in 2008. However, the table actually shows a roughly constant path of the share of the risk-induced component of vulnerability (i.e., the component of vulnerability associated with a high estimated variance of consumption, but expected consumption above the poverty line) after an initial drop at the eve of the liberalisation process (between 1992 and 1998). During the period 1998-2008 it never fell below the threshold of 31 per cent of the overall VEP. As we will see below, this is a significant issue that needs careful investigation.

Table 1: Vulnerability and Poverty in Vietnam (1992-2008)

	1992	**1998**	**2002**	**2004**	**2006**	**2008**
Poverty Rate in the Survey (%)	55.21	29.89	27.99	19.44	15.33	16.40
Poverty Rate (%) GSO	58,1	37,4	28,9	19,5	16.00	14,5
VEP Rate (%)	56.11	21.50	18.26	10.77	7.06	8.31
Risk-induced VEP (% vulnerable)	18.74	33.73	30.99	31.24	32.64	31.06

It is now time to undertake the most difficult task in our analysis: investigate the presence of a likely relationship between risk-induced vulnerability and trade liberalisation in Vietnam. The simple evidence that the two phenomena coexist under *Doi Moi* cannot be the only argument in favour of a direct link between the two. At the same time, this coexistence makes the effort worthwhile. Table 2 reports the poverty and vulnerability statistics by trading sector. For each surveyed year, in the first two columns it shows the characteristics of households in terms of income distribution (proxied by the percentage of population below the fourth decile of the income distribution) and poverty rates (percentage of population below the poverty line). In the last two columns for each surveyed year, it shows as in Table 1 the total percentage of vulnerable households and the percentage of vulnerable households that are considered as risk induced. As can be seen in the Table 2, under the period of observation, the percentage of vulnerable people decreased in all trade-related sectors following a quite regular pattern (with some jumps moving from VLSS to VHLSS, probably due to the substantial

$V_{h,t+k} = 1 - [P(lnc_{ht} > lnz)]^k$, given the information set at t. In this exercise we use $k = 2$.

[18] Imai et al., (2011) suggest a method of making such a comparison by means of a multinomial logit model, adding $VEP_{h,t-1}$ as one of the arguments.

difference in the sampling frame between the two surveys). As a result, in 2008 (our last year of observation), all trade-related sectors register, without exception, a lower percentage of vulnerable households than in 1992. Nevertheless, farm activities show higher percentages than non-farm ones with the relevant exception of non-traded crops.

According to our VEP estimates, the sectors with the lowest percentage of vulnerable households are non-traded services (they also show the lowest percentage of poor people and, in general, of people with income below the fourth decile[19]) and non-traded crops (in both cases, the percentage of vulnerable households is below 2% in 2008). Among farm activities, the production sector with the highest percentage of vulnerable households is import-competing sectors followed by rice. Acknowledging the peculiar nature of the rice sector which is, at the same time, the main production sector and the main source of food for Vietnamese households, the last two rows of Table 2 also show the decomposition of vulnerability patterns between rice net producers and net consumer households where both the percentages of the poor and vulnerable are higher among net rice producers than among net rice consumers. Notwithstanding the fact that households involved in main-export crops share similar mean income/consumption levels with those involved in non-traded services (see Table A.2), the percentage of vulnerable people in the former is permanently higher than in the latter. This is noteworthy if we consider the relatively low incidence of poor households in export crops and the relative equal distribution of income across deciles that characterise it (see the first two columns in Table 2). Hence, we can argue, first of all, that the hypothesis of heterogeneity in vulnerability by trade sector is not rejected by the empirical data in Vietnam. Furthermore, it should be noted that all non-farm activities register in 2008, generally speaking, a higher share of risk-induced vulnerability than farm ones where import-competing crops and rice seem to be the least exposed. Although this share is computed on a smaller total, this is a relevant issue for policymaking. However, it is intrinsically related to one of the main VEP weaknesses (i.e., the inability to model risk explicitly)[20]. To this end, the next section tries to overcome the VEP approach, specifically, by shedding light on the black box of the risk-induced VEP component and disentangling the relative "importance" of its various determinants.

[19] Note that, except in 1992, there are no poor households in the fifth or higher decile of income.

[20] It is worth recalling here that the VEP measure assumes that the observed inter-household distribution of consumption at a point in time represents the future distribution of consumption across states of the nature for each household.

Table 2: Vulnerability to expected poverty by trade-related sectors

	1992				1998				2002			
Trade sectors	**% pop ≤ IV dec**	**% Poor**	**% VEP**	**% Risk VEP**	**% pop ≤ IV dec**	**% Poor**	**% VEP**	**% Risk VEP**	**% pop ≤ IV dec**	**% Poor**	**% VEP**	**% Risk VEP**
non farm activities												
Exporting manuf.	13.27	28.57	22.45	31.82	23.94	20.30	10.00	48.48	22.04	21.58	10.82	39.44
Importing manuf.	18.58	47.30	43.58	26.36	12.60	12.21	6.11	43.75	13.10	13.10	7.95	45.07
Non traded services	12.57	23.25	18.86	33.33	11.62	10.36	5.78	48.28	11.22	9.80	5.51	49.05
farm activities												
Main exports	29.70	59.41	54.46	23.64	18.55	20.56	14.92	56.76	33.92	31.07	25.86	32.14
Other exports	40.45	62.92	51.12	20.88	42.86	38.35	26.32	17.14	39.67	38.02	25.35	31.85
Imp competing	46.30	62.96	58.33	14.29	34.63	44.96	39.53	25.49	46.14	44.71	36.82	20.19
Non traded crops	18.75	28.13	43.75	42.86	17.43	18.35	22.02	62.50	22.50	20.94	10.76	50.91
Rice	36.44	66.95	71.55	16.50	44.23	43.88	32.12	32.36	46.38	43.16	27.76	28.49
Net consumer	25.63	51.10	45.06	20.51	21.70	24.29	16.35	27.45	22.92	21.31	13.28	30.37
Net producer	34.75	59.72	68.16	17.52	39.41	36.51	27.48	37.88	39.06	32.28	20.54	34.00
	2004				**2006**				**2008**			
Trade sectors	**% pop ≤ IV dec**	**% Poor**	**% VEP**	**% Risk VEP**	**% pop ≤ *IV* dec**	**% Poor**	**% VEP**	**% Risk VEP**	**% pop ≤ *IV* dec**	**% Poor**	**% VEP**	**% Risk VEP**
non farm activities												
Exporting manuf.	20.07	12.86	5.32	41.94	27.44	10.98	3.77	40.91	21.85	7.20	2.31	55.56
Importing manuf.	15.76	9.19	4.13	45.45	20.98	7.23	2.89	37.50	22.26	6.68	3.18	60.00
Non traded services	13.63	6.12	2.81	49.35	18.18	4.48	1.45	52.38	18.07	5.44	1.36	66.67
farm activities												
Main exports	23.24	16.45	10.97	52.38	27.85	10.07	3.02	55.56	30.70	7.04	3.38	50.00
Other exports	43.83	28.87	16.80	31.25	48.62	17.43	7.34	62.50	43.50	18.83	9.28	45.71
Import competing	47.29	36.24	26.82	25.44	40.53	19.38	13.22	40.00	52.84	28.09	19.33	25.33
Non traded crops	31.21	13.48	2.84	75.00	35.79	9.47	1.05	0.00	32.41	8.33	1.85	50.00
Rice	46.46	32.11	17.77	26.54	40.50	27.28	13.40	28.18	33.00	23.72	12.32	26.42
Net consumer	23.28	14.52	7.76	34.58	25.72	10.96	4.28	37.70	28.37	12.46	5.38	35.43
Net producer	38.44	24.99	14.36	28.80	35.35	20.15	10.34	29.94	31.57	19.92	11.10	29.26

The net contribution of "risk-induced" determinants of vulnerability

Table 3 reports the estimated coefficients of our consumption regression (eq. 8) for each round of the observations. In these estimates, the current value in thousand dong of the households' fixed assets and durable goods has been used as a proxy for wealth in the denominator of the scaling factor. The estimated coefficients of the same equation using the linear combination of the principal component factors of a sub-set of housing characteristics and physical land availability as a proxy for wealth in the denominator of the scaling factor are reported in Table 3C-4 in Appendix 3C. For an idea of how these alternative strategies actually soften possible endogeneity bias in the relationship between current consumption and expected wealth, Table 3C-5 in Appendix 3C reports the coefficients of the same estimates using observed consumption as a measure of wealth in the scaling factor.

As shown in Table 3, all the covariates are statistically significant and show the expected signs. The signs of age and its square coefficients confirm, in principle, the well-known concave age-consumption profile, even if the decreasing rate is in this case meaningless. Not surprisingly, having children reduces household per capita consumption while being married increases it. Whether the head of the household is male or female is correlated with consumption too. The education variables also behave as expected, that is, higher levels of education actually correspond to higher levels of consumption. Lastly, the presence of a set of village characteristics (urban status and availability of paved roads, electricity, tap water and public transport) are associated with a higher level of consumption too.

The striking feature of our empirical exercise lies in the fact that both our *ex-post* and *ex-ante* stochastic components of income are significantly correlated with household consumption behaviour.[21] More specifically, in each of the surveys under analysis there is a negative correlation between the *ex-ante* component of income innovation and expected consumption (although this is not statistically significant for some of the available rounds). The same relation holds for the *ex-post* negative shocks.

Even if our exercise cannot be considered a proper test of the precautionary saving theory - because of its static nature - our results are consistent with the provisions made by the theory, that is, *ex-ante* risk implies a lower level of current consumption. In other words, our consumption estimates confirm that households are, generally speaking, lowering their current path of consumption because of both *ex-ante* risk (as a function of mitigating strategies) and *ex-post* negative shocks (as a function of coping strategies)

[21] The outcomes of the income equation (eq. 4) which are used to separate the *ex-ante* and *ex-post* components of risk, are reported in Table 3A-5 in Appendix 3A.

Table 3: Consumption estimates (1992-2008)

	1992	1998	2002	2004	2006	2008
Demographic characteristics						
Age of the household head	0.0129***	0.0187***	0.0116***	0.00875***	0.0115***	0.0142***
	(0.00326)	(0.00289)	(0.00103)	(0.00204)	(0.00217)	(0.00246)
Age^2 of the household head	-0.000103***	-0.000155***	-0.0000974***	-0.0000653***	-0.0000996***	-0.000122***
	(0.0000328)	(0.0000276)	(0.00000983)	(0.0000190)	(0.0000209)	(0.0000232)
Household Size	-0.0561***	-0.110***	-0.0816***	-0.0742***	-0.0623***	-0.0551***
	(0.0119)	(0.00968)	(0.00401)	(0.00723)	(0.00808)	(0.0104)
Household $Size^2$	0.00214***	0.00491***	0.00407***	0.00369***	0.00271***	0.00142+
	(0.000761)	(0.000797)	(0.000336)	(0.000605)	(0.000702)	(0.000951)
No. of Children	-0.0476***	-0.0657***	-0.103***	-0.113***	-0.113***	-0.113***
	(0.00712)	(0.00557)	(0.00245)	(0.00443)	(0.00486)	(0.00575)
Married hh head (yes=1)	0.0660***	0.127***	0.0863***	0.0935***	0.0802***	0.0773***
	(0.0222)	(0.0171)	(0.00757)	(0.0148)	(0.0150)	(0.0187)
hh head sex (male=1)	-0.0571***	-0.0482***	-0.0670***	-0.0962***	-0.0749***	-0.0664***
	(0.0183)	(0.0150)	(0.00653)	(0.0125)	(0.0122)	(0.0147)
Education						
Prim educ (yes=1)	0.0898***	0.117***	0.144***	0.169***	0.159***	0.201***
	(0.0183)	(0.0257)	(0.00598)	(0.0105)	(0.0114)	(0.0128)
Low secondary educ (yes=1)	0.144***	0.256***	0.256***	0.308***	0.288***	0.325***
	(0.0220)	(0.0293)	(0.00670)	(0.0121)	(0.0125)	(0.0137)
Upper secondary educ (yes=1)	0.243***	0.402***	0.413***	0.417***	0.408***	0.404***
	(0.0312)	(0.0321)	(0.00905)	(0.0169)	(0.0176)	(0.0191)
Tech/voc edu (yes=1)	0.218***	0.402***	0.520***	0.533***	0.543***	0.515***
	(0.0256)	(0.0344)	(0.0104)	(0.0155)	(0.0162)	(0.0180)
Univers. Edu (yes=1)	0.436***	0.676***	0.731***	0.741***	0.775***	0.741***
	(0.0495)	(0.0436)	(0.0125)	(0.0216)	(0.0200)	(0.0241)
Village characteristics						
Geographical loc (urban=1)	0.220***	0.290***	0.274***	0.267***	0.176***	0.0759***
	(0.0606)	(0.0318)	(0.0125)	(0.0176)	(0.0219)	(0.0218)
Roads (yes=1)	0.0156	0.0624*	-0.00638	0.0486***	0.0249+	0.0347*
	(0.0403)	(0.0371)	(0.0132)	(0.0163)	(0.0152)	(0.0189)
Electricity (yes=1)	0.0537	0.173***	0.119***	0.121***	0.254***	0.195***
	(0.0476)	(0.0456)	(0.0166)	(0.0315)	(0.0387)	(0.0520)
Water (yes=1)	0.0705	0.0690*	0.122***	0.0160	0.0669***	0.0616***
	(0.0605)	(0.0354)	(0.0122)	(0.0154)	(0.0198)	(0.0191)
Transport (yes=1)	-0.0455+	0.00983	0.0439***	0.0457***	0.0290***	0.0485***
	(0.0278)	(0.0211)	(0.00849)	(0.00999)	(0.0101)	(0.0115)
Ex-Ante Components						
Income risk	-0.00221***	-0.000222	-0.00204***	-0.00400	-0.000916**	-0.00860
	(0.000639)	(0.000987)	(0.000525)	(0.00474)	(0.000443)	(0.00772)
Ex-Post Components						
Positive Income Shock	2.011***	3.089***	4.376***	4.410***	4.161***	3.613***
	(0.175)	(0.165)	(0.0897)	(0.131)	(0.139)	(0.158)
Negative Income Shock	-1.637***	-1.757***	-5.197***	-4.041***	-4.810***	-4.088***
	(0.161)	(0.152)	(0.0922)	(0.156)	(0.157)	(0.180)
Constant	6.788***	6.868***	7.486***	7.964***	7.723***	8.412***
	(0.100)	(0.0950)	(0.0578)	(0.0848)	(0.0902)	(0.101)
Province Dummies	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Adjusted R^2	0.524	0.653	0.749	0.714	0.683	0.623
Obs	3377	5212	26304	7820	7801	6307

+$p \leq 0.15$; $*p \leq 0.10$; $**p \leq 0.05$; $***p \leq 0.01$

with negative welfare implications in their consumption prospects. It also highlights the presence of *ex-ante* welfare effects (i.e., changing behaviour in consumption because of "ex-ante" risk) for households that did not actually experience any shock. Note that this is based on a better identification strategy able to separate *ex-ante* and *ex-post* risks. However, as will be discussed below, we cannot rule out measurement errors and unobservable bias because of the lack of panel data.

Table 4 shows the standardised coefficients in Eq. 8.[22] As can be seen in Fig. 1, which plots the standardised coefficients in Eq.8, the ex-ante stochastic component (i.e., the income risk variable) does not matter as much as the other components.[23] However, if we look at the evolution of its net contribution over time [24] for the entire period under observation (1992-2008), we see that the risk component influences consumption negatively in every round of observations and does not evidence a clear downward trend (with the significant exception of a strong reduction from 1992 to 1998 within the VLSS, see Fig. 2)

Table 3C-1 in Appendix 3C reports additional estimates for eq. 8 which also include dummies for trade categories. On the one hand, this helps us capture possible unobservable income effects other than those already controlled for by the observable characteristics, neutralising differences in average income between groups (i.e., households in different trade categories show heterogeneous consumption because of heterogeneous income). On the other hand, while the risk term is supposed to capture in principle both within and between group effects, the inclusion of trade categories acknowledges that some risks can be common to households in the same trade group and allows us to isolate the risk effect within groups (i.e., risks are identified within the groups) better than in the estimates reported in Table 3.[25] The outcomes reported in Table 3C-1 show the following stylised facts: i) the trade dummies show, generally speaking, negative coefficients, i.e., they are associated with lower consumption prospects than the reference category (non-farm non-trade); ii) the overall fit of the model with the trade dummies slightly improves; iii) the coefficients of the risk terms do not change signifi-

[22]Standardised coefficients are simply the regression coefficients when all variables have been standardised to mean zero and variance one (z scores). For more details, see Achen (1982).

[23]These outcomes are very much in line with the other Essays in this thesis and with Lucas (2003)'s computations.

[24]The net contribution on consumption behaviour is here intended simply as its "level importance", computed by multiplying the mean of the independent variable by its coefficient.

[25]It is useful here to remark that equality of the means and variances of income residuals by trade categories is rejected by the data.

Table 4: Consumption estimates: standardised coefficients

	1992	**1998**	**2002**	**2004**	**2006**	**2008**
Demographic characteristics						
Age of the household head	0.382***	0.432***	0.270***	0.198***	0.261***	0.343***
	(0.00326)	(0.00289)	(0.00103)	(0.00204)	(0.00217)	(0.00246)
Age^2 of the household head	-0.300***	-0.367***	-0.237***	-0.157***	-0.238***	-0.310***
	(0.0000328)	(0.0000276)	(0.00000983)	(0.0000190)	(0.0000209)	(0.0000232)
Household Size	-0.241***	-0.360***	-0.246***	-0.214***	-0.181***	-0.168***
	(0.0119)	(0.00968)	(0.00401)	(0.00723)	(0.00808)	(0.0104)
Household Size^2	0.114***	0.187***	0.136***	0.119***	0.084***	0.045+
	(0.000761)	(0.000797)	(0.000336)	(0.000605)	(0.000702)	(0.000951)
No. of Children	-0.133***	-0.144***	-0.203***	-0.213***	-0.214***	-0.220***
	(0.00712)	(0.00557)	(0.00245)	(0.00443)	(0.00486)	(0.00575)
Married hh head (yes=1)	0.052***	0.085***	0.054***	0.058***	0.052***	0.051***
	(0.0222)	(0.0171)	(0.00757)	(0.0148)	(0.0150)	(0.0187)
hh head sex (male=1)	-0.052***	-0.037***	-0.048***	-0.068***	-0.055***	-0.050***
	(0.0183)	(0.0150)	(0.00653)	(0.0125)	(0.0122)	(0.0147)
Education						
Prim educ (yes=1)	0.079***	0.095***	0.107***	0.125***	0.124***	0.166***
	(0.0183)	(0.0257)	(0.00598)	(0.0105)	(0.0114)	(0.0128)
Low secondary educ (yes=1)	0.129***	0.210***	0.196***	0.229***	0.228***	0.275***
	(0.0220)	(0.0293)	(0.00670)	(0.0121)	(0.0125)	(0.0137)
Upper secondary educ (yes=1)	0.111***	0.232***	0.193***	0.183***	0.187***	0.193***
	(0.0312)	(0.0321)	(0.00905)	(0.0169)	(0.0176)	(0.0191)
Tech/voc edu (yes=1)	0.137***	0.160***	0.219***	0.282***	0.288***	0.286***
	(0.0256)	(0.0344)	(0.0104)	(0.0155)	(0.0162)	(0.0180)
Univers. Edu (yes=1)	0.138***	0.212***	0.227***	0.237***	0.257***	0.232***
	(0.0495)	(0.0436)	(0.0125)	(0.0216)	(0.0200)	(0.0241)
Village characteristics						
Geographical loc (urban=1)	0.188***	0.224***	0.196***	0.189***	0.131***	0.053***
	(0.0606)	(0.0318)	(0.0125)	(0.0176)	(0.0219)	(0.0218)
Roads (yes=1)	0.010	0.033*	-0.003	0.024***	0.013+	0.019*
	(0.0403)	(0.0371)	(0.0132)	(0.0163)	(0.0152)	(0.0189)
Electricity (yes=1)	0.030	0.077***	0.051***	0.026***	0.042***	0.036***
	(0.0476)	(0.0456)	(0.0166)	(0.0315)	(0.0387)	(0.0520)
Water (yes=1)	0.063	0.052*	0.082***	0.012	0.053***	0.051***
	(0.0605)	(0.0354)	(0.0122)	(0.0154)	(0.0198)	(0.0191)
Transport (yes=1)	-0.044+	0.008	0.038***	0.038***	0.025***	0.045***
	(0.0278)	(0.0211)	(0.00849)	(0.00999)	(0.0101)	(0.0115)
Ex-Ante Components						
Income risk	-0.064***	-0.002	-0.012***	-0.005	-0.007**	-0.008
	(0.000639)	(0.000987)	(0.000525)	(0.00474)	(0.000443)	(0.00772)
Ex-Post Components						
Positive Income Shock	0.218***	0.238***	0.268***	0.275***	0.248***	0.232***
	(0.175)	(0.165)	(0.0897)	(0.131)	(0.139)	(0.158)
Negative Income Shock	-0.144***	-0.132***	-0.286***	-0.240***	-0.269***	-0.256***
	(0.161)	(0.152)	(0.0922)	(0.156)	(0.157)	(0.180)
Constant	6.788***	6.868***	7.486***	7.964***	7.723***	8.412***
	(0.100)	(0.0950)	(0.0578)	(0.0848)	(0.0902)	(0.101)
Province Dummies	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Adjusted R^2	0.524	0.653	0.749	0.714	0.683	0.623
Obs	3377	5212	26304	7820	7801	6307

+p$\leq$ 0.15; $*p \leq 0.10$; $**\,p \leq 0.05$; $***p \leq 0.01$

Figure 1: Dispersion importance of the determinants of household consumption (average values 1992-2008)

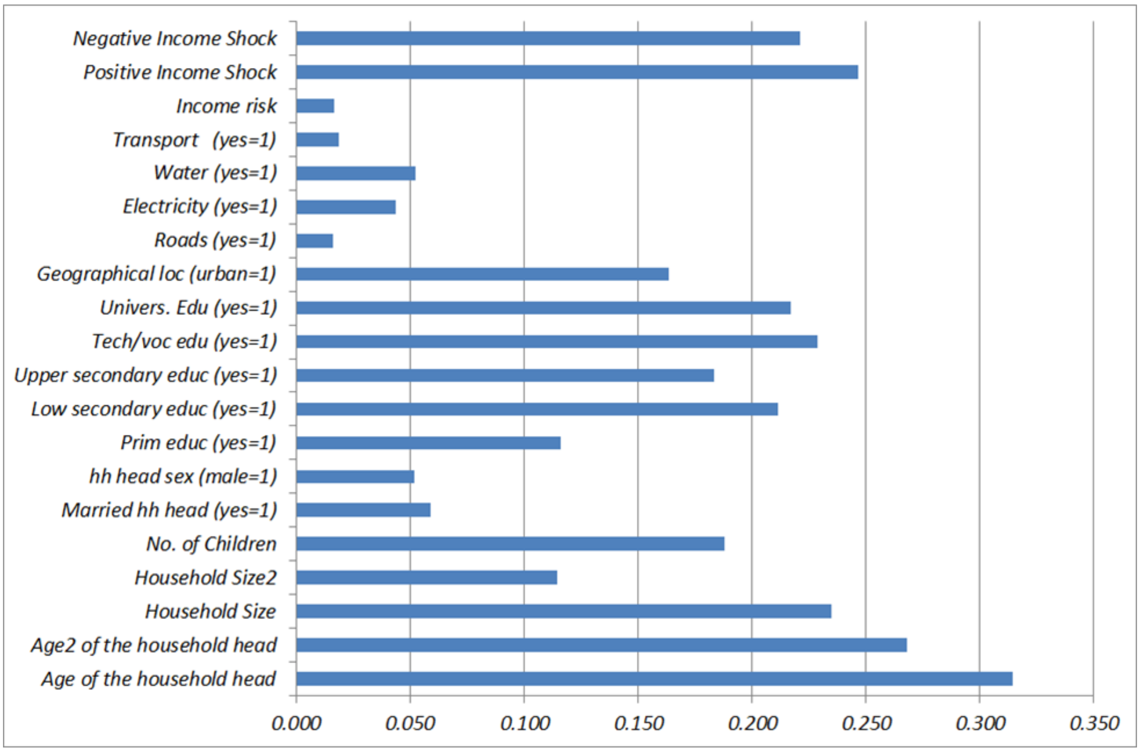
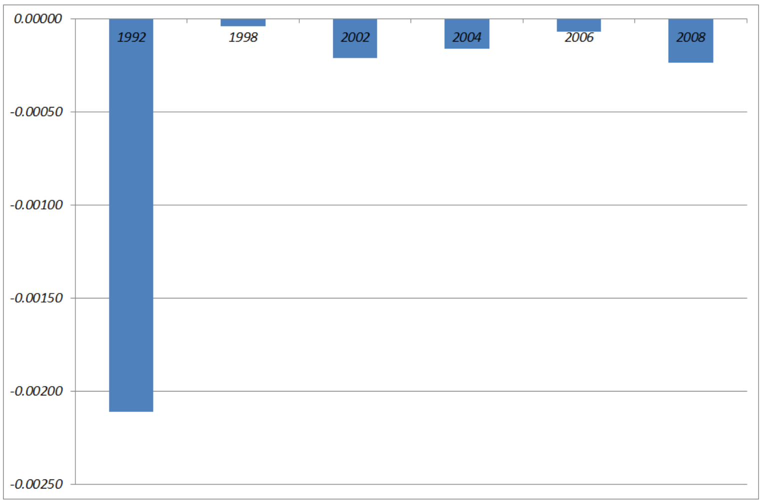


Figure 2: Evolution of the net contribution of the "ex-ante" stochastic determinants on average household consumption (1992-2008)



cantly. The above evidence suggests that the trade dummies mainly capture differences in mean income which do not influence the risk channel depicted above.

As a further robustness check, Table 3C-4 in Appendix 3C reports additional estimates of eq. 8 with a linear combination of housing and land availability as principal component factors to proxy for wealth in the denominator of the π term. It also includes the trade dummies in the regression. It is worth noting that in the case of the VLSS rounds, the use of this index dramatically reduces the number of observations because of the high number of missing observations. It actually hampers the degree of confidence of the regression outcomes for these rounds. In the case of the VHLSS rounds, however, the negative relationship between income risk and consumption is still there even if only weakly significant for some rounds. Finally, the same estimates are reported in Table 3C-5 using observed consumption as a proxy for the expected wealth of the denominator of the scaling factor. They show the same pattern. The only difference, as expected, is that the coefficients for ex-ante risk are higher in magnitude and more significant in all rounds. In short, the negative relationship between ex-ante risk and consumption seems to hold and is robust to alternative empirical proxies for wealth.

Before drawing any conclusion, however, we should mention that the lack of panel data prevents us from isolating the risk component properly. If we correctly assume the variance of income innovation as a comprehensive measure of risk component, variance in non-stochastic household heterogeneity and variance in measurement error, it is apparent that our estimates should be seen as an upper-bound of the possible welfare impact of the risk component. However, is the hypothesis of time-varying heterogeneity and measurement error reasonable?

On the one hand, while the VHLSS data are universally considered to be of better quality than VLSS and widely used by both national and international research communities, as already discussed, we cannot exclude the presence of time-varying measurement error in income (Lee et al., 2010; Glewwe, 2011).[26] Furthermore, in a dynamic emerging economy like Vietnam, in the midst of a deep and comprehensive process of reform such as *Doi Moi*, we cannot exclude the presence of time-varying unobserved household heterogeneity either.

On the other hand, if we come back to the main focus of our analysis, i.e., the trade openness debate, and we test whether or not there are likely to be statistical differences in the *ex-ante* component of income innovation across households in relation to their affiliation to each trade-related group, the F-statistics of the one-way ANOVA and the Levene's T-test[27] reject in each round of observations the null hypotheses that the means and the variances of the estimated income residuals are the same across trade-related production groups (Table 5). We are thus confronting heterogeneity in unexplained stochastic components when households are gathered by trade-related sectors (see Figure 3 for the full picture of the dispersion of income residuals across households by trade-related category for all the available households surveys).

Fig. 4 shows, as in Fig.2, the evolution of the net contribution of the *ex-ante* component of income innovation on households' consumption behaviour (derived from estimating Eq. 8), by clustering households across groups of industries classified as traded, not traded and rice, according to Coello et al. (2010). The picture highlights a relatively higher average of the *ex-ante* stochastic component in the case of the trading sectors compared with the other ones, especially in the most recent rounds, net of the usual jump between VLSS and VHLSS.

This last result confirms that we are confronting heterogeneity in the variance of income innovation which is correlated to the relative degrees of trade openness of production sectors. Again, if we are willing to assume

[26]For instance, being selected for the VHLSS survey has been seen to have an independent increasing positive impact on average household consumption (Hansen and Trung Dange, 2010).

[27]The Levine test is similar to the standard one-way Anova test, but less sensitive to the eventual violation of normality assumption. The null hypothesis of both tests is equality of variances across trade groups. This is rejected with a probability of below 0.05.

Table 5: Testing Mean and Variance of the income residuals by trade categories

Levene's T-test for equal variances of the income residuals

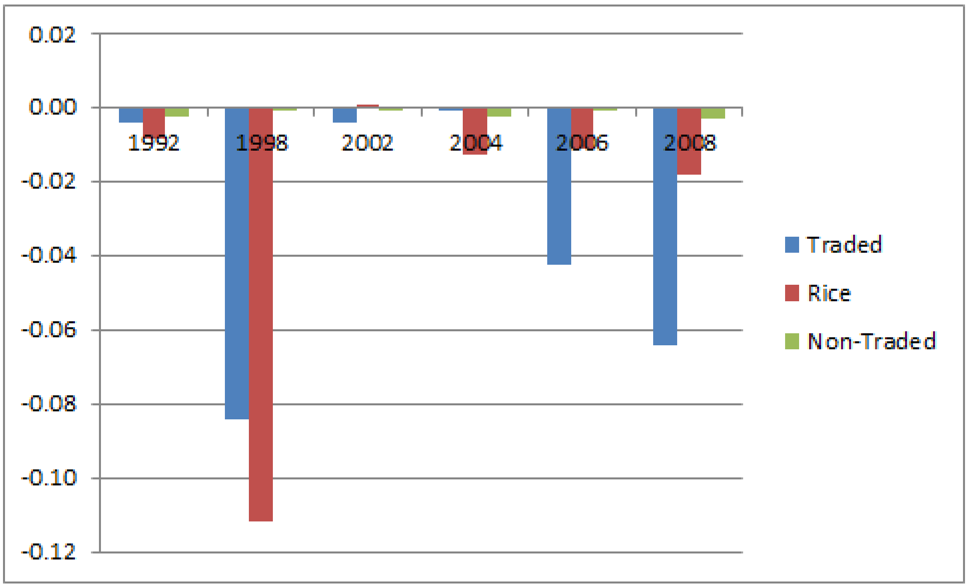
	1992	**1998**	**2002**	**2004**	**2006**	**2008**
	9.27	4.93	22.72	6.05	6.27	6.43
p-value	0.000	0.000	0.000	0.000	0.000	0.000

One way ANOVA Test of equality of means under unequal variances

	1992	**1998**	**2002**	**2004**	**2006**	**2008**
	3.78	10.501	43.086	17.107	6.861	18.084
p-value	0.000	0.000	0.000	0.000	0.000	0.000

Figure 3: Box plots of income residuals by trade categories

Figure 4: Evolution of the net contribution of the risk component on average household consumption (1992-1008) in traded, not traded and rice sectors



it is the upper bound of a proper measure of the risk component, the plain conclusion is that, not only is risk increasing over time in Vietnam under *Doi Moi*, but that its relevance (in terms of net contribution both to the expected average and to the variance of household consumption) is proportionally higher the higher the trade exposure of the sector the household is involved in.

However, since we acknowledge that we are not able to separate pure risk from unobserved household heterogeneity and measurement error, we cannot make this conclusion without considering the opposite hypothesis. To this end, let us suppose that our *ex-ante* component is entirely determined by unobserved household heterogeneity and measurement error. This means that both the unobservable heterogeneity and measurement error change according to household trade exposure across sectors, i.e households working in a more exposed trading sector are more, and increasingly, severely affected by unobservables and measurement error than households working in a less trade-exposed sector. This would indeed be an interesting conjecture, even if it has not been explored by the literature so far. But even so, why should their impact on consumption behaviour be negative? Such a hypothesis would need to assume that the households that self-select to participate in the more exposed trade sectors present a set of common characteristics, unobserved to the researcher, or alternatively, a common path in their relative measurement error, that have a negative impact on their consumption behaviour. If that were the case, it would be a very relevant issue for policymaking and would also imply a revision of the assumed trade benefits for the welfare of Vietnamese households working in the most exposed trading sector, at least partially, i.e., when looking at heterogeneity in their unexplained stochastic components of consumption behaviour. My impression, however, is that we are probably simply assessing what we are looking for: i.e., the dynamic of risk heterogeneity across households according to their degree of risk exposure. This is reasonably increasing over time and is relatively higher for the households that are more exposed to trade due to the relative impact of foreign risks. Furthermore, it is negatively correlated with *ex-ante* consumption behaviour even for the households that do not actually experience any shock.

3.5 Conclusions

This paper presents - to the best of my knowledge - the first comprehensive analysis of vulnerability to poverty induced by trade liberalisation in Vietnam under *Doi Moi* for the entire period 1992-2008. As a result, a number of useful insights into the phenomena under analysis can be derived. First of all, a decreasing trend in vulnerability to poverty along with a decreasing trend in poverty; second, a non-decreasing share of risk-induced vulnerability and; third, the non-decreasing importance (both in terms of impact level and in terms of dispersion) of the vulnerability component of consumption behaviour linked to the ex-ante stochastic determinants, an issue traditionally overlooked by the empirical literature in the field. Finally, our estimates confirm that risk exposure varies systematically according to the trade exposure of surveyed households. Notwithstanding the fact that households involved in main-export farm activities share similar mean income/consumption levels with those involved in non-traded non-farm ones, the percentage of vulnerable people in the former is permanently higher than in the latter. While the nature of the heterogeneity of the *ex-ante* income innovation by trade-related sector as well as the role of risk management strategies actually engaged in by Vietnamese households need more careful investigation, these first empirical outcomes appear to be very relevant to policymaking. They highlight the need to include possible influences of trade-related risk exposure in the welfare assessments of the impacts of trade policies.

