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VULNERABILITY AND RESILIENCE: CONCEPTS AND INDICATORS FOR ECONOMIES WITH A HIGH AGRICULTURAL IMPORT CONTENT

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Vulnerability and Resilience: Concepts and Indicators for Economies with a High Agricultural Import Content

1. INTRODUCTION

Economic vulnerability is associated with exposure to exogenous shocks, related to the inherent characteristics of a particular economy, such as high degrees of economic openness, export concentration and dependence on strategic imports. The exposure is considered to be permanent or quasi-permanent and cannot be assumed to be responsive to policy measures. Economic resilience, on the other hand, refers to the ability of an economy to recover from or adjust to the negative impacts of external economic shocks. Thus the risk of being adversely affected by an exogenous shock is a function of two elements, the first is associated with the inherent conditions of the country that is exposed to the shocks and the second associated with conditions developed to absorb, cope with or bounce back from external shocks (Briguglio, 2005).

This paper will discuss the concepts of vulnerability and resilience, which have been extensively researched in small states studies, and their relevance for economies with a high agricultural import content. There are obvious vulnerability connotations when a country depends heavily on agriculture, especially on imported food for consumption. It can be argued that where resilience is typically weak, vulnerability tends to retard growth in the initial phases of development, thereby contributing to slow down convergence between developed and developing countries (Cordina, 2004). Thus, in the absence of resilience building policies, countries with a high vulnerability due to high agricultural import content may suffer adverse effects on economic growth.

The paper will be structured as follows. Section 2, which follows this introduction will define economies with a high agricultural import content, identify some common characteristics of these countries and outline reasons for such high agricultural import content. A measure for vulnerability to exogenous shocks faced by this particular country group will be proposed in Section 3, and correlations will be carried out to identify whether renowned vulnerability indices capture this specific type of vulnerability. Section 4 will discuss the concept of resilience and its relevance for economies with a high agricultural import content and analyse the extent of resilience building these countries have in place. Section 5 will present a risk framework, integrating the measures of vulnerability and resilience presented in the previous two sections, to assess risk levels of economies with a high agricultural import content, while Section 6 will provide main conclusions and possibilities for further research.

2. ECONOMIES WITH A HIGH AGRICULTURAL IMPORT CONTENT

Economies with a high agricultural import content are by definition economies, where the imports of agricultural goods, especially food, is significant. Since the literature does not provide any definition of these types of economies, it is likely that different researchers may have conflicting views about what they consider to be a 'high' import content, and consequently whether an economy has a high agricultural import content or not.

Possible definitions of high agricultural economies include:

- net importers of agricultural commodities, such as food or agricultural raw materials;
- positive percentage deviations from the world average imports of agricultural commodities;
- imports of agricultural commodities that are higher than a specified benchmark.

All these measures have limitations and related advantages and disadvantages. Since the first measure is a net indicator, that is an indicator involving differences between two variables, in this case imports and exports, it is possible that the same net value is associated with very different import and export values. For instance, let us assume that Country A and Country B are two countries of a similar size. If Country A has imports of $4,000 and exports of $2,000, then it is a net importer of $2,000. However, Country B, with imports of $42,000 and exports of $40,000 is also a net importer of $2,000. Thus, they both have the same net value even though Country A is a relatively closed economy, while Country B is a relatively open economy.

The second measure has a number of problems. First of all, if the average is calculated by means of the mean, then outlier values can influence the world average imports. This problem can be counteracted by the use of other averaging methods such as the median or the mode. Other problems are related to the comparability of this indicator over time, given that the world average will change over time. Thus, in order for a specific country to register an increase in agricultural imports, then this country must experience an increase which is higher than the increase for the world average.

The limitations associated with the third measure concern the subjectivity related to the specified benchmark. Some authors may prefer a relatively high upper limit, while other authors may prefer a relatively lower one. Very often, the choice of the upper bound depends on the nature of the study and the group of countries that the author wants to focus on.

Appendix A lists countries classified as high agricultural import economies according to at least one of three different measures: (1) net food importers; (2) net agricultural raw materials imports; and (3) positive deviation from world average agricultural imports of 1.77%. It can be seen that only one fifth of the 120 countries in the list meet all three of the criteria, over a half meet two of the criteria and 25% are classified as high agricultural

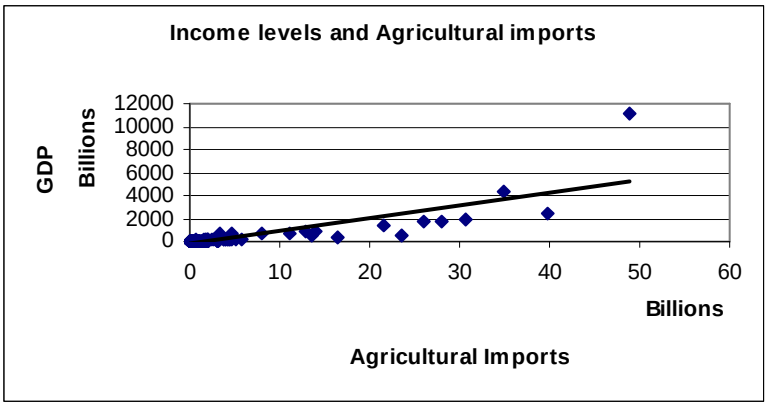
import economies because they satisfy one of the criteria. The objective of this simple exercise just reported is not to justify one measure over another, but just to illustrate that depending on the measure chosen a country can or can not be classified as a high agricultural import economy.

In order to avoid problems related to the measures described above, this study will not aim to make a distinction between high agricultural import economies and low agricultural import economies, but it will derive conclusions based on the degree of agricultural import content. This section will involve the correlation of certain variables with agricultural imports (% of GDP) in order to identify some reasons why countries have a high agricultural import ratio. The main conclusions are listed and described briefly below. All data has been obtained from the World Bank's World Development Indicators and the FAO and the period analysed is 2001 to 2005.

1. State of development

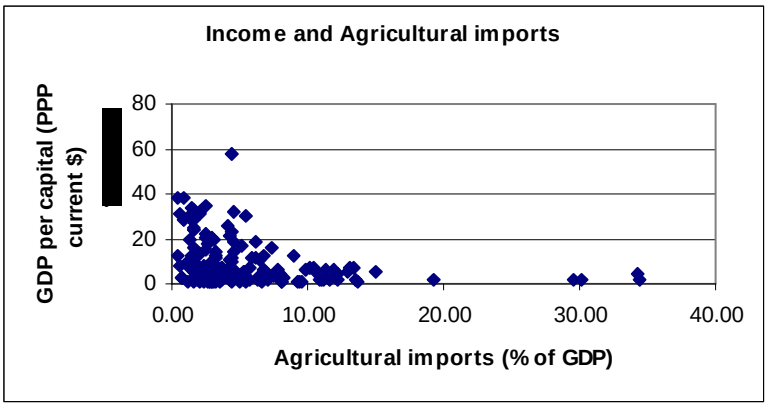
There is no relationship between the state of development of an economy and the proportion of agricultural imports. Indeed, while agricultural imports are positively correlated to the level of output in an economy, meaning that as the size of the GDP increases, the level of agricultural imports increases (see Figure 1), this relationship is not observed when output is expressed in per capita terms (see Figure 2).

Figure 1



Source: FAO, World Bank, Author's calculations

Figure 2

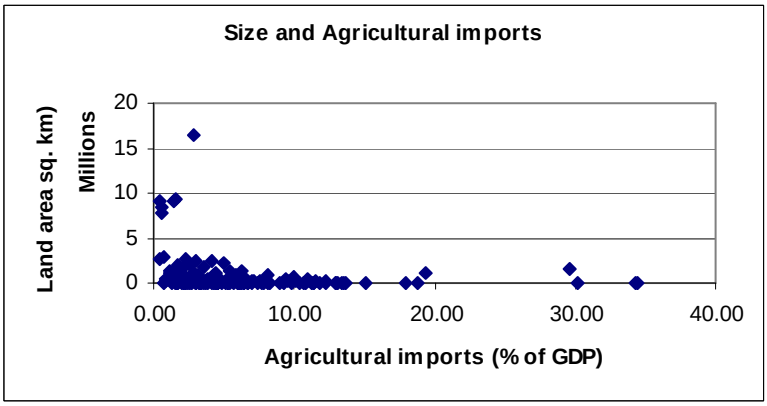


Source: FAO, World Bank, Author's calculations

2. Size of economies

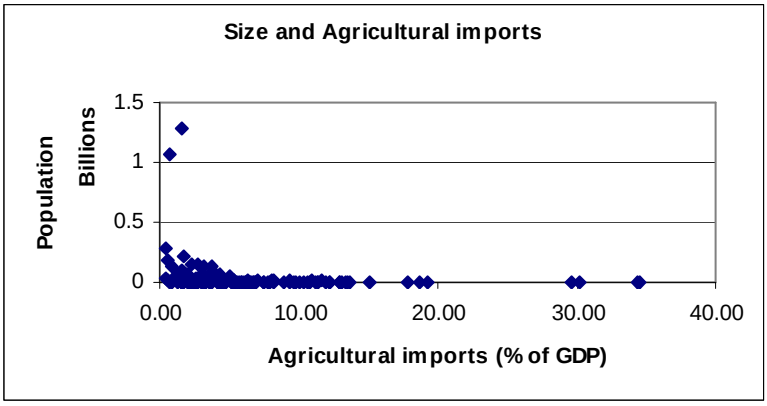
Agricultural imports are better explained by population density than country size. Indeed, there is no linear relationship between the size of economies and agricultural imports (see Figures 4 and 5). This is expected, as high agricultural imports are expected in small economies, where the agricultural sector is too small to satisfy the needs of all its inhabitants, as well as in large economies, where the population is too large in relation to domestic agricultural production. The relationship improved slightly when population density, rather than size per se was considered (see Figure 6).

Figure 3



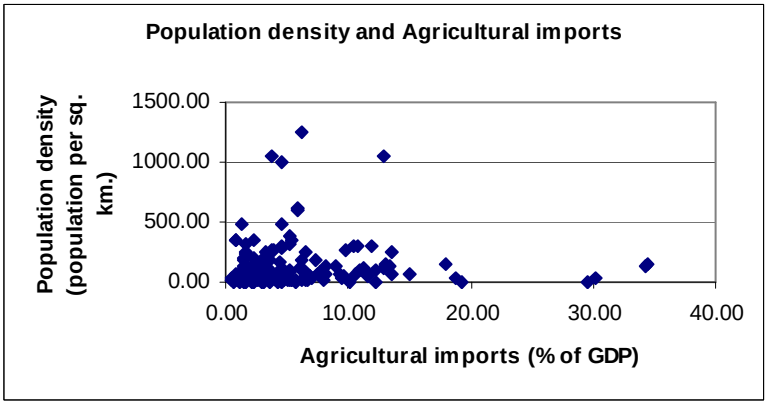
Source: FAO, World Bank, Author's calculations

Figure 4



Source: FAO, World Bank, Author's calculations

Figure 5

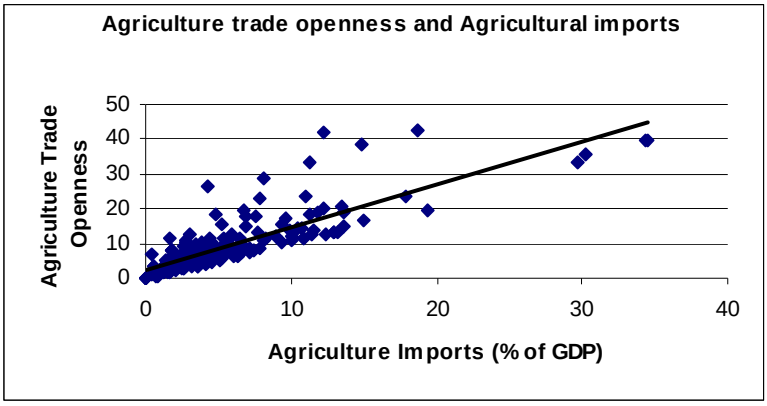


Source: FAO, World Bank, Author's calculations

3. Trade openness

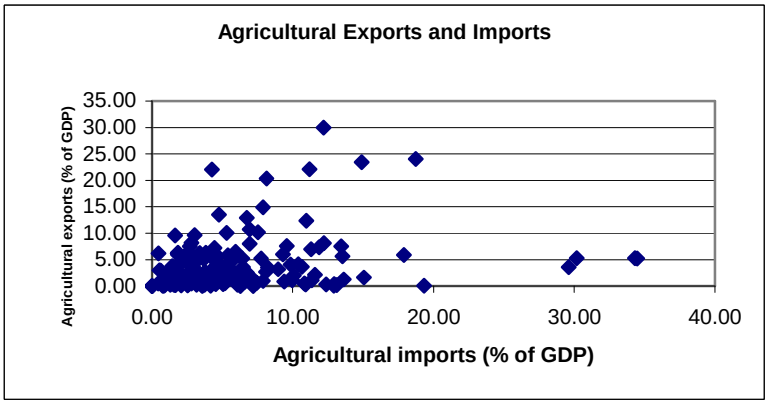
There is a clear and strong relationship between agricultural trade openness and agricultural imports (see Figure 6) as well as between imports and exports of agriculture (see Figure 7). This means that an economy that imports a high proportion of agricultural products is also likely to export a high proportion of agricultural products, whereas an economy that imports only a small proportion of agricultural products is also likely to export only a small proportion of such products. It was observed that although most open economies import a high proportion of agricultural products, there was a significant number of economies where imports of agricultural goods was high, notwithstanding that they were not significantly very open economies (see Figure 8).

