Macro vulnerability in low income countries and aid responses

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Macro vulnerability in low income countries and aid responses *[1]

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Abstract

Macro vulnerability of the poor countries, an increasing concern of the international community, is analyzed as the risk that their development be hampered by the shocks they face, natural or external. Structural vulnerability mainly results from the size of the shocks and the exposure to the shocks, while general vulnerability also depends on resilience, mainly determined by policy.

We first explain how, through instability, vulnerability affects growth and development, arguing four main points. The ex post effects are at least as important as the ex ante or risk effects. Instability affects productivity growth rather more than the level of investment. Primary or exogeneous instabilities lower growth through intermediate and policy related instabilities. Instability also increases the level of poverty (and child mortality), beyond its effects through the rate of growth.

Second we examine how, for operational purposes, a synthetic measure of structural vulnerability can be obtained in an Economic Vulnerability Index (EVI), as that developed at the UN. The components of such a structural vulnerability indicator should be related both to the size of the natural and external shocks and to the exposure to these shocks. They should be averaged so that to reflect the interaction between shocks and exposure.

The last part considers the implications for aid policy of the macro vulnerability of poor countries. It relies on the view that aid dampens consequences of vulnerability (i.e. vulnerability increases aid effectiveness) and that the aid volatility issue must be reexamined with this regard. Three aid responses are considered. Vulnerability (EVI) can be used as a criterion for aid allocation. Aid can be also designed as an insurance, if it can be disbursed quickly and effectively. Finally, but difficultly, aid can be oriented to contribute to the long-term reduction of vulnerability.

Introduction

Economic vulnerability of developing countries is not really a new issue. If we consider the development literature of forty years ago, the issue of instability, especially for primary exports and international prices, held a significant part in the analysis of the problems faced by developing countries. The policy measures recommended indeed were far from being convergent. But the fact is that during the first UNCTAD conferences the response to give to world price instability was an important matter of concern, with a culminating period of interest in the mid-seventies (as evidenced by the Nairobi UNCTAD IV (1976) and its Integrated Program for Commodities, over ambitious, misdesigned and not really followed by significant achievements).

Recently the economic vulnerability of developing countries has appeared to be high again on the international agenda. Not only the world economy has remained unstable, but instability has also evidenced new aspects and consequences. Several trends and events contribute to explain this renewed interest on macro vulnerability in the last decade.

Reasons of a renewed interest on macro vulnerability. First, small island developing states (SIDS) have repeatedly expressed a concern about their level of vulnerability. It was evidenced in 1994 at the Barbados Conference on Sustainable Development of Small Island Developing States. Following this Conference which asked for « the development of vulnerability indices and other indicators that reflect the status of small island developing countries and integrate ecological fragility and economic vulnerability », the United Nations General Assembly, in 1996, requested the Secretary General to prepare a report on the vulnerability index and the Committee for Development Planning (CDP) to examine this index.

In 1998, the UN Commission on Sustainable Development urged the CDP to present its conclusion and other UN bodies to accord priority to work on vulnerability of SIDS. In 1999 the Committee for Development Policy (new name of the CDP), after considering several available indicators proposed a new and relatively simple index (United Nations 1999). Ten years after the Barbados Conference, the Mauritius Conference (December 2004) reiterated the concern of the international community about the vulnerability of small islands. Few days later, the tsunami evidenced the relevance of this concern.

Second, in accordance with the own suggestions of the CDP, the General Assembly requested this Committee to consider "the usefulness of the vulnerability index as a criterion for the designation of the Least Developed Countries" (LDCs). As said above, this was done by the new CDP in 1999: a new "economic vulnerability index" (EVI) was proposed as one of the criteria to be used for the identification of LDCs, besides the other two criteria (the level of GDP per capita and an index of human capital). The CDP, in 2000 and again in 2003 in its review of the list of LDCs implemented the EVI index as an identification criterion. This list was endorsed by ECOSOC and the new vulnerability criterion as well.

Third and most important, the unsustainability of growth episodes in Africa has become a major intellectual and political challenge. Moreover the problem of conflicts, which is particularly acute in Africa, has drawn the attention of the international community on the risk of civil wars (and on the factors of their duration as well, cf. Collier et al.). It is mainly in reference to these situations and other possible sources of collapse that the World Bank has designed a special category of countries called the LICUS (low income countries under stress). The expression of "fragile states" also used reflects the vulnerability of these countries (Chauvet and Collier 2004).

Fourth, answering to the concern about the instability of international commodity prices, and their possibly higher impact on producers in a context of liberalized domestic agricultural markets, an International Task Force for Commodity Risk Management has been set up at the initiative of the World Bank to make proposals on the ways by which commodity

dependent economies can manage the risks they face in a market based approach. Such proposals are directly intended to cope with the vulnerability of these economies and so involve to assess their vulnerability (World Bank 1999, Varangis et al. 2005).

Fifth, in the second part of the nineties, the "Asian crisis" made it clear that not only small island developing states, LDCs, Africa, and/or commodity dependent economies are vulnerable. Many comments and analyses of the causes of this crisis and other financial crises have underlined the vulnerability of some emerging countries, which before the crisis registered a high level of capital inflows with a weak financial structure. In that perspective, several authors have tried to assess the risk of a financial crisis (Berg and Patillo1999), others to estimate the factors of GDP growth volatility (Easterly, Islam, Stiglitz 2001, Combes et al 2000), which is another way to look at vulnerability.

Finally the attention brought to vulnerability at the household level, which has emerged from the huge amount of work on poverty (and which is considered in the paper of Stephan Dercon) has also reinforced the interest on vulnerability at the macro level. Vulnerability of households results to a large extent from macro vulnerability.

Macro vulnerability as understood in that paper. By macro vulnerability we mean the risk for (poor) countries to see their development hampered by the shocks they face, natural or external. We refer to two main kinds of exogenous shocks, then two main sources of vulnerability: 1) environmental or "natural" shocks, namely natural disasters such as earthquakes or volcanic eruptions, and the more frequent climatic shocks, such as typhoons and hurricanes, droughts, floods, etc. ; 2) external (trade and exchange related) shocks, such as slumps in external demand, world commodity prices instability (and correlated instability of terms of trade), international fluctuations of interest rates, etc. Other (i.e. non-environmental) domestic shocks may also be generated by political instability, or more generally by unforeseen political changes. This kind of shocks however cannot be considered by the same way, as far as they seem less "exogenous".

We see vulnerability as the result of three components:[2]

a- the size and frequency of the exogenous *shocks*, either observed (ex post vulnerability) or anticipated (ex ante vulnerability)

b- the *exposure* to the shocks

c- the capacity to react to the shocks, or "*resilience*"[3]

The resilience is more dependent on the current policy, more easily reversible, less structural. But there may also be a structural element in the resilience component of vulnerability.[4]

A distinction thus can be made between *structural vulnerability*, which results from factors that are durably independent from the current political will of countries, and the *vulnerability deriving from policy*, which results from recent choices. For instance, the vulnerability of the Asian countries in the mid nineties, after the 1997 crisis, is very different from the vulnerability of small economies which export raw materials or of small islands. It is less structural, more the result of policy, then more transient. This feature is clearly evidenced when vulnerability is measured by the probability of a financial crisis, estimated mainly from financial and policy variables (see for instance Berg and Patillo, 1999, Goldstein et al. 2000). If a vulnerability index is to be used for selecting certain countries and providing them with a durable support by the international community, the vulnerability to be measured is naturally the structural one, which essentially results from the size of the shocks that can arise and the exposure to such shocks.

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[2] A similar decomposition has been used to study the transmission of cycles from one area to another one (Guillaumont 1985), the three components being named sensitivity, dependence and receptivity.

[3] The concept of resilience is largely used in some works more specifically oriented towards the environmental or natural sources of vulnerability (cf. Kaly et al. 1998). A distinction close to the previous one can be found in Rodrik (1999) who, looking for the risk of social conflict in countries facing external shocks, considered separately the severity of the shocks, the depth of latent social conflict (likely to increase the impact of the shocks), and the quality of conflict management institutions.

[4] Consider, for instance, a small country that is a primary commodity exporter. Its vulnerability to trade shocks results first from the world price fluctuations, reflected by the instability of its terms of trade, second from the exposure to the shocks expressed by the ratio of (commodities) export to GDP, and third from the capacity of the country to efficiently manage such shocks. The size of the shocks for a price taker small country (its export price instability) is clearly an exogenous factor of instability. The resilience, or the capacity to manage instability, clearly depends on the policy pursued. The country (its export price instability) is clearly an exogenous factor of instability. The resilience, or the capacity to manage instability, clearly depends on the policy pursued. The exposure to the shocks is more ambiguous: it is mainly a structural factor, but to some extent it is also dependent on policy and it is all the more so that the period considered is longer.

Without forgetting the various contexts in which the concept of macroeconomic vulnerability has appeared to be relevant, we here examine macro vulnerability under two specific aspects: first we focus on vulnerability of *low income countries*, leaving aside the vulnerability of emerging economies, and developed countries as well; second we consider mainly the *structural vulnerability*, which in the short term does not depend on policy, and is particularly high in many low income countries.

The next sections the paper are organized as follows. First we argue that vulnerability matters, in particular for low income countries: drawing from the literature and some on-going works, we examine how vulnerability lowers growth, and beyond its effect through growth, slows down poverty reduction. Second, in a part devoted to concept and measurement issues, we examine how to assess structural vulnerability and present an index of economic vulnerability likely to be used for development cooperation guidance, as it is already the case for the identification of the Least Developed Countries. Third, using such an index, we consider the implications for aid policy of the macro vulnerability of poor countries, with the view to dampen the ex post consequences of the shocks, as well as to lower the uncertainty resulting from them.

Why vulnerability matters? The impact of structural vulnerability.

If vulnerability is the risk to be harmed by shocks, a first question is how to measure the harmfulness. It could be the immediate losses of welfare resulting from a shock. When successive and opposite shocks of equal size occur, the welfare loss associated to the instability of income is due only to the decreasing marginal utility of income. Of main concern for low income countries are the possible negative effects of the shocks on growth and development, which refer to a dynamic definition of vulnerability. Then the relevant vulnerability is the risk of economic growth to be markedly and durably reduced by shocks (or the risk of the long-term

average rate of growth to be reduced by shocks)[5]. It is seen as a handicap to growth. Another dynamic definition, somewhat broader, is the likelihood of negative and durable effects of shocks on poverty reduction, either due to their effect on growth or to a direct effect on poverty, which we underline below. Of course while vulnerability is costly, it cannot be reduced without cost, and anyway cannot be totally cancelled.

We examine the links between vulnerability and growth referring to the three main components of vulnerability identified above: shocks, exposure and resilience. Then we underline social effects of macro vulnerability, beyond those linked to growth.

