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Does trade openness increase vulnerability?
A survey of the literature

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Abstract: This work focuses on the welfare costs of exposure to shocks and uncertainty linked to trade openness – a prominent issue in international debate. It contributes by presenting a comprehensive review of the literature on the "destabilizing effects" of trade openness, drawing together studies in different fields. It provides a conceptualization of vulnerability and three promising lines of reasoning for future research on the link between trade and vulnerability.

Key Words: vulnerability, trade openness, volatility, crisis transmission, developing countries.

JEL Classification: F40; I32; C82; E17, D60

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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 both 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 centered on trade liberalization to foster growth and welfare.

However, trade theory does not provide a full understanding of the possible links of trade openness with uncertainty and exposure to foreign shocks and their eventual long term effects on the welfare of partner countries. These issues are currently hotly debated by practitioners. The theoretical and applied trade literature on these issues is fuzzy and does not reach a common stance.

Further investigation is needed to control for the presence of a true "vulnerability hazard" linked to trade openness.[i] This requires an assessment of whether or not there are long term consequences of international trade such as: increasing exposure to external shocks; raising uncertainty about the future and/or greater stress on certain actors. Whether or not these consequences are more likely to emerge in the first stages of trade liberalization and/or particularly harmful for developing countries is also relevant.

Assessing vulnerability is not straightforward and there are several misconceptions relating to its analysis. Moreover, the link between vulnerability and trade has been rather overlooked. In an attempt to bridge the trade and vulnerability literature, this survey provides a comprehensive review of the studies on the "destabilizing effects" of

trade openness; that originates from different fields of analysis. It also provides a conceptualization of the vulnerability phenomenon- which is still at the “let a hundred flowers bloom" stage, as stated by Hoddinott and Quisumbing (2003).

This work contributes to the current debate on the effects of trade openness on developing countries by proposing guidelines about how to apply vulnerability analysis to the trade literature. In the end, it identifies three directions for future research.

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

2. Is trade openness “destabilizing” 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, 2001, 2002, 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 belittled by the above literature concerns the possible link between trade and the excessive fluctuation of the main aggregate variables, a phenomenon that is increasing over time for a high fraction of low and middle income countries (Agenor &

al., 2000; Kose & al., 2003; Wolf 2004b). 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 specialization 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 specialization process in developing countries – to be more volatile than those of manufacture goods (Malik & Temple, 2009); iii) the inconsistency between the shocks prevailing in open markets and traditional coping mechanisms and local market structures (Dercon, 2001); iv) the occurrence of boom–bust cycles of investment induced by trade openness in countries characterized by inadequate infrastructures and shortages of skilled labor (Razin & al. 2003); v) the role of trade liberalization in altering households' optimal portfolios, coupled 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).

While the literature often refers to "volatility" and "shocks" as if they were a sole subject of analysis, it is necessary to acknowledge that "volatility" relates mainly to uncertainty[ii], while "shocks" and "sudden stops"[iii] are actually manifestations of risks[iv] and are likely to have differential impacts on country's welfare. In the case of uncertainty, we are referring to a long term phenomenon which hampers the correct functioning of markets, likely producing an impact on consumption. In the case of shocks (or crises), these are short term episodes of economic downturn characterized by

likely pervasive and long term incidences of poverty and well-being. Aizenman & Pinto (2004) introduce the notion of "crisis volatility" to stress that the unpredictable component of total observed volatility is more closer to a "pure risk". Dehn (2000), who tests separately the effects of uncertainty and shocks on commodity prices in developing countries, confirms the two effects should be kept separately: while large, discrete, negative commodity price "shocks" have large, highly significant and negative effects on per capita growth,[v] commodity price "uncertainty" does not affect growth.[vi] As a result, most of the empirical works that emphasize the role of trade openness as a key determinant of uncertainty are grounded in the literature on aggregate volatility (Easterly & al., 1993; Mendoza, 1995; Gavin & Hausmann, 1996; Prasad & Gable, 1998; Rodrik, 1998; Kose, 2002; Kose & Yi, 2001, 2006; Wolf, 2004a; Kose & al., 2005); while investigation of the links between trade openness and shocks is usually tackled as a complementary, real aspect in the empirical literature on currency crises (Milesi-Ferretti & Razin, 1998, 2000), underlining the role of international trade in triggering "sudden stops" (Cavallo & Frankel, 2008), or as a vehicle to spread out crises, especially in regional contexts (Glick & Rose, 1999; Easterly & Kraay, 1999; Forbes, 2001).

The empirical results from the first strand of literature are mixed. While some studies find that an increase in the degree of trade openness leads to higher output volatility, especially in developing countries (Karras & Song, 1996; Easterly & al., 2001; Kose & al., 2003;; Di Giovanni & Levchenko, 2006; Raddatz, 2007; Loayza & Raddatz, 2007; Krishna & Levchenko, 2009), others find no significant relationship between an increased degree of trade interdependence and domestic macroeconomic volatility

(Calderòn & al., 2005; Kose & Yi, 2006; Cavallo, 2007) or just a temporary relationship (Santos-Paulino, 2007). 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., 2002; Baxter & Kouparitsas, 2004; 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 "trade–co-movement puzzle".

