Food Policy 35 (2010) 565–575

Contents lists available at ScienceDirect

Food Policy

journal homepage: www.elsevier.com/locate/foodpol

Risk management and finance along value chains of Small Island Developing States. Evidence from the Caribbean and the Pacific

Federica Angelucci *, Piero Conforti

Trade and Markets Division, Food and Agriculture Organization of the United Nations (FAO), Viale delle Terme di Caracalla, 00153 Rome, Italy

ARTICLE INFO

Article history:
Received 30 July 2009
Received in revised form 9 June 2010
Accepted 2 July 2010

Keywords:
The Caribbean
Pacific region
Fruits
Vegetables and spices value chain
Risk management
Finance

ABSTRACT

The paper analyses agricultural risks and risk management in selected Small Island Developing States which are part of the African Caribbean Pacific country group. Focus is on the value chains of fruits, vegetables and spices. A survey was conducted in Grenada, Jamaica, Fiji and Vanuatu, aimed at identifying sources of risk which are most important to value chain stakeholders; the nature and quality of existing and potential risk management mechanisms; and the possibility of enhancing them in view of improving the functioning of the value chains. The sample included farmers, processors, traders, retailers, extension agents, Government officials and private services providers. Results reveal limited ability to handle price and production variability, due to lack of both horizontal and vertical co-ordination along value chains, reduced use of support services, notably credit and underinvestment in equipment. In addition, lack of demand contributes to make insurance markets incomplete and characterised by undersupply or lack of customised products. Promoting light forms of vertical and horizontal co-ordination, such as production contracts and producers' associations, as well as value chain-based credit and finance may address some of the issues highlighted.

Introduction

Diversifying agriculture and supporting business development is the centrepiece of a number of rural development programmes in several countries and in many Small Island Developing States (SIDS) belonging to the African Caribbean Pacific (ACP) group. In these countries, long standing efforts are underway to overcome the economic regime shaped by trade preferences and promote an increased integration of agriculture into wider business chains. Taking a value chain perspective implies looking holistically at all activities leading from primary production to consumption. Value chains have been recognized as effective entry points to support small holder farmers, and promote their incomes through better market integration and value addition.

The development of value chains in SIDS can be hindered by several constraints: thin domestic market, scarce natural resources and high level of strategic imports such as food and fuel; inability to influence international prices; uncertainty of supply due to remoteness and insularity; lack of economies of scale and vulnerability to natural disasters (Briguglio, 2003; Commonwealth Secretariat, 2000). Despite differences among countries, most SIDS are characterised by high transaction and communication costs that may prevent a full use of potential comparative advantages (Winters and Martins, 2004; FAO, 2005; IFC, 2009)[1]. Vulnerability to natural disasters is also more significant in SIDS compared to other countries, especially in terms of potential damage per unit of area and, due to the small size of the territory and high recovery costs per capita which may impact negatively on the economic resilience in the aftermath of a disaster.

Increasingly complex value chains entail both increased opportunities and risks for the economic agents involved – we shall refer to them as stakeholders – and especially for farmers, which are normally more numerous and physically more dispersed. They often operate on a relatively small scale and tend to be among the most vulnerable in the value chain. Common risk sources that can affect farmers and other stakeholders include price, production and personal risks. These can produce permanent negative effects on revenues, as well as hinder the organization of value chains: in the absence of appropriate mitigation and management tools, risky events can disrupt business relationships that may take a long time to rebuild.

To further complicate matters, risks can affect stakeholders along the value chains in different ways and to different extents.

* Corresponding author. Tel.: 39 06 5705 3720; fax: +39 06 5705 4495.
E-mail addresses: federica.angelucci@fao.org (F. Angelucci), piero.conforti@fao.org (P. Conforti).

[1] According to the IFC (2009), SIDS rank 89th in terms of the ease of doing business out of a list of 181 economies. Ranking is based on 10 indicators of business regulation.

0306-9192/$ - see front matter © 2010 200x Food and Agriculture Organization of the United Nations. Published by Elsevier Ltd. All rights reserved.
doi:10.1016/j.foodpol.2010.07.001

A production loss experienced by farmers may not be a problem for processors, as long as they can source raw agricultural products elsewhere. In fact, value chains normally incorporate more or less formal and effective arrangements aimed at managing risks, which are also defined by the institutional environment. Policies too can be ultimately conceived as tools to manage risks, typical examples being protection, subsidies or price stabilisation for farmers.

This paper aims at shedding light on risks and risk management mechanisms in selected SIDS which are part of the ACP country group. Specifically, those that are striving to diversify their agriculture, are switching from the traditional agricultural economy based on sugar and bananas, or that are driven by trade preferences, to the development of more complex value chains such as those based on other fruits, vegetables and spices.

Reviewing risk management mechanisms was identified as an important element of this process. Participatory processes undertaken within the All ACP Agricultural Commodity Programme (AAACP), financed by the EU, highlighted that several difficulties encountered by farmers and other stakeholders in organizing production and marketing along value chains and maintaining organizations through time can be framed as risks, and possible solutions as risk management mechanisms. Consequently, an exploratory survey was organized on risks and risk management along value chains in selected SIDS countries.

Primary information was collected in Grenada, Jamaica, Fiji and Vanuatu on risk considered in a broad sense, taking into account simultaneously elements that contribute to shape it along value chains. Policies and access to credit were considered as factors affecting farmers' and other stakeholders' ability to cope with expected price variability, along with technical capabilities, the availability of expertise and advice and the participation in associations, commodity groups and other more or less formal organizations.

The next section offers a review of the basic concepts employed in the paper concerning risks and risk management along value chains, and discusses risk layering. The following section describes the survey and the methods applied to analyse the data collected, while the results of the analysis are illustrated in the fourth section. The last section concludes and discusses areas for further investigation and action.

Conceptualizing and assessing risk management along a value chain

Risks affecting agri-businesses activity can be classified according to different criteria; the following six categories are frequently referred to in the literature (Eeckhoudt et al., 1992; European Commission, 2001; Hardaker et al., 2004).

Price risk, arising from sudden unanticipated changes in input and/or output prices; it can affect one or more stakeholders depending on its origin[2].

- Production or yield risks, mostly arising from natural hazards which affect crops quantity and/or quality; all stakeholders are exposed to such risks.
- Asset risks, arising from theft, fire or other loss and damage of equipment, buildings and other productive assets for agriculture, processing or trading.
- Institutional risk, resulting from changes in national and international policies or in the concentration of market power along a value chain.
- Financial risk, arising from unexpected changes in the cost of capital, exchange rate fluctuations or disruptions in the ability to access credit and/or equity losses.
- Human or personal risk, due to death, illness or injury of the labour force.