Shocks: the Negative Impact of Instability on Growth

Focusing on instability.. There is no much debate about the negative impact of "one side" natural shocks such as earthquakes, typhoons or floods. The damage caused by these events is often huge, first by the number of deaths, second by the destruction of physical capital. The debate is rather about the measurement of the size of these losses. But, when the shocks are "two sided" (up and down and again…), as are many shocks, in particular external ones, their overall impact may seem less clear. Depending on the method used to measure the shocks, the respective sizes of positive and negative shocks (not their time profile) tend to equalize. It is the very nature of instability to be a succession of booms and slumps (of export prices, external demand, rainfalls …). This is why in what follows we mainly consider the impact of instability or volatility rather than the impact of separate shocks. What needs to be evidenced is that the impact of these successive "up and down" is not neutral. Their impact may result either from an asymmetry of *ex post* reaction to positive and negative shocks (even their time profile may not be symmetrical) or from the uncertainty generated by their previous

[5] At first glance *vulnerability* (with regard to growth) may appear simply as the opposite of the *sustainability* of growth, a concept even more extensively used: the more vulnerable a country, the less sustainable its growth, ceteris paribus. But the

succession. Thus, there are both *ex post* and *ex ante* effects of instability (as clearly underlined by Gunning 2004). *Ex post* effects may be easier to evidence than the *ex ante* ones, which depend on a perception of the risk. Most measures used in cross section literature rather rely on *ex post* concepts.

Since the observation of a succession of ups and downs (i.e. the measurement of instability) needs a multiyear period, cross-sectional (or panel) regressions are often an appropriate tool to analyse the effects of instability (on growth or other aggregates). Moreover they can give support to the use of an index internationally comparable, considered in the next section. But an important literature also examines the effects of trade shocks under their theoretical aspects and through country case studies (cf. the important work edited by Collier and Gunning 1999 on the mainly positive trade shocks) or (Kose and Reizman 2001).they compare time series (Deaton an Miller 1996) or they model a typical (African) economy

There may be some doubts about the (static) negative welfare effects of macro economic instability in a developed economy, as expressed by Lucas (2003), but less doubt about these effects in developing economies (Pallage and Robe 2003). We here argue that there is little doubt on the basis of cross-section studies including a large number of developing economies that macro economic instability is unfavourable to growth. However an issue hardly addressed is whether there is a threshold above which such effects occur or more generally whether there are non linearities in the effects of instability.

Instability of growth and average growth. Let us refer to three empirical studies which offer a test of the macro vulnerability, without considering specifically and separately the main sources of instability or vulnerability. A comprehensive test of macro vulnerability is given by the well known study of Ramey and Ramey (1995): they show a significant link between the instability of the rate of economic growth and the average rate of growth itself (exogeneity of

sustainability of growth not only (negatively) depends on the vulnerability to shocks, but also results from other and permanent factors, such as the rate of human and physical capital accumulation, and the natural resources preservation.

the instability tested). But this instability can be due to structural factors and to policy factors as well, a reason why the volatility of growth cannot be an approximate indicator of *structural* vulnerability (cf. infra). Also not trying to separate structural from policy sources of vulnerability, Rodrik (1999) tests significantly a negative influence on the change in the rate of growth between two fifteen-year periods of a multiplicative index of "conflict", which multiplies an index of "shocks" by an index of "latent social conflict" (the ethnolinguistic fragmentation index or a Gini coefficient of income inequality), then by an index of the quality of conflict management institutions (namely the lack of democracy or the quality of governmental institutions, as measured by Knack and Keefer 1995). Each of these, introduced alternatively, appears highly significant. Rodrik also tests the respective effects of trade "shocks" and of either an exposure index or an index of the capacity to manage. A third, recent and systematic attempt to assess the link between output volatility and growth is due to Hnathovska and Loayza (2004), who evidence both a higher sensibility of growth to volatility in low income countries and an impact of volatility higher in the last two decades than during the previous ones. The authors also evidence that volatility is more detrimental when institutions are poor (through a multiplicative variable). But they do not assess the impact of structural vulnerability as such.[6]

The effects of *export instability*, a main source of structural vulnerability in developing countries, have been discussed for many years in the literature using growth regressions. Two decades ago the results could appear as mixed, due partly to methodological shortcomings, and partly to an excess of concern about the effects on savings (see infra). There seems to be now a consensus emerging from several studies to conclude that export instability (or in some studies terms of trade instability) has a negative effect on growth [7]. More significant effects are found when the studies test simultaneously the (positive) effect of export growth, and the (negative)

[6] They check the exogeneity of growth volatility through instrumental variables, which are mainly policy variables.

effect of export instability and when the export instability (size of the shocks) is either weighted by the average export to GDP ratio during the period (Guillaumont 1994, Combes and Guillaumont 2001), a ratio which is ceteris paribus the higher the lower the population size, or is an instability of the export to GDP ratio itself (Dawe 1996): the exposure to the shocks is thus taken into account.

Export earnings instability is not the only kind of instability the effects of which have been tested. We have previously estimated the influence of several *primary instabilities*, mainly exogenous, on the rate of growth and argued that these instabilities, significantly higher in South of the Sahara Africa than in other developing countries, may have been a major factor of the slow rate of growth in Sub-Saharan Africa during the seventies and eighties, since here on average these instabilities appear to have been higher than in other developing countries (Guillaumont et al.1999). They are the instability of the terms of trade, weighted by the average export to GDP ratio, or that of the real value of exports, weighted in the same way, the instability of the agricultural value added (weighted by the average share of agricultural value added in GDP) and political instability. The first and the third instabilities appeared to have a significant effect on growth, but not that of the agricultural value added. However in another work both the instabilities of real value of exports and of agricultural value added, here unweighted, appear to be significant (Guillaumont and Chauvet 2001). Recently Miguel, Satyanath and Sergenti (2004) have evidenced the impact of rainfall variations on growth in African countries during 1981-1999 and followingly on the likelihood of the civil conflict.[8]

What are the channels of transmission from shocks to growth? What are the intermediate variables which are rendered unstable, so that growth is negatively affected?

[7] See for instance Bleany and Greenaway 2001, Glezakos 1984, Gyimah-Brempong 1991, Fosu 1992, 2001 Guillaumont 1994, Lutz 1994, Dawe 1996, Guillaumont et al. 1999, Combes and Guillaumont, 2001, Mendoza 2000 and the review of the literature by Araujo Bonjean et al. 1999

[8] Actually the aim of this paper is to test the impact of negative growth shocks on the likehood of civil conflict, and only use rainfall variations as an instrumental variable for economic growth.

Factor productivity more affected than investment. As noted above, a large part of the literature on the effects of export instability was devoted to its effects on saving, which are ambiguous. On one hand instability has long been supposed to enhance precautionary saving (Yotopoulos and Lau 1976), an assumption mainly relevant for private saving, and dependent on the degree of risk aversion, as shown by Mendoza 2001. On the other hand instability may also generate ratchet effects on consumption, mainly on public consumption. And it can refrain the private sector to invest, due to risk perception, as argued and tested by Aizenman and Marion 1999, which is not the case of the public sector, often pushed to invest in the boom periods, possibly with the help of procyclical borrowing, a higher public indebtedness resulting. Not surprisingly the net result on the overall rate of investment is ambiguous, if not on its composition.

Effects of instability on productivity growth are on the contrary clearly negative and result in negative effects on GDP growth, as evidenced by several studies. [9]In the previously quoted cross-section growth regressions, the instabilities, either the so-called "primary instabilities" (Guillaumont et al. 1999) or that of rate of growth (Ramey and Ramey 1995), essentially lessen the rate of growth of total factor productivity. Actually the instability of the terms of trade appears to increase rather than lower the rate of investment (Guillaumont 1999), which makes the effect on the growth residual alone stronger than the total effect on growth[10]. Finally we do not find evidence in the literature on low income countries of a possible cleansing effect of the recession periods: indeed it was an expected effect of adjustment policy, but it does not seem to be associated to structural vulnerability. Or it may work only below some threshold.

[9] Growth regressions on instability or vulnerability indicators either include or exclude the rate of investment besides the other control variables. When the rate of investment (investment to GDP ratio) is included, the coefficient of the instability or vulnerability indices only expresses their impact on the growth residual, whereas when it is excluded, the coefficient is assumed to assess their total effect, both through the rate of investment and the growth of factor productivity.

Instability channelled to investment, real exchange rate, producer prices…Guill*a*umont et al. 1999, tested the hypothesis that the primary instabilities (terms of trade, agricultural production, political instability) influence growth through two important *intermediate instabilities*, namely the instability of the rate of investment and that of the relative prices. These two intermediate instabilities have negative effects on growth and are related to policy, which by this way is weakened by structural vulnerability.

First, the instability of the rate of investment is a factor, curiously neglected in the literature, of lower average capital productivity: as a result of the declining marginal productivity of investment, the gain in total output due to a high level of investment is less than the loss due to a low level of investment. This effect, illustrated during the boom periods by the projects oversized, under prepared and weakly productive, mainly concerns public investment.

Second, intermediate instability, that of the relative prices, proxied by the instability of the real effective exchange rate (REER) also appear to have a strong negative effect on the rate of growth. It is assumed to blur the market signals and induce a misallocation of investment. This negative effect of the REER instability or volatility has also been evidenced in several papers (Aizenman and Marion 1999, Ghura and Grennes 1993, Serven 1997). It appears to have not only an effect on the total factor productivity, but also a negative effect on the rate of investment (Guillaumont et al. 1999).

Either due to the macro policy through REER instability or to the passing through to farmers of world agricultural prices fluctuations, the instability of the real producer prices is generally considered as a factor of a lower average agricultural output (as well as a factor of lower welfare), noticeably by its effects on the adoption of new techniques, as does the weather risk (Newbery and Stiglitz 1981, and United Nations 2001b for a review of studies on the impact of risk on agricultural productivity). Time-series studies on producer price variability are most often related to some specific products and countries (for instance Behrman 1968, Just

[10] Similar results about the effects of export instabilities were found by Guillaumont (1994) and Dawe (1996), who underline the effects through the growth residual rather than through the rate of investment. These instabilities are "weighted" by the

1974, Lim 1977, Guillaumont and Bonjean 1991, Araujo 1995). At a macro level the effects of the real producer prices instability on the growth of agricultural production have also been significantly tested from a sample pooling several products in many countries (Guillaumont and Combes 1996, Boussard and Gérard 1996, and as to the effects of real border prices instability, Subervie 2005).

Thus it seems that external instability has negative effects through the instability of the rate of investment and that of the real exchange rate, either by its impact on public finance when retained at the government level or by its impact at the producer level when passed through to producers.

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Exposure: the Vulnerability of Small Countries

Major influence of country size. The main structural factor of a greater exposure to exogenous shocks is of course the smallness of a country. Among several ways by which the size of a country can be measured, the most meaningful is the number of inhabitants. In some cases (possibly for natural shocks) the area smallness could be a more relevant measure of the exposure to the shocks. But to assess the main economic consequences of the size of a country, independently from its income per capita, the most usual measure is the number of its population.

The vulnerability issue meets the old and renewed debate on the consequences of the size of nations (see recent works of Alesina and Spolaore 2004 and Winters and Martins 2004). Of course country size has many consequences, all of them at first glance not related to vulnerability, in particular scale economies in many sectors of activity, industry as well as government (the unit costs of public administration are expected to be higher in smaller countries). However, when investigating the channels by which size matters for development,

export to GDP ratio (cf. infra)

links with vulnerability more clearly appear. There are at least three main channels (or intermediate variables) through which small size influences the exposure components of vulnerability: trade intensity, government size and social cohesion.