Appendix 3A - Tables & Figures

Table 3A-1: Industries classification by trade-related sectors

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

Source: Coello et al., (2010)

Table 3A-2: List of fixed assets and durable goods used to proxy households' wealth

Perennial crop gardens	Telephone sets
Aquaculture production area	Mobilephones
Fish/shrimp-rearing cages/rafts	Sewing, weaving, embroidering machines
Other production land area	Other machines and equipment
Buffalo, cow, horse for production and breeding	Fishing net
Breeding male and female pig	Durable containers for storage
Basic herds of poultry and cattle	Other professional equipment
Breeding facilities	Video players
Feed grinding machines	Color T.V sets
Rice milling machines	Black and white T.V sets
Rice plucking off machine	Multi-tier stereos
Pesticide sprayers	Radios/Cassette
Workshops	Recorders/Disc players
Shops	Computers
Other production bases	Cameras, Video cameras
Cars	Refreezerators, Freezers
Tractors	Air-condioners
Trailers	Washing machines and driers
Tractor ploughs	Electric fans
Motorbikes	Water heaters
Bicycles	Gas cookers
Cart	Electric cookers, rice cookers, pressure cookers
Motor boats, ferries ...	Trollers of various kinds
Boats, ferries without motor	Wardrobes of various kinds
Other means of transportation	Beds
Lathes and welding and milling machines	Tables, chairs, sofas ...
Punchers	Vacuum cleaners, water filters
Wooden sawing machines	Microwaves
Pumps	Liquidizer, juicer
Power generators	Other valuable things
Printers, photocopiers	(Antiques, pianos, dressing tables...)
Fax machines	

Table 3A-3: Main descriptive statistics of households in the sample by trade-related sectors

Trade sectors	Statistics	Real pc consumption	Real pc income	Current value of Assets/Durables	Real pc consumption	Real pc income	Current value of Assets/Durables	Real pc consumption	Real pc income	Current value of Assets/Durables
			1992			1998			2002	
Exporting industries	Mean	2192.451	4411.844	50768.46	3412.447	5272.34	36800.08	3581.795	6192.238	90606.57
	Std Dev.	1561.628	4115.385	60503.03	2260.809	4494.307	40726.13	2319.123	4590.791	135475.1
	Min	659.5261	702.151	770	781.2977	580.001	2891	666.2547	908.5842	780
	Max	9416.787	28112.09	254030	13071.95	31198.08	320369	18474.96	32929.32	1612400
	Obs.	90	90	90	313	313	313	1882	1882	1882
Import-competing industries	Mean	1703.968	4010.86	40157.48	4128.725	6742.565	37319.39	3993.802	6906.522	99507.89
	Std Dev.	1096.584	4141.78	69949.56	2521.305	4987.061	41747.78	2495.643	4745.421	139213.7
	Min	644.5936	685.3751	420	1000.463	725.8027	1789	774.4517	877.4553	800
	Max	6964.31	32100.77	557640.00	15113.75	28302.5	339667	17656.49	32483.17	1128750
	Obs.	248	248	248	246	246	246	1715	1715	1715
Non trade non food	Mean	2141.634	4513.755	54588.53	4575.739	7008.84	39891.78	4610.45	7149.777	122618.8
	Std Dev.	1344.579	4356.647	110483.2	2869.457	5516.867	44393.46	2846.255	4654.243	182739.7
	Min	632.6236	588.8931	325	672.0535	607.9286	1606	776.3353	600.4697	330
	Max	13302.89	31179.41	1856910	18447.21	33397.65	569448	18206.18	32900.31	2690650
	Obs.	764	764	764	1444	1444	1444	8192	8192	8192
Rice	Mean	1205.835	2228.961	11760.01	2188.854	3272.888	29498.69	2370.043	3881.12	37594.71
	Std Dev.	588.1142	2181.356	14503.86	1134.081	2615.77	15094.29	1262.312	2637.034	50991.64
	Min	632.6989	581.9226	250	641.6957	580.1642	4395	636.3497	592.4973	400
	Max	9823.781	32836.96	200165	17954.53	32352.02	187352	16062.52	32126.7	1653200
	Obs.	1984	1984	1984	2233	2233	2233	9992	9992	9992
Main export crops	Mean	1415.444	3392.292	14058.95	2913.869	6095.626	50035.58	2865.149	4745.447	87781.05
	Std Dev.	763.8515	3268.074	13966.92	1396.513	5332.938	22506.29	1681.762	3278.303	108277.1
	Min	655.5554	595.1584	700	668.3075	641.0767	13251	661.9562	697.8714	1100
	Max	5502.093	20253.97	65835	7743.051	31930.03	161200	15316.62	32263.17	936000
	Obs.	79	79	79	243	243	243	1181	1181	1181
Other export crops	Mean	1422.605	2839.797	12518.11	2371.039	3299.853	30405.18	2641.501	4309.072	42263.15
	Std Dev.	685.3914	3739.296	16657.67	1352.125	2531.955	16198.06	1633.2	3023.609	58158.55
	Min	641.1921	601.6185	145	642.0324	616.2089	6555	678.9702	683.3324	810
	Max	4300.459	25073.38	125210	12183.87	16451.14	162416	16090.9	30092.4	1260690
	Obs.	115	115	115	257	257	257	1129	1129	1129
import-competing crops	Mean	1434.692	2303.38	16439.59	2223.277	4110.429	30030.66	2438.909	4152.161	41147.29
	Std Dev.	785.5209	1808.142	52780.9	1124.119	3511.499	14803.79	1495.762	3064.595	68697.35
	Min	638.0425	583.5345	310	763.335	687.3796	5162	632.3506	766.8577	500
	Max	4542.778	11332.75	429000	7330.38	23243.84	101753	12432.19	30170.09	1301850
	Obs.	68	68	68	369	369	369	1712	1712	1712
Non-traded food	Mean	1713.105	3394.557	9093.655	2944.834	5428.627	36216.86	3212.053	5584.73	80363.81
	Std Dev.	821.2369	2458.819	8167.273	1560.53	4595.308	18145.84	1635.302	3774.486	88996.52
	Min	766.6361	707.5646	1240	1133.982	650.2026	4147	781.5004	1139.245	1250
	Max	3904.79	9992.304	38770	12939.04	27087.97	119059	10509.04	33041.25	759300
	Obs.	29	29	29	107	107	107	501	501	501
Total	Mean	1501.673	2994.423	24725.37	3075.931	4828.271	34363.51	3314.752	5368.969	75403.3
	Std Dev.	985.8579	3260.65	61269.39	2202.777	4409.839	30268.27	2309.087	4038.796	128504.5
	Min	632.6236	581.9226	145	641.6957	580.001	1606	632.3506	592.4973	330
	Max	13302.89	32836.96	1856910	18447.21	33397.65	569448	18474.96	33041.25	2690650
	Obs.	3377	3377	3377	5212	5212	5212	26304	26304	26304

All monetary values are in VN dongs

Table 3A-4: Main descriptive statistics of households in the sample by trade-related sectors (cont'd)

Trade sectors	Statistics	Real pc consumption	Real pc income	Current value of Assets/Durables	Real pc consumption	Real pc income	Current value of Assets/Durables	Real pc consumption	Real pc income	Current value of Assets/Durables
			2004			2006			2008	
Exporting industries	Mean	4194.41	7098.479	166570.5	5484.575	8104.154	178169.8	7431.721	8807.368	305554.5
	Std Dev.	2373.103	4872.359	243364.5	2910.144	4973.715	243101.4	3326.838	5019.76	392335.1
	Min	659.4932	1068.277	1300	1267.986	1358.74	1800	1890.487	1399.764	3000
	Max	18009.55	31422.96	1600000	17637.29	31921.04	2014000	18603.3	32504.56	3200000
	Obs.	567	567	567	561	561	561	357	357	357
Import-competing industries	Mean	4751.13	7275.56	209212.8	5830.48	8496.445	225846	7213.916	8786.651	306531.6
	Std Dev.	2883.759	4727.285	289705.9	2881.169	4785.573	280211.4	3409.095	5256.447	362044.7
	Min	804.9464	1373.189	2000	1176.05	1406.036	2800	1202.683	831.3502	6000
	Max	17426.08	31739.94	2048380	17756.82	32552.32	1643450	18455.94	32561.08	3006300
	Obs.	506	506	506	519	519	519	584	584	584
Non trade non food	Mean	5442.173	7799.166	240375	6827.813	8997.766	264558	7998.437	9280.396	362571.2
	Std Dev.	3058.865	4758.865	309790.3	3450.417	4902.625	319453.3	3773.926	5262.812	449682.1
	Min	762.8577	742.0001	600	930.5538	1295.668	417	1290.584	909.3856	2400
	Max	18538.53	32610.54	3400000	18586.1	33385.17	2400000	18620.55	33084.13	3023950
	Obs.	2548	2548	2548	2664	2664	2664	1151	1151	1151
Rice	Mean	2963.063	4482.403	67849.33	3909.159	7039.552	83972.15	5315.16	7805.027	125349.8
	Std Dev.	1632.501	3113.673	114108	2107.268	4862.857	116821.2	2800.208	5300.841	161537.2
	Min	636.2792	662.9399	500	672.7744	1287.076	1500	682.2064	857.7307	1199
	Max	15168.72	32610.57	2250000	18482.16	33404.89	2400000	18584.97	33315.67	2065000
	Obs.	2891	2891	2891	3242	3242	3242	3032	3032	3032
Main export crops	Mean	3897.313	6512.622	152681.3	5693.544	8731.128	257178.7	7612.386	8280.179	389977.8
	Std Dev.	2201.884	4347.045	174252	2959.028	5593.56	283022.7	3490.674	5379.078	376865.4
	Min	660.0689	723.0797	10000	1234.334	1582.989	8000	1485.559	1027.04	3000
	Max	15519.49	30273.98	1980700	17913.47	31283.97	2090000	18552.71	28746.93	2118500
	Obs.	379	379	379	290	290	290	328	328	328
Other export crops	Mean	3343.519	5054.932	90692.55	4698.161	6307.187	131835.8	6193.856	6795.463	162927.4
	Std Dev.	2152.001	3978.047	143519	2419.178	3901.14	155912.8	3323.963	4636.765	190772.5
	Min	649.9424	618.9159	1500	779.4249	1259.98	2500	1199.062	954.6352	3388
	Max	15193.62	29642.49	1262000	13095.32	25989.33	1230200	17675.93	31684.09	1530000
	Obs.	372	372	372	215	215	215	369	369	369
import-competing crops	Mean	2900.893	4627.119	69519.02	4671.11	6601.615	118328.4	5374.714	5834.104	152408.7
	Std Dev.	1667.725	3135.846	108253.4	2424.836	4061.37	206149.1	3098.08	3888.351	223396.5
	Min	671.829	993.0854	2000	1258.001	1334.528	5000	1300.961	1141.184	2200
	Max	10585.72	21311.11	1020000	17009.25	24843.68	2000000	18198.8	29505.73	1803800
	Obs.	417	417	417	220	220	220	384	384	384
Non-traded food	Mean	4114.86	5867.191	162244.5	5629.526	7690.066	180524.9	6875.863	7992.48	283518.5
	Std Dev.	2018.181	4038.008	180554	3147.224	5826.151	170270.9	3200.153	5353.364	343254.9
	Min	1184.327	878.6608	2000	1548.176	1482.076	4400	1828.302	1525.087	4000
	Max	12254.45	26558.29	1039000	17925.98	31339.33	916500	16404.09	32152.04	1724500
	Obs.	140	140	140	90	90	90	102	102	102
Total	Mean	4056.495	6091.663	147345.6	5276.399	7919.612	171695.1	6300.213	8070.583	215784.7
	Std Dev.	2617.109	4341.264	235251	3079.31	4964.403	248729.6	3373.366	5239.045	309481.4
	Min	636.2792	618.9159	500	672.7744	1259.98	417	682.2064	831.3502	1199
	Max	18538.53	32610.57	3400000	18586.1	33404.89	2400000	18620.55	33315.67	3200000
	Obs.	7820	7820	7820	7801	7801	7801	6307	6307	6307

All monetary values are in VN dongs

Table 3A-5: Income regressions (1992-2008) with dummies for trade categories

dep.variable: log of real per capita income	**1992**	**1998**	**2002**	**2004**	**2006**	**2008**
Demographic characteristics						
Age of the household head	0.000682	0.0173***	0.0103***	0.00204	0.0128***	0.0176***
	(0.908)	(0.001)	(0.000)	(0.574)	(0.000)	(0.000)
Age^2 of the household head	0.0000117	-0.000136***	-0.0000836***	-0.0000341	-0.000114***	-0.000167***
	(0.841)	(0.006)	(0.000)	(0.325)	(0.000)	(0.000)
Household Size	-0.0147	-0.0373**	-0.0747***	-0.0256**	-0.0619***	-0.0668***
	(0.496)	(0.048)	(0.000)	(0.037)	(0.000)	(0.000)
Household $Size^2$	0.000731	0.00204	0.00422***	0.000954	0.00336***	0.00380**
	(0.637)	(0.181)	(0.000)	(0.344)	(0.003)	(0.029)
No. of Children	-0.0872***	-0.113***	-0.118***	-0.118***	-0.110***	-0.117***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Married Head	0.0347	0.134***	0.100***	0.0782***	0.113***	0.117***
	(0.326)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)
Head sex	0.00275	-0.00864	-0.0396***	-0.0598***	-0.0459**	-0.0401+
	(0.937)	(0.757)	(0.000)	(0.004)	(0.013)	(0.106)
Education						
Primary education	0.119***	0.103***	0.131***	0.125***	0.141***	0.161***
	(0.002)	(0.005)	(0.000)	(0.000)	(0.000)	(0.000)
Lower secondary education	0.206***	0.280***	0.228***	0.238***	0.244***	0.287***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Upper secondary education	0.282***	0.424***	0.355***	0.288***	0.310***	0.384***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Tech/voc education	0.213***	0.349***	0.437***	0.381***	0.423***	0.450***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
University	0.305***	0.559***	0.569***	0.550***	0.517***	0.640***
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Occupation						
White-collar	0.0898	0.223***	0.0914***	0.103***	0.112***	0.133***
	(0.156)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)
Personal services	0.267***	0.182***	0.110***	0.0343	0.0618**	0.00921
	(0.000)	(0.000)	(0.000)	(0.228)	(0.016)	(0.757)
Production	0.106*	0.0286	0.0286**	-0.0165	-0.0240	-0.00320
	(0.052)	(0.436)	(0.024)	(0.478)	(0.269)	(0.930)
None	-0.00468	-0.0462	-0.0173	-0.0830***	-0.0604**	-0.0179
	(0.913)	(0.193)	(0.230)	(0.003)	(0.035)	(0.587)
Village characteristics						
Urban	-0.0574	-0.0840	0.0785***	0.0114	-0.0538*	-0.0987***
	(0.655)	(0.240)	(0.000)	(0.695)	(0.083)	(0.007)
Roads	-0.0853	-0.0326	-0.0452**	0.0606**	-0.0611**	0.00751
	(0.258)	(0.613)	(0.038)	(0.014)	(0.026)	(0.804)
Electricity	0.0533	0.315***	0.110***	0.0843	0.302***	0.201***
	(0.445)	(0.000)	(0.000)	(0.150)	(0.000)	(0.006)
Water	0.117	0.105	0.0719***	0.0162	0.0341	0.0616*
	(0.314)	(0.185)	(0.000)	(0.518)	(0.231)	(0.051)
Transport	0.00384	0.0308	0.0408***	0.0269*	0.0373**	0.0416**
Constant	7.627***	6.959***	8.114***	8.743***	8.121***	8.420***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Dummies for trade categories	(0.933)	(0.437)	(0.003)	(0.094)	(0.016)	(0.015)
Exporting industries	0.0144	-0.0550	-0.0337*	0.0231	-0.00539	-0.00468
	(0.857)	(0.380)	(0.081)	(0.435)	(0.845)	(0.887)
Import-competing industries	0.0457	0.101*	0.0471**	0.0361	0.0661**	0.0506*
	(0.463)	(0.054)	(0.011)	(0.197)	(0.013)	(0.072)
Rice	-0.265***	-0.293***	-0.260***	-0.273***	-0.0573**	-0.0000530
	(0.000)	(0.000)	(0.000)	(0.000)	(0.013)	(0.998)
Main export crops	0.182	0.136	-0.103***	-0.0208	0.0811*	-0.0187
	(0.264)	(0.243)	(0.000)	(0.636)	(0.086)	(0.706)
Other export crops	-0.162*	-0.275***	-0.198***	-0.214***	-0.231***	-0.202***
	(0.070)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
import-competing crops	-0.223**	-0.0979+	-0.186***	-0.227***	-0.125***	-0.204***
	(0.016)	(0.116)	(0.000)	(0.000)	(0.005)	(0.000)
Non-traded food	0.0609	0.0715	-0.0839**	-0.193***	-0.188***	-0.134**
	(0.660)	(0.536)	(0.019)	(0.001)	(0.009)	(0.041)
Province Dummies	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Adjusted R^2	0.263	0.357	0.427	0.353	0.296	0.305
Obs	3377	5212	26304	7820	7801	6307

+p$\leq$ 0.15; $*p \leq 0.10$; $**p \leq 0.05$; $***p \leq 0.01$

Appendix 3B - The VEP estimation procedure

VEP method uses an ordinary least squares (OLS) procedure to estimate a standard reduced-form of the consumption function based on the following simple linear econometric specification:[28]

$$c_{ht} = \alpha + \beta X_{ht} + \varphi V_t + \epsilon_{ht} \tag{3B-1}$$

where c_{ht} is the log of per capita consumption of household h at time t; $X$and V are two vectors of exogenous variables which control, respectively, for the households and villages characteristics; ϵ_{it} is an error term. It acknowledges the stochastic nature of consumption simply by noting that the error term in Eq. 3B-1 is not the same for all households (i.e., violation of the homoskedasticity hypothesis), rather there is heterogeneity in consumption volatility around the mean. Thus, it addresses the issue, by using a 3-steps Feasible Generalized Least Squares (FGLS) econometric procedure suggested by Amemiya (1977). At first, it estimates the residuals from the equation 3B-1 and run the following estimating process of the error variance assumed as a function of the same covariates included in the specification of the consumption process. Specifically, we have:

$$\epsilon^2_{ht} = \delta X_{ht} + \lambda V_{ht} + \eta_{ht} \tag{3B-2}$$

Eq. 3B-2 solves the heteroskedasticity problem and contributes to build up efficient estimates of the expected consumption level. From an economic perspective, it provides a robust method to link the households characteristics to the amount of unexplained consumption which is peculiar to vulnerability analysis. The outcomes of the regressions of Eq. 3B-2 are reported in Table 3B-1.

The predictions of Eq. 3B-2 are thus used to weight the previous equation, obtaining the following transformed version:

$$\frac{\epsilon^2_{ht}}{\epsilon^2_{ht,OLS}} = \delta \frac{X_{ht}}{\epsilon^2_{ht,OLS}} + \lambda \frac{V_{ht}}{\epsilon^2_{ht,OLS}} + \frac{\eta_{ht}}{\epsilon^2_{ht,OLS}} \tag{3B-3}$$

As reported in Chaudhuri (2003), the OLS estimation of Eq. 3B-3 gives us back an asymptotically efficient FGLS estimate, δ^{FGLS}, λ^{FGLS} and thus ϵ^2 is a consistent estimate of σ^2_{ht}, the variance of the idiosyncratic component of

[28]It is worth noting that such a simple specification of the consumption function has already been used by previous works on poverty in Vietnam which exploit the same VLSS and VHLSS surveys, e.g. Glewwe et al. 2002; Minot and Baulch 2005; Niimi et al. 2007; Justino et al. 2008; Cuong et al. 2010, Nguyen and Winters 2011.

household consumption. Once we obtain an efficient estimate of the variance we can finally take the square root of it and transform Eq.3B-1 as follows:

$$\frac{lnc_{ht}}{\widehat{\sigma}_{ht,FGLS}} = \theta\frac{X_{ht}}{\widehat{\sigma}_{ht,FGLS}} + \phi\frac{V_{ht}}{\widehat{\sigma}_{ht,FGLS}} + \frac{\eta_{ht}}{\widehat{\sigma}_{ht,FGLS}} \tag{3B-4}$$

The OLS estimation of Eq. 3B-4 provides consistent and asymptotically efficient estimate of θ^{FGLS}; ϕ^{FGLS}. It is thus possible to estimate both the expected log consumption and its variance as follows:[29]

$$\widehat{E}[(lnc_{ht}|X_{ht}, V_{ht})] = \theta^{FGLS}X_{ht} + \phi^{FGLS}V_{ht} \tag{3B-5}$$

$$\widehat{Var}[(lnc_{ht}|X_{ht}, Y_{ht})] = \delta^{FGLS}X_{ht} +^{FGLS} V_{ht} \tag{3B-6}$$

To compute the vulnerability rates in Table 1 households are considered vulnerable to expected poverty if they show a probability of being poor ($\widehat{V_h}$) bigger than that of being non-poor ($1-\widehat{V_h}$), which seems to us a fair decision strategy. To better clarify the concept, it is useful to provide a representation of the distribution of the aggregate VEP vulnerability across different thresholds and comparing it across the different years of observation. Figure 3B-1 shows the relationship between the incidence of vulnerability in the total population (on the vertical axis) and the different probability thresholds (on the horizontal axis, ranging from 0 to 1). To understand this relationship it is useful starting from the extreme cases: when the probability threshold is set to zero, all the households should be considered as vulnerable (no households in Vietnam show a probability equal zero to fall below the poverty line); when the probability threshold is set to one, the vulnerability incidence on the total population is equal to zero (no households show full probability to fall below the poverty line). Consequently, it is straightforward to see that when the probability threshold is set somewhere in between, the percentage of vulnerable households over the total population falls somewhere in between too.

Table 1 in section 3.4 reports the vulnerability rates as percentage of total population (vertical axis) corresponding to 0.50 on the horizontal axis. For instance, comparing the picture of 1992 with 1998 it is straightforward to see the jump in the VEP figures reported in Table 1 (the upper line corresponding to 0.50 probability threshold is above the 50% of total population on the vertical axes in 1992 it is in fact 56.11% - and largely below 50% in 1998

[29]To address measurement errors and likely omitted variable bias, Chaudhuri and Datt (2001) make a multiplicative adjustment to the estimated variances such that the predicted mean of the consumption be equal to its observed mean for each year of estimation.

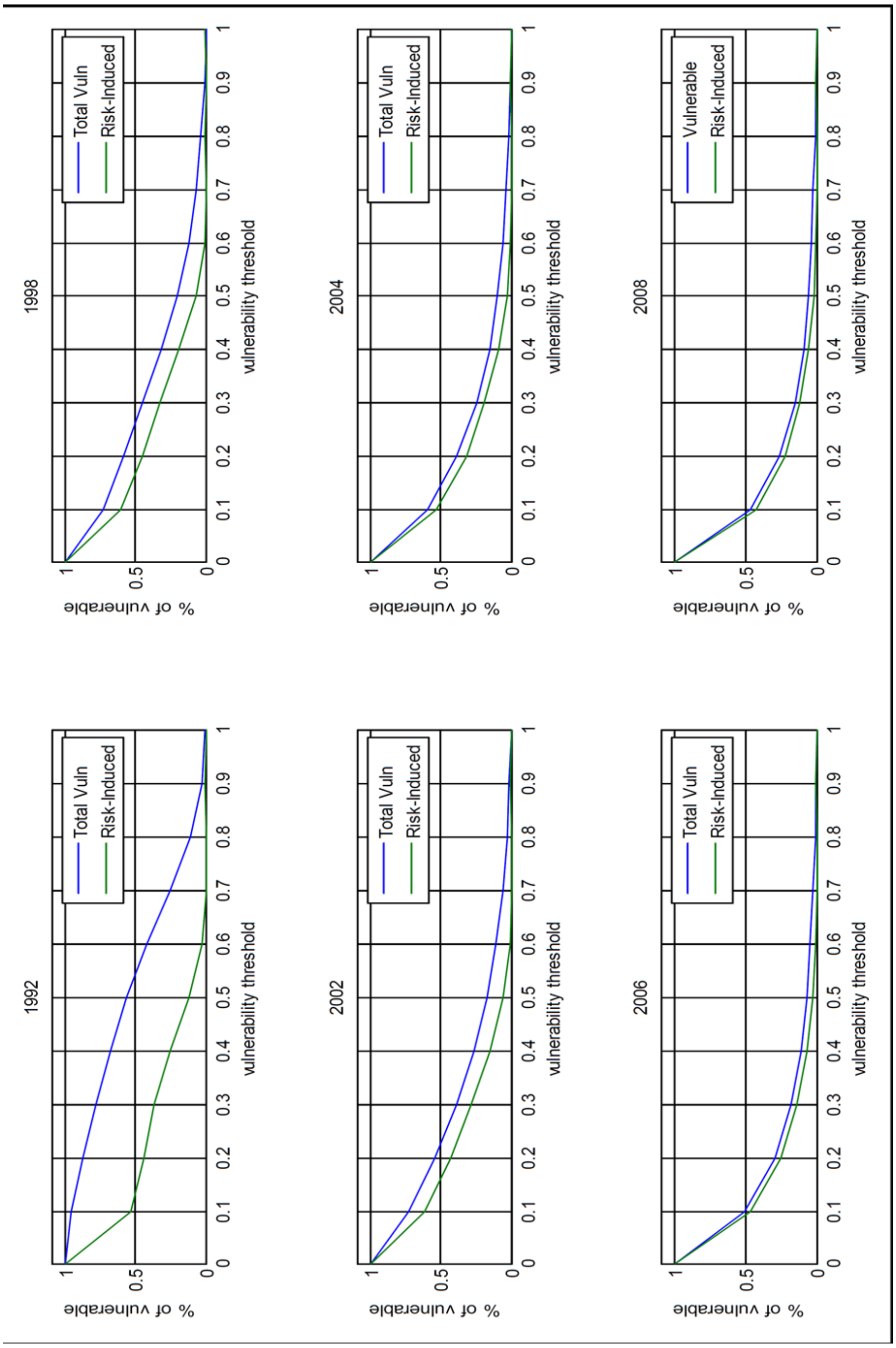
it is actually 21.50%). Thanks to Figure 3B-1 we can see that a similar pattern is actually in place for different probability thresholds and that the decreasing trend of vulnerability is apparent for all the possible thresholds. This is evident looking at the decreasing slopes of the curves representing vulnerability which become increasingly convex year after year. From this figure it is also easy to detect the narrowing gap between the fraction of risk induced vulnerable within the overall vulnerable population. As we can see from the Figure 3B-1, the distance between the two lines decrease over time, indicating that recently most of the Vietnamese households are vulnerable not because of their structural characteristics, rather because of the presence of risk.

Table 3B-1: Variance regressions (1992-2008)

dep.variable:Variance of cons. eq. residuals	**1992**	**1998**	**2002**	**2004**	**2006**	**2008**
Demographic characteristics						
Age of the household head	0.00783	-0.00402	0.00944*	0.00346	0.00938	0.0118
	(0.00667)	(0.0112)	(0.00540)	(0.0118)	(0.0140)	(0.0160)
Age^2 of the household head	-0.000114*	0.0000155	-0.0000884*	-0.0000526	-0.0000308	-0.0000395
	(0.0000668)	(0.000108)	(0.0000509)	(0.000109)	(0.000130)	(0.000148)
Household Size	-0.0241	0.0469	0.00279	0.0425	-0.158***	-0.212***
	(0.0206)	(0.0388)	(0.0222)	(0.0435)	(0.0535)	(0.0656)
Household Size^2	0.000789	-0.00181	-0.00302+	-0.00492	0.0116**	0.0116*
	(0.00137)	(0.00315)	(0.00192)	(0.00383)	(0.00490)	(0.00624)
No. of Children	-0.0802***	-0.119***	-0.0211+	-0.0157	-0.0454	0.0501
	(0.0149)	(0.0235)	(0.0131)	(0.0279)	(0.0331)	(0.0389)
Married Head	-0.113**	-0.132*	-0.213***	-0.190**	-0.354***	-0.276**
	(0.0480)	(0.0717)	(0.0381)	(0.0819)	(0.0936)	(0.111)
Head sex	0.0581	-0.0388	0.138***	0.122*	0.199**	0.164*
	(0.0406)	(0.0607)	(0.0320)	(0.0685)	(0.0784)	(0.0952)
Education						
Primary education	0.109***	0.179**	0.240***	0.101+	0.0701	0.0608
	(0.0396)	(0.0799)	(0.0302)	(0.0630)	(0.0733)	(0.0839)
Lower secondary education	0.174***	0.0583	0.240***	0.0446	0.0352	-0.0255
	(0.0445)	(0.0880)	(0.0328)	(0.0686)	(0.0796)	(0.0902)
Upper secondary education	0.150**	-0.0792	-0.0395	0.00624	-0.0289	-0.0186
	(0.0717)	(0.0993)	(0.0449)	(0.0960)	(0.112)	(0.130)
Tech/voc education	0.366***	0.174+	0.0241	-0.0299	-0.131	0.114
	(0.0563)	(0.119)	(0.0494)	(0.0854)	(0.101)	(0.115)
University	0.593***	0.113	0.301***	0.351***	-0.104	-0.0994
	(0.100)	(0.137)	(0.0621)	(0.121)	(0.138)	(0.164)
Village characteristics						
Urban	-0.0652	-0.347***	-0.490***	-0.430***	-0.233*	0.332***
	(0.106)	(0.103)	(0.0353)	(0.0964)	(0.127)	(0.129)
Roads	0.118*	-0.131	0.189***	-0.0193	0.131	-0.0379
	(0.0638)	(0.103)	(0.0375)	(0.0832)	(0.0957)	(0.110)
Electricity	0.132*	0.0142	0.240***	0.100	-0.0876	-0.166
	(0.0705)	(0.118)	(0.0501)	(0.185)	(0.296)	(0.315)
Water	-0.188*	-0.135	-0.306***	0.0381	0.0422	-0.138
	(0.102)	(0.108)	(0.0337)	(0.0881)	(0.117)	(0.112)
Transport	0.0976**	-0.0485	-0.000999	-0.0445	-0.0213	0.0357
	(0.0411)	(0.0572)	(0.0264)	(0.0525)	(0.0603)	(0.0673)
Constant	0.822***	0.500	-1.696***	-1.387***	-2.275***	-2.894***
	(0.213)	(0.438)	(0.185)	(0.446)	(0.559)	(0.630)
Province Dummies	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Adjusted R^2	0.297	0.226	0.084	0.043	0.023	0.020
Obs	4222	5446	27140	8117	8162	6702

+p$\leq$ 0.15; $*p \leq 0.10$; $**\,p \leq 0.05$; $***p \leq 0.01$

Figure 3B-1: Incidence of vulnerability for different vulnerability thresholds by year



Appendix 3C - Additional consumption estimates (robustness checks)

Figure 3C-1: Visual representation of factor loadings

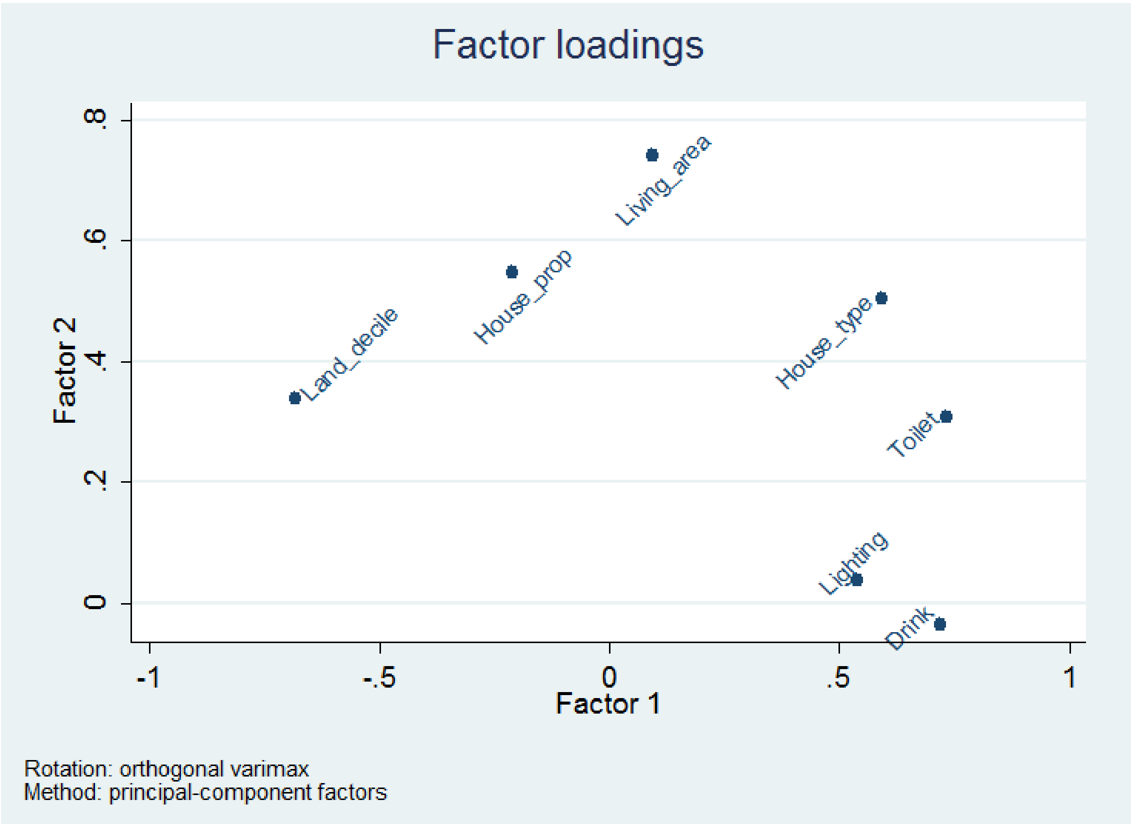


Table 3C-1: Consumption estimates (1992-2008) with dummies for trade categories

	1992	**1998**	**2002**	**2004**	**2006**	**2008**
Demographic characteristics						
Age of the household head	0.0129***	0.0202***	0.0140***	0.0116***	0.0145***	0.0158***
	(0.00325)	(0.00286)	(0.000989)	(0.00198)	(0.00210)	(0.00244)
Age^2 of the household head	-0.000102***	-0.000170***	-0.000114***	-0.0000855***	-0.000120***	-0.000133***
	(0.0000325)	(0.0000274)	(0.00000950)	(0.0000185)	(0.0000201)	(0.0000229)
Household Size	-0.0517***	-0.110***	-0.0811***	-0.0754***	-0.0646***	-0.0591***
	(0.0117)	(0.00972)	(0.00386)	(0.00714)	(0.00760)	(0.0101)
Household Size^2	0.00195**	0.00496***	0.00413***	0.00383***	0.00299***	0.00194**
	(0.000754)	(0.000800)	(0.000323)	(0.000600)	(0.000652)	(0.000927)
No. of Children	-0.0498***	-0.0652***	-0.103***	-0.111***	-0.113***	-0.113***
	(0.00718)	(0.00519)	(0.00231)	(0.00428)	(0.00463)	(0.00562)
Married Head	0.0660***	0.124***	0.0871***	0.0949***	0.0906***	0.0797***
	(0.0221)	(0.0176)	(0.00720)	(0.0142)	(0.0143)	(0.0184)
Head sex	-0.0492***	-0.0370**	-0.0551***	-0.0860***	-0.0704***	-0.0670***
	(0.0184)	(0.0149)	(0.00608)	(0.0119)	(0.0117)	(0.0143)
Education						
Primary education	0.0818***	0.114***	0.133***	0.159***	0.147***	0.194***
	(0.0178)	(0.0250)	(0.00559)	(0.0101)	(0.0108)	(0.0124)
Lower secondary education	0.131***	0.244***	0.235***	0.290***	0.267***	0.314***
	(0.0214)	(0.0280)	(0.00621)	(0.0115)	(0.0118)	(0.0134)
Upper secondary education	0.222***	0.374***	0.378***	0.378***	0.368***	0.385***
	(0.0319)	(0.0305)	(0.00846)	(0.0162)	(0.0164)	(0.0187)
Tech/voc education	0.191***	0.365***	0.457***	0.477***	0.491***	0.488***
	(0.0258)	(0.0326)	(0.00957)	(0.0151)	(0.0154)	(0.0176)
University	0.387***	0.627***	0.661***	0.669***	0.701***	0.691***
	(0.0478)	(0.0425)	(0.0122)	(0.0212)	(0.0195)	(0.0239)
Village characteristics						
Urban	0.126**	0.213***	0.213***	0.214***	0.123***	0.0276
	(0.0519)	(0.0307)	(0.0116)	(0.0172)	(0.0208)	(0.0215)
Roads	0.0235	0.0484	-0.0201+	0.0337**	-0.00357	0.0285+
	(0.0374)	(0.0342)	(0.0122)	(0.0153)	(0.0142)	(0.0183)
Electricity	0.0672+	0.175***	0.110***	0.0994***	0.246***	0.195***
	(0.0451)	(0.0420)	(0.0148)	(0.0311)	(0.0386)	(0.0512)
Water	0.0703	0.0534*	0.0967***	0.00931	0.0554***	0.0580***
	(0.0528)	(0.0322)	(0.0111)	(0.0148)	(0.0186)	(0.0187)
Transport	-0.0519**	0.00199	0.0357***	0.0367***	0.0164*	0.0432***
	(0.0262)	(0.0201)	(0.00757)	(0.00957)	(0.00954)	(0.0110)
Ex-Ante Components						
Income risk	-0.00243***	-0.000253	-0.00228***	-0.00513	-0.00108***	-0.00777
	(0.000631)	(0.00103)	(0.000555)	(0.00459)	(0.000366)	(0.00605)
Ex-Post Components						
Positive Income Shock	1.952***	3.083***	4.388***	4.420***	4.139***	3.568***
	(0.170)	(0.159)	(0.0873)	(0.127)	(0.131)	(0.152)
Negative Income Shock	-1.722***	-1.761***	-5.180***	-4.026***	-4.824***	-4.128***
	(0.154)	(0.150)	(0.0906)	(0.152)	(0.153)	(0.175)
Constant	6.914***	7.036***	7.561***	8.002***	7.783***	8.101***
	(0.0922)	(0.0914)	(0.0501)	(0.0826)	(0.0833)	(0.101)
Dummies for trade categories						
Exporting industries	-0.0383	-0.116***	-0.0725***	-0.0351**	-0.0382**	0.00262
	(0.0438)	(0.0263)	(0.0108)	(0.0153)	(0.0169)	(0.0187)
Import-competing industries	-0.0680*	-0.0333	-0.0261***	-0.0334**	-0.0240+	0.0000625
	(0.0360)	(0.0299)	(0.00882)	(0.0147)	(0.0153)	(0.0163)
Rice	-0.176***	-0.204***	-0.218***	-0.205***	-0.223***	-0.155***
	(0.0226)	(0.0200)	(0.00630)	(0.0105)	(0.0105)	(0.0131)
Main export crops	-0.0313	0.0303	-0.0799***	-0.0343	0.0358	0.0894***
	(0.0636)	(0.0420)	(0.0195)	(0.0246)	(0.0291)	(0.0278)
Other export crops	-0.121***	-0.174***	-0.180***	-0.159***	-0.133***	-0.0715***
	(0.0460)	(0.0306)	(0.0125)	(0.0215)	(0.0277)	(0.0252)
import-competing crops	-0.162***	-0.160***	-0.191***	-0.211***	-0.0833***	-0.0867***
	(0.0473)	(0.0248)	(0.0108)	(0.0184)	(0.0239)	(0.0220)
Non-traded food	0.00948	0.00609	-0.109***	-0.0839***	-0.0506	-0.0321
	(0.0646)	(0.0514)	(0.0172)	(0.0316)	(0.0385)	(0.0349)
Province Dummies	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Adjusted R^2	0.536	0.667	0.768	0.732	0.707	0.638
Obs	3377	5212	26304	7820	7801	6307