Figure 6



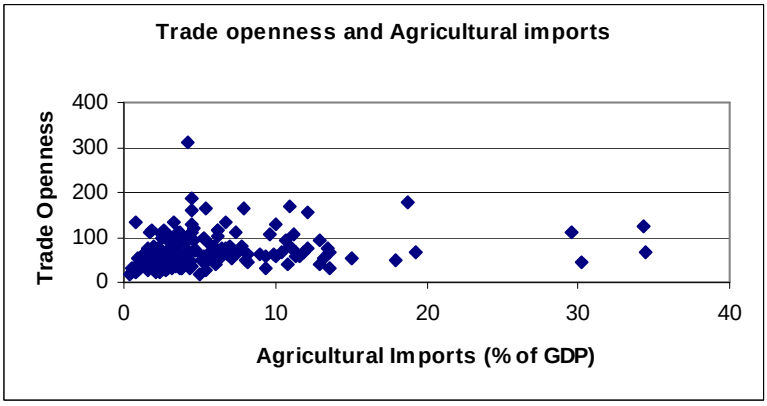
Source: FAO, World Bank, Author's calculations

Figure 7



Source: FAO, World Bank, Author's calculations

Figure 8

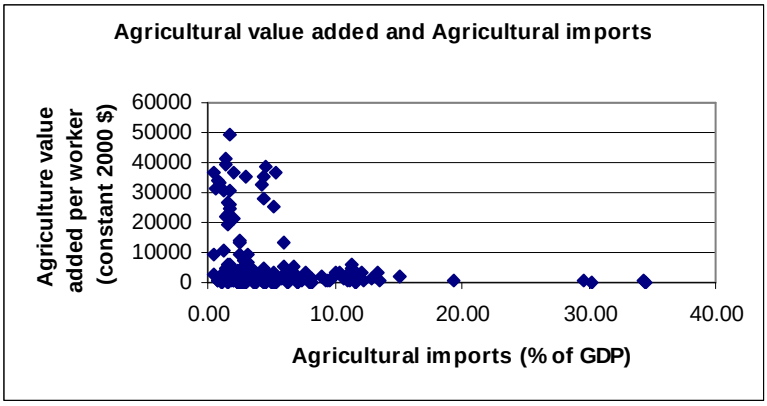


Source: FAO, World Bank, Author's calculations

4. Importance of the agricultural sector in the economy

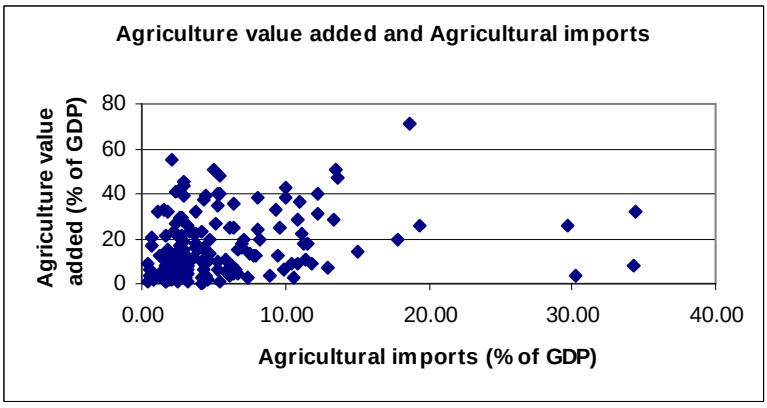
A priori it was expected that agricultural imports would be higher in economies where the agricultural sector is typically not an important sector of economic activity. It was thus expected that agricultural imports would be negatively related to agricultural value added, to employment in agriculture and to the rural population, amongst others. This assertion was, however, not confirmed by the empirical analysis conducted (see Figures 9, 10, 11 and 12).

Figure 9



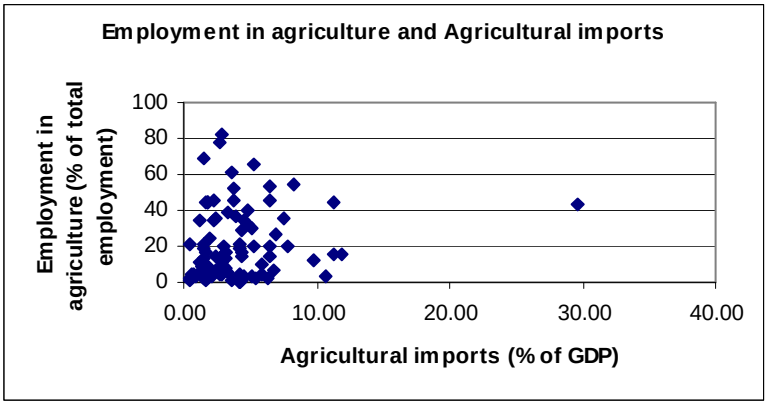
Source: FAO, World Bank, Author's calculations

Figure 10



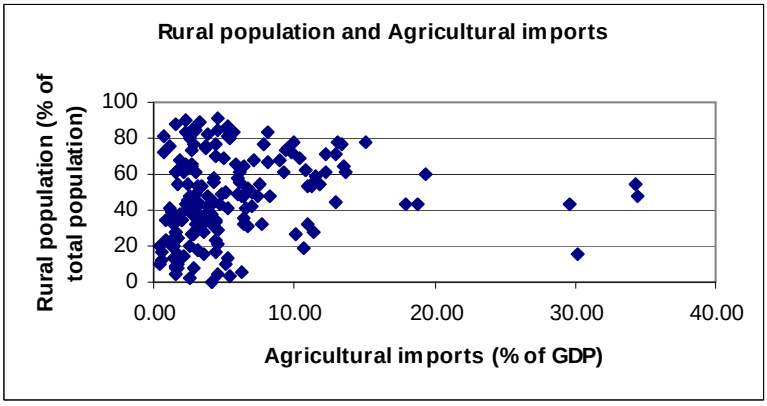
Source: FAO, World Bank, Author's calculations

Figure 11



Source: FAO, World Bank, Author's calculations

Figure 12

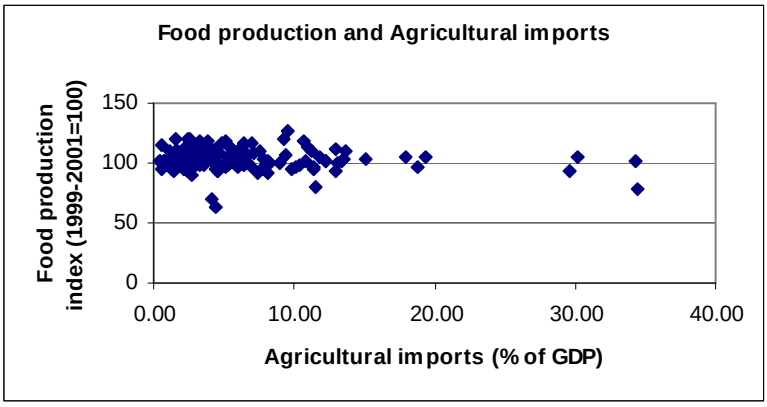


Source: FAO, World Bank, Author's calculations

5. Agricultural production

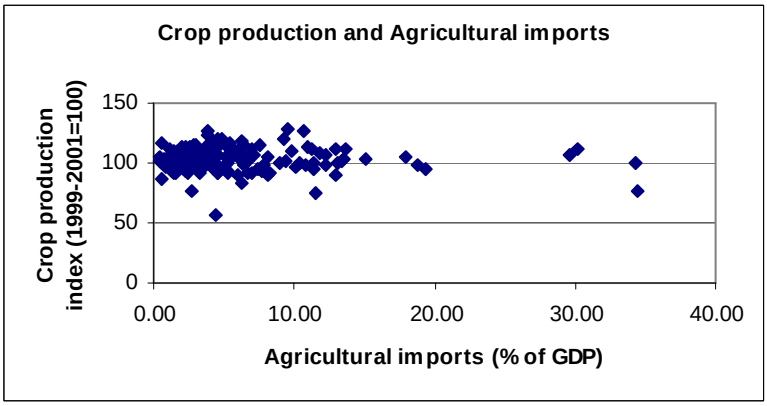
Related to the above observation, although it was a priori expected that low levels of agricultural production would lead to higher levels of agricultural imports, this again was not confirmed by empirical analysis (see Figures 13, 14, 15 and 16). Food production, crop production and cereal production and yields are analysed.

Figure 13



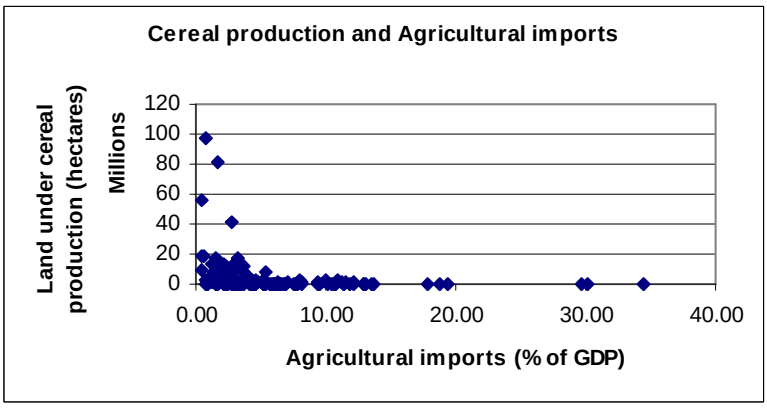
Source: FAO, World Bank, Author's calculations

Figure 14



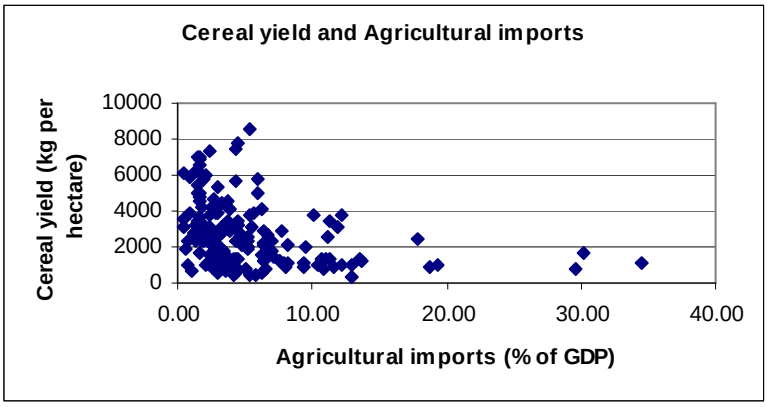
Source: FAO, World Bank, Author's calculations

Figure 15



Source: FAO, World Bank, Author's calculations

Figure 16

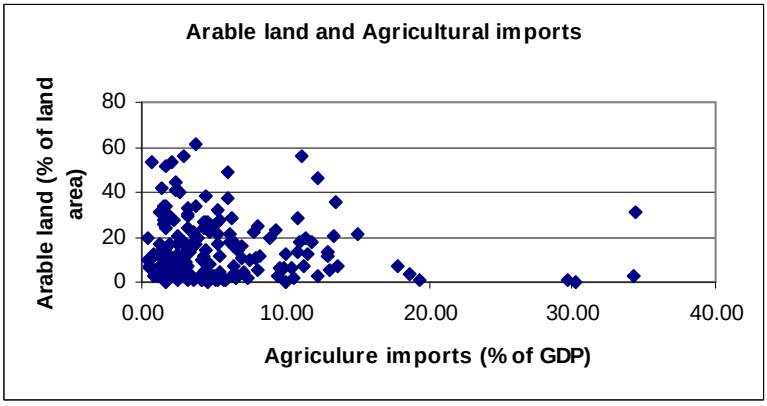


Source: FAO, World Bank, Author's calculations

6. Arable land

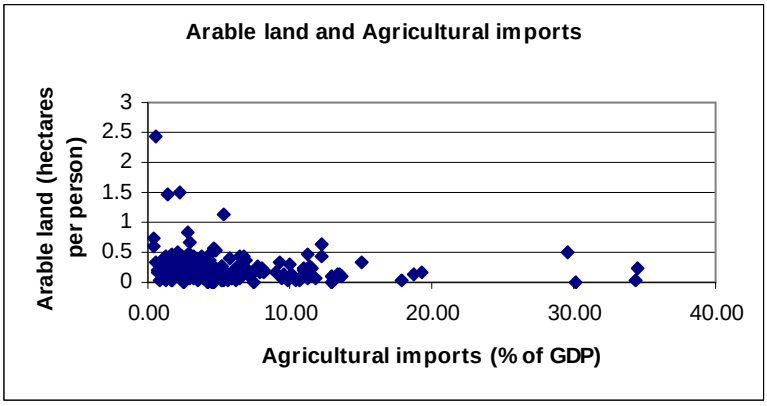
As expected, in view of the results obtained above, no strong relationship could be derived for the availability of arable land and agricultural imports, although a negative relationship between the two variables would have been expected. Figures 17, 18, 19 and 20 depict the relationships between various land indicators and agricultural imports.