In the second strand of the literature, the role of trade openness in fostering macroeconomic crises is also hotly debated.[vii] 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"[viii]. 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 (2001) demonstrate empirically the role of "trade linkages" in spreading crises in regions. The central point here is that currency crises spread along the lines of trade linkages[ix] 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.[x]

3. From exposure to shock and uncertainty to a "vulnerability analysis": conceptualization, measurement and common misbeliefs

Before going deeper into the "trade and vulnerability link", it is worth providing additional details on the vulnerability phenomenon, in terms of theoretical conceptualization and empirical application, and proposing a differential analysis with similar phenomena that avoids falling into some common misconceptions.

3.1 Vulnerability or vulnerabilities?

As Hoddinott & Quisumbing (2003) underline, vulnerability means different things to different people. It is a complex phenomenon, not easily determined by one measurable factor. 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 analyze 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 centers, multilateral and bilateral organizations and agencies have developed their own definitions and methods to analyze vulnerability.[xi] It is notable that not all these definitions include the same key elements and they also use slightly different terminology.[xii] 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).

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 & Jørgensen, 2001; Heitzmann & al., 2001).[xiii] 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: a thorough analysis of risks (i.e. the exogenous side)[xiv]; an assessment of the degree of resilience and/or responsiveness[xv] (i.e. the endogenous side); a benchmark (i.e. a socially accepted minimum norm for each outcome under which households is said to be vulnerable to future loss)[xvi]. Another prominent approach to vulnerability is the "*Sustainable Livelihood Vulnerability*" (SLV) adopted by many international development agencies, such as UNDP, DFID, IDS, Oxfam, CARE, to produce project appraisals and reviews (see Carney &. al., 1999). The SLV approach is linked to Sen's 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, 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").[xvii]

3.2 Measuring vulnerability: a taxonomy

Different approaches to defining vulnerability lead to differences in methods of estimation. The most common methods to measure vulnerability are monetary and typically express welfare in terms of consumption. Consumption variability is in fact considered as a better measure of risk than income volatility since the 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 household's 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 "expected welfare" under "uncertainty" (Chaudhuri, 2001, 2003; Ligon & Schechter, 2003; Calvo & Dercon, 2007). A taxonomy of the main methods applied in vulnerability analysis is provided by Hoddinott & Quisumbing (2003). A slight update to this identifies three typologies of vulnerability measures:

- *VEP-Vulnerability to Expected Poverty* (Christiaensen & Boisvert, 2000; Christiaensen & Subbarao, 2001; Chaudhuri, 2001, 2003; Chaudhuri & al., 2002; Pritchett & al., 2000). This is the most commonly applied method. It assesses

vulnerability as the expected value of the standard FGT class of decomposable poverty measures (Foster & al., 1984)[xviii] as follows:

$$V_{ht} = E_t P_{ht+1} = E_t\left[\frac{(z - c_{ht+1})^a}{z^a} I(z > c_{ht+1})\right]$$

where *z* is a constant consumption poverty line; I(.) is an indicator function that equals 1 if the household consumption is below the poverty line and zero otherwise, and the parameter α sets the degree of sensitivity of the vulnerability measure to the distance from the poverty line. The standard VEP measure is the expected poverty headcount (assuming α=0), which however does not take into account the incidence and severity of poverty.[xix]

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 the probability of a household with characteristics X_h to fall below the poverty line using the estimated expected mean and variance of consumption. Thus:

$$V_{ht} = \Pr(\ln c_h < \ln z \mid X_h) = \Phi\left[\frac{(\ln z - X_h \hat{\beta})}{\sqrt{X_h \hat{\tau}}}\right]$$

where Φ is the cumulative density of the standard normal distribution. The main advantage of the VEP method is that it can be used to assess vulnerability with a single round of cross-sectional data, particularly convenient in the absence of panel data, which is the case for most developing countries. The VEP model assumes that 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, but captures the impact of both idiosyncratic and covariate shocks on consumption, that can be explained by a set of observable household characteristics.[xx] The model relies on the strong assumption that cross-sectional variability also proxies inter-temporal variance in consumption. Hence, it misses the impact of household-invariant but time-variant shocks. Notwithstanding its empirical advantages, the standard VEP model has some additional limitations. Firstly, it lacks a solid theoretical background: it relies on the strong assumption of stationary time series and assumes further that the distribution of shocks to consumption is independent normal.[xxi] Secondly, it implies that households have increasing absolute risk aversion, which contrasts to the empirical evidence on the risk preferences of the poor (Ligon & Schechter, 2004). 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 again is in sharp contrast to the poor being risk averse (Hoddinott & Quisumbing, 2003).[xxii] Finally, this model is not suited to differentiating between unexplained variance at household level (i.e. the impact of idiosyncratic shocks) and unexplained variance at community level (i.e. the impact of covariate shocks).[xxiii]

- VEU - *Vulnerability as Low Expected Utility* (Ligon & Schechter 2003, 2004). The VEU model tries to counteract some of the weaknesses 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, z_{ce} (above which the household would not be considered vulnerable; something analogous to a poverty line),[xxiv] and the expected utility of consumption, as follows:

$$V_h = U_h(z_{ce}) - EU_h(c_h)$$

where U_h is a weakly concave, strictly increasing function.