+p$\leq$ 0.15; $*p \leq 0.10$; $**p \leq 0.05$; $***p \leq 0.01$

Table 3C-2: List of the housing characteristics used in the principal component analysis

Variables	Questions	Options	1992 Obs.	1992 Mean	1992 Std. Dev.	1992 Min	1992 Max	1998 Obs.	1998 Mean	1998 Std. Dev.	1998 Min	1998 Max	2002 Obs.	2002 Mean	2002 Std. Dev.	2002 Min	2002 Max
Lighting	What is the main source of lighting in your house? 2=Gas, Oil, Kerosene Lamps; 3=Battery Lamp, Resin Torch; 4=Electricity	1=None; 3368	3.11	0.99	2	4	5165	3.63	0.77	2	4	26303	3.69	0.76	1	4	
Toilet	What type of toilet does your household have? 2=Others; 3=Toilet over the water; 4=Double Vault Compost Latrine; 5=Sulabh; 6=Flush Toilet with septic Tank/sewage pipes	1=No Toilet; 3377	1.79	0.41	1	2	5212	1.84	0.37	1	2	26303	4.20	1.70	2	6	
Drink	What is the main source of cooking/drinking water of your household? 2=Water from hand-dug and uncovered wells; 3=Water from hand-dug and covered wells; 4=Water from hand-dug and reinforced wells; 5= Water pumped from deep drill wells; 6=rain water; 7=Filtered spring water; 8=Bought water; 9=Public tap water; 10=private tap water	1=River, Lake, Pond; 3377	9.96	1.56	6	10	5212	9.57	2.65	4	10	26303	9.74	2.46	5	10	
House type	What type of structure does your household belong to? 2=Semi-permanent house; 3=Houses with a shared kitchen or bath/toilet; 4=Houses with a private kitchen and bath/toilet; 5=Villas	1= Temporary House; 645	1.84	1.21	1	5	842	2.31	1.30	1	5	26274	1.96	0.74	1	5	
House prop.	Does your household own this dwelling? 3=yes	2=No; 3377	2.93	0.25	2	3	5212	2.96	0.21	2	3	26274	2.97	0.17	2	3	
Living area	What is the household total living area in sqm?		513	59.61	40.19	3	420	5212	46.22	24.22	3.5	342	26287	56.11	45.87	0	1998
Land decile	Reference decile of the total agricultural land area		2533	3.66	2.51	1	10	3288	6.50	1.89	3	10	26304	5.19	3.13	1	10

Variables	Questions	Options	2004 Obs.	2004 Mean	2004 Std. Dev.	2004 Min	2004 Max	2006 Obs.	2006 Mean	2006 Std. Dev.	2006 Min	2006 Max	2008 Obs.	2008 Mean	2008 Std. Dev.	2008 Min	2008 Max
Lighting	What is the main source of lighting in your house? 2=Gas, Oil, Kerosene Lamps; 3=Battery Lamp, Resin Torch; 4=Electricity	1=None; 7820	3.84	0.57	1	4	7801	3.89	0.48	1	4	6307	3.91	0.48	1	4	
Toilet	What type of toilet does your household have? 2=Others; 3=Toilet over the water; 4=Double Vault Compost Latrine; 5=Sulabh; 6=Flush Toilet with septic Tank/sewage pipes	1=No Toilet; 7820	4.42	1.77	1	6	7801	4.66	1.78	1	6	6307	4.70	1.77	2	6	
Drink	What is the main source of cooking/drinking water of your household? 2=Water from hand-dug and uncovered wells; 3=Water from hand-dug and covered wells; 4=Water from hand-dug and reinforced wells; 5= Water pumped from deep drill wells; 6=rain water; 7=Filtered spring water; 8=Bought water; 9=Public tap water; 10=private tap water	1=River, Lake, Pond; 7820	8.85	2.63	4	10	7801	9.43	3.26	1	10	6307	9.39	3.07	1	10	
House type	What type of structure does your household belong to? 2=Semi-permanent house; 3=Houses with a shared kitchen or bath/toilet; 4=Houses with a private kitchen and bath/toilet; 5=Villas	1= Temporary House; 7820	2.04	0.76	1	5	7801	2.11	0.77	1	5	6307	2.14	0.75	1	5	
House prop	Does your household own this dwelling? 3=yes	2=No; 7820	2.99	0.11	2	3	7801	2.99	0.10	2	3	6307	2.99	0.08	2	3	
Living area	What is the household total living area in sqm?		7820	59.81	32.91	1	600	7801	62.32	33.00	5	425	6307	65.45	35.25	1	600
Land decile	Reference decile of the total agricultural land area		6733	6.42	2.53	1	10	5410	7.01	2.23	3	10	5723	6.10	2.98	1	10

Table 3C-3: Rotated factor loadings (pattern matrix) and unique variances

Variable	Factor1	Factor2	Uniqueness
Lighting	0.5586	0.0519	0.6853
Toilet	0.6736	0.4065	0.3810
Drink	0.7137	0.0274	0.4899
House prop	-0.2717	0.4053	0.7619
House type	0.4878	0.5973	0.4053
Living area	-0.0695	0.7838	0.3808
Land deciles	-0.7294	0.2047	0.4261

Uniqueness is the percentage of variance for the variable that is not explained by the common factors.

Table 3C-4: Consumption estimates (1992-2008) with wealth in scaling factor proxied by an index of housing characteristics and land availability (and dummies for trade categories)

	1992	**1998**	**2002**	**2004**	**2006**	**2008**
Demographic characteristics						
Age of the household head	0.0468***	0.0142	0.0140***	0.0129***	0.0136***	0.0160***
	(0.0148)	(0.0221)	(0.000989)	(0.00217)	(0.00245)	(0.00260)
Age^2 of the household head	-0.000530***	-0.0000986	-0.000114***	-0.0000988***	-0.000117***	-0.000135***
	(0.000152)	(0.000202)	(0.00000951)	(0.0000202)	(0.0000237)	(0.0000244)
Household Size	-0.0318	-0.134***	-0.0804***	-0.0743***	-0.0649***	-0.0580***
	(0.173)	(0.0447)	(0.00386)	(0.00760)	(0.00927)	(0.0106)
Household Size^2	0.00138	0.00906**	0.00408***	0.00369***	0.00323***	0.00186*
	(0.0120)	(0.00425)	(0.000324)	(0.000631)	(0.000799)	(0.000976)
No. of Children	-0.0958+	-0.105***	-0.103***	-0.112***	-0.120***	-0.113***
	(0.0568)	(0.0378)	(0.00232)	(0.00468)	(0.00538)	(0.00585)
Married Head	0.131	0.216**	0.0875***	0.0857***	0.0853***	0.0802***
	(0.125)	(0.0896)	(0.00720)	(0.0156)	(0.0183)	(0.0191)
Head sex	0.0180	-0.182**	-0.0554***	-0.0773***	-0.0664***	-0.0717***
	(0.171)	(0.0745)	(0.00609)	(0.0128)	(0.0158)	(0.0148)
Education						
Primary education	0.00291	0.142	0.133***	0.156***	0.146***	0.194***
	(0.188)	(0.102)	(0.00559)	(0.0110)	(0.0129)	(0.0129)
Lower secondary education	-0.0623	0.318***	0.234***	0.288***	0.258***	0.312***
	(0.0727)	(0.0834)	(0.00622)	(0.0127)	(0.0139)	(0.0140)
Upper secondary education	-0.00190	0.378***	0.378***	0.369***	0.367***	0.382***
	(0.0766)	(0.0906)	(0.00847)	(0.0177)	(0.0204)	(0.0196)
Tech/voc education	0.0574	0.402***	0.457***	0.461***	0.465***	0.481***
	(0.132)	(0.126)	(0.00961)	(0.0163)	(0.0194)	(0.0186)
University	.	0.489***	0.661***	0.671***	0.677***	0.679***
	.	(0.153)	(0.0122)	(0.0231)	(0.0314)	(0.0245)
Village characteristics						
Urban	-2.023**	-0.0374	0.213***	0.212***	0.0846***	0.0171
	(0.767)	(0.136)	(0.0116)	(0.0184)	(0.0262)	(0.0222)
Roads	0.386*	0.135	-0.0197+	0.0379**	-0.00725	0.0377**
	(0.190)	(0.221)	(0.0123)	(0.0157)	(0.0160)	(0.0190)
Electricity	1.597***	-0.243+	0.110***	0.111***	0.244***	0.250***
	(0.337)	(0.155)	(0.0148)	(0.0332)	(0.0426)	(0.0603)
Water	.	0.0511	0.0966***	0.00734	0.0333*	0.0706***
	.	(0.142)	(0.0111)	(0.0157)	(0.0201)	(0.0192)
Transport	0.453	-0.00441	0.0359***	0.0334***	0.0155+	0.0377***
	(0.400)	(0.0577)	(0.00758)	(0.0103)	(0.0103)	(0.0115)
Ex-Ante Components						
Income risk	-0.00000155	-0.000000156	-1.81e-14***	1.95e-10+	-4.17e-12**	-3.23e-10+
	(0.00000291)	(0.000000243)	(3.67e-15)	(1.31e-10)	(1.73e-12)	(2.22e-10)
Ex-Post Components						
Positive Income Shock	2.645**	2.418***	4.385***	4.503***	4.206***	3.530***
	(1.005)	(0.357)	(0.0873)	(0.135)	(0.157)	(0.160)
Negative Income Shock	-2.275+	-0.654	-5.179***	-3.962***	-4.748***	-4.128***
	(1.378)	(0.908)	(0.0907)	(0.162)	(0.181)	(0.185)
Constant	7.258***	7.182***	7.703***	7.687***	8.528***	8.395***
	(1.329)	(0.581)	(0.0436)	(0.0954)	(0.0965)	(0.103)
Dummies for trade categories						
Exporting industries	-0.398	-0.101	-0.0728***	-0.0301*	-0.0167	-0.000104
	(1.158)	(0.129)	(0.0108)	(0.0170)	(0.0236)	(0.0192)
Import-competing industries	-1.178*	0.0367	-0.0261***	-0.0327**	-0.0203	0.00375
	(0.671)	(0.192)	(0.00883)	(0.0163)	(0.0204)	(0.0171)
Rice	-1.023+	-0.146**	-0.218***	-0.210***	-0.187***	-0.153***
	(0.609)	(0.0634)	(0.00631)	(0.0115)	(0.0121)	(0.0138)
Main export crops	.	0.422**	-0.0786***	-0.0412+	0.0685**	0.0902***
	.	(0.182)	(0.0196)	(0.0258)	(0.0313)	(0.0280)
Other export crops	-0.917*	0.0739	-0.180***	-0.168***	-0.102***	-0.0790***
	(0.526)	(0.136)	(0.0125)	(0.0230)	(0.0300)	(0.0267)
import-competing crops	.	-0.0934	-0.190***	-0.219***	-0.0609**	-0.0863***
	.	(0.126)	(0.0108)	(0.0195)	(0.0253)	(0.0235)
Non-traded food	.	-0.151	-0.108***	-0.0681**	-0.0448	-0.0317
	.	(0.113)	(0.0172)	(0.0339)	(0.0400)	(0.0357)
Province Dummies	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Adjusted R^2	0.568	0.508	0.768	0.728	0.668	0.639
Obs	84	305	26274	6733	5410	5723

+p$\leq$ 0.15; $*p \leq 0.10$; $**p \leq 0.05$; $***p \leq 0.01$

Table 3C-5: Consumption estimates (1992-2008) with wealth in scaling factor proxied by observed consumption

	1992	**1998**	**2002**	**2004**	**2006**	**2008**
Demographic characteristics						
Age of the household head	0.016***	0.014***	0.009***	0.003	0.010***	0.015***
Age^2 of the household head	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
Household Size	-0.061***	-0.087***	-0.086***	-0.075***	-0.084***	-0.090***
Household Size^2	0.003***	0.004***	0.004***	0.004***	0.004***	0.004***
No. of Children	-0.080***	-0.096***	-0.108***	-0.116***	-0.113***	-0.116***
Married Head	0.084***	0.121***	0.088***	0.098***	0.067***	0.040**
Head sex	-0.067***	-0.040***	-0.064***	-0.105***	-0.054***	-0.02
Education						
Primary education	0.154***	0.127***	0.152***	0.176***	0.172***	0.219***
Lower secondary education	0.264***	0.307***	0.273***	0.331***	0.301***	0.350***
Upper secondary education	0.371***	0.466***	0.437***	0.470***	0.440***	0.456***
Tech/voc education	0.357***	0.492***	0.553***	0.601***	0.583***	0.571***
University	0.595***	0.755***	0.772***	0.866***	0.812***	0.858***
Village characteristics						
Urban	0.280***	0.324***	0.296***	0.278***	0.188***	0.121***
Roads	-0.032	0.079**	-0.018	0.072***	0.025	0.028
Electricity	0.071	0.227***	0.144***	0.137***	0.305***	0.183***
Water	0.142*	0.160***	0.136***	0.044***	0.052**	0.032*
Transport	-0.017	0.035*	0.051***	0.062***	0.048***	0.049***
Ex-Ante Components						
Income risk	-0.534***	-1.907***	-2.306***	-2.934***	-3.944***	-3.246***
Ex-Post Components						
Positive Income Shock	2.915***	5.091***	5.144***	5.592***	5.516***	5.102***
Negative Income Shock	1.585***	2.900***	5.867***	4.983***	5.710***	5.185***
Constant	6.799***	7.869***	8.674***	9.202***	9.416***	9.565***
Province Dummies	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Adjusted R^2	*0.601*	*0.757*	*0.807*	*0.792*	*0.772*	*0.73*
Obs	*4222*	*5446*	*27140*	*8117*	*8162*	*6702*

*p$\leq$ 0.10; $**p \leq 0.05$; $***p \leq 0.01$

Chapter 4

Essay 4 - Trade openness and vulnerability to poverty in Vietnam: a panel empirical test in the period 2002-2006

This paper assesses trade-induced vulnerability in Vietnam by presenting an extended version of Ligon and Schechter's (2003) measure of Vulnerability as low Expected Utility (VEU) and using the VHLSS panel data available for 2002-06. The empirical results show that risk-induced vulnerability and heterogeneity in trade exposure by industry matters in determining household overall vulnerability. They also show that the *ex-ante* permanent risk is significantly correlated with both the non-stochastic, via the precautionary saving channel, and the risk components of vulnerability and that this correlation actually increases for the upper percentiles of vulnerability distribution (with the most vulnerable households being the most severely affected). This work is relevant to policymaking since it is, to the best of my knowledge, the first empirical evidence of the direct influence of the trade-related risks on household vulnerability in a panel setting.

Keywords: trade openness, vulnerability, poverty, risk, consumption behaviour, Vietnam.

JEL: F14, O12, D12, C31

4.1 Introduction

Various attempts have been made to empirically investigate the link between trade liberalisation and household welfare in Vietnam under *Doi Moi*, focusing mainly on the impact of liberalisation on poverty indicators (Justino et al., 2008; Jenkins, 2004; Nadvi et al., 2004; van de Walle and Cratty, 2004; Jensen and Tarp, 2005; Nguyen and Ezaki, 2005; Fujii and Roland-Holst, 2007; Niimi et al., 2007; Abbott et al., 2009 ; Heo and Doanh, 2009; Coello et al., 2010). Few attempts have been made to date to further investigate the impact of the Vietnamese opening process on *ex-ante* measures of vulnerability to poverty and the consequent role played by the permanent components of risk associated with trade liberalisation. This can be considered a remarkably weakness since trade can alter a household's risk exposure and its vulnerability. As shown in Essay 2, risk-averse people react to risk by modifying their optimal behaviour, thus encouraging additional/extra saving and reducing current consumption. Although consumption fluctuations are seen as optimal responses to risk, they imply a smoothless path of consumption which in turn implies permanent negative effects on welfare. This is especially true for people characterised 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-saving and follow conservative choices shying away from profitable but risky investments (Winters et al., 2004).

To deal with this issue, here we propose a novel empirical approach to isolating the trade-induced component of vulnerability, taking into account the different role played by the *ex-ante* effects of risk and the *ex-post* effects of shocks. More specifically, we present: i) an extended version of the Ligon and Schechter's (2003) measure of Vulnerability as low Expected Utility (VEU) able to isolate the component of risk-exposure associated with trade openness (i.e., risks that are not fully shared across trade-related industries) as well as the *ex-ante* effects of risk from the *ex-post* effects of shocks; and ii) an empirical application of the proposed extended measure by exploiting the panel data available in Vietnam for the period 2002-06.[1]

Our results show that i) trade exposure and its related risks matter in determining household overall vulnerability; ii) the *ex-ante* permanent risk is significantly correlated with both the "random" and "non-random" components of vulnerability: iii) the relative impact of the *ex-ante* permanent

[1]The VHLSS collected information from a sample of 29,530 households in 2002 of which 4,476 were re-interviewed in 2004 and 2006, out of samples of 9,188 in total in 2004 and 9,189 in 2006. A new wave was also collected in 2008 but, unfortunately, it does not include panel data with the previous rounds.

risk actually increases for the upper percentiles of vulnerability distribution (with the most vulnerable households being the most severely affected).

This empirical evidence has strong policy implications. Although it does not represent, by any means, an argument against free trade, it is a quest to deepen our knowledge on the stabilisation needs of trade reforms, e. g., the promotion of credible stabilisation policies (e.g., reducing price fluctuations) and/or the design of new insurance schemes that target vulnerable households (e.g., raise the creditworthiness of small farmers' participation in export cropping).

The paper is organised as follows: Section II reviews the literature and presents the conceptual framework on trade and vulnerability to poverty; Section III provides the details on the adopted vulnerability measure; Section IV presents the empirical model and the data; Section V the empirical results and Section VI concludes.

4.2 Trade and vulnerability to poverty: the conceptual framework

Trade theory is mainly focused on the first moment of the relationship between trade openness and welfare which is incomplete when people are risk averse. Empirical evidence is mixed, scattered in separate fields of analysis and does not reach a common stance. As a result, current literature fails to make a full assessment of the net welfare impact of the opening-up process (see Essay 1).

In principle, trade openness could alter households' optimal portfolios, so that their current ones become sub-optimal *ex-ante*.[2] This is because trade openness can alter risk, impact on households' optimal portfolios, and lead to net welfare effects that are less positive than expected in the long run (Winters, 2002; Winters and al., 2004; Calvo and Dercon, 2007a).

As a result, households in the midst of trade reforms may decide to employ strategies to mitigate risks and reduce welfare variability.[3] These actions can

[2]Of course, *ex-post*, a household may lose out because of unlucky realisations. Hence, 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]Both management and coping strategies can operate through i) an informal channel, which includes personal, family and community arrangements; ii) a market-based channel, based on the opportunity provided by institutions such as banks, insurance or microfinance corporations; or iii) a public channel, which implies a series of welfare state interventions aimed at protecting specific subsets of the population, e.g. measures to deal with unemployment, old-age, work injury, disability, widowhood and sickness.

imply conservative choices, especially for the poor, that lower the expected value of income (and consumption) in exchange for lower variability.[4] While consumption fluctuations are seen as optimal responses to risk, they imply a smoothless path of consumption. Hence, these strategies can be costly in the short run because they encourage additional/extra saving and reduce current consumption (Kimball, 1990; Caballero, 1990; Deaton, 1992; Caroll, 2001; Caroll & Kimball, 2008) with permanent negative effects on welfare (Ravallion 1988; Morduch 1994; Dercon, 2005).

Consequently, any measure of vulnerability which is not able to adequately take into account trade exposure and the effect of the *ex-ante* change in behaviour induced by trade liberalisation is lacking an important component of welfare analysis.

To undertake the issue operationally, here we propose a workable measure of vulnerability that is able to isolate the net welfare cost of trade exposure and the relative effect of the *ex-ante* changing behaviour under trade risks. We then apply this measure to the VHLSS panel data for the available period 2002-06 to test the presence of heterogeneity in households' vulnerability associated with their degree of trade exposure. More specifically, our hypothesis is that the presence of heterogeneity in vulnerability scores is associated with heterogeneity in risk exposure and/or in the adopted mitigating strategies between households involved in "traded" and "non-traded" sectors. This is because while households engaged in non-traded sectors are mainly affected by domestic risks (e.g., bad weather, crops failure, livestock diseases, etc.), households engaged in import- and export-related sectors are also affected by foreign markets' risks (e. g, international price fluctuations, exchange rate fluctuations, etc.). This heterogeneity in risk exposure leads, *ceteris paribus*, to heterogeneity in risk management strategies including changes in their *ex-ante* consumption behaviour.

Note that the focus here is on behavioural heterogeneity. We do not make any additional assumption regarding the typology and sign of possible correlations between domestic and foreign risks (an issue on which empirical evidence has been somewhat inconclusive, see McCulloch et al., 2001) since this it is neither necessary nor particularly informative for our empirical analysis. Furthermore, we acknowledge that the presence of significant differences in vulnerability across households employed in different trade-related sectors

[4]The literature on income smoothing mainly focuses its interest on aspects related to farm production such as the intensity of input adoption (Morduch, 1990; Dercon and Christiaensen, 2011), diversification of activities (Morduch, 1990, Townsend, 1995, Dercon, 1996), occupational choices (Rosenzweig and Stark, 1989; Kochar, 1999; Rose, 1995) and their net impact on the expected profit of the household (Rosenzweig and Binswanger, 1993).

of specialisation does not provide information on the nature of the foreign risks and/or their channels of transmission to changes in household welfare. However, it is undeniable that the presence of heterogeneity in vulnerability scores across households classified by trade exposure strongly suggests the need for further, more detailed, analyses of the links between trade and vulnerability which is an issue that has so far been ignored in the specialised literature, both theoretical and applied.

4.3 Vulnerability as Expected Utility for trade analysis

In order to isolate the trade risk component of vulnerability, in this Essay we propose an extended version of Ligon and Schechter's (2003) measure of Vulnerability as low Expected Utility (VEU). By using a utilitarian approach, VEU assesses vulnerability as the difference between the utility derived from some level of certainty-equivalent consumption (based on and analogous to the choice of a poverty line in the literature of poverty measurement, z) above which the household would not be considered vulnerable, and the expected utility of consumption $[EU_i(c_i)]$, as follows:

$$V_i = U_i(z) - EU_i(c_i) \tag{1}$$

where U_i is a weakly concave, strictly increasing function.[5] Taking expectations of the increasing, concave function of consumption expenditures has the effect of making vulnerability depend not only on mean consumption, but also on its variation over time (Ligon and Schechter, 2003). To this end, VEU disentangles "poverty-induced" vulnerability - as a low expected mean of consumption - from "risk-induced" vulnerability, linked to consumption fluctuations, as follows:

$$V_i = [U_i(z) - U_i(E(c_{it}))] + [U_i(E(c_{it})) - EU_i(c_{it})] \tag{2}$$

where $E(c_{it})$ indicates the non-random expected level of consumption (i.e., the certainty equivalent consumption). While the first bracketed term of Eq.2 involves no random variables, the second one measures the "risk premium", i.e., the amount of utility the household would be prepared to give up rather than face a risky prospect. This is the "natural" counterpart,

[5]This method applies to the class of von Neumann-Morgenstern expected utility functions.

denominated in utils, of the risk premium the household would be willing to forego in order to eliminate risk.[6]

The VEU method 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.[7] Furthermore, it is micro founded, empirically based, and presents some clear advantages over other groups of micro-founded vulnerability measures, e.g., the class of vulnerability measures looking at the threat of poverty (VTP) (Calvo and Dercon, 2013; Povel, 2015, Chaudhuri et al., 2002; Kamanou & Morduch, 2004; Pritchett, Suryahadi, & Sumarto, 2000; Dutta et al., 2011; Gunther & Maier, 2008).[8] First, unlike the VTP class of measures, VEU addresses vulnerability to risk only after aggregation across states has been performed (Calvo, 2008). It implicitly assumes that it 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 the VTP class of measures using the short panel data currently available in developing countries.

Notwithstanding its virtues, the VEU measure presents drawbacks too. First, it treats mean consumption as being independent of risk, implying that risks affect only the volatility of consumption around its mean, but not the mean itself, thus underestimating the overall effect of risk (Elbers and Gunning, 2003). Second, it does not distinguish between whether vulnerability is generated by exposure to shocks, i.e., the lack of coping mechanisms (*ex-post* effects), or risk-induced change in behaviour, i.e., the long-term cost of undertaking *ex-ante* mitigating strategies (*ex-ante* effects). The latter issue is prominent since, as underlined in the previous sections, this distinction should be considered as an unavoidable element in the design of policy interventions.

To overcome the above caveats, we provide an extended version of the VEU measure for trade and vulnerability analysis in three steps.

[6]The concavity of the utility function implies that the so-called "Jensen's inequality" holds, i.e., the difference between the utility of consuming the expected consumption with certainty and the expected utility from consuming c_i is positive, on average.

[7]For a survey of the main methods applied in vulnerability analysis, please refer to the Appendix 1.A in Essay 1.

[8]VTP measures compute vulnerability as the *ex-ante* probability weighted average[s] of state-specific indices of deprivation. The main advantage of this group of measures is that vulnerability is associated with the extent that poverty cannot be safely ruled out in any of the possible future scenarios (Calvo, 2008).

First, following on from Ligon and Schecher (2003) and Ligon (2006), we further decompose the risk component of the VEU measure filtering out "aggregate risk", "meso (trade-related) risk" and "measurement error and idiosyncratic risk" respectively, as follows:

$$\begin{aligned} V_i = [U_i(z) - U_i(Ec_{it})]+ & \qquad \text{(Poverty)} \\ [U_i(Ec_{it}) - EU_i(E(C_{it}|\mu_k))]+ & \qquad \text{(trade-related risk)} \\ [EU_i(E(C_{it}|\mu_k)) - EU_i(E(C_{it}|\mu_k, \mu_t))]+ & \qquad \text{(Aggregate risk)} \\ [EU_i(E(C_{it}|\mu_k, \mu_t)) - EU_i(c_{it})]+ & \qquad \text{(Measurement error and idyosincratic risk)} \end{aligned} \tag{3}$$

where μ_t is an aggregate risk term, common to all households, which may vary over dates and (aggregate) states; μ_k represents a risk term which varies across k clusters of households that are supposed to be characterised by heterogeneity in their exposure to foreign risks.[9] 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 we assume heterogeneity in risk exposure between households involved in traded and non-traded sectors, we should verify that risks are not fully shared across them (because they are different in nature and/or because the lack of appropriate risk-sharing mechanisms) and that aggregate risks do not affect households homogeneously. To take this into account in our vulnerability measure, we filter out a further "meso component" able to capture any systematic variation in the expected level of log consumption across households classified by trade clusters. A simple joint significance test of the latent terms will provide an appropriate empirical test for this intuition (see section IV). To this end, it seems more natural to look at the aggregate/covariate risk as a residual sub-component of the VEU overall risk component after controlling for trade groups' deviations from risk sharing. If, on the other hand, we filter out the trade groups' deviations from the overall component of aggregate risk, this will imply that deviations from risk sharing by trade categories are considered as the residual subcomponent of the VEU overall risk component. Since trade cannot be considered orthogonal to time risks (i.e., they are correlated), both strategies are legitimate. Of course, the first component always captures all the common elements and, for this reason, we adopt the first strategy as the preferred one: it gives more emphasis to the trade-related risk component (Figs.1 and 2 show the comparison of the decomposition of overall risk using

[9]A similar procedure has been followed by Ligon (2006) for a different purpose.

the two different strategies highlighting this difference). It is worth noting that in all cases, we are simply attempting to provide alternative possible distributions of the VEU overall risk component - which remains invariant - into trade-related and non-trade-related sources. The added value is to exclude possible extreme interpretations that Vietnamese households are facing alternatively only trade-related risks or only non-trade-related risks.[10] The final sub-component in Eq. 3 contains the remaining idiosyncratic risk, i.e., any systematic deviation by households from the predictions of complete markets, other than trade risk heterogeneity, and likely measurement errors.

Second, as suggested by several authors (Elbers and Gunning 2003, Elbers et al. 2007, Elbers et al. 2009, Carter and Ikegami, 2009), we assume that households correctly perceive the distribution of risk they face even when they do not actually experience any shock. Hence. we further decompose the final sub-component of Eq. 3 by filtering out two additional sub-components of vulnerability: the *ex-ante* permanent component of risk and the *ex-post* component of shocks. This further decomposition presents some clear advantages over the standard VEU measure. First, it provides a distinct evaluation of the costs of mitigation strategies compared with the coping ones. Second, the permanent component of *ex-ante* risk also captures the impact of risk on mean consumption, via the standard precautionary savings channel, overcoming the main weakness of Ligon & Schechter's (2003) version of VEU. Our extended VEU measure becomes thus fully consistent with the theoretical and empirical prediction that a rational consumer can safeguard against future bad shocks by reducing current consumption and over accumulating saving in safe (unproductive) assets (see Essay 2 and also Caballero 1990, Deaton 1992, Caroll 2001). Unfortunately, we cannot decompose the impact of the *ex-ante* permanent risk on the non-random level of consumption from its impact on risk premium. However, we can test the significance of the two channels by presenting the correlates between our measure of permanent risk and the various components of our vulnerability measure (see section V).

Once we have filtered out both the *ex-ante* and the *ex-post* idiosyncratic components of risk, we leave only the unexplained risk and/or measurement error in the residuals, as follows:

[10]For an extensive discussion on how to work out with the original VEU measure after removing the hypothesis of complete markets, please refer to Ligon (2006).

$$\begin{aligned}
V_i = [U_i(z) - U_i(Ec_{it})] + & \quad \text{(Poverty)} \\
[U_i(Ec_{it}) - EU_i(E(c_{it}|\mu_k))] + & \quad \text{(trade-related risk)} \\
[EU_i(E(c_{it}|\mu_k)) - EU_i(E(c_{it}|\mu_k, \mu_t))] + & \quad \text{(Aggregate risk)} \\
[EU_i(E(c_{it}|\mu_k, \mu_t)) - EU_i(E(c_{it}|\mu_k, \mu_t, s^2_{\eta it}))] + & \quad \text{(Ex-ante idiosyncratic risk)} \\
[EU_i(E(c_{it}|\mu_k, \mu_t, s^2_{\eta it})) - EU_i(E(c_it|\mu_k, \mu_t, s^2_{\eta it}, x_{it}))] + & \quad \text{(Ex-post idiosyncratic risk)} \\
[EU_i(E(c_{it}|\mu_k, \mu_t, s^2_{\eta it}, x_{it})) - EU_i(c_{it})] + & \quad \text{(Unexplained risk and measurement error)}
\end{aligned} \tag{4}$$

where $s^2_{\eta it}$ is a latent idiosyncratic term for the *ex-ante* component of risk and x_{it} is a bundle of time variant idiosyncratic households characteristics. Thus, $E(c_{it}|\mu_k, \mu_t, s^2_{\eta it})$ is the expected value of household consumption conditional on knowledge of *ex-ante* idiosyncratic risk whereas $E(c_{it}|\mu_k, \mu_t, s^2_{\eta it}, x_{it})$ is the expected value of household consumption conditional on knowledge of *ex-ante* risk and a vector of idiosyncratic household characteristics able to capture the heterogeneity in households' exposure and their ability to cope with it. As in Ligon and Schechter (2003), this controls for the idiosyncratic risk component of the vulnerability measure that can be attributed to variation in m observed time-varying household characteristics by filtering it out from the risk component which cannot be explained by these characteristics and from the aggregate and meso variables as well as from all the other components (i.e., the unexplained variance and measurement error in consumption).