Figure 17



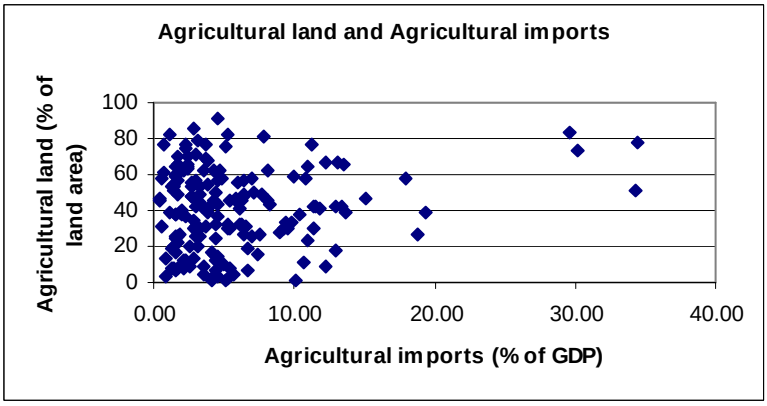
Source: FAO, World Bank, Author's calculations

Figure 18



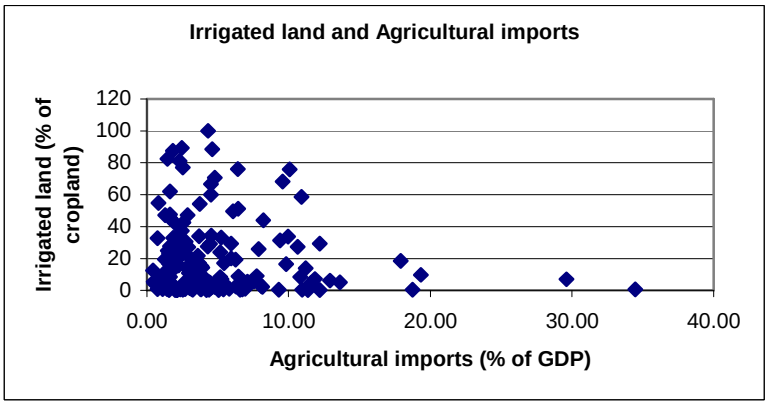
Source: FAO, World Bank, Author's calculations

Figure 19



Source: FAO, World Bank, Author's calculations

Figure 20

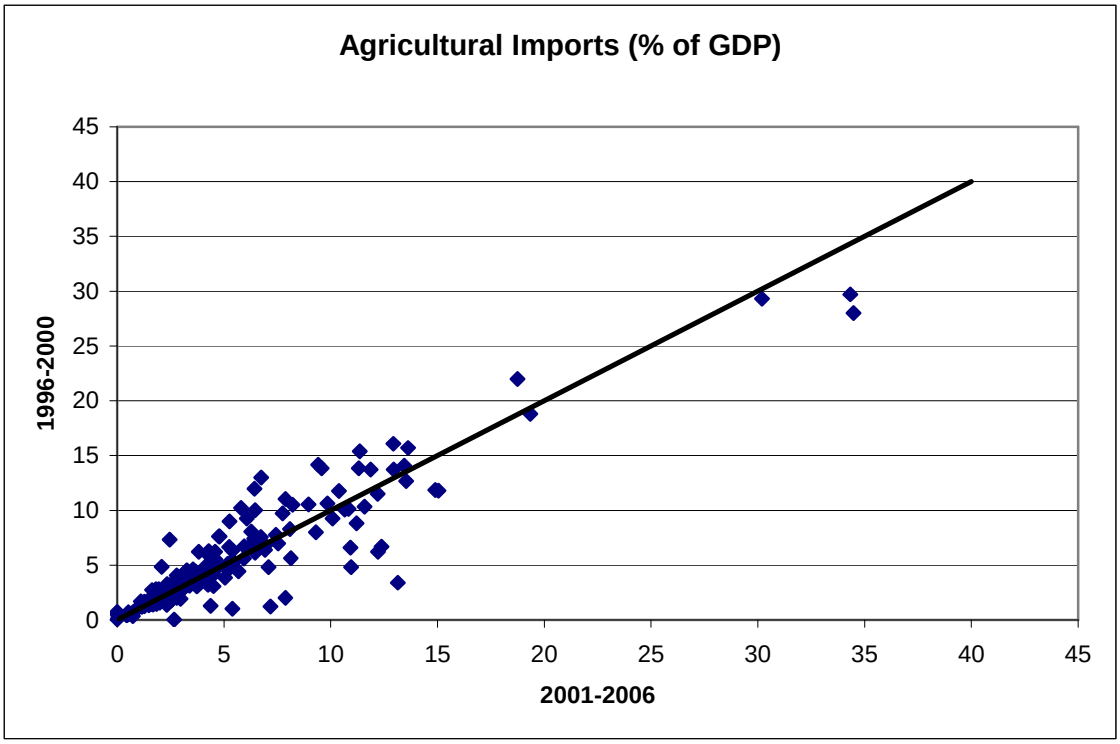


Source: FAO, World Bank, Author's calculations

The above shows that high agricultural import economies cannot be classified as a homogenous group of countries. Even the reasons for having a high agricultural import content could not be clearly delineated. However, it will be shown, later on, that these economies, whether large or small, high developed or developing, all suffer vulnerability related to high dependence on imported agricultural products. This will be treated in detail in the following section.

As detailed above this analysis, being an investigative analysis attempting to understand the reasons for high agricultural imports, takes a five period average, in order to ensure that any out-of-the-ordinary fluctuations are smoothened out. However, it is also interesting to analyse the trend in agricultural imports in recent years. Figure 21 shows that while some countries had a higher agricultural import content during the period 1996 to 2000, compared to the period 2001 to 2005 (represented by the points above the 45 degree line, which equates agricultural imports in the period 1996-2000 with agricultural imports in the period 2001-2006), other countries had the opposite situation (represented by the points below the 45 degree line). However, Figure 21 shows that more countries displayed the former trend rather than the latter.

Figure 21



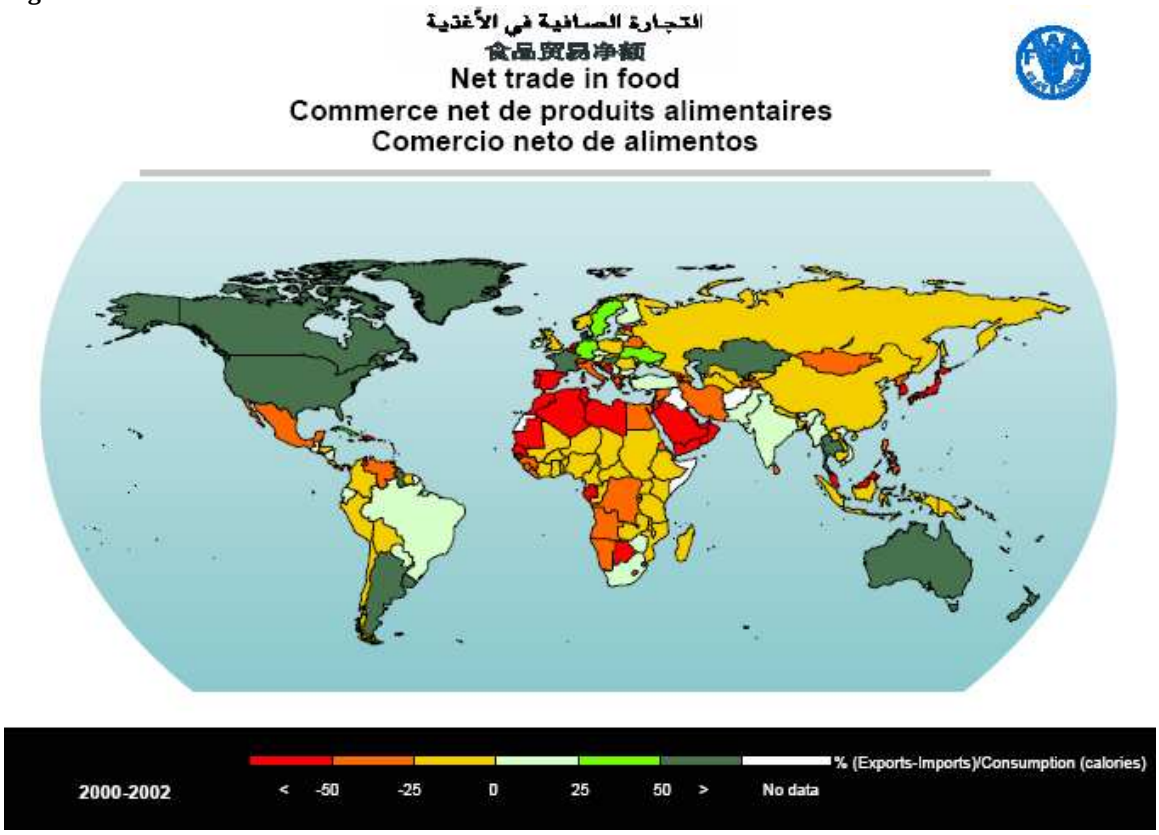
Source: FAO, Author's calculations

A study by FAO (2006) shows that food import bills in developing countries have increased recently because of domestic exchange rate depreciation, higher quantities of food imported on a commercial basis rather than through food aid and higher food prices. The study also attributes the increase in agricultural imports to trade liberalization, since in many developing countries local production is less competitive than imported goods.

3. VULNERABILITY RESULTING FROM HIGH AGRICULTURAL IMPORTS

As Briguglio and Galea (2003) assert, there are obvious vulnerability connotations when a country depends heavily on imported food for consumption. Figure 22 shows a map depicting the world net trade in food. It shows that many countries in Northern Africa and in Central Europe are heavy net food importers.

Figure 22



Source: FAO

The vulnerability suffered by economies with high agricultural imports mainly relates to the prices at which they purchase the imported goods, which can affect the supply of these imports. Volatile agricultural commodity prices are not a rare occurrence. Agricultural commodity prices rose sharply in 2006 and continued to rise even more sharply in 2007, with the FAO food price index rising on average by 23 per cent in 2007, compared to 9 per cent a year earlier (FAO, 2008). Volatility in the prices of agricultural products is due to a number of supply and demand side factors. Supply-side factors include weather-related production shortfalls, reductions in stock levels and increasing fuel costs. On the demand-side, this is a result of the changing structure of demand, the

emerging biofuels market and speculative operations on financial markets which contributes to raising spot price volatility.

At the macro-level, substantial increases in fuel and food prices may have a negative impact on foreign exchange earnings, incomes and the welfare of many vulnerable countries (FAO, 2008). Meanwhile, at the micro-level, vulnerable people are affected by rapid increases in the international prices of many basic food commodities, which affects their ability to buy enough food to meet the needs of their families (FAO, 2008).

3.1 Underlying Difficulties of Index Construction

This section presents the results of an attempt to construct a composite index of vulnerability resulting from high agricultural imports (AIV index). Some words of caution are warranted at this stage. The choice of the variables which compose the index is somewhat subjective. However care was taken to base the choice on a set of desirable criteria related to appropriate coverage, simplicity and ease of comprehension, affordability, suitability for international comparisons and transparency. A more detailed consideration of these criteria is given in Brigugulio (2003) and Farrugia (2008).

In addition, the summing of the components of the index also involves subjective decisions, principally in selecting the weighting procedure. There is considerable debate in the literature on composite indices on this issue. Again, these questions are discussed in Briguglio (2003) and Farrugia (2008) and are not elaborated upon in this paper.

3.2 The Components of the AIV Index

The vulnerability index proposed in this section is intended to measure an economy's exposure to an exogenous shock to agricultural imports. It is hypothesised that the variables that capture these effects are the following:

- Dependence on agricultural imports
- Dependence on a narrow range of agricultural imports
- Dependence on agricultural imports subject to price volatility.

Dependence on agricultural imports

This captures the degree to which a state is susceptible to conditions in the rest of the world. It is measured as the ratio of agricultural imports as a percentage of GDP. This variable is available for a reasonably wide set of countries spread over a spectrum of stages of development, size and geographical characteristics. The source of this data and country ranking results are presented in Appendix B.

Dependence on a narrow range of agricultural imports

The range of imports captures the extent to which a country lacks import diversification, a condition exacerbating the degree of agricultural import content. It is measured by a concentration index of agricultural imports, calculated using the Herfindahl-Hirschman method (Hirschman, 1964). This involves the summing of the square of the shares of

agricultural product import shares (imports of specific types of agricultural commodities divided by total agricultural imports) of all the countries for which data was available.

$$HHI = \sum_{i=1}^{n} S_i^2$$

where: HHI = the Herfindahl-Hirschman agricultural import concentration index.