The VEU method 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, by taking account of expectations of an increasing, concave function of consumption expenditures $U_h(Ec_h)$ as follows[xxv]:

$$V_h = [U_h(z_{ce}) - U_h(Ec_h)] + [U_h(Ec_h) - EU_h(c_h)]$$

where the first bracketed term (i.e. the difference in utility at z_{ce} compared to the utility of households' expected consumption)[xxvi] is the measure of "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".[xxvii] 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:

$$V_h = [U_h(z_{ce}) - U_h(E(c_h)] + [U_h E(c_h) - EU_h(c_h | x_t)] + [EU_h(c_h | x_t) - EU_h(c_h)]$$

where the first bracketed component is again vulnerability to poverty, but the second and third components break down vulnerability to risk into two subcomponents: 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: firstly, the obvious circumstance that the choice of the particular functional form of the utility function directly affects the magnitude of the phenomenon; 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, 2007).

- *VFP - Vulnerability as Threat of Future Poverty* (Calvo & Dercon, 2003, 2005, 2007). VFP assesses vulnerability as "the burden of the threat of future poverty" and tries to avoid some of weakness of both VEP and VEU. Starting from the assumption that people suffer and are wary of the future if their knowledge of what it holds is uncertain, Calvo & Dercon (2007) picture the desirable properties of the vulnerability measure by proposing the following set of axioms. 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. 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). If all the above axioms are satisfied, the following vulnerability measure applies:

$V_a = 1 - E[x^a]$ with $0<\alpha<1$

where $0<x<1$ and represents the "rate of coverage of basic needs", which is derived, for each state of the world, as: $x_i \equiv \frac{\tilde{y}_i}{z}$ where $\tilde{y}_i \equiv \min(y_i, z)$; y_i is the consumption level (after all consumption smoothing efforts have been deployed); *z* is the standard poverty line; and *a* represents "risk sensitivity" (as *a* increases to 1, household approaches risk-neutrality). It follows then, that vulnerability is equal to the probability of being poor only if outcomes are expected to be zero in every state of the world where the individual is poor. In this respect, the VFP measure complements VEP, which, according to this view, risks to overestimate vulnerability. Furthermore, with the introduction of the minimum operator and the "focus axiom", the VFP measure complements also VEU.

Two main caveats apply to use of the VFP measure. Firstly, it follows from the definition above that for those facing no uncertainty with known $x_i=x^*<1$, for all i, $V_a>0$; 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. Secondly, this generous method of building an "axiomatic approach" to vulnerability needs to be compounded with wide and robust empirical analyses capable of providing clear added value to standard VEP outcomes. Finally, it should be borne in mind that there is a trade off between more accurate vulnerability estimates and the vast amounts of data required on all possible states of the world.

In sum, each vulnerability method presents its own virtues and weaknesses. They share some commonalities as well. First, they all focus 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. Second, they all make reference to a welfare indicator as a benchmark; they assume its expected value to be linked to household characteristics and its variance to uncertainty or the impact of shocks coupled with coping mechanisms.[xxviii] Third, they generally adopt a two step procedure of estimating the distribution of future consumption expenditures for every household and then constructing a statistic to capture the reduction in welfare due to shocks in household consumption expenditures.[xxix] And finally, they all derive aggregate measures of vulnerability essentially by summing household vulnerability across all households.[xxx] Ligon & Schechter (2004) conducted Monte Carlo

experiments designed to explore the performance of different estimators using these vulnerability measures, under different assumptions regarding the economic environment[xxxi]. They find that all measures show high correlation and that the three approaches perform best in different environments. More specifically, when the environment is stationary and consumption expenditures are measured without error, the best estimator is that proposed by Chaudhuri (2001), whatever vulnerability measure is employed[xxxii]. If the vulnerability measure is risk-sensitive and consumption is measured with error, then the estimators proposed by Ligon & Schechter (2003) and Calvo & Dercon (2003) 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.

3.3 The most common misconceptions about vulnerability

Notwithstanding the amount of analytical and empirical work on the topic of vulnerability, its analysis is still affected by several misconceptions. First, most analyses liken vulnerability to ex-post poverty. Although interconnected, these two concepts are different. They can be seen as two sides of the same coin. The observed poverty status of a household is the ex-post realization of a state, whereas vulnerability is its *ex-ante* probability (Chaudhuri & al., 2002). Some recent studies on the dynamics of poverty find that most poverty is temporary in nature (Baulch & Hoddinott, 2000).[xxxiii] Standard poverty assessments deal with the above evidence trying to separate transient and chronic poverty, and provide information on "how often" a household is poor; vulnerability analyses deal with it distinguish between those who are vulnerable due to low expected mean consumption (i.e. low endowment) and those who

are vulnerable due to high volatility of consumption (i.e. high uninsured income fluctuations). This provides an answer to the question of "why the poor are poor" (Chaudhuri & Datt, 2001). It follows that if we are interested in getting additional information on the dynamic of poverty, vulnerability analysis is extremely useful. Moreover, if the characteristics of the "vulnerable" differ significantly from those of the poor, targeting only the latter will exclude a significant group of households that are at risk of a decline in living standards. In other words, the distinction between poverty and vulnerability remains key for economic policy.