Take first the *exposure to external shocks*, well reflected by the export to GDP ratio. The smaller the (population) size, the higher (ceteris paribus) the trade to GDP ratio is (and the more "dependent" the economy). Country size is the main structural factor determining the trade to GDP ratio, then the main determinant of the "natural openness" and the main factor to be neutralized if an index of "openness policy" is drawn from the observed ratios (Guillaumont 1989, 1994). It is clear that the impact of a given export shortfall is higher, the larger the share of export in GDP. For that reason the impact of export instability (and of export growth as well) is better estimated when the export instability variable (export growth as well) is multiplied by the export to GDP ratio, i.e. when it is a "weighted" instability. While natural openness, mainly determined by smallness, increases the exposure to trade shocks and consequently their negative effect on growth, openness policy is not only a positive factor of growth, but also a factor of greater resilience (Guillaumont 1994, Combes and Guillaumont 2002).[11]

Moreover diseconomies of scale associated to smallness result in a stronger difficulty to diversify at low cost. As a consequence small low income countries face a higher risk than larger countries to implement inefficient or costly policies when they adopt protectionist measures; for the same reason a protectionist trend at the world level is likely to be more damaging for small countries. Alesina and Spolaore (2004) have tested such an effect in a cross-section growth regression through a multiplicative variable of the (log of) population and openness: the coefficient of this multiplicative variable is found significantly negative, while that of each of two variables added independently in the regression is significantly positive.

[11] Let us add that with regard to natural shocks or disasters, as far as they generally concern some specific groups of the population, the larger the population, the smaller the aggregate exposure: in a large country, climatic shocks are likely to affect only a small part of the population.

Another reason why smallness is thought to be a factor of lower growth is its assumed impact on the *size of government*. The assumption of a (negative) relationship between (population) size and the relative size of government activities has been successfully tested by Alesina and Spolaore (2004). An interpretation can be found in a previous work by Rodrik (1998) who argue that high trade to GDP ratio (itself related to the population size) leads to an extension of the role of state in order to provide more insurance to the citizens. Or this relationship can be linked to a stronger effect of public revenue instability on public consumption. If a large size of government activities is a source of higher costs, there may be again a source of vulnerability due to smallness, likely to lower growth.

A third channel by which the country (population) size may impact vulnerability and growth is through *social cohesion*. It could be an advantage of smallness to allow more social cohesion (less ethnic, linguistic or religion fragmentation): if social fragmentation is a negative factor of growth *and* if fragmentation increases with population size, smallness is an advantage not an handicap. To be noted fragmentation, as a handicap, is not unrelated to vulnerability: one reason why it is assumed to negatively impact growth is that this structural factor influences the exposure or the resilience to the shocks (Rodrik, 1999). The reality may be more complex, and several works evidence non-linear relationships where linear ones are assumed. In particular rather than social fragmentation social polarization may be a handicap (and a factor of vulnerability) (Arcand et al. 2002), and polarization does not increase with population size: it (at least beyond a low threshold) rather decrease with it[12]. For that reason also smallness may appear to enhance and not lower vulnerability.[13]

Anyway it clearly appears from several cross-country regressions that when appropriate control variables are used the (log of) population size is a significant positive factor of growth (Alesina and Spolaore 2004, Bosworth and Collins, 2003, Guillaumont and Guillaumont 1988,

[12] Even the assumption of a negative correlation between population size and other linguistic fragmentation is debatable: when fragmentation is explained both by the population size and the surface, the coefficient of population size is significantly negative, while that of surface is (significantly) positive. Since the absolute value of the coefficients are similar, it means that fragmentation decreases with population density (internal work in process at CERDI).

[13] The greater social cohesion of small islands is also debated by Helleiner (1996).

Guillaumont and Chauvet 2001, Millner and Weyman-Jones 2003) and a negative factor of export instability (Easterly and Kraay 2000). That smallness lowers growth may be due either to higher vulnerability or to scale diseconomies or to their conjunction.

Other factors of exposure. Besides smallness of population size, other factors of exposure to shocks are to be considered. They are related to the structure of the economy and to the location of the country, primary economies and remote countries being more exposed to external and natural shocks. The extent to which they are so are examined in the next section , with the indicators of exposure.

Resilience: the Ambiguous Role of Policy

Vulnerability of policy and institutions. As seen above, the instability of overall income transmitted to public revenue is a factor of public deficit and indebtness, of instability and then low productivity of public investment, of real exchange rate instability, etc. Our conclusion was that structural vulnerability weakens policy. This hypothesis is supported by the inclusion of a vulnerability indicator in a model where the explained variable is a composite indicator of macro policy. Let us consider an indicator of macro policy similar to that used by Burnside and Dollar (1997), including as components the ratio of budget surplus to GDP, the rate of inflation, and the Sachs and Warner measure of openness, weighted by their impact on growth in a cross-section model with other common control variables (it is a measure of the impact on growth of these three identified factors, ceteris paribus). On a pooling of ten years periods this indicator of policy appears itself to be significantly and negatively influenced by the level of economic vulnerability, as measured by an index, and positively by the initial level of human capital as well (Guillaumont and Chauvet 2001). However the long run effect of the instability on the quality of institutions remains an open issue.

Policy as a determinant of resilience. Structural vulnerability not only has an impact on the quality of economic policy; its direct effects (on growth) also depend on policy. Policy and institutions are the main factors of the *resilience* with regard to shocks, in other words of the capacity of a country to effectively cope with exogenous shocks. This is why structural vulnerability has to be distinguished from overall vulnerability, which includes an autonomous policy component essentially through the resilience. Indeed institutions and policy are themselves influenced by other far reaching factors, as argued by Acemoglu et al.(2003), precisely to explain their impact on the volatility of growth and the occurrence of crises

One important element of the resilience, depending on policy, is the capacity of the country to maintain an appropriate level of competitiveness. By this way an outward looking policy, even if it may increase the exposure of a country to external shocks, as does and more significantly a small size (natural openness), enhances its resilience. It means that in the growth regressions the absolute value of the (negative) coefficient of the (weighted) export or terms of trade instability is the smaller the more outward looking is the policy (Guillaumont 1994, Combes and Guillaumont 2002). Thus three effects of a more open trade policy can be identified: the well known positive effect of the growth of exports, the negative effect of the increase of the exposure to instability (the export to GDP ratio weighting the export instability), and the positive effect of lessening the impact of a given export instability, which means a greater resilience. As argued in the last part of the paper, foreign aid can be another important factor of resilience.

Beyond Growth: Social Consequences of Vulnerability

Instability by lowering growth has deleterious consequences on the social variables depending on economic growth, leading in particular to slower poverty reduction. It also has direct social effects on these variables independently of their effects on growth. Two reasons

make these direct effects likely. One is the feeling of frustration generated by a shortfall of income following a rapid expansion which creates new needs and exaggerated expectations. The other reason is due to poverty traps, linked to the asymmetry of reactions of health, education, employment to income fluctuations. Let us illustrate these two possibilities by some cross section results.

Social frustration generated by instability. Some recent studies have examined the economic factors influencing social tragic events such as civil war and criminality the results of which can be re-interpreted or modified when economic instability is taken into account. For instance Collier and Hoeffler (2004) have evidenced a higher risk of civil war in countries where primary commodities are a large share of exports. They explain this relationship mainly by a rent seeking behaviour of the rebels and their easier access to finance. Another reasonable assumption is that the instability of exports, all the higher that exports are primary, exacerbates the frustration feelings. When the instability of exports, weighted by the openness rate is introduced in a conflict occurrence model à la Collier- Hoeffler, not only the coefficient of determination significantly increases, but also the share of primary commodities in exports becomes unsignificant (Guillaumont et al. 2005). Other exogeneous shocks may have similar effects on the risk of conflict: Miguel, Satyanatah and Sergenti (2004), examining the impact of civil war on growth, instrument civil war by rainfall instability which then appears to be a significant factor of it.

Several studies have examined the economic factors of the rates of criminality Fajnzylber et al. 2002, Neumayer 2003, 2005). Are considered factors the average income per capita, the inequality of its distribution, the level of education, but not the vulnerability factors. Using the recent large data base of Neumayer, we find that the volatility of income growth is a significant factor both of rates of homicide and rates of robbery; for robbery instabilities of exports and of agricultural value added introduced instead of growth volatility also appear to be significant factors (Guillaumont and Puech 2005).

Anti-poor bias of unstable growth. Previous relationships are related to specific events which reflect social resent. Let us now consider the transmission of the macro economic vulnerability to the overall social situation, besides the effect expected from a lower growth.

Probably the best single indicator of the evolution of the social situation in low income countries is the child mortality under five as made available by the Demographic and Health Surveys and extended by the WHO. Child mortality is a very sensitive indicator, likely to reflect the strong asymmetric effect which can be expected from income instability: if a rise in mortality results from an income shortfall, it will not be compensated afterwards by equal income increase…. Due to the existence of a lower limit to child mortality, the best functional form to be tested is that where the dependent variable is expressed as a logit (log of the ratio of survival to mortality) (Grigoriou 2004). Tested first with fixed effects, then in GMM, with observations every five years from 1980 to 2000, the effect of previous income instability on child mortality appears to be significantly positive for a sub sample of low income countries, with both estimations, but to a less extent on a larger sample and only in GMM (the control variables being the level of income per capita and DPT immunization) (table 1). Income instability is measured on the five previous years (from a ten-year mixed trend, both determinist and stochastic, see next section). The specific impact of structural vulnerability is evidenced when (weighted) export instability and agricultural production instability are used instead of income volatility as explanatory variables (in particular with fixed effects) (from an on-going work with C. Korachais).

Finally we introduce the macro vulnerability concern in the burgeoning cross country research on the determinants of the level and evolution of poverty, made feasible by the extension of comparable set of data at the World Bank. Main concern has been until now to assess the growth and inequality elasticities of poverty (good recent illustration in Adams 2004), but without similar concern for the effects of income instability on poverty reduction (S.Guillaumont Jeanneney and Kpodar 2004 however examined the effects of financial

instability on poverty). Starting from the standard model (as used by Adams 2004) where the change in the level of poverty depends on growth in income per capita and on change in inequality, we have estimated an augmented model including as an additional variable the instability of income per capita: the assumption is that an instability of income pushes people in poverty traps (poor people contracting health handicaps, children leaving the school, workers staying out of the labour market,…), so that the poverty reaction to a rise of average income is less than its reaction to a fall (see for instance in the context of Latin America de Janvry and Sadoulet 2000). This effect is expected to lower the absolute level of the average growth elasticity of poverty, and/or to increase poverty independently of income growth and inequality change: the instability of income must then be introduced both additively and multiplicatively with income growth. Poverty change is the log of the headcount index of poverty (HP). As for the child mortality model, income instability is the standard deviation of the level of income per capita from its trend value estimated by a "mixed" (determinist/stochastic) trend .

The model is tested (in OLS, as by Adams) on a sample of at ten year spells of change in poverty (from POVCAL data of the World Bank). We control for the initial level of poverty. The results are significant (see table 2). The direct impact of a 3% income instability in low income countries is approximately to lower by one third the income elasticity of poverty, and by an half in low income countries. We must not forget that besides this direct impact growth volatility lowers the average rate of growth. And it is also correlated with the increase of inequality: higher coefficient is obtained without this last variable, which is consistent with the idea that instability increases inequality, as found by Breen and Garcia-Penalosa (2005). We have also estimated another model in a panel form, with a slightly different assumption, namely that the level of previous instability (as an additive variable) influences the level rather than the change of poverty. The model estimated successively with fixed effects (and time dummies) gives results supporting the assumption of an income instability increasing poverty independently of growth, and doing so partly through an effect on income inequality, as it

appears when the Gini index is purged from the impact instability (table 2bis). The impact is particularly high in low income countries and in Sub Sahara countries. Briefly, not only "growth is good for the poor", and stability is good for growth, but also stability makes growth better for the poor. A stable growth is a pro-poor growth.