S_i^2 = the square of the market share of the *i*th agricultural commodity, measured as the import of that commodity divided by total agricultural imports. The raw data was obtained from the FAO.

n = the number of agricultural commodities. This index, which utilised raw data from the FAO, considered 26 different types of agricultural commodities, namely barley, maize, rice, wheat, cereals, pulses, potatoes, apples, bananas, pineapples, soybeans, sunflower, seed, sunflower seed cake, soybean oil, cotton seed, ground nuts, cocoa bean, coffee ground, cotton lint, sugar, meat, milk, tea, tobacco and wine & vermouth.

This index would be close to zero when there are a large number of different types agricultural commodities imported. It would be close to 1 when the economy depends heavily on a specific type of agricultural commodity.

The results of the import concentration index and country ranking results are presented in Appendix B.

Dependence on agricultural imports subject to price volatility

The types of imports an economy is dependent upon are associated with different levels of vulnerability, due to different levels of price stability, ex: cereals and vegetable oilseeds exhibit different levels of price stability and, consequently, different levels of vulnerability.

This type of vulnerability was measured by analysing the distribution of expenditure by product and their respective price instability as follows:

$$PTV = \sum_{i=1}^{n} I_i S_i$$

where: PTV= the product type vulnerability index.

I_i = the price instability index of the *i*th agricultural commodity. The instability indices were obtained from UNCTAD. The measure of price instability is $1/n\sum\left[\left(\left|Y_t - y_t\right|\right)/y_t\right]\times 100$, where Y_t is the observed magnitude of the variable, y_t is the magnitude estimated by fitting an exponential trend to the observed value and n is the number of observations. Accordingly, instability is measured as the percentage deviation of the variables concerned from their exponential trend levels for a given period – 2002 to 2004.

S_i = market share of the *i*th agricultural commodity, measured as the import of that commodity divided by total agricultural imports. The raw data was obtained from the FAO.

The relative data and country ranking results with regard to this component of the Index are presented in Appendix B.

3.3 Correlation between the Components of the Index

In order to assess whether any of the variables are redundant, that is, explained by other variables in the index, correlations between the variables making up the index were carried out. Table 1 shows that the variables are weakly correlated to each other, thus excluding any possibility of redundancy. Thus, all three variables were retained in the composite index.

Table 1: Correlation Matrix

	Dependence	Concentration Index	Price Instability Index
Dependence	1		
Concentration Index	0.18	1	
Price Instability Index	0.01	-0.08	1

3.4 Other Determinants of Agricultural Import Vulnerability

Agricultural import vulnerability can also be viewed to be determined by other factors apart from those mentioned above. It may be argued, for example, that it could be useful to consider the effects of vulnerability arising from the country of origin of the imports, as vulnerability can be increased if a country is importing its goods from an unstable economy or from a number of unstable economies. However, a country of origin concentration index would have resulted in conflicting results with regard to interpretation, in the sense that a country which imports most of its goods from a stable economy would register a higher vulnerability than a country that imports commodities from a number of unstable economies. Besides the data provided by the FAO on imports by country of origin is broken down into 586 commodities. Since 234 countries are available, in order to calculate the concentration index, a matrix of size (234 x 586) would have had to be calculated for each country considered.

Another factor, which could have been taken into account in constructing the agricultural import vulnerability index is dependence on imported fuel. Since international food price increases were partly caused by (and were partly incidental to) increases in crude oil prices, it may be illustrative to identify countries that are not only net food importers but also net fuel importers (FAO, 2008).

For this reason, the AIV index was modified to also include this additional component of vulnerability. Dependence on imported fuel was calculated by taking the average imports of commercial energy as a percentage of domestic energy production. Data was obtained from the World Bank. This vulnerability index was named the EAIV index (extended agricultural import vulnerability index). The relative data and country ranking results are presented in Appendix C. A Pearson rank correlation test, to assess the rank correlation between the AIV and the EAIV indices gave a result of 0.85, thus showing that the two indices are highly correlated.

3.5 Computation of the Composite Index

The composite index was computed by taking a simple average of the components just described. The AIV comprised agricultural import dependence, agricultural import concentration and agricultural import price instability. The EAIV also included dependence on imported fuel. Data for 169 countries was obtained for the AIV index, while the EAIV index was computed for 125 countries. Thus, the index is available for an extensive set of countries. All observations of the components of the index were normalised using the well-known transformation:

$$XS_{ij} = \left(X_{ij} - MinX_j \right) \Big/ \left(MaxX_j - MinX_j \right)$$

where:

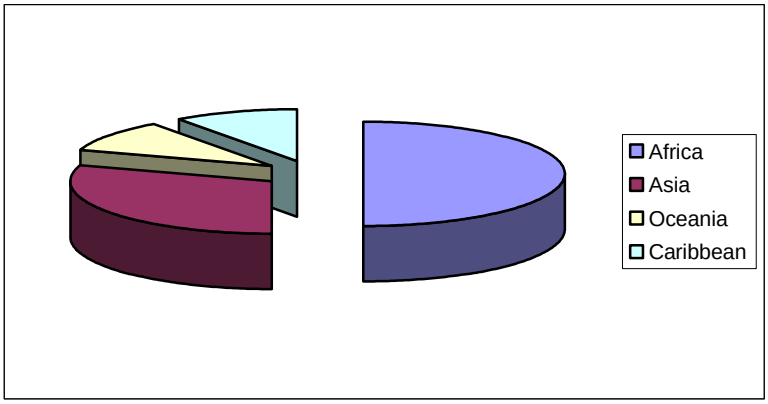
- XS_{ij} is the value of the standardised observation for country *i* of component *j*;
- X_{ij} is the actual value of the same observation;
- $MinX_j$ and $MaxX_j$ are the minimum and maximum values of the same observations for component *j*.

This transforms the values of observations in a particular variable array so that they take a range of values from 0 to 1.

3.6 Results

The results of the AIV index are given in Appendix B. These show that the highest agricultural import economies are the Gambia, Tajikistan, Eritrea, Chad, Tonga, Turkmenistan, Ethiopia, St. Lucia, Guinea-Bissau and Kazakhstan. The distribution of the 10 economies that registered the highest agricultural import vulnerability by region is shown in Figure 23.

Figure 23: Distribution of Top 10 High Agricultural Import Economies by Regions



The results of the EAIV index are given in Appendix C. As reported above, the Pearson rank coefficient is of 0.86, thus the results change somewhat. According to the EAIV, the most vulnerable economies are Tajikistan, Singapore, Senegal, Haiti, Togo, Georgia, Jordan, Ghana, Moldova and Yemen. Since the purpose of this paper is to analyse agricultural import vulnerability in its pure form, the AIV serves this purpose better than the HAIV, thus the remainder of the paper will focus on this index.

3.6 Relation with Economic Vulnerability

Another interesting question, which this paper analyses, is whether economic vulnerability captures this specific form of vulnerability, that is, vulnerability due to high agricultural imports. In order to test this hypothesis a correlation was carried out between the AIV index, constructed in this paper, and a well-known economic vulnerability index, namely Briguglio and Galea (2003), which is reproduced in Appendix D. The Pearson rank correlation coefficient is 0.39, thus implying that economic vulnerability and agricultural import vulnerability are two different concepts. The result also implies that a country that is economically vulnerable need not suffer from agricultural import vulnerability, while a country that has high agricultural import vulnerability need not be economically vulnerable. It thus confirms the importance of the vulnerability measure constructed in this paper, as it measures a specific type of vulnerability that is not captured by well-known economic vulnerability measures.

4. BUILDING RESILIENCE TO OFFSET VULNERABILITY

4.1 Importance of Resilience-Building

The concept of resilience-building, which can offset the negative impacts of vulnerability is important, as it has been noted that different countries are able to respond and manage the fluctuations and shocks to economic activity with varying degrees of success. This depends on the economy's state of development, on policy responses, and on differences

in labour, product and financial market regulation, amongst others. Thus, while vulnerability and random shocks may be regarded as purely exogenous factors, the economy's susceptibility to such shocks may be viewed to change according to the state of development and to policy responses (Briguglio *et al*., 2006). FAO (2008) also states that the extent and nature of the impact of a negative exogenous shock will depend on the nature of resources countries are endowed with and on the constraints that their economies face.

The concept of resilience has its origins in fields of ecology and engineering. Lundberg and Johansson (2006) state that the term resilience originates from the paper "Resilience and Stability of Ecological Systems" by Holling (1973), who argues that "resilience determines the persistence of relationships within a system and is a measure of the ability of these systems to absorb changes of state variables, driving variables and parameters, and still persist".

The entry of the concept of resilience into economics has been associated with dynamic economics and the notion of a steady state. In this context, economic resilience is defined as the ability of the economic system to return to a steady-state position after a perturbation or exogenous shock. Economic resilience comprises at least the following dimensions: (a) the speed with which economies revert to normal following a shock (shock counteraction), (b) the extent to which shocks are damped (shock absorption), and (c) to extent to which shocks are altogether avoided (inherent resilience) (Briguglio *et al.*, 2006).

Shock counteraction and shock absorption can be considered to be aspects of nurtured resilience, resilience which can be developed and managed over time, and which is therefore policy responsive. Thus, in this sense, a country can adopt resilience-building policies which enable it to cope with or mitigate the negative impacts associated with inherent vulnerability. Conversely, a country can adopt policies which exacerbate the negative impacts of inherent vulnerability. There is thus a bi-directional and inverse relationship between resilience and vulnerability. The vulnerability of an economic system can be reduced by building up economic resilience, while a loss of resilience can lead to increased vulnerability (Briguglio, 2004). The inherent aspect of resilience may be considered as the obverse of inherent vulnerability, in the sense that inherently resilient countries should have a low vulnerability.

4.2 The Briguglio *et al.* (2006) Resilience Index

Following a call by the participants at the Mauritius International Meeting held in January 2005 for the establishment of a Task Force to develop a resilience index (Paragraph 81 of the Mauritius Strategy), (see United Nations, 2005), the University of Malta has proposed a method by which a resilience index can be constructed. The index is made up of four variables, namely (a) macroeconomic stability; (b) microeconomic market efficiency; (c) good governance; and (d) social development.

This is based on the hypothesis that resilience is viewed to depend upon appropriate interventions to secure adequate policy approaches in four principal areas namely macroeconomic stability, microeconomic market efficiency, good governance and social development. Macroeconomic stability is essential so that an adverse economic shock does not hit the economy when it is already in a weak position, and that fiscal policy is in a position to mobilise resources so as to be able to rebound from the effects of such shocks. Microeconomic market efficiency is required to ensure the economy's competitiveness so as to be able to withstand the effects of shocks and rapidly reallocate resources to alternative uses when necessary. Good governance is an essential underpinning to appropriate policy formulation and hence an indispensable element of economic resilience. Social development, as reflected in a collaborative and constructive pattern of interaction between government, the social partners and civil society, is also crucial to the formulation and effective implementation of policy, and therefore essential to economic resilience.

4.3 Adjusted Resilience Index

In order to measure the capacity of an economy to counteract or absorb the negative impact of exogenous shocks to agricultural imports, a resilience measure is required. It is recognised that this specific type of vulnerability requires targeted and specific policy responses that requires further research. However, it is also recognised that the resilience index proposed by Briguglio *et al.* (2006) can also be used as to measure resilience to agricultural import vulnerability. This is because an economy that lacks macroeconomic stability, microeconomic market efficiency, good governance and social development, will surely exacerbate the negative effects of a shock rather than counteract or absorb it. However, FAO (2008) argues that vulnerability is likely to be exacerbated in those countries where the proportion of their population who are considered to be undernourished is greater than 30 per cent. Since the resilience index by Briguglio *et al.* (2006) does not consider undernourishment as one of its variables, this was included in order to better measure resilience to agricultural import vulnerability. Thus, an adjusted resilience index was constructed, basically by taking the scores reported in Briguglio *et al.* (2006) and adding another component, that of undernourishment.

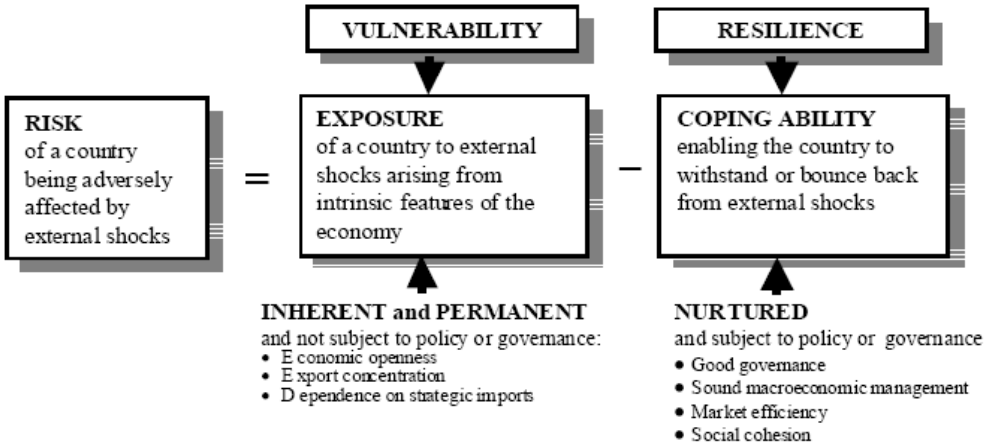
4.4 Index Results

The adjusted resilience index was computed for 83 countries, the number of countries that had data for undernourishment prevalence and the Briguglio *et al.* (2006) resilience index. The countries with the highest resilience scores are Iceland, New Zealand, United States, Denmark, Canada, Finland, Australia, Switzerland, Ireland and Austria. A Pearson rank correlation coefficient of the two indices gives a value of 0.97, thus implying the resilience index developed by Briguglio *et al.* (2006) and the adjusted resilience index computed in this study are not significantly different. It also shows that the inclusion of the prevalence of undernourishment indicator does not significantly alter the results. Indeed, the first ten placings in both indices are the same.