Third, we average the VEU outcomes and the value of its risk premia sub-components across the household cohorts belonging to the groups of industries grouped according to their degree of trade exposure and investigate them comparatively.

4.4 Model specification and Data

Model specification

To compute household vulnerability by using our extended VEU measure, we follow a three-step procedure.

First, we choose the utility function and its degree of concavity (i. e., the risk aversion parameter). As for the utility function, in line with Ligon and Schechter (2003), we adopt the Constant Relative Risk Aversion (CRRA) utility function which takes the form:

$$U(c) = \begin{cases} log(c) & \text{if } \gamma = 1, \\ \frac{c^{1-\gamma}}{1-\gamma} & \text{otherwise.} \end{cases} \tag{5}$$

where γ measures household relative risk aversion (Arrow, 1965; Pratt, 1964). Concerning the risk aversion parameter, estimates of risk aversion in the empirical literature range from 1 (i.e., log utility) to no more than 4 (Lucas, 2003).[11] Thus, we carry out our empirical analysis within this range (specifically, from 1 to 3).[12] We also normalise consumption for the poverty lines available for each period, so that for poor household consumption is below 1.

Second, we estimate the unconditional and the conditional expectations of household i consumption included in our vulnerability measure. In the first case, we assume a stationary environment - which is indeed reasonable in our case considering the very short panel - and compute the unconditional expectation of consumption as follows: $Ec_{it} = \frac{1}{T}\sum_{t=1}^{T} c_{it}$. For the conditional expectations, we assume that the expected consumption expenditure of household i in industrial trade cluster k at time t can be estimated using a linear equation of the conditional log consumption expenditure as follows:

$$E(c_{it}|\mu_k, \mu_t, s^2_{\eta it}, x_{it}) = \alpha_i + \mu_k + \mu_t + \omega s^2_{\eta it} + \beta x_{it} + v_{it} \tag{6}$$

where $\alpha, \mu_k, \mu_t, \omega, \beta$ are unknown parameters to be estimated: α captures the influence of the fixed household characteristics on predicted consumption; μ_k 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 (it follows: $\sum \mu_k = 0$); ω is the parameter attached to permanent *ex-ante* risk; and β is a vector of parameters attached to the matrix of household characteristics.[13] Note that if the latent variables μ_k are

[11]The common critique to these values is the Mehra and Prescott (1985) "equity premium puzzle". It shows that if we want to use a stochastic growth model with CRRA preferences to account for the entire return differential between stocks and bonds - historically about 6 percent - as a premium for risk, the parameter γ must be enormous, perhaps 50 or 100 (Lucas, 2003).

[12]According to Ligon and Schechter (2003), we do not expect our results to be very sensitive to the actual choice of γ since 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 the choice of γ (i.e., to the shape of the utility function), the relative magnitudes of the different components are less sensitive since greater concavity reflects greater welfare losses associated with all the components. We will see that our expectations are confirmed in the empirical analysis.

[13]In order to catch the individual contribution of the m sources of idiosyncratic risks,

jointly significant, then we can reject the null hypothesis of complete aggregate risk sharing across households clustered by trade-related industries.[14] The intuition behind 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. Similarly, if some risk is shared at the aggregate level, then estimates of μ_t will be significant too. The use of a panel fixed effects econometric procedure wipes out further sources of bias due to unobservable household heterogeneity in consumption.

Third, to derive parsimonious information on *ex-ante* risk from our data, we exploit the longitudinal dimension of the panel and derive the variance of innovations in income. The estimated equation, similarly to what has done in many of the previous empirical works (Carroll and Samwick 1997, 1998; Hubbard et al, 1994; Gourinchas and Parker, 2002; Jalan and Ravallion, 2001; Meghir and Pistaferri, 2004; Storesletten et al., 2004) is the following:

$$y_{it} = \delta_i + \gamma_k + \theta_t + \tau z_{it} + u_{it} \tag{8}$$

To filter out the permanent component of *ex-ante* risk, as in Carroll and Samwick (1997) and Krebs et al. (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. We then rely on the intuition that the random walk component in income of each household i implies a linearly increasing income dispersion over time as follows (for additional details on this decomposition, see Appendix 2B in Essay 2):

$$E[var[\Delta_d y_{it}]] = 2\sigma_\epsilon^2 + d\sigma_\eta^2 \tag{9}$$

we orthogonalise the m variables x_{it} by using a Gram-Schmidt procedure and then rewrite the fourth line of equation 4 as follows:

$$\begin{aligned}
[EU_i(E(c_{it}|\mu_k, \mu_t, s^2_{\eta it})) - EU_i(E(c_{it}|\mu_k, \mu_t, s^2_{\eta it}, x_{it}))] = \\
[EU_i(E(c_{it}|\mu_k, \mu_t, s^2_{\eta it})) - EU_i(E(c_{it}|\mu_k, \mu_t, s^2_{\eta it}, x_{1t}))] + \\
[EU_i(E(c_{it}|\mu_k, \mu_t, s^2_{\eta it})), x_{1t}) - EU_i(E(c_{it}|\mu_k, \mu_t, s^2_{\eta it}, x_{2t}))] + \\
\ldots \\
[EU_i(E(c_{it}|\mu_k, \mu_t, s^2_{\eta it})), x_{(m-1)it}) - EU_i(E(c_it|\mu_k, \mu_t, s^2_{\eta it}, x_{1t}...x_{mit}))].
\end{aligned} \tag{7}$$

[14]We are of course 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.

where $var[\Delta_d y_{it}]$ is the variance of log difference of income of length d for each household in the sample. By using two $var[\Delta_d y_{it}]$ of different lengths we can estimate the permanent component of the variance of income innovation at the household level as follows:

$$s^2_{\eta_i} = \upsilon^2_{yid} - \upsilon^2_{yid-1} \tag{10}$$

where $E(s^2_{\eta_i}) = \sigma^2_\eta$ and $\upsilon^2_{yid} = var[\Delta_d y_{it}]$. The latter relies on the assumption of no individual specific growth rates for income (other than those predictable by occupation, education, industry and other personal characteristics).[15]

We have already highlighted in section 3 that filtering out the permanent component of *ex-ante* risk lets us also capture the impact of risk on mean consumption via the standard precautionary savings channel, overcoming the main weakness of the Ligon & Schechter's (2003) version of VEU. A second motivation is that according to our econometric specification of the income process, filtering out the permanent component from the stochastic component of consumption leads to unbiased estimates of the *ex-ante* risk (since the transitory component also absorbs measurement errors). A third motivation is that the more persistent the effect of the stochastic component of income is, the larger its impacts are assumed to be (for a thorough analysis of this issue, see Reis, 2009).

Finally, in line with adoption of the CRRA utility function, we assume that poorer households are more responsive to changes in risk. To this end, we again scale up the permanent component of income *ex-ante* risk by the ratio between current household's income and expected lifetime wealth. Our final proxy for *ex-ante* permanent risk for each household i is thus the following:

$$s^2_{\eta_i t} = \pi_{it} s^2_{\eta_i} \tag{11}$$

where $\pi_{it} = (y_{it}/\widehat{w}_{it})^n$ and $\widehat{w}_{it}$ is our measure of the expected wealth.[16]

[15]As a robustness check, we run our income equation by also controlling for an additional time trend component in order to capture additional predictable linear unobservable components in the model (which may not be captured by the other predictable components). Unfortunately, we cannot control for this time trend at the household level since $T = 3$ and $\sum(\widehat{u}_1 + \widehat{u}_2 + \widehat{u}_3) = 0$. Hence, we assume that the unobservable components captured by the time trend are homogeneous within each trade category (and additional to those already captured by the trade categories fixed effects). The outcomes of the income equation that includes the linear trend by trade categories as well as the parameters for the fresh consumption equation are reported in Appendix 4B.

[16]Due to difficulties in extracting reliable information on the expected wealth from the available observations, we follow Banks et al. (2001) and Giles and Yoo (2007) by replacing expected wealth with an observed level of per capita consumption.

Again as a robustness check, we carry out our empirical analysis for different values of the exponent of the scaling factor (for $n = 1; 2; 3$, consistently with the various estimates of risk aversion parameter).[17] 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 to the households' responses to permanent risk and, hence, heterogeneity in expected mean consumption.

Data

We used panel data for the period 2002-2004-2006 taken 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 Statistics Office (GSO), jointly with the United Nations Development Programme (UNDP) and the Swedish International Development Agency (SIDA) with technical assistance from the World Bank. In each wave, two questionnaires were filled in, a household questionnaire and a community questionnaire. The first one contained 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 programmes. The community questionnaire gathered information on the demography, health, education and infrastructure of all the rural communities. The VHLSS collected information from a sample of 29,530 households in 2002 of which 4,476 were re-interviewed in 2004 and 2006, out of samples of 9,188 in total in 2004 and 9,189 in 2006. The number of surveyed communes was 2,091 in 2002, 3,063 in 2004 and 3,065 in 2006. Taking into account some inconsistency in the GSO original panel, here we used the Brandt et al. (2009) revised version of VHLSS panel data.[18] Moreover, the following sample restriction was introduced to reduce the influence of unobservables and measurement errors. First of all, we dropped all the households that match the following criteria: i) head of household changed during the panel period and ii) head of household not in the labour force during the entire period. Second, we dropped all the households for which we do not have information on income,

[17]According to Skinner (1988) and Guiso et al (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 declines with the household's resources and the decline is faster the higher the value.

[18]As highlighted by Brandt et al. (2009), the GSO original panel data 2002-06 are incorrect: of the 4,476 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.

consumption and/or assets. Third, to reduce the influence of outliers, we dropped households with per capita income or consumption lower than the first percentile or higher than the last one. Finally, we kept only the households that have observations for the entire panel period as well as real per capita income, consumption and assets other from zero. As a result of these restrictions, the sample decreased to a panel of 988 households.

The variable used for consumption was real per capita food and non-food expenditure in the past 12 months re-adjusted by price indexes of regions and months. Food expenditure included information on both market purchases and consumption from home production of 58 items whereas the non-food expenditure collected information on 32 items such as fabric, clothing, blankets, pillow, tailoring or laundry service, shoes, nylon sheeting, electrical equipment, etc. Poverty lines were expressed in Vietnamese *dongs* as follows: 1,915,000 for 2002; 2,070,000 for 2004; 2,559,000 for 2006.

Lastly, we converted all nominal variables into nationally representative January 2006 prices using three different set of deflators, as suggested by Brandt et al. (2009). Considering that households within each survey are interviewed during different months, the first set were monthly deflators which are needed to convert the income and consumption values to January prices in the respective year. Second, in order to take into account the differences in the cost of living across regions, we used regional deflators.[19] Third, to link January prices of 2002 and 2004 to January 2006, we used the Consumer Price Index (CPI) indicators provided by the GSO, which are 1.279 for 2002 and 1.193 for 2004.

For household per capita income, since the VHLSS do not provide a synthetic measure, we did as follows (for additional information, see also Brandt et al., 2009). We aggregated income into six major categories: income from crops, income from agricultural sidelines, household business income, wage income, gifts and remittances, and other residual sources of income. Income from crops is net income (gross revenue minus current expenditures) from rice; other cereals, vegetables, and annual crops; industrial crops; fruit crops; and crop by-products such as straw, leaves, etc. Agricultural sidelines include livestock and other animal products, agricultural services, forestry services, hunting, trapping, and domesticating wild animals, and aquaculture. Household business income is net income from non-agriculture, non-forestry, and non-aquaculture businesses run by the household and includes the processing of agricultural, forestry and aquaculture products. Wage income includes

[19]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.

salary or wage payments plus additional payments such as holiday contributions, social insurance payments, etc. for all jobs held by individuals during the past 12 months. Gifts and remittances include payments from both domestic and overseas sources. Finally, "other" residual sources of income include items such as government transfers and earned interest as well as rental income from land and housing.

The set of covariates used in our empirical exercise includes household characteristics (such as characteristics of the head of household head, i.e., linear and quadratic age, marital status, sex; linear and quadratic terms of family size and number of children); education achievements (primary, secondary, upper secondary, technical/vocational, university) as well as village-level infrastructure characteristics (such as the presence of roads, water pipelines, public transports, urban/rural environment). We also include province dummies to control for spatial heterogeneity. As in Essay 3, the classification of industries by trade exposure has been taken from Coello et al. (2010). This is reported in Table 3A-3 in the Appendix in Essay 3. Coello et al. (2010) manually matched the ISIC code of any sector with the SITC classification used in Comtrade and GSO statistics and classified industries as net exporter or net importer according to their trade performance. Non-traded industries are those that cannot be matched with trade data. Crops are classified as export-oriented, import-competing and subsistence crops (non-traded). The main export crops are those that represent the bulk of Vietnam's agricultural exports, whereas rice is classified as a special category since it is both an export crop and the most important item for self-consumption. The full list of the variables used in the empirical analysis as well as the main descriptive statistics are reported in Tables 4A-1 and 4A-2.

4.5 Empirical results

In this section, we follow the pattern depicted in the previous sections first by predicting expected consumption using eq. 6 and then by estimating the different conditional expectations shown in eq. 4. We thus derive our vulnerability measure and its sub-components. Finally, we present the empirical correlation between our measure of *ex-ante* permanent risk and each vulnerability sub-component.

Since the presence of observed consumption in the scaling term makes it likely that errors in the measurement of this term will be correlated with errors in the measurement of the dependent variable, as in Essay 3, we apply alternative strategies to deal with this issue. As a first strategy , we use one lag of the observed consumption. Table 1 reports the estimated coefficients of eq. 6. using this strategy.[20] Two different specifications are presented and replicated for different values (from one to three) of the exponents of the scaling factor: the first column presents the outcomes with only household and time fixed effects specification[21]; the second column adds the trade-related fixed effects.

It should be noted first that, in both specifications, the covariates are statistically significant and show the expected signs. The signs of age of the head of household and its square coefficients confirm the well-known concave age-consumption profile. Not surprisingly, having children reduces household consumption. The education variables also behave as expected: i.e., higher levels of education actually correspond to higher levels of consumption (although the estimated coefficients are only significant for university education). Urban households, as expected, consume more than rural ones whereas the characteristics of the head of household do not seem to be significant.

Second, the joint significance of the trade-related fixed effects (i.e., groups of households belonging to clusters of industries that are supposed to be characterised by a similar degree of trade exposure), confirms the intuition of the presence of a significant systematic variation in household consumption patterns by trade-related clusters of industries.[22] The significance of the aggregate year fixed effects shows that some time variant shocks are shared at the macro level too. Note that the estimated coefficients attached to these fixed effects should be read relative to the benchmark category (non-traded non-food activities and year 2002, respectively, for trade-related and year fixed effects) and, as expected, they are positive by year and negative (with different magnitudes) by trade-related clusters. Due to the joint significance of the trade-related fixed effects, we can argue that the model specification presented in the first columns is mis-specified due to omitted variable bias.

We should take into account that the identification of trade fixed effects in the triple fixed effect specification (i.e., including time, household and trade cluster) applied in the model shown in the second columns is driven by those households that move across trade-related groups. This is because

[20] It is worth recalling that because of the use of lagged consumption in the scaling factor, the panel is reduced to 1976 observations (i.e., T=2)

[21] We assume that the random effects estimators are inconsistent since we cannot rule out the possibility that the heterogeneity terms are correlated with the observables. This implies the inability to identify separately the parameters associated with the set of household observed characteristics which are time-invariant.

[22] To preserve these moving patterns across the trade-related industry clusters in the empirical analysis, we do not control for time variant trade-related fixed effects which would be able, in principle, to capture further time variant factors which are contemporaneous to the moving of households across trade-related sectors.

Table 1: Panel regression on household consumption in Vietnam (2002-06)

dep.var.: log of real pc consumption	1 (with π)		2 (with π^2)		3 (with π^3)	
Ex-ante components						
permanent risk						
(expected wealth in scaling factor=						
L. real pc cons.)	0.00000813	-0.0000743	-5.75e-08**	-6.97e-08***	-1.05e-11***	-1.18e-11***
	(0.000214)	(0.000234)	(2.30e-08)	(2.46e-08)	(2.70e-12)	(3.06e-12)
transitory risk	0.0000120	0.000131	-1.36e-09	5.57e-09	2.06e-12	2.78e-12+
	(0.000167)	(0.000170)	(1.35e-08)	(1.44e-08)	(1.69e-12)	(1.89e-12)
Ex-post components						
Age hh head	0.0417**	0.0424***	0.0423**	0.0434***	0.0424**	0.0435***
	(0.0165)	(0.0159)	(0.0165)	(0.0159)	(0.0165)	(0.0159)
Age sq. hh head	-0.000394**	-0.000398***	-0.000400***	-0.000408***	-0.000401***	-0.000410***
	(0.000153)	(0.000148)	(0.000153)	(0.000148)	(0.000153)	(0.000149)
hh size	-0.158***	-0.158***	-0.160***	-0.161***	-0.159***	-0.160***
	(0.0300)	(0.0298)	(0.0297)	(0.0294)	(0.0295)	(0.0292)
hh size sq	0.00613***	0.00612***	0.00620***	0.00627***	0.00616***	0.00623***
	(0.00226)	(0.00223)	(0.00225)	(0.00222)	(0.00224)	(0.00221)
No of children	-0.0527**	-0.0516**	-0.0526**	-0.0519**	-0.0532**	-0.0525**
	(0.0231)	(0.0233)	(0.0231)	(0.0233)	(0.0231)	(0.0233)
Married hh head (yes=1)	0.0344	0.0346	0.0316	0.0314	0.0326	0.0321
	(0.0865)	(0.0837)	(0.0865)	(0.0838)	(0.0865)	(0.0839)
hh head sex (male=1)	-0.0222	-0.0320	-0.0191	-0.0273	-0.0207	-0.0277
	(0.0915)	(0.0895)	(0.0915)	(0.0894)	(0.0915)	(0.0895)
Prim educ (yes=1)	0.0401	0.0394	0.0405	0.0397	0.0401	0.0391
	(0.0461)	(0.0464)	(0.0465)	(0.0468)	(0.0464)	(0.0467)
Low secondary educ (yes=1)	0.0830	0.0815	0.0838	0.0814	0.0832	0.0805
	(0.0582)	(0.0584)	(0.0584)	(0.0586)	(0.0583)	(0.0584)
Upper secondary educ (yes=1)	0.0132	0.00630	0.0144	0.00735	0.0138	0.00624
	(0.0819)	(0.0812)	(0.0822)	(0.0813)	(0.0820)	(0.0812)
Tech/voc edu (yes=1)	0.0698	0.0696	0.0735	0.0729	0.0720	0.0707
	(0.0665)	(0.0669)	(0.0666)	(0.0670)	(0.0665)	(0.0669)
Univers. Edu (yes=1)	0.235*	0.226+	0.238*	0.227+	0.237*	0.226+
	(0.138)	(0.139)	(0.138)	(0.140)	(0.138)	(0.140)
Geographical loc (urban=1)	0.172**	0.157*	0.171**	0.154*	0.173**	0.155*
	(0.0708)	(0.0853)	(0.0707)	(0.0853)	(0.0706)	(0.0851)
pos. Income shocks	2.356***	2.379***	2.550***	2.681***	2.502***	2.636***
	(0.569)	(0.569)	(0.536)	(0.532)	(0.535)	(0.531)
neg. Income shocks	2.298***	2.128***	2.296***	2.194***	2.265***	2.175***
	(0.538)	(0.539)	(0.507)	(0.507)	(0.505)	(0.504)
cons	8.240***	8.217***	8.237***	8.219***	8.223***	8.204***
	(0.546)	(0.539)	(0.540)	(0.534)	(0.543)	(0.538)
Fixed effects:						
trade-related:						
Exporting industries		-0.0943*		-0.0919*		-0.0914*
		(0.0508)		(0.0502)		(0.0502)
Import-competing industries		-0.0623+		-0.0558		-0.0506
		(0.0411)		(0.0408)		(0.0409)
Rice		-0.0401+		-0.0417+		-0.0411+
		(0.0271)		(0.0269)		(0.0269)
Main export crops		-0.172***		-0.171***		-0.172***
		(0.0526)		(0.0522)		(0.0523)
Other export crops		-0.0810+		-0.0809+		-0.0813+
		(0.0552)		(0.0556)		(0.0554)
import-competing crops		-0.144***		-0.123***		-0.115***
		(0.0537)		(0.0447)		(0.0435)
Non-traded food		-0.0485		-0.0486		-0.0527
		(0.0995)		(0.0976)		(0.0976)
household	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
years	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
No Obs.	1976	1976	1976	1976	1976	1976
Adj R-sq	0.823	0.824	0.824	0.825	0.825	0.826

Robust standard errors in parentheses. $^{+}p \leq 0.15 * p \leq 0.10; ** p \leq 0.05; *** p \leq 0.01$
In the fixed effects specification the category "non-traded activities" and year 2002 act, respectively, as the benchmark from trade-related and year fixed effects.

the k trade cluster 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 et al., 2006). This identification strategy looks reasonable since the kernel densities of log consumption of both moving and non-moving households look quite similar (see Fig. 4A-1 in the Appendix), whereas the lack of a significant correlation across households between the permanent component of *ex-ante* risk (filtered out from the residuals of the income regression as shown in Eq. 10) and the trade-related fixed effects on consumption supports the assumption of exogeneity of the moving decision with regard to risk (see Table 4A-6 in the Appendix). Hence, our identification strategy based on moving households does not seem to be affected by any significant bias. For a closer look into how many households move from one trade group to another over the course of the panel and what the origin and destination trade groups are, see Tables 4A-3 and 4A-4 in Appendix 4A. Specifically, Tab. 4A-3 derives the number of moving households by trade categories by decomposing the between and within variation of the panel. The between variation looks at the variation across households whereas the within variation indicates the percentage of households that are always in the reference trade category. In practice, when looking at a specific trade category, the between variation tells us how many households have been in that trade category at least once, whereas the within variation tells us how many of these households have always been in that trade category (the latter is a measure of stability of the trade-related status). For example, focusing on "exporting industries", the table shows that 78 households have ever been in that category over the course of the panel (7.89% of the 988 total households in the panel). This figure includes 47 households that have always been in that category (i.e., 60.26% of the 78 households that have ever been in this specific trade category). This means that 31 households out of 78 (3.14% of the total households in the sample) have not always been in the same trade category over the course of the panel. Looking at all trade categories, the table confirms that, notwithstanding some heterogeneity across groups, 496 households in the panel actually move across trade-related categories over the course of the panel (i.e., 50.2% of the 988 total households in the panel). Another way to look at the issue is to compute the between total percentage for the entire panel time frame (i.e., the fraction of total households that have ever been in one of the possible trade categories: $[1484/988] * 100 = 150.2\%$). This confirms that 50.2% of the households have been counted more than once because they actually moved across groups. Tab. 4A-4 shows the details of the transition matrices by trade group of origin and trade group of destination (i.e., the frequencies and associated percentages of households that moved across trade categories over the periods 2002-2004 and 2004-2006).

Specifically, the frequencies (and associated percentages) of the households that changed trade categories from one survey to another for both periods are those that lie off the diagonal of the respective transition matrix.

Third, as expected, the *ex-ante* permanent component of risk is significantly and negatively correlated with household consumption. This also shows the consistency of our empirical exercise with the theoretical prediction of precautionary saving behaviour 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. In line with the outcomes in Essay 2, the overall loss due to permanent risk is tiny but statistically significant (about 0.03% of annual real per capita consumption for the average consumer characterised by a concave utility function).

To be consistent with the outcomes in Essay 3, even if in this case the adopted panel fixed effect specification softens the risk of residual endogeneity, we report in Table 2 the outcomes of the same estimates where in the scaling factor we proxy household wealth with the same index of house characteristics and land physical availability applied in Essay 3. It is useful to recall that this is derived by applying principal component analysis to available VHLSS data and is not influenced by monetary terms. Table 2 shows that the permanent risk coefficients in this case decline both in magnitude and significance. However, it is apparent that the negative relation is still significant when we assume that the poorer households are characterised by a higher degree of concavity of the utility function (i.e., when we adopt the square of the scaling factor in the estimates). It is worth noting that, also in this case, we face a slight reduction in the number of observations because of the availability of data for the variables included in the index (see Tables 4A-1 and 4A-2 in Appendix 4A). As largely expected, the magnitude of the phenomenon actually decreases along with the number of additional controls to soften endogeneity in the estimates. Since we are working with a very short panel a prudent interpretation is to see the difference between the coefficients in Table 1 and Table 2 as upper bounds and lower bounds, respectively, of the true parameters.

As a further robustness check, we also run another income equation by controlling for an additional time trend component by trade categories in order to capture additional predictable linear unobservable components in the model (which may not be captured by the existing ones). The outcomes of the income equation that includes the linear trend by trade categories as well as the parameters for the fresh consumption equation are reported in Appendix 4B. As can be seen from Table 4B-2, whereas the outcomes are of course different in detail, the parameters for the consumption equation

Table 2: Panel regression on household consumption in Vietnam (2002-06): permanent risk with an index of house characteristics and land physical availability as a measure for wealth in the scaling factor

dep.var.: log of real pc consumption	1 (with π)		2 (with π^2)		3 (with π^3)	
Ex-ante components						
permanent risk						
(expected wealth in scaling factor=						
Index of house charact. & land)	-0.000000155	-0.000000106	-1.69e-13***	-1.78e-13***	-5.77e-21	-5.90e-21
	(0.000000276)	(0.000000290)	(4.12e-14)	(4.23e-14)	(8.98e-21)	(9.24e-21)
transitory risk	6.59e-08	4.09e-08	7.95e-14***	8.37e-14***	2.72e-21	2.78e-21
	(0.000000131)	(0.000000138)	(1.94e-14)	(1.99e-14)	(4.27e-21)	(4.39e-21)
Ex-post components						
Age hh head	0.0309***	0.0321***	0.0308***	0.0322***	0.0309***	0.0321***
	(0.00913)	(0.00902)	(0.00910)	(0.00899)	(0.00912)	(0.00901)
Age sq. hh head	-0.000301***	-0.000310***	-0.000300***	-0.000311***	-0.000300***	-0.000311***
	(0.0000842)	(0.0000833)	(0.0000839)	(0.0000830)	(0.0000841)	(0.0000832)
hh size	-0.148***	-0.149***	-0.147***	-0.148***	-0.148***	-0.149***
	(0.0265)	(0.0265)	(0.0265)	(0.0264)	(0.0265)	(0.0265)
hh size sq	0.00607***	0.00619***	0.00601***	0.00613***	0.00608***	0.00620***
	(0.00224)	(0.00223)	(0.00223)	(0.00223)	(0.00224)	(0.00223)
No of children	-0.0417***	-0.0414***	-0.0423***	-0.0418***	-0.0417***	-0.0413***
	(0.0150)	(0.0149)	(0.0150)	(0.0149)	(0.0150)	(0.0149)
Married hh head (yes=1)	-0.0309	-0.0348	-0.0312	-0.0343	-0.0310	-0.0346
	(0.0569)	(0.0559)	(0.0569)	(0.0558)	(0.0569)	(0.0559)
hh head sex (male=1)	-0.0275	-0.0230	-0.0272	-0.0238	-0.0274	-0.0231
	(0.0654)	(0.0646)	(0.0655)	(0.0645)	(0.0654)	(0.0646)
Prim educ (yes=1)	0.0319	0.0305	0.0324	0.0307	0.0321	0.0305
	(0.0369)	(0.0363)	(0.0369)	(0.0363)	(0.0369)	(0.0363)
Low secondary educ (yes=1)	0.0672+	0.0666+	0.0660+	0.0651+	0.0676+	0.0671+
	(0.0450)	(0.0448)	(0.0449)	(0.0447)	(0.0450)	(0.0448)
Upper secondary educ (yes=1)	0.0316	0.0286	0.0281	0.0248	0.0316	0.0285
	(0.0656)	(0.0654)	(0.0656)	(0.0654)	(0.0656)	(0.0654)
Tech/voc edu (yes=1)	0.0771	0.0775	0.0710	0.0713	0.0763	0.0767
	(0.0555)	(0.0556)	(0.0556)	(0.0556)	(0.0556)	(0.0557)
Univers. Edu (yes=1)	0.0980	0.0921	0.0947	0.0889	0.0978	0.0919
	(0.107)	(0.109)	(0.107)	(0.108)	(0.107)	(0.109)
Geographical loc (urban=1)	0.0187	0.0156	0.0194	0.0172	0.0188	0.0158
	(0.0753)	(0.0760)	(0.0753)	(0.0760)	(0.0753)	(0.0760)
pos. Income shocks	2.864***	2.946***	2.895***	2.988***	2.869***	2.952***
	(0.421)	(0.423)	(0.422)	(0.424)	(0.422)	(0.423)
neg. Income shocks	2.356***	2.267***	2.332***	2.229***	2.353***	2.261***
	(0.438)	(0.441)	(0.438)	(0.441)	(0.438)	(0.441)
cons	8.119***	8.084***	8.117***	8.076***	8.120***	8.083***
	(0.357)	(0.358)	(0.357)	(0.358)	(0.357)	(0.358)
Fixed effects:						
trade-related:						
Exporting industries		-0.00318		-0.00458		-0.00351
		(0.0552)		(0.0552)		(0.0552)
Import-competing industries		-0.00860		-0.0180		-0.0106
		(0.0392)		(0.0391)		(0.0392)
Rice		-0.0312		-0.0330		-0.0316
		(0.0250)		(0.0250)		(0.0250)
Main export crops		-0.105**		-0.106**		-0.105**
		(0.0512)		(0.0513)		(0.0512)
Other export crops		-0.0460		-0.0461		-0.0461
		(0.0433)		(0.0431)		(0.0432)
import-competing crops		-0.0866*		-0.0948**		-0.0884*
		(0.0460)		(0.0457)		(0.0456)
Non-traded food		-0.0156		-0.0176		-0.0160
		(0.0767)		(0.0765)		(0.0767)
household	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
years	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
No Obs.	2341	2341	2341	2341	2341	2341
Adj R-sq	0.832	0.832	0.833	0.833	0.832	0.832

Robust standard errors in parentheses. $^{+}p \leq 0.15 * p \leq 0.10; ** p \leq 0.05; *** p \leq 0.01$
In the fixed effects specification the category "non-traded activities" and year 2002 act, respectively, as the benchmark from trade-related and year fixed effects.

are consistent with those in Tables 1 and 2. The relationship between expected consumption and the permanent risk components (computed using the new set of income residuals) is still negative and statistically significant (even if smaller in magnitude). It is worth noting that the presence of the additional time trend component actually reduces both the magnitude and significance of the coefficients associated with the observed characteristics in the income equation (see Table 4B-1), highlighting that our preferred specification (without time trend) does not leave out relevant non-random trends in income that inflate our permanent proxy for income risk.

Table 3 reports the outcomes of the various components of our vulnerability measure (Eq.4) by column both for the overall sample and for the subsample of households classified as vulnerable (about 20% of the sample). The first three columns in Table 3 show overall vulnerability, in utils, as well as the relative weights of its poverty and risk components. Of course, if we look at the entire sample, the average level of vulnerability is negative and so is its poverty-induced component, whe all the components are positive if we select only the sub-sample of households classified as vulnerable. Note that the risk-induced vulnerability sub-components (trade-related included, see section 3) are, on average, positive for all sampled households. It also demonstrates that the households not classified as vulnerable show, on average, positive risk-induced vulnerability.

Again for sensitivity purposes, we present the vulnerability outcomes for different values of the CRRA utility derived for different levels of the risk aversion parameter ($\gamma = 1; 2; 3$). Total vulnerability is the sum of risk-induced and poverty components. 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 much. For instance, "risk-induced" vulnerability (reported in the "overall risk" column in Table 2) actually doubles for the entire sample (from 3% to 6% of overall vulnerability) and becomes more than five times larger for vulnerable households (from 3% to 16%), but its relative contribution on overall vulnerability does not change. Acknowledging that the overall risk-induced component includes both unexplained risk and measurement error, the columns from four to eight report the further decomposition of overall risk proposed in Eq.4. The fourth column shows the meso (trade-related) component of overall risk-induced vulnerability, cleaned by unobservables and measurement errors. It turns out to be the main component of risk-induced vulnerability, on average, for all sampled households ranging from 4% to 12% (and from 6% to 49% for vulnerable households). This confirms our intuition that trade-related risks (i.e., risks that are not fully shared across households clustered by trade-related industries) matter in determining household risk-induced vulnerability. The fifth column filters out the component of truly covariate shocks. The sixth column isolates the component of vulnerability due to the ex-ante permanent risk. It shows once again that the relative weight of the ex-ante risk component is low compared with the others (even if we are here assuming this to be a lower bound of the possible true influence of this component in vulnerability analysis). The seventh column refers to the ex-post idiosyncratic components of risk. The last one is the residual unexplained sub-component. All these sub-components sum together to form the overall risk component.

Fig.1 provides a breakdown of the sub-components of the VEU overall risk component for the sub-sample of households classified as vulnerable (for the sake of brevity, only when $\gamma = 2$). It is clear from Fig.1 that the risk-sharing deviations by categories of households classified by trade exposure are significant and, in some cases (e.g., exporting industries, rice, other export crops, and import competing crops), represent the most significant component. Fig.2 reports the same statistics, but is computed 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). Table 4A-7 in Appendix 4A shows the full statistics. As largely expected, in the latter case, the relative weight of the risk-sharing deviations by trade categories is greatly reduced and is no longer the most significant component. However, also in this case, the sub-component of risk-sharing deviations by trade categories is different from zero, in line with the statistical significance of the fixed effects by trade categories in Tables 1 and 2. This exercise highlights the need to include a trade meso component of risk in VEU.