How to Measure Structural Vulnerability? Designing an Economic Vulnerability Index

Since structural vulnerability matters for growth and poverty reduction, it is a reasonable to take it into account in the formulation of cooperation policies, what involves a synthetic and comparable measurement. Designing an economic vulnerability index likely to be measured for the full set of low income countries needs to choose appropriate components reflecting the main structural sources of vulnerability of these countries, and then, as for any composite index, to find an adequate way to aggregate them. Since the main formal attempt to design such an index has been done with the view to identify the Least Developed Countries (LDCs), we shall also refer to this purpose.

Let us first explain why we are considering a composite index rather than a single one such as the *growth volatility*, which has been used in many econometric works. The volatility or instability of the rate of growth of income (per capita) reflects ex post a macro economic instability which does depend on exogeneous shocks and structural factors of exposure, but also on policy factors, either as a reaction to the shocks or as autonomous policy shocks. There is a clear empirical evidence of the influence of policy factors on growth volatility (Easterly et al.2001, Combes et al. 2000) [14]. For that reason growth rate volatility cannot be considered as a good synthetic indicator of structural vulnerability. Moreover the negative impact of shocks on

[14] For instance, Easterly et al. 2001 have stressed the negative effect (up to a point) of financial depth and the positive effect of openness on volatility. More specifically, concerning the effects of openness, Combes et al. 2000 find first that structural vulnerability (depending on structural factors, including population size) makes growth more unstable, whereas outward looking policy makes it more stable. Bleaney and Fielding 2002 also examine the impact of the exchange rate regime on output volatility, beside that of exogenous factors such as the instability of the terms of trade.

growth does not necessarily involve growth instability, if costly insurance or compensatory mechanisms are at work. Anyway (see Table 3) growth volatility is high in developing countries, even if it has been declining in the nineties: it has been significantly declining from the 70s to the 90s in the middle income developing countries, but rather stable in the low income ones, where it is now higher than in the middle income ones. And it is higher in the LDCs than in the non-LDCs low income countries.

Looking for a composite index, two main issues are to be considered: the choice of the components and the way by which they are aggregated. We then consider the relevance of the resulting index.

Choosing the Components of a Structural Vulnerability Index

Indicators of structural economic vulnerability must be drawn from the analysis of the shocks likely to affect low-income countries and of their exposure to these shocks. They also need to be largely available and reliable. As noted in introduction, twice in 2000 and 2003 at the UN the CDP used an Economic Vulnerability Index (EVI) in its review of the list of the LDCs[15]. In March 2005 the CDP has revised the definition and measurement of EVI, by a way corresponding to a large extent to the principles presented below (and in Guillaumont, 2005).

Shock indicators and instability measurement. Climatic and other natural shocks are a main source of vulnerability in many developing countries and cover a large variety of events: earthquakes, typhoons or hurricanes, floods, droughts, insects' invasions, etc. An indicator of

the risk of natural catastrophes might be the frequency of such events, measured over a long period of time. But as evidenced by the recent Asian tsunami, the most severe and exceptional events do not correspond to any measurable probability. The potential negative impact of these very different events differs from one to the other, and even within one kind of event. Measuring the economic losses resulting from these events in all the developing countries concerned seems to be an impossible task. Taking the number of people affected, if it is known, seems to be a better approach, but people may be more or less severely affected. Indicators of the average proportion of the population affected by these events can be used, specific to the way by which the population is affected (killed, displaced …) (for instance Atkins et al. 1998)[16]. The percentage of population displaced due to natural disasters (homeless index) has been retained as a component of EVI only from 2003, when comparable data appeared available.

Due to this problem of data and to the fact not all natural shocks (as for instance recurrent droughts in Sahelian countries) were registered as "disasters" another proxy had to be looked for. It was found in the instability of agricultural production measured with regard to its trend value. Whereas the trend, if significantly measurable, of agricultural production may be supposed to mainly depend on the economic policy pursued and on permanent factors, the fluctuations around the trend may be supposed to reflect the occurrence and severity of natural shocks, because they are likely to affect agricultural production[17]. For these reasons this indicator was retained as a component of the EVI.

The previous two measures of natural shocks, which are not correlated, are only complementary proxies of the size of the natural shocks likely to affect growth prospects

[15] The EVI was measured from 5 components, with a 6th one used in 2003 for a supplementary measure:1) (small) population size (in log); 2) (small) share of manufacturing and modern services in GDP; 3) merchandise export concentration coefficient; 4) instability of exports of goods and services; 5) instability of agricultural production; and optionally 6) "homeless": share of population displaced by natural disasters.

[16] The main source of the data is the Emergency Events Data base, compiled by the Center for Research on Epidemiology of Disaster (CRED) at the School of Public Health, Université Catholique de Louvain, data also given and supplemented in the IRC annual *World Disasters Report*. Relying on these data, a picture of natural disasters in each LDCs can be found in UNDP (2001).

[17] We used this indicator in several previous works (cf. for instance Guillaumont P. and S. 1988, Guillaumont, Guillaumont Jeanneney and Brun 1999).

(likely to be aggregated in a single average level of natural economic shocks). They give a picture of the average size of *past* shocks which is only a proxy of the risk of similar future shocks. The risk of the most severe or exceptional natural shocks, such as the December 2004 Asian tsunami, cannot be captured *ex ante* by any index of the likelihood of the shock. It can only be reflected *ex post* in the measures here presented, and more as a durable damage, i.e. a structural handicap, than as a risk. This difficulty leads to give more attention to exposure indices.

An indicator of *trade shocks* is given by the instability of the real export proceeds around its trend. It has to be applied to the total exports of goods and services: shocks affect service exports as well good exports, and often service exports are a large part of total export receipts in small (developing) countries. Some private transfers, such as migrant remittances, could also be included. It is assumed that for small countries this instability is structural, resulting from exogenous events, namely fluctuations in world prices, in external demand and in domestic events (for instance climatic shocks) not related to policy. Of course, some fluctuations of the export volume with regard to its trend may be due to the instability of the policy itself, but it can be supposed that policy influences more the trend than the fluctuations of the export volume.

The use of *instability indices* as components of a vulnerability indicator raises measurement problems. Instability is always relative to a reference or trend value. It is measured, for instance, by the average absolute deviation rom the reference or the trend value, or more often, by the variance of this deviation. A critical issue is then the choice of this reference value, in particular the estimation of the trend. A deterministic trend has long been assumed (for instance, in the literature on export instability) , what was often inappropriate due to the possibility of non stationarity of the series. Since on the other hand the series may not be purely stochastic, the reference value can be conveniently estimated from a «mixed» function, combining a deterministic element and a stochastic element: this is the way by which instabilities of exports and of agricultural production have been estimated in the EVI used by

CDP and that we retain in the next simulations. Several other measures are used in the empirical literature on matters of our concern. For instance, measurements of growth volatility generally use the standard deviation of the rate of growth (which may not be appropriate, when the rate of growth is not stationary). Other works on volatility (in particular of aid volatility considered in the next section) use empirical filters such as the Hodrick-Prescott filter, from which a series is shared into a "cycle" and a "trend" components. In most cases these measures, intended to be internationally comparable, only reflect *ex post* instabilities, the deviations from a trend observed in the past , not a risk variable perceived by economic agents, which would involve to specify of a model of anticipations, possibly differing among countries.

Exposure indicators: population size, output structure and location. Among the three components of EVI considered to reflect exposure to the shocks, the first and least debatable is the size of the population (expressed in logarithm), corresponding to the idea that, ceteris paribus, countries are the more vulnerable the smaller they are, and more generally that small size is a negative factor of growth (cf. supra). In particular a small population size is considered as the main structural factor explaining a high level of the trade to GDP ratio, i.e. the exposure to trade shocks, then a better indicator of structural exposure than the export to GDP ratio itself, since the latter depends not only on structural, but also on policy factors[18].Small size is also associated to a greater exposure to natural shocks.

A second indicator of exposure, included in EVI, is the Hirschman export concentration coefficient, as calculated for many years by UNCTAD. Export concentration is indeed supposed to increase the risk of export instability. However it could be given up without loss of useful information. It is limited to goods, not including services, which are a large part of total exports in many concerned countries: no classification of services corresponding to the SITC has been set up until now. Moreover the export concentration index is sometimes misleading,

[18] The export to GDP ratio has however been used in several attempts to measure economic vulnerability (cf. for instance Briguglio 1995, Crowards 1999, Atkins et al. 1998, Easter 1999).

when it involves breaking down exports of a same kind of product between several items of SITC (without corresponding decrease of dependence and instability).

A third indicator of exposure to shocks should be related to the structure of production. Until now the CDP used the share of manufacturing and modern services in GDP (actually 100 minus this share). This indicator, itself inherited from the past, will be usefully replaced by the share of agriculture (including forestry and fisheries) in GDP, for at least three reasons. First, among modern services, tourism rather increases rather than decreases the exposure to shocks. Second, an increasing international concern is about the special exposure to shocks due to agricultural policies in developed countries. Third, as far as the index is intended to be used for granting preferential treatment, it must not give an advantage to countries benefiting from mineral resources.

Another indicator of exposure, the remoteness from the main world markets, can be added, as now retained by CDP among the components of EVI. Remoteness involves high transport costs and relative isolation. It is a structural obstacle to trade and growth and a possible source of vulnerability when shocks occur. It reflects a specific handicap of numerous SIDS, the vulnerability of which has been several times referred to. It may also be adjusted upward for landlocked countries. Even in the present wave of globalization, distance remains a critical impediment to trade. Several recent papers have evidenced its persistent influence on trade, an influence even increasing for low income countries (see Brun et al. 1999, 2002, Carrère and Shiff 2004,). Remoteness or related notions have been considered as a possible component of an index of vulnerability in several attempts to build such an index[19]. For our purpose, remoteness can be designed as (an index of) a weighted average of the distance to the main world markets. Relevant weights are the relative shares in world trade of the main world importers, what means identical weights for all countries. So designed, remoteness is a

[19] For instance, Briguglio (1995) retains "remoteness" or "peripherality" proxied by the ratio of the cost of insurance and freight to the import value as a component of his vulnerability index. Easter (1999), following Atkins et al. (1998) consider this measurement without retaining it in the final calculation. Limao and Venables (2001) also use this measure, but as a proxy of some transport costs, so not exactly for remoteness. The reliability and coverage of this proxy of remoteness is actually under debate.

potential average distance to the world market. This weighting is preferable to the relative shares of the different importers (exporters) in each country exports (imports), which would give for each country an *actual average trade distance*, because the latter is endogenous: a far and isolated country may trade relatively little with largest markets precisely because they are far[20].

Landlocked countries face higher difficulties to trade, with higher transportation costs for a given distance (cf. Limao and Venables, 2001, see also Faye et al. 2004). It justifies an upward adjustment of the remoteness measure for landlocked countries. To what extent? An adjustment coefficient can be obtained for by estimating the relative marginal impact on the trade/GDP ratio of the (unadjusted) remoteness index and a landlockness dummy variable. We found by this way that an adjustment for landlockness of 10% was an acceptable minimum. Faye et al. 2004 when measuring the ratio of freight and insurance to value of exports (but not controlling for the distance) evidence on a regional basis an even higher difference between the averages of landlocked and maritime countries.