5. ANALYSING RISK SUFFERED BY HIGH AGRICULTURAL IMPORT ECONOMIES

This paper has developed a vulnerability and resilience framework for high agricultural import economies, based on Briguglio (2003), which makes it possible to create a methodological framework for assessing the risk of being affected by exogenous shocks, as shown in Figure 24.

Figure 24: Risk of Being Harmed by Exogenous Shocks



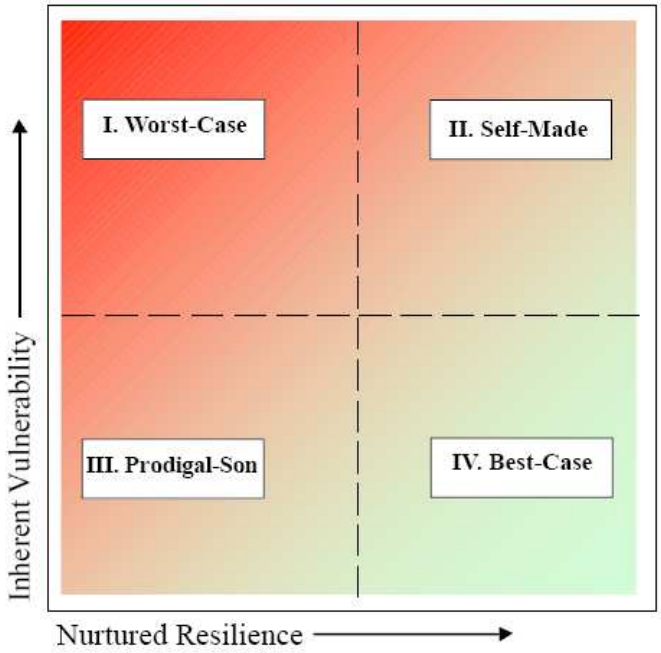
Source: Briguglio *et al.* (2006)

Figure 24 shows that such risk has two elements, the first associated with economic vulnerability and related to the inherent conditions of the country that is exposed to external shocks while the second is associated with resilience and related to the conditions developed to absorb, cope with or bounce back from adverse shocks. The risk of being adversely affected by external shocks is therefore the combination of the two elements. The negative sign in front of the resilience element indicates that the risk is reduced as resilience builds up. It should be noted that this paper considered the specific case of vulnerability resulting from high agricultural imports, rather than general economic vulnerability. However, this does not hinder the application of the above framework to this special case.

On the basis of this approach, Briguglio *et al.* (2006) identified four possible scenarios into which countries may be placed according to their vulnerability and resilience characteristics. These scenarios are termed as “best case”, “worst case”, “self made”, and “prodigal son”. The “best-case” category applies to countries that are not inherently vulnerable and which at the same time adopt resilience-building policies. The “worst-case” category refers to countries that compound the adverse effects of inherently high

vulnerability by adopting policies that run counter to economic resilience. Countries classified as "self-made" are those with a high degree of inherent economic vulnerability, but which are economically resilient through the adoption of appropriate policies that enable them to cope with or withstand the effects of their inherent vulnerability. Countries falling within the "prodigal-son" category are those with a relatively low degree of inherent economic vulnerability but whose policies are deleterious to economic resilience, thereby exposing them to the adverse effects of shocks.[1] These four scenarios are depicted in Figure 25, where the axes measure inherent economic vulnerability and nurtured resilience, respectively.

Figure 25: The Four Scenarios



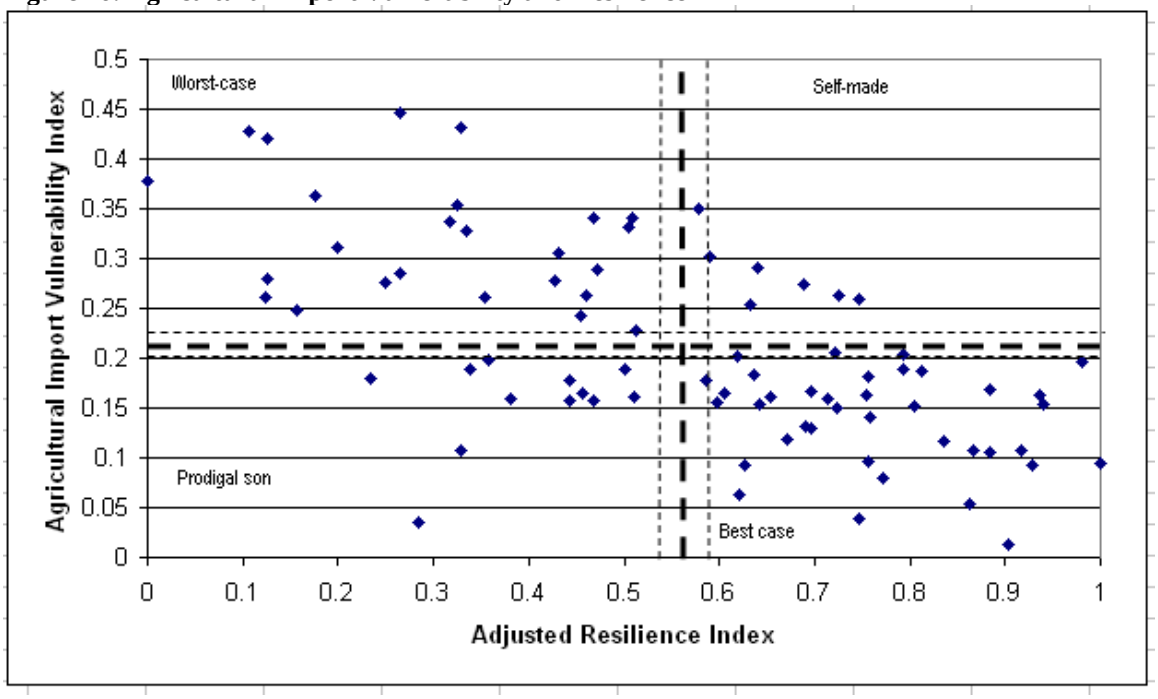
Source: Briguglio *et al.* (2006)

Using the vulnerability and resilience indices computed in this paper, it is possible to place the countries included in both indices in the four quadrants shown therein. The results are shown in Figure 26. It should be pointed out here that the cut-off values (represented by the thick dashed lines in Figure 26) chosen for the quadrants are the averages of the vulnerability and resilience scores for all countries. This decision is subjective and the classification of countries will change if different cut-off points are chosen. Consequently it was decided to allow a "borderline" margin of +/- 5% for the vulnerability and resilience indices (shown by the thin dashed lines) and countries falling within these margins are classified as "borderline" cases.

Appendix F shows the classification of countries within the different quadrants.

[1] The analogy with the prodigal son is that these countries, though "born in a good family", squander their riches.

Figure 26: Agricultural Import Vulnerability and Resilience



Appendix G provides an analysis of risk in terms of vulnerability and resilience. It shows that the countries with high risk, although displaying signs of high vulnerability also lack resilience building policies. Thus this confirms the importance of analysing risk in terms of these two important elements.

6. CONCLUSIONS AND FURTHER RESEARCH

This paper has dealt with conceptual and methodological aspects associated with agricultural import vulnerability and resilience. It also attempted to derive explanations as to why some countries have a high agricultural import content.

The vulnerability index developed here covers three aspects of agricultural import vulnerability, namely dependence on agricultural imports, agricultural import concentration and price stability of agricultural imports. It also analysed the effect of dependence on imported energy. The resilience index comprises macroeconomic stability, microeconomic efficiency, good governance, social development and prevalence of undernourishment. Each of these areas contain variables which are considered suitable to gauge the extent to which countries are exposed to shocks and the degree to which the policy framework is conducive to absorb and counteract the effects of shocks.

The vulnerability and resilience indices developed are useful to support decision making, especially for setting directions and justifying choice of priorities for resilience building. In particular they could help to disseminate information on and drawing attention to the issues of vulnerability and resilience, focus the discussion and promote the idea of integrated action.

The vulnerability to shocks to agricultural imports measure derived is quite comprehensive and correlations with economic vulnerability confirm that this is an interesting and separate subject and merits separate indicators and measurement. Further research could be directed at developing a resilience measure that is more specifically directed to these types of shocks.

The results of this research provide an analysis of the risk of a country being adversely affected by shocks to agricultural imports. It can be argued that risk is low because countries are inherently not vulnerable to shocks from agricultural imports or because they are resilient in the face of the vulnerability that they face. The observe is also true, in that countries may have a high risk to being adversely affected by external shocks because they are not sufficiently resilient.

Thus, it can be concluded that vulnerability need not necessarily lead to poverty or welfare reductions. Consideration of resilience building thus conveys the message that vulnerable states should not be complacent in the face of their vulnerability, but could, and should, adopt policy measures to enable them to improve their ability to cope with external shocks. Thus, it is not enough to identify the weaknesses – of more importance, perhaps, is to propose ways and means of overcoming such weaknesses.

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APPENDIX A: NET FOOD IMPORTERS AND NET AGRICULTURE RAW MATERIALS IMPORTERS

Country	Net Food Importers [a]	Net Agriculture Raw Materials Imports [b]	Positive deviation from world average of 1.77%
Albania	□		
Algeria	□	□	□
Antigua and Barbuda	□	□	
Armenia	□	□	
Aruba	□	□	
Austria	□		□
Azerbaijan	□		
Bahamas, The	□	□	□
Bahrain	□	□	
Bangladesh	□	□	□
Barbados	□	□	□
Belarus	□		□
Belgium		□	
Belize		□	
Benin	□		□
Botswana	□	□	
Brunei	□	□	
Burkina Faso	□		
Burundi		□	
Cambodia	□	□	□
Cape Verde	□	□	
Central African Republic	□		□
China		□	□
Croatia	□		
Cuba	□	□	
Cyprus	□	□	
Czech Republic	□	□	
Dominica	□	□	
Dominican Republic		□	□
Egypt, Arab Rep.	□	□	□
El Salvador		□	□
Estonia	□		□
Faeroe Islands		□	□
Finland	□		□
France		□	□
French Polynesia	□	□	
Gabon	□		
Gambia, The	□	□	□
Georgia	□		
Germany	□	□	

Country	Net Food Importers	Net Agriculture Raw Materials Imports	Positive deviation from world average of 1.77%
Greece	□	□	
Greenland		□	
Grenada	□	□	□
Guinea	□	□	
Hong Kong, China	□	□	
Hungary		□	
Iceland		□	□
India		□	
Iran, Islamic Rep.	□	□	
Ireland		□	
Israel	□	□	
Italy	□	□	□
Jamaica	□	□	
Japan	□	□	□
Jordan	□	□	
Kazakhstan	□		
Kiribati	□	□	
Korea, Rep.	□	□	□
Kuwait	□	□	
Kyrgyz Republic	□		□
Latvia	□		□
Lebanon	□	□	
Luxembourg	□	□	
Macao, China	□	□	
Macedonia, FYR	□	□	
Maldives	□	□	□
Mali	□		
Malta	□	□	
Mauritius		□	□
Mexico	□	□	
Moldova		□	□
Mongolia	□		
Morocco		□	□
Mozambique	□		
Namibia		□	
Nepal	□	□	□
New Caledonia	□	□	
Niger	□	□	□
Nigeria	□	□	
Norway		□	□
Oman	□	□	
Pakistan	□	□	□
Panama		□	

Country	Net Food Importers	Net Agriculture Raw Materials Imports	Positive deviation from world average of 1.77%
Philippines	□	□	
Poland		□	□
Portugal	□	□	
Qatar	□	□	
Romania	□		
Russian Federation	□		
Rwanda	□	□	□
Samoa	□	□	
Saudi Arabia	□	□	
Senegal	□	□	□
Serbia and Montenegro	□	□	□
Seychelles		□	
Sierra Leone	□	□	□
Singapore	□	□	
Slovak Republic	□		
Slovenia	□	□	□
South Asia		□	
Spain		□	
St. Kitts and Nevis	□	□	□
St. Lucia	□	□	□
St. Vincent and the Grenadines	□	□	□
Sudan	□		
Suriname	□		
Sweden	□		
Switzerland	□	□	
Syrian Arab Republic	□		□
Togo	□		
Trinidad and Tobago	□	□	
Tunisia	□	□	□
Turkey		□	□
United Arab Emirates	□	□	
United Kingdom	□	□	
United States	□	□	
Venezuela, RB	□	□	
Vietnam		□	□
Yemen, Rep.	□	□	
Zambia	□		

Source: Author's Calculations, World Development Indicators Online

[a] Calculated as the difference between food imports and exports, where food comprises the commodities in SITC sections 0 (food and live animals), 1 (beverages and tobacco), and 4 (animal and vegetable oils and fats) and SITC division 22 (oil seeds, oil nuts, and oil kernels).