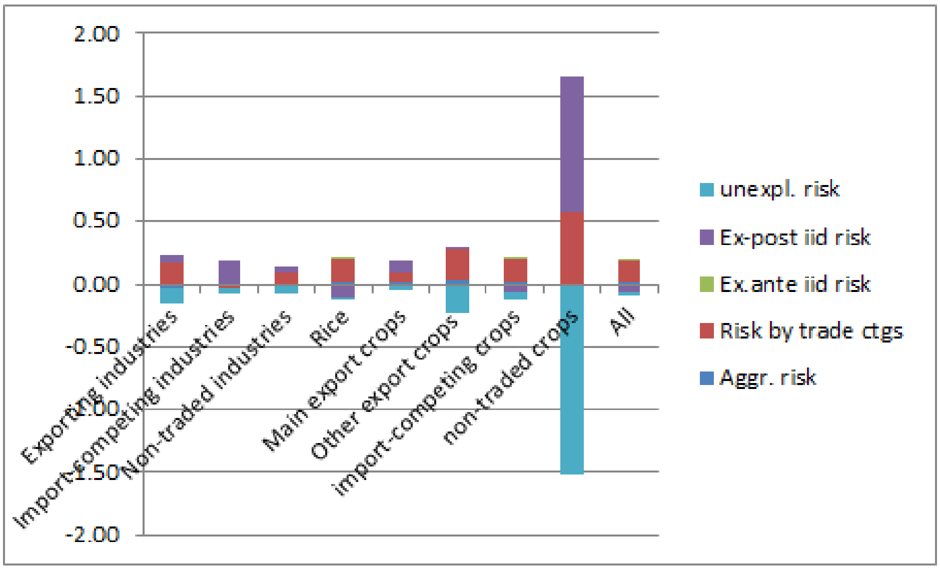
Unfortunately, we cannot assess the separate impacts of the *ex-ante* permanent risk on the poverty and the risk components of vulnerability. We can only test for the presence of possible correlations between the *ex-ante* permanent risk and the various components of VEU. To test this we also relax the assumption of homogeneity across the conditional distribution of vulnerability by applying a quantile regression framework.[23] Fig. 3 plots the values of the quantile estimated coefficients of the relationship between the *ex-ante* permanent risk and the various components of our extended vulnerability measure for each 5% of vulnerability distribution (reported on the

[23]The quantile approach assumes that the conditional distribution of the dependent variable is not homogeneous across households. It applies a linear programming approach to obtaining the coefficient estimates which does not involve simply running a set of separate OLS regressions. It is worth noting that the precision of the estimates is dependent on the density of the points in each quantile.

Table 3: Vulnerability decomposition in utils (all sample and vulnerable households) in Vietnam in the period 2002-06

	Overall Vulnerability (V)	Poverty induced (P)	Overall Risk (V-P)	Risk by trade ctgs	Aggr. risk	Ex.ante iid risk	Ex-post iid risk	unexpl. risk
all sample								
$\gamma = 1$								
Exporting industries	-0.485	-0.524	0.039	0.042	-0.010	-0.00000781	-0.003	0.009
Import-competing industries	-0.642	-0.667	0.025	0.022	-0.015	0.00000003	0.000	0.017
Non-traded industries	-0.704	-0.735	0.032	0.025	-0.008	0.00000031	-0.002	0.017
Rice	-0.242	-0.274	0.033	0.027	0.008	0.00001460	0.024	-0.026
Main export crops	-0.423	-0.473	0.050	0.008	0.006	0.00000473	0.018	0.019
Other export crops	-0.328	-0.354	0.026	0.025	0.007	0.00000535	0.022	-0.029
import-competing crops	-0.273	-0.308	0.036	0.025	0.009	0.00000154	0.009	-0.007
non-traded crops	-0.673	-0.706	0.033	0.024	-0.001	0.00000734	0.009	0.001
All	-0.415	-0.449	0.034	0.025	0.002	0.00000730	0.014	-0.007
$\gamma = 2$								
Exporting industries	-0.300	-0.350	0.050	0.045	-0.007	0.00000065	0.016	-0.004
Import-competing industries	-0.419	-0.447	0.028	0.016	-0.009	0.00000202	0.007	0.012
Non-traded industries	-0.435	-0.467	0.033	0.021	-0.005	0.00000288	0.003	0.013
Rice	-0.113	-0.164	0.052	0.067	0.009	0.00003850	-0.017	-0.006
Main export crops	-0.229	-0.303	0.074	0.023	0.005	0.00001080	0.041	0.005
Other export crops	-0.163	-0.201	0.038	0.076	0.009	0.00002550	0.028	-0.075
import-competing crops	-0.128	-0.180	0.052	0.066	0.009	0.00002010	-0.004	-0.020
non-traded crops	-0.441	-0.471	0.030	0.025	0.000	0.00000731	0.018	-0.013
All	-0.235	-0.281	0.046	0.048	0.003	0.00002190	-0.002	-0.003
$\gamma = 3$								
Exporting industries	-0.192	-0.250	0.058	0.055	-0.007	0.00001120	0.087	-0.079
Import-competing industries	-0.295	-0.324	0.029	0.015	-0.006	0.00000330	0.017	0.002
Non-traded industries	-0.297	-0.328	0.031	0.022	-0.003	0.00000639	0.008	0.004
Rice	0.003	-0.076	0.080	0.194	0.012	0.00017210	2.506	-2.657
Main export crops	-0.095	-0.201	0.106	0.051	0.006	0.00002780	0.098	-0.049
Other export crops	-0.030	-0.086	0.057	0.222	0.013	0.00012950	0.286	-0.466
import-competing crops	-0.011	-0.085	0.074	0.187	0.012	0.00011180	0.302	-0.429
non-traded crops	-0.315	-0.342	0.026	0.029	0.000	0.00001020	0.047	-0.049
All	-0.111	-0.175	0.064	0.123	0.006	0.00009630	1.204	-1.287
	Overall Vulnerability (V)	Poverty induced (P)	Overall Risk (V-P)	Risk by trade ctgs	Aggr. risk	Ex.ante iid risk	Ex-post iid risk	unexpl. risk
only vulnerable								
$\gamma = 1$								
Exporting industries	0.177	0.138	0.039	0.108	-0.021	-0.00001520	-0.043	-0.005
Import-competing industries	0.237	0.192	0.045	-0.041	-0.015	0.00000030	0.088	0.013
Non-traded industries	0.135	0.105	0.031	0.040	-0.009	0.00001240	0.033	-0.033
Rice	0.275	0.241	0.034	0.065	0.015	0.00003400	0.049	-0.095
Main export crops	0.284	0.229	0.055	0.017	0.011	0.00001440	0.014	0.014
Other export crops	0.342	0.311	0.031	0.073	0.018	0.00000592	-0.005	-0.055
import-competing crops	0.282	0.249	0.033	0.054	0.015	-0.00000003	0.006	-0.042
non-traded crops	0.269	0.214	0.054	0.383	-0.005	0.00011960	0.466	-0.790
All	0.266	0.230	0.036	0.060	0.011	0.00002470	0.037	-0.073
$\gamma = 2$								
Exporting industries	0.238	0.158	0.080	0.164	-0.024	0.00000699	0.075	-0.135
Import-competing industries	0.320	0.220	0.100	-0.010	-0.019	0.00000102	0.185	-0.056
Non-traded industries	0.162	0.101	0.061	0.092	-0.010	0.00003140	0.045	-0.066
Rice	0.358	0.275	0.083	0.180	0.020	0.00010780	-0.106	-0.010
Main export crops	0.355	0.208	0.147	0.075	0.014	0.00003770	0.103	-0.046
Other export crops	0.471	0.402	0.069	0.243	0.028	0.00008010	0.026	-0.229
import-competing crops	0.382	0.307	0.074	0.180	0.021	0.00005600	-0.065	-0.062
non-traded crops	0.368	0.239	0.130	0.576	-0.006	0.00021620	1.073	-1.513
All	0.346	0.261	0.085	0.167	0.016	0.00008670	-0.058	-0.039
$\gamma = 3$								
Exporting industries	0.249	0.128	0.121	0.209	-0.024	0.00004770	0.439	-0.503
Import-competing industries	0.445	0.256	0.189	0.041	-0.023	0.00001510	0.391	-0.222
Non-traded industries	0.189	0.083	0.106	0.142	-0.011	0.00005930	0.077	-0.103
Rice	0.534	0.365	0.169	0.569	0.031	0.00052040	7.712	-8.249
Main export crops	0.495	0.213	0.282	0.181	0.017	0.00010060	0.312	-0.228
Other export crops	0.664	0.524	0.140	0.752	0.043	0.00044680	0.962	-1.617
import-competing crops	0.537	0.388	0.150	0.557	0.032	0.00034240	0.891	-1.330
non-traded crops	0.525	0.267	0.258	0.876	-0.007	0.00039110	2.516	-3.127
All	0.495	0.327	0.168	0.489	0.024	0.00040410	5.222	-5.614

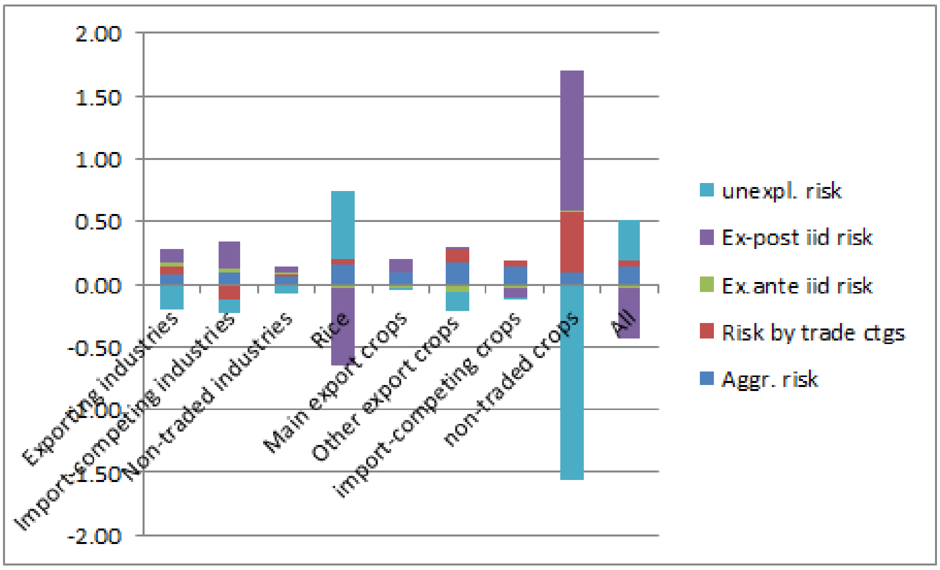
Figure 1: Comparison between the sub-components of the VEU overall risk by clusters of households computed as in Eq.3 (vulnerable households)



horizontal axis) across all the sampled households (for the sake of brevity, also in this case, only the estimates for $\gamma = 2$ have been shown in the figure. The outcomes of the regressions for the 25th, 50th and 75th percentiles of vulnerability distribution for different values of the γ parameters are reported in Tabs. 4A-8, 4A-9 and 4A-10 in the Appendix).

The OLS (mean) regression coefficients are also reported in the graphs (represented by the dashed line) as well as the confidence intervals both for the quantile regressions (represented by the grey areas) and the OLS ones (represented by the lighter dotted lines). Even if based on different scales, the graphs clearly show that the *ex-ante* permanent risk correlates with vulnerability both via its poverty-induced and its risk-induced components (see the first three graphs reported in the first row of Fig. 3). Within the risk components (see the graphs in the second row), there is, on average, a negative correlation with aggregate vulnerability (the mean regression coefficient is negative) and a positive correlation with trade-related vulnerability and idiosyncratic vulnerability. The main feature of Fig. 3 is, however, that the relative impact of the *ex-ante* permanent risk actually increases moving up across different quantiles of vulnerability distribution (with the most vulnerable households being the most severely affected). This pattern is confirmed, with some degree of heterogeneity, for all the sub-components in our extended

Figure 2: Comparison between the sub-components of the VEU overall risk by clusters of households computed reversing the order in Eq.3 (vulnerable households)

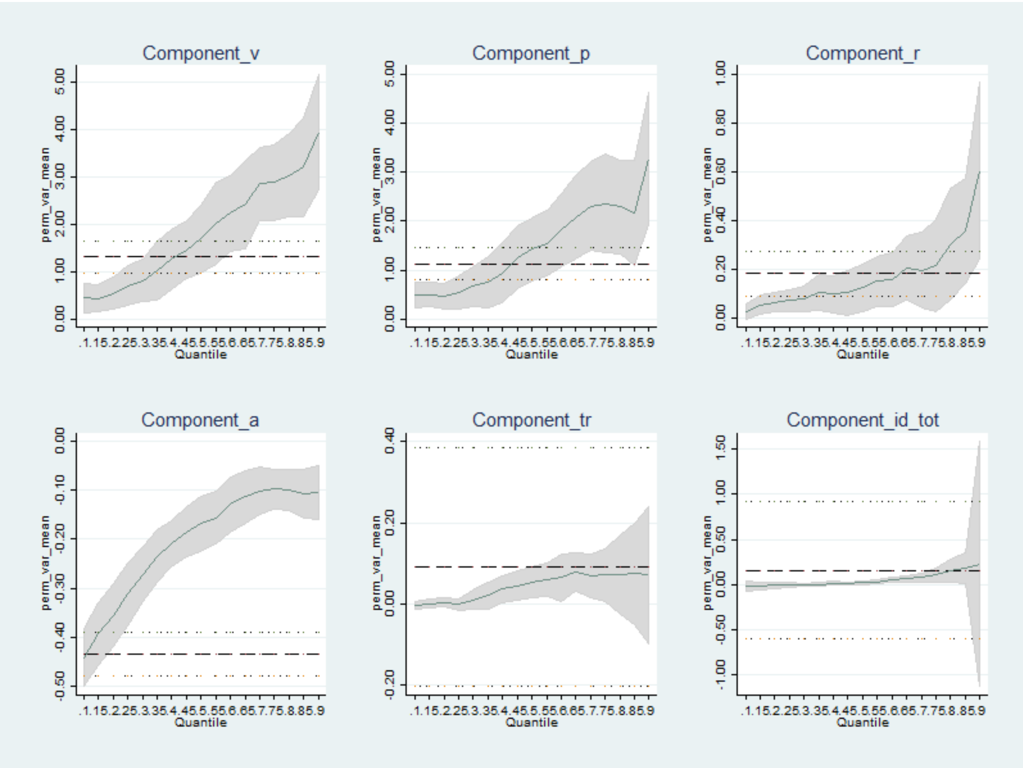


vulnerability measure. Note that in this case, running a simple OLS, which assumes homogeneity in the conditional distribution of vulnerability, would underestimate the relationship between *ex-ante* risk and the aggregate component of vulnerability and overestimate the relation with the trade-related and idiosyncratic components, respectively.

4.6 Conclusions

This paper addresses the timely issue of trade-induced vulnerability using the Vietnam Household Living Standard Survey (VHLSS) panel data for the period 2002-2004-2006. The added value of this exercise stands in proposing an extended version of the VEU measure of vulnerability that is able to address the presence of trade-related heterogeneity in households' exposure to risk more appropriately and overcome the most common weaknesses of current available measures of vulnerability. More specifically, we present a method of decomposing the impact on vulnerability of the *ex-ante* risk and its correlated risk-mitigating strategies from the *ex-post* ones and looking separately at the relationship between *ex-ante* risk, risk premium and mean consumption. Our empirical results reveal a number of useful insights for

Figure 3: Permanent risk correlates with VEU components by quantiles of the households' vulnerability distribution



Legend:
v=vulnerability; p=poverty induced; r=risk induced;
a= aggregate risk; tr=trade-related risk; id=idiosyncratic risk

policymaking: first, the risk-induced component of vulnerability consistently matters in determining households' overall vulnerability and second, the presence of a relative inability, on average, to share risks across households involved in different trade-related clusters. 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. Third, we show that the *ex-ante* permanent risk is significantly correlated with both poverty, via the precautionary saving channel, and all the subcomponents of the risk components of vulnerability (trade-related included). Fourth, we show that the relative impact of the *ex-ante* permanent risk actually increases along with the increase in the upper percentiles of vulnerability distribution (with the most vulnerable households being the most severely affected).

Appendix 4A - Tables & Figures

Figure 4A-1: Kernel density of log-consumption between moving and not-moving households

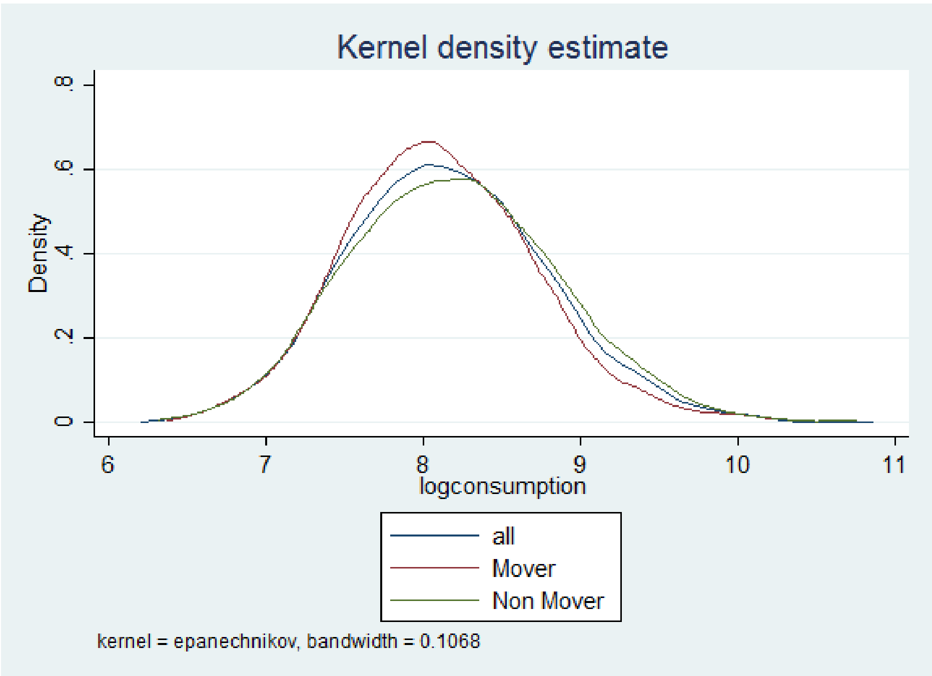


Table 4A-1: Main descriptive statistics of the variables used in the empirical analysis by trade categories

Exporting industries						**Import-competing industries**					
Variable	Obs	Mean	Std. Dev.	Min	Max	Variable	Obs	Mean	Std. Dev.	Min	Max
Real pc income (in dongs)	98	10170.52	31512.73	1245.478	306380.1	Real pc income (in dongs)	110	8635.612	6810.547	1452.949	53522.48
Real pc food \& non food consumption (in dongs)	98	3965.8	2166.411	1172.041	11693.78	Real pc food \& non food consumption (in dongs)	110	4766.755	3010.914	926.1472	21632.55
Age hh head	98	44.34694	9.483683	26	70	Age hh head	110	44.18182	9.926502	25	80
Age sq. hh head	98	2055.673	888.578	676	4900	Age sq. hh head	110	2049.673	964.1713	625	6400
Household size	98	4.836735	1.590525	2	9	Household size	110	4.436364	1.517647	2	12
Household size sq	98	25.89796	16.72857	4	81	Household size sq	110	21.96364	17.03958	4	144
No of children	98	1.408163	1.147267	0	5	No of children	110	1.163636	.9817348	0	4
Married hh head (yes=1)	98	.9387755	.2409742	0	1	Married hh head (yes=1)	110	.9181818	.2753419	0	1
Household head sex (male=1)	98	.8979592	.3042583	0	1	Household head sex (male=1)	110	.8363636	.3716384	0	1
Prim educ (yes=1)	98	.3265306	.4713549	0	1	Prim educ (yes=1)	110	.2181818	.4149017	0	1
Low secondary educ (yes=1)	98	.2653061	.443766	0	1	Low secondary educ (yes=1)	110	.4	.4921401	0	1
Upper secondary educ (yes=1)	98	.0408163	.1988818	0	1	Upper secondary educ (yes=1)	110	.0636364	.2452212	0	1
Tech/voc edu (yes=1)	98	.0510204	.2211707	0	1	Tech/voc edu (yes=1)	110	.1181818	.3243007	0	1
Univers. Edu (yes=1)	98	0	0	0	0	Univers. Edu (yes=1)	110	.0545455	.2281302	0	1
Geographical loc (urban=1)	98	.1530612	.3618977	0	1	Geographical loc (urban=1)	110	.1909091	.3948163	0	1
House prop (yes=1)	98	.9591837	.1988818	0	1	House prop (yes=1)	110	.9909091	.0953463	0	1
House type (1=Temp.-5=Villa)	98	2	.7864838	1	4	House type (1=Temp.-5=Villa)	110	2.027273	.7597572	1	4
Living area (mq)	98	57.60306	32.67733	13	211	Living area (mq)	108	58.51852	31.44896	15	200
Land deciles	98	3.469388	2.740322	1	10	Land deciles	110	3.718182	2.201467	1	10
Non traded non food						**Rice**					
Variable	Obs	Mean	Std. Dev.	Min	Max	Variable	Obs	Mean	Std. Dev.	Min	Max
Real pc income (in dongs)	549	8342.432	7907.228	1332.982	112984.6	Real pc income (in dongs)	1138	5691.468	4965.254	813.3669	53922.07
Real pc food \& non food consumption (in dongs)	549	4891.991	3084.553	1128.267	23517.45	Real pc food \& non food consumption (in dongs)	1138	3231.156	1916.063	554.6757	17623.94
Age hh head	549	43.16029	9.658956	21	97	Age hh head	1138	46.20035	10.24375	23	81
Age sq. hh head	549	1955.936	924.2864	441	9409	Age sq. hh head	1138	2239.315	984.2234	529	6561
Household size	549	4.42623	1.33746	2	11	Household size	1138	4.872583	1.873888	1	20
Household size sq	549	21.37705	13.76225	4	121	Household size sq	1138	27.25044	26.08861	1	400
No of children	549	1.12204	.9879043	0	5	No of children	1138	1.260105	1.29304	0	9
Married hh head (yes=1)	549	.9234973	.2660432	0	1	Married hh head (yes=1)	1138	.8927944	.3095105	0	1
Household head sex (male=1)	549	.845173	.3620695	0	1	Household head sex (male=1)	1138	.8497364	.3574867	0	1
Prim educ (yes=1)	549	.2258652	.4185322	0	1	Prim educ (yes=1)	1138	.254833	.4359589	0	1
Low secondary educ (yes=1)	549	.3825137	.4864442	0	1	Low secondary educ (yes=1)	1138	.3611599	.480548	0	1
Upper secondary educ (yes=1)	549	.0874317	.2827242	0	1	Upper secondary educ (yes=1)	1138	.0659051	.2482252	0	1
Tech/voc edu (yes=1)	549	.1493625	.3567705	0	1	Tech/voc edu (yes=1)	1138	.0474517	.2126964	0	1
Univers. Edu (yes=1)	549	.0455373	.2086696	0	1	Univers. Edu (yes=1)	1138	.0043937	.0661681	0	1
Geographical loc (urban=1)	549	.2568306	.4372836	0	1	Geographical loc (urban=1)	1138	.0386643	.1928784	0	1
House prop (yes=1)	549	.9817851	.1338499	0	1	House prop (yes=1)	1138	.973638	.1602799	0	1
House type (1=Temp.-5=Villa)	549	2.094718	.7796156	1	5	House type (1=Temp.-5=Villa)	1138	1.988576	.7122817	1	5
Living area (mq)	544	59.05662	37.02739	10	480	Living area (mq)	1124	58.88639	32.31376	10	400
Land deciles	549	3.681239	2.658555	1	10	Land deciles	1138	6.002636	2.471116	1	10

Table 4A-2: Main descriptive statistics of the variables used in the empirical analysis by trade categories (cont'd)

Main export crops						**Other export crops**					
Variable	Obs	Mean	Std. Dev.	Min	Max	Variable	Obs	Mean	Std. Dev.	Min	Max
Real pc income (in dongs)	195	7487.782	6300.176	1438.247	43851.2	Real pc income (in dongs)	99	5243.904	4885.847	1087.22	29642.49
Real pc food \& non food consumption (in dongs)	195	4037.537	2820.954	660.0689	16379.2	Real pc food \& non food consumption (in dongs)	99	3101.611	1721.263	837.2051	7745.69
Age hh head	195	44.15897	9.814798	24	74	Age hh head	99	45.64646	10.42007	26	72
Age sq. hh head	195	2045.851	946.6909	576	5476	Age sq. hh head	99	2191.081	1005.463	676	5184
Household size	195	5.169231	1.778183	1	12	Household size	99	4.79798	1.778441	1	10
Household size sq	195	29.86667	20.9787	1	144	Household size sq	99	26.15152	18.75152	1	100
No of children	195	1.594872	1.241455	0	7	No of children	99	1.464646	1.486766	0	7
Married hh head (yes=1)	195	.8615385	.3462728	0	1	Married hh head (yes=1)	99	.7979798	.4035505	0	1
Household head sex (male=1)	195	.8769231	.3293711	0	1	Household head sex (male=1)	99	.8383838	.3699716	0	1
Prim educ (yes=1)	195	.3589744	.4809344	0	1	Prim educ (yes=1)	99	.3030303	.461907	0	1
Low secondary educ (yes=1)	195	.2717949	.4460299	0	1	Low secondary educ (yes=1)	99	.3131313	.4661274	0	1
Upper secondary educ (yes=1)	195	.0307692	.1731364	0	1	Upper secondary educ (yes=1)	99	.020202	.1414068	0	1
Tech/voc edu (yes=1)	195	.025641	.1584687	0	1	Tech/voc edu (yes=1)	99	.0707071	.2576394	0	1
Univers. Edu (yes=1)	195	.0102564	.1010126	0	1	Univers. Edu (yes=1)	99	0	0	0	0
Geographical loc (urban=1)	195	.0923077	.2902049	0	1	Geographical loc (urban=1)	99	.020202	.1414068	0	1
House prop (yes=1)	195	.9692308	.1731364	0	1	House prop (yes=1)	99	.9393939	.2398206	0	1
House type (1=Temp.-5=Villa)	195	2	.7179582	1	4	House type (1=Temp.-5=Villa)	99	2.080808	.9111192	1	4
Living area (mq)	193	58.92902	28.40251	14	198	Living area (mq)	95	63.16105	39.1304	15	200
Land deciles	195	8.179487	2.161898	1	10	Land deciles	99	6.383838	2.538307	1	10
import-competing crops						**Non-traded food**					
Variable	Obs	Mean	Std. Dev.	Min	Max	Variable	Obs	Mean	Std. Dev.	Min	Max
Real pc income (in dongs)	139	5791.805	5605.037	542.1406	46145.41	Real pc income (in dongs)	42	7092.524	3794.102	1622.224	20179.32
Real pc food \& non food consumption (in dongs)	139	3105.186	2125.411	586.4355	12432.19	Real pc food \& non food consumption (in dongs)	42	4642.696	3730.844	984.6059	24198.92
Age hh head	139	42.56115	11.47216	15	70	Age hh head	42	46.35714	10.96073	26	74
Age sq. hh head	139	1942.115	1031.636	225	4900	Age sq. hh head	42	2266.262	1077.946	676	5476
Household size	139	4.532374	1.807	1	12	Household size	42	4.333333	1.028062	2	8
Household size sq	139	23.78417	20.62282	1	144	Household size sq	42	19.80952	9.959033	4	64
No of children	139	1.230216	1.287152	0	6	No of children	42	.6666667	.9016696	0	2
Married hh head (yes=1)	139	.8417266	.3663172	0	1	Married hh head (yes=1)	42	.9047619	.2971018	0	1
Household head sex (male=1)	139	.7985612	.4025257	0	1	Household head sex (male=1)	42	.8809524	.3277701	0	1
Prim educ (yes=1)	139	.2733813	.4473068	0	1	Prim educ (yes=1)	42	.3333333	.4771187	0	1
Low secondary educ (yes=1)	139	.3093525	.4638984	0	1	Low secondary educ (yes=1)	42	.3809524	.4915074	0	1
Upper secondary educ (yes=1)	139	.028777	.1677838	0	1	Upper secondary educ (yes=1)	42	.0714286	.2606612	0	1
Tech/voc edu (yes=1)	139	.057554	.2337404	0	1	Tech/voc edu (yes=1)	42	.0238095	.1543033	0	1
Univers. Edu (yes=1)	139	0	0	0	0	Univers. Edu (yes=1)	42	.0238095	.1543033	0	1
Geographical loc (urban=1)	139	.1726619	.3793216	0	1	Geographical loc (urban=1)	42	.0238095	.1543033	0	1
House prop (yes=1)	139	.9640288	.1868919	0	1	House prop (yes=1)	42	1	0	1	1
House type (1=Temp.-5=Villa)	139	2.071942	.8309266	1	5	House type (1=Temp.-5=Villa)	42	1.97619	.7804969	1	4
Living area (mq)	138	59.07246	38.81091	9	260	Living area (mq)	41	74.97561	60.7361	12	350
Land deciles	139	6.244604	2.747441	1	10	Land deciles	42	6.97619	2.599138	1	10

Table 4A-3: Between and within variation decomposition over the course of the panel by trade categories

Trade categories	Overall		Between		Within		Movers	
	Freq.	Percent (of total hhs)	Freq.	Percent (of total hhs)	Freq.	Percent (of between)	Freq.	Percent (of total hhs)
Exporting industries	141	4.76	78	7.89	47	60.26	31	3.14
Import-competing industries	149	5.03	95	9.62	50	52.28	45	4.55
Non traded non food	744	25.1	366	37.04	248	67.76	118	11.94
Rice	1372	46.29	626	63.36	457	73.06	169	17.11
Main export crops	222	7.49	101	10.22	74	73.27	27	2.73
Other export crops	122	4.12	86	8.7	41	47.29	45	4.55
import-competing crops	164	5.53	101	10.22	55	54.13	46	4.66
Non-traded food	50	1.69	31	3.14	17	53.76	14	1.42
Total	2964	100.00	1484	150.2	989	66.58	495	50.20

Table 4A-4: Transition matrix over the course of the panel by trade categories

from 2002 to 2004									
trade categories	Exporting industries	Import-competing industries	Non traded non food	Rice	Main export crops	Other export crops	import-competing crops	Non-traded food	Total
				frequencies					
Exporting industries	29	2	7	3	0	2	0	0	43
Import-competing industries	3	23	8	6	1	0	1	0	42
Non traded non food	7	4	170	32	1	9	3	5	231
Rice	9	18	40	345	3	17	13	2	447
Main export crops	0	0	7	6	66	3	0	1	83
Other export crops	1	3	4	12	2	20	4	2	48
import-competing crops	0	1	8	16	3	4	41	0	73
Non-traded food	0	1	1	6	1	0	1	11	21
Total	**49**	**52**	**245**	**426**	**77**	**55**	**63**	**21**	**988**
				percentages					
Exporting industries	67	5	16	7	0	5	0	0	100
Import-competing industries	7	55	19	14	2	0	2	0	100
Non traded non food	3	2	74	14	0	4	1	2	100
Rice	2	4	9	77	1	4	3	0	100
Main export crops	0	0	8	7	80	4	0	1	100
Other export crops	2	6	8	25	4	42	8	4	100
import-competing crops	0	1	11	22	4	5	56	0	100
Non-traded food	0	5	5	29	5	0	5	52	100
Total	**5**	**5**	**25**	**43**	**8**	**6**	**6**	**2**	**100**
from 2004 to 2006									
trade categories	Exporting industries	Import-competing industries	Non traded non food	Rice	Main export crops	Other export crops	import-competing crops	Non-traded food	Total
				frequencies					
Exporting industries	31	0	4	12	1	0	1	0	49
Import-competing industries	1	29	13	7	0	0	2	0	52
Non traded non food	2	7	189	37	8	1	1	0	245
Rice	13	12	43	354	1	2	1	0	426
Main export crops	0	2	1	21	51	1	1	0	77
Other export crops	1	4	10	24	0	14	2	0	55
import-competing crops	1	1	6	34	1	0	20	0	63
Non-traded food	0	0	2	10	0	1	0	8	21
Total	**49**	**55**	**268**	**499**	**62**	**19**	**28**	**8**	**988**
				percentages					
Exporting industries	63.27	0	8.16	24.49	2.04	0	2.04	0	100
Import-competing industries	1.92	55.77	25	13.46	0	0	3.85	0	100
Non traded non food	0.82	2.86	77.14	15.1	3.27	0.41	0.41	0	100
Rice	3.05	2.82	10.09	83.1	0.23	0.47	0.23	0	100
Main export crops	0	2.6	1.3	27.27	66.23	1.3	1.3	0	100
Other export crops	1.82	7.27	18.18	43.64	0	25.45	3.64	0	100
import-competing crops	1.59	1.59	9.52	53.97	1.59	0	31.75	0	100
Non-traded food	0	0	9.52	47.62	0	4.76	0	38.1	100
Total	**4.96**	**5.57**	**27.13**	**50.51**	**6.28**	**1.92**	**2.83**	**0.81**	**100**

Table 4A-5: Panel regression on household income in Vietnam (2002-06)

dep.var.: log real pc income	Coeff.	Std. Err.
Age hh head	0.00912	0.0167
Age sq. hh head	-0.000105	0.000161
hh size	-0.164***	0.0280
hh size sq	0.00719***	0.00215
No of children	-0.0490***	0.0173
Married hh head (yes=1)	0.0259	0.0781
hh head sex (male=1)	-0.0939	0.0948
Prim educ (yes=1)	0.0266	0.0384
Low secondary educ (yes=1)	0.0341	0.0500
Upper secondary educ (yes=1)	0.0106	0.0769
Tech/voc edu (yes=1)	0.117*	0.0686
Univers. Edu (yes=1)	-0.0366	0.124
Geographical loc (urban=1)	-0.338***	0.111
Cons	9.706***	0.695
Fixed effects:		
household	yes	
year	yes	
trade categories	yes	
No Obs.	2964	
Adj R-sq	0.725	

Robust standard errors in parentheses. $^{+}p \leq 0.15 * p \leq 0.10; ** p \leq 0.05; ***p \leq 0.01$
In the fixed effects specification the category "non-traded activities" and year 2002 act, respectively, as the benchmark from trade-related and year fixed effects.