Value chains can be conceived as networks that support three types of flows: physical, financial and informational. These are responsible for movements of physical products, payments and lending arrangements, and for co-ordination among physical and financial flows. Hence, value chains interact with markets and consumers in order to extract revenues from sales of products (Khan and Burnes, 2007).

Risks and their management are more complex along a value chain than for an individual agent. Risk transmission along a value chain has not yet been fully explored. The Commodity Risk Management Group of the World Bank has recently proposed an operational framework to assess risks in an agri-food chains (CRMG, 2007). Risk and vulnerability are framed in a system approach, which takes into account exposure, potential losses and options for risk management as well as relations with markets outside the chain by both individual stakeholders and groups.

The CRMG (2007) framework borrows extensively from the literature on vulnerability. Risks are mostly related to the chain as a whole, with limited attention to its distribution among stakeholders. However, risks are also shaped by the way in which transactions are organized along the chain, within the continuum that extends from spot markets, on the one hand, to full vertical integration, on the other. In turn, the organization of transaction stems from the associated costs which are attached to flows along the chains.

The technical characteristics of production play a significant part in the organization of flows. Storable products such as grains, for instance, can resort to organized markets and hedge risks through forward and option contracts (Glover, 1994). More generally, the range of price risk management tools widens when storage is possible. Warehouse receipts, for instance, provide another means to convert inventories into readily tradable assets. They are directly negotiable, and can be traded, sold, swapped, used as collateral to support borrowing or accepted for delivery against a derivative instrument such as futures, or traded in a commodity exchange (Lacroix and Varangis, 1996).

Transaction costs embedded in perishable products, instead, call for a more complex setup. There are clear incentives to organize and pre-determine transactions, in order to reduce the associated costs, for instance through contracts (Minten et al., 2006)[3]. Contracts are in fact an intermediate term between full vertical integration and spot markets. Farmers and buyers resort frequently to contracts as mechanisms to transfer and share risk (da Silva, 2005). The more products become specialised, and the more they involve high unit values, the more contracts become complex to write and enforce. This frequently calls for a wider role of associations in dealing with other stakeholders; typically, farmer associations can negotiate contracts with traders or large-scale retailers. The details of such contracts, in fact, do include mechanisms to transfer risk, whose direction indicates whether and how idiosyncratic risks are effectively pooled along the chain; or market power is employed to increase the risk borne by some stakeholders.

[2] For instance, a collapse in the retail price will typically affect all stakeholders along the value chain, while an increase in the price of a fertilizer will affect mostly farmers, by squeezing their profits if they are price takers in the output market.

[3] There are several types of contracts. Swinnen and Maartens (2006) classify them in two main categories: marketing contracts, which are (verbal or written) agreements between a contractor and a grower that specify *ex ante* some form of price and outlet. Production contracts, instead, are more extensive forms of coordination, in which contractor supplies items such as detailed production practices, extension services, inputs, quality and quantity of a commodity and a price.

From a transaction cost perspective, any vertically integrated structure such as a value chain can be conceived as the revealed best response of agents to the existence of risks associated with both the natural environment and the functioning of markets. However, this may not be the case when markets are either incomplete, or characterised by structural constraints that prevent their development, as it is the case for SIDS, or they are simply not competitive.

Where markets surrounding the value chain are incomplete or fragmented – particularly service markets such as those of credit and insurance – stakeholders may encounter difficulties in accessing convenient tools to manage risk. If structural constraints prevent communication, or information sharing, or access to relevant markets, the observed organization of the value chain may indeed reflect these constraints rather than the transaction costs structure of the commodity chain itself.

Difficulties in managing risks may arise, particularly for farmers, also where markets surrounding value chains are not competitive. It is usually observed that processors, traders and retailers are far more concentrated than farmers. This corresponds to a greater ability to set prices and other contractual terms and conditions, given also that these segments of the value chain are closer to final consumers, and thus in a better position to receive and react to demand signals. In SIDS and in the case of exported goods, the geographic distance between areas of production and final consumers, can contribute to exacerbate the asymmetry in information between producers and stakeholders operating in world markets.

Qualitative information on SIDS countries in the Pacific and the Caribbean confirms the presence of the mentioned types of risks and bottlenecks affecting specific value chains. These risks, together with the SIDS structural macro economic vulnerability[4], contribute to increase risk exposure of SIDS compared to other countries. According to processors and retailers, one frequent difficulty in sourcing primary products from local producers is the uncertainty about the availability of consistent, timely and standardized supplies, together with the difficulty of interacting with a myriad of small farmers scattered across wide territories. At the same time, the lack of credible market outlet can undermine incentives for farmers to invest in compliance with standards. Cases have also been reported in which contractual arrangements have not been honoured due to inadequate forward price level, and of default risks further down the chain. It is not infrequent to hear of foreign buyers that decided not to honour a more or less formal contract in response to changed market conditions. This can be the consequence of market fragmentation and the scarce knowledge about each stakeholder risk exposure, as well as a weak legal system for contract enforcement. The availability of this kind of information would allow stakeholders, for example, to subscribe agreements which are more appropriate for specific value chain and market contexts.

Is it possible to quantify these phenomena? Assessing risks requires the identification of risk-generating events, and their impact. Financial losses are the most straightforward way to quantify impacts, as a value can be associated to each of them. Even though an accurate quantification of both extent of losses and probability of occurring is virtually impossible, it is useful to have at least a rough idea of their range, in order to be able to define risk management tools and strategies.

A common practice in financial risk management is the so called layering, which is the identification of different areas in a probability distribution of potential losses. Three "layers" of risk can be identified: a "retention layer" including financial losses that are expected in normal business activity, and are generally retained by entrepreneurs; the "insurance market layer", which includes losses large enough to disrupt normal business practices. Their size, however, allows pooling them in an insurance product to be sold in the market. Finally, the "tail risks" layer includes catastrophic events that private insurers are unwilling to cover, and for which public intervention is usually required, at least in partnership with private insurers (World Bank, 2005; Cafiero, 2008).

Risk layering is rarely emphasized in agriculture, due to the difficulty of exactly quantifying losses and the associated probabilities. However, qualitative considerations on risks which fall within each layer offer guidance in understanding the elements that shape the risk profile of stakeholders, as well as the most appropriate risk management mechanisms.

Losses in the retention layer are highly frequent, but of a limited size; they are normally addressed through simple strategies, such as good agricultural practices, income diversification, engagement in off-farm activities, savings, consumption smoothing. Access to credit is clearly an important element allowing entrepreneurs to retain small risks, especially for farmers, who usually face long production cycles and need to purchase inputs well in advance of harvests. In fact, vulnerable population groups and subsistence farmers may show a very limited ability to retain small risks which may increase their probability to fall into poverty traps. The integration into more complex value chains should also be framed as an opportunity to improve risk management and the resilience to expected price and output variability.