[b] Calculated as the difference between agricultural raw materials imports and exports, where agricultural raw materials comprise SITC section 2 (crude materials except fuels) excluding divisions 22, 27 (crude

fertilizers and minerals excluding coal, petroleum, and precious stones), and 28 (metalliferous ores and scrap).

APPENDIX B: THE AIV INDEX – DATA AND COUNTRY RANKING RESULTS

	Agricultural Import Dependence [a]	Agricultural Import Concentration [b]	Agricultural Price Instability [c]	AIV Index [d]	Rank [e]
Albania	0.165	0.205	0.346	0.262	80
Algeria	0.109	0.290	0.424	0.329	58
Angola	0.171	0.226	0.362	0.290	70
Antigua and Barbuda	0.169	0.559	0.361	0.496	18
Argentina	0.001	0.294	0.546	0.340	54
Armenia	0.176	0.304	0.363	0.342	52
Australia	0.005	0.176	0.136	0.012	168
Austria	0.046	0.107	0.315	0.107	153
Azerbaijan	0.128	0.598	0.408	0.523	14
Bahamas	0.139	0.528	0.301	0.420	35
Bahrain	0.120	0.128	0.215	0.104	156
Bangladesh	0.097	0.208	0.410	0.261	82
Barbados	0.161	0.092	0.286	0.151	138
Belarus	0.122	0.088	0.421	0.209	100
Belgium	0.145	0.000	0.452	0.188	110
Belize	0.185	0.349	0.245	0.301	65
Benin	0.261	0.510	0.187	0.413	37
Bhutan	0.055	0.577	0.227	0.352	48
Bolivia	0.072	0.357	0.324	0.286	72
Bosnia and Herzegovina	0.321	0.105	0.415	0.341	53
Botswana	0.111	0.227	0.315	0.223	99
Brazil	0.002	0.450	0.287	0.277	75
Brunei Darussalam	0.091	0.301	0.131	0.141	144
Bulgaria	0.082	0.063	0.457	0.190	106
Burkina Faso	0.099	0.460	0.099	0.226	97
Burundi	0.120	0.674	0.350	0.530	13
Cambodia	0.142	0.935	0.000	0.488	20
Cameroon	0.062	0.401	0.332	0.311	63
Canada	0.030	0.058	0.356	0.092	159
Cape Verde	0.367	0.119	0.362	0.345	50
Central African Republic	0.050	0.366	0.510	0.394	40
Chad	0.020	0.626	0.831	0.738	4
Chile	0.029	0.216	0.470	0.262	81
China	0.035	0.189	0.356	0.177	117
Colombia	0.033	0.318	0.363	0.261	83
Comoros	0.385	0.372	0.301	0.476	22
Congo	0.180	0.213	0.264	0.225	98
Congo, Democratic Rep of	0.135	0.287	0.254	0.237	93
Costa Rica	0.076	0.318	0.340	0.273	77
Côte d'Ivoire	0.112	0.439	0.143	0.248	87

	Agricultural Import Dependence	Agricultural Import Concentration	Agricultural Price Instability	AIV Index	Rank
Croatia	0.082	0.029	0.433	0.155	135
Cyprus	0.113	0.187	0.242	0.153	137
Czech Republic	0.066	0.088	0.354	0.132	146
Denmark	0.049	0.223	0.285	0.163	128
Dominica	0.320	0.304	0.343	0.419	36
Dominican Republic	0.095	0.260	0.260	0.199	104
Ecuador	0.041	0.347	0.390	0.301	66
Egypt	0.114	0.318	0.352	0.305	64
El Salvador	0.142	0.202	0.317	0.228	96
Equatorial Guinea	0.048	0.351	0.269	0.232	95
Eritrea	0.351	1.000	0.310	0.854	3
Estonia	0.185	0.024	0.390	0.189	109
Ethiopia	0.074	0.806	0.370	0.597	7
Fiji	0.191	0.205	0.290	0.243	89
Finland	0.025	0.068	0.376	0.107	154
France	0.030	0.207	0.213	0.096	157
Gabon	0.080	0.260	0.190	0.146	142
Gambia	1.000	0.275	0.620	1.000	1
Georgia	0.229	0.426	0.461	0.513	15
Germany	0.036	0.080	0.309	0.080	162
Ghana	0.309	0.284	0.351	0.405	38
Greece	0.059	0.204	0.312	0.174	118
Guatemala	0.086	0.256	0.340	0.241	91
Guinea	0.195	0.348	0.255	0.314	62
Guinea-Bissau	0.425	0.570	0.220	0.575	9
Guyana	0.345	0.410	0.257	0.447	26
Haiti	0.305	0.394	0.322	0.453	24
Honduras	0.208	0.296	0.235	0.277	76
Hungary	0.036	0.061	0.407	0.130	147
Iceland	0.036	0.101	0.312	0.095	158
India	0.009	0.492	0.486	0.432	29
Indonesia	0.039	0.194	0.365	0.189	108
Iran, Islamic Republic of	0.044	0.164	0.341	0.158	133
Ireland	0.059	0.133	0.274	0.106	155
Israel	0.035	0.181	0.411	0.206	101
Italy	0.030	0.127	0.328	0.118	149
Jamaica	0.177	0.243	0.407	0.332	57
Japan	0.011	0.219	0.327	0.163	127
Jordan	0.300	0.232	0.325	0.351	49
Kazakhstan	0.053	0.376	0.784	0.573	10
Kenya	0.063	0.398	0.417	0.364	44
Korea, Republic of	0.025	0.222	0.434	0.240	92
Kuwait	0.061	0.219	0.255	0.149	139

	Agricultural Import Dependence	Agricultural Import Concentration	Agricultural Price Instability	AIV Index	Rank
Kyrgyzstan	0.175	0.178	0.346	0.251	86
Lao People's Democratic Rep.	0.147	0.254	0.373	0.298	67
Latvia	0.177	0.133	0.244	0.161	130
Lebanon	0.141	0.087	0.303	0.147	141
Lesotho	0.009	0.196	0.092	0.000	169
Liberia	0.538	0.440	0.180	0.539	12
Libyan Arab Jamahiriya	0.093	0.742	0.273	0.507	17
Lithuania	0.115	0.039	0.465	0.202	103
Luxembourg	0.116	0.421	0.049	0.181	113
Macedonia	0.215	0.255	0.377	0.344	51
Madagascar	0.067	0.366	0.468	0.378	41
Malawi	0.226	0.265	0.232	0.266	79
Malaysia	0.117	0.062	0.370	0.158	132
Mali	0.115	0.223	0.224	0.166	124
Malta	0.171	0.123	0.417	0.259	84
Mauritania	0.555	0.218	0.341	0.511	16
Mauritius	0.162	0.128	0.271	0.165	125
Mexico	0.036	0.188	0.331	0.161	129
Moldova, Republic of	0.316	0.232	0.126	0.237	94
Morocco	0.100	0.301	0.441	0.340	55
Mozambique	0.224	0.493	0.294	0.447	25
Namibia	0.157	0.256	0.561	0.424	33
Nepal	0.071	0.079	0.201	0.034	167
Netherlands	0.120	0.023	0.241	0.054	165
New Zealand	0.035	0.096	0.480	0.197	105
Nicaragua	0.190	0.292	0.262	0.280	74
Niger	0.146	0.414	0.128	0.245	88
Nigeria	0.080	0.377	0.406	0.355	47
Norway	0.013	0.068	0.401	0.116	150
Oman	0.122	0.204	0.208	0.149	140
Pakistan	0.055	0.716	0.199	0.421	34
Panama	0.082	0.203	0.274	0.164	126
Papua New Guinea	0.142	0.498	0.195	0.337	56
Paraguay	0.127	0.712	0.030	0.358	46
Peru	0.035	0.312	0.411	0.289	71
Philippines	0.102	0.231	0.219	0.160	131
Poland	0.029	0.009	0.358	0.062	164
Portugal	0.073	0.041	0.409	0.141	145
Qatar	0.035	0.268	0.220	0.142	143
Romania	0.057	0.153	0.389	0.189	107
Russian Federation	0.069	0.185	0.431	0.243	90
Rwanda	0.056	0.266	0.438	0.290	69
Saint Kitts and Nevis	0.251	0.300	0.512	0.479	21

	Agricultural Import Dependence	Agricultural Import Concentration	Agricultural Price Instability	AIV Index	Rank
Saint Lucia	0.276	0.605	0.343	0.580	8
Saint Vincent and Grenadines	0.336	0.239	0.405	0.427	32
Samoa	0.429	0.336	0.407	0.548	11
Saudi Arabia	0.062	0.219	0.210	0.122	148
Senegal	0.328	0.428	0.226	0.429	31
Serbia and Montenegro	0.099	0.348	0.128	0.174	119
Seychelles	0.205	0.174	0.207	0.181	114
Sierra Leone	0.387	0.260	0.231	0.364	43
Singapore	0.110	0.134	0.186	0.084	161
Slovakia	0.083	0.095	0.403	0.178	116
Slovenia	0.076	0.078	0.410	0.167	122
Solomon Islands	0.154	0.286	0.436	0.363	45
South Africa	0.021	0.174	0.249	0.092	160
Spain	0.035	0.064	0.260	0.038	166
Sri Lanka	0.120	0.249	0.452	0.328	59
Sudan	0.074	0.681	0.302	0.475	23
Suriname	0.283	0.230	0.470	0.429	30
Swaziland	0.219	0.334	0.175	0.269	78
Sweden	0.036	0.193	0.334	0.167	123
Switzerland	0.032	0.264	0.270	0.168	121
Syrian Arab Republic	0.139	0.182	0.572	0.373	42
Tajikistan	0.269	0.596	1.000	0.981	2
Tanzania, United Republic of	0.073	0.601	0.406	0.490	19
Thailand	0.041	0.260	0.246	0.157	134
Togo	0.346	0.327	0.263	0.399	39
Tonga	0.382	0.698	0.297	0.676	5
Trinidad and Tobago	0.081	0.100	0.408	0.183	112
Tunisia	0.093	0.215	0.453	0.291	68
Turkey	0.024	0.175	0.270	0.108	152
Turkmenistan	0.059	0.515	0.689	0.605	6
Uganda	0.033	0.550	0.428	0.447	27
Ukraine	0.074	0.200	0.319	0.186	111
United Arab Emirates	0.117	0.086	0.369	0.173	120
United Kingdom	0.036	0.235	0.351	0.204	102
United States of America	0.000	0.197	0.347	0.154	136
Uruguay	0.069	0.072	0.560	0.253	85
Uzbekistan	0.040	0.283	0.477	0.315	61
Vanuatu	0.116	0.443	0.188	0.282	73
Venezuela, Bolivarian Republic of	0.033	0.168	0.383	0.179	115
Viet Nam	0.095	0.247	0.135	0.113	151
Yemen	0.264	0.336	0.393	0.436	28
Zambia	0.068	0.177	0.174	0.077	163
Zimbabwe	0.066	0.438	0.310	0.323	60

[a] The agricultural import dependence sub-index is the ratio of agricultural imports as a percentage of GDP for the period 2001 to 2005. Data for agricultural imports was obtained from FAO, while GDP data was obtained from the World Bank.
[b] The agricultural import concentration sub-index consists of a Herfindahl-Hirschman concentration index computed by the author. Data for the components was obtained from FAO and the period analysed is 2001 to 2005.
[c] The agricultural price instability sub-index utilizes price instability data from UNCTAD and agricultural import data from FAO. The index was computed by the author for the period 2002 to 2004.
[d] The AIV index is the simple average of the three indices in the previous three columns.
[e] The rank shows the agricultural import vulnerability in descending order. Thus, 1 represents the country with the highest agricultural import vulnerability.