Table 4A-6: Correlation matrix across aggregate and trade *ex-ante* permanent risk

Risk by trade categories	*Aggregate Risk*
Exporting industries	0.0343
Import-competing industries	-0.0919
Non-traded industries	0.1312
Rice	0.266
Main export crops	0.189
Other export crops	-0.1587
import-competing crops	-0.9389
Non traded crops	0.1732

Table 4A-7: Vulnerability decomposition in utils (all sample and vulnerable households) in Vietnam in the period 2002-06 computed reversing the order in Eq.3

	Overall Vulnerability (V)	Poverty induced (P)	Overall Risk (V-P)	Aggr. risk	Risk by trade ctgs	Ex.ante iid risk	Ex-post iid risk	unexpl. risk
all sample								
$\gamma = 1$								
Exporting industries	-0.485	-0.524	0.039	0.011	0.022	0.010	-0.002	-0.002
Import-competing industries	-0.642	-0.667	0.025	0.007	-0.003	0.018	-0.001	0.002
Non-traded industries	-0.704	-0.735	0.032	0.007	0.010	0.008	-0.002	0.009
Rice	-0.242	-0.274	0.033	0.019	0.016	-0.009	0.024	-0.017
Main export crops	-0.423	-0.473	0.050	0.013	0.001	-0.006	0.018	0.025
Other export crops	-0.328	-0.354	0.025	0.019	0.014	-0.009	0.022	-0.020
import-competing crops	-0.273	-0.308	0.035	0.018	0.013	-0.007	0.008	0.003
non-traded crops	-0.673	-0.706	0.033	0.007	0.017	0.001	0.009	0.000
All	-0.415	-0.449	0.033	0.014	0.012	-0.002	0.013	-0.005
$\gamma = 2$								
Exporting industries	-0.300	-0.350	0.050	0.020	0.017	0.009	0.022	-0.018
Import-competing industries	-0.419	-0.447	0.028	0.011	-0.006	0.011	0.007	0.003
Non-traded industries	-0.435	-0.467	0.032	0.012	0.005	0.004	0.003	0.008
Rice	-0.113	-0.164	0.052	0.056	0.019	-0.013	-0.178	0.169
Main export crops	-0.229	-0.303	0.074	0.028	0.000	-0.006	0.040	0.012
Other export crops	-0.163	-0.201	0.038	0.056	0.030	-0.017	0.023	-0.055
import-competing crops	-0.128	-0.179	0.052	0.051	0.020	-0.010	-0.009	-0.001
non-traded crops	-0.441	-0.471	0.030	0.009	0.016	0.001	0.019	-0.014
All	-0.235	-0.281	0.046	0.038	0.013	-0.006	-0.076	0.078
$\gamma = 3$								
Exporting industries	-0.192	-0.250	0.058	0.032	0.016	0.010	0.126	-0.127
Import-competing industries	-0.295	-0.324	0.029	0.016	-0.008	0.009	0.020	-0.009
Non-traded industries	-0.297	-0.328	0.031	0.016	0.003	0.003	0.008	0.000
Rice	0.003	-0.076	0.079	0.183	0.021	-0.036	28.423	-28.785
Main export crops	-0.095	-0.201	0.106	0.056	0.001	-0.009	0.091	-0.034
Other export crops	-0.030	-0.086	0.057	0.159	0.080	-0.047	0.173	-0.312
import-competing crops	-0.011	-0.085	0.074	0.138	0.050	-0.025	0.219	-0.311
non-traded crops	-0.315	-0.342	0.026	0.011	0.018	0.001	0.049	-0.052
All	-0.111	-0.175	0.063	0.110	0.018	-0.019	13.193	-13.441
	Overall Vulnerability (V)	Poverty induced (P)	Overall Risk (V-P)	Aggr. risk	Risk by trade ctgs	Ex.ante iid risk	Ex-post iid risk	unexpl. risk
only vulnerable								
$\gamma = 1$	0.177	0.139	0.039	0.030	0.058	0.023	-0.040	-0.032
Exporting industries	0.237	0.192	0.045	0.033	-0.093	0.020	0.095	-0.011
Import-competing industries	0.135	0.105	0.030	0.028	0.004	0.008	0.033	-0.043
Non-traded industries	0.275	0.241	0.034	0.043	0.037	-0.017	0.048	-0.077
Rice	0.284	0.229	0.055	0.037	-0.009	-0.012	0.013	0.027
Main export crops	0.342	0.311	0.031	0.048	0.045	-0.024	-0.004	-0.034
Other export crops	0.282	0.249	0.033	0.042	0.023	-0.013	0.005	-0.024
import-competing crops	0.269	0.214	0.054	0.034	0.345	0.007	0.477	-0.808
non-traded crops	0.266	0.230	0.035	0.041	0.030	-0.013	0.036	-0.059
All								
$\gamma = 2$								
Exporting industries	0.24	0.16	0.08	0.08	0.06	0.03	0.11	-0.21
Import-competing industries	0.32	0.22	0.10	0.09	-0.12	0.03	0.22	-0.12
Non-traded industries	0.16	0.10	0.06	0.07	0.02	0.01	0.05	-0.08
Rice	0.36	0.28	0.08	0.15	0.05	-0.03	-0.62	0.54
Main export crops	0.36	0.21	0.15	0.10	-0.01	-0.02	0.10	-0.02
Other export crops	0.47	0.40	0.07	0.18	0.10	-0.05	0.01	-0.16
import-competing crops	0.38	0.31	0.07	0.14	0.05	-0.03	-0.08	-0.01
non-traded crops	0.37	0.24	0.13	0.09	0.48	0.01	1.11	-1.57
All	0.35	0.26	0.08	0.14	0.05	-0.03	-0.40	0.33
$\gamma = 3$								
Exporting industries	0.249	0.128	0.121	0.130	0.056	0.038	0.647	-0.750
Import-competing industries	0.445	0.256	0.188	0.189	-0.176	0.046	0.514	-0.384
Non-traded industries	0.189	0.083	0.106	0.116	0.016	0.008	0.080	-0.115
Rice	0.534	0.365	0.169	0.537	0.058	-0.107	88.162	-89.699
Main export crops	0.495	0.213	0.282	0.197	0.002	-0.029	0.286	-0.173
Other export crops	0.664	0.524	0.140	0.543	0.273	-0.161	0.559	-1.074
import-competing crops	0.537	0.388	0.149	0.413	0.148	-0.072	0.626	-0.965
non-traded crops	0.525	0.267	0.257	0.180	0.690	0.022	2.646	-3.280
All	0.495	0.327	0.168	0.443	0.066	-0.083	57.869	-58.648

Table 4A-8: Permanent risk and other covariates correlates with the various components of vulnerability (first quartile: 25th percentile)

	rho1					
	Overall Vulnerability (V)	Poverty induced (P)	Overall Risk (V-P)	Trade-related risk	Aggr. risk	ex-post id. risk
q25	v	p	r	tr	a	id_tot
Ex-ante components						
perm risk	0.646**	0.596*	0.0485*	-0.00741	-0.545***	-0.00351
	(2.84)	(2.43)	(2.08)	(-1.51)	(-21.25)	(-0.44)
trans risk	0.739**	0.639*	0.0421	-0.00650	-0.587***	-0.00838
	(2.97)	(2.27)	(1.68)	(-1.19)	(-20.28)	(-0.97)
Ex-post components						
Age hh head	0.00202	-0.000988	-0.000310	-0.000124	0.000362	-0.0000348
	(0.24)	(-0.10)	(-0.75)	(-0.88)	(1.50)	(-0.14)
Age sq. hh head	-0.0000520	-0.0000190	0.00000411	0.000000911	-0.00000312	-0.000000103
	(-0.57)	(-0.17)	(0.93)	(0.63)	(-1.31)	(-0.04)
hh size	0.0369	0.0428	0.000383	-0.000788	-0.000356	0.00128
	(1.54)	(1.94)	(0.33)	(-1.22)	(-0.33)	(1.28)
hh size sq	-0.00163	-0.00184	-0.00000114	0.000110	0.0000911	-0.000123
	(-0.74)	(-0.93)	(-0.01)	(1.62)	(0.81)	(-1.18)
No of children	0.0358**	0.0363**	-0.000815	0.00118***	0.000377	-0.00197***
	(2.69)	(3.02)	(-1.35)	(5.84)	(0.75)	(-3.84)
Married hh head (yes=1)	-0.0113	-0.00880	-0.000324	0.000151	0.00101	0.0000996
	(-0.24)	(-0.17)	(-0.16)	(0.23)	(0.80)	(0.12)
hh head sex (male=1)	0.0407	0.0415	-0.0000718	0.000442	-0.000141	-0.000271
	(1.26)	(1.04)	(-0.06)	(0.99)	(-0.19)	(-0.43)
Prim educ (yes=1)	-0.0765**	-0.0725**	-0.00167	-0.00119*	-0.00111	0.000947
	(-2.66)	(-3.03)	(-1.22)	(-2.20)	(-0.82)	(0.89)
Low secondary educ (yes=1)	-0.0687**	-0.0704*	-0.00114	-0.00113*	-0.000962	0.00160
	(-2.63)	(-2.48)	(-0.87)	(-2.11)	(-0.82)	(1.49)
Upper secondary educ (yes=1)	-0.136**	-0.134**	0.00128	-0.00159**	-0.00414*	0.00153
	(-2.97)	(-2.82)	(0.53)	(-2.72)	(-2.08)	(1.33)
Tech/voc edu (yes=1)	-0.182***	-0.186***	-0.000430	-0.00204***	-0.00362*	0.000630
	(-4.76)	(-4.74)	(-0.15)	(-3.55)	(-2.57)	(0.74)
Univers. Edu (yes=1)	-0.291***	-0.278***	-0.00453	-0.00108	-0.00433***	0.00000433
	(-6.29)	(-5.32)	(-1.72)	(-1.73)	(-3.32)	(0.00)
Geographical loc (urban=1)	-0.275***	-0.287***	-0.000195	-0.00236***	-0.00661***	0.000772
	(-12.19)	(-10.20)	(-0.17)	(-7.79)	(-8.43)	(1.80)
lppc_incom n	-0.705***	-0.706***	-0.00329***	-0.00807***	0.000622	0.00404***
	(-29.80)	(-30.98)	(-3.78)	(-13.01)	(1.10)	(5.87)
cons	5.273***	5.304***	0.0355***	0.0824***	0.0815***	-0.0381***

	rho2					
	Overall Vulnerability (V)	Poverty induced (P)	Overall Risk (V-P)	Trade-related risk	Aggr. risk	ex-post id. risk
q25	v	p	r	tr	a	id_tot
Ex-ante components						
perm risk	0.706***	0.545**	0.0688***	-0.00126	-0.313***	-0.00392
	(3.34)	(3.08)	(3.75)	(-0.15)	(-10.12)	(-0.30)
trans risk	0.905***	0.673***	0.0619**	0.00856	-0.342***	-0.0218
	(4.11)	(3.82)	(2.87)	(0.94)	(-10.08)	(-1.45)
Ex-post components						
Age hh head	-0.00579	-0.00684	-0.000588	-0.000166	0.000119	0.00000947
	(-1.36)	(-1.74)	(-1.13)	(-0.63)	(0.49)	(0.03)
Age sq. hh head	0.0000446	0.0000570	0.00000615	0.000000895	-0.00000122	-0.000000153
	(1.03)	(1.47)	(1.15)	(0.33)	(-0.51)	(-0.05)
hh size	-0.00297	-0.00698	-0.0000828	-0.00197	-0.000629	0.00399
	(-0.24)	(-0.51)	(-0.04)	(-1.37)	(-0.49)	(1.26)
hh size sq	0.00150	0.00173	0.0000551	0.000258	0.000128	-0.000389
	(1.27)	(1.47)	(0.29)	(1.60)	(0.89)	(-1.08)
No of children	0.0397***	0.0400***	-0.000748	0.00215***	0.000582	-0.00456***
	(5.16)	(5.33)	(-0.99)	(4.41)	(1.24)	(-4.37)
Married hh head (yes=1)	-0.0133	0.0177	-0.00175	-0.000239	0.000756	-0.00140
	(-0.53)	(0.77)	(-0.84)	(-0.20)	(0.75)	(-0.78)
hh head sex (male=1)	0.0176	0.0102	0.000886	0.000807	0.0000732	0.000423
	(1.37)	(0.72)	(0.84)	(1.09)	(0.12)	(0.40)
Prim educ (yes=1)	-0.0601***	-0.0546**	-0.00395*	-0.00257*	-0.00164	0.00402*
	(-3.50)	(-2.86)	(-1.99)	(-2.33)	(-1.35)	(1.99)
Low secondary educ (yes=1)	-0.0448**	-0.0439*	-0.00280	-0.00248*	-0.00183	0.00532**
	(-2.67)	(-2.16)	(-1.59)	(-2.44)	(-1.56)	(2.75)
Upper secondary educ (yes=1)	-0.0759***	-0.0670**	-0.00229	-0.00333*	-0.00393**	0.00659**
	(-3.31)	(-3.11)	(-0.84)	(-2.26)	(-2.72)	(3.07)
Tech/voc edu (yes=1)	-0.0836***	-0.0772***	-0.00314	-0.00312**	-0.00426***	0.00343
	(-4.64)	(-3.96)	(-1.32)	(-3.22)	(-4.17)	(1.82)
Univers. Edu (yes=1)	-0.0751**	-0.0637**	-0.00294	-0.000980	-0.00502***	-0.0000322
	(-2.83)	(-2.89)	(-1.09)	(-0.76)	(-3.79)	(-0.02)
Geographical loc (urban=1)	-0.111***	-0.106***	-0.00116	-0.00395***	-0.00637***	0.000964
	(-9.79)	(-10.06)	(-0.95)	(-6.19)	(-8.71)	(1.05)
lppc_incom n	-0.385***	-0.371***	-0.00833***	-0.0141***	0.00155*	0.00862***
	(-26.90)	(-24.63)	(-7.62)	(-10.89)	(2.32)	(7.39)
cons	2.926***	2.815***	0.0886***	0.138***	0.0441***	-0.0875***

	rho3					
	Overall Vulnerability (V)	Poverty induced (P)	Overall Risk (V-P)	Trade-related risk	Aggr. risk	ex-post id. risk
q25	v	p	r	tr	a	id_tot
Ex-ante components						
perm risk	0.788***	0.545***	0.0828***	0.0282	-0.109***	-0.0101
	(3.95)	(3.68)	(4.17)	(1.89)	(-5.34)	(-0.55)
trans risk	0.974***	0.665***	0.0798***	0.0461**	-0.114***	-0.0389
	(4.49)	(3.96)	(4.01)	(2.77)	(-5.22)	(-1.92)
Ex-post components						
Age hh head	-0.00327	-0.00291	-0.000702	-0.0000312	0.0000593	0.0000679
	(-1.10)	(-0.97)	(-1.59)	(-0.11)	(0.42)	(0.11)
Age sq. hh head	0.0000214	0.0000227	0.00000686	-0.000000473	-0.000000651	-0.000000833
	(0.69)	(0.73)	(1.54)	(-0.16)	(-0.46)	(-0.14)
hh size	-0.0215	-0.0222	-0.00136	-0.00277	-0.00110	0.00581
	(-1.42)	(-1.57)	(-0.73)	(-1.23)	(-1.11)	(1.03)
hh size sq	0.00314	0.00281	0.000206	0.000321	0.000156	-0.000548
	(1.92)	(1.86)	(1.19)	(1.26)	(1.36)	(-0.81)
No of children	0.0232***	0.0239***	0.000239	0.00262***	0.000416	-0.00737***
	(4.10)	(4.28)	(0.28)	(4.01)	(1.48)	(-3.93)
Married hh head (yes=1)	-0.0104	0.00812	-0.00259	-0.00000458	0.000736	-0.00226
	(-0.76)	(0.51)	(-1.30)	(-0.00)	(1.30)	(-0.97)
hh head sex (male=1)	0.0170	0.00800	0.00129	0.00127	-0.000141	0.00000777
	(1.57)	(0.65)	(1.22)	(1.44)	(-0.35)	(0.01)
Prim educ (yes=1)	-0.0470**	-0.0329**	-0.00441*	-0.00365**	-0.000762	0.00543
	(-3.21)	(-2.74)	(-2.31)	(-3.08)	(-1.08)	(1.64)
Low secondary educ (yes=1)	-0.0372**	-0.0272*	-0.00326	-0.00322**	-0.00110	0.00679*
	(-2.81)	(-2.32)	(-1.86)	(-2.83)	(-1.57)	(2.31)
Upper secondary educ (yes=1)	-0.0488**	-0.0266	-0.00380	-0.00356*	-0.00172*	0.00874**
	(-3.18)	(-1.61)	(-1.66)	(-2.16)	(-1.97)	(2.67)
Tech/voc edu (yes=1)	-0.0501***	-0.0398***	-0.00195	-0.00360***	-0.00185*	0.00455
	(-3.84)	(-3.67)	(-0.77)	(-3.64)	(-2.29)	(1.66)
Univers. Edu (yes=1)	-0.0219	-0.0114	-0.00106	-0.000843	-0.00197*	-0.000619
	(-1.41)	(-0.89)	(-0.43)	(-0.58)	(-2.35)	(-0.20)
Geographical loc (urban=1)	-0.0486***	-0.0459***	-0.00164	-0.00385***	-0.00318***	0.000346
	(-6.39)	(-6.71)	(-1.47)	(-5.12)	(-6.08)	(0.30)
lppc_incom n	-0.244***	-0.207***	-0.0136***	-0.0169***	0.000655	0.0124***
	(-15.77)	(-17.87)	(-11.22)	(-8.25)	(1.12)	(5.86)
cons	1.772***	1.445***	0.137***	0.154***	0.0160*	-0.124***

Standard errors below the corresponding coefficients. $*p \leq 0.10; **\ p \leq 0.05; ***p \leq 0.01$

Table 4A-9: Permanent risk and other covariates correlates with the various components of vulnerability (Second quartile: 50th percentile)

q50	rho1 Overall Vulnerability (V)	rho1 Poverty induced (P)	rho1 Overall Risk (V-P)	rho1 Trade-related risk	rho1 Aggr. risk	rho1 ex-post id. risk
	(20.60)	(20.38)	(4.07)	(10.33)	(8.44)	(-3.75)
Ex-ante components						
perm risk	0.894*	0.670	0.0800*	-0.000750	-0.397***	0.00937
	(2.56)	(1.90)	(2.11)	(-0.09)	(-12.54)	(1.24)
trans risk	1.012**	0.692	0.0867*	0.00689	-0.452***	0.00128
	(2.65)	(1.77)	(2.25)	(0.70)	(-13.71)	(0.19)
Ex-post components						
Age hh head	-0.00704	-0.00949	-0.000221	-0.000249	0.000278	-0.0000720
	(-1.28)	(-1.47)	(-0.35)	(-1.05)	(1.10)	(-0.31)
Age sq. hh head	0.0000530	0.0000767	0.00000434	0.00000216	-0.00000231	0.000000991
	(0.92)	(1.13)	(0.66)	(0.95)	(-0.89)	(0.41)
hh size	0.0270	0.0337	0.000546	-0.00166*	0.000633	-0.00267
	(0.94)	(1.50)	(0.27)	(-2.57)	(0.63)	(-0.99)
hh size sq	-0.000343	-0.000938	-0.0000343	0.000213**	-0.00000762	0.000286
	(-0.14)	(-0.50)	(-0.19)	(3.04)	(-0.07)	(0.99)
No of children	0.0265*	0.0274**	-0.00121	0.00203***	0.00156***	-0.00156**
	(2.55)	(2.77)	(-0.94)	(5.90)	(3.41)	(-3.21)
Married hh head (yes=1)	-0.0370	-0.0243	-0.00230	0.000367	-0.000436	-0.000425
	(-0.79)	(-0.65)	(-0.61)	(0.44)	(-0.35)	(-0.33)
hh head sex (male=1)	0.0528	0.0490	0.00428	0.000508	0.000660	-0.000446
	(1.64)	(1.95)	(1.54)	(0.87)	(0.90)	(-0.77)
Prim educ (yes=1)	-0.0876**	-0.0763***	-0.000999	-0.00347***	-0.00361**	0.000348
	(-3.23)	(-3.63)	(-0.37)	(-3.63)	(-2.65)	(0.35)
Low secondary educ (yes=1)	-0.103***	-0.0868***	-0.00266	-0.00359***	-0.00495***	0.000600
	(-4.32)	(-4.11)	(-1.15)	(-4.21)	(-4.66)	(0.61)
Upper secondary educ (yes=1)	-0.146***	-0.139***	-0.00126	-0.00431***	-0.00550***	0.000129
	(-4.00)	(-4.13)	(-0.43)	(-4.69)	(-3.46)	(0.12)
Tech/voc edu (yes=1)	-0.212***	-0.202***	0.00273	-0.00413***	-0.00659***	0.000147
	(-5.88)	(-5.13)	(0.63)	(-3.67)	(-5.18)	(0.14)
Univers. Edu (yes=1)	-0.353***	-0.322***	-0.00325	-0.00200	-0.00644***	-0.0000248
	(-6.89)	(-6.82)	(-0.62)	(-1.70)	(-4.43)	(-0.02)
Geographical loc (urban=1)	-0.280***	-0.286***	-0.00205	-0.00244***	-0.00844***	-0.000470
	(-13.17)	(-13.51)	(-0.93)	(-4.81)	(-12.11)	(-0.91)
lppc_incom n	-0.691***	-0.691***	-0.00135	-0.0116***	-0.00332***	-0.000236
	(-33.77)	(-39.54)	(-0.65)	(-16.06)	(-4.63)	(-0.38)
cons	5.497***	5.536***	0.0180	0.120***	0.102***	0.0113

q50	rho2 Overall Vulnerability (V)	rho2 Poverty induced (P)	rho2 Overall Risk (V-P)	rho2 Trade-related risk	rho2 Aggr. risk	rho2 ex-post id. risk
	(19.32)	(15.86)	(5.84)	(9.23)	(4.50)	(-5.68)
Ex-ante components						
perm risk	1.690***	1.432	0.123**	0.0524**	-0.168***	0.0192
	(5.05)	(1.22)	(3.13)	(2.69)	(-7.14)	(1.73)
trans risk	2.048***	1.773	0.144***	0.0767***	-0.195***	0.0138
	(5.80)	(1.76)	(3.41)	(3.51)	(-7.38)	(1.49)
Ex-post components						
Age hh head	-0.00869	-0.00423	-0.000737	-0.000720	0.000245	0.000186
	(-1.85)	(-0.19)	(-0.84)	(-1.21)	(1.20)	(0.65)
Age sq. hh head	0.0000767	0.0000307	0.00000937	0.00000589	-0.00000218	-0.00000191
	(1.62)	(0.13)	(1.03)	(0.98)	(-1.06)	(-0.67)
hh size	-0.0115	-0.0123	0.00258	-0.0103**	-0.00119	-0.00168
	(-0.60)	(-0.53)	(0.67)	(-2.73)	(-1.37)	(-0.61)
hh size sq	0.00198	0.00208	-0.000151	0.00119**	0.000161	0.000190
	(1.01)	(1.02)	(-0.41)	(2.83)	(1.87)	(0.62)
No of children	0.0375***	0.0439**	-0.000287	0.00479***	0.00190***	-0.00162**
	(4.41)	(3.25)	(-0.18)	(4.87)	(4.20)	(-3.01)
Married hh head (yes=1)	0.0186	0.0150	-0.00263	0.000913	0.000702	-0.000402
	(0.82)	(0.78)	(-0.69)	(0.43)	(0.69)	(-0.29)
hh head sex (male=1)	0.0147	0.0138	0.00421	0.00147	0.000449	-0.000602
	(0.83)	(0.37)	(1.55)	(0.93)	(0.68)	(-0.95)
Prim educ (yes=1)	-0.108***	-0.0814	-0.00773	-0.00879***	-0.00331***	-0.000791
	(-5.21)	(-1.24)	(-1.71)	(-3.58)	(-3.44)	(-0.78)
Low secondary educ (yes=1)	-0.106***	-0.0823	-0.00827*	-0.00759***	-0.00390***	-0.0000759
	(-6.37)	(-1.95)	(-2.16)	(-3.50)	(-4.24)	(-0.06)
Upper secondary educ (yes=1)	-0.138***	-0.104	-0.00757	-0.00836***	-0.00509***	-0.000609
	(-6.36)	(-1.25)	(-1.39)	(-3.75)	(-3.87)	(-0.52)
Tech/voc edu (yes=1)	-0.146***	-0.127	-0.00389	-0.00697**	-0.00583***	-0.000669
	(-6.88)	(-0.83)	(-0.84)	(-2.91)	(-4.71)	(-0.60)
Univers. Edu (yes=1)	-0.114***	-0.0899	-0.00500	-0.000442	-0.00524***	-0.000875
	(-3.71)	(-0.73)	(-0.97)	(-0.15)	(-3.77)	(-0.85)
Geographical loc (urban=1)	-0.0995***	-0.102***	-0.00515*	-0.00390**	-0.00556***	-0.000336
	(-5.96)	(-8.63)	(-2.27)	(-2.96)	(-8.58)	(-0.62)
lppc_incom n	-0.450***	-0.427***	-0.0142***	-0.0254***	-0.00472***	-0.000252
	(-30.76)	(-29.71)	(-7.45)	(-12.19)	(-5.80)	(-0.38)
cons	3.486***	3.183***	0.136***	0.263***	0.0767***	0.00217

q50	rho3 Overall Vulnerability (V)	rho3 Poverty induced (P)	rho3 Overall Risk (V-P)	rho3 Trade-related risk	rho3 Aggr. risk	rho3 ex-post id. risk
	(11.55)	(10.70)	(8.21)	(7.58)	(2.39)	(-4.60)
Ex-ante components						
perm risk	1.488***	1.209***	0.147***	0.114***	-0.0411***	0.0183*
	(5.87)	(6.76)	(3.53)	(3.62)	(-3.43)	(2.03)
trans risk	1.797***	1.469***	0.204***	0.164***	-0.0423**	0.0152
	(6.63)	(7.78)	(4.86)	(5.22)	(-3.23)	(1.73)
Ex-post components						
Age hh head	-0.00679	-0.00710	-0.000471	-0.000935	0.0000862	0.0000781
	(-1.59)	(-1.82)	(-0.59)	(-0.92)	(0.53)	(0.41)
Age sq. hh head	0.0000616	0.0000640	0.00000463	0.00000679	-0.000000902	-0.000000780
	(1.37)	(1.66)	(0.60)	(0.66)	(-0.56)	(-0.41)
hh size	-0.0264	-0.0287*	-0.00116	-0.0234*	-0.00322***	-0.00116
	(-1.83)	(-2.32)	(-0.23)	(-2.22)	(-3.34)	(-0.48)
hh size sq	0.00331*	0.00359**	0.000204	0.00270*	0.000360**	0.000143
	(2.23)	(3.01)	(0.39)	(2.22)	(3.28)	(0.53)
No of children	0.0395***	0.0344***	0.00180	0.00702***	0.00142***	-0.00134**
	(6.16)	(4.33)	(0.96)	(3.82)	(3.99)	(-3.29)
Married hh head (yes=1)	-0.00582	0.0103	-0.00273	0.00558	0.00100	-0.000731
	(-0.37)	(0.67)	(-0.74)	(1.29)	(1.35)	(-0.66)
hh head sex (male=1)	0.0106	0.00658	0.00239	0.000132	0.000194	-0.0000874
	(0.79)	(0.56)	(0.97)	(0.06)	(0.40)	(-0.14)
Prim educ (yes=1)	-0.0714***	-0.0573***	-0.0117**	-0.0147**	-0.00289**	-0.000634
	(-4.09)	(-3.40)	(-2.64)	(-3.06)	(-3.14)	(-0.67)
Low secondary educ (yes=1)	-0.0660***	-0.0565***	-0.00971*	-0.0131***	-0.00294***	-0.0000662
	(-4.13)	(-4.05)	(-2.36)	(-3.41)	(-3.71)	(-0.08)
Upper secondary educ (yes=1)	-0.0782***	-0.0639***	-0.0110*	-0.0139**	-0.00303***	0.000193
	(-4.20)	(-3.96)	(-2.47)	(-2.80)	(-3.55)	(0.21)
Tech/voc edu (yes=1)	-0.0580***	-0.0613**	-0.00771	-0.00756	-0.00352***	-0.000325
	(-3.31)	(-3.06)	(-1.62)	(-1.58)	(-3.79)	(-0.44)
Univers. Edu (yes=1)	-0.000487	-0.00547	-0.00687	0.00633	-0.00259*	-0.000201
	(-0.02)	(-0.21)	(-1.49)	(1.32)	(-2.36)	(-0.26)
Geographical loc (urban=1)	-0.0384**	-0.0357***	-0.00330	-0.00288	-0.00264***	-0.0000314
	(-2.96)	(-3.56)	(-1.76)	(-1.23)	(-5.68)	(-0.09)
lppc_incom n	-0.329***	-0.282***	-0.0270***	-0.0414***	-0.00502***	-0.000550
	(-21.93)	(-18.78)	(-8.92)	(-9.16)	(-6.33)	(-1.02)
cons	*2.520****	*2.134****	*0.245****	*0.422****	*0.0604****	*0.00479*

Standard errors below the corresponding coefficients. $*p \leq 0.10; **p \leq 0.05; ***p \leq 0.01$

Table 4A-10: Permanent risk and other covariates correlates with the various components of vulnerability (Upper quartile: 75th percentile)

	rho1					
	Overall Vulnerability (V)	Poverty induced (P)	Overall Risk (V-P)	Trade-related risk	Aggr. risk	ex-post id. risk
q75	(27.76)	(29.18)	(0.78)	(13.19)	(9.03)	(1.13)
Ex-ante components						
perm risk	1.699*	1.583*	0.158*	0.0142	-0.247***	0.0435
	(2.58)	(2.07)	(2.11)	(0.96)	(-8.14)	(1.78)
trans risk	2.316**	2.244**	0.196*	0.0283	-0.294***	0.0395
	(3.08)	(2.73)	(2.55)	(1.80)	(-8.95)	(1.45)
Ex-post components						
Age hh head	-0.00510	-0.00233	-0.000703	-0.000364	0.000195	0.000343
	(-0.91)	(-0.35)	(-0.52)	(-1.12)	(1.08)	(0.81)
Age sq. hh head	0.0000442	0.00000930	0.0000114	0.00000352	-0.00000154	-0.00000255
	(0.75)	(0.14)	(0.74)	(1.10)	(-0.85)	(-0.55)
hh size	0.0211	0.0318	-0.00100	-0.00378	-0.000844	-0.0267**
	(1.05)	(1.69)	(-0.21)	(-1.85)	(-0.90)	(-2.95)
hh size sq	0.0000480	-0.000937	0.000178	0.000451	0.000150	0.00303**
	(0.03)	(-0.57)	(0.38)	(1.91)	(1.48)	(2.97)
No of children	0.0342**	0.0296**	-0.00271	0.00329***	0.00154***	-0.00142
	(3.16)	(2.65)	(-0.95)	(5.08)	(3.31)	(-1.80)
Married hh head (yes=1)	0.00162	0.00478	-0.00258	-0.000100	-0.00178*	0.00204
	(0.04)	(0.14)	(-0.28)	(-0.08)	(-1.97)	(0.77)
hh head sex (male=1)	0.0102	0.0130	0.0000242	0.00138	0.00224***	-0.000501
	(0.37)	(0.41)	(0.00)	(1.27)	(3.34)	(-0.41)
Prim educ (yes=1)	-0.0733**	-0.0937***	-0.0104	-0.00451**	-0.00272**	-0.00608*
	(-3.26)	(-3.92)	(-1.67)	(-3.04)	(-3.27)	(-2.40)
Low secondary educ (yes=1)	-0.120***	-0.123***	-0.0132*	-0.00592***	-0.00404***	-0.00424
	(-5.39)	(-5.71)	(-2.00)	(-4.89)	(-5.09)	(-1.77)
Upper secondary educ (yes=1)	-0.152**	-0.167***	-0.0147*	-0.00671***	-0.00512***	-0.00401
	(-3.27)	(-4.64)	(-2.03)	(-4.53)	(-4.00)	(-1.19)
Tech/voc edu (yes=1)	-0.163***	-0.211***	-0.0123	-0.00482**	-0.00645***	-0.00415
	(-3.70)	(-4.36)	(-1.69)	(-2.98)	(-5.04)	(-1.44)
Univers. Edu (yes=1)	-0.375***	-0.378***	-0.0163	-0.000586	-0.00495***	-0.00412
	(-9.44)	(-7.52)	(-1.75)	(-0.29)	(-3.95)	(-1.62)
Geographical loc (urban=1)	-0.256***	-0.241***	-0.00329	-0.00189*	-0.00750***	-0.00248**
	(-9.79)	(-7.11)	(-0.72)	(-2.40)	(-7.40)	(-2.75)
lppc_incom n	-0.668***	-0.671***	0.00472	-0.0148***	-0.00569***	-0.00444***
	(-39.73)	(-37.13)	(1.20)	(-17.42)	(-10.06)	(-4.68)
cons	5.181***	5.130***	-0.00572	0.155***	0.105***	0.0891***
	(25.94)	(23.21)	(-0.13)	(11.20)	(14.15)	(4.37)

	rho2					
	Overall Vulnerability (V)	Poverty induced (P)	Overall Risk (V-P)	Trade-related risk	Aggr. risk	ex-post id. risk
q75	*(20.01)*	*(10.30)*	*(4.96)*	*(9.73)*	*(7.45)*	*(0.18)*
Ex-ante components						
perm risk	2.875***	2.361***	0.213*	0.0712*	-0.0972***	0.106**
	(6.17)	(6.43)	(2.46)	(2.52)	(-5.03)	(2.62)
trans risk	3.452***	2.963***	0.283**	0.113***	-0.119***	0.118**
	(7.11)	(7.41)	(3.08)	(3.39)	(-5.30)	(2.76)
Ex-post components						
Age hh head	-0.00687	-0.00585	0.000697	-0.000900	0.000276	0.000613
	(-1.29)	(-1.14)	(0.36)	(-0.80)	(1.31)	(0.73)
Age sq. hh head	0.0000721	0.0000543	-0.00000754	0.00000873	-0.00000223	-0.00000537
	(1.32)	(1.01)	(-0.38)	(0.78)	(-1.05)	(-0.60)
hh size	-0.0411	-0.0240	-0.0103	-0.0167*	-0.00336	-0.0385
	(-1.26)	(-0.80)	(-1.14)	(-2.39)	(-1.52)	(-0.86)
hh size sq	0.00501	0.00364	0.00114	0.00200*	0.000380	0.00443
	(1.44)	(1.15)	(1.23)	(2.30)	(1.51)	(0.84)
No of children	0.0568***	0.0514***	-0.000263	0.0107***	0.00358***	-0.000982
	(4.94)	(4.58)	(-0.09)	(5.34)	(6.29)	(-0.80)
Married hh head (yes=1)	-0.00548	0.00420	0.00131	0.00256	-0.000166	0.00145
	(-0.20)	(0.16)	(0.15)	(0.60)	(-0.13)	(0.25)
hh head sex (male=1)	0.0210	0.0267	0.000332	0.00110	0.000520	-0.00180
	(0.97)	(1.33)	(0.07)	(0.38)	(0.51)	(-0.82)
Prim educ (yes=1)	-0.0694**	-0.0806***	-0.0136	-0.0175***	-0.00443***	-0.00770
	(-2.94)	(-4.12)	(-1.39)	(-3.61)	(-3.43)	(-1.79)
Low secondary educ (yes=1)	-0.100***	-0.106***	-0.0169*	-0.0189***	-0.00488***	-0.00704
	(-5.49)	(-6.26)	(-2.00)	(-4.25)	(-4.43)	(-1.62)
Upper secondary educ (yes=1)	-0.123***	-0.132***	-0.0269*	-0.0193***	-0.00688***	-0.00435
	(-4.03)	(-5.77)	(-2.53)	(-3.96)	(-4.72)	(-0.90)
Tech/voc edu (yes=1)	-0.0517	-0.0815***	-0.0188*	-0.0117*	-0.00522***	-0.00374
	(-1.55)	(-3.50)	(-2.25)	(-2.24)	(-3.87)	(-0.79)
Univers. Edu (yes=1)	-0.0292	-0.0304	-0.0222*	0.000731	-0.00213	-0.00339
	(-0.50)	(-0.76)	(-2.38)	(0.11)	(-1.15)	(-0.78)
Geographical loc (urban=1)	-0.0975***	-0.0932***	-0.00655	-0.00197	-0.00589***	-0.00370*
	(-5.07)	(-7.40)	(-1.40)	(-0.77)	(-6.54)	(-2.38)
lppc_incom n	-0.511***	-0.468***	-0.0240***	-0.0372***	-0.00992***	-0.0104***
	(-29.56)	(-30.80)	(-6.13)	(-12.97)	(-11.04)	(-4.44)
cons	3.845***	3.469***	0.233***	0.389***	0.118***	0.151
	(20.57)	(19.01)	(3.71)	(8.25)	(11.45)	(1.68)

	rho3					
	Overall Vulnerability (V)	Poverty induced (P)	Overall Risk (V-P)	Trade-related risk	Aggr. risk	ex-post id. risk
q75	(14.55)	(14.40)	(7.58)	(8.22)	(8.42)	(0.64)
Ex-ante components						
perm risk	2.250***	1.641***	0.415***	0.208**	-0.00783	0.171**
	(7.66)	(7.15)	(3.80)	(3.28)	(-0.45)	(2.88)
trans risk	2.684***	2.057***	0.531***	0.318***	-0.00559	0.208**
	(7.96)	(8.09)	(4.45)	(4.27)	(-0.29)	(2.68)
Ex-post components						
Age hh head	-0.00901	-0.00662	0.00191	-0.00189	0.000313	0.000651
	(-1.50)	(-1.27)	(0.94)	(-0.75)	(0.85)	(0.36)
Age sq. hh head	0.0000981	0.0000667	-0.0000179	0.0000204	-0.00000269	-0.00000578
	(1.58)	(1.28)	(-0.85)	(0.78)	(-0.74)	(-0.27)
hh size	-0.0949*	-0.0671*	-0.0105	-0.0416***	-0.00511	-0.0559
	(-2.41)	(-2.05)	(-0.82)	(-3.43)	(-1.96)	(-0.16)
hh size sq	0.0106*	0.00792*	0.000984	0.00498**	0.000574	0.00650
	(2.31)	(2.15)	(0.69)	(3.13)	(1.79)	(0.17)
No of children	0.0708***	0.0617***	0.00804*	0.0224***	0.00459***	-0.000528
	(6.15)	(5.83)	(2.30)	(4.71)	(5.10)	(-0.25)
Married hh head (yes=1)	0.0325	0.00847	-0.00167	0.00885	-0.0000728	-0.00208
	(1.23)	(0.39)	(-0.16)	(0.83)	(-0.04)	(-0.08)
hh head sex (male=1)	-0.0141	0.000979	0.00165	0.000399	0.00120	-0.00108
	(-0.58)	(0.06)	(0.29)	(0.07)	(1.14)	(-0.36)
Prim educ (yes=1)	-0.108***	-0.0898***	-0.0273*	-0.0395***	-0.00629***	-0.0101
	(-3.33)	(-3.76)	(-2.10)	(-3.37)	(-3.78)	(-1.17)
Low secondary educ (yes=1)	-0.125***	-0.107***	-0.0318*	-0.0406***	-0.00674***	-0.0107
	(-4.12)	(-5.27)	(-2.50)	(-3.93)	(-4.38)	(-1.30)
Upper secondary educ (yes=1)	-0.143***	-0.116***	-0.0368**	-0.0369**	-0.00756***	-0.00741
	(-4.49)	(-4.60)	(-3.20)	(-3.19)	(-4.98)	(-0.91)
Tech/voc edu (yes=1)	-0.0571	-0.0663*	-0.0230	-0.0246*	-0.00463**	-0.00244
	(-1.33)	(-2.35)	(-1.79)	(-2.07)	(-2.66)	(-0.25)
Univers. Edu (yes=1)	0.0584	0.0393	-0.00695	0.000959	-0.000456	-0.000883
	(0.93)	(0.83)	(-0.52)	(0.07)	(-0.24)	(-0.09)
Geographical loc (urban=1)	-0.0161	-0.00959	-0.00199	0.00497	-0.00259**	-0.0000574
	(-0.82)	(-0.75)	(-0.37)	(0.88)	(-2.62)	(-0.02)
lppc_incom n	-0.420***	-0.348***	-0.0580***	-0.0723***	-0.0123***	-0.0198***
	(-22.23)	(-21.39)	(-9.00)	(-10.29)	(-10.39)	(-3.66)
cons	3.412***	2.750***	0.462***	0.745***	0.121***	0.257
	(14.31)	(15.44)	(6.63)	(6.97)	(10.23)	(0.37)

Standard errors below the corresponding coefficients. $*p \leq 0.10; **p \leq 0.05; ***p \leq 0.01$

Appendix 4B - Additional income and consumption estimates (robustness checks)

Table 4B-1: Panel regression on household income in Vietnam (2002-06) with time trends

dep.var.: log of real pc income	Coeff.	Std. Err.
Age hh head	0.012	0.0166
Age sq. hh head	-0.000***	0.000160
hh size	-0.162***	0.0278
hh size sq	0.008***	0.00215
No of children	-0.042**	0.0170
Married hh head (yes=1)	0.0162	0.0759
hh head sex (male=1)	-0.056	0.0921
Prim educ (yes=1)	0.025	0.0387
Low secondary educ (yes=1)	0.027	0.0497
Upper secondary educ (yes=1)	-0.005	0.0769
Tech/voc edu (yes=1)	0.110+	0.0686
Univers. Edu (yes=1)	-0.046	0.123
Geographical loc (urban=1)	-0.319***	0.108
time trend	0.215***	0.0180
Cons	8.973***	0.681
Fixed effects:		
household	yes	
year	yes	
trade categories	yes	
No Obs.	2964	
R-sq	0.824	

Robust standard errors in parentheses. $^{+}p \leq 0.15 * p \leq 0.10; ** p \leq 0.05; ***p \leq 0.01$
In the fixed effects specification the category "non-traded activities" and year 2002 act, respectively, as the benchmark from trade-related and year fixed effects.