It could be objected that, if remoteness is a structural handicap to growth, it does not mean that it is a factor of vulnerability, then a relevant component of an economic vulnerability index. However remoteness may delay the arrival of basic goods when needed and this increases vulnerability (Encontre 1999). Moreover, since resilience to shocks depends on competitiveness, these higher transportation costs may be seen as a negative structural factor of resilience, limiting the adaptive capacity of the economy when shocks occur. As for landlocked countries the specific vulnerability due to their location is not only linked to higher transportation costs. It is also associated to several forms of dependence on neighbours (Faye et

[20] For the same reason, independently of its low reliability and frequent inconsistency, the average ratio of the gap between the f.o.b. value of export and the c.i.f. value of the corresponding imports, is not an appropriate measure of "remoteness".

al. 2004)[21]. Anyway it has to be recognized that exposure indicators all refer to structural

handicaps which influence growth beyond vulnerability stricto sensu.

Resulting components of a revised EVI. The new EVI would rely on following components. Three indices would reflect exogenous shocks: for external shocks, the instability of exports of goods and services, for natural shocks, an average of the instability of agricultural production and the "homeless" component of the natural disaster index. And three/four indices would reflect the structural exposure to shocks: an index of smallness of the (log of the) population size, the remoteness from the world markets (adjusted for landlockness), and the relative share of agricultural value added in GDP (possibly averaged with export concentration coefficient in an index of structural weakness)

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Aggregating the Components: Weighting and Averaging Issues

How the component indicators should be weighted and averaged in a composite vulnerability index should be examined with regard to the very meaning of vulnerability.

Arbitrary or revealed weights: vulnerability measured as an expected loss of growth? The simplest and most transparent way to aggregate is, after measuring each component on the same scale depending on maximum and minimum values, to calculate an unweighted average of these components (as commonly done for some popular indices such as the HDI). There is indeed an apparent arbitrariness in this weighting since the actual weight is given by the number of components, then results from the choice of the components themselves. But it may seem reasonable to give equal weight to the shock components and to exposure components so that the vulnerability index is an average of a shock index and an exposure index. It is also reasonable to give equal weight to trade shocks and natural shocks. As to the exposure index, since the main factor of exposure is the (small) size of the population, it could be given a half weight, the other half being shared between the other components (location and structure). This

is the solution retained by the CDP in March 2005 (with the export concentration coefficient included within the second half of the exposure index).

To avoid the arbitrariness of equal weighting, some measures of vulnerability weigh the components by their estimated impact on the rate of growth or its instability. For instance Guillaumont and Chauvet 2001,2004 have used a set of component indicators to build a composite indicator of vulnerability, with the weights not chosen a priori, but drawn from an econometric regression so that they reflect the estimated impact on economic growth of the different components indicators (which is consistent with the definition of vulnerability as a handicap to growth). The resulting vulnerability indicator can be seen as the *ceteris paribus* impact on economic growth of the exogenous shocks and exposure variables. It is the estimated loss of growth due to structural vulnerability.[22] However it has to be recognized that this method of measurement of structural vulnerability, dependent on the quality of the regressions, seems more appropriate for academic use than for international policy. Moreover specific problems arise to aggregate vulnerability indicators, which must be addressed in any case.

Reflecting the interaction between shocks and exposure. Let us consider the index of economic vulnerability as relying on four following elements: a shock index composed by a trade shock index and of a natural shock index, and an exposure index composed by a (low) size index and a "location and structure index". Several averaging methods may be used to combine shocks and exposure indices. The (traditional) arithmetic averaging of the four indices does not make any difference between the two categories of indices, each index being taken independently from the other. If we want to take into account the fact that structural vulnerability depends on the interaction of shocks and exposure, we may consider two other methods of averaging.

Our preferred method is a *"semi-geometric" averaging*. It combines a geometric averaging the two composite shock and exposure indices and an arithmetic averaging the respective components of these shock and exposure indices: the exogenous shocks indices,

because these shocks are substitute, are arithmetically averaged in an index of the shocks, and an index of the exposure to the shocks is similarly measured as an arithmetic average of the corresponding components, but the two respective indices of shocks and of exposure to the shocks are geometrically averaged, because shocks and exposure have multiplicative effects. Shocks make a country all the more vulnerable that it is more exposed. Exposure makes a country all the more vulnerable that the shocks are more important.

Reflecting the increasing marginal impact of vulnerability components. The geometric average of the shock and exposure indices (EXP and SK) can be calculated by two ways. One is to calculate:

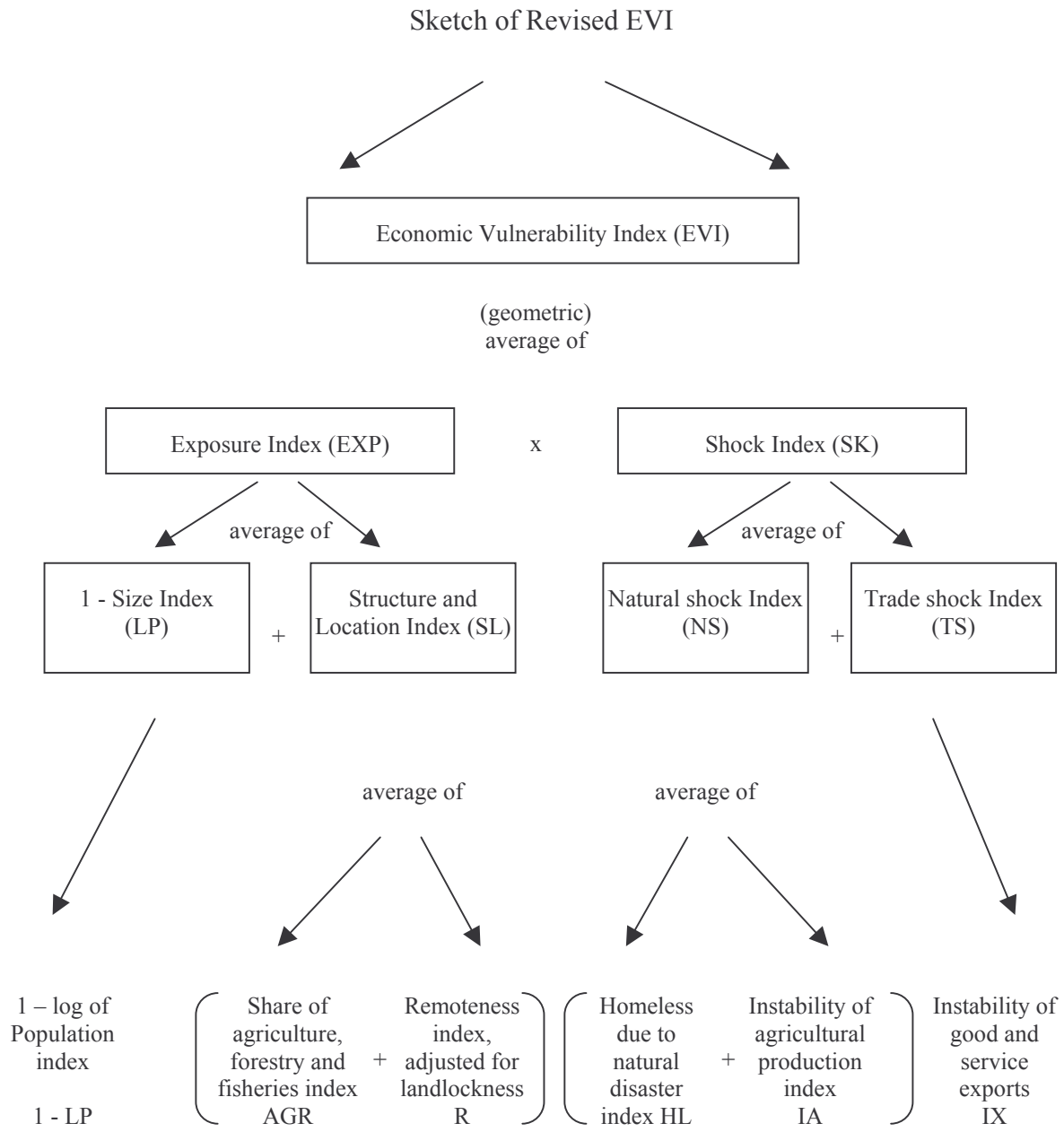
$$EVI = \sqrt{EXP \cdot SK},$$

The other one would be to consider that the higher impact is to be given to that of the two shock and exposure indices which is the lower or higher and to calculate:

$$EVI = 1 - \sqrt{(1 - EXP)(1 - SK)}$$

The EVI is then calculated from a multiplicative index of low vulnerability. The relevance of this measurement can be illustrated by tsunami: as far as the likelihood of shocks is not easy to assess, it is all the more important to consider very exposed countries as vulnerable, even if the past frequency of the shocks has been low.[23]

Another kind of averaging, which is an intermediate, but also convenient, solution, is to take an arithmetic average of the indices of log values of both the shock and exposure indices. It allows one to capture the various interactions between these elements in the determination of vulnerability (each component being first measured as a low vulnerability indicator, transformed in log, then taken as one less the index of this log value, so that to reflect a likely increasing marginal impact of factors of vulnerability).The resulting EVI is decomposable into each of the four indices (and their sub grouping in shocks and exposure indices).



Relevance of the Economic Vulnerability Index

A vulnerability index has been initially designed and used in 2000 and 2003 for the purpose of LDCs identification. A revision, close to the EVI proposed above, has been recommended by the CDP in March 2005.[24] We now examine the relevance of such an index, both with regard to its initial purpose and with the view that a relevant macro economic vulnerability indicator may be used in designing aid policies.

A higher average vulnerability of the LDCs, whatever the measurement. As seen above, LDCs have a more unstable growth than other low income countries and than middle income ones. They are also, according to EVI and whatever its definition, more vulnerable than other developing countries and in particular than other low income countries (of course at the country level the measurements are sensitive to the choice of components and averaging): the average EVI of the 49 LDCs is always significantly higher than that of the 15 other low income countries (relying on 2003 data). For instance with our revised EVI (and a semi-geometric averaging), over the 64 (=49+15) LDCs and other low income countries, the median rank is 40 for the LDCs and 11 for the other low income countries. The difference between LDCs and other low income countries (OLIC) is significant both for the composite index and for each of its components: the LDCs have on average a smaller population, a higher remoteness index, a higher share of agriculture, forest and fisheries in GDP, a higher export concentration coefficient, a stronger instability of export proceeds, and of agricultural production as well, a higher level of homeless index. The differences are significant not only with regard to the other low income countries, but also with regard to the full set of other developing countries.

Sensitivity of indices to the choice of the components and averaging. A rather low correlation between the various components leads to expect significant consequences of the choice of the components and averaging. The impact on EVI of the different choices of components appear when we compare the previous EVI with five components to our augmented EVI, but still with arithmetic averaging of the components. The average of absolute rank difference is rather high, close to 10. The *impact of alternative averaging has been measured* with the components of our revised EVI: compared to arithmetic average, we note a moderate impact of the semi-geometric, slightly lower than that of the arithmetic average of the log indices (average absolute rank difference of 4.0 versus 6.1). Both indices increase the EVI of small countries. If on the whole the impact of averaging appears rather lower than that of the choice of the components, it is not the case for all countries, in particular for small islands,

as evidenced by the utmost case of Maldives, country for which the rank differences between various measures is the highest. This country in December 2004 was devastated by tsunami. Occurrence of tsunami could hardly have been taken into account *ex ante* in the shock index components; it will only increase its level *ex post* and consequently the vulnerability index. But having given a higher impact to the high exposure index of this country, as with our (preferred) semi-geometric average of low exposure and low shock indices, would have also increased *ex ante* its level of vulnerability.