APPENDIX C: THE EAIV INDEX – DATA AND COUNTRY RANKING RESULTS

	Fuel Import Dependence [a]	EAIV Index [b]	Rank [c]
Albania	0.016	0.344	35
Algeria	0.001	0.340	37
Angola	0.001	0.364	33
Argentina	0.004	0.252	61
Armenia	0.018	0.419	26
Australia	0.002	0.000	125
Austria	0.021	0.117	111
Azerbaijan	0.004	0.517	15
Bahrain	0.003	0.173	89
Bangladesh	0.008	0.277	51
Belarus	0.047	0.275	53
Belgium	0.028	0.268	57
Benin	0.009	0.553	11
Bolivia	0.003	0.277	52
Bosnia and Herzegovina	0.009	0.538	13
Botswana	0.011	0.263	58
Brazil	0.007	0.212	72
Brunei	0.000	0.180	85
Bulgaria	0.012	0.207	77
Cameroon	0.003	0.514	16
Canada	0.004	0.081	120
Chile	0.020	0.223	68
China	0.006	0.156	96
Colombia	0.002	0.220	70
Congo, Rep.	0.000	0.322	42
Congo, Dem. Rep.	0.006	0.296	47
Costa Rica	0.014	0.274	54
Cote d'Ivoire	0.006	0.288	50
Croatia	0.015	0.180	86
Cyprus	0.186	0.294	49
Czech Republic	0.008	0.147	102
Denmark	0.004	0.158	94
Dominican Republic	0.033	0.242	65
Ecuador	0.002	0.259	59
Egypt, Arab Rep.	0.005	0.329	41
El Salvador	0.012	0.295	48
Estonia	0.009	0.296	46
Ethiopia	0.007	0.533	14
Finland	0.015	0.093	116
France	0.013	0.094	115
Gabon	0.000	0.173	90

	Fuel Import Dependence	EAIV Index	Rank
Georgia	0.013	0.599	6
Germany	0.017	0.084	118
Ghana	0.009	0.583	8
Greece	0.019	0.182	84
Guatemala	0.009	0.255	60
Haiti	0.008	0.620	4
Honduras	0.014	0.396	29
Hungary	0.016	0.121	110
Iceland	0.009	0.092	117
India	0.008	0.338	38
Indonesia	0.004	0.168	92
Iran, Islamic Rep.	0.003	0.148	101
Ireland	0.056	0.145	103
Israel	0.128	0.236	66
Italy	0.042	0.121	109
Jamaica	0.056	0.428	25
Japan	0.037	0.139	105
Jordan	0.138	0.593	7
Kazakhstan	0.003	0.479	18
Kenya	0.008	0.332	40
Korea, Rep.	0.037	0.211	74
Kuwait	0.001	0.157	95
Kyrgyz Republic	0.013	0.342	36
Latvia	0.014	0.274	55
Lebanon	0.165	0.301	44
Libya	0.001	0.477	19
Lithuania	0.011	0.245	64
Luxembourg	0.461	0.457	21
Macedonia, FYR	0.011	0.451	22
Malaysia	0.004	0.211	75
Mexico	0.004	0.143	104
Moldova	0.263	0.581	9
Morocco	0.117	0.396	28
Mozambique	0.006	0.544	12
Namibia	0.027	0.467	20
Nepal	0.007	0.076	122
Netherlands	0.008	0.134	107
New Zealand	0.008	0.169	91
Nicaragua	0.011	0.381	31
Nigeria	0.003	0.337	39
Norway	0.000	0.082	119
Oman	0.001	0.211	73
Pakistan	0.008	0.378	32

	Fuel Import Dependence	EAIV Index	Rank
Panama	0.023	0.197	81
Paraguay	0.004	0.393	30
Peru	0.008	0.246	62
Philippines	0.012	0.207	76
Poland	0.007	0.057	123
Portugal	0.044	0.175	88
Qatar	0.001	0.129	108
Romania	0.008	0.184	83
Russian Federation	0.003	0.235	67
Saudi Arabia	0.001	0.137	106
Senegal	0.015	0.626	3
Serbia and Montenegro	0.009	0.217	71
Singapore	1.000	0.626	2
Slovak Republic	0.018	0.203	78
Slovenia	0.013	0.185	82
South Africa	0.005	0.077	121
Spain	0.027	0.055	124
Sri Lanka	0.012	0.353	34
Sudan	0.004	0.434	24
Sweden	0.010	0.151	100
Switzerland	0.015	0.153	97
Syrian Arab Republic	0.003	0.398	27
Tajikistan	0.014	1.000	1
Tanzania	0.007	0.443	23
Thailand	0.012	0.151	99
Togo	0.008	0.613	5
Trinidad and Tobago	0.002	0.198	80
Tunisia	0.008	0.297	45
Turkey	0.021	0.100	114
Turkmenistan	0.001	0.513	17
Ukraine	0.012	0.201	79
United Arab Emirates	0.001	0.221	69
United Kingdom	0.006	0.179	87
United States	0.009	0.108	113
Uruguay	0.016	0.245	63
Uzbekistan	0.006	0.269	56
Venezuela, RB	0.001	0.152	98
Vietnam	0.005	0.163	93
Yemen, Rep.	0.001	0.563	10
Zambia	0.007	0.109	112
Zimbabwe	0.007	0.305	43

[a] The fuel import dependence sub-index is the ratio of energy imports to energy production. Data pertains to the period 2001 to 2005 and was obtained from the World Bank. Energy imports are estimated as energy

use less production, while energy production refers to forms of primary energy, namely petroleum, natural gas, solid fuels, and combustible renewables and waste.

[b] The HAIV index is the AIV index adjusted for fuel import dependence.

[c] The rank shows the agricultural import vulnerability in descending order. Thus, 1 represents the country with the highest agricultural import vulnerability.

APPENDIX D: THE BRIGUGLIO AND GALEA VULNERABILITY INDEX

	Economic Vulnerability Index	Rank
Albania	0.263	74
Argentina	0.077	108
Armenia	0.531	26
Australia	0.141	98
Austria	0.166	94
Azerbaijan	0.447	39
Bangladesh	0.240	78
Barbados	0.549	24
Belarus	0.488	32
Belgium	0.294	66
Belize	0.588	19
Bolivia	0.229	81
Brazil	0.001	113
Cameroon	0.304	64
Canada	0.089	105
Cape Verde	0.950	2
Chile	0.290	67
China, P.R.: Mainland	0.000	114
Colombia	0.194	89
Congo, Republic Of	0.654	14
Costa Rica	0.334	59
Cote D'ivoire	0.401	46
Croatia	0.368	51
Cyprus	0.643	16
Czech Republic	0.236	79
Denmark	0.311	63
Dominica	0.588	19
Ecuador	0.345	57
Egypt	0.504	30
El Salvador	0.277	71
Estonia	0.695	12
Ethiopia	0.543	25
Finland	0.219	86
France	0.099	104
Gambia	0.708	9
Germany	0.076	109
Ghana	0.420	41
Greece	0.501	31
Guatemala	0.211	87
Guyana	0.605	18
Honduras	0.409	44
Hungary	0.225	83
Iceland	0.465	36

	Economic Vulnerability Index	Rank
India	0.154	97
Indonesia	0.133	102
Iran, Islamic Rep	0.389	48
Ireland	0.284	68
Israel	0.339	58
Italy	0.062	110
Jamaica	0.706	10
Japan	0.081	106
Jordan	0.555	22
Kazakhstan	0.327	60
Kenya	0.391	47
Korea	0.225	83
Kuwait	0.560	21
Kyrgyz Republic	0.526	27
Latvia	0.550	23
Lithuania	0.357	53
Luxembourg	0.471	35
Macedonia, Fyr	0.296	65
Madagascar	0.356	54
Malaysia	0.449	38
Malta	0.765	4
Mauritania	0.725	7
Mauritius	0.484	33
Mexico	0.035	112
Moldova	0.794	3
Morocco	0.208	88
Nepal	0.250	76
Netherlands	0.279	69
New Zealand	0.245	77
Nicaragua	0.442	40
Niger	0.484	33
Nigeria	0.518	29
Norway	0.416	42
Oman	0.413	43
Pakistan	0.267	73
Panama	0.640	17
Papua New Guinea	0.389	48
Paraguay	0.227	82
Peru	0.186	91
Philippines	0.371	50
Poland	0.134	101
Portugal	0.185	92
Romania	0.158	96
Russia	0.184	93
Senegal	0.355	56

	Economic Vulnerability Index	Rank
Seychelles	1.000	1
Singapore	0.743	6
Slovak Republic	0.273	72
Slovenia	0.235	80
South Africa	0.113	103
Spain	0.192	90
Sri Lanka	0.318	62
St. Kitts and Nevis	0.685	13
St. Lucia	0.765	4
St. Vincent & Grenadines	0.647	15
Sudan	0.260	75
Suriname	0.724	8
Sweden	0.159	95
Switzerland	0.136	100
Tanzania	0.368	51
Thailand	0.278	70
Togo	0.704	11
Trinidad And Tobago	0.408	45
Tunisia	0.326	61
Turkey	0.140	99
Uganda	0.457	37
United Kingdom	0.081	106
United States	0.046	111
Uruguay	0.221	85
Venezuela	0.356	54
Yemen, Republic Of	0.526	27

Source: Briguglio and Galea (2003)

APPENDIX E: THE BRIGUGLIO ET AL. (2006) RESILIENCE INDEX AND THE ADJUSTED RESILIENCE INDEX – DATA AND COUNTRY RANKING RESULTS

	Macroeconomic stability	Microeconmic efficiency	Good governance	Social development	Resilience Index	Undernourishment [a]	Adjusted Resilience Index [b]	Resilience Index Rank	Adjusted Resilience Index Rank
Albania	0.250	0.387	0.411	0.765	0.453	0.901	0.460	60	55
Argentina	0.534	0.259	0.227	0.868	0.472	0.993	0.509	56	49
Australia	0.472	0.800	0.971	0.988	0.808	1.000	0.903	7	7
Austria	0.693	0.531	0.928	0.956	0.777	1.000	0.867	10	10
Bangladesh	0.635	0.305	0.174	0.223	0.334	0.225	0.123	77	81
Barbados	0.632	0.627	0.722	0.915	0.724	1.000	0.805	15	15
Belgium	0.661	0.474	0.800	0.982	0.729	1.000	0.812	14	14
Belize	0.186	0.671	0.607	0.754	0.554	0.944	0.591	47	44
Bolivia	0.468	0.360	0.174	0.619	0.405	0.423	0.264	67	73
Brazil	0.388	0.210	0.423	0.721	0.436	0.859	0.427	63	61
Cameroon	0.443	0.451	0.344	0.232	0.368	0.352	0.199	73	76
Canada	0.633	0.798	0.910	0.977	0.829	1.000	0.928	5	5
Chile	0.636	0.562	0.611	0.859	0.667	0.958	0.726	26	25
China	0.653	0.095	0.468	0.704	0.480	0.732	0.442	54	58
Colombia	0.417	0.273	0.220	0.754	0.416	0.690	0.355	65	64
Costa Rica	0.609	0.470	0.623	0.853	0.639	0.944	0.689	29	32
Cote d'Ivoire	0.422	0.327	0.237	0.000	0.246	0.690	0.157	83	78
Croatia	0.524	0.516	0.451	0.824	0.579	0.873	0.599	38	43
Cyprus	0.360	0.407	0.687	0.886	0.585	1.000	0.643	36	35
Czech Republic	0.571	0.444	0.631	0.856	0.626	1.000	0.690	33	31
Denmark	0.716	0.682	1.000	0.944	0.836	1.000	0.936	4	4
Dominican Republic	0.657	0.470	0.305	0.654	0.521	0.282	0.359	50	63
Egypt, Arab Rep.	0.588	0.151	0.403	0.504	0.412	0.972	0.432	66	60
El Salvador	0.655	0.485	0.351	0.645	0.534	0.761	0.513	49	47
Estonia	0.635	0.705	0.673	0.850	0.716	0.993	0.794	16	16
Finland	0.638	0.671	0.997	0.971	0.819	1.000	0.917	6	6
France	0.494	0.526	0.744	0.962	0.681	1.000	0.756	21	21
Germany	0.551	0.349	0.932	0.947	0.695	1.000	0.771	18	18
Honduras	0.425	0.388	0.157	0.584	0.389	0.437	0.249	69	74
Hungary	0.435	0.598	0.656	0.830	0.630	1.000	0.695	32	30
Iceland	0.722	0.912	0.960	0.968	0.890	1.000	1.000	1	1
India	0.501	0.309	0.555	0.396	0.440	0.507	0.330	62	67
Indonesia	0.420	0.060	0.285	0.633	0.350	0.901	0.339	75	65
Iran, Islamic Rep.	0.595	0.000	0.555	0.630	0.445	0.958	0.467	61	54
Ireland	0.748	0.632	0.855	0.927	0.790	1.000	0.883	9	9
Israel	0.599	0.348	0.730	0.933	0.652	1.000	0.722	27	27