Table 4B-2: Panel regression on household consumption in Vietnam (2002-06) with income residuals controlling for trade categories time trend

dep.var.: log of real pc consumption	1 (with π)		2 (with π^2)		3 (with π^3)	
Ex-ante components						
permanent risk						
(expected wealth in scaling factor=						
L. real pc cons.)	-0.0000234	-0.000108	-6.46e-08**	-7.74e-08***	-1.18e-11***	-1.32e-11***
	(0.000224)	(0.000248)	(2.58e-08)	(2.75e-08)	(3.08e-12)	(3.37e-12)
transitory risk	-0.00000809	0.000114	-5.45e-09	4.27e-10	1.36e-12	1.95e-12
	(0.000169)	(0.000175)	(1.40e-08)	(1.46e-08)	(1.52e-12)	(1.62e-12)
Ex-post components						
Age hh head	0.0418**	0.0424***	0.0421**	0.0433***	0.0423**	0.0434***
	(0.0165)	(0.0159)	(0.0164)	(0.0159)	(0.0165)	(0.0159)
Age sq. hh head	-0.000395**	-0.000399***	-0.000399***	-0.000408***	-0.000400***	-0.000410***
	(0.000153)	(0.000148)	(0.000153)	(0.000148)	(0.000153)	(0.000148)
hh size	-0.159***	-0.158***	-0.159***	-0.161***	-0.159***	-0.160***
	(0.0300)	(0.0298)	(0.0297)	(0.0294)	(0.0295)	(0.0292)
hh size sq	0.00616***	0.00613***	0.00619***	0.00625***	0.00616***	0.00622***
	(0.00226)	(0.00223)	(0.00225)	(0.00222)	(0.00224)	(0.00221)
No of children	-0.0527**	-0.0517**	-0.0528**	-0.0522**	-0.0535**	-0.0529**
	(0.0231)	(0.0233)	(0.0231)	(0.0233)	(0.0230)	(0.0233)
Married hh head (yes=1)	0.0339	0.0341	0.0317	0.0309	0.0327	0.0319
	(0.0865)	(0.0836)	(0.0866)	(0.0837)	(0.0865)	(0.0838)
hh head sex (male=1)	-0.0215	-0.0316	-0.0191	-0.0268	-0.0207	-0.0275
	(0.0916)	(0.0895)	(0.0916)	(0.0894)	(0.0915)	(0.0895)
Prim educ (yes=1)	0.0404	0.0394	0.0405	0.0397	0.0402	0.0393
	(0.0462)	(0.0465)	(0.0466)	(0.0468)	(0.0464)	(0.0466)
Low secondary educ (yes=1)	0.0832	0.0817	0.0837	0.0814	0.0834	0.0806
	(0.0582)	(0.0584)	(0.0584)	(0.0586)	(0.0583)	(0.0584)
Upper secondary educ (yes=1)	0.0136	0.00632	0.0146	0.00722	0.0141	0.00640
	(0.0819)	(0.0812)	(0.0822)	(0.0813)	(0.0820)	(0.0812)
Tech/voc edu (yes=1)	0.0706	0.0701	0.0736	0.0730	0.0724	0.0711
	(0.0665)	(0.0668)	(0.0667)	(0.0670)	(0.0665)	(0.0668)
Univers. Edu (yes=1)	0.236*	0.226+	0.238*	0.227+	0.237*	0.226+
	(0.138)	(0.139)	(0.138)	(0.140)	(0.138)	(0.140)
Geographical loc (urban=1)	0.171**	0.157*	0.170**	0.154*	0.172**	0.155*
	(0.0711)	(0.0852)	(0.0707)	(0.0850)	(0.0705)	(0.0849)
cons	8.245***	8.220***	8.243***	8.222***	8.225***	8.205***
	(0.546)	(0.538)	(0.540)	(0.533)	(0.543)	(0.538)
pos. Income shocks	2.400***	2.404***	2.559***	2.689***	2.515***	2.650***
	(0.570)	(0.565)	(0.535)	(0.530)	(0.533)	(0.530)
neg. Income shocks	2.313***	2.126***	2.283***	2.180***	2.247***	2.156***
	(0.531)	(0.535)	(0.505)	(0.505)	(0.504)	(0.503)
Fixed effects:						
trade-related:						
Exporting industries		-0.0953*		-0.0925*		-0.0915*
		(0.0507)		(0.0502)		(0.0502)
Import-competing industries		-0.0637+		-0.0560		-0.0503
		(0.0415)		(0.0407)		(0.0409)
Rice		-0.0403+		-0.0415+		-0.0411+
		(0.0270)		(0.0269)		(0.0269)
Main export crops		-0.170***		-0.169***		-0.171***
		(0.0536)		(0.0521)		(0.0522)
Other export crops		-0.0880+		-0.0855+		-0.0830+
		(0.0567)		(0.0556)		(0.0554)
import-competing crops		-0.146***		-0.123***		-0.115***
		(0.0537)		(0.0447)		(0.0435)
Non-traded food		-0.0658		-0.0579		-0.0542
		(0.0989)		(0.0978)		(0.0978)
household	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
years	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*
No Obs.	1976	1976	1976	1976	1976	1976
Adj R-sq	0.823	0.824	0.824	0.825	0.825	0.826

Robust standard errors in parentheses. $+p \leq 0.15$; $*p \leq 0.10$; $**p \leq 0.05$; $***p \leq 0.01$
In the fixed effects specification the category "non-traded activities" and year 2002 act, respectively, as the benchmark from trade-related and year fixed effects.

Conclusions

Although each essay focuses on a specific issue, by putting them together, this thesis provides a thorough understanding of trade-induced vulnerability, both conceptually and empirically. Moreover, in all the reported empirical analyses - except those with cross-sectional data (Essay 3) - we are able to isolate a clean measure of the ex-ante permanent risk, by filtering out possible measurement errors using Carroll and Samwick's (1997) decomposition, as well as to control for possible additional endogeneity in the model by using panel fixed effects (Essay 4) and system-GMM estimation techniques (Essay 2). In this respect, Essay 3 is an exception. It is a first effort to present a comprehensive analysis of vulnerability under *Doi Moi* by exploiting the full set of available rounds of household surveys currently available. While the lack of panel data makes it impossible to rule out the influence of unobservables, this effort represents, in my opinion, a fruitful way to address the issue, conceptually. Since we are facing a chronic lack of panel data in developing contexts and market failures hamper the actual predictability of simulation exercises, I believe that deriving insights from available cross-sectional data, taking explicitly into account the problems of observability without the availability of panels, actually represents an opportunity that should not be missed. It would be at least as fruitful as investing in the creation of additional panel data at the household level.

The review of the literature in Essay 1 clearly shows that trade openness could in principle magnify risk, impact on households' optimal portfolios, and lead to net welfare effects that are less positive than expected in the long run. As a result, households in the midst of trade reforms may employ strategies to mitigate risks and reduce welfare variability. For instance, households may try to reduce the variability of their welfare by relying on income diversification (i.e., combining activities with low positive covariance), income skewing (i.e., allocating resources to low-risk and low-return activities), asset smoothing, strategic migration, etc. (Dercon, 2005). These actions can result in deviations from a smoothing path of consumption (and saving) behaviour and/or imply, especially for the poor, conservative choices that lower the expected value of income (and consumption) in exchange for lower variability. Hence, these strategies can be costly in the short run (Coate and Ravallion, 1993; Udry, 1994; Townsend, 1994, 1995; Besley, 1995; Morduch, 2002; Elbers and Gunning, 2007; Giles and Yoo, 2007; Jalan and Ravaillon, 2001) with negative permanent effects also in the long-run (Ravallion 1988; Morduch 1994; Dercon, 2005). Consequentely, any measure of trade-induced vulnerability which is not able to take adequately into account the risk-induced component of "*ex-ante*" changes in behaviour is biased downwards. For example, households in the midst of a trade reform may deviate from consumption smoothing to safeguard against unexpected future bad shocks by carrying out "extra saving" (shying away from profitable but risky investments) and/or by self-imposed reluctance to borrow (Caroll, 2001, Caballero, 1990, Deaton, 1992) with permanent effects on their welfare. This is the innermost source of vulnerability since it is neither directly observable nor linked to an actual manifestation of shocks.

Essay 2 builds on this intuition using a long cross-country panel data set. It highlights a significant cross-country association, on average and *ceteris paribus*, between *ex-ante* permanent risk and deviations from consumption smoothing, resulting in a significant amount of extra-saving and lower consumption prospects. It shows that this is particularly evident in the most recent decades and holds across the entire income distribution. The conclusion argues that standard certainty equivalent analyses that do not control for the precautionary saving component can be affected by omitted variable bias and underestimate risk. On the other hand, it also shows that these empirical results ultimately confirm the Lucas's (1987) intuition regarding the low value of stabilisation policies.

Consistent empirical evidence is derived in Essay 3 by relaxing the representative agent assumption and taking advantage of the availability of several rounds of household living standard survey data (VLSS and VHLSS, covering a period between 1992 and 2008). Even if, as already stated, this empirical exercise cannot be considered a proper test of the precautionary saving theory because of its static nature, these results are consistent with the provisions made by theory, i.e., that *ex-ante* risk implies a lower level of current consumption. The inconsistency of alternative interpretations of these results is apparent: why should both the unobservable heterogeneity and measurement error change according to household trade exposure across sectors? And why are households working in the more exposed trading sector more, and increasingly, severely affected by unobservables and measurement errors than households working in the less trade-exposed sector? And, even more so, why should the impact of unobservables and measurement errors on consumption behaviour be negative? To provide explanations, we need to assume that the households that self-select to participate in the more exposed trade sectors present a set of common characteristics, unobserved to the researcher, or alternatively a common path in their relative measurement error, that have a negative impact on their consumption behaviour. Even if these assumptions are correct, the empirical result would still be a very relevant issue for policymaking and would imply a partial revision of the assumed trade benefits for the welfare of Vietnamese households working in the most exposed trading sector. As a matter of fact, the nature of the heterogeneity of the *ex-ante* income innovation on trade-related sectors as well as the role of risk management strategies actually engaged in by Vietnamese households need more careful investigation.

Essay 4 applies the same empirical exercise to the available set of panel data (at the expense of reducing the time span of the analysis) and presents an extended version of Ligon and Schechter's (2003) measure of vulnerability as low expected utility in order to isolate the trade component of vulnerability. This shows more robust empirical outcomes: first, risk-induced vulnerability consistently matters in determining the overall vulnerability of households and second, the relative inability, on average, to share risks across households involved in different trade-related clusters. This confirms the intuition that trade-related risks (i.e., risks that are not fully shared across trade-related industries) matter in determining household overall vulnerability. Third, it shows that *ex-ante* permanent risk is significantly correlated with both poverty, via the precautionary saving channel, and all the subelements of the risk components of vulnerability (trade-related included). Fourth, it shows that the relative impact of *ex-ante* permanent risk actually increases as vulnerability distribution increases (with the most vulnerable households being the most severely affected).

The main contribution of this work has been to provide a set of useful insights to reconcile, conceptually and empirically, the theory of precautionary saving with an empirical analysis of vulnerability, that have been considered to date as two separate issues (current vulnerability measures continue to use average consumption as the risk-free counterfactual). Second, it demonstrates, empirically, that household consumption behaviour is sensitive to permanent risk and that this empirical evidence holds both in a long-term (pre-crisis) cross-country (see Essay 2) scenario and in a within-country context (see Essays 3 and 4). Third, it shows different workable methods of complementing current standard vulnerability measures with an analysis of trade-related risks (taking advantage of empirical evidence of the absence of full risk sharing across households clustered in different trading industries). Finally, it detects empirically significant differences in household vulnerability showing that the relative impact of the *ex-ante* permanent risk (included its trade-related component) actually increases as vulnerability distribution increases (with the most vulnerable households being the most severely affected).

This research has strong policy implications. First of all, by demonstrating that the characteristics of the vulnerable differ significantly from those of the poor, it shows that targeting only the latter means that we exclude a significant group of households that are at risk of a decline in living standards. Moreover, it challenges the widespread idea that the poor will be among the most vulnerable people (World Bank, 2000; Calvo & Dercon, 2007a). Empirical analyses show that: i) shocks occur everywhere across the income distribution and affect the poor and non-poor alike (Tesliuc and Lindert, 2004); ii) the poor can show a higher degree of resilience even if they rely on coping strategies that could damage their growth prospects (Jalan & Ravaillon, 1999, Zimmerman & Carter, 2003; Carter & Barrett, 2006; Carter & al., 2007). This illustrates a key difference between resilience and responsiveness that is also worth bearing in mind when drawing policy implications. Second, it demonstrates that output volatility does not translate one for one to consumption volatility and that *ex-ante* permanent risk is significantly correlated with both poverty, via the precautionary saving channel, and all the subcomponents of the risk components of vulnerability. Finally, it shows that risk-induced vulnerability consistently matters in determining households' overall vulnerability and, specifically, that trade-related risks (i.e., risks that are not fully shared across trade-related industries) also matter in determining household overall vulnerability.

To the best of my knowledge, this is the first conceptualisation, supported by thorough empirical assessments, of the influence of trade-related risks on household vulnerability. Although it does not represent, by any means, an argument against free trade, it is a necessary quest to deepen our knowledge of the stabilisation needs linked to trade reforms ranging from the promotion of credible stabilisation policies (e.g., reducing price fluctuations) to the design of new insurance schemes that target vulnerable households (e.g., raise the creditworthiness of small farmers' participation in export cropping). As a result, this work clearly improves our capacity to assess the "vulnerability hazard" of trade reforms, at different levels of analysis. While an evaluation of the impact of covariate risks induced by trade openness is of major interest to international economic policy, an assessment of trade-related idiosyncratic risks will help national policymakers to set priorities and calibrate domestic mitigation strategies and safety nets. The empirical evidence of the persistence of a significant presence of risk-induced vulnerable households in Vietnam during *Doi Moi*, combined with the inability to share risks by households clustered in different trade-related groups of activities, should inform national policy in terms of safety nets. In this respect, it has to be stressed once more that trade-induced vulnerability is not directly observable or linked to the actual manifestation of shocks.

While informative and comprehensive, this piece of work prepares the ground for a number of additional research questions. First, Essays 1, 3 and 4 highlight the significance and relevance of the "meso" dimension of vulnerability. At present, this appears to be one of the most promising paths towards empirical evidence of trade-induced vulnerability at the household level thanks to the robust empirical evidence of heterogeneity in risk exposure by trading industries. What actually drives this heterogeneity (heterogeneity in risk-mitigating strategies and/or in the inherent exposure to different kinds of foreign risks) is something that needs additional careful investigation. Second, Essay 4 presents a first attempt to provide an extended version of VEU. The primary scope of this piece of work was to amend it to filter out a "meso trade-related" component of permanent risk. It incidentally also dealt with the main weakness of the VEU measure related to the inability to take full account of precautionary saving behaviour. While this essay presents a first insight into this issue by filtering out the *ex-ante* risk from *ex-post* shock within the VEU measure, additional efforts should be made to provide a causal analysis of their relative influence on the separate poverty and risk-induced VEU components.

Bibliography

[1] Abbott, P., Bentzen, J. & F., Tarp (2009) Trade and Development: Lessons from Vietnam's Past Trade Agreements. *World Development*, 37(2), pp. 341-353.

[2] Acemoglu, D., S., Johnson, J., Robinson, & Y., Thaicharoen (2003). Institutional causes, macroeconomic symptoms: volatility, crises and growth. *Journal of Monetary Economics*, 5(1), 49-123.

[3] Achen, H., (1982). Interpreting and using regression. SAGE Publications Ltd., United Kingdom.

[4] Agenor, P., R., C., J., McDermott, & E., S., Prasad (2000). Macroeconomic fluctuations in developing countries: some stylized facts. *World Bank Economic Review*, 14(2), 251-285

[5] Ahmed I.I., & M., Lipton (1999). *Impact of structural adjustment on sustainable rural livelihoods: a review of the literature*. IDS Working Paper 62, Sussex: Institute for Development Studies (IDS).

[6] Aizenman, J., & N., Marion (1999). Volatility and Investment: Interpreting Evidence from Developing Countries. *Economica*, 66, 157-79

[7] Aizenman, J., & B. Pinto (eds) (2005). *Managing economic volatility and crises: a practitioner's guide*. Cambridge: Cambridge University Press.

[8] Aizenman, J., & Noy, I. (2013). *Public and private saving and the long shadow of macroeconomic shocks*. National Bureau of Economic Research, No. w19067.

[9] Alesina A., R., Hausmann, R., & Hommes, E., Stein (1999). Budget institutions and fiscal performance in Latin America. *Journal of Development Economics*, 59, 253–273.

[10] Alwang, J., P. B., Siegel, & S. L., Jorgensen (2001). *Vulnerability: a view from different disciplines*. Social Protection Discussion Paper Series No.0015, Washington DC: The World Bank.

[11] Amemiya T. (1977) The maximum likelihood estimator and the nonlinear three stage least squares estimator in the general nonlinear simultaneous Equation model. *Econometrica*, 45, pp. 995-968.

[12] Amin, S., A.S., Rai, & G., Topa (1999). *Does Microcredit Reach the Poor and Vulnerable? Evidence from Northern Bangladesh*. CID Working Paper No.28, Cambridge MA: Center for International Development, Harvard University.

[13] Anderson, H., Kwark, N.S., & F., Vashid (1999). *Does International Trade Synchronize Business Cycles?* Texas: Manuscript, Monash University and Texas AM University.

[14] Andrews, M., Schank, T., & Upward, R. (2006). Practical fixed-effects estimation methods for the three-way error-components model. *Stata Journal*, 6(4), 461.

[15] Arellano, M., & Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. *Journal of econometrics*, 68(1), 29-51.

[16] Arellano, M., & S., Bond. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *Review of Economic Studies* 58: 277–297.

[17] Arrow, K. J. (1965). Aspects of the theory of risk-bearing. Yrjo Jahnssonin Saatio.

[18] Asdrubali P., & S., Kim (2008). Incomplete Inter-temporal Consumption Smoothing and Incomplete Risk Sharing. *Journal of Money, Credit and Banking*, 40:7.

[19] Atkins, J.P., & S., Mazzi (1999). *Small States: A Composite Vulnerability Index*. Washington DC: Advisory Board to the Joint Commonwealth Secretariat/World Bank Task Force on Small States, World Bank.

[20] Baiardi, D., Manera, M., & Menegatti, M. (2013). Consumption and precautionary saving: An empirical analysis under both financial and environmental risks. *Economic Modelling*, 30, 157-166.

[21] Banks, J., Blundell, R. & A., Brugiavini (2001). Risk Pooling, Precautionary Saving and Consumption Growth, *Review of Economic Studies,* Wiley Blackwell, vol. 68(4), pages 757-79, October.

[22] Barrientos, A. (2007). *Does vulnerability create poverty traps?* CPRC Working Paper No. 76, Sussex: Institute of Development Studies (IDS), May.

[23] Battistin, E., Blundell, R., Lewbel, A. (2009). Why is consumption more log normal than income? Gibrat's law revisited. *Journal of Political Economy*, 117(6), 1140-1154.

[24] Baulch, B., & J., Hoddinott (2000). Economic Mobility and Poverty Dynamics in Developing Countries. *Journal of Development Studies*, 36(6), 124.

[25] Baxter, M., & Kouparitsas, M. (2005). Determinants of Business Cycle Co-movement: A Robust Analysis. *Journal of Monetary Economics*, 52(1), pp.113-157.

[26] Becker, G., S., (1965). A theory of the allocation of time. *The Economic Journal*, 75(299), 493-517.

[27] Bekaert G., C. R. Harvey, C. Lundblad (2005). Does financial liberalization spur growth?. *Journal of Financial Economics*, 77(1): 3-55.

[28] Bertola, G., & R., J., Caballero (1994). Irreversibility and Aggregate Investment. *The Review of Economic Studies*, 61(2), 223-246.

[29] Besley, T., (1995). Nonmarket Institutions for Credit and Risk Sharing in Low-Income Countries, *Journal of Economic Perspectives*, 9(summer), 115-27.

[30] Bhagwati, J., & T., N., Srinivasan (2002).Trade and poverty in the poor countries. *The American Economic Review*, 92(2), 180-183.

[31] Blackburn, K., & A., Pelloni (2004). On the relationship between growth and volatility. *Economics Letters*, 83, 123–127.

[32] Blackburn, K., & A., Pelloni (2005). Growth, cycles, and stabilization policy. *Oxford Economic Papers*, 57, 262–282.

[33] Blanchard, O., & S., Fischer (1989). *Lectures on Macroeconomics*, Cambridge, Mass.: MIT Press.

[34] Blundell, R., & S., Bond (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of econometrics*, 87(1), 115-143.

[35] Blundell, R., & T., Stoker (1999). Consumption and the timing of income risk, *European Economic Review*, Elsevier, vol. 43(3), pages 475-507, March.

[36] Bond, S. R., Hoeffler, A., J., R., Temple (2001). *GMM estimation of empirical growth models*. Mimeo.

[37] Bordo M., D. (2005). *Historical Perspective on Global Imbalances*. NBER Working Paper Series, No. 11383, Cambridge MA: National Bureau of Economic Research.

[38] Brandt, L., Benjamin, D., & B., McCaig (2009), *The Evolution of Income Inequality in Vietnam*, Centre for Economic Policy Research Discussion Paper No. 622, ANU.

[39] Briguglio, L., (1995). Small island developing states and their economic vulnerabilities. *World Development*, 23(9), 1615-1632.

[40] Briguglio, L., & W., Galea (2003). Updating the Economic Vulnerability Index. Occasional Papers on Islands and Small States.

[41] Briguglio, L., G., Cordina, N., Farrugia, & S., Vella (2009). Economic Vulnerability and Resilience: Concepts and Measurements. *Oxford Development Studies*, 37(3), 229-247.

[42] Broner, F. & J., Ventura (2011). Globalization and risk sharing. *Review of Economic Studies* 78(1), 49-82.

[43] Browning, M., & A., Lusardi (1996). Household Saving: Micro Theories and Micro Facts, *Journal of Economic Literature*, American Economic Association, vol. 34(4), pages 1797-1855, December.

[44] Caballero R., J., (1990), Consumption Puzzles and Precautionary Savings, *Journal of Monetary Economics* 25, 113-136.

[45] Caballero R., J., (1991), On the Sign of the Investment-Uncertainty Relationship. *The American Economic Review*, 81(1), 279-288.

[46] Caballero R., J., & A., Krishnamurthy (2009). *Global Imbalances and Financial Fragility*. NBER Working Paper Series, No. 14688. Cambridge MA: National Bureau of Economic Research.

[47] Calderon, C. A., N., Loayza, & K., Schmidt-Hebbel (2005). *Does openness imply greater exposure?* World Bank Policy Research Working Paper No. 3733, World Bank.

[48] Calderon, C. A., A. E., Chong, & E. H., Stein (2007). Trade intensity and business cycle synchronization: are developing countries any different? *Journal of International Economics*, 71(1), 2-21.

[49] Calderon, C. & R., Fuentes (2010). *Characterizing the Business Cycles of Emerging Economies*. Policy Research Working Paper, 5343, The World Bank, DC, June.

[50] Calvo, C. (2008). Vulnerability to multidimensional poverty: Peru, 1998-2002. *World Development*, 36(6), 1011-1020.

[51] Calvo, C., & S., Dercon (2003). *Vulnerability: an axiomatic approach*. Oxford: Mimeo, Department of Economics, University of Oxford.

[52] Calvo, C., & Dercon, S. (2005). *Measuring individual vulnerability*. Discussion paper no. 229. Oxford: University of Oxford.

[53] Calvo, C., & S., Dercon (2007a). *Vulnerability to poverty*. CSAE WPS 2007-03, Oxford: University of Oxford.

[54] Calvo, C., & S., Dercon (2007b). *Chronic Poverty and All That: The Measurement of Poverty over Time*. CSAE Working Paper Series 2007-04, Centre for the Study of African Economies, University of Oxford.

[55] Calvo, C., & S., Dercon (2013). Vulnerability to individual and aggregate poverty. *Social Choice and Welfare*, 41(4), 721-740.

[56] Calvo, G.A., A., Izquierdo & L.F., Mejia. (2004). *On the empirics of sudden stops*. NBER Working Paper No 10520. Cambridge, MA: National Bureau of Economic Research.

[57] Canova, F., & H., Dellas, (1993). Trade interdependence and the international business cycle, *Journal of International Economics*. 34, 2347.

[58] Carney, D. (1999). *Livelihoods approaches compared*. London: Department for International Development.

[59] Carriére-Swallow, Y. and L., F., Céspedes (2013). The Impact of Uncertainty Shocks in Emerging Economies. *Journal of International Economics*. doi: 10.1016/j.jinteco.2013.03.003.

[60] Carroll, C., D. (2000). Requiem for the Representative Consumer? Aggregate Implications of Microeconomic Consumption Behaviour. *The American Economic Review*. 90(2), 110-115.

[61] Carroll, C., D. (2001a). A theory of the consumption function with and without liquidity constraints. *The Journal of Economic Perspectives*, 15(3), 23-45.

[62] Carroll, C., D. (2001b). *Death to the Log-Linearized Consumption Euler Equation! (And Very Poor Health to the Second-Order Approximation)*, Advances in Macroeconomics: Vol. 1: No. 1, Article 6.

[63] Carroll, C., D. (2013). *Consumption with Constant Absolute Risk Aversion (CARA) Utility*, mimeo.

[64] Carroll, C., D., & M., S., Kimball (2008). "Precautionary saving and precautionary wealth." in Durlauf, S., N., & L., E., Blume (Eds.). *The New Palgrave Dictionary of Economics*. Second Edition. Palgrave Macmillan.

[65] Carroll, C. D., Hall, R. E., Zeldes, S. P. (1992). The buffer-stock theory of saving: Some macroeconomic evidence. *Brookings papers on economic activity*, 1992(2), 61-156.

[66] Carroll, C. & A., Samwick (1997) The nature of precautionary wealth, *Journal of Monetary Economics*. 40(1), pp. 41-71.

[67] Carroll, C. & A., Samwick (1998) How Important Is Precautionary Saving?, *The Review of Economics and Statistics*. 80(3), pp. 410-419.

[68] Carter, M. R. & C., B., Barrett (2006) The economics of poverty traps and persistent poverty: An asset based approach, *Journal of Development Studies*. 42, 178-199.

[69] Carter, M. R. & M., Ikegami (2009). *Looking forward: theory-based measures of chronic poverty and vulnerability*. In: Addison, T.; Hulme, D.; and Kanbur R. (eds), Poverty Dynamics: Interdisciplinary Perspectives, Oxford University Press: 128-153.

[70] Carter, M. R., P.D., Little, T., Mogues, & W., Negatu (2007). Poverty traps and the long-term consequences of natural disasters in Ethiopia and Honduras. *World Development*, 35(5), 835-856.

[71] Cavallo, E., A. (2007). Output volatility and openness to trade: a reassessment. *Economia*, 9(1), 105-138.

[72] Cavallo, E., A., & J., A., Frankel (2008). Does openness to trade make countries more vulnerable to sudden stops, or less? using gravity to establish causality. *Journal of International Money and Finance*, 27(8), 1430-1452.

[73] Chaudhuri, S. (2001). Empirical methods for assessing household vulnerability to poverty, unpublished manuscript.

[74] Chaudhuri, S. (2003) *Assessing vulnerability to poverty: concepts, empirical methods and illustrative examples*. New York: Mimeo, Department of Economics, Columbia University.

[75] Chaudhuri, S. & G., Datt (2001). *Assessing Household Vulnerability to Poverty: a Methodology and Estimates for the Philippines*. World Bank Draft.

[76] Chaudhuri S., Jalan, J. & A., Suryahadi (2002) *Assessing Household Vulnerability to Poverty from Cross-sectional Data: A Methodology and Estimates from Indonesia*, (mimeo), Department of Economics, Columbia University: New York.

[77] Cherif, R., & F., Hasanov (2012). *The Volatility Trap: Precautionary Saving, Investment, and Aggregate Risk*, IMF working paper, 12/134.

[78] Christiaensen, L., & R., Boisvert (2000). *On measuring household food vulnerability: Case evidence from Northern Mali*. Working Paper 2000-05. Ithaca, NY: Cornell University, Department of Applied Economics and Management.

[79] Christiaensen, L. & K., Subbarao (2005) Towards an Understanding of Household Vulnerability in Rural Kenya, *Journal of African Economies*, vol. 14(4), pages 520-558.

[80] Claessens, S., S., Evenett & B., Hoekman (eds) (2010). *Rebalancing the Global Economy: A Primer for Policymaking*. London (UK): Vox.org CEPR.

[81] Clark, T. E., & E., van Wincoop (2001). Borders and business cycles. *Journal of International Economics*, 55, 5985.

[82] Cline, W. R (2004). *Trade policy and global poverty*. Washington (DC): Institute of International Economics.

[83] Coate, S. & M., Ravallion (1993) Reciprocity without Commitment: Characterisation and Performance of Informal Insurance Arrangements, *Journal of Development Economics*. 40, 1-24.

[84] Coello, B., Fall, M. & A., Suwa-Eisenmann (2010). *Trade liberalization and poverty dynamics in Vietnam 2002-2006*. PSE Working Papers, HAL.

[85] Constantinides, G., & D., Duffie (1996). Asset Pricing with Heterogeneous Consumers. *Journal of Political Economy*, 104(2), 219-40.

[86] Corsetti, G., P., Pesenti, N., Roubini, & C., Tille (2000). Competitive devaluations:toward a welfare based approach. *Journal of International Economics*. 51(1), 217-241.

[87] Crucini, M., J. & G., D. Hess (2000). *International and Intranational risk sharing*. in Hess, G., D. and Van Wincoop, E., Intranational macroeconomics, Cambridge University Press, Cambridge, UK.

[88] Cuong, N. V., Truong, T. N. & R., van der Weide (2010) Poverty and Inequality Maps in Rural Vietnam: An Application of Small Area Estimation. *Asian Economic Journal*. 24: 355-390.