EVI as a relevant index to explain lagging growth. We have surveyed in the first section several studies evidencing under various aspects the impact of instability on growth. A test of the relevance of EVI as an indicator of structural handicap to growth is to examine whether it is a good (lack of) growth predictor and simultaneously an adequate indicator for the identification of LDCs. An econometric test supports this view: when estimating over 30 years a cross-country GDP per capita (y) growth regression, (previous) EVI (with the 5 components recalculated on average for the whole period) was found to be a significant negative factor, beside the initial GDP per capita (convergence factor) and the composite human assets index HAI , the low level of which is the other criterion of structural handicap used for LDCs identification (Guillaumont 2005). The empirical relevance of the revised index has also been tested with a smaller sample, due to the lack of data needed to measure the revised EVI over past decades. The result obtained not only is as significant as that obtained with the previous EVI, but, when added, the LDC dummy variable, which remained significant beside the previous EVI (and HAI) is no longer so. It means that the new EVI, more logically grounded, also better reflects the vulnerability of the present set of LDCs.

In conclusion it appears feasible to build an indicator of structural macro vulnerability relevant for low income countries. As designed in 2000, recently refined, and possibly to be improved, the EVI used at the UN can be used, in conjunction with an index of human capital,

to identify among them the low income countries suffering the most from structural handicaps to growth, what may be of interest in the formulation of aid policy.[25]

How Aid Interacts With Vulnerability? Implications for Aid Allocation and Design

If structural economic vulnerability is an obstacle to growth and poverty reduction, it follows that it is a key variable to be considered in the formulation of aid policies. It needs to be done after considering the way by which aid actually contributes to dampen or to enhance the effects of vulnerability.

Aid Effectiveness and Vulnerability

Aid effectiveness higher in vulnerable countries. The debate initiated by the influential paper of Burnside and Dollar (1997,2000) and the book *Assessing Aid* has at least made clear that aid effectiveness depends on specific features of the recipient country. The focus of Burnside and Dollar (then of Collier and Dollar 2001,2002) was on the quality of economic policy and of institutions. The resulting message of a priority to be given in aid allocation to countries with "good" policies and institutions met a moral sentiment not always grounded on an assessment of aid effectiveness. The debate on the Burnside –Dollar thesis has been mainly related to the robustness of their econometric results, secondarily to the consistency of the relying hypotheses (see Hansen and Tarp 2001). In two previous papers (Guillaumont and Chauvet 2001 and Chauvet and Guillaumont 2004) we have argued that a major factor conditioning aid effectiveness in recipient countries was the economic vulnerability they face. In vulnerable countries foreign support has a high productivity in avoiding collapses when shocks occur or long standing recessions afterwards; it is expected to smooth public

expenditure and to lower the risk of fiscal deficit. .Consequently the marginal contribution of aid to growth of recipient countries is expected to be the higher the more vulnerable they are.

This effect of vulnerability on aid effectiveness was captured in a growth regression by a multiplicative explanatory variable (aid to GDP ratio x vulnerability indicator), similar to the variable used by Burnside and Dollar (aid to GDP ratio x policy indicator), and found significantly positive (what was not the case, at least in our 2001 paper, for the aid x policy variable). The measure of the vulnerability variable was not the same in the two papers. Only the 2001 paper used a concept of vulnerability close to that used for LDCs identification, including (small) population size, export instability, agricultural production instability,…The 2004 paper used a narrower concept, limited to export instability and (negative) terms of trade trend, but extended the analysis to the impact on aid effectiveness of political instability (negative effect), of present economic policy (positive effect) and of previous economic policy (negative effect, due to the possible effect of aid on policy improvement from a ”bad” initial situation, an effect neglected in the standard Burnside Dollar model). Another paper by Collier and Dehn (2001) also evidenced the role of aid as a factor dampening the export price shocks considered on a year by year basis, defined from a forecasting model, and retained only if they were on the tail of the distribution; although this model did not allow to measure the long term effect of instability on growth, it made a useful distinction between the effect of a change of aid, found to lower the negative effect of a negative shock, and the effect of aid level itself, found to increase the positive effect of a positive shock. Finally Collier and Hoeffler (2004) have tested the higher effectiveness of aid in post-conflict situations (which also can be regarded as an expression of vulnerability…)[26]

Aid volatility, pro cyclicality and destabilizing impact: a misplaced concern? Recently several papers, followed by political declarations, have underlined the problem raised by aid volatility (Bulir and Hamann 2003, 2005, Lensink and Morrissey 2001, Pallage and Robe 2001, Rand and Tarp 2002): if aid is unstable, it may contribute to the macro economic instability,

then to be itself a factor of vulnerability. This concern has been reinforced by the prospect of an acceleration of disbursements, which could not be sustained in the future. Aid indeed is volatile at the recipient level, although not at the donor level. Measured by a cycle component with regard to a trend drawn from a Hodrick-Prescott filter, the volatility of aid, expressed in logs, is equal on average to 15.5% over 1990-1999 (Table 4). This volatility is often compared (at the country level) to that of domestic aggregates, most often the tax revenue (curiously through a ratio of the two instabilities rather than a difference, what may lead to enormous ratios when the reference aggregate is pretty stable). Beyond the measurement problems, not negligible, the aid volatility prosecution may be misplaced if aid has a compensatory profile, what could be consistent with the finding of an aid more effective in more vulnerable countries. In that case aid volatility, rather than a problem, would be a solution.

This is why volatility of aid is not so much prosecuted than its unpredictability and its pro cyclicality . Unpredictability of aid is certainly harmful, but is difficult to assess. Its assessment would need a forecasting model of aid at the recipient level, where the predicted level depending among other factors on the kind of aid delivered and on the shocks…Pro cyclicality is easier to assess. It then appears not to be the rule, not even the majority of cases, as sometime asserted. The pro cyclical character of aid can be measured by the correlation between the "cycle" of aid (i.e. its deviation from its trend) and the "cycle" of the aggregate to which aid is compared. An usual comparison is with tax revenue, to examine the effect of aid instability on public budget stability. We here prefer to compare the aid cycle to that of exports. As far as we are concerned by macro economic vulnerability, better is to compare aid with the aggregate the most likely to be affected by exogeneous shocks: tax revenue is influenced by the overall impact of exports, and aid as well. Moreover all aid flows are not channelled through the public budget. We here consider as a reference flow exports of goods and services, but not international capital flows , the volatility of which may exacerbate the consequences of trade shocks in middle income countries, as studied in the case of Chile (Cabalerro 2002): extending the reference flow to capital movements seems less relevant in the case of low income

countries. In emerging economies the issue is less the procyclicality of aid than of capital flows (underlined by Kaminsky et al.2003 and Reinhard et al.2003).

Using the Hodrick and Prescott filter and considering 104 developing countries for the whole period 1960-1999 the country correlation between the cycle of (net) aid disbursements and the cycle of exports of goods and services, we find a positive correlation in 43 cases and a negative one in 61 cases (average of the correlation coefficients: -0.035) (Chauvet and Guillaumont 2005). It means that aid is not more often pro cyclical than contra cyclical. The evolution (on a varying sample: data do not cover all countries over the whole period) evidences that aid was on average rather slightly contra cyclical in three of the four decades, the only exception being the eighties. For a large set of 104 countries it has been during the nineties rather contra cyclical with an average of coefficients of -0.042 (55 cases of negative correlation, with only 16 significant, against 49 positive ones, and 14 significant (Ibid.).

Contra or pro cyclicality is indeed an important parameter. But it is not the only relevant one to determine whether the aid inflow is stabilising or destabilising. A pro cyclical aid can still be stabilising (on the total aid plus export flow) if its volatility (expressed in relative terms) is lower than that of exports. On the reverse there may be cases where aid is contra cyclical and destabilising, when its volatility is significantly higher than that of exports, in a proportion depending on the relative level of aid and exports[27]. What is the real picture? To assess the stabilising character of aid we build an index which is the difference between the instability (volatility) of exports and that of the aid plus exports flow: if the difference is positive, aid is stabilising; if it is negative, aid is destabilising. On average it has been stabilising and more clearly during the eighties and nineties than during the two previous decades (cf Table 4): the average of the indicator (the difference between the value of the two variances) may seem low (0.003 in 1990-1999), but it represents one fourth of the average value of the volatility of exports (0.015). To be noted, the “paradoxical” cases are not so few: over 1990-1999, among 104 recipient countries, in 27 countries aid is pro cyclical and stabilizing (e.g. Comoros), in 8 countries it is contra cyclical and destabilizing (e.g. Madagascar), while it is pro cyclical and

destabilising (e.g. Togo) in 22 countries, and contra cyclical and stabilising in 47 other ones (eg. Laos). On the whole it is destabilizing in only 8+22=30 cases and stabilizing in 27+47=74 cases (nearly 3/4).

To summarize, aid volatility is high, but is a matter of concern only if it is destabilising , which occurs in a minority of cases, more likely when it is pro cyclical rather than contra cyclical, the impact also depending on the relative volatility and on the relative level of aid and the other flows to which aid is compared.

Aid stabilizing impact and aid effectiveness: an augmented model. Does the fact that on average aid has been more stabilizing than destabilizing explain why aid is more effective in more vulnerable economies? We can address this issue relying on a model similar to those we have already used in the papers where vulnerability appears as a factor of higher aid effectiveness (Guillaumont and Chauvet 2001, Chauvet and Guillaumont 2004). We again use an index of aid "stabilizing impact", built with reference to exports, only considering the instability of exports as a source of instability, actually the main one. Here the instability and the stabizing impact are measured with regard to trends drawn from an econometric adjustment (mixed, i.e. with both a deterministic and a stochastic component), as generally done in the tests of the negative effects of export instability we referred above. We first test a baseline model (results reported in table 5) where the rate of growth depends on, beside traditional control variables (log of initial income per capita, quality of institutions measured by ICRG), the following variables of interest (expected sign of coefficient between brackets): the aid to GDP ratio (+), the instability of exports (-), and a variable multiplicative of the two previous ones (+). The model is estimated in GMM system over 1975-1999 with five four year periods related to 89 recipient countries (and checked in GMM difference). All the coefficients have the expected sign (col.1), and all are significant, except the aid to GDP ratio: the results support the hypothesis that aid lowers the negative impact of instability and is more effective in more vulnerable countries. Then (col.2) we replace in an alternative model the multiplicative variable (aid x export instability) by the stabilizing impact of aid, which also appears to be significant

(at 11% level). Since these two alternative variables are highly correlated, they are not simultaneously significant (col.3) (see more details in Chauvet and Guillaumont 2005).

Let us recall that the previous effects are effects on average growth .The stabilizing or destabilizing impact of aid has other effects, static and dynamic. There is, without any impact on growth, as argued by Pallage et al. 2004, a potential of foreign aid to increase welfare only by a simple reallocation of flows across time. Moreover since, as argued above, instability makes growth less "good for the poor", aid may contribute to the reduction of poverty beyond its effect through average growth, when it has a stabilizing impact. These results have some implications for aid policy.