An additional related issue concerns the links between vulnerability and poverty. There is a widespread idea that the poor will be among the most vulnerable people. As Calvo & Dercon (2007) point out, if vulnerability is about the threat of poverty, then being poor will be the dominant threat. Moreover, according to the World Bank (2000) the poor are the most exposed to a wider array of risks, that is, they "are often among the most vulnerable in society". Their low income means they are less able to save and accumulate assets. This, in turn, reduces their ability to deal with shocks when they occur, forces them to smooth productive assets to preserve their likelihood, and can result in a structural inability to escape poverty in the future (Jalan & Ravaillon, 1999, Zimmerman & Carter, 2003; Carter & Barrett, 2006; Carter & al., 2007).[xxxiv] However, the issue of the relative incidence of shocks according to the welfare position of the household remains tricky. There is 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), in a study of Guatemala, suggest, for instance, that shocks occur everywhere along the distribution

and affect poor and non-poor households alike.[xxxv] They highlight however that the poor are more exposed to natural shocks (but less exposed to "man made" ones), show a lower degree of resilience and rely on coping strategies that damage their growth prospects.

Another distinctive feature of vulnerability analysis that is worth bearing in mind, concerns precisely the above distinction between "adaptability" or "resilience", and "coping capacity" and "responsiveness". Notwithstanding their obvious interconnection, these are two different concepts not a single one as is often assumed in the literature. 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 scores (Naudé & al., 2009; Guillamont, 2007, 2009). A similar distinction is been in the "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 behavior as a result of shocks or stress. Note that, a greater capacity to cope usually builds resilience, and vice versa.

It should be acknowledged also 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 on observable data because vulnerability does not depend on, say, what consumption expenditures are actually realized, but rather on what they might be (Ligon & Schechter, 2004). Future consumption being uncertain, the estimation problem in vulnerability analysis generally involves 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). Since vulnerability is not observable, it needs not only a factual analysis (i.e. a forward looking measure from the observed facts) but also 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, collecting data on 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, that are characterized by virtues and deficiencies as well, from simple augmented specifications of a typical consumption regression with shock dummies (Datt & Hoogeveen, 2000),[xxxvi] to an extensive application of the Oaxaca decomposition (Oaxaca, 1973)[xxxvii] or the use of non-parametric density estimations (Di Nardo & al., 1996).[xxxviii] Finally, as illustrated previously, without any benchmark, the term "vulnerability" is too imprecise to be practically useful. Every person in the world is in fact potentially subject to a decline in well being as the result of a negative shock. Monetary vulnerability measures, for instance, assess vulnerability as the risk of falling below a specific minimum consumption level, while the sustainable livelihood literature defines vulnerability with respect to a minimum livelihood level. Hence, vulnerability should be defined in terms of the potential to fall below a socially accepted minimums. Its measurement should thus include a cut-off or benchmark, which should be chosen with great care (Alwang & al., 2001).

4. Towards a "vulnerability to trade" analysis: three directions for future research

The hypothesis of a "vulnerability hazard" in developing countries – that is, a likely long term negative welfare effect of exposure to external shocks and uncertainty -

induced by trade openness, is hotly debated (Montalbano & al., 2006, 2008; Guillaumont, 2007, 2009; Naudé & al., 2009a).[xxxix]

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, thereby leading to sub-optimal choices, especially for the poor, because of their "poor" ability to bear "new risks", and weak capabilities to insure themselves against adverse impacts; Calvo & Dercon (2007) and Ligon & Schechter (2004) highlight that risk averse behavior by households can be negatively affected by rising uncertainty, as in the case of ongoing trade reform.

4.1 What is missing from current analyses

Unfortunately, there is no clear and exact criterion against which to judge trade openness from the perspective of "risk exposure" and "vulnerability hazard". At the same time, approaches that condemn any shocks that cause even one individual to suffer a reduction in income, will inevitably fail, given the wide heterogeneity of households and the strongly redistributed nature of trade shocks (Winters, 2002). A more detailed analysis of the welfare effects of trade openness is needed in order to achieve a better understanding of who are "the vulnerable" as well as a more accurate assessment of the costs - to risk averse households in an open environment - of choices that minimize expected poverty or maximize their expected utility.