[89] Datt, G., & H., Hoogeveen (2000). El Nino or El Peso? crisis, poverty and income distribution in the Philippines. *World Development*, 31(7), 1103-1124.

[90] Deaton, A. (1992). *Understanding consumption*. Clarendon, Oxford

[91] Dehn, J. (2000). *The effects on growth of commodity price uncertainty and shocks*. Policy Research Working Paper No. 2455, World Bank.

[92] Demir, F. (2009). Financial liberalization, private investment and portfolio choice: Financialization of real sectors in emerging markets. *Journal of Development Economics*, 88, 314-324.

[93] Denizer, C., M., P., Iyigun, & A., L., Owen (2002). Finance and macroeconomic volatility. *Contributions to Macroeconomics*, 2(1).

[94] Dercon, S. (2001) *Assessing Vulnerability to Poverty*. Oxford: Mimeo, Jesus College and CSAE, Department of Economics, Oxford University.

[95] Dercon, S. (2005) Risk, *Insurance, and Poverty: A Review*. In: Dercon, S. (ed.), Insurance against Poverty, Oxford University Press.

[96] Dercon, S., & P., Krishnan (2000). Vulnerability, seasonality and poverty in Ethiopia. *Journal of Development Studies*. 36(6): 25-53.

[97] Dercon, S., & L., Christiaensen (2011). Consumption risk, technology adoption and poverty traps: Evidence from Ethiopia. *Journal of Development Economics*. 96 (2), 159-173.

[98] di Giovanni, J., & A., Levchenko (2009). Trade Openness and Volatility. *Review of Economics and Statistics* 91(3), 558-585

[99] Di Nardo, J., N., Fortin, & T., Lemieux (1996). Labor market institutions and the distribution of wages, 1973-1992: a semiparametric approach. *Econometrica*, 64(5), 1001-44.

[100] Dinar, A. (1998). *Measuring the impact of climate change on Indian agriculture*. World Bank Technical Paper No. 402, Washington (DC): World Bank.

[101] Dollar, D., & A., Kraay (2002). Growth is good for the poor. *Journal of Economic Growth*, 7(3), 195-225.

[102] Dollar, D., & A., Kraay (2004). Trade, growth, and poverty. *The Economic Journal*, 114(493), F22-F49.

[103] Driscoll, J., & A., C., Kraay (1998). Consistent covariance matrix estimation with spatially dependent data. *Review of Economics and Statistics*, 80: 549-56.

[104] Dynan, K. E., (1993), How prudent are consumers? *Journal of Political Economy*, 101(6), 1104-1113.

[105] Dutta, I., Foster, J., & A., Mishra (2011). On measuring vulnerability to poverty. *Social Choice and Welfare*, 37(4), 743761.

[106] Easterly, W., M., Kremer, L., Pritchett, & L., Summers (1993). Good policy or good luck?: country growth performance and temporary shocks. *Journal of Monetary Economics*, 32(3), 459-483.

[107] Easterly, W.R., & A., Kraay (2000). Small States. Small Problem? Income, Growth, and Volatility in Small States, *World Development*, 28(11), 2013-2027.

[108] Easterly, W.R., R., Islam, & J., E., Stiglitz (2001). *Shaken and Stirred: Explaining Growth Volatility*. In Pleskovic B. & N., Stern (eds) Annual Bank Conference on Development Economics 2000, Washington, DC: World Bank, 191-211.

[109] Edwards, S. (1993). Openness, trade liberalisation and growth in developing countries. *Journal of Economic Literature*, 31, 1358-93.

[110] Edwards, S. (2004). Financial openness, sudden stops and current account reversals. *American Economic Review*, 94(2), 59-64.

[111] Eichengreen, B., & A., K., Rose (1999). *Contagious currency crises: channels of conveyance*. In Ito, T., & A., Krueger (eds.) Changes in exchange rates in rapidly developing countries theory, practice, and policy issues. NBER-East Asia Seminar on Economics, 7, Chicago (USA): Chicago University Press, 2955.

[112] Eichengreen, B. & M., D., Bordo (2002). *Crises Now and then: What Lessons from the Last Era of Financial Globalization*. NBER Working Paper Series No 8716. Cambridge, MA: National Bureau of Economic Research.

[113] Elbers, C., & J., W., Gunning (2003). *Vulnerability in a stochastic dynamic model*. Tinbergen Institute Discussion Paper, 070/2, Amsterdam (NL): Department of Economics, Tinbergen Institute.

[114] Elbers, C., Gunning, J. W. & B., Kinsey (2007) Growth and Risk: Methodology and Micro Evidence, *World Bank Economic Review*, Oxford University Press, 21(1), pp. 1-20.

[115] Elbers, C., Gunning, J. W. & L., Pan (2009) Growing out of poverty: Evidence from rural Ethiopia, *Development and Comp Systems* 0408015, EconWPA.

[116] Fatás, A. (2000) Do business cycles cast long shadows? short-run persistence and economic growth. *Journal of Economic Growth*, 5, 147–162.

[117] Fatás, A., & I., Mihov (2003). The case for restricting fiscal policy discretion. Quarterly Journal of Economics, 118(4), 1419-1447.

[118] Fatás, A., & I., Mihov (2005). Policy Volatility, Institutions and Economic Growth. *The Review of Economics and Statistics.*

[119] Federici, A. & P., Montalbano (2012). *Macroeconomic volatility, consumption behaviour and welfare: A cross-country analysis*, Economics Department Working Paper Series, No 36, University of Sussex.

[120] Feenstra, R., C., Inklaar, R. & M., P., Timmer (2015). The Next Generation of the Penn World Table. *American Economic Review*, 105(10), 3150-3182, available for download at www.ggdc.net/pwt.

[121] Ferreira da Silva, G. (2002). The impact of financial system development on business cycles volatility: cross-country evidence. *Journal of Macroeconomics*, 24, 233-253.

[122] Forbes, K. (2002). *Are trade linkages important determinants of country vulnerability to crises?*. In Edwards S., & J., Frankel (Eds), Preventing Currency Crises in Emerging Markets. Chicago The University of Chicago Press.

[123] Foster, J., J. ,Greer, & E., Thorbecke (1984). A class of decomposable poverty measures. *Econometrica*, 52(3), 761-766.

[124] Frankel, J.A., & A.K., Rose (1996). Currency crashes in emerging markets: an empirical treatment. *Journal of International Economics*, 41, 351-368.

[125] Frankel, A.J., & D., Romer (1999). Does trade cause growth? *The American Economic Review*. 89(3), 379-99.

[126] Frankel, J.A., & S.J., Wei (2004). *Managing macroeconomic crises: policy lessons*. In Aizenman, J., & B., Pinto (eds) (2004). Managing volatility and crises: a practitioners guide. New York: Cambridge University Press.

[127] Fritzen, S. (2002) Growth, inequality and the future of poverty reduction in Vietnam. *Journal of Asian Economics*, 13, pp. 653-657.

[128] Fujii, T. & D., Roland-Holst (2007). *How Does Vietnam's Accession to the World Trade Organisation Change the Spatial Incidence of Poverty*, Research Paper No. 2007/12, UN-Wider, United Nations University.

[129] Gallopin, G., C., (2006). Linkages between vulnerability, resilience and adaptive capacity. *Global Environmental Change*, 16, 293-303.

[130] Gavin, M., & R., Hausmann (1996). *Sources of Macroeconomic Volatility in Developing Economies*. mimeo, Inter-American Development Bank: Washington DC.

[131] Ghosh, A., R., & J., D., Ostry (1995). The Current Account in Developing Countries: A Perspective from the Consumption-Smoothing Approach. *The World Bank Economic Review*, 9(2), 305-333.

[132] Ghosh, A., R., & J., D., Ostry (1997). Macroeconomic Uncertainty, Precautionary Saving, and the Current Account. *Journal of Monetary Economics*, 40, 121-139.

[133] Gibson, J. & K., Bonggeun (2007). Measurement Error in Recall Surveys and the Relationship between Household Size and Food Demand. *American Journal of Agricultural Economics*, 89(2), 473-489.

[134] Giles, J. & K., Yoo (2007) Precautionary Behavior, Migrant Networks, and Household Consumption Decisions: An Empirical Analysis Using Household Panel Data from Rural China, *The Review of Economics and Statistics*, 89(3), pp. 534-551.

[135] Glewwe, P. (2011). How much of observed economic mobility is measurement error? IV methods to reduce measurement error bias, with an application to Vietnam. *World Bank Econ. Rev.* 26(2), 236264.

[136] Glewwe, P., & G., Hall (1998). Are some groups more vulnerable to macroeconomic shocks than others? Hypothesis tests based on panel data from Peru. *Journal of Development Economics*, 56(1), 181-206.

[137] Glewwe P., M. Gragnolati, & H., Zaman (2002). Who gained from Vietnams boom in the 1990s?. *Economic Development and Cultural Change*, 50(4), 773-792.

[138] Glick, R., & A., Rose (1999). Contagion and trade. why are currency crises regional. *Journal of International Money and Finance*, 18(4), 630-17.

[139] Goldberg, P. K., & N., Pavcnik (2004). Trade, inequality, and poverty: what do we know? Evidence from recent trade liberalization episodes in developing countries. *Brookings Trade Forum*, 223-269.

[140] Goldstein, H. (1999). *Multilevel statistical models*. London: Arnold.

[141] Gourinchas, P. (2000). *Precautionary Savings, the Life Cycle, and Macroeconomics*. Unpublished manuscript, Princeton University.

[142] Gourinchas, P. & J., Parker (2002) Consumption Over the Life Cycle, *Econometrica*, 70(1), pp. 47-89.

[143] Guidotti, P., F., Sturzenegger & A. Villar, (2004).On the consequences of sudden stops. *Economia*, 4(2), 1-44.

[144] Guillaumont P., (2009). An economic vulnerability index: its design and use for international development policy states and the least developed countries. *Oxford Development Studies*, 37(3), 193-228.

[145] Guillaumont P., (2010). Assessing the economic vulnerability of small island developing states and the least developed countries. *Journal of Development Studies*, 46(5), 828 - 854.

[146] Guiso, L., Jappelli, T., & D., Terlizzese (1992). Earnings uncertainty and precautionary saving. *Journal of Monetary Economics* 30, 307-337.

[147] Gunning J., W., (2010). Risk and savings: A taxonomy. *Economics Letters*, 107, 39–41.

[148] Gunther, I., & K., Harttgen (2009) Estimating Households Vulnerability to Idiosyncratic and Covariate Shocks: A Novel Method Applied in Madagascar, *World Development*, 37(7), pp. 1222-1234.

[149] Gunther, I., & J., Maier (2008). *Poverty, vulnerability and loss aversion.* Manuscript, University of Gottingen.

[150] Ha, D., & G., Shively (2008) Coffee Boom, Coffee Bust and Smallholder Response in Vietnam's Central Highlands, *Review of Development Economics*, 12(2), pages 312-326.

[151] Haddad, M. E., Lim J. J. & C., Saborowski (2010) *Trade openness reduces growth volatility when countries are well diversified.* Policy Research Working Paper Series 5222, The World Bank.

[152] Hahn, F., (1970). Savings and uncertainty. Review of Economic Studies, 37, 21-24.

[153] Hansen, H. & L., Trung Dange (2010). *The Importance of Being Surveyed: The Representativeness and Impact of the Vietnam Household Living Standards Surveys*, Department of Food and Resource Economics, University of Copenaghen, mimeo.

[154] Heaton, J., & D., Lucas (1996). Evaluating the Effects of Incomplete Markets on Risk Sharing and Asset Pricing. *Journal of Political Economy*, 104(3), 443-87.

[155] Heitzmann, K., Canagarajah, R., & P., B., Siegel (2001). *Rationale and guideline for a risk and vulnerability assessment.* Social Protection Discussion Paper Series No 0218, World Bank.

[156] Heo, Y. & N., K., Doanh (2009) Trade Liberalisation and Poverty Reduction in Vietnam, *The World Economy*, 32(6), pp. 934-964.

[157] Hnatkovska, V., & N., Loayza (2005). *Volatility and growth.* In Aizenman, J. and B. Pinto (eds), Managing volatility and economic crises: a practitioners guide. New York: Cambridge University Press.

[158] Hoddinott, J., & A., Quisumbing (2003). *Methods for microeconometric risk and vulnerability assessments.* Social Protection Discussion Paper Series No 0324, World Bank.

[159] Hoechle, D., (2007). Robust standard errors for panel regressions with cross-sectional dependence. *The Stata Journal*, 7(3), 281-312

[160] Holtz-Eakin, D., Newey, W., & H., S., Rosen. (1988). Estimating vector autoregressions with panel data. *Econometrica*, 56: 1371–1395.

[161] Holzmann, R. (2001). *Risk and vulnerability: the forward looking role of social protection in a globalizing world.* Social Protection Discussion Paper Series No. 0109, World Bank.

[162] Holzmann, R., & S., Jorgensen (2001). *Social risk management: a new conceptual framework for social protection and beyond.* International Tax and Public Finance, 8, 525-552.

[163] Hubbard, R., G., Skinner, J., S. & S., P., Zeldes (1994). *The importance of precautionary motives for explaining individual and aggregate saving.* In: Meltzer, A.H., Plosser, C.I., (Eds.), Carnegie- Rochester Conference Series on Public Policy, Vol. 40, 59 126.

[164] Hubbard, R., Skinner, J. & S., P., Zeldes (1994) Expanding the Life-Cycle Model: Precautionary Saving and Public Policy, *American Economic Review*, 84(2), pp. 174-79.

[165] Imai K., Gaiha R. & W., Kang (2011) Vulnerability and poverty dynamics in Vietnam, *Applied Economics*, 43(25), pp. 3603-3618.

[166] Imbs, J. (2004). Trade, finance, specialization, and synchronization. *Review of Economics and Statistics*, 86(3), 723-734.

[167] Irvin, G. (1997) Vietnam: Adjustment, Growth and Poverty. *Journal of International Development*, 9 (September), pp. 783-801.

[168] Inklaar R., & M., P., Timmer (2013). *Capital, labor and TFP in PWT 8.0.* Mimeo.

[169] Jalan, J., & M., Ravallion (1999). Are the poor less well insured? evidence on vulnerability to income risk in rural China. *Journal of Development Economics*, 58, 61-81.

[170] Jalan, J., & M., Ravallion (2001) Behavioral responses to risk in rural China, *Journal of Development* Economics, 66(1), pp. 23-49.

[171] Jenkins, R. (2004) Vietnam in the Global Economy: Trade, Employment and Poverty, *Journal of International Development*, 1613-28.

[172] Jensen H.T. & F., Tarp (2005) Trade Liberalization and Spatial Inequality: a Methodological Innovation in a Vietnamese Perspective, *Review of Development Economics*, 9(1), pp. 69-86.

[173] Johnson, S., Larson, W., Papageorgiou, C., & Subramanian, A. (2013). Is newer better? Penn World Table Revisions and their impact on growth estimates. *Journal of Monetary Economics*, 60(2), 255-274.

[174] Judson, R., & A., Orphanides (1999). Inflation,Volatility and Growth. *International Finance*, 2(1), 117–138.

[175] Justino, P., & J., Litchfield (2004) Welfare in Vietnam during the 1990s: Poverty, inequality and poverty dynamics. *Journal of the Asia Pacific Economy*, 9 (2). pp. 145-169. ISSN 1354-7860

[176] Justino, P., Litchfield, J. & H., T., Pham (2008) Poverty Dynamics During Trade Reform: Evidence From Rural Vietnam, *Review of Income and Wealth*, 54(2), pp. 166-192.

[177] Kamanou, G. & J., Morduch (2004). *Measuring Vulnerability to Poverty*, in Dercon, S. (ed.), Insurance against Poverty, Oxford University Press.

[178] Karras, G., & F., Song (1996). Sources of business-cycle volatility: An exploratory study on a sample of OECD countries. *Journal of Macroeconomics*, 18(4), 621-37.

[179] Kimball, M., S. (1990). Precautionary saving in the small and in the large. *Econometrica: Journal of the Econometric Society*, 5373.

[180] Knight, F., H. (1921). *Risk, Uncertainty, and Profit.*

[181] Koren, M., & S., Tenreyro (2007a). Volatility and development. *Quarterly Journal of Economics*, 122 (1), 243-87.

[182] Koren, M., & S., Tenreyro (2007b) Technological Diversification. CEPR Discussion Paper No. DP6523.

[183] Kose, M. A. (2002). Explaining business cycles in small open economies, How much do world prices matter? *Journal of International Economics*, 56, 299-327.

[184] Kose, M. A., & K. M., Yi (2001). International trade and business cycles: Is vertical specialization the missing link? *The American Economic Review*, 91(2), 371.

[185] Kose, M. A., & K. M., Yi (2006). Can the standard international business cycle model explain the relation between trade and comovement? *Journal of International Economics*, 68, 267-295.

[186] Kose, M. A., Prasad E., S. & M.E., Terrones (2003). *Financial integration and macroeconomic volatility.* IMF Staff Papers, 50, Special Issue, International Monetary Fund.

[187] Kose, M. A., E. S., Prasad & M. E., Terrones (2005). Growth and volatility in an era of globalization, *IMF Staff Papers*, 52, Special Issue.

[188] Kose, M. A., Prasad E., S. & M. E., Terrones (2007). *How does financial globalization affect risk sharing? patterns and channels.* IMF Working Papers, 07-238, International Monetary Fund.

[189] Kose, M. A., Prasad E., S. & M. E., Terrones (2009). Does financial globalization promote risk sharing? *Journal of Development Economics*, 89(2), 258-270.

[190] Kose, M. A., Prasad E., S. & A.D., Taylor (2011). Thresholds in the process of international financial integration. *Journal of International Money and Finance*, 30(1), 147-179.

[191] Krebs, T., (2003). Growth and welfare effects of business cycles in economies with idiosyncratic human capital risk, *Review of Economic Dynamics*, 6(4), 846-868.

[192] Krebs, T., Krishna, P., & W., Maloney (2010). Trade policy, income risk, and welfare. *The Review of Economics and Statistics*, 92(3), 467-481.

[193] Krishna, P. & A.A., Levchenko (2009) *Comparative advantage, complexity, and volatility.* NBER Working Paper No. 14965, Cambridge, MA: National Bureau of Economic Research.

[194] Krueger, A., O. (1978). *Foreign trade regimes and economic development: Liberalization attempts and consequences.* Cambridge, MA: Ballinger Pub. Co. for NBER.

[195] Krusell, P., & A., Smith. (1998). Income and Wealth Heterogeneity in the Macroeconomy. *Journal of Political Economy*, 106 (5), 867-96.

[196] Krusell, P., Mukoyama, T., Sahin, A., & A.A., Smith Jr. (2009). Revisiting the welfare effects of eliminating business cycles, *Review of Economic Dynamics*, 12(3), 393-404.

[197] Le, H. & A., Booth (2010), *Urban-Rural Living Standard Inequality in Vietnam*, 1993-2006. Mimeo.

[198] Lee, J. J., & Y. Sawada (2010). Precautionary saving under liquidity constraints: evidence from rural Pakistan. *Journal of Development Economics*, 91, 77–86.

[199] Lee, N., Ridder, G., & J., Strauss (2010). *Estimating Poverty Transition Matrices with Noisy Data. Department of Economics.* University of Southern California.

[200] Ligon, E. (2006) Poverty and the welfare costs of risk associated with globalization, *World Development*, 34(8), pp. 1446-1457.

[201] Ligon, E. (2011) *Dynamics, risk, and vulnerability.* CUDARE Working Papers No.1112.

[202] Ligon, E. & L., Schechter (2003) Measuring Vulnerability, *Economic Journal*, 113(486), pp. 95-102.

[203] Ligon, E. & L., Schechter (2004). *Evaluating Different Approaches to Estimating Vulnerability*, Social Protection Discussion Paper Series, No. 0410, June.

[204] Liu, A., (2001) *Gender wage gap in transition in Vietnam, International and Development Economics.* Working Papers idec01-3, International and Development Economics.

[205] Loayza, N., Rancire V, R., Servén, L. & J., Ventura (2007) Macroeconomic volatility and welfare in developing countries: An introduction, *The World Bank Economic Review*, 21(3), 343-357.

[206] Loayza, N., V, & C., Raddatz (2007). The structural determinants of external vulnerability. *The World Bank Economic Review*, 21(3), 359-387.

[207] Lucas, R., E., Jr. (1987), *Models of Business Cycles,* New York, Basil Blackwell.

[208] Lucas, R., E., Jr. (1988). On the mechanics of economic development. *Journal of Monetary Economics*, 22 (1), 3-42.

[209] Lucas, R., E., Jr. (2003). Macroeconomic Priorities. *The American Economic Review*, 93 (1), 1-14.

[210] Lundberg, M., & L., Squire (2003). The simultaneous evolution of growth and inequality. *Economic Journal*, 113(487), 326-344.

[211] Madsen, J., B. & M., Mcaleer (2000). Direct Tests of the Permanent Income Hypothesis under Uncertainty, Inflationary Expectations and Liquidity Constraints. *Journal of Macroeconomics*, 22(2), 229-252.

[212] Malik, A., & J.R.W., Temple (2009). The geography of output volatility. *Journal of Development Economics*, 90 (2), 163-178.

[213] Martin, P., & H., Rey (2006). Globalization and emerging markets: with or without crash?. *The American Economic Review.* 96(5), 1631-1651.

[214] McCulloch, N., L. A., Winters, & X., Cirera (2001). *Trade liberalization and poverty: a handbook.* London, Centre of Economic Policy Research.

[215] Meghir, C. and Pistaferri, L., (2004). Income Variance Dynamics and Heterogeneity, *Econometrica*, Econometric Society, 72(1), pages 1-32.

[216] Mehra, R., & E.C., Prescott (1985). The equity premium: A puzzle. *Journal of Monetary Economics*, Elsevier, vol. 15(2), pages 145-161.

[217] Mendoza, E. G. (1995). The terms of trade, the real exchange rate and economic fluctuations. *International Economic Review*, 36(1), 10137.

[218] Milesi-Ferretti, G.M., & A., Razin (1998). Sharp reductions in current account deficits: an empirical analysis. *European Economic Review.* 42(3-5): 897-908.

[219] Milesi-Ferretti, G.M., & A., Razin (2000). *Current account reversals and currency crises: empirical regularities.* In P.Krugman (ed.). Currency Crises. Chicago, United States: University of Chicago Press.

[220] Minot, N. & B., Baulch (2005) Spatial patterns of poverty in Vietnam and their implications for policy, *Food Policy*, 30(5-6), pp. 461-475.

[221] Mody, A., Ohnsorge, F., & D., Sandri (2012). Precautionary Savings in the Great Recession. *IMF Economic Review*, 60(1), 114-138.

[222] Montalbano, P., & U., Triulzi (2009). *Assessing SIDS vulnerability to trade openness*. Mimeo, Rome (Italy): Department of Economic Theory, Sapienza University.

[223] Montalbano, P., & U., Triulzi (2002). *Towards socio-economic vulnerability analysis: integrating conflict analysis into development programmes and strategies*. Paris, DAC Network on Conflict, Peace and Development Co-operation, DCD/DAC/CPDC 3.

[224] Montalbano, P., Federici, A., Pietrobelli C., & U., Triulzi (2006). *Trade openness and vulnerability in Central and Eastern Europe*. In M., Nissanke, & E., Thorbecke (eds), The impact of globalization on the worlds poor: transmission mechanisms. Palgrave Macmillan.

[225] Montalbano, P., Federici, A., Pietrobelli, C., & U., Triulzi (2008). *Socio-economic vulnerability and trade liberalization: a cross-country evidence in Central and Eastern Europe during the transition*. In L. Squire, & J. M., Fanelli (eds.), Dimensions of Reform: Reach, Range, Reason. Northampton, MA: Edward Elgar Publishing.

[226] Morduch, J., (1994). Poverty and vulnerability. *The American Economic Review*, 84(2), 221-25.

[227] Morduch, J., (2002) *Consumption Smoothing Across Space: Testing Theories of Risk-Sharing in the ICRISAT Study Region of South India*, Working Papers UNU-WIDER Research Paper, World Institute for Development Economic Research (UNU-WIDER).

[228] Nakata, H., Sawada, Y., & M., Tanaka (2009). Asking retrospective questions in household surveys: evidence from Vietnam. Discussion Paper Series 10-E-008. Tokyo: RIETI.

[229] Nadvi, K., Thoburn, JT., Thang, BT, Ha, N., Hoa, N., Le D. & E., De Armas (2004) Vietnam in the global garment and textile value chain: impacts on firms and workers, *Journal of International Development*, 16(1), pages 111-123.

[230] Naude, W., A. Santos-Paulino, & M., McGillivray (eds) (2009a), *Vulnerability in developing countries*, UNU-WIDER, Tokyo and New York: UNU Press.

[231] Naude, W., Santos-Paulino, A., & M., McGillivray (2009b). Measuring vulnerability: an overview and introduction. *Oxford Development Studies*, 37(3),183-191.

[232] Naude, W., M., McGillivray, & S., Rossouw (2009). Measuring the Vulnerability of Subnational Regions in South Africa, *Oxford Development Studies*, 37(3),249-276.

[233] Nguyen, M. C. & P., Winters. (2011) The impact of migration on food consumption patterns: The case of Vietnam, *Food Policy*, 36(1), pp. 71-87.

[234] Nguyen, T. D. & M., Ezaki (2005), Regional Economic Integration and its impacts on growth, poverty and income distribution: the case of Vietnam, *Review of Urban & Regional Development Studies*, 17: 197-215.

[235] Nickell, S. J. (1981). Biases in dynamic models with fixed effects. *Econometrica*, 49:14171426.

[236] Niimi, Y, Dutta, P.V., & L. A., Winters (2007). Trade liberalisation and poverty dynamics in Vietnam. *Journal of Economic Integration*, 22(4), 819-851.

[237] Oaxaca, R. (1973). Male-female wage differentials in urban labor markets. *International Economic Review*, 14(3), 693-709.

[238] Obstfeld, M. & K., Rogoff (1996). *Foundations of International Macroeconomics*, The MIT Press, Cambridge (MA).

[239] Otto, G., Voss, G., & L., Willard (2001). *Understanding OECD output correlations*, Discussion Paper 2001-05. Reserve Bank of Australia Research.

[240] Pallage, S., & M. A., Robe (2003) On the welfare cost of economic fluctuations in developing countries. *International Economic Review*, 44(2).

[241] Parker, J., A. & B., Preston (2005). Precautionary Saving and Consumption Fluctuations. *American Economic Review*, 95(4), 1119-1143.

[242] Pesaran, M. H., & R., Smith (1995). Estimating long-run relationships from dynamic heterogeneous panels. *Journal of econometrics*, 68(1), 79-113.

[243] Pham, H. T., & B., Reilly (2007) *The Gender Pay Gap In Vietnam, 1993-2002: A Quantile Regression Approach*, MPRA Paper 6475, University Library of Munich, Germany.

[244] Pierucci, E. & L., Ventura (2012). *International risk sharing and globalization*, MPRA Paper No. 35869, online at http://mpra.ub.uni-muenchen.de/35869/.

[245] Ponomareva, N., & H., Katayama (2010). Does the version of the Penn World Tables matter? An analysis of the relationship between growth and volatility. *Canadian Journal of Economics/Revue canadienne d'conomique*, 43(1), 152-179.

[246] Povel, F. (2015). Measuring Exposure to Downside Risk with an Application to Thailand and Vietnam. *World Development*, 71, 4-24.

[247] Prasad, E. S. (2013). *Saving in Developing Countries.* NBER Reporter, 2013(1), 12.

[248] Prasad, E. S. , & J. A., Gable (1998). *International Evidence on the Determinants of Trade Dynamics*, IMF Staff Papers, 45(3).

[249] Pratt, J. W. (1964). Risk aversion in the small and in the large. *Econometrica: Journal of the Econometric Society*, 122-136.

[250] Pritchett, L., Sumarto, S. & A., Suryahadi (2000) *Quantifying Vulnerability to Poverty: A Proposed Measure with Application to Indonesia*, World Bank Policy Research Department Working Paper No.2437, World Bank: Washington DC.

[251] Raddatz, C., (2006), Are external shocks responsible for the instability of output in low-income countries? *Journal of Development Economics.*

[252] Ramey, G., & V., Ramey (1995). Cross-country evidence on the link between volatility and growth. *American Economic Review*, 85(5), 1138-51.

[253] Ravallion M., (1988) Expected poverty under risk-induced welfare variability, *Economic Journal*, 98(393), pp. 1171-1182.

[254] Razin, A. & A.k., Rose (1992). *Business-Cycle Volatility and Openness: An Exploratory Cross-Sectional Analysis.* In: Leiderman and Razin (eds.), Capital Mobility: The Impact on Consumption, Investment and Growth, Cambridge U. Press. Cambridge, pp. 48-82.

[255] Razin, A., Sadka, E., & T., Coury (2003). Trade openness, investment instability and terms-of-trade volatility. *Journal of International Economics*, 61, 285-306.

[256] Reis, R. (2009). The Time-Series Properties of Aggregate Consumption: Implications for the Costs of Fluctuations. *Journal of the European Economic Association*, 7(4), 722-753.

[257] Rodrik, D. (1998). Why do more open economies have bigger governments? *Journal of Political Economy*, 106(5), 997-1032.

[258] Rodrik, D. (1999). Where did all the growth go? External shocks, social conflict, and growth collapses. *Journal of Economic Growth*, 4(4), 385-412.

[259] Roodman, D. (2009). How to do xtabond2: An introduction to difference and system GMM in Stata. *Stata Journal*, 9(1), 86.

[260] Rose, A. (2005). A reason why countries pay their debts: renegotiation and international trade. *Journal of Development Economics*, 77(1), 189-206.

[261] Rosenzweig, M., & K., Wolpin (1993).Credit market constraints, consumption smoothing, and the accumulation of durable production assets in low-income countries: investments in bullocks in India. *Journal of Political Economy*, 101, 223-244.

[262] Rothschild, M., & J.E., Stiglitz (1970). Increasing risk: a definition. *Journal of Economic Theory*, 2, 225243.

[263] Sachs, J.D., & A.M., Warner (1995). Economic reform and the process of global integration. *Brookings Papers on Economic Activity*, 1, 195.

[264] Santos-Paulino, A., U. (2010). Terms of Trade Shocks and the Current Account in Small Island Developing States, *Journal of Development Studies*, 46(5), 855-876.

[265] Sarris, A., & P., Karfakis, (2006). *Household vulnerability in rural Tanzania*, Paper presented at the CSAE Conference 2006: Reducing Poverty and Inequality: How can Africa be included?, 19-21 March 2006; Oxford, UK.

[266] Servén, L. (1997). Irreversibility, Uncertainty and Private Investment: Analytical Issues and Some Lessons for Africa. *Journal of African Economies*, 6 (3), 229-68.

[267] Singh, N. & J., Gilman (1999). Making livelihoods more sustainable. *International Social Science Journal*, 162, 539-545.

[268] Skinner, J. (1988), Risky income, life-cycle consumption and precautionary saving. *Journal of Monetary Economics,* 22, 237-255.

[269] Stadler, G.W. (1994). Real business cycles. *Journal of Economics Literature*, 32, 1750-1783.

[270] Storesletten, K., Telmer, C. & Y., Amir (2004). Consumption and risk sharing over the life cycle, *Journal of Monetary Economics*, Elsevier, vol. 51(3), pages 609-633, April.

[271] Tesliuc, E. & K., Lindert (2004). *Risk and vulnerability in Guatemala: A quantitative and qualitative assessment.* Social Protection Discussion Paper 0404. Washington: World Bank.

[272] Townsend, R. (1994). Risk and insurance in village india. *Econometrica*, 62(3), 539-91.

[273] Townsend, R. (1995). Consumption insurance: an evaluation of risk-bearing systems in low-income economies. *The Journal of Economic Perspectives*, 9(3), 83-102.

[274] Udry, C. (1994) Risk and Insurance in a Rural Credit Market: An empirical Investigation of Northern Nigeria, *Review of Economic Studies*, 61(3), pp. 495-526.

[275] UNDP (1999). Sustainable livelihoods: concepts, principles and approaches to indicator development. New York.

[276] UNDP (2000), Section I: participatory assessment and planning for sustainable livelihoods, draft No. 1, Social Development and Poverty Elimination Division (SEPED/BDP), Working Paper.

[277] UN/ISDR (2004). *Living with risk: a global review of disaster reduction initiatives.* Inter-Agency Secretariat of the International Strategy for Disaster Reduction.

[278] UNU-WIDER (2008). *Fragility States.* Research Brief, 3.

[279] Valenzuela, E. (2006). *Poverty, vulnerability and trade policy in general equilibrium.* PhD dissertation. Purdue University, West Lafayette.

[280] van de Walle, D. & D., Cratty (2004) *Is the emerging non-farm market economy the route out of poverty in Vietnam?*, The Economics of Transition, The European Bank for Reconstruction and Development, 12(2), pp. 237-274.

[281] Weil, P. (1990). *Precautionary savings and the permanent income hypotheses*. Mimeo. Harvard University. Cambridge. (MA).

[282] Wincoop, E., & K. Yi (2000). Asia crisis post-mortem: where did the money go and did the United States benefit?. *Economic Policy Review*, 6(3), 51-70.

[283] Winters, L., A. (2002). Trade liberalisation and poverty: what are the links?. *The World Economy*, 25(9), 1339-1367.

[284] Winters, L., A. (2004). Trade liberalisation and economic performance: an overview. *The Economic Journal*, 114, F4-F21.

[285] Winters, L. A., & P. M., Martins (2004). When comparative advantage is not enough: business costs in small remote economies. *World Trade Review*. 3(03), 347383.

[286] Winters, L., A., McCulloch N., & A. McKay (2004). Trade liberalization and poverty: the evidence so far. *Journal of Economic Literature*, 42(1), 72-115.

[287] Witter, M., Briguglio, L. & A., Bhuglah (2002). *Measuring and managing the economic vulnerability of Small Island Developing States*. Paper presented at the Global Roundtable on Vulnerability and Small Island Developing States: Exploring Mechanisms for Partnerships, Montego Bay, Jamaica, 9-10 May http://www.undp.org/capacity21/docs/Econ-Vulnerability-Paper.doc

[288] Wolf, H. (2004). Accounting for consumption volatility differences. *IMF Staff Papers*, 50, Special Issue, International Monetary Fund: Washington DC.

[289] Wolf, H. (2005). Volatility: definitions and consequences. In Aizenman, J., and B., Pinto (eds), *Managing volatility and economic crises: a practitioner's guide*. New York: Cambridge University Press.

[290] Wooldridge, J. M. (2002). *Econometric Analysis of Cross Section and Panel Data*. Cambridge: MIT Press. pp. 562566. ISBN 0-262-23219-7.

[291] World Bank (2000). Attacking poverty. *World Development Report* 2000/2001, New York: Oxford University Press.

[292] Zeldes, S., P. (1989). Consumption and liquidity constraints: an empirical investigation. *Journal of Political Economy*, 97, 305–346.

[293] Zimmerman, F. J., & M.R., Carter (2003). Asset smoothing, consumption smoothing and the reproduction of inequality under risk and subsistence constraints. *Journal of Development Economics*, 71(2), 233-60.