Insurable risks – in the second layer – requires the presence of a functioning insurance market. On the demand side, the willingness to purchase insurance products will depend both on the likelihood of extreme variability in prices and production, and on the ability to retain risks individually. In some OECD countries, for instance, the presence of generous support policies reduces risks directly faced by individual farmers; in turn, this may reduce the willingness to purchase insurances. Extremely poor farmers, at the other extreme, may have high rates of discount on the future, and consequently a reduced willingness to pay for insuring against uncertain events[5]. On the supply side, insurance companies often face high transaction costs, lack of information, and difficulties in enforcing contracts arising from the classical moral hazard problem; all leading to undersupply of insurance products.

Finally, tail risks are included in the so called "market failure" layer. This includes risks that, if not adequately pooled, cannot be transferred to insurance companies, given their highly covariate nature and the magnitude of associated losses. Tail risks management opportunities may be obtained through the establishment of public–private partnerships (Linnerooth-Bayer and Mechler, 2007).

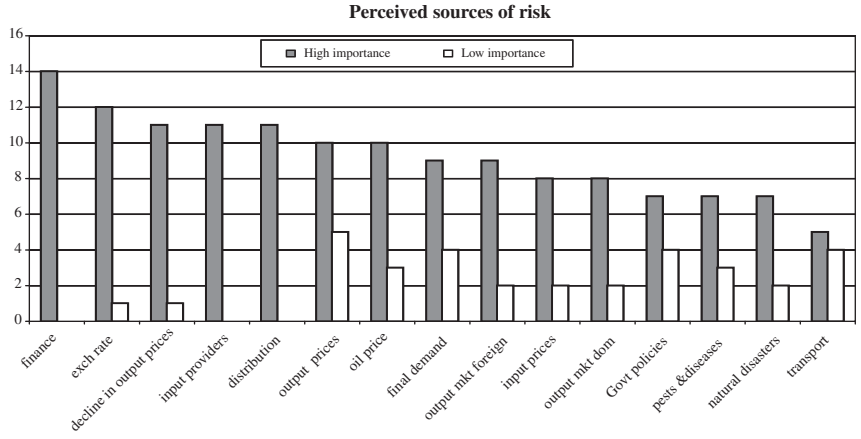
As mentioned, an exact quantification of losses and probabilities in each layer was out of reach in this work. Moreover, in dealing with value chains, such measurement should be repeated separately for each type of stakeholder, also taking into account interactions between risks along the chain.

Instead, we took a broader standpoint, based on the approach proposed by the CRMG (2007). Our survey was addressed to different stakeholder types, and collected information on critical elements that contribute to shape risks and the related

[4] Guillaumont (2010) provides an assessment of how vulnerability affects growth, development and poverty reduction in small developing economies. Structural vulnerability is computed on the basis of an Economic Vulnerability Index (EVI), endorsed by the United Nations by the Committee for Development Policy (CDP). The EVI is a composite index that takes into account the exposure of a country to shocks, including natural, political and exogenous shocks; as well as its remoteness, population size and the share of agriculture in GDP. The index is meant to trigger for policies and aid.

[5] Evidence on this point, however, is not straightforward: empirical studies have shown that subsistence farmers, even under extreme conditions, make considerable efforts to preserve productive assets, showing reduced rates of time preferences; see, for instance, Moseley (2001). Also, risk perceptions can be extremely variable, depending upon contingent events (Doss et al., 2008).

Respondents were 21, including farmers producing cocoa, cinnamon, vegetables, nutmeg, mango, bananas, livestock and flowers with a farm size that ranges from 1.5 to 600 acres. Traders, processors, input suppliers and government officials were also represented. Most traders, processors and input suppliers are also farmers.



A minority of respondents is member of a farmers' association, supplying marketing, contractual agreements with processors and retailers; information on policies and incentives, as well as training and extension.

Change in the conditions of finance is considered to be the most important risk source, followed by changes in exchange rate and long term output price decline. Changes in the operation of input providers and distribution failures are also deemed important. On the contrary, production risk due to pests and diseases and weather events is not a concern. Changes in policies are considered important only by large farmers producing nutmeg and cocoa, and by Government officials. Few farmers consider hurricanes important, while Government officials and processors do. Average to small farmers, traders and input suppliers consider financial conditions to be of high importance.

Processors and small farmers indicated contracts -- involving the sale of output and provision/purchase of inputs -- as the most effective mean to manage risk, along with insurance and credit. These are hardly used by large scale farmers due to high transaction costs and lack of customised products; as well as by smallholders, due to high costs. Collateralization is not considered an issue by farmers; rather it is considered so by processors. The small scale and the risk of default are also important according to some small farmers.

Box. 1. Grenada.

management mechanisms, starting from the ability to retain and manage risks. We surveyed access to credit, insurances, participation in producers organizations and policies along, and in connection with, risks and their management. In terms of actual value chains, focusing mostly on perishable products, which are both more relevant to the SIDS countries and more problematic, given high transaction costs and a reduced availability of risk management tools.

The survey and the methods for analysing results

Our survey was aimed at identifying: (i) the type of risk that is most important to each stakeholder; (ii) the nature and quality of the associated management mechanisms, if any; and (iii) the possibility of enhancing risk management. The importance of the elements that shape the ability to retain small risks also suggested the need to collect information on the existence of production contracts, access to credit, and participation in producers' associations.

The questionnaire consisted of five groups of questions, enquiring about the following:

- Role of the respondent in the value chain, and her/his participation in associations[6];
- Perceived sources of risk and their impact on the stability of the business;
- Existing formal and informal risk management and mitigation mechanisms;
- Suggestions for improvement in terms of government intervention and training activities[7];
- Constraints for banks and insurance companies in selling their services to mentioned stakeholders.

Qualitative information was also asked through open questions concerning the above points as well as information about training requirements, and perceptions about the stability of operations[8].

As mentioned, the questionnaire was administered in Grenada, Jamaica, Fiji and Vanuatu to stakeholders involved in the value chains of fresh fruits, vegetables and spices. In each country the sample included representatives of agricultural input providers, farmers, processors, traders, retailers, representatives of stakeholder associations, government official and extension agents.