Despite the number of significant and useful studies that have been conducted in recent years to assess the pervasive incidence of trade openness on the economic performance of developing countries, we still do not have a comprehensive analysis of the likely effects of trade openness on vulnerability in developing countries. Current empirical works use numerous different methods and empirical instruments, and studies are separated across widely different fields of investigation which often do not communicate.[xl] In addition, most of these investigations are ex post studies, targeted mainly at issues not directly linked to vulnerability. At the same time, we must acknowledge the limits of current vulnerability analyses, most of which are based on household surveys not designed to provide a full accounting of the actual impacts of shocks and, generally, focused on specific micro socio-economic contexts.

Hence, additional efforts are needed to build a sound methodology to assess vulnerability to trade openness. To this end, some pre-requisites should be fulfilled and some refinements to the current literature on the effects of trade openness have to be done. First, we need to move from ex post assessments, based on aggregate volatility or crisis transmission, to build an ex ante measure of the likelihood and magnitude of experiencing a reduction in well-being as a result of trade openness (or the process of opening up). Second, we need to choose a suitable benchmark to distinguish actual vulnerability from normal variability. Third, since vulnerability is an "ex ante" condition and it is not observable, it requires a counterfactual analysis. Finally, since the data derived from household surveys are severely limited, we need 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).

As emphasized, there is no single methodology to assess vulnerability to trade openness. However, we can highlight three promising lines of research that might provide us with more adequate assessments of developing countries' vulnerability to trade openness. They are related to three levels of analysis: macro, micro and meso. From a macro point of view the key challenge is to incorporate a forward looking approach to the standard macro literature on cross-country effects of trade openness; from a micro point of view the aim is to assess the 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 phenomenon 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.

4.2 Vulnerability from trade: towards a macro approach

Cross country investigations remain an essential component of vulnerability to trade analyses and benefit from a truly comparative approach. The need for a macro approach to vulnerability is grounded in the recognition that, in the context of international trade, covariate external shocks are increasingly and quantitatively important and are more likely to have a larger impact on welfare than idiosyncratic ones. These shocks, the

result of a perverse combination of international turmoil and economic policy mismanagement, manifest themselves in various forms (e.g. public budget, balance of payments, currency and banking crises, hyperinflation) and primarily affect[xli] the countries that are most integrated in the world economy (Easterly & Kraay 1999). A second reason for a macro approach is related to policy. Recent events highlight the paucity of ex ante international macroeconomic policies capable of properly recognizing and coping with the systemic nature of macroeconomic crises and their actual effects.

Montalbano & al. (2006, 2008) and Federici & Montalbano (2010) provide a first effort to address the issue of vulnerability to trade covariate shocks in cross-country comparisons. Following a broader definition of vulnerability to trade openness than simply "vulnerability to poverty because of trade openness" (Naudé & al., 2009b), recalling Hnatkovska & Loayza's (2004) decomposition method to derive the notion of "extreme volatility" as a proxy for "perturbation", provide a sound method and a first empirical cross-country test for vulnerability to trade openness. Montalbano & al. (2006, 2008) conduct a vulnerability analysis of the controversial case of the impacts of trade liberalization on the countries of Central and Eastern Europe after the collapse of the CMEA.[xlii] Federici & Montalbano (2010) highlight a robust and significant long term relationship, for a large sample of countries, between trade openness, the "extreme volatility" of consumption (crisis and boom) and the deviation in consumption growth from the expected path. The intuition behind both models is that vulnerable countries should be characterized, ceteris paribus, by a higher probability to be harmed by covariate shocks in an open environment, with long run consequences in terms of

welfare. These empirical tests show that vulnerability is a compound outcome not necessarily related to simple variability in the terms-of-trade and/or other aggregate variables linked to trade openness. Furthermore, they demonstrate that a positive association between trade openness and growth can actually hinder the presence of permanent "consumption gaps" between observed consumption growth and its "expected path", induced by "perturbations" linked to trade openness. Additional work is needed to provide a more comprehensive method to assess, at the aggregate level, vulnerability to trade openness. However, the above analyses are definitively a first step towards a new direction for future research.

4.3 Addressing vulnerability to trade at the household level

A macro approach to vulnerability to trade 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.

Trade openness is key to assessing vulnerability at household level. 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, 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. In this respect, the pervasive effect of trade openness in constraining households' optimal portfolios is underlined. Exposing people to external shocks that generate uncertainty could result in a chronic inability to undertake "ex ante" potentially profitable new activities due to risk averseness, with likely negative effects in the long run (Winters, 2002; Winters & al., 2004; Calvo & Dercon, 2007). 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' behavior induced by risk exposure and uncertainty linked to the trade reform process. From the point of view of the factual analysis, standard literature sees consumption smoothing as a primary behavioral objective. However, other strands of the literature underline the existence of constrained circumstances that may lead individuals to depart from consumption smoothing. 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 dipping to a poverty trap. Caroll (2001) observes the precautionary savings motive can generate

a behavior 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 behavior of the poor, by preventing them to raise the optimal amount of savings. Rosenzweig & Wolpin (1993) and Townsend (1994, 1995) investigate the role of different risk coping strategies in different socio-economic contexts and underline a number of salient features on the actual households' ability to smooth consumption. A counterfactual analysis should be able to measure instead the expected level of consumption expenditure in the absence of uncertainty, net of the mean effects generated by trade.