Aid Policy to Face Vulnerability

Three main lessons, may be of decreasing importance, can be drawn from the previous analysis for aid policies. The first is to take vulnerability into account in the design of aid selectivity. The second is to examine how aid can be used as an insurance. The third is to consider how aid can be targeted with the view to lower the structural vulnerability of low income countries. In the three cases a special attention is to be brought to the LDCs, more vulnerable than other low income countries XXX EN NOTE(a recent review of responses to term of trade shocks can be found in Varangis et al. 2005).

Vulnerability as a criterion of aid selectivity: a case for the LDCs. An important debate as recently emerged on the guiding principles of selectivity in aid allocation. In line with the Burnside and Dollar/ Collier and Dollar approach it has been argued that selectivity must essentially rely on the extent of poverty and the quality of governance of the recipient countries. The supposed rationale is that the aim of aid is to minimize the number of poor in the world, that poverty reduction essentially depends on growth and that the growth effectiveness of aid essentially depends on the quality of policy, institutions and governance. A clear

illustration of this position is given in the 2004 and 2005 IMF/Word Bank *Global Monitoring Report* in a chapter relying on a paper by Dollar and Levin 2004: an index of selectivity is built for each donor which is the average of its aid elasticity to policy (measured by the CPIA) and (minus) its aid elasticity to income per capita. Vulnerability does not appear in this quantitative analysis of selectivity (as well as in more refined other analyses such as that of Roodman 2004b), what raises two problems.

The first is that structural economic vulnerability, as we have seen, is a factor of aid effectiveness quite as important as, and probably more, than policy, institutions, governance, as reflected by CPIA. Thus to make on the whole aid more effective, aid selectivity has to include among its criteria the structural economic vulnerability of the developing countries. In this perspective the availability of the revised economic vulnerability index, endorsed by the UN and transparent, may appear particularly useful.

The second problem raised by the omission of vulnerability in the design of selectivity is related to the aim of aid. Aid, in a perspective of Rawls justice, may aim at promoting equality of chance (Llavador and Roemer.2001, Cogneau and Naudet 2004). If we look for the equality of chance among nations to reduce poverty (through growth), structural handicaps to growth, at least partly, are to be compensated and to be included in selectivity criteria. This an additional reason to retain vulnerability as a criterion, not only beside other factors of aid effectiveness, as argued above, but also beside other structural handicaps, the main other one being a low level of human capital. In that perspective, the preference officially given in aid allocation to the LDCs, which are identified as the low income countries suffering the most from structural handicaps, in particular from vulnerability, seems legitimate.

To illustrate the change brought to the assessment of selectivity when vulnerability is taken into account, it is enlightening to compare the index of selectivity as calculated by Dollar and Levin and used in the GMR 2004 and 2005 with a similar index relying on other sets of criteria including vulnerability, measured by the EVI such as defined and recently revised at the UN (Amprou et al. 2005). The aid elasticities are estimated for each donor from an

allocation function (of gross 2003 ODA) between developing countries using as explanatory variables the indicators retained as selectivity criteria. Three variants are estimated including every time GNIpc and either a governance index[28] or EVI and finally the two last indices as well as HAI, the human assets index used for LDCs identification. The ranking of the 22 OECD donors according to their "aid selectivity" is radically changed when we move from one criterion to another one. Comparing with the ranking of Dollar and Levin, we observe a significant average absolute value of rank differences, reaching 7.6 when using EVI as a criterion instead of CPIA (table 6).

Aid as insurance: how to make compensatory finance effective? Since aid is more effective (as well as welfare enhancing) when it is stabilizing, there is some advantage to make it more stabilizing. This role for aid is all the more important that there is little room for reducing the size of the shocks, including international commodity price shocks: as the experiment of the international commodity price agreements has shown, it is difficult to smooth efficiently the evolution of world prices. A need for insurance then appears at two levels. As seen above at the macro economic level, shocks affect macro economic variables; in particular they are deleterious for public budget management, and, since they are more and more passed through to producers, have strong microeconomic consequences. Low income countries, to some extent differing from middle income countries on that matter, may hardly manage their external trade shocks through the insurance instruments available on the market. Moreover their public external debt is mainly towards public bilateral donors or international institutions. Hence we do not consider here how international institutions can offer insurance to emerging countries facing financial crisis and capital outflows, such as proposed by Cabalerro (2003). But we meet two issues common to any macro insurance scheme: how to deliver resources on time and how to make that insurance promotes rather than breaks needed reforms (see Cordella and Levy Yeyati 2004)

The idea of offering aid to developing countries in order to compensate the (negative) shocks they face is not new. The Compensatory Finance Facility has been set up more than forty years ago (1963). The Stabex was created thirty years ago with the Lomé Convention (1975), replaced in the Cotonou Agreement (2000) by a new facility, the so called Flex…This long experiment and partial failure precisely enlighten the conditions to be met to implement effectively schemes of insurance supported by ODA. We shall concentrate on the case of Stabex, more thoroughly examined elsewhere (Collier et al. 1998). The Stabex (a European Scheme of compensation of shortfalls in specific agricultural exports due to international prices or to export volume) was set up with two innovative but contradictory principles: it was both intended to be automatic and to be targeted on the compensation of agricultural sectors concerned by the export shortfall. This is why along with the successive conventions, under the pressure of European countries, the control of the Commission on the use of Stabex funds was strengthened at the cost of greater and greater delays in disbursements; it thereby eliminated any counter cyclical use of funds, without guaranteeing that the farmers affected by the shortfall would be genuinely compensated. This lost of Stabex automaticity was reinforced by the fact that the resources allocated to the mechanism repeatedly fell short of the mark: this can be seen as the outcome of a poor understanding of the cyclical and long term components of export shortfalls. The method used to calculate the drops vis-à-vis an arithmetic means of past values led to an underestimation of the drops whenever the drops occurred following an upward trend (the most frequent situation in the seventies) and an overestimation following a downward trend (as was the case for many products in the 1980' and even in the 1990'). The new "Flex" of the Cotonou Agreement has not really addressed the issues raised by the Stabex, but is designed in such a way that it could do so.

An insurance scheme should be credible, which first means with adequate resources, allow quick disbursements to be compensatory and induce right incentive to avoid moral hazard. In that perspective it needs to take into account positive as well as negative shocks, in

order to address the instability issue rather than the only shortfall one. Such a scheme could be designed according the following lines.

First insurance is to be considered as a contract: it offers a guarantee conditioned by rules. The international community cannot content itself with stressing the importance of sound domestic macroeconomic management all over the cycle for purposes of dampening shocks, in that instability makes the conduct of economic policy more difficult. The role of the international community in response to shocks could be to act simultaneously to provide insurance and promote sound management. The general idea is that the international community could help to introduce automatic stabilization mechanisms by financing their costs subject to the prior adoption of agreed and controllable management rules. In short, the international community would offer a guarantee in exchange for a commitment as to rules. This principle can be applied on a macroeconomic scale and on a microeconomic or sectoral scale.

Second, debt service can be adjusted in response to shocks. It is a way by which aid can be quickly delivered and by which smoothing may cover ups as well as downs. A now frequent proposal is to tie the way the debt is treated to developments in commodity export prices. Easing debt service when prices are low and raising it when prices are high exerts a countercyclical effect on public finances: the easing of external debt service makes it possible to maintain other domestic expenditure despite the decline in tax receipts induced by the drop in export earnings, while increasing debt service in a period of spiking prices prevents a destabilizing increase in public expenditure that would be difficult to reverse. Such a system could be put in place for any country that wanted it and would undertake to increase debt service in the event of commodity price rises. A problem to be resolved is the introduction of a financial mechanism making it possible to scale back debt service automatically while ensuring that creditors share the cost equitably. Conceivably, a multilateral rescheduling fund could be introduced to this end, which would be funded by the surplus debt service received from debtor countries benefiting from high prices as well as from an initial endowment from bilateral and

multilateral donors and lenders. One important question, that it is not possible to examine here, concerns the modalities for modulating debt cost via interest payments or amortization payments. Note that the proposal may also apply to the occurrence of natural disasters.

Countries eligible for the Highly Indebted Poor Countries (HIPC) Initiative, which are particularly dependent on commodity exports, could find this new mechanism of interest even though they are benefiting from debt cancellation. The objective of the HIPC Initiative is to reduce the ratio of debt to exports to 150 percent when the completion point has been reached. However, the analysis of the sustainability of that debt level assumes that exports will expand at a given rate, without any explicit provision being made to adjust the debt and debt service levels in light of export price developments. .

Third, the not highly indebted poor countries should be offered a similar scheme. This type of proposal should not mask the reality that other countries, while not heavily indebted, remain extremely dependent on their commodity exports and subject to significant price shocks (and natural shocks as well). It would be paradoxical for a new international initiative intended to address such shocks not to take such countries into account or to exclude them for the simple reason that they are not heavily indebted. The logical response would then be for automatic assistance in loan form to be extended to them in the event of price drops, indexed on commodity prices, or in grant form beyond a certain threshold of price declines, subject to the sole condition that the country undertook to limit the growth of its public expenditure during periods of high prices. The country would thus be prompted to set aside a portion of the gains registered when prices are high in order to maintain its spending levels when prices decline to the extent such drops are not offset by the international community. This would thus play the role of insurance and constitute an incentive for self-insurance. It should be possible to mobilize the resources necessary to such a new mechanism for automatic assistance insofar as it would be limited to the category of Least Developed Countries.

Fourth, macroeconomic and sectoral supports are to be interconnected. Since instability has unfavorable effects on both the macroeconomic and sectoral levels, it is logical for the

mechanisms to be designed in such a way as to remedy the effects of instability at each of these levels. In other words, if aid is to be used as an insurance at the macro level in low income countries, it is useful to link this support with the promotion of sectoral, possibly private, insurance schemes at the sectoral or micro level. This holds both for natural disaster insurance, as examined by Auffret 2003 and Dayton-Johnston 2004, and for price shocks. Our focus here is on mechanisms aimed at attenuating the effects of price instability in the agricultural sector. The intensity with which international price instability is transmitted to exporters and agricultural producers depends on the tax and parafiscal policies of the government as regards agricultural exports. In the absence of such levies, price changes are transmitted in their entirety, which does not preclude an influence on general tax receipts owing to the impact of price changes on national income. In the case of levies that are proportional to the value of exports and constant, the direct income gain or loss is shared by the government and the sector, which may result in greater producer price instability than international price instability if marketing costs are rigid. Naturally, by modifying its tax rates, the government changes the conditions under which gains or losses are divided between itself and the stakeholders in the sector. For this reason, the external support for a policy aimed at using insurance mechanisms to reduce the risks incurred by producers owing to price variability must ensure that it does not constitute a pretext for a greater transfer of risk from the government to producers. In other words, it must be accompanied by fiscal conditionality.

The international community could assist with establishing insurance mechanisms for agricultural producers in low-income countries who currently find them out of reach owing to their cost. The external support should both cover a portion of the costs of managing the options and guarantee the financing of the possible gap between the option exercise price and the producer price corresponding to the international price at the time the export product is sold. Details are given in Collier et al. 1998, 1999 (see also Sarris 2003). The advantage of this solution is that the sale of options could be managed by private operators. Moreover, it could be associated with insurance on the volume of harvests.