A total of 82 persons responded to the questionnaire. While the group does not constitute a statistically designed sample, it is highly representative of the targeted population in each country, due to the process followed in the selection of both value chains and respondents. Targeted value chains were identified through

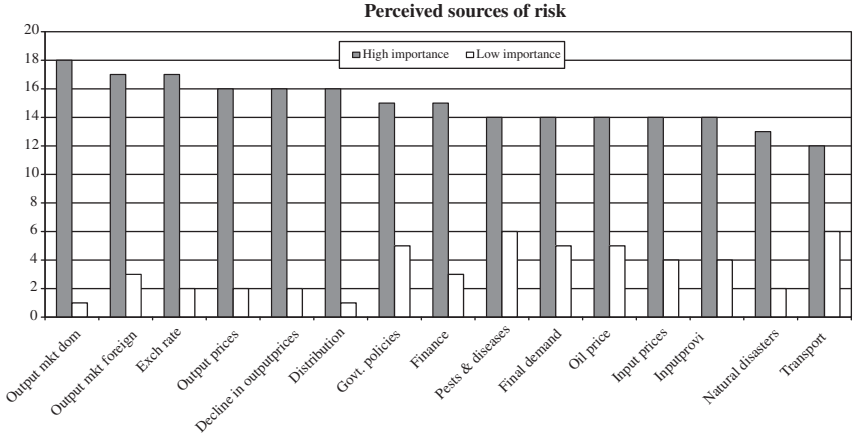
[6] This section included detailed questions on the type, location, size of operation, membership in associations, and types and quality of services supplied by associations (Brace, 2004).

[7] This section included detailed questions on contractual arrangements, insurance products, short and long term credit, reasons for lack of use of these services and difficulties encountered in accessing.

[8] The full text of the questionnaire is available from the authors upon request.

Respondents were 21, mostly farmers involved also in other activities such as processing, trading, retailing or input supply. Only six respondents are exclusively farmers, traders or processors. The large majority of farmers are member of an organization. Extension, information and training are the most common services provided; few mentioned contracts and supply management.

Changes in output markets, both foreign and domestic, play a prominent role among perceived risk sources together with output prices variability. Changes in policies are considered an important source of risk, together with distribution failures, and pests and diseases. Sugar and coffee farmers are less concerned with pests and diseases and natural disasters than other farmers. Some small scale traders -- "higglers" -- are also small farmers, and show similar patterns of replies. Traders are less concerned with finance and natural disasters.



Contracts and diversification are considered the two most effective means to manage risk, followed by improvements in infrastructures and insurances. Contracts are considered effective especially by small farmers with more diversified production mix, but they are hardly used.

Insurance is considered important by most stakeholders, but purchased in fact only by five. Contracts cover products in warehouse; transportation of goods and contents; loss, theft and damage; product liability. Credit is used by 9 respondents out of 21; most of them indicated it as a mean to reduce risk. Small farmers use credit to purchase inputs such as feeds, medication, fertilizer, insecticides, and fungicides. Large farmers access loans from commercial banks. High transaction costs or interest rates, lack of customised products are the main reason limiting access to credit.

Key factors limiting access to insurances are the unwillingness of insurance companies and the consequent lack of appropriate insurance products which is indicated as the main aspect from the side of potential clients.

Box. 2. Jamaica.

the ranking of multiple indicators, in a procedure known as Trade Opportunity Scan, whose results were validated and endorsed at the regional level[9]. Stakeholders to whom the questionnaire was administered were identified through a wide and long exchange of information and communications between local institutions and the five international organizations involved in the AAACP[10]. They were interviewed during meetings organized in the framework of the AAACP programme, and specifically within a participatory sector strategy development exercise led by the International Trade Centre. For these reasons, respondents should be considered to be highly and fully representative of key local interests, including farmers and smallholders groups.

The questionnaire did not discriminate against replies referencing single variables. Hence, while being a farmer presumably affects the type of risk faced by the respondent, individual replies still change, for instance due to the size of the farm, or the degree of involvement in processing or trade.

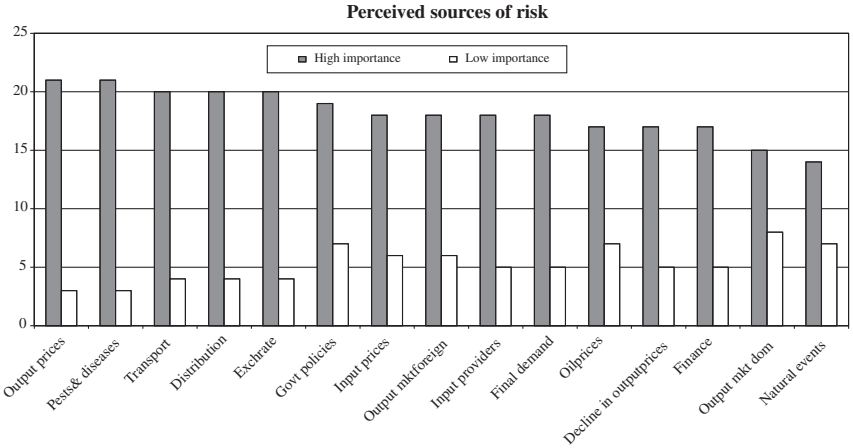
Results were firstly analysed qualitatively, by exploring regularities in responses across the four countries. Furthermore, given the non hierarchical structure of the questionnaire, we conducted a Principal Component Analysis (PCA) to identify some more formal associations among responses. The PCA notoriously reduces the number of dimensions in the data, while minimizing information losses, and assists in identifying patterns in large datasets. The technique computes linear combinations of variables – named "principal components" – each one accounting for a share of the variance of the original dataset. Another advantage of the PCA, which applies in this case, is that it can

[9] The Trade Opportunity Scan for the AAACP was developed by the International Trade Centre and FAO. It consists in ranking sectors based on a set of indicators reflecting relative products performance at the regional level in terms of capacity and efficiency in production (Production index); of their current export performance (Export index); in terms of regional reliance on imports (Import index); and identified opportunities for trade on the basis of world market conditions (world market index). Details are available in the AAACP website at http://www.euacpcommodities.eu/en.

[10] This means, in practice, that stakeholders were selected as a joint effort of the EU Commission, the FAO decentralized offices, the World Bank, UNCTAD, the International Trade Centre and the Common Fund for Commodities.

Respondents were 28. The sample includes farmers producing vegetables – such as papaya, pineapple, eggplant, pumpkin, chilies, tomatoes, okra, cucumber - intercropped with taro, cassava and sugarcane. Farm size varies from 3 to 234 acres. Some farmers are also involved in processing, trading, retailing and sale of inputs. Respondents also encompass processors, traders, banks and government officials. Participation in farmers' associations is very limited; they provide information, training and extension.

Major risks were indicated to be the variability of output prices, and pests and diseases. Output prices change is a minor concern, while changes in the conditions of finance are considered very important by smallholders. Traders and retailers are mostly concerned about transport and distribution failures, changes in input and output price and in consumer demand.



Farmers indicated crop diversification, contracts, new equipment, informal insurance and assistance from banks are the most effective risk mitigation mechanisms. Processors indicated contracts as effective tools to reduce risks, while traders indicated market-based instruments such as bank loans, commodity exchanges as the major means to reduce their exposure.

Half the respondents believe that insurance would be useful, but only few subscribed contracts The major limiting factor to access insurance is reported to be the high cost, especially for farmers. Retailers and farmers claim lack of information, unwillingness of companies to supply policies, high risk and small scale of operation.

According to the (single) bank representatives interviewed, credit is supplied mainly to farmers and marginally to other stakeholders. Farmers show high probability of default; insufficient collaterals and lack of transparency in operations are the main reasons for banks to deny credit, followed by the lack of customised credit products.

Box. 3. Fiji.

be applied both to discrete and continuous variables[11] (Gower, 1966; Jolliffe, 1991). Results can be interpreted by considering weights of variables into the principal components, called "loadings", which synthesize the strengths of the effect of that variable and the association with other variables in the component. In a typical analysis involving m highly correlated variables, components are ranked in terms of the share of the total variance that they account for, and the first n is retained within $n < m$.

Finally, in order to explore possible associations between responses to variables of interest, we resorted to cross tabulation. This technique reports on a double entry table the number of cases in which responses to the questions corresponding to the row and column labels are positive and homogeneous. Rows and columns in the table refer to the responses to any pair of questions. Entries on the main diagonal indicate the number of responses to each particular variable which were both positive.

The results of the survey

Main regularities

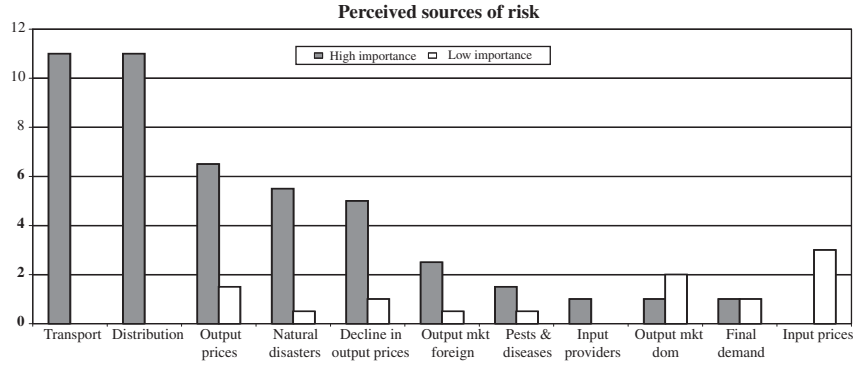
Four main points emerge from the qualitative analysis of responses. Firstly, on the characterisation of the value chains, farmers holding relatively larger operations show a tendency to diversify their activities across production stages, rather than across products, hence pursuing vertical integration. This is common among larger-size farmers, who also declared operating as traders, processors, retailers, and input suppliers[12]. Given the small size business environment of the SIDS, only by undertaking more than one activity within the production chains are farmers likely to improve on the efficiency of resource allocation (IFC, 2009). Small farmers, on the contrary, seem to operate mostly on an individual basis, with erratic relations both with other producers (horizontal) as well as with other stakeholders along the value chain (vertical). Most of their responses indicate the absence of institutions

[11] The PCA was applied to the covariance matrix of 53 variables to yield seven components. Data was rotated with the orthogonal varimax criterion to allow maximizing the sum of the variance of the loading vectors. This simplifies the interpretation, as after a varimax rotation each original variable tends to be associated with one (or a small number) of factors, and each factor represents only a small number of variables (Jolliffe, 2002).

[12] In principle, the presence of respondents operating simultaneously at different stages of the production chain may have biased the responses on the sources of risk and on the risk mitigation mechanisms; however, it is impossible to quantify the extent to which responses may have been affected.

Total respondents were 12, two of which are farmers. The sample also includes one processor, three financial institutions one of which is a micro-finance institution and one is a cooperative that supplies credit to its members and the third is a commercial bank which does not supply credit to the agriculture. There are no farmers associations in the country.

Apart from a few large fruit and vegetable commercial producers that market regularly either to the local market or to hotels and restaurants – most of which are foreigners – most rural households grow fruit and vegetable for own consumption, as they do for other staples. Occasionally surpluses are sold in local markets, to raise cash.



Large commercial producers do not express concerns about access to credit or the need for risk management tools. Some highlighted lack of infrastructure, such as transport and processing facilities, as major constraints to export fruit and vegetables. In order to facilitate rural finance, several initiatives have been undertaken to mobilise smallholders' savings, especially in remote areas.

Box. 4. Vanuatu.

informing on market opportunities, managing supply, or facilitating access to financial resources. A difference arises, in this respect, between the Caribbean and the Pacific: farmers associations in Jamaica and, even more so, in Grenada appear to be slightly more characterised as services providers; whereas this is less the case in Fiji, where only a few associations provide intermediation services; and in Vanuatu, where associations are absent.

Secondly, all respondents indicated output prices variability among the major sources of risk, along with changes in exchange rates, the conditions of finance and variability in domestic and foreign markets. The importance attached to these sources of risks may also stem from the fact that the 15 traders and exporters are also farmers themselves. Institutional risks arising from changes in government policies are more of a concern in Jamaica and Fiji, together with risks arising from natural hazards, such as pests and diseases; while weather events are seen as a less relevant source of risk. Respondents would not indicate a clear ranking of these risks, neither in terms of frequency nor of importance. The fact that the main sources of risk indicated by stakeholders, with the exception of pests and diseases, are linked to the market indicates that stakeholders are vulnerable to the normal variability of prices and income flows, let alone large disruptive shocks. Even the wide range of risks indicated appears coherent with a condition in which stakeholders are challenged by small and frequent risks: variability of prices – which should be possible to handle with individual mitigation strategies, such as saving, credit or consumption smoothing – is perceived in the same way as the occurrence of events such as pests and disease attacks, or thefts, which are expected to be far more disruptive phenomena are not even considered: due to their low frequency, the attitude toward such "tail events" seems to be one of underestimation, despite their known damage potential in the SIDS. This is probably also the outcome of widespread expectations of government or donors support in case of extreme events. Replies on risks appear to be consistent with poorly organized value chains. Discussions with small farmers showed that fruits and vegetables are not even considered as a solid business, but rather as a backyard activity, that may at best provide erratic income integration.

Thirdly, most respondents agreed that risk mitigation mechanisms based on market transactions - such as production contracts and assistance from banks – would be effective. It is interesting to note that very few respondents were in fact making use of them: only 24 respondents out of 82 have declared access to formal credit; and only 16 were engaged in production contracts. Insurance, instead, is not considered effective, but rather regarded as expensive and not transparent. High transaction costs, high interest rates for credit, and the lack of customised products both in the credit and the insurance markets are quoted as major obstacles to a wider use of such services. High probability of default is also identified as an obstacle in accessing credit, as well as complication of insurance contracts. Production diversification, which is the rule among respondents, is considered an effective risk mitigation mechanism, as well as technical change, particularly where pests and diseases are prominent risks. Government policies are not considered effective; rather, their change was identified as a source of risk, especially in the Caribbean. In general, these responses seem consistent with those on risk sources: market based mechanisms are seldom used, due to both supply and demand limitations. The (single) respondent among representatives of commercial banks indicated lack of collaterals and business transparency as the major reasons why their potential clients in the fruits and vegetable value chains are considered unreliable. High prices and transaction costs are limiting demand, so that banks and insurances lack incentive to supply customised products. Hence diversification, across products and production stages along the value chain, is the main mitigation strategy in use.

Finally, as a fourth point, it is worth highlighting some specificities of the countries in which the questionnaire was administered. More details by country are reported in Boxes 1–4. In Grenada, government officials and traders appear more concerned than

farmers about the effect of hurricanes. The fact that farmers are not so concerned despite the fact that hurricanes are frequent indicates that the government-as well as the Grenada Co-operative Nutmeg Association which ensures strong institutional support to its members – is expected to cover for such covariate risk. In Jamaica, the organization of fruits and vegetable production appears polarised. Small-scale traders – known as *higglers* – market most fruits and vegetables on behalf of small farmers, who do not have direct access to markets; and some of them are small farmers themselves. Credit, contracts and insurances are only employed by larger-scale farmers and traders, who appear to be far less concerned about production and financial risks. Also in Fiji, there appear to be a clear distinction between small farmers on the one hand, who are concerned mainly with price changes, and large-size farmers and other stakeholders on the other hand, who are more concerned with financial conditions.

Results of the principal component analysis

Variables included in the PCA are a reduced set compared to those included in the questionnaire. Some were omitted to avoid the dataset being discriminated by variables of minor importance, which would hide fundamental aspects of the survey behind a wealth of details. Specifically: (i) responses of banks and insurance companies were dropped, as they were very few in number; (ii) very general responses, such as opinions on business stability in the future, were also omitted; and (iii) details, such as those about the type of credit, insurance or contracts adopted, were also dropped. The resulting data set includes 53 variables (Table 1), all discrete; and 82 observations.

The first seven components capture about 68% of total variance, but the first is by far the most important, explaining about 38%. The second explains 9% of total variance, the third about 6%; and the

Table 1
Loadings of the first seven components[a]. Source: author's calculation

	Component 1	Component 2	Component 3	Component 4	Component 5	Component 6	Component 7
Jamaica							0.23
Grenada		−0.16		0.13	0.16		
Fiji							−0.17
Vanuatu		0.10			−0.17		
Farmer			0.31				
Specialised							
Fruit and vegetable (F&V)							
F&V and other crops							
F&V and cattle							
F&V and spices							0.10
Farm size (<3 ha; 3–10 ha; >10 ha)			0.87				
Processor							
Trader							
Retailer							
Bank							
Insurer							
Input provider							
Government official			−0.12				
Association membership		−0.12			0.15		
Changes in output prices		0.23			0.27		0.26
Changes in input prices		0.20				0.31	0.13
Decline in output prices		0.18			0.35	0.28	
Changes in the operation of input provider	0.10	0.41					
Changes in domestic markets	0.13	0.25				−0.30	
Adverse weather events							0.54
Pests & diseases	0.11	0.19			0.11		
Transports failure					0.50	−0.12	
Distribution failures		−0.11			0.59		
Changes in government policies	0.17	0.12		0.17			−0.21
Changes in foreign market conditions				0.23		−0.37	
Changes in consumer demand				0.61			
Changes of exchange rate	0.14	0.24	0.13	0.30			−0.36
Changes in oil prices		−0.22					
Effectiveness of government policies	0.28		0.17			0.18	
Effectiveness of crop diversification	0.16					0.15	−0.19
Effectiveness of production contracts	0.26					0.12	0.14
Effectiveness of infrastructure	0.14					0.28	
Effectiveness of new equipment	0.19					0.24	
Effectiveness of informal credit and insurance	0.25					0.13	
Effectiveness of formal credit and insurance	0.31						0.10
Effectiveness of assistance from banks	0.30			−0.14			
Effectiveness of savings	0.28	0.16				−0.26	0.27
Effectiveness of sale of assets	0.42					−0.13	
Effectiveness of commodity exchanges	0.34				0.12	−0.13	
Opinion on collateral substitutes							
Opinion on government policies		0.11					
Opinion on technical assistance							
Opinion on farmer association							
Use of production contracts				0.12		−0.40	
Use of insurance							
Use of credit		−0.17		0.46	−0.13		0.20
Opinion on insurance usefulness		−0.10		0.21			0.29
Small farm size influences supply of insurance				−0.19			

[a] Blanks are loadings whose absolute value is smaller than 10.

Table 2
Cross tabulation. Source: author's calculation

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1)	Effectiveness of government policies	31	23	22	20	22	20	17	20	16	11	14	13	5
(2)	Effectiveness of crop diversification		43	26	30	34	26	24	29	22	16	18	27	12
(3)	Effectiveness of production contracts			34	24	27	23	22	21	22	15	16	20	9
(4)	Effectiveness of infrastructure				40	34	24	23	26	21	12	16	25	11
(5)	Effectiveness of new equipment					43	28	23	28	24	14	17	27	11
(6)	Effectiveness of informal credit and insurance						35	23	27	21	14	18	22	10
(7)	Effectiveness of formal credit and insurance							30	25	18	12	18	19	7
(8)	Effectiveness of assistance from banks								37	20	14	18	22	8
(9)	Effectiveness of savings									32	14	16	23	11
(10)	Effectiveness of sale of assets										20	13	16	6
(11)	Effectiveness of commodity exchanges											22	15	7
(12)	Farmer												43	21
(13)	Farm size (<10 acres)													21

others capture from 6% to 3% of the total variance. To facilitate the reading of the results, loadings smaller than .10 were omitted from Table 1.

The first component includes high loading for variables describing mitigation strategies and their effectiveness. The high percentage of variance explained by this component indicates the importance that mitigation strategies have in discriminating among respondents. Those who attached importance to commodity exchanges, credit and finance, savings, policies, and production contracts also indicated changes in government policies, demand, and the exchange rate as major sources of risk (Table 1). Respondents concerned about price risks, in other words, would mainly consider services such as finance to smooth income flows, and contracts to reduce transaction costs along the chain[13]. Given the observed limited use of services, this is consistent with the previous observation on the fragility of the system with respect to expected price variability.

The second component includes mainly responses to the questions on the sources of risks. The discrimination between respondents is mainly determined by changes in conditions offered by input providers, input and output prices. Oil prices appear with high loadings, together with the absence of credit use –with negative sign – and market risk sources, such as demand and output prices, and the exchange rate (Table 1). This reflects the concern, expressed by several respondents, about the high level reached by oil prices in the period in which the questionnaire was administered. It is interesting to note, moreover, the negative correlation with the use of credit in this component, as well as with the participation in farmers' associations. Concerns about changing market conditions, in other words, seem to be more prominent in respondents who do not make use of services, operate in isolation from other producers, and are hence more exposed to income fluctuations.

The two most important variables in the third component are the answers to the question on whether the respondent is a farmer, and the size of the farm. These appear with the highest loadings, together with concerns about the exchange rate as a source of risk, and policies as a source of risk, with a negative sign (Table 1). This indicates that large farmers are concerned with exchange rate risk, while they do not see changes in policies as a source of risk, but rather as a mitigation tool.

The fourth component is characterised by changes in consumer demand and the exchange rate, which appear in association with the subscription of contracts and access to credit. Loadings indicate that stakeholders concerned about change in consumers' taste, who are also looking at foreign markets, do make use of contracts and credit, and believe that insurances would be useful. The fifth component is also dominated by risk sources, especially those related to output prices, transports and distribution failures, as well as the participation in producers associations.

Finally, the loadings of the variables entering the sixth and the seventh components, which explain a minimal variance share, show that responses on risk sources and mitigation mechanisms are related to the absence of production contracts. This is particularly the case for price risks in input and output markets.

Based on the above results, it is worth further exploring the association between variables expressing the opinions of the respondents on the effectiveness of various management mechanisms, and the condition of farmer, especially small scale, in the value chain. Cross tabulation was therefore conducted on these two variables, to check the number of instances in which replies appear simultaneously, and those in which one reply excludes the others. Table 2 reports in a two-way table the number of cases in which the respondent was a farmer, and the risk management mechanisms that (s)he considered to be effective in reducing risks.

Farmers look primarily at crop diversification and the availability of new equipment as means to mitigate risks; followed, in order, by infrastructures, the availability of savings, assistance from banks, and conditions specified in production contracts. Joint replies also appear among diversification, improvements in equipment and the availability of infrastructures, as well as access to credit, formal or informal. The importance attached to diversification stems in part from the type of farmers interviewed: fruits and vegetables producers in the countries in which the questionnaire was administered usually diversify by planting different crops during the year, and are hardly specialised. However, the importance which is simultaneously attached to equipment and infrastructure, on the one hand, and savings, credit and finance and the low access to credit on the other, signals a condition of substantive under investment. A similar pattern applies to small scale farmers, cultivating less than 10 acres.

Concluding remarks and policy perspectives

Results depict a complex situation, which stems from the economic features of SIDS, combined with those of agriculture in the ACP countries and of fruits, vegetables and spices production in particular. The remoteness and the small size of the economy which characterises SIDS calls for business diversification, which takes place both across products, and across value chains, particularly for larger farmers, who tend to integrate vertically and operate also as processors, retailers and traders. At the same time, the small size of the domestic market makes any value chain highly dependent upon foreign demand, for inputs and outputs. The

[13] The only outlier with respect to this point is the presence in the component of a high coefficient for the "sale of assets'. This is an exitalpost coping strategy, to which stakeholders are expected to resort under extreme conditions. It is interesting to notice, however, that insurance does not appear here.

physical and economic accessibility of import and export markets and the degree of competitiveness are hence of particular importance: foreign buyers may easily substitute the source of a small imports quantity supplied by a SIDS economy following small changes in supply conditions.

Many of these constraints would not apply to larger-size economies. A larger domestic supply and demand usually imply a wider array of alternatives for marketing products, so that the economic environment along value chains is likely to be more competitive. This facilitates risk pooling along the chains. Moreover, a larger-size supply would justify higher investment in intermediate goods and services. More machinery and equipment can mitigate production risks, while better access to services such as credit helps smoothing income flows and the retention of small risks. Finally, a more diversified economy – those of the SIDS are usually focused on few activities – provides more off-farm employment opportunities, hence allowing income sources diversification.

As in every country, the technical characteristics of fruits, vegetables and – to some extent – spice production, push towards vertical integration between different segments of the value chain, especially for exportable products. However, in the surveyed countries, vertical integration seems to be limited to farmers operating also as (small) processors or traders. The more typical tools for lowering transaction costs in perishable products, which are business contracts, are seldom used. Emphasis on equipment and infrastructures as mitigation strategies indicates substantial underinvestment, which generates increased risks of pest and disease outbreaks and makes fresh products more perishable and less safe. The small size of the SIDS and the reliance on few export products that characterised the agricultural economy in the ACP until recently seems to be still preventing the formation of larger and more integrated agri-business operations.

The limited degree of ranking among risks and the relatively higher emphasis on price risks speak for a limited ability to cope with "normal" or expected" output and income variability, which seems to be a problem especially for small farmers. Larger farmers and other stakeholders, instead, seem to value – and to some extent make use of – market based risk mitigation strategies, including insurances.

The limited use of insurances revealed by the survey appears obvious: especially for weaker stakeholders, demand for products that shield from disruptive events is limited by more pressing issues. If accessing credit to purchase inputs at the beginning of the season is difficult, the allocation of money in insurance seems an unlikely choice. Together with the small size of the market and the high covariate nature of risks, this prevents, or limits, the supply of customised insurance products.

Based on these results, it seems that actions to improve risk management and the functioning of value chains may be taken in at least three directions. Firstly, given the evidence of poor vertical co-ordination along value chains, strengthening and stabilising linkages among domestic and foreign stakeholders may be one way to better exploit comparative advantages in products like fruits and vegetables and spices. "Light" forms of vertical integration, such as formal or informal production contracts can probably play a role in income stabilisation. Forward contracts might be complex agreements, through which farmers can reduce the uncertainty on sales prices and market outlets, while receiving inputs and technical assistance by agri-business firms. Usually farmers receive from buyers the required inputs in exchange for a commitment to deliver products by a given date at a given price. In order to promote these types of arrangement, efforts are also required in terms of the definition of incentive-compatible frameworks, and in terms of the legal basis for ensuring enforcement.

Secondly, given the evidence of limited ability to cope with small and frequent risks, credit and finance is another area for intervention. Promoting improved access to such services appears to be an important prerequisite for setting up credible business, and promote more coherence and vertical integration along the production chains. On the supply side, diversifying credit products could be part of a strategy aimed at increasing access, by designing customised products that take into account the specific needs of farmers and other entrepreneurs operating along the value chain. As seen from the survey, collateralization is also a major issue, which may be addressed by widening the range of goods and titles accepted by banks. In some countries land property titles are not well defined, or their definition is outdated; and this can be a major problem for accessing credit and finance for investment. For small farmers two different avenues could be explored: the enhancement of horizontal organizations, such as producers groups, on the one hand; and vertical relations along the value chain on the other hand. As seen, producers' organizations are not particularly involved in providing services, other than extension, in the countries surveyed, and do not seem to play a significant role in managing risks; hence their role in this area could be enhanced. They may subscribe collective commitments with financial institutions, a feature that has proven effective in the micro-credit experience. A necessary condition for this approach to work, however, is the existence of mutual trust, reinforced by repeated transactions, which is not always the case in the country surveyed. Enhancing vertical relations along the value chain could also contribute to ease access to credit. For instance, contracts between farmers and processors may be considered as collaterals. There are examples of similar arrangements which have been successful. Vegetables production in Uganda, for instance (Henson and Jaffee, 2007), or the federation of agricultural cooperatives (FECOAGRO) of San Juan, Argentina (Santacoloma et al., 2005) are relevant experiences.

Thirdly, given the widespread evidence of undersupply in insurance markets, efforts may be devoted to remove constraints in this area. Better organized, integrated and technically equipped value chains would allow more efficient handling of expected variability in prices and incomes, and facilitate the use of credit to invest and smooth consumption. In turn, releasing constraints to managing this variability would probably facilitate the management of more disruptive risks, and the emergence of a demand for formal tools like contracts or insurance. Today, insurance markets are incomplete due to lack of both demand and supplies. Also in the insurance market there are examples in which vertical relations and linkages with credit helped developing the market (Angelucci, 2003). In Malawi, for instance, groundnut producers receive loans to purchase hybrid seed along with an index-based insurance against drought. If drought triggers indemnities, part of the funds are directly channelled to banks, in order to settle the loans (Alderman and Haque, 2007). Also collective insurance schemes are not infrequent, as in the cases of organic bananas in Peru and organic cocoa and bananas in Costa Rica, where farmers associations purchased collective insurances against natural disasters and the risk of default from the buyers (Slingerland et al., 2004).

Acknowledgements

Helpful comments from Carlo Cafiero, Nigel Poole and anonymous referees are gratefully acknowledged, along with editorial assistance from Emily Carroll. The paper reports results generated within the All ACP Agricultural Commodity Programme financed by the European Union under FAO project GCP-INT-045-EC.

References

Alderman, H., Haque, T., 2007. Insurance Against Covariate Shocks. The Role of Index-Based Insurance in Social Protection in Low-Income Countries of Africa. World Bank Working Paper No. 95.

Angelucci, F., 2008. Weather Indexes in Agriculture: A Review of Theoretical Literature and Developing Countries' Experiences Mimeo, FAO EST, May 2008.
Brace, I., 2004. Questionnaire design: how to plan structure and write survey material for effective market research. Market Research in Practice Series, London.
Briguglio, L., 2003. The vulnerability index and Small Island Developing States. A review of conceptual and methodological issues. Working Paper, University of Malta.
Cafiero, C., 2008. Agricultural producer risk management in a value chain context: implications for developing countries' agriculture, AAACP paper series n. Trade and Markets Division, FAO, Rome.
Commodity Risk Management Group (CRMG), 2007. Assessing Agri-Food Supply Chain Risk and Risk Management. Conceptual Framework and Guidelines for application. World Bank, Washington DC, November 2007.
da Silva, Carlos, A.B., 2005. The growing role of contract farming in agri-food systems developments: drivers, theory and practise. Agricultural Management, Marketing and Finance Service, FAO, Rome.
Doss, C.L., McPeak, J., Barrett, C., 2008. Interpersonal, intertemporal and spatial variation in risk perceptions: evidence from East Asia. World Develop. 3 (8), 1453–1468.
Eeckhoudt, L., Gollier, C., Schlesinger, H., 1992. Economic and financial decisions under risk. Princeton University Press.
European Commission – Agriculture Directorate – General, 2001. Directorate A. Economic Analyses, Forward Studies, Evaluation. Working Document. Risk Management Tools for EU Agriculture, with a Special Focus on Insurance, January 2001.
FAO, 2005. Small Island Developing States. Agricultural Production and Trade, Preferences and Policy. FAO Commodities and Trade Technical Paper No. 7, FAO Commodities and Trade Division, Rome.
Glover, D., 1994. Contract farming and commercialization of agriculture in developing countries. In: Von Braun, J., Kennedy, E. (Eds.), Agricultural Commercialization Economic Development and Nutrition. Johns Hopkins, pp. 166–175.
Gower, J.C., 1966. Some distance properties of latent root and vector methods used in multivariate analysis. Biometrika 53, 325–338.
Guillaumont, P., 2010. Assessing the economic vulnerability of Small Island Developing States and the least developed countries. J Develop Studies 46 (5).
Hardaker J.B., Huirne R.B.M., Anderson J.R., Lien, G., 2004. Coping with Risk in Agriculture. Cabi Publishing, June 17.
Henson, S., Jaffee, S., 2007. Understanding developing country strategic responses to the enhancement of food safety standards. University of Guelph, Canada, The World Bank, Washington, DC.
IFC, 2009. Doing Business in Small Islands Developing States. <http://www.doingbusiness.org/documents/subnational/DB2009_Small_Island_developing_states.pdf>.
Jolliffe, I.T., 1991. Discarding variables in a principal component analysis I: artificial data and II: real data. Appl. Stat.
Jolliffe, I.T., 2002. Principal Component Analysis. Springer Series in Statistics, second ed.
Khan, O., Burnes, B., 2007. Risk and supply chain management: creating a research agenda. Int. J. Logist. Manage. 18 (2), 197–216.
Lacroix, R., Varangis, P., 1996. Using warehouse receipts in developing and transition economies. Finance Develop. September.
Linnerooth-Bayer, J., Mechler, R., 2007. Disaster safety nets for developing countries: extending public–private partnerships. Environ. Hazards 7 (1), 54–61.
Minten, B., Randrianarison, L., Swinnen, J.F.M., 2006. Global Retail Chains and Poor Farmers: Evidence from Madagascar. LICOS Discussion Paper 164, Leuven.
Moseley, W.G., 2001. African evidence on the relation of poverty, time preference and the environment. Ecol. Econ. 38, 317–326.
Santacoloma, P., Suarez, R., Riveros, H., 2005. Strengthening Agribusiness Linkages with Small-scale Farmers. Case Studies in Latin America and the Caribbean. AGSF Occasional Paper 4, FAO.
Slingerland, M., Ruben, R., Nijhoff, H., Zuurbier, J.P.P., 2004. Food chains and networks for development. Lessons and outlook. University and Research Centre, Wageningen.
Winters, A., Martins, P., 2004. When comparative advantages is not enough: business costs in small remote economies mimeo. Centre for Economic Policy research, London.
World Bank, 2005. Managing Agricultural Production Risk Innovations in Developing Countries, Washington DC.