A useful attempt to provide an overall assessment of trade reforms on household welfare at the micro level, was conducted by Niimi & al. (2007). Adopting Glewwe & al.'s (2000), Justino & Litchfield's (2002) and Winters' (2002) conceptual framework, Niimi & al. (2007) analyze 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.[xliii] We still do not know, however, whether the process of opening up the Vietnamese economy has also had an identifiable impact on people's behavior, and long term effects on their welfare, by increasing their degree of uncertainty towards the future and/or their exposure to risk.

4.4 Adding the "meso" level to vulnerability to trade analysis

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 adequate knowledge of the overall, long term welfare analysis of the risks induced by trade liberalization. A meso approach is thus required to compound the outcomes of cross-country vulnerability analyses with those at household level in "within country" approaches. 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 across industries and a closer look at 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 Naudé, McGillivray, & Rossouw (2009) that provide an example of a Local Vulnerability Index (LVI) by using data from South Africa on 10 vulnerability domains across the country's 354 magisterial districts. They conclude that remoteness, dominance of primary (agricultural) production in a local economy, and low population densities are the dominant features of the most vulnerable subnational districts. Also Günther & Harttgen (2009) present a method to differentiate the relative importance of covariate shocks at "community level" (i.e. geographically clustered) with idiosyncratic shocks at household level. Starting from the traditional VEP method

and using a multilevel analysis (Goldstein, 1999), they provide a suitable way to decompose the unexplained variance of consumption into a household and a "community" component, presenting a robust assessment of the relative impact of idiosyncratic and covariate shocks and providing asymptotically efficient and consistent estimation parameters.[xliv]

Proponents of the "industry level approach" are Imbs (2004), Montalbano & al. (2005), di Giovanni & Levchenko (2006) 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. A striking feature of Imbs's (2004) work is that growth and volatility are negatively correlated across countries, but are positively correlated across industries, since, arguably, at the "meso level" risks and return are positively correlated across industries. According to this empirical evidence, the negative association between macroeconomic volatility and long-run economic growth is supposed to be exacerbated in countries with poor institutions, undergoing intermediate stages of financial development or unable to conduct countercyclical fiscal policies (Aizenman & Pinto, 2004). Montalbano & al. (2005) highlight a spread phenomenon of trade de-specialization in some relevant "tradable" manufacturing industries in the Moroccan economy and relate this with episodes of "extreme volatility" of industries' outputs linked to the euro-Mediterranean trade integration process. Di Giovanni & Levchenko (2006), using a broad, industry-level panel dataset of manufacturing production and trade (59 countries and 28 manufacturing sectors over a period of 30 years), provide an in depth analysis of the mechanisms through which trade affects volatility across

industries and on a wider set of outcome variables than aggregate GDP and consumption, for example, employment, salaries and prices at industry level. By including country fixed effects, they confirm Imbs's (2004) results on the apparent differences between country-level and industry-level growth-volatility relationships. They highlight also that the more open that industries tend to be, ceteris paribus, the more volatile (since they are more exposed to world supply and demand shocks) they are[xlv] and the less correlated to the rest of the economy (since they depend more on global shocks and less on the domestic cycle - Kraay & Ventura 2007). The net effect is a reduction in aggregate volatility together with a pervasive role of trade openness on volatility at the "meso" or industry level. Di Giovanni & Levchenko's results are quite robust for all volatility measures considered, over different sized panels, and to the inclusion of several different fixed effects. Krishna & Levchenko (2009) provide theoretical explanations of Koren & Tenreyro's (2007) hypothesis that developing countries are more volatile because their production specializations are in more volatile sectors. They find that less developed countries with low levels of human capital or with lower institutional ability, tend to specialize in less complex goods (i.e. that require fewer inputs for the production of one unit of the good), which are characterized by higher levels of output volatility. This last is a somewhat surprising feature. 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, 2008). Of course, we are still far from a comprehensive

analysis of “meso” vulnerability. However, we already got very useful, although still scattered, contributions.

5. Conclusions

It is still uncertain whether - and eventually to what extent - current trade reforms imply long term welfare discounting for some countries or households by raising their uncertainty about the future and/or their “risk exposure” to a new set of external shocks. However, it warrants more careful investigation of this issue.

The literature review presented here highlights the amount and extent of the work and information currently available on this topic and also the urgent need for more detailed work in order to provide a better understanding of the implications of trade openness in terms of vulnerability. The present work provides useful insights into the current debate on the destabilizing effects of trade openness for developing countries, and some promising lines of reasoning for future research on the link between trade and vulnerability. One of the main difficulties lies in the need to bring together disparate pieces of knowledge. The added value of the present work is to reassemble within a single framework these different fields of investigation and get a comprehensive conceptualization of “vulnerability to trade openness”. The ultimate aim is to achieve a common method of assessing whether or not a “vulnerability hazard” can be induced by the process of trade liberalization that is currently ongoing. To this end, the paper highlights three directions for future research 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 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 at the local level as well as the role of industrial and competition polices.