Italy	0.564	0.277	0.669	0.930	0.610	1.000	0.672	34	33
	Macroeconomic stability	**Microeconmic efficiency**	**Good governance**	**Social development**	**Resilience Index**	**Undernourishment**	**Adjusted Resilience Index**	**Resilience Index Rank**	**Adjusted Resilience Index Rank**
Jamaica	0.404	0.413	0.468	0.783	0.517	0.803	0.506	51	50
Japan	0.473	0.530	0.745	0.974	0.681	1.000	0.755	22	22
Jordan	0.388	0.480	0.637	0.727	0.558	0.887	0.579	46	46
Kenya	0.489	0.471	0.283	0.299	0.385	0.197	0.175	70	77
Kuwait	0.579	0.656	0.705	0.748	0.672	0.930	0.724	25	26
Latvia	0.523	0.490	0.555	0.824	0.598	0.986	0.654	35	34
Lithuania	0.548	0.391	0.471	0.848	0.564	1.000	0.619	44	41
Luxembourg	0.170	0.752	0.910	0.894	0.682	1.000	0.756	20	20
Madagascar	0.362	0.266	0.256	0.255	0.285	0.000	0.000	81	83
Malaysia	0.732	0.493	0.625	0.748	0.649	0.986	0.714	28	28
Malta	0.484	0.631	0.708	0.871	0.674	1.000	0.747	23	23
Mauritius	0.602	0.371	0.625	0.701	0.575	0.915	0.606	41	42
Mexico	0.607	0.281	0.294	0.777	0.490	0.930	0.511	53	48
Morocco	0.496	0.373	0.566	0.405	0.460	0.901	0.468	58	53
Nepal	0.492	0.458	0.310	0.261	0.380	0.592	0.284	71	71
Netherlands	0.483	0.656	0.971	0.979	0.772	1.000	0.862	11	11
New Zealand	0.690	0.882	0.951	0.974	0.874	1.000	0.981	2	2
Nicaragua	0.024	0.486	0.187	0.566	0.316	0.310	0.126	79	79
Nigeria	0.472	0.509	0.219	0.232	0.358	0.817	0.324	74	69
Norway	0.557	0.550	0.910	0.982	0.750	1.000	0.835	12	12
Pakistan	0.395	0.414	0.148	0.205	0.291	0.408	0.126	80	80
Panama	0.582	0.536	0.384	0.806	0.577	0.394	0.457	40	56
Paraguay	0.578	0.164	0.106	0.730	0.395	0.648	0.317	68	70
Peru	0.568	0.401	0.316	0.739	0.506	0.732	0.473	52	52
Philippines	0.451	0.388	0.285	0.771	0.474	0.549	0.381	55	62
Poland	0.569	0.304	0.520	0.874	0.567	1.000	0.622	43	40
Portugal	0.595	0.458	0.768	0.915	0.684	1.000	0.759	19	19
Romania	0.388	0.290	0.409	0.765	0.463	1.000	0.500	57	51
Russian Federation	0.517	0.092	0.348	0.751	0.427	0.986	0.454	64	57
Senegal	0.403	0.225	0.342	0.067	0.260	0.465	0.106	82	82
Slovak Republic	0.446	0.446	0.536	0.830	0.564	0.887	0.586	45	45
Slovenia	0.660	0.308	0.664	0.903	0.634	0.986	0.696	31	29
South Africa	0.576	0.600	0.664	0.446	0.571	1.000	0.627	42	39
Spain	0.545	0.556	0.625	0.968	0.673	1.000	0.746	24	24
Sri Lanka	0.318	0.407	0.356	0.751	0.458	0.451	0.334	59	66
Sweden	0.474	0.574	0.949	1.000	0.749	1.000	0.835	13	13
Switzerland	0.557	0.744	0.912	0.950	0.791	1.000	0.883	8	8
Thailand	0.399	0.473	0.582	0.733	0.547	0.465	0.442	48	59
Trinidad and Tobago	0.641	0.562	0.557	0.780	0.635	0.775	0.636	30	37

Tunisia	0.511	0.484	0.683	0.651	0.582	1.000	0.640	37	36
Turkey	0.000	0.213	0.391	0.674	0.320	0.986	0.329	78	68
	Macroeconomic stability	**Microeconmic efficiency**	**Good governance**	**Social development**	**Resilience Index**	**Undernourishment**	**Adjusted Resilience Index**	**Resilience Index Rank**	**Adjusted Resilience Index Rank**
Uganda	0.516	0.424	0.370	0.199	0.377	0.535	0.264	72	72
United Kingdom	0.062	0.844	0.977	0.971	0.714	1.000	0.793	17	17
United States	0.646	0.907	0.860	0.944	0.839	1.000	0.940	3	3
Uruguay	0.523	0.376	0.537	0.874	0.577	0.993	0.632	39	38
Venezuela, RB	0.511	0.091	0.000	0.777	0.345	0.563	0.235	76	75

Source: Briguglio *et al.* (2006), FAO, Author's calculations.

[a] Prevalence of undernourishment (% of population): Population below minimum level of dietary energy consumption (also referred to as prevalence of undernourishment) shows the percentage of the population whose food intake is insufficient to meet dietary energy requirements continuously. Data was obtained from FAO for the period 2003 to 2004. An index value of 1 shows that the prevalence of undernourishment is very low, while an value of 0 shows that prevalence of undernourishment is very high.

[b] The adjusted resilience index is the simple average of the 5 components: macroeconomic stability, microeconomic efficiency, good governance, social development and undernourishment.

APPENDIX F: THE FOUR COUNTRY CATEGORIES

	Adjusted Resilience Index	AIV Index	Country Categories		Adjusted Resilience Index	AIV Index	Country Categories
Australia	0.903	0.012	Best-case	China	0.442	0.177	Prodigal son
Austria	0.867	0.107	Best-case	Dominican Republic	0.359	0.199	Prodigal son
Barbados	0.805	0.151	Best-case	Indonesia	0.339	0.189	Prodigal son
Belgium	0.812	0.188	Best-case	Iran, Islamic Rep.	0.467	0.158	Prodigal son
Canada	0.928	0.092	Best-case	Mexico	0.511	0.161	Prodigal son
Croatia	0.599	0.155	Best-case	Nepal	0.284	0.034	Prodigal son
Cyprus	0.643	0.153	Best-case	Panama	0.457	0.164	Prodigal son
Czech Republic	0.690	0.132	Best-case	Philippines	0.381	0.160	Prodigal son
Denmark	0.936	0.163	Best-case	Romania	0.500	0.189	Prodigal son
Estonia	0.794	0.189	Best-case	Thailand	0.442	0.157	Prodigal son
Finland	0.917	0.107	Best-case	Turkey	0.329	0.108	Prodigal son
France	0.756	0.096	Best-case	Venezuela, RB	0.235	0.179	Prodigal son
Germany	0.771	0.080	Best-case	Belize	0.591	0.301	Self-made
Hungary	0.695	0.130	Best-case	Chile	0.726	0.262	Self-made
Iceland	1.000	0.095	Best-case	Costa Rica	0.689	0.273	Self-made
Ireland	0.883	0.106	Best-case	Jordan	0.579[2]	0.351	Self-made
Israel	0.722	0.206[3]	Best-case	Malta	0.747	0.259	Self-made
Italy	0.672	0.118	Best-case	Tunisia	0.640	0.291	Self-made
Japan	0.755	0.163	Best-case	Uruguay	0.632	0.253	Self-made
Kuwait	0.724	0.149	Best-case	Albania	0.460	0.262	Worst-case
Latvia	0.654	0.161	Best-case	Argentina	0.509	0.340	Worst-case
Lithuania	0.619	0.202[3]	Best-case	Bangladesh	0.123	0.261	Worst-case
Luxembourg	0.756	0.181	Best-case	Bolivia	0.264	0.286	Worst-case
Malaysia	0.714	0.158	Best-case	Brazil	0.427	0.277	Worst-case
Mauritius	0.606	0.165	Best-case	Cameroon	0.199	0.311	Worst-case
Netherlands	0.862	0.054	Best-case	Colombia	0.355	0.261	Worst-case
New Zealand	0.981	0.197	Best-case	Cote d'Ivoire	0.157	0.248	Worst-case
Norway	0.835	0.116	Best-case	Egypt, Arab Rep.	0.432	0.305	Worst-case
Poland	0.622	0.062	Best-case	El Salvador	0.513	0.228	Worst-case
Portugal	0.759	0.141	Best-case	Honduras	0.249	0.277	Worst-case
Slovak Republic	0.586[1]	0.178	Best-case	India	0.330	0.432	Worst-case
Slovenia	0.696	0.167	Best-case	Jamaica	0.506	0.332	Worst-case
South Africa	0.627	0.092	Best-case	Kenya	0.175	0.364	Worst-case
Spain	0.746	0.038	Best-case	Madagascar	0.000	0.378	Worst-case
Switzerland	0.883	0.168	Best-case	Morocco	0.468	0.340	Worst-case
Trinidad and Tobago	0.636	0.183	Best-case	Nicaragua	0.126	0.280	Worst-case
United Kingdom	0.793	0.204[3]	Best-case	Nigeria	0.324	0.355	Worst-case
United States	0.940	0.154	Best-case	Pakistan	0.126	0.421	Worst-case
				Paraguay	0.317	0.337	Worst-case
				Peru	0.473	0.289	Worst-case
				Russian Federation	0.454	0.243	Worst-case
				Senegal	0.106	0.429	Worst-case
				Sri Lanka	0.334	0.328	Worst-case

Uganda	0.264	0.447	Worst-case

[1] Borderline with “prodigal son”
[2] Borderline with “worst case”
[3] Borderline with “self made”

APPENDIX G: ANALYSING RISK IN TERM IS VULNERABILITY AND RESILIENCE

	Standardised AIV Index	StandardisedAdjusted Resilience Index	Standardised Risk Index	Risk Rank		Standardised AIV Index	StandardisedAdjusted Resilience Index	Standardised Risk Index	Risk Rank
Albania	0.576	0.460	0.580	25	Kuwait	0.315	0.724	0.282	60
Argentina	0.755	0.509	0.655	17	Latvia	0.342	0.654	0.337	51
Australia	0.000	0.903	0.000	82	Lithuania	0.436	0.619	0.411	44
Austria	0.219	0.867	0.145	75	Luxembourg	0.388	0.756	0.305	55
Bangladesh	0.573	0.123	0.771	10	Madagascar	0.842	0.000	0.994	2
Barbados	0.321	0.805	0.239	66	Malaysia	0.337	0.714	0.299	56
Belgium	0.404	0.812	0.282	58	Malta	0.568	0.747	0.413	43
Belize	0.666	0.591	0.557	27	Mauritius	0.352	0.606	0.370	48
Bolivia	0.630	0.264	0.723	14	Mexico	0.343	0.511	0.419	42
Brazil	0.610	0.427	0.619	22	Morocco	0.755	0.468	0.678	16
Cameroon	0.688	0.199	0.793	8	Nepal	0.051	0.284	0.382	46
Canada	0.184	0.928	0.091	79	Netherlands	0.097	0.862	0.079	80
Chile	0.575	0.726	0.429	41	New Zealand	0.425	0.981	0.198	69
China	0.380	0.442	0.479	33	Nicaragua	0.616	0.126	0.794	7
Colombia	0.572	0.355	0.638	20	Nigeria	0.788	0.324	0.779	9
Costa Rica	0.601	0.689	0.464	35	Norway	0.239	0.835	0.175	72
Cote d'Ivoire	0.543	0.157	0.735	13	Pakistan	0.940	0.126	0.978	3
Croatia	0.328	0.599	0.360	49	Panama	0.349	0.457	0.453	37
Cyprus	0.324	0.643	0.333	52	Paraguay	0.748	0.317	0.760	11
Czech Republic	0.275	0.690	0.278	61	Peru	0.636	0.473	0.608	23
Denmark	0.346	0.936	0.179	71	Philippines	0.339	0.381	0.491	32
Dominican Republic	0.430	0.359	0.555	28	Poland	0.115	0.622	0.226	67
Egypt, Arab Rep.	0.674	0.432	0.652	18	Portugal	0.297	0.759	0.251	65
El Salvador	0.497	0.513	0.505	31	Romania	0.407	0.500	0.461	36
Estonia	0.406	0.794	0.294	57	Russian Federation	0.531	0.454	0.558	26
Finland	0.219	0.917	0.117	78	Senegal	0.958	0.106	1.000	1
France	0.194	0.756	0.195	70	Slovak Republic	0.382	0.586	0.398	45
Germany	0.157	0.771	0.165	74	Slovenia	0.357	0.696	0.322	53
Honduras	0.609	0.249	0.720	15	South Africa	0.184	0.627	0.262	64
Hungary	0.270	0.695	0.272	62	Spain	0.060	0.746	0.124	77
Iceland	0.191	1.000	0.054	81	Sri Lanka	0.728	0.334	0.739	12
India	0.965	0.330	0.877	5	Switzerland	0.360	0.883	0.216	68
Indonesia	0.406	0.339	0.553	29	Thailand	0.333	0.442	0.453	39
Iran, Islamic Rep.	0.336	0.467	0.440	40	Trinidad and Tobago	0.394	0.636	0.377	47
Ireland	0.216	0.883	0.134	76	Tunisia	0.641	0.640	0.515	30
Israel	0.447	0.722	0.358	50	Turkey	0.220	0.329	0.453	38
Italy	0.244	0.672	0.271	63	Uganda	1.000	0.264	0.934	4
Jamaica	0.735	0.506	0.645	19	United	0.440	0.793	0.314	54

					Kingdom				
Japan	0.347	0.755	0.282	59	United States	0.327	0.940	0.165	73
Jordan	0.779	0.579	0.629	21	Uruguay	0.554	0.632	0.470	34
Kenya	0.809	0.175	0.876	6	Venezuela, RB	0.384	0.235	0.600	24