This highlights the objective of reducing the variability of the prices paid to producers, notwithstanding the flaws in the operation of former stabilization funds. Conceivably, the international community could provide its support to guarantee funds whose operation would meet two key conditions, not met in the past, which pertain to the flexibility of the reference price and the placement of the monetary assets involved. The price guaranteed to the producer should be calculated on the basis of an international price that is gradually adjusted toward the international market trend. The cash assets of the guarantee fund, built up both by contributions from producers during periods of high prices and by international assistance, should be managed by a body that is independent of the government and preferably has an international status or is the property of producers.. These funds would thus be beyond the government's reach, which is necessary in order to ensure the credibility of the system and would make it possible to use them countercyclically.

Fifth, long term signals must not be blurred. The compensatory purpose is related to short or medium term fluctuations around long term trends against which no automatic insurance can be offered. This holds of course for the reference export/import price to be used in debt indexation, as well as for the producer price. The past trend, whatever its kind, must be used both to avoid shortage of finance and wrong incentives at the macro and micro level. Same caveat applies to the possible calculation of a volume reference (of exports, harvests …).

Structural vulnerability reduction as aid target? Implementing aid as insurance is supposed to enhance the resilience of low income countries to shocks. As we have presented it, insurance is closely linked to the management of the shocks. Is there a role for aid to help the country to lower their exposure to exogeneous shocks? Or even the likelihood of such shocks? Many answers are conceivable, more or less effective. An answer through project or sector support meets the problem of fungibility. Moreover if the idea is to diversify, it is a long term answer, and, as we know, diversification to a large extent endogeneous (it results from development, rather than causes it ,Imbs and Wacziarg 2004); otherwise it is costly and its cost

has to be compared to the expected benefits of lower vulnerability. Other aid responses, at a regional or global level, may be effective. One is the support to regional integration, an underestimated to reduce structural vulnerability. Another is the financing of research on the prevention (or at least the assessment of risks) of natural disaster and climatic shocks (including the research on resistant agricultural varieties). Not the least, developed countries have a major responsibility in lowering the sources of instabilities both through their macro economic management and their agricultural policies. Moreover in the present global economy adequate responses to shocks occurring in emerging economies, not considered in that paper, may also contribute to lower the vulnerability of low income countries.

Conclusion

We have tried in this paper to underline the importance of structural vulnerability for low income countries, in particular for LDCs, where it is significantly higher than in other developing countries. Structural vulnerability weakens policy. It lowers growth. It discriminates against the poor.

Staying at the macro economic level, several analytical issues remain unsolved, the main ones, to our mind being the following. The difference between ex ante and ex post effects of vulnerability is not enough enlightened. Threshold effects have been little investigated (probably vulnerability mainly matters above some threshold). Passing through mechanisms are crucial and may have changed over time. Finally the macro economic links between macro vulnerability and poverty, tentatively evidenced above, must be explored with the help of micro and macro country case studies.

As to the implications for aid policy, they can briefly summarized as follows. First, selectivity principles have to be revisited, so that vulnerability becomes one of the main criteria, both because it increases aid effectiveness and because it is a structural handicap to growth, to be legitimately, at least partly, compensated by the international community. It is a good reason to make more use of the LDC category, which precisely identifies those among the

low income countries suffering the most from structural handicaps, in particular from vulnerability. Second aid can be used as insurance in a new conditionality framework , where a guarantee is offered under the condition that some rules of shock management are ex ante agreed upon. Finally and the more difficult, lowering the size of the shocks and the exposure of low income countries remain in multiple areas a matter to consider, with regard to its costs and benefits: actions at the global or regional level may be the more promising.

Table 1 : Income instability increases child mortality in low income countries

Dependent variable : Under-5 Mortality				
	Fixed Effects		GMM system	
	full sample	**LICs only**	**full sample**	**LICs only**
Regression no.	**(1)**	**(2)**	**(3)**	**(4)**
Income Instability	0,004	0,024	0,025	0,054
	(0,64)	(2,59)**	(1,94)*	(3,77)***
Ln Income per capita	-0,105	0,017	-0,840	-0,713
	(1,86)*	(0,21)	(8,03)***	(4,88)***
DPT Immunization	-0,003	-0,006	-0,006	-0,004
	(3,67)***	(4,00)***	(2,84)***	(1,79)*
Constant	-1,499	-1,609	4,430	3,324
	(3,40)***	(2,85)***	(6,26)***	(3,10)***
Observations	401	126	401	126
Countries	96	33	96	33
R-squared	0,61	0,50		
p(Sargan)			0,199	0,995
AR(1)			0,000	0,182
AR(2)			0,494	0,754

Dependent variable : logit transformation of U5 Mortality.
Periods : 1980, 1985, 1990, 1995 and 2000.
Absolute value of t-statistics in parentheses for Fixed Effects estimations, Robust value of t-statistics for GMM System estimations. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 2 : Income instability makes income growth less favourable to the poor

Dependent variable : Variation of Poverty				
	full sample			**LICs only**
Regression no.	**(1)**	**(2)**	**(3)**	**(4)**
Income Instability	0,052	0,121	0,081	0,020
	(0.037)	(0.055)**	(0.039)**	(0.027)
Income Growth	-3,171	-1,958	-2,708	-2,301
	(0.655)***	(0.474)***	(0.617)***	(0.757)***
Income Instability*Income Growth	0,369		0,341	0,332
	(0.098)***		(0.105)***	(0.181)*
Gini Coefficient Growth	3,966	3,882		2,174
	(1.060)***	(1.040)***		(0.609)***
Initial Poverty	-0,189	-0,190	-0,205	-0,309
	(0.074)**	(0.071)***	(0.083)**	(0.109)***
Constant	-0,405	-0,617	-0,478	-0,095
	(0.160)**	(0.170)***	(0.171)***	(0.103)
Observations	135	135	135	60
R-squared	0,35	0,33	0,26	0,52

Dependent variable : variation of the poverty headcount index (%).
Method : Ordinary Least Squares.
Periods : 1981-1990 and 1990-1999.
Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3 : Growth volatility among developing countries

Growth volatility	1970-1980	1980-1990	1990-2001	1980-2001
Developing (131)				
average	6,22	5,43	4,50	5,40
median	4,50	4,66	3,51	4,67
Low and middle income (121)				
average	5,91	5,50	4,57	5,48
median	4,49	4,67	3,51	4,68
Low income (57)				
average	5,36	5,25	5,43	5,96
median	4,50	4,43	3,99	4,90
Middle Income (64)				
average	6,40	5,72	3,80	5,05
Median	4,38	4,83	3,18	4,59
EIT		(16)	(27)	(16)
average		4,59	10,10	7,84
Median		4,59	8,91	7,79
LDCs (49)				
average	5,98	5,87	5,73	6,39
Median	4,50	5,20	3,99	4,98
Low income non-LDCs (15)				
average	5,46	4,22	3,68	4,54
Median	6,17	4,12	3,35	4,66
Oil exporters (25)				
average	8,29	6,12	4,40	5,66
Median	8,17	5,92	3,48	5,15

Source : United Nations, DESA calculations.

Table 4: Aid and export volatilities compared

	1960-1969	1970-1979	1980-1989	1990-1999
	N = 54	N = 64	N = 74	N = 104
Average Volatily of aid	0.2592	0.2207	0.0652	0.1553
Average Volatility of exports	0.0077	0.0136	0.0120	0.0151
Relative volatility % of countries [var(A) / var(X)] > 1	92.6	89.1	79.7	88.5
Average Volatility (X + A)	0.0089	0.0135	0.0102	0.0144
Stabilizing Impact Var(X) – Var(X + A)	0.0006	0.0022	0.0039	0.0030
Average Correlation Corr[cycle(X), cycle(A)]	-0.0290	-0.0765	0.0237	-0.0421

Note : N : number of observations

Source : Chauvet et Guillaumont 2005.

Table 5: Aid, export instability and per capita income growth

Ln income p.c, t	GMM-SYSTEM		
	1	2	3
Ln income p.c, t-5	0.968***	0.969***	0.961***
	(0.000)	(0.000)	(0.000)
ICRG (100 : low risk, 0 : high risk)	0.007**	0.007**	0.008***
	(0.025)	(0.019)	(0.008)
Instability of exports	-0.011**	-0.008**	-0.007
	(0.037)	(0.028)	(0.139)
ODA/GNI	-0.389	-0.228	-0.373
	(0.189)	(0.231)	(0.136)
ODA/GNI x Instability of exports	0.045**		0.026
	(0.049)		(0.407)
Instability of exports – Instability of exports plus aid		0.016°	0.005
		(0.109)	(0.790)
Dummy 1980-1984	-0.110***	-0.104***	-0.104***
	(0.000)	(0.000)	(0.000)
Dummy 1985-1989	-0.110***	-0.100***	-0.094***
	(0.000)	(0.000)	(0.000)
Dummy 1990-1994	-0.171***	-0.162***	-0.153***
	(0.000)	(0.000)	(0.000)
Dummy 1995-1999	-0.186***	-0.177***	-0.183***
	(0.000)	(0.001)	(0.000)
Constant	0.144	0.067	0.088
	(0.553)	(0.767)	(0.650)
Observations	304	304	304
Countries	79	79	79
F-test	0.000	0.000	0.000
AR(1) (*p*-value)	0.000	0.000	0.000
AR(2) (*p*-value)	0.883	0.522	0.546
Sargan (*p*-value)	0.471	0.517	0.453
Nb of instruments	63	66	77

Second-step GMM-SYSTEM estimations, corrected for the small-sample bias (Windmeijer 2000). *p*-values in parentheses. *** : significant at 1% ; ** : significant at 5% ; * : significant at 10% ; ° : significant at 15%.

Source : Chauvet et Guillaumont 2005..

Table 6 Aid elasticities measured from two models of aid geographical allocation

	(1) Income per capita	(2) EVI	(3) Average [(2)-(1)]/2	(4) Rank	(5) Rank Dollar & Levin, 2002	(6) Différence between ranks
Australie	0,425	3,025	1,300	6	16	-10
Autriche	-0,118	1,019	0,569	18	6	12
Belgique	-0,605	2,033	1,319	5	8	-3
Canada	0,263	1,603	0,670	15	14	1
Danemark	-0,609	1,772	1,191	7	1	6
Finlande	-0,106	1,187	0,647	16	7	9
France	-0,077	1,331	0,704	13	20	-7
Allemagne	-0,528	-0,760	-0,116	21	11	10
Grèce	0,549	2,595	1,023	8	21	-13
Irelande	-0,470	3,457	1,964	2	10	-8
Italie	-0,318	1,139	0,729	12	17	-5
Japon	0,780	0,793	0,007	20	13	7
Luxembourg	0,019	3,852	1,917	3	9	-6
Pays Bas	-1,085	0,443	0,764	11	4	7
Nelle Zélande	0,720	4,525	1,903	4	18	-14
Norvège	-0,976	0,945	0,961	9	5	4
Portugal	0,467	6,150	2,842	1	19	-18
Espagne	0,179	-0,286	-0,233	22	22	0
Suède	-0,869	1,020	0,945	10	3	7
Suisse	-0,627	0,729	0,678	14	12	2
Royaume Uni	-0,736	0,468	0,602	17	2	15
Etats Unis	-0,718	0,357	0,538	19	15	4

Average of absolute value of rank differences : 7,6
Source : Amprou et al.2005

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