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[i] This work will not specifically address the long standing debate on the relative measures of trade liberalization and openness. It builds on McCulloch & al.'s (2001) views 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. For a comprehensive list of standard measures of trade openness, see McCulloch & al. (2001).

[ii] The phenomenon of aggregate volatility has been confined in standard cycle theory for a long time, 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. It has been from the work of Ramey & Ramey (1995) onwards, that empirical cross-country studies have consistently found that volatility exerts a significant negative impact on long-run growth and welfare, especially in developing economies (Fatas, 2000; Pallage & Robe, 2003; Wolf, 2004a; Aizenman & Pinto, 2004) and that consumption volatility increases with respect to income (Kose & al. 2003).

[iii] The expression "sudden stops" as a synonym for crisis was first used by Dornbusch & al., (1995).

[iv] While in the case of uncertainty several possible outcomes are associated with an event, but the assignment of probabilities to the outcomes is not possible, risk permits the assignment of probabilities to the different outcomes (Aizenman & Pinto, 2004)

[v] Positive shocks have no impact (Dehn, 2000).

[vi] This result holds for 9 definitions of uncertainty from the "simple unconditional standard deviation" to "Garch's conditional standard deviation of one step ahead forecast error dummying out all shocks" (Dehn, 2000).

[vii] Frankel & Wei (2004) who attempted to model crisis probability using a key list of macroeconomic variables do not put trade at the top of the list of the determinants of "sudden stops". They emphasize the role of corruption, inflationary policies with high budget deficits, and the composition of capital inflows. Actually, their results challenge a number of persisting "conventional wisdoms", e.g. they find no clear evidence of a negative role of financial liberalization or intermediate floating exchange rate regimes: crises also appear to occur with hard pegs (Argentina), floating (Brazil after January 1999), and intermediate exchange rate regimes (Mexico, Thailand, Korea, Russia, Turkey).

[viii] Guidotti & al. (2004) provide evidence that economies that trade more, recover more quickly from output contractions that usually accompany "sudden stops". Calvo & al. (2003) 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.

[ix] 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.

[x] The issue is analyzed in more depth by Forbes (2001), who, 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 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. Analyzing data on trade flows for a sample of countries that experienced a crisis in the 1990s, Forbes (2001) suggests that competitiveness and income effects are negative, significant and quantitatively relevant, while the positive cheap import effect remains weak. 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 linked to a rise in interest rates.

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

[xii] For instance what USAID FEWS NET calls risk, is more commonly described as vulnerability to an undesired outcome, and what they refer to as vulnerability others call an analysis of household characteristics and risk response mechanisms. According to USAID, vulnerability is a condition that may lead to risk of food shortage (depending on the hazard), rather than the result of risk exposure and risk response mechanisms. Similarly, risk of food shortage is not an *ex-ante* condition; it is rather the outcome of the hazard (risky event) and an individual's or household's vulnerability to that hazard. It is important to note, however, that these nuances are a question of semantics rather than actual differences in conceptual meaning.

[xiii] 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).

[xiv] They can be characterized by a known or unknown probability distribution, by different magnitude (size and spread), history, frequency, correlation, duration, timing and severity. 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).

[xv] 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. The two concepts, although, interconnected present slight differences.

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

[xvii] Efforts have been made to combine the "sustainable livelihood" approach and "environmental 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, 2007). 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".

[xviii] Foster & al. (1984) introduce a class of poverty measures based on the following general formula: $P_\alpha = \frac{1}{n}\sum_{i=1}^{q}\left[\frac{z-y_i}{z}\right]^a$, where q is the number of poor and n the number of the whole population; z is the

poverty line and y_i is the income of poor household i. The FGT index defines poverty as the normalized weighted sum of the gap between income and the poverty line, where weights are the same distances from the poverty line. The parameter α sets the degree of sensitivity of the poverty measure to the distance from the poverty line. It takes the values *0* for the headcount poverty measure, *1* for the poverty gap (i.e. the depth of poverty) and *2* for the squared poverty gap (i.e. the severity of poverty).

[xix] To overcome this problem, 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. This measure of vulnerability is similar to a measure of the incidence or severity of poverty.

[xx] A three-step feasible generalized least squares (FGLS) is applied by Chaudhuri (2001, 2003) to overcome the problem of heteroschedasticity.

[xxi] Actually, if markets are not complete and the random walk hypothesis for consumption does not hold, consumption is not expected to follow a stationary process due to a multiplicity of factors (preferences, demographics, liquidity constraints, etc.) and we need to rely on a lifecycle model.

[xxii] 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 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.

[xxiii] Acknowledging the latter caveat, Günther & Harttgen (2006, 2009) and Sarris & Karfakis (2006) present a method to assess vulnerability using a single round of cross-sectional data, but differentiating the relative importance of covariate shocks at the "community level" with idiosyncratic ones at household level.

[xxiv] This is accomplished simply by setting *z* equal to expected per capita consumption expenditures (Ligon & Schechter, 2004). To operationalize the idea, we let *c* denote per capita expenditure. In fact, if every household definitely consumes *c*, then there is no vulnerability - no risk and no inequality (and hence no relative poverty). Then the vulnerability of household *i* could be defined as: $V_h = U_h(c) - EU_h(c_h)$

[xxv] This decomposition is not peculiar to utility based measures of vulnerability.

[xxvi] The concavity of utility implies that as the expected consumption approaches the poverty line an additional unit of expected consumption diminishes the marginal value in reducing poverty.

[xxvii] 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*, written as $U_hE(c_h)$-$EU_h(c_h)=\rho$.

[xxviii] However, they differ in what the welfare indicator is: FGT poverty measures in VEP, CES utility function in VEU, rate of coverage of basic needs in VFP.

[xxix] Ligon & Schechter (2004) highlight that only the second step actually measures vulnerability.

[xxx] Indeed, in the case of the VFP approach, a set of additional axioms and a slight modification to the aforementioned ones are required. For a detailed explanation of the measurement of VFP aggregate vulnerability as a convenient combination of individual levels, see Calvo & Dercon (2007).

[xxxi] They actually tried also to mix-and-match estimators and measures.

[xxxii] Chaudhuri (2001)'s estimator takes advantage of information on the variance of residuals to improve efficiency, such as Generalized Least Squares improves on OLS.

[xxxiii] 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.

xxxiv.The poor are said to be especially devastated by economic crises, as they are covariant and generally catastrophic in nature. They represent great sources of vulnerability and insecurity for present and future generations alike. They wreak irreversible and unrecoverable damage and loss on human capital through a chain of events, beginning with economic crisis and ending with loss of income and selling off of assets at depressed prices. The upshot is a general slow-down in the accumulation of human, financial and physical capital, making escape from poverty that much farther from reach.

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

[xxxvi] Consumption or income in the absence of a shock was estimated by setting all shock variables to *0*. Thus, counterfactual consumption will be the familiar consumption function found in most cross-sectional poverty studies, while the impact of a shock will be the difference between the predicted consumption level and the part of the actual consumption positively correlated with the observed shock. Unfortunately, in this model the estimated parameters seem not to be resistant to alternative specifications of the functional form. Moreover, simple specifications of the consumption or income regression with shock dummies tend to emphasize the positive impact for some shocks.

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

[xxxviii] 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).

[xxxix] This issue must be separated from the issue of Small Islands Development States (SIDS) and "Fragile States". SIDS are states characterized by a "natural and/or endogenous inability to face external shocks" (Montalbano & Triulzi, 2009; UNU-WIDER, 2008; Briguglio 1995; Atkins & Mazzi, 1999; Easterly & Kraay, 1999; Briguglio & Galea, 2003; Winters & Martins, 2004; Witter, Briguglio, & Bhuglah, 2002; Briguglio & al., 2009). A presumptive "special status" of SIDS was granted at the first Global Conference on Sustainable Development of SIDS in Barbados in April 1994. It highlights the special situation of SIDS in terms of vulnerability calling for distinctive policy approaches to effectively address their sustainable development problems. However, they are largely an informal group, formed in 85% of cases by medium-high income countries. Fragile states are countries whose policy and institutional assessment, essentially the World Bank's country policy and institutional assessment (CPIA), falls below a particular threshold. Of course, many countries may meet both criteria of structural vulnerability as well as state fragility, owing to the likely influence of the former on the latter, but the two concepts are founded on opposite grounds, structural versus policy factors, and cannot be used in the same way to design international policies, as we see below in the case of aid policies (Guillaumont, 2009). More specifically, a state is classified as fragile if 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).

[xl] 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, 2004; Wolf, 2004a; Calderòn & 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 2007). 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).

[xli] 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.

[xlii] CMEA was established in 1949 with the aim of encouraging economic, scientific and technological cooperation and developing economic integration among Socialist member countries which included USSR, Bulgaria, Czechoslovakia, Hungary, Poland, Romania, Albania (1949); DDR (1950), Mongolia (1962); Cuba (1972) and Vietnam (1978).

[xliii] They apply a multinomial logit (MNL) model to analyze the probability of being in a particular state, out of several unordered alternatives. In its more general form with j alternatives, the multinomial logit is expressed as:

$$\pi_{ij} = \frac{\exp[\mathbf{x}_i'\boldsymbol{\beta}_j]}{\sum_{j}^{k}\exp[\mathbf{x}_i'\boldsymbol{\beta}_j]}$$

where k is the number of outcomes being modelled. This, in general terms, expresses the probability that an individual with characteristics xi chooses the jth category.

[xliv] Using the squared residuals, Günther & Harttgen (2009) estimate the variance at household and community levels, depending on a set of observable characteristics at household and community level.

[xlv] If trade opening also increases the elasticity of labor demand, then not only output, but also wages and employment are more volatile in the presence of shocks.

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