



**Food and Agriculture Organization  
of the United Nations**

**Agricultural producer risk management  
in a value chain context:  
Implications for developing countries' agriculture**

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## **Disclaimer**

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*“The evolution of the food chain from a competitive industry characterized by many participants at all levels to an increasingly integrated system provides a unique risk management opportunity to those who have market power. In the absence of effective intervention by public institutions, highly integrated firms are able to transfer the majority of unacceptable risk to the ends of the chain; in particular, to farmers, ranchers and retail consumers.”*

*“While public policy intervention may partially mitigate risk through a variety of programmes and regulations designed to address risk symptoms, past and current policies have generally failed to address a primary cause of the inequity in risk transfer by not ensuring an adequate level of competition throughout the food chain.”*

*(Swenson 2000)*

## **Abstract**

*The integration of small holder agricultural producers within complex value chains poses many interesting questions to the researcher interested in analyzing risk management costs and opportunities. While the role of value chain integration in the distribution of average returns between producers and other agents has been extensively explored in the agricultural economics literature, much less effort seems to have been devoted to the analysis of its impact in terms of the distribution of returns. This paper attempts at starting filling the gap by introducing some of the elements that could inform research on the mechanisms and policies for risk mitigation that can be used within agricultural and food value chain contexts. The focus is on small producers in developing countries, although some of the elements that are introduced might prove useful also for the analysis of agricultural and food value chains in developed economies. A framework that classifies value chains depending on product characteristics is introduced to facilitate the analysis of issues such as: the likelihood that small farmers might participate in the value chain; the size of the share of the incremental value added that can be appropriate by small farmers; the potential for income risk reduction (if any) that farmers might enjoy by participating in the value chain, and the role for effective public actions that might increase producers' risk management ability.*

## *Introduction*

The increased attention that has been devoted to the concept of “value chain” within the discussions on the role of agriculture in development, and the correspondingly high number of activities that have been initiated in developing countries by Governments, non-Governmental Organizations (NGOs) and by private initiative to promote creation and success of value chains, has been recently described as the establishment of a new “development concept” (Sheperd 2007). A number of forums have been promoted, over the last five years or so, to study the potential for the new value chain paradigm to promote agricultural-pushed growth and to analyze the ways in which it might be obtained so that the interests of the poor are safeguarded (see for example Johnson e Hofman 2004; Henson, et al. 2008)

While the discussion has often touched questions related to the risks involved in the transition to a new organization of the agricultural production and distribution sectors, with the notable exception of Siegel and Jaffee (2007), no contribute has of yet been *explicitly* devoted to the issue of risk management within developing countries’ agricultural value chains. Yet, with the continued processes of vertical integration of agricultural production within ‘farm-to-fork’ commodity chains, the exposure to income risk of the involved agricultural producers has changed significantly. A simplistic settings that considers the natural environment (weather, pests, natural disasters, etc.) as the major source of *income* risk is probably no longer adequate, even to represent the economic conditions of farm families in developing countries. More and more often, other events such as, for example, the possibility of contract breaches by the contractual counterpart, disruptions in the transportation logistics, unpredictable changes in the final demand due to safety concerns of consumers, the introduction of new standards required to access western markets, and a plethora of other phenomena which used to be overlooked in the past, are becoming more and more relevant in determining the overall level and type of risks to which developing countries agricultural producers are exposed.

This lack of attention seems to be rapidly being corrected. In their valuable contribution to the analysis of the problems of risk assessment and risk management in agro-food supply chains, and to the aim of developing an operational framework to analyze and manage agro-food supply chain risk, Siegel and Jaffee (2007) borrow extensively from the existing literature on Supply Chain Risk Management (SCRM) and on the strand of development literature that has been concerned with the concept of “vulnerability”. SCRM, however, sees the value chain as an economic entity of its own that, as a whole, interacts with markets and consumers in order to possibly extract a premium over production costs from the sale of a given products.<sup>1</sup> Risk management, in that context, is mostly seen from the perspective of a fully vertically integrated enterprise, concerned with the risk of the disruption of the chain, with limited or no attention to the *distribution* of risk along the different chain’s participants (See for example Khan and Burnes 2007). The main objective of SCRM appears to be that of identifying the major events that might possibly hinder the objective of brining the “right products (quantity and quality), in the right amounts, to the right place, at the right time, and at a competitive

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<sup>1</sup> In the taxonomy presented by Williamson (1991) and recalled by Gereffi, Humphrey e Sturgeon (2005), it is as if risk management decisions are taken within a value chain whose governance is of the “hierarchy” type.

cost” (Siegel and Jaffee 2007, p.5). From that perspective, vulnerability (defined as the combined result of the probability of an event occurring and of the economic damage that may derive from such event) is taken to be the vulnerability *of the chain itself*, that is, the possibility that the chain might not succeed in bringing the right product in the right amounts to the right place at the right time and at a competitive cost.

Although the issues discussed in this paper are the same ones that inform SCRM (i.e.: how to define and identify the relevant risks, analyzing the available or potential risk management tools and suggesting possible policy prescriptions), here they are analyzed through the lenses of the economic theory, to the aim of providing indications to the possible welfare incidence of the analyzed tools and policies.

Without the ambition to even come close to fully resolve all of the problems listed in the next section, the discussion in this paper is bounded in two important ways. First, the focus will be on ‘price’ or ‘market’ risk for agricultural producers, making only passing reference, when deemed necessary, to the problem of managing ‘production’ risk, which has been more extensively covered in the literature.<sup>2</sup>

Second, the problem of risk exposure and risk management will be mainly considered from a ‘micro’ perspective. This last decision, albeit justified by the fact that the major concern in this paper is on the welfare of poor households, does not imply a conviction that the problem of agricultural price risk management does not poses important questions also from a ‘macro’ perspective in most developing countries. On the contrary, we are aware that there are indeed important considerations to be made, related to such issues as the national budget, the inflation level, the balance of payments and other macroeconomic variables which are related to the variability of agricultural and food prices. As important as they are, however, these consideration will exceed the scope of this paper, and are left for further research, perhaps once the micro dimension of the problem will be better understood.

The paper is organized in four major sections. Section 1 takes stock of the current status of the literature on agricultural value chain, and points to the limited attention that has been devoted to the welfare implications of the risk that farmers must face when entering the type of contractual agreements required by value chain participation.

In section 2, the main issues that have challenged, to different extents, producers, policy makers and researchers in trying to understand the consequences, and then to devise actions intended to ‘manage’ risk will be discussed. Broadly defined, risk management will be intended as comprising the set of actions intended to limit the negative consequences of the uncertainty that surrounds the process of income generation and the livelihoods of agricultural households in developing countries, as opposed to simply the reduction of the variability of monetary returns.

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<sup>2</sup> An example of a detailed analysis of the climate risk affecting an agricultural value chain is presented in Everingham, et al. (2002)

Then, Section 3 first introduces a typology of possible value chain organizations that are of relevance for the agricultural sector of developing countries, and then discusses the role that, in each of them, risk considerations might play in determining small farmers' participation and the potential welfare benefits or costs that they may receive. In particular, the attempt will be to answer in turn all of the following questions: (a) which ones are the major types of risk that farmers would have to face if participating in that value chain? (b) Which are the best suited risk management instruments? (c) Which are the major obstacles to use of such tools? (d) What are possible solutions?

Finally, in Section 4, some conclusions and suggestions for policy actions and further research will be drawn.

### **1. The current literature on agricultural value chain and the lack of attention to the welfare implications of risk**

The question of who benefits from the recent evolution of agro-food markets has been addressed quite extensively in the development literature, and there are several important contributions inspired by the objective of informing the promotion of pro-poor supply chains in developing countries (see for example Kaplinsky and Morris 2001, Kaplinsky 2006, Wheatley and Peters 2004, Brennan 2004, Wheatley, Woods and Setyadjit 2004, Humphrey 2006, Sheperd 2007). Nevertheless, all this literature pays limited attention to questions related more specifically to risk and risk management. The distribution of long-run, expected value added along the chain is analyzed without explicit consideration of the embedded riskiness. This is a limit, because the same average return might be associated with different distributions, and therefore imply different impacts in terms of welfare.

The reasons for the current predominant emphasis of the literature on agricultural value chains on the static levels of value added that is appropriated by farmers could arguably be found in a series of conceptual, analytical and empirical difficulties on which I shall briefly elaborate before moving to the more applied discussion.

First, the conceptual difficulty and the number of still unresolved issues in analyzing the *welfare consequences of risk exposure* and, consequently, in assessing the possible benefits of risk management policies should be recognized. The attempts at extending typical measures of welfare change, such as equivalent and compensating variation to the case of uncertainty are still largely unsatisfactory.<sup>3</sup> One particularly relevant issue for example, when the uncertainty concerns the possibility of falling under poverty, is the failure to properly recognize the inherently ex-ante dimension of the welfare cost associated to risk exposure. This explains, for example, why the poor would engage in risk coping strategies that, ex-post, appear to be extremely costly when assessed in terms of expected utility. If properly assessed, those

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<sup>3</sup> See for example the discussion in Marshall (1989). For a state-of-the-art presentation, see Just, Hueth and Schmitz (2004, chapter 12).

choices would be revealed as being fully rational, and, by the same token, any policy that might help avoiding them would be better justified.<sup>4</sup>

The second problem is of a conceptual nature, and it is linked to the uneasiness in applying the neoclassical theory of frictionless market transactions to the conditions of many agricultural commodity chains and to the difficulty in deriving empirically testable propositions from the alternative New Institutional Economics framework of analysis.

In the prevailing modern development economic literature, in fact, the “transaction costs economics” (TCE) points of view has often been deemed more appropriate in analyzing the relationship of farmers with markets (or the lack thereof). From such a perspective, however, to devote specific attention to risk considerations when discussing of value chains might appear, to a certain extent, superfluous. Considered from a TCE point of view, the creation of the set of formal and informal institutions that constitute a supply chain could, in facts, be deemed as *the economy’s* response to the very problem of risk management and of the presence of transaction costs associated with alternative market based solution.<sup>5</sup>

In other words, the reason why agents might decide to enter in implicit or explicit contractual agreements within a value chain might be precisely because it is the best possible available compromise between risks and returns. If one adheres to the view that economic actions is guided by the attempt of minimizing transaction costs, and that uncertainty (coupled with the lack of explicit risk and contingent markets) is one of the major sources of transaction costs, then to devote specific attention to the study of risk exposure within the value chain may be of limited relevance: after all, whatever form of institutional arrangements ends up prevailing within the supply chains, it must be taken as the *revealed best response* to risk, conditional on the prevailing institutional conditions. The only remaining role for public policies, then, would be to identify the reasons that prevent the full development of insurance and other risk markets and to try and reduce their relevance.

I personally find such approach to be unsatisfactory. In some sense, it means to elude the very question of why some value chains take forms that are far away from that of simple vertically linked, free market transactions, and do not provide much insights into the welfare incidence of certain institutional organizations.

The third problem is of an empirical nature and has various facets. One important aspect to be taken into account is that, in order to hope to be able to *measure risk exposure*, one needs sufficient data to characterize the actual *ex-ante distribution* of net returns. One common practice in the economic analysis of risky environments is to refer to the past history to estimate the relevant probability distributions. In a rapidly evolving settings, however, even if long time

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<sup>4</sup> See Alwang, Siegel and Jorgenson (2001) and Cafiero and Vakis (2005).

<sup>5</sup> Blandon, Henson and Cranfield (2007, p. 4) for example, explicitly state: “While we do not focus specifically on the degree to which small-scale producers benefit (or are captured) by the contractual relationships associated with these supply chains, such considerations are implicit to the attributes that we contend govern the propensity of small-holders to engage in supermarket supply chains rather than spot markets.” This position can be considered exemplary of much empirically oriented literature inspired by TCE. See also Henson *et al.* (2008) and Dorward *et al.* (2005).



series of data were available, it would be problematic to assume that the underlying data generating process has been unchanged over the period covered by the data, and therefore the estimate of the probability distribution would be unreliable. Moreover, in analyzing the variability shown by past data, the problem arises of how to identify pure shocks from the effects of possible structural changes that have occurred over that period.

A second empirically relevant question in the analysis of economic behavior under risk is that observation of the *outcomes* does not allow for identification of *risk exposure* from the effects of *risk response*, unless one is either willing to assume a certain risk response behavior or capable to exogenously identify random shocks that are independent of the agents' decisions. While such an identification might be reasonably easy for shocks due, for example, to natural hazards, the question becomes considerably more problematic when the discussion involves price shocks, whose 'fundamentals' might be rather difficult to identify in the context of a complex value chain.

A third empirical challenge arises when one is not inclined to blindly take the 'reveled preference' view described above, according to which the value chain organization is the 'best' response to risk, and consider instead that other phenomena (such as for example asymmetries in bargaining and market power) might have led to the observed contractual arrangements between producers and buyers. The point is that, if there are two or more concomitant causes that lead to a certain arrangement, and lacking detailed information on the bargaining process that has led to the agreement, to identify the relevance of each of the causes becomes a matter that is difficult to settle empirically.<sup>6</sup>

Considering all of the problems briefly mentioned so far, it comes as no surprise that discussions on the welfare analysis of risk related policy and tools in the context of agricultural value chain analysis are still largely missing. On the other hand, the topic is of relevance if the TCE view is not fully endorsed and if one believes that there are important equity issues associated with the distribution of welfare along the value chain, the presence of residual uninsured risk and the transmission of price shocks. Although the development of economic institutions is undeniably the result of the combination of the incentives faced by the various agents involved, and although we all agree that risk related considerations play, in this, a crucial role, the fact that we see some value chains emerging and taking certain organizational forms, does not mean that the problem of the welfare incidence of risk exposure has been solved, let alone in a universally acceptable "best" way.

The motivation for the remaining of this paper thus emerges from the belief that there are still very interesting considerations and, most importantly, practical policy prescriptions that might be derived from a careful analysis of the risks embedded in the prevailing organization of agricultural commodity supply chains.

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<sup>6</sup> For example, there has been a considerable effort in attempts at measuring the degree of market power within commodity chains through econometric models based on the analysis of price transmission mechanisms (See for example: Lloyd, et al. 2006, Meyer e von Cramon-Taubadel 2004, Frey e Manera 2007). However, these empirical models are based on the assumption that any detected asymmetry in price transmission following exogenous shocks is due to the exercise of bargaining power, implicitly *assuming* risk neutral behavior on the part of all parties involved.

## 2. Risk and risk management in the context of agricultural based value chains

The analysis of the welfare consequences of residual risk exposure and of the potential welfare improving character of new public policies, given an observed organizational structure of the value chain, contains three conceptually distinct processes: (a) identification of the *subject* exposed to risk, (b) definition of the ex-ante condition of *risk exposure*, and (c) assessment of the potential *welfare consequences* of residual risk exposure, once the set of possible private risk management actions by the involved agent have been duly considered. Each of these analytic processes presents some difficulties, which will be briefly described below.

### 2.1. Identification of the agents: personal vs. functional incidence analysis

In the context of development policy, if we are concerned with risk at all, it is because we believe that risk affects people's quality of life. It is *people*, and not impersonal concepts such as the 'market', the 'value chain', the 'farm' which are exposed to risk. On the other hand, in most of the economic literature concerned with incidence analysis, including that on risk, the reference is usually made to the *functions* (i.e., producers, traders, consumers, etc.), not the *persons*, involved. To this respect, value chain analysis is no exception: in many analyses, the value chain is represented as a list of the *functions* involved, that is: (a) input and service providers, (b) producers, (c) traders, (d) processors, (e) retailers and (f) consumers.

While functional incidence might be easier to conduct, from a development policy perspective it may not suffice, and *personal* incidence should be tackled instead. The same "risk," in facts, may be of different relevance depending on the social structure and the correspondence that exists between economic functions and income classes. For example, the risk of importing high food prices due to turbulences in the international markets will certainly be pernicious to all consumers and probably beneficial to agricultural producers. How much this is relevant to an institution devoted to poverty alleviation in a developing country, however, depends on "who" are the consumers and whether or not they are also producers: the same kind of risk will likely be much more relevant for a net food importing country, where the population is highly concentrated in the suburbs of large cities, as opposed to an agricultural products exporting country with a large rural basis.

### 2.2. The nature of the links. Market vs. contractual relationships

Identifying the functions that constitute the economic value chain and matching them with the corresponding social groups is usually not sufficient to understand the mechanisms for *risk transfer along the chain*. The next needed step is therefore to characterize the *nature of the links* at which the different transactions occur. There is ample literature on the governance of value chain based on the analysis of the prevailing type of relationship among the participants, which can be traced back to the economic analysis of institution initiated by Williamson (1991) and which informs most of the recent value chain analysis.

In this literature, the type of transaction that occurs at a given link of a value chain is classified as one of a range of types extending from the two extremes of "arm's-length" or "market" transaction (where the two parties are only indirectly confronted through their respective supply and demand function,) to that of a "fully vertically integrated" or "hierarchy" relationship. In between, there is wide range of either implicit or explicit contractual relationships between the seller and the buyer, which have been generically denominated as "hybrid" (Wil-

liamson 1991). Most of the literature on supply chain governance that has followed, has employed a sort of “revealed preference” strategy in deriving the potential role of various conditions (such as product characteristics, level of uncertainty, etc.) in shaping the contractual form.<sup>7</sup> For the purposes of this paper, this may be not enough: even if we conclude that a certain contractual relationship exists *because* of risk considerations, if we want to proceed and derive policy prescriptions, we need to understand what is the residual risk exposure for the involved parties and if there are policy actions that may further reduce it, especially so for the party which is left with the heavier risk burden after having gathered even the best possible available contractual opportunity.

At first glance, the question might be framed in terms of relative market power, that is, the degree of competition that each of the party involved in the transaction faces. One may agree that, other things being equal, of the two parties that are involved in the stipulation of a contract, the one that faces the higher competitive threat will have to accept to bear a larger share of risk. The actual level of competition, however, is not easy to measure; the number of agents involved in the same activity, for example, is only a rough proxy. For example, in the contractual relationship between a buyer of an agricultural products and a producer, even if there exist in principle many producers of a certain product, it may not be so easy for the buyer of that product to promptly find an alternative source at low cost, and this to some extent, reduces the effective competition faced by the seller.

Moreover, the possibility of resolving disputes in front of a court is one other reason why some contractual agreements might be incomplete (in the sense that they do not explicitly stipulate insurance provisions) and yet implicitly include some risk sharing features. If a public court can be easily called upon, one of the party involved may decide not to transfer all of the risk deriving from an external shock to the other party, for fear that that this might be taken as ground for a legal dispute, which would be costly. When the value chain is international in scope, however, lack of jurisdiction may give more power to a leading multinational buyer in the relationship with their supplier. In such contexts, the relationship between buyer and seller becomes more of a hierarchy type because it internalizes also the function of dispute resolution and this may imply a more asymmetric risk sharing than if both parties were subject to the treat of being brought in front of a jurisdictionally empowered public court.

The examples above, far from being exhaustive, have the purpose of highlighting the type of problems that one have to face when trying to derive general conclusions on the implications of contractual participation in terms of risk exposure. The current status of theoretical literature in economics is largely insufficient to settle the issue, and more research is highly needed in this field.

Most of the research has focused on the analysis of the completeness and symmetry of price transmission to detect the presence of market power, and has been conducted with no risk related considerations. Study of the price transmission mechanisms is complicated by the fact that, if the (either implicit or explicit) contractual relationship that exist at the stage one ana-

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<sup>7</sup> See for example Hueth, Ligon e Melkonyan (2008) for a recent review of agricultural contracting in California Agriculture.

lyzes, includes some risk transferring feature, then the transmission of price changes could be *incomplete and asymmetric* even in absence of market power by one of the parties. If the two parties are characterized by different degrees of risk aversion, the one which is more risk averse should be willing to give up some of the upward price adjustments in order to be protected against downward price swings. The result would be that the difference between the average price at two consecutive links of a chain might differ by more or less than the “value added” at that link of the chain, depending on whether the upstream agent is more or less risk averse than the downstream one.

Although much needed, further exploration of the mechanisms of price transmission under imperfect competition and uncertainty is beyond the scope of the present paper.

### **2.3. The “fundamentals” of risk**

Another conceptually different problem is that of identifying the sources of disturbances that might lead to possible price risk for the agents in the value chain.

Siegel and Jaffee (2007, Table 1) list all possible sources of risk potentially affecting agricultural value chains. They identify seven categories: weather related risks, natural disasters (including extreme weather events), biology and environmental risks, market related risks, policy and institutional risks, logistics and infrastructural risks, and management and operational risks, and then discuss them in some detail, from the perspective of the whole value chain.

Although an interesting information, listing the potential sources of risk does not suffice to provide practical suggestions on which kind of policies might be more suitable to the objective of protecting the interests of one or some of the various value chain participants, given that not all of the listed sources of risk will have the same relevance or the same kind of implications for all participants.

Any shock that originates risk may ‘hit’ at one or more of the relevant *loci* that form the value chain.<sup>8</sup> But then, the consequences of the shock may be partly or entirely transferred to other agents within the supply chain, depending on the kind of links existing between them. For an informed analysis of the consequences of risk exposure for the various chain participants, each possible source of risk must thus be traced back from the locus where it ‘hits’ to the various economic functions involved, assessing the extent of risk transmission occurring at each of the links, and then evaluating how the risk that has reached that function affects the welfare of the involved persons. To do so, a visual representation of the value chain, such as the one included in Fig. 1 below can prove rather useful. It should indicate which *persons*, *functions*, *loci* and *sources of risk* will be relevant for the particular value chain considered, linking them in a “map” that identifies the correspondences between the persons and the functions, highlights the mechanisms that links the various functions, and associates the functions to the loci where the events that generate risk might manifest their first effect.

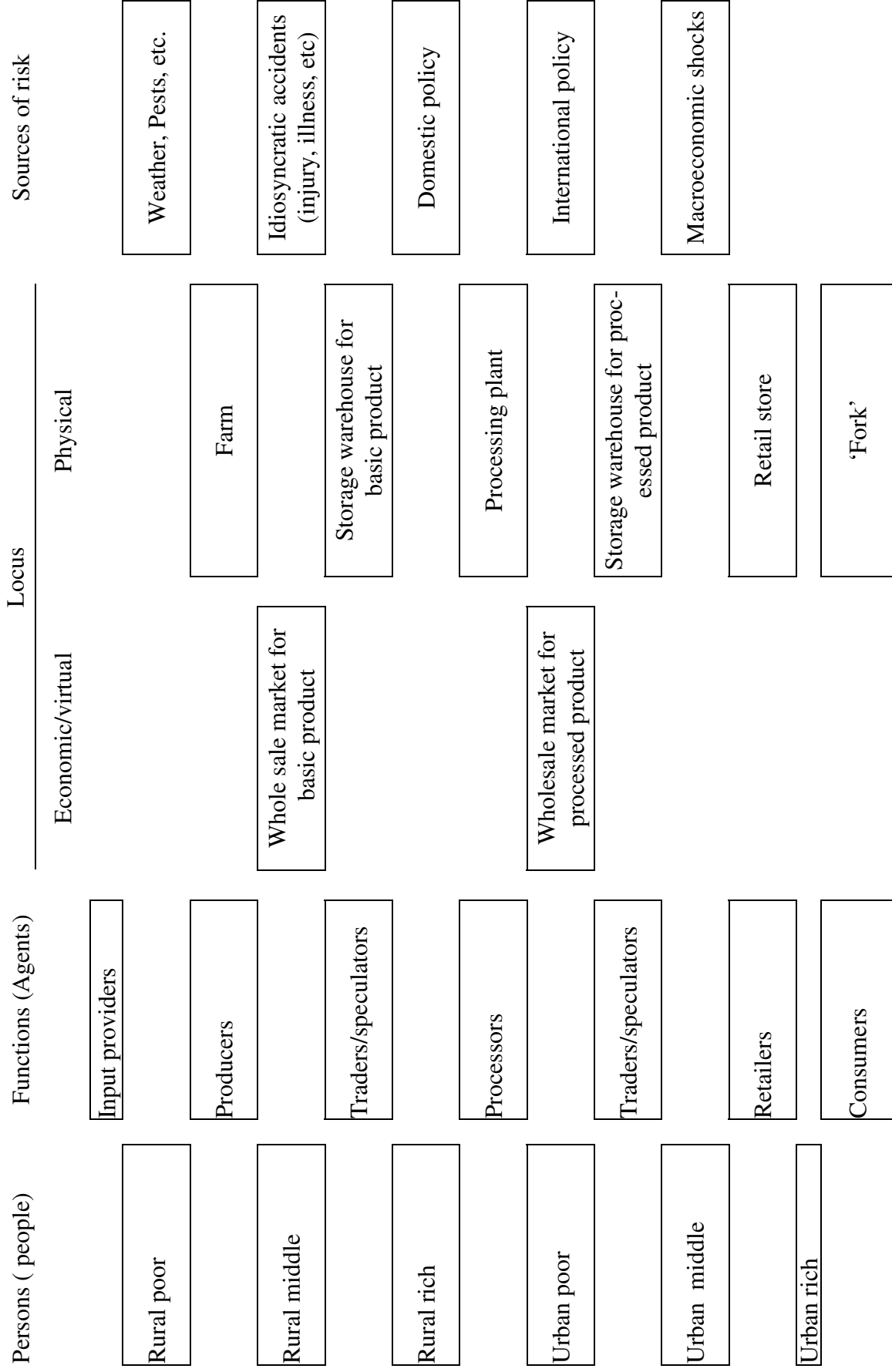
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<sup>8</sup> For example, bad weather may affect crop production on farm, or may disrupt transportation and logistics; macroeconomic shocks might be felt by consumers and by producers, etc. See Siegel and Jaffee (2007, Table 2)

In Fig. 1, the **persons** are classified in six groups, obtained by crossing the rural/urban dimension with a three grade scale of income: poor, middle income, and rich. The **functions** listed are the traditional ones identified in many supply chain analyses, namely: input providers, producers, traders, processors, retailers and consumers, not all of which might be relevant in all of the possible supply chains. Possible relevant **loci** “from farm-to-fork” are classified as *physical* (Farm, Storage warehouse for basic product, Processing plant, Storage warehouse for processed product, Retail store, ‘Fork’) and *virtual* (markets). Finally, possible **sources of risk** are identified with: weather, pests, and other natural phenomena; idiosyncratic accidents involving injuries, illnesses, etc., domestic policy, international policy and generic macroeconomic shocks.

Although perhaps not exhaustive, the elements included in the framework will suffice to facilitate discussion of the main issues presented in this paper, with reference to a number of prototypical supply chains, as it will be done in section 3 below.

Fig. 1 - A visual representation of the food value chain: 'from-farm-to-fork' and the correspondence between persons and functions



## **2.4. Elements for a coherent risk management strategy**

Before moving to the explicit discussion of risk consideration in actual supply chains, it may be useful to briefly discuss the process of *risk management* and the elements of a *risk management strategy* that may be used to limit the negative consequences of risky events.

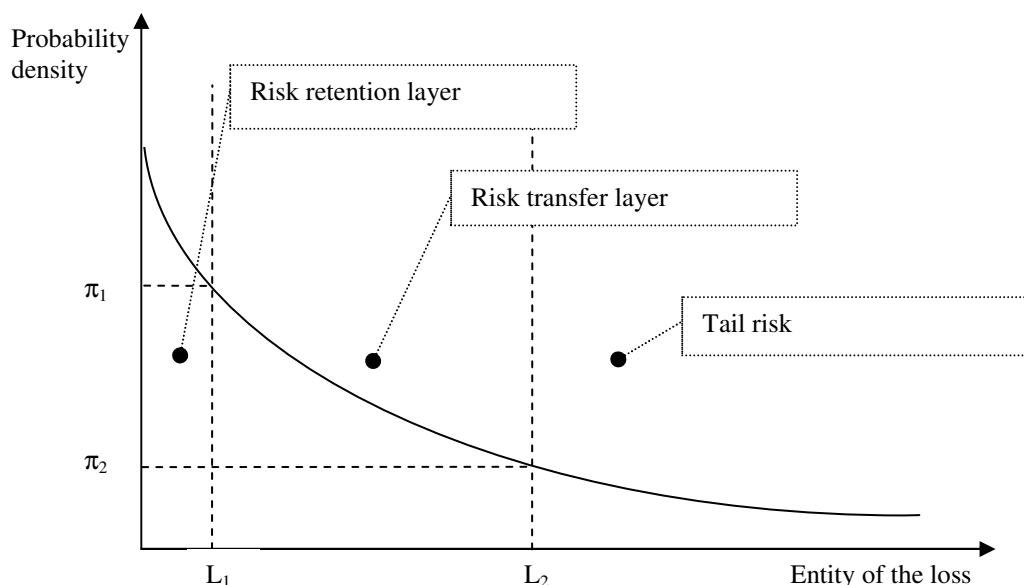
Usually, a risk management *strategy* is the combination of different actions which include preliminary risk and vulnerability assessment, and subsequent risk management choice, possibly followed by monitoring and re-evaluation of the actions taken. I shall briefly elaborate on each of these elements below.

### **2.4.1. Risk assessment**

Risk assessment implies identification of the possible risk-generating events, quantification of the impact that each will have in terms of financial losses, and association of a probability value to each of them. Even though *precise* quantification of both extent of losses and probability of occurring is virtually impossible, to have even a rough idea of their range can be extremely important in defining the optimal strategy.

One very informative practice which is common in finance risk management is the so called process of **risk layering**, in which a probability distribution of potential losses is formed. Quite obviously, when the only dimension being considered is the *entity of the financial loss*, irrespective of what is the event that might cause it, the distribution will have the kind of shape depicted in Fig. 2 below, with smaller financial losses having higher probability of occurring. Once the probability distribution is formed, three “layers” of risk are identified by choosing the levels of financial losses that separate the **risk retention** level from the **risk transfer** layer and this latter form the so called “**tail risk**”. This practice is particularly useful in informing the process of risk management through insurance, in that it allows for the identification of the part of the financial losses that the enterprise might want to insure against (the risk transfer layer), with the risk retention layer corresponding to the losses that the enterprise is willing to retain and eventually cope with own resources (i.e., the “deductable” stipulated in the insurance coverage) and the “tail risk” as the part that will not be covered through formal insurance.

**Fig. 2 - Risk layering**



Despite its usefulness, and as opposed to what happens for example in the finance literature, in the agricultural economics literature the process of risk layering is rarely emphasized, probably as a result of the difficulties posed by the process of quantifying the extent of losses and the associated probabilities, but also because of the limited extent of the diffusion of commercial insurance in agriculture.<sup>9</sup> What makes the risk layering process useful, however, is that it forces to think about the cost/benefit ratio associated with transferring the risk. In principle, any risk, no matter how frequent, could be transferred (that is,  $L_1$  in Fig. 2 could be driven to zero), but that would imply a high insurance cost. On the other hand, the welfare effect of highly frequent, small losses is going to be rather limited and lower than the cost of transferring the risk to other, which would imply excessive transaction costs for monitoring and assessing the losses. Usually, self-insurance (a form of risk coping) can take care efficiently of such events, or, as it is sometime said, “a little coping goes a long way.”

#### **2.4.2. Risk management**

Once the extent of risk exposure has been assessed, the next step is to consider which actions can be taken to reduce the welfare losses associated with risk exposure. There exist an ex-

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<sup>9</sup> Also, the pervasiveness of government intervention – as it can be found, for example, in the US Federal Crop Insurance system – makes some elements of the careful analysis of farms’ financial risks less relevant for farmers, which might be more interested in how to get the maximum returns from the existing public programs, rather than properly analyzing the risk landscape they face. This is an example of how the presence of public policies might alter not only the type of risks farmers are *effectively* exposed to, but also the way in which analysts think about the problem. It is my impression that, for too long, the experience of the US Crop Insurance system has negatively conditioned the progresses in the agricultural economics literature on risk. Fortunately, things seems to have been changing recently, with more and more contributes highlighting the drawbacks of the system based on subsidized insurance, and resurrecting attention towards the fundamental elements of risk management in agriculture. (See for example Glauber 2004)



tended literature on agricultural risk management,<sup>10</sup> and virtually all discussions start with a consideration of the special nature of agricultural production, with its strong dependence on biological processes and thus a high vulnerability to natural phenomena such as weather, pests, etc. The major focus in that literature is (quite understandably) on *yield* or *production* risk, that is, the possibility that – because of phenomena partly or fully beyond farmers’ control – the realized physical production might turn out to be lower than expected. In most of such models, either price is considered fixed and non random, or, when the randomness is acknowledged, price is taken as independent of yield.

This assumption has several shortcomings, such as for example to neglect the possibility of natural hedge when price and production are negatively correlated, or the possibility that, by affecting prices, producers might in part compensate for averse in production, given that what ultimately matters is income, and not simply production.

Given the abundance of contribution on yield risk, however, I shall focus here on price risk. In principle, three conceptually different groups of actions can be described that allow to manage price risk.<sup>11</sup> These are attempts at: (a) directly affecting the distribution of prices, so to make negative price swings less likely, (b) *ex-ante hedging* against predicted possible negative price fluctuations, and (c) *ex-post coping* with the consequences of ‘bad’ prices. Each of these actions, which can be described as examples of (a) *risk avoidance or risk reduction*, (b) *risk transfer* and (c) *risk coping*, respectively, can be taken either directly by the interested private agents or be part of a government program intended to provide income protection to those agents. The ability to assess the potential effectiveness of each risk management action depends on the extent to which the *causes* of price variability in the first place and the mechanisms through which these variations are transmitted up to the relevant locus, are correctly understood.<sup>12</sup> In particular, from the perspective of producers within complex value chains, one crucial element that needs to be considered is what the actions other agents in the chain might engage in, that will eventually condition the variability of prices faced by the producer and the producers’ ability to mitigate negative fluctuations. With these caveat in mind, I shall briefly discuss each of the three mechanisms in turn.

#### ***2.4.3. Price risk reduction. Affecting price distribution through production, storage and marketing decisions***

The sources of variation that are relevant for agricultural producers can be distinct depending on whether they manifest their effect behind the ‘farm gate’ or beyond it. This corresponds to the traditional distinction made between *production* (or *yield*) risk and *market* (or *price*) risk. Production risk is mostly related to the natural conditions that govern agricultural production, and – as I said – I shall not be mostly concerned with it here. Nevertheless, it is probably worth to stress once more that, in terms of its welfare consequences, *price risk considerations cannot and should not be separated by considerations related to production variability*, and in

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<sup>10</sup> See, for example, Hardaker, et al. (2004), and Just and Pope (2002) for recent book-length treatments.

<sup>11</sup> Given the focus will mostly be on producers, I shall often implicitly consider price *reductions* as negative events.

<sup>12</sup> Notice that Government action might also be a cause of increased risk for a given social group. This may happen, for example, when government intends to reduce risk exposure of *other* agents, or when public actions has objectives other than risk reduction. For example, a government might want to protect consumers from the risk of high prices and, to do so, engage in activities that might increase the probability of price drops, thus increasing producers’ price risk.

particular, to the possibility that production and prices be negatively correlated. Such a possibility creates what is usually referred to as ‘natural hedge’, that is, a mechanism through which the negative consequences of a low harvest are partly transferred to the buyers of the agricultural commodity through a higher price.

What concerns us more here, is the possibility that, through decisions on the amount being sold or on the timing of sales, the producer can directly affect the price (s)he receives, and therefore production and marketing decisions themselves can be considered mechanisms for risk management.

The extent to which the level of production and the price received by the producer are negatively correlated depends on the relative scale of the producer and of the market with which it is confronted. The smaller the market, the higher is the possibility that the natural hedge can be effective. Many have contended that for small producers, changes in individual production are not capable of affecting prices, and they have used this assumption to justify the practice of analyzing yield risk management independently of the price received, but this reasoning is at least partly faulty. Even if at the individual level, producers may have little scope for affecting the price level through management of the quantity marketed, to the extent that production shocks are correlated across producers, individual production and total production will be correlated, and therefore some scope for natural hedge would exist anyhow.

Furthermore, the possibility exists that, in some circumstances, producers *as a group* might exploit the ability to increase the price they receive by reducing the quantity they market. This is the rationale which is behind, for example, the practice of **product withdrawal** that has been pursued for some time by European producers of fresh fruits and vegetables, and that has beneficial effects when the elasticity of demand with respect to price is smaller than one in absolute value. When demand is inelastic, in fact, even a slight increase in the quantity sold can depress the price up to the point of reducing the overall revenue, and therefore it may be convenient for producers to withdraw and destroy part of the product. For such a strategy to be effective, however, coordination among all producers that supply their product to a given market is crucial. If coordination fails, the incentive for any single producer to sell all of his production when all others withdraw theirs will lead to a typical prisoner’s dilemma settings.

Withdrawal (and destruction) of excess production is an option for perishable products. Easily storable products, such as grains, present another opportunity for producer to alter the distribution of prices they receive, through the management of stocks. When technically feasible, the possibility of private **storage management** is a very powerful means of price risk management for producers, and probably still the least well understood in the economic literature on commodity markets.<sup>13</sup> It is not the case to review here the various implications of storage on the dynamics of commodity prices, extensively presented in Williams and Wright (1991). The major conclusion that can be drawn from them, however, is that, unless there are technical conditions that hinder the possibility of storage, the exposure to price risk for producers should always be assessed by taking into due account the opportunities for inter-temporal ar-

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<sup>13</sup> Notable exception are Miranda e Helmberger (1988) and several papers by B.D. Wright and J.C. Williams, summarized in Williams and Wright (1991, chapter 12). Even the famous, and for many good reasons, celebrated book by Newbery and Stiglitz (1981), in analyzing the merits of public price stabilization policies, fails to properly consider the deep implications linked to private storage.

bitrage that can be exploited through storage management.<sup>14</sup> The consequence of this is that, **for storable products, pure price risk is rarely an issue for producers:** when the conditions are such that selling the product would yield a low price, then there exist the highest incentive to build-up stocks. One immediate consequence of this is that any activity directed towards reducing the cost of storage (which comprise of both physical and financial components) will always have very strong implications on producers' ability to cope with price risk.<sup>15</sup>

Most of the literature on storage and commodity markets focuses on competitive storage, that is, it is assumed that there are no significant barriers to entry into the storage activity, and the implications on price dynamics are derived for the condition of stochastic supply and competitive demand.<sup>16</sup> Less attention has been devoted to cases where either (a) supply is monopolized or (b) where there are transportation costs and other logistic problems that make producers in a region to effectively confront a monopsonistic buyer. The first situation is particularly relevant for the analysis of the markets for minerals, oil and other natural resources whose extraction might be effectively controlled by cartelized firms, while the second is more of relevance here, considering the objectives of this paper, given that producers who participate into modern supply chains are often put in the conditions of facing buyers who enjoy market power. The literature on this topic is still in its infancy. There has been some attention to the practice of predatory purchasing behaviour by oligopolistic firms,<sup>17</sup> but, to the best of my knowledge, no formal model has been developed to understand the implications of storage under noncompetitive conditions on producers' price risk exposure.

One other aspect that complicates the analysis of price distribution in presence of storage is the presence of active public intervention. Usually, public programs intended to achieve price stabilization in developing countries are justified as means to protect consumers, and various mechanisms have been put in place (including buffer stock mechanisms and export restrictions) to the aim of preventing food prices from rising above ceilings level. The literature on price stabilization policies is vast, especially within the development economics field, and a survey would be beyond the scope of this paper.<sup>18</sup> One point I want to make is that, from the producers' perspective, unpredicted changes in the set of public policies that directly and indirectly affect commodity markets is perhaps the most relevant source of pure price risk (i.e., price change which is mostly independent of producers' behaviour.) In this respect, part of government lobbying by producers' interests groups can be seen as a mechanism for price risk management.

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<sup>14</sup> Private storage can be huge even in the conditions of small holding production in developing countries. In a study of household risk management in China, Park (2006) reports that "Perhaps the most striking characteristic of household behaviour in the study area is the large amount of grain stored on farm between harvest seasons." (Park 2006, p. 1096). Surveyed farm households were found to hold, on average, stocks amounting at 65% of the normal year harvest.

<sup>15</sup> The buffering effect of storage, however, can break down when a stockout occurs, and therefore it cannot prevent prices from spiking. This means that food price risk is still a very relevant political problem, given that poor consumers have a large food budget share and are commonly unable to diversify consumption away from staple foods.

<sup>16</sup> Interesting discussions on the consequences of monopoly behavior on storage decisions in commodity markets are included in Wright e Williams (1982 and 1984) and summarized in Williams and Wright (1991, chapter 12.)

<sup>17</sup> See Just e Rausser (2007).

<sup>18</sup> Most literature conclude that

#### **2.4.4. Hedging price variation**

When individual producers are confronted with a large market, so that there are no direct ways for them to modify the actual level and distribution of prices, still the possibility of *hedging* against the residual price risk exposure remains. Hedging is intended here as the activity by which producers enter in a contractual agreement with the objective of countering possible negative variations of the price. To be sure, the most effective way of hedging the price exposure would be that of entering in a contractual agreement directly with the final consumers, who will have the exact opposite stand in terms of price, and therefore would provide the most effective price risk sharing opportunity. In most cases this is impractical, given the physical and economic separation that exists between producers and consumers, but nevertheless, at least for some products, there are other hedging mechanisms that could be exploited by agricultural producers, which include **forward sale contracts** to be stipulated with an intermediary buyer of the product,<sup>19</sup> and **price-contingent contracts** to be traded on organized exchanges.

The possibility of effectively exploiting the hedging potential of formal contracts traded on local or international exchanges depends largely on the institutional settings that allows for their enforcement, which is usually quite limited for developing countries' producers. The practice of stipulating forward sale contracts is, instead, rather common in the developing world, and it is usually seen occurring between producers and local traders and processors (which may be either private enterprises or governmental agencies).

Two aspects of forward contracting deserve to be highlighted. First, it is often the case that many producers deal with few traders, who therefore may exploit local monopsony power in determining the terms of the contract, especially on the stipulated level of price.<sup>20</sup>

Second, when a relevant share of local production is sold through forward contracts, the concept of a "spot" market price loses some of its significance from the point of view of the producers. In other words, the link between the wholesale price that forms at the level of final consumption and the 'farm gate' price is broken. While this might protect producers from the consequences of events that may occur beyond the farm gate after the contract has been signed, it usually comes at the price of foregoing the possibility of benefiting from demand expansions.

One other aspect to be considered is that the signing of a forward contract introduce a whole new type of risk for the producers, namely the possibility that the counterparty would default on the terms of the contract and fail to take delivery of the product at the specified conditions. The extent of this **counterparty risk** depend strongly on the prevailing legal system and the ability that producers have to call upon a public court to require the enforcement of the contract.

Concerning price contingent contracts (futures and options), as I said, in the conditions of many developing countries the institutional settings may not be robust enough to sustain an

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<sup>19</sup> To be sure, forward sale contract might have been included among the price risk reduction mechanisms described in the previous section, in that they are a way of deeply altering the probability distribution of prices. However, they share with the hedging mechanism the property that they are contracts signed with a party who has the opposite stake in price variation. To some extent, they can be considered a "perfect hedge".

<sup>20</sup> For a recent analysis of predatory buying behavior, see Just e Rausser (2007)

active *local* trade of such contracts. On the other hand, the correlation of local prices with the reference prices for contracts traded on organized exchanges in other parts of the world may be too weak to allow for an effective hedge for producers, especially when trade policies are in place.<sup>21</sup>

For exported commodities, however, traders of product originating in developing countries might find opportunities to hedge their selling price risk exposure through contingent contracts traded on international exchanges. The possibility that this might have consequences on the price risk exposure of local producers depends, once again, on the existence of either formal or informal contractual agreements between producers and traders, and on their relative market power. The worst condition for producers would likely be that of a competitive and uncoordinated local supply facing a monopolized exporting sector and where no contractual agreements exist between producers and exporters. In this case, producers might find themselves exposed to the risk of low prices that, originating on the international consumption markets, might get fully transferred to them, while not benefiting from possible price increases that the exporters might capture as rents. An argument can be made that in principle, at least part of the risk reduction that the trader might obtain from hedging through futures and options trading could be transferred to local producers, but the likelihood that this might happen will always be related to the presence of at least a competitive threat for local exporters, or to the possibility that producers be in the conditions to exercise at least some market power.

#### ***2.4.5. Coping with price variation***

The last element of a price risk management strategy by producers is the possibility to cope with the variation of prices, revenues or returns by other mechanisms which would allow to keep smooth consumption patterns. If we focus on income risk, the ability to cope and its implicit cost depend essentially on the conditions in which **access to credit** is feasible and on the possibility of using personal savings. In other words, the cost of any activity intended to cope with monetary income shocks is given by the opportunity cost of personal savings and/or by the effective interest rate to pay for credit.

Problems arise when access to credit is limited or absent. A full understanding of the role of coping strategies in such conditions requires that one looks at welfare cost of price or income risk from the overall households' consumption perspective. It has long been established that lack of access to credit makes consumption and production decisions non-separable (Singh, Squire and Strauss, 1986). Such relationship may show up in the most pernicious way following income shocks, and the consequences might be dramatic, jeopardizing the future ability of the household to escape poverty, as when coping strategies involve the mobilization of productive assets (selling animals or machines) or the reduction the investments in human capital. (Dercon, 2005) In this context, the numerous and growing positive experiences of the microfinance initiatives, and the development of analogous micro-insurance programs, in so far as they allow to release the connection that makes income shocks to negatively affect the long-run asset status of a rural household, should be looked at with special attention. In other words, even though it might be described as a means to promote investments in productive ac-

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<sup>21</sup> This is not to say that contingent contracts traded on international exchanges are not potentially beneficial, as we will see below, as they may be a very fruitful way of hedging *import* prices by, for example governmental agencies responsible for grain storage and distribution. (See for example Sarris, Conforti e Prakash 2006).

tivities, the value of micro-credit is that it allows to buffer possible consumption shocks, and there is growing evidence that this is the case in many contexts (see Morduch and Johnston, 2007).

### ***2.5. A few summary considerations on price risk management within commodity chains and the role of contracts***

The emergence of institutionally complex value chains in the markets for agricultural and food products poses a big challenge to defenders of the free-market ideology. These arrangements demonstrates, at a minimum, that there are coordination and information problems that prevents the trade of agricultural product from being efficiently regulated by free market forces alone. With reference to the risk implications, for example, a somewhat generally felt impression is that unfettered markets become a means through which those who can enjoy greater bargaining power can “transfer the majority of unacceptable risk” (Swenson 2000) onto others, rather than a mechanism through which the socially optimal distribution of risk is achieved.

Despite being potentially very informative, a thorough analysis of the risk transfer implications of monopoly pricing is, to the best of my knowledge, still missing in the literature. Quotes like the one reported at the beginning of this essay might convey the impression that the ability to extract rents associated with market power can also be exploited to transfer more than the ‘fair’ share of risk, although this must be considered no more than a conjecture. Nevertheless, the fundamental message that the preceding discussion wants to deliver is that, in discussing risk management from a value chain perspective, it is imperative to analyze the competitive structure at each and every link of the chain and to try and understand how the real conditions of the transaction that occurs at that link allow one of the two parties to transfer risk to the other.

At least to my understanding, the way in which the transfer of risk is achieved (if it is achieved at all) through a market transaction, when the market is not perfectly competitive is not obvious, and there is some evidence pointing to the possibility that the simple impersonal market mechanism does not allow for the same flexibility in exploiting market power to transfer risk as much as it does in extracting rent. This last speculation would be consistent, for example, with observation that trade in products characterized by high production and demand risk is often regulated by *contracts* rather than through open market transactions, in spite of the market power enjoyed by one of the parties (think for example to the contracts that regulate vertical integration within fruits and vegetables value chains, with oligopolistic buyers).

Market power can definitely play a role in the bargaining process that leads to the definition of the contractual terms, in the sense that it may force those who have many competitors to accept less advantageous conditions. Yet, as far as risk is concerned and contrary to the speculation declared in the quote by Swenson reported above, one can conceive of cases in which the presence of risk may somehow offset the effects of monopoly power, i.e., it may work to the benefit of the competitively weaker party. The analysis of procurement contracts by the vegetable processing industry, or by the organized retail for fresh fruits and vegetables, for example, might shed some light on the extent to which these value chain actors might need to take direct responsibility for some of the production risks, in order to avoid disruptions in the continuity of their processing and sales activity, and how they do it through contractual clauses.

Another example is provided by some form of forward sales that were common in the fresh fruit sector of Southern Italy, where the buyer (usually a wholesale trader) would take part of the yield risk, in order to ensure the procurement of the product. The contract stipulates the lump sum to be paid to the producer for the entire production of a given field, usually at the end of the winter and right after the pruning of the trees, when only a rough estimate of total production could be made, based on the appearance of the flower buds. In this way, producers transfer the residual yield risk to the traders who, becoming effective monopolists on the local retail market, are in a better position to exploit the natural hedge that existed on the local markets for fresh fruits such as apricots and cherries, where price used to be strongly inversely related to the locally produced quantity.

These examples are intended to demonstrate that, in specific cases, risk along the value chain is better dealt with through complex contractual agreements rather than simply through sales. To think that contracts unambiguously reduce the overall risk for both parties involved, however, would be mistaken, as to link contract choice exclusively to risk consideration is probably also wrong. There are two conceptually distinct, although related issues at stake: one is the ex-ante view of how the presence of risk affects contract choice, and the other is the ex-post view of how, having entered into a contractual agreement, this affects the exposure to risk, both needing additional theoretical and empirical research before we may be able to provide definitive answers to many questions related to the impact of supply chain integration on risk exposure and risk management.<sup>22</sup>

## **2.6. *The role of governments***

One final issue to which it is worth to pay attention before moving to the next section, is the role of Government intervention. There is no doubt that, of all the reasons why a Government might want to intervene in the economy, the provision of some form of insurance is probably the least controversial one, so that it should come as no surprise that risk management and public policies are intimately related.

In agriculture, for example, many policies worldwide have been explicitly justified by the desire to reduce risk and stabilize income, and the history of stabilization policies in agriculture is long, rich and diverse, although there still is debate going on about the overall merit of such

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<sup>22</sup> In an empirical analysis of agricultural contracts in the US, Allen e Lueck (1999) fail to find support to the hypothesis that the choice of contract type is determined by risk considerations.

This, however, does not mean that the type of contract does not have consequences on the way in which the risk is shared. MacDonald, et al. (2004), who survey the existing evidence on contract farming in US agriculture find that:

“over half of contracting producers of grain in 1993-95 surveys rated cash-forward contracts as “effective” or “very effective” in providing price risk protection, while less than a third rated spot market sales as “effective” or “very effective” in doing so (Patrick, Musser, and Eckman, 1998). In their survey of hog producers, Lawrence and Grimes (2001) found that those with production contracts cited reduction in financial risks as a major advantage of contracts, as did those with marketing contracts. Finally, Lawrence, Schroeder, and Hayenga (2001) surveyed cattle and hog packers on the use of marketing contracts. Each group rated reduced price risk as an important contract motivation for producers.” (MacDonald, et al. 2004, p. 32)

Dorward (2001) develops an analytic framework to model contractual choices in presence of risk, although no empirical application of his model seems to have followed.

Chapter 4 of MacDonald, et al. (2004) includes a survey of available evidence on the risk reducing role of contracts, while Roberts e Key (2005) presents one of the few available analyses of the welfare impact of the diffusion of contracts in agriculture.

policies. With reference to prices, and linked to our discussion of price risk, one accepted conclusion should be that price stabilization *per se* should never be considered a desirable policy objective, that the fundamental source of instability should be addressed, and that the incidence of the policy depends crucially on parameters such as supply and demand elasticity (Wright and Williams 1988, Newbery and Stiglitz 1979). Everything else being equal, the attempt at stabilizing prices without an understanding of the fundamental cause for price instability, will result in transferring instability from one sector of the economy to another, or to transfer the burden of the instability from one social group to another, but with no clear net social benefit.<sup>23</sup>

Nevertheless, direct price stabilization policies and other forms of government intervention in agricultural and food markets are still very common, and they happen to be periodically brought up in the policy agenda, following unpredicted swings in the levels of prices, as it occurred for example in the recent agricultural price “crisis” earlier this year. If we add to this the consideration that many policies, which are not directly addressed to risk, end up having relevant consequences in terms of price variability, we must conclude that it would be very unwise to neglect a careful analysis of the presence of public policies in any study of price risk management. A few considerations will try to make the point clearer.

One first consideration has to do with the concept of “tail risk” which was introduced above (see Fig. 2 on page 16). Tail risk involve rare but dangerous events, such as for example natural disasters or extremely adverse economic conditions. As the recent (still ongoing) experience of the banking system crisis demonstrates, when such events occur, Governments will eventually “step in” by taking most of the burden of the catastrophe from the shoulders of those most directly involved and spreading it on the wider population, as the political cost of not doing so might be too large. However, anticipation of this form of intervention by economic agents will have the consequence that they will under invest in private risk prevention activities, making the overall social cost of the bail-out larger than it could have been, if proper preventative measure had been taken.<sup>24</sup> The purpose of this consideration here is not to discuss the merits of the type of public bail-out that have been mentioned, but rather to point that even just the anticipation of government intervention will likely alter private risk management behavior, which will not take into account the cost associated with tail risk.

The second consideration relates to the role that information plays in risk management and to the eminently public good nature of information. A key step in the design of any risk man-

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<sup>23</sup> An argument can be made that price stabilization policies have nevertheless been beneficial for economic growth, based on the observation that the most powerful agricultural economies that we can observe today have developed while such policies were in place. Such an argument, however, should include consideration of *other* policy induced effects that might have contributed to the growth of the agricultural sector aside from pure price stabilization. In fact, most of the actually pursued policies have stabilized prices at a price *higher* than those which would have prevailed in their absence, thus including a net transfer of resources towards the agricultural sector. It can be argued then that it is the net subsidy, rather than the stabilization effect, that has promoted agricultural growth by implicitly taxing consumers through higher food prices.

<sup>24</sup> Another example can be found in the experience of the public intervention in subsidizing crop insurance premiums. In the US, the need for sizeable subsidies to crop insurance was justified by the consideration that they would promote farmers participation in the insurance program, and thus reduce the need for costly disaster payments. Experience has shown that the amount of ad hoc payment needed to compensate farmers for damages due to natural disasters has increased, despite commitments to the contrary that were included in the various US Federal Crop Insurance reforms (Glauber 2004).



agement strategy is the assessment of the probability of negative events occurring. Information on the frequency with which such events occurred in the past and on the impact that they had is thus crucial to form a reasoned view of what is at stake. Unfortunately, if the information is kept private,<sup>25</sup> there will be a less than optimal amount of information flowing. In this, public services may (and often do) play a crucial role. To collect, validate, certify and diffuse information that may help in assessing the probability distribution of bad events is perhaps *the* most important role for public policies as concerning risk management.

With reference to price risk, commodity exchanges typically serve the function of information brokerage on the prices for the actively traded commodities, and their diffusion in developing countries will certainly help improving the overall market risk management ability of producers (World Bank 2008, chapter 5).

### **3. Economic risk and types of value chains in developing countries' agriculture**

Having surveyed some of the relevant general issues concerning producers' price risk management, I am now in the position to discuss some more specific issues related to the kind of arrangements that are usually seen in the developing world. One potentially fruitful way of discussing of the practical implications of risk and of the potential role of private and public actions intended to increase farmers' share of the benefits associated with participation in value chains is by classifying the possible value chains in a set of prototypical organizations.

The characteristics of relevance will be driven essentially by product characteristics such as:

- a) The degree of product's perishability, which dictates the possibility for storage and long distance transportation;
- b) The degree of product's quality standardization/differentiation, which may either be intrinsically determined by the products' nature and geographic origin, or virtually determined by marketing promotion policies by the supply chain managers, and which greatly determine the degree of 'market power' that producers may enjoy;
- c) The degree of processing, or the extent to which the bulk product is used also as an input for other industries, which may condition characteristics (a) and (b) above. For example, using the agricultural product as an input in a processing activity may increase the storability of the products and drive a wedge between consumers and producers of the bulk commodity (i.e., the consumers' market for coffee or chocolate is largely distinct from the market for coffee or cocoa beans). Also, If the bulk agricultural product is used as an input in other industries, the price variation for the agricultural product is only indirectly linked to the evolution of the final demand.

The capacity of supplying international markets with fresh, perishable, unprocessed, "specialty" food products is what probably holds the bigger promises in terms of value added that can potentially be "extracted" from rich consumers and that can be appropriated by supply chain participants, both in developed and in emerging countries. This justifies the increased attention that products such as specialty coffee, or fresh fruits and vegetables are receiving in many discourses on how to promote developing countries' agriculture. However, as we shall

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<sup>25</sup> As it occurs for example within the insurance industry, in which there are no sufficient incentives for insurance companies to truthfully reveal the actuarial performance of the contract they sold.

see, this poses special questions in terms of the kind of risks the chain is exposed and of the risk management options available for producers: while the more perishable, the more differentiated and the less processed is the product, the larger is the “bargaining power” that producers may exploit in the supply chain relationships, the delivery of these types of products imposes a host of new types of risks, mostly related to the timing of delivery and the assurance of quality characteristics, which have received less attention than traditional price and yield risks in the prevailing agricultural economics and development literature.<sup>26</sup>

Depending on the products’ characteristics, the supply chain organization will differ along the following dimensions relevant for the objective of exploring the impact on producers of the basic agricultural product, and especially small farmers:

- the level of complexity/integration (i.e., whether producers are in contact only with the direct purchaser of their product or also with other agents down the chain, up to consumers, and the type of relationship existing, whether formal, informal, involving liability, information sharing, etc.)
- the extent of control operated by the various agents (i.e., the possibility that contracts imposes technical and financial obligations)
- what is the central “price formation” locus,
- which are the major risks, other than price variation, to which the producer is exposed;

These, in turn, will determine:

- the likelihood that small farmers might participate in the value chain;
- the size of the share of value added that can be appropriate by small farmers;
- the potential for income risk reduction that farmers might enjoy by participating in the value chain;
- the role for effective public actions that might increase points (b) and (c) above.

Table 1 lists a set of possible prototypical value chains that can be observed involving developing countries agricultural products. In the remaining of the paper, I shall analyze some of them in greater detail, to the aim of highlighting the implications in terms of price risk exposure and management by producers.

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<sup>26</sup> The analysis of risk in food products has received instead a greater attention within the literature related to *technical* and *legal* aspects of quality assurance. For example, there is a growing literature on the role of communication in reducing health risk associated with food. For an extended list of references, see the web page of the *Joint Initiative between the Food and Drug Administration* of the US Government and the University of Maryland, at <http://jifsan.umd.edu>, and the activities of the *European Food Information Council*, <http://www.eufic.org>. The economics of quality assurance in food chains in Europe is explored in (Ziggers e Trienekens 1999) and in (European Commission 2006).

**Table 1 A typology of DC's agricultural supply chains**

Product characteristics			Label	Products	Complexity of the chain	Farmers' control on price	Price formation locus	Major risks
perishability	standardization	processing/double						
low	high	low	"Staple foods"	Rice, Wheat, Cassava	Simple	Limited	Domestic wholesale markets Governments	Yield Domestic policy Logistics
low	high	high	"Highly standardized, high-volume internationally traded commodities"	Corn, Cotton, Soybeans, Sugar, Coffee, Tea	Simple / Medium	Minimum or nil	commodities exchanges; border	Price fluctuations, Trade policies
low	low	high	"Specialty commodities for international markets"	coffee, tea, cocoa, wines, certified free trade, organic, etc.	Highly integrated	Low/Medium	Trade and processing	Quality Contractual breaches
medium	low	medium	"Tropical fruits for international markets"	Bananas , Pineapples	Integrated	Limited	Trade	Demand fluctuations Logistics, transportation
high	low	high	"Fruits and vegetable for processing"	Potatoes, Oranges	Integrated	limited	Wholesale markets, Contracts	Contractual breaches Technology
high	low/medium	low	"Fresh fruits and vegetables for domestic consumption"	various	Medium	Medium/high	Urban centers, Farm gate	Yield, Logistics disruption
high	high	low	"Fresh fruits, vegetables and flowers for international markets"	Apples, pears, cut-flowers	Integrated	Medium	Auctions on final markets	Transport and logistics Demand fluctuations

### 3.1. *Staple foods for domestic consumption*

The production of staple foods is still the most important in many agricultural based and transition countries (World Bank 2008, p.118). There are two major destination for staple foods: domestic consumption and export. The share of total production that is destined for domestic consumption still covers a large share of agricultural production in developing countries (see Table 2 for cereals), and especially that of small farmers.

**Table 2 – Food balance indicators for cereals (excluding beer), 2001-2003**

COUNTRIES	Production/ Trade	Production/ Consumption	Share of World production (Percent)
India	23.43	1.14	9.96
Myanmar	16.41	1.53	0.84
Poland	15.51	4.32	1.37
China	12.63	1.54	17.77
Bangladesh	8.25	1.01	1.43
Romania	8.21	3.28	0.82
Pakistan	7.44	1.21	1.36
Turkey	7.32	1.96	1.61
Indonesia	6.50	1.04	2.35
Russian Federation	6.34	3.54	4.14
Brazil	5.50	2.80	2.92
Nigeria	5.12	1.16	1.09
Viet Nam	5.12	1.67	1.34
Ukraine	3.64	4.05	1.71
United States of America	3.50	9.82	17.09
South Africa	3.50	1.42	0.63
Hungary	3.29	9.74	0.63
Kazakhstan	3.05	5.96	0.82
Philippines	3.00	1.18	0.71
Germany	2.44	4.71	2.35
Iran, Islamic Republic of	2.44	1.25	0.94
United Kingdom	2.35	3.19	1.13
Thailand	2.30	2.93	1.18
Canada	1.83	11.81	2.30
France	1.79	8.77	3.28
Australia	1.77	18.85	1.70
Egypt	1.75	1.02	0.92
Mexico	1.63	1.67	1.60
Argentina	1.60	6.51	1.80
Spain	1.59	4.99	1.07
Italy	1.33	2.07	1.03

Note: the table lists the countries that contribute to more than 0.5% of total World production. Column one is the ratio between production and total trade volume (import+export). Column two is an index of self sufficiency (production/consumption).

Source FAO Statistical Yearbook vol.1, table D.3, available on line at [http://www.fao.org/statistics/yearbook/vol\\_1\\_1/xls/d03.xls](http://www.fao.org/statistics/yearbook/vol_1_1/xls/d03.xls)

The value chain organization, in these cases can range from the lowest level of complexity, being formed – in the simplest possible cases – by producers and local consumers in the village, to increasingly more complex chains that involve the presence of traders, who concentrate the supply in the producing areas and serve the wholesale markets, from where other traders might take on and serve the urban markets. (See World Bank 2008, Figure 5.1, p. 119). Also, often there is a large involvement of government in collection, storage and distri-

bution activities; examples can be found in the rice market in India and in Bangladesh, or in the wheat market in Syria.

With reference to the framework introduced on Fig. 1 on page 14, Fig. 3 below highlights the major actors and links in this type of value chain.

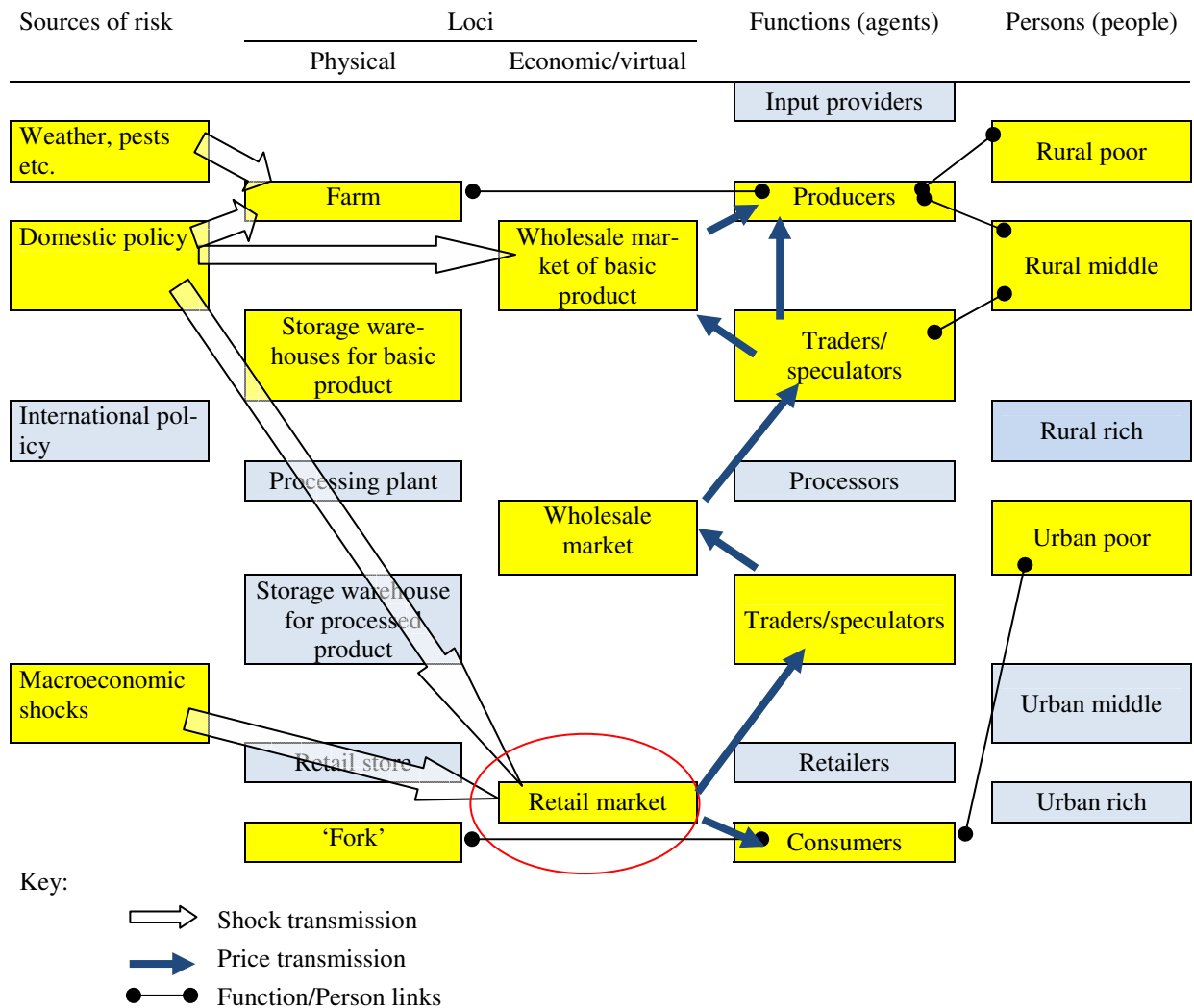
The level of either formal or informal contractual agreements of farmers with other agents in these cases is limited. In many instances, especially in the conditions where producers are asset poor and access to formal credit is limited, one common arrangement is the one where “a trader (or a “commission agent”, as he is called in some parts of India) enters into a contract with a farmer under which the farmer agrees to sell his harvest to (or through) the trader (often, though not always, at a price stipulated in the contract), in return for which the trader provides credit for cultivation at terms specified in the contract” (Bell and Srinivasan 1989).

Similar arrangements exist for example in Syria, where wheat producing farmers either possess an official license, which entitles them not only to produce and sell wheat to government establishments but also to obtain short term credit in the form of advance payments, or, when they cannot obtain the license, enter into informal agreements with traders who often are the only source of short term credit.

To the extent that the major destination of the product is domestic consumption, the main price formation locus (indicated by a red oval in the figure) is the retail market, where consumption occurs, and it is determined partly by the local supply and demand conditions, but often by Government intervention, usually intended at consumers’ protections and which may involve various forms of price control and stabilization initiatives, considered to be easily implementable given the possibility of storage, and which often involve public storage.

The price then is transmitted to producers (see the blue arrows) through traders who might also control stocks.

**Fig. 3 - The value chain for staple foods domestically consumed**



Although price risk, in principle, should not be of great concern to producers who enter into contracts with the traders or the government establishments, thus fixing in advance the price they will receive, there is arguably a large scope for improvement of the market information systems that link producers to the final market. As discussed in (World Bank 2008), chapter 5), this might be of great benefit to producers in remote areas, who might be currently excluded from the benefits of expanding consumer markets by wastage and losses due to poor storage infrastructures and by the presence of wide marketing margins, poor marketing integration, limited access to finance and weak regulatory institutions. Improvement in the marketing infrastructure and in the market information system might have an impact on the contractual terms that farmers may obtain from their trading counterpart. Lacking precise information of the condition of final markets, it is very likely that producers might implicitly pay a higher than needed risk premium in the contract they sign with intermediaries, accepting a fixed low price simply for the impossibility to assess what might be a reasonable price to expect for their product.

Apart from price risk, yield risks and personal accidents are likely to be the most relevant risks which might, in the first case, reduce the income derived from farming, in the second case, compromise the ability of farmer to repay the debts incurred in borrowing from traders and others. Also, natural hazards might have large consequences on the already poor marketing infrastructure. This points to the benefits that may derive to producers and their families from **improved access to credit** and to modern form of **index based protection against covariate risks** such as droughts, flood, etc.

### ***3.2. Fresh fruits and vegetables for domestic consumption***

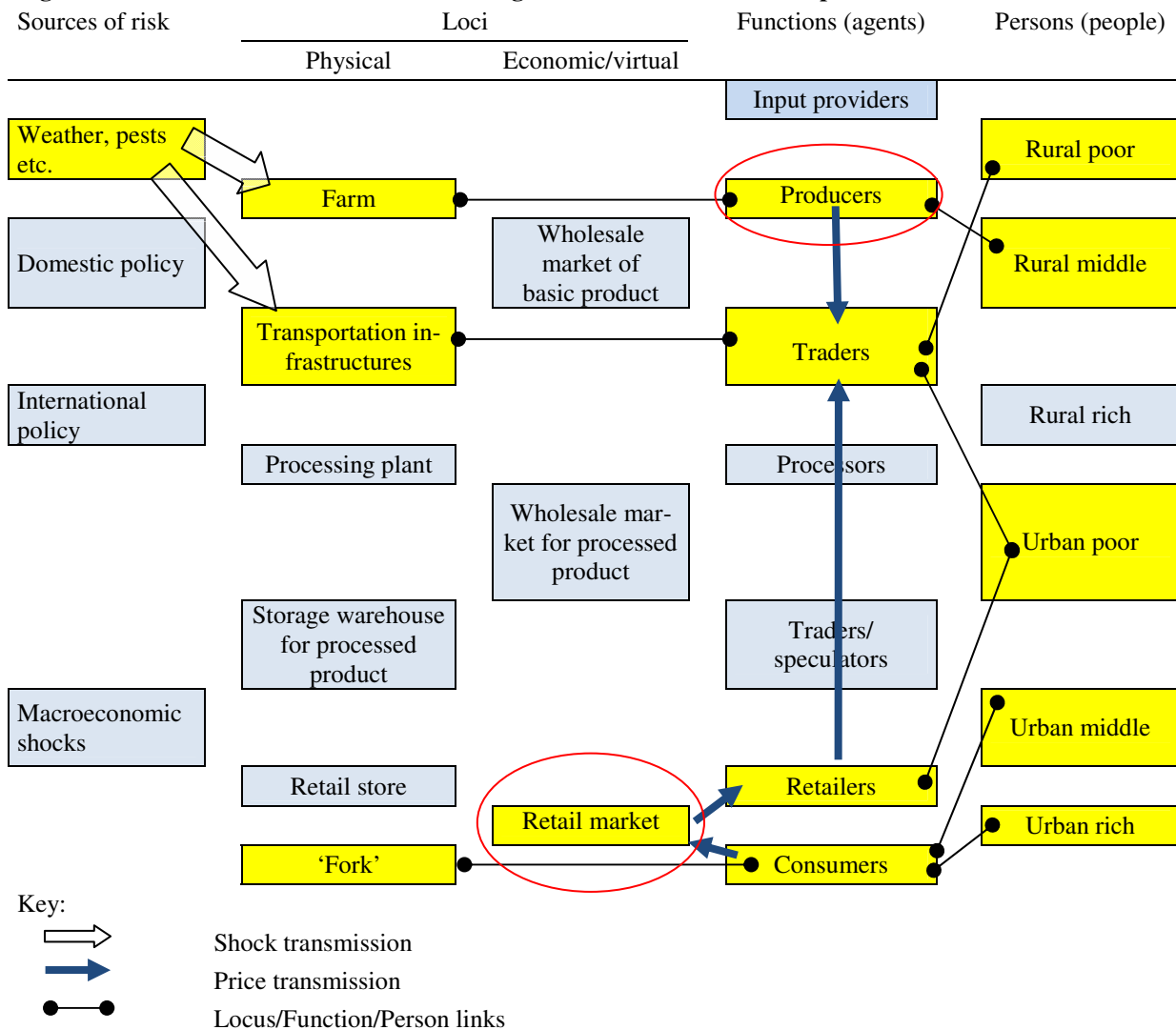
In the fresh fruits and vegetables supply chains (Fig. 4), the role of traders and of infrastructures (transport, short term storage, village markets) is probably larger than in the case of staple food.

In this supply chains, the poorer and weaker link of the chain is probably not the farmer, rather the trader and the small individual retailer. Fruits and vegetable producing farmers are usually not among the asset poorest farmers: they will have irrigation, make intensive use of labor, which means that they have made some investments and have already been able to step away from self subsistence and staple food production. On the other hand, for fresh fruits and vegetables the possibility of arbitraging through storage is precluded by the perishability of the products, which gives less of an edge to traders, who often have to procure and pay the product before even knowing if and how well they might be able to sell it, thus bearing most of the risk associated with product deterioration, which may be particularly high in many developing countries due to poor infrastructures.

Here too the supply chain risk is particularly vulnerable to weather shocks, although, rather than affecting production, they are likely to mostly affect trade and distribution activities. While insurance may be problematic, essentially for problems related to the possibility of writing detailed contracts and to damage assessment, investment in infrastructures by the public and provision of medium term loans to private traders are likely to be very effective means to reduce the overall risk exposure of the chain and to benefit the poorer.

The described condition is likely to change. Although open air markets and road-side kiosks are still the dominant forms of retail for fresh fruits and vegetables, the change in the retail organization is progressing in developing countries too. As noted by (Humphrey 2006), p. 34), even if supermarkets will never gain market dominance in the sales of fresh fruits and vegetables in developing countries, it is plausible that they will be forcing the modernization of other parts of the chain, in ways that will likely affect the organization of the supply chains. If nothing else, there will be a segmentation of the market operated through a sizeable difference in prices among vegetables and fruits sold in the supermarkets and those sold in traditional open air markets and road side kiosks. The impact of this development on the organization of supply chains will be likely be that of increasing the role of retailers in conditioning mechanisms for price transmission. A growing share of the production will be procured by large retailers and better organized traders, through production contracts rather than through open market transactions, and this will likely be true especially when timing and quality of production becomes crucial. The development of the supply chain organization and the development of the needed transportation and information infrastructures are likely to progress parallel: no one is achievable without the other, and the role of public expenditure, in this sense, will be crucial.

**Fig. 4 - The value chain for fresh fruit and vegetable for domestic consumption**



### 3.3. Highly standardized, high-volume internationally traded commodities

For commodities such as coffee, cocoa, tea, cotton, etc., for which there is an active international trade, the central locus where the price is formed is usually abroad, and the scope for trying and affect the process of formation of such price by domestic producers, consumers or governments in developing countries may be very limited.<sup>27</sup>

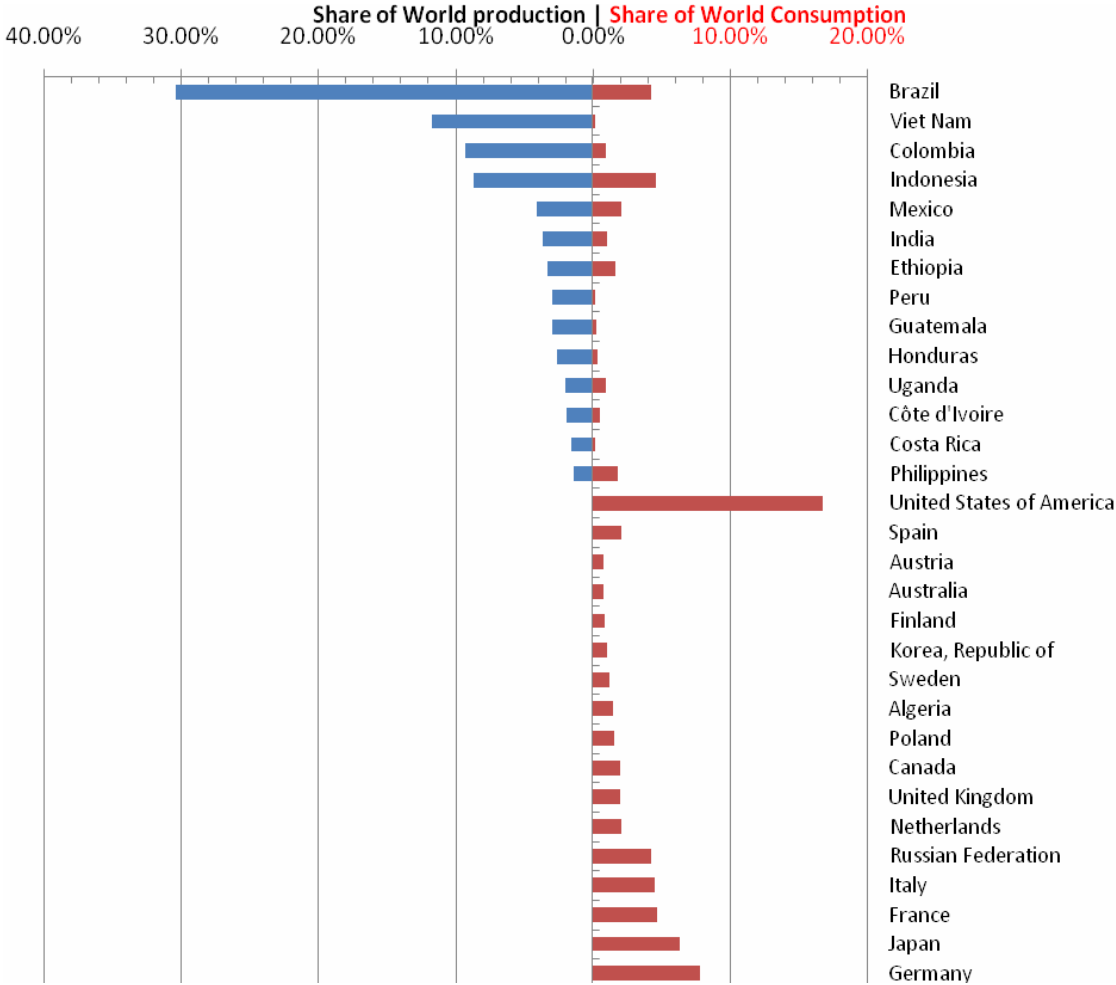
If the market were free from distortions, producers would be exposed to the price risk associated with the variability of international markets. In most countries, however, governments can, and in fact do, greatly alter the level and variability of the effective price that producers receive for their product, by affecting the transmission of the prices across the border through various forms of trade policies and thus breaking the correlation between internationally quoted prices and effective farm gate prices. The level of complexity of the value chain in

<sup>27</sup> In the trade literature parlance, this is referred to as the 'small country' hypothesis. Even when domestic consumption is not a negligible share of World production as for coffee in Brazil and Indonesia, or cocoa in Brazil and Mexico, it is likely to be the case that the price is determined by international trade



these cases is thus generally low; producers sell their product either on wholesale markets where exporters buy them, or, very often, to State Trade Enterprises, whose presence, as said, usually breaks the direct link between agricultural producers and the immediate downstream purchasers (Fig. 8).

**Fig. 5 – Coffee World economy**



Note: production: average 2005-2007; consumption: average 2001-200. Countries are sorted based on the share of World production.

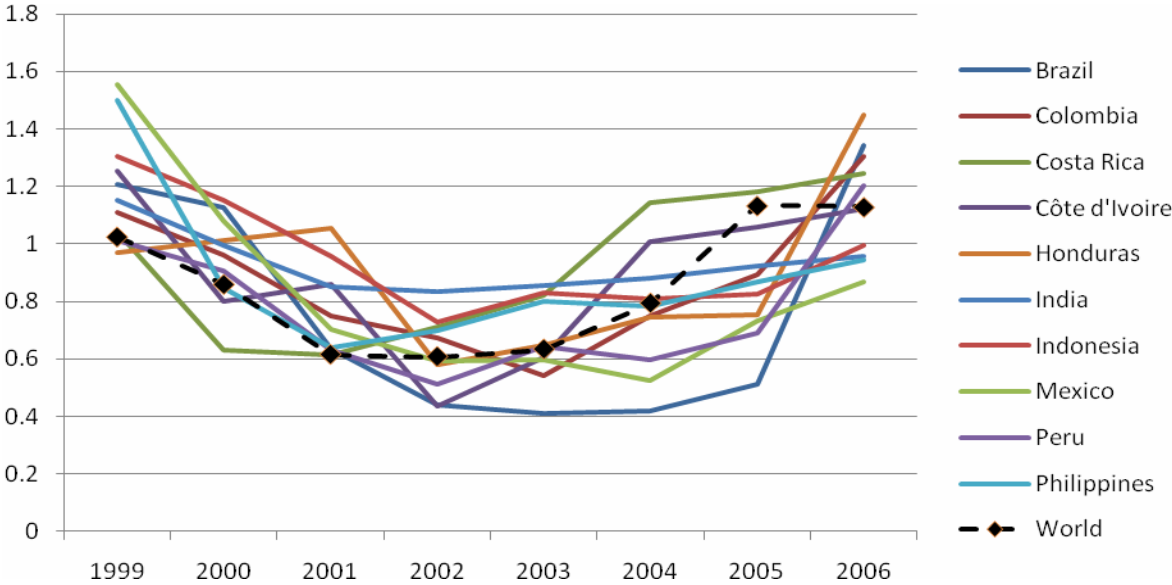
Source: our elaboration on FAOSTAT data.

Although producers themselves might not be in the condition to use futures and options to hedge price risk, the international dimension of the market and the presence of commodity exchanges for these products provide nevertheless important scope for hedging against negative price variations, which might be done by elevators and other intermediaries who then transfer part of the benefits to farmers in terms of more stable prices.

The effectiveness of hedging through futures depends on the level of correlation existing between the spot price on the delivery market on which the futures contracts are quoted and the

relevant spot price for the destination market of the country production. A low correlation would imply high basis risk which might make hedging not effective. For some of these commodities, there is compelling evidence that the major destination markets are quite integrated.<sup>28</sup>

**Fig. 6 – Coffee: produces prices in various origin Countries and comparison with destination prices.**



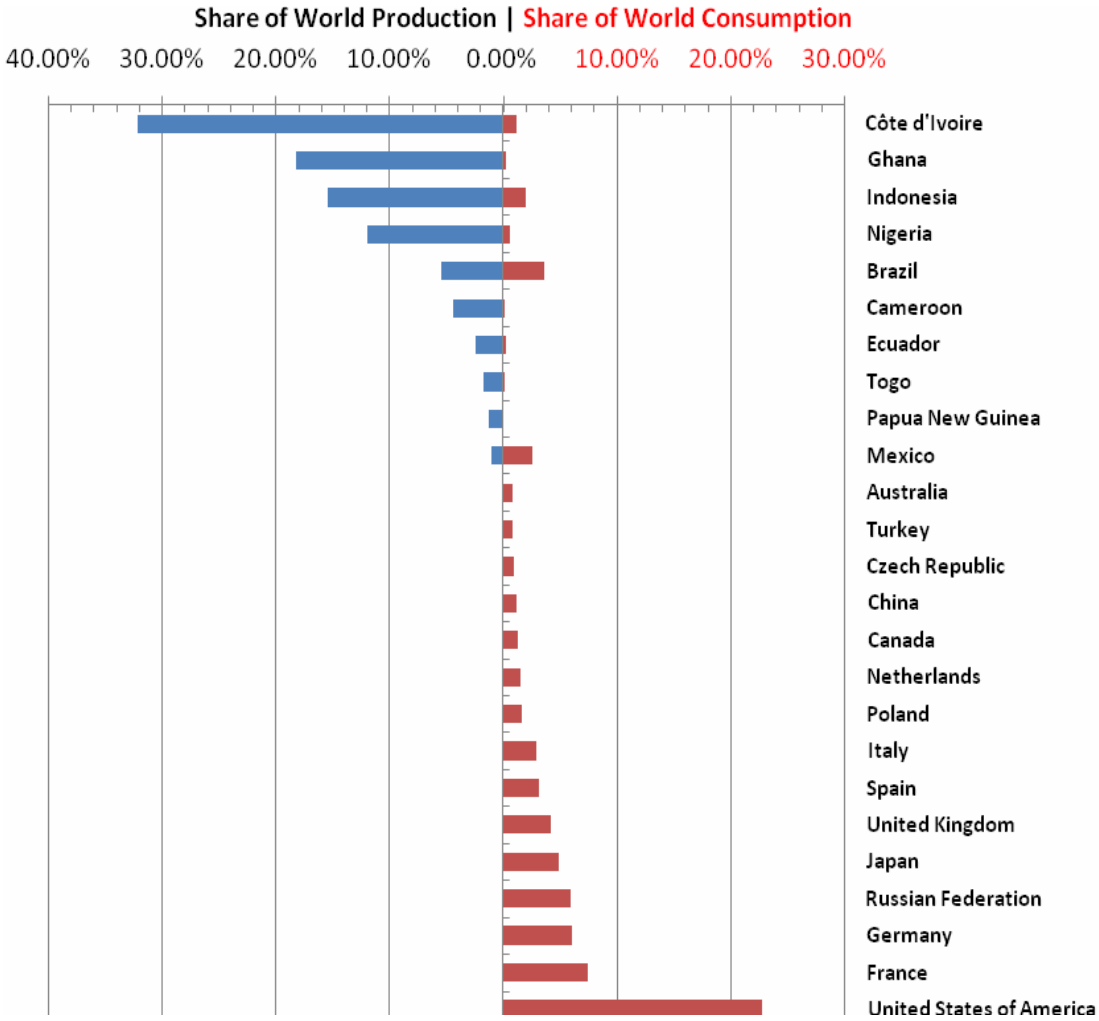
Note: The data are indexes of producer prices in USD/tonne, normalized to the mean over the period 1999-2006. The series labeled “World” contains the International Coffee Organization (ICO) indicator price, for Arabicas, average of New York and Bremen/Hamburg markets, ex-dock

Source: FAOSTAT and WorldBank “Pinksheet” data.

On the other hand, in those cases when local markets for tradable commodities are not integrated with international markets, the reason is often because of some form of Governmental intervention that contributes to stabilize prices (as, for example, the case of coffee markets in Rwanda reported by Rapsomanikis et al. 2006), and therefore the issue of price risk for producers becomes rather one of *institutional* risk, that is, the risk that the Government might change policy in unexpected, adverse ways.

<sup>28</sup> See Abdulai (2006) for the analysis of commodity markets in sub-Saharan Africa, and Rapsomanikis, Conforti e Hallam (2006) for a review of evidence.

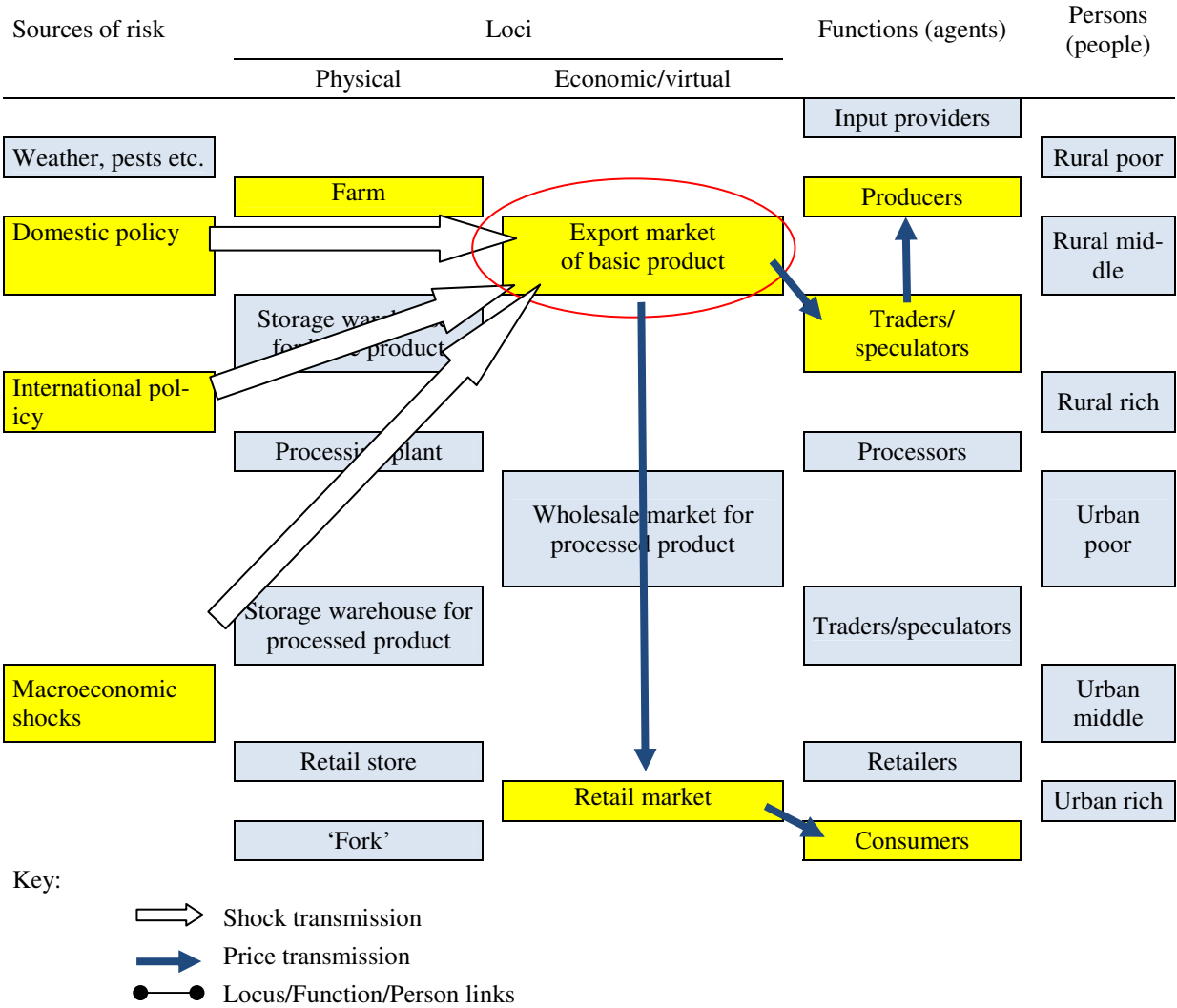
**Fig. 7 – Cocoa World economy**



Note: production: average 2005-2007; consumption: average 2001-200. Countries are sorted based on the share of World production.

Source: our elaboration on FAOSTAT data.

**Fig. 8 - The value chain for highly traded export commodities**



There is an active effort in many developing countries in establishing new commodity exchanges where futures on products such as cereals, sugar, cotton, oilseeds, etc. are traded. China, India, South Africa and Thailand all have active agricultural futures exchanges, although the merits of their function and the impact their presence has on the price of food is still debated. The impression I have is that their role is undeniably positive, provided the right institutional settings is in place to prevent dominant positions from exploiting informational advantages. The public role in ensuring transparent information is likely to be crucial in this respect.

One other change that is occurring in the supply chains of traditionally bulk commodities such as coffee, cocoa and tea, is the attempt at colonize new market niches, resulting in a wave of diversification of traditional bulk commodities into specialty commodities, up to the point of causing the switch to a distinctly different commodity chain organization (see next section).

**3.4. Specialty commodities for international markets**

One significant evolution in the markets for traditional food products such as coffee, chocolate and tea has been the creation of special niches to try and attract rich consumers. This has

been done by attaching to the product some “quality” dimension in the attempt at diversifying buyers away from the mature traditional bulky markets. Brands, denominations of origin, organic certified, free trade, socially responsible, etc. are all very common labels attached to the more or less traditional products to extract more value added from the consumers.

Such a switch has already had an impact on the organization of some of the most traditional supply chains, such as coffee and tea and on the distribution of the value added along it. Although the fundamental reasons for the development of this type of institutions and/or participation by large private companies involved in the trade, processing and retail of agricultural commodities could be questioned (i.e., is it really a genuine interests towards the conditions of the poor, or rather is it just seen as an opportunity to colonize and revitalize old markets through smart and innovative product differentiation?) the fact is that they certainly provide new opportunities and present new challenges to developing countries producers.

Switching away from a traditional undifferentiated product toward a “quality” product has implications on the characteristics of the demand faces by that retailers. On one side, the price elasticity of demand is dramatically reduced, which allow sellers who are able to effectively differentiate their product from the competing ones, to sustain price mark-ups over marginal costs; on the other hand, the demand for these products tends to be more volatile and extremely fragile to perceived drops in the reliability of the quality information.

Product differentiation is a fundamental chapter of the Industrial Organization literature, and to review it would vastly exceed the scope of this paper. Also, the literature on the economics of quality attributes applied to agricultural and food products has been growing at a very fast pace in the last decade or so, and the number of papers is huge. What this literature highlights, is that there are different strategies that should be pursued depending on the type of quality attribute that is involved, that is whether the quality attribute that is associated with the product can be objectively assessed by the consumers or not, and what is the cost of gathering information.<sup>29</sup>

Most of the attributes that are becoming more relevant in food products are of a “credence” type: the truthfulness and the actual content of labels such as “GMO free”, “organic”, “pesticide free”, “fair trade”, “socially responsible”, “denomination of origin” and the like, cannot be objectively assessed by the consumers, who must thus rely on some form information which can be either privately or publicly provided.

When the certification is reliable and where a strong institutional settings exist to enforce the truthfulness of labeling, retailers have to coordinate and control the attributes of their offerings across the entire supply chain, given that the cost of detected fraud would be very high. This will imply a stronger integration with producers, which could be obtained through complete vertical integration, that is with the retailer taking direct control of production by obtaining ownership of the plantations and production farms, although experience seems to show that other forms of contractual agreements between trader/processors/retailers and producers

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<sup>29</sup> Depending on the possibility of assessing them, quality attributes are classified as “search”, “experience” and “credence” (Stigler 1961, Nelson 1970 and 1974; Darby and Karni 1973). Attributes are classified as of an “experience” type if they can be costlessly assessed by the consumer through the actual consumption act, whereas they are classified as “credence” if they cannot be assessed, even after the consumption of the good, if not at prohibitive cost.

prevail, where a reciprocal commitment is established in sharing responsibility for the product quality.

These forms of contractual relationship between producers and other agents can definitely allow producers, even in developing countries, to participate in the distribution of the value added generated by the product diversification, however, they will usually:

- a) require some form of investment by the producers, needed to comply with special production requirements (i.e., organic production, or integrated pest management techniques, or equipments for on farm post harvest treatment and packaging) or to allow for the monitoring of the production processes (notice that such investments may be highly specific and therefore be partly or totally irreversible);
- b) require the establishment of a traceability system which allow for producer identification.

Associated with these requirements, new types of risk for producers arise. First, after the needed investments are realized, the other participants of the chain may fail to accept delivery of the product, if a cheaper source of production becomes available. The irreversibility of the investment cost may thus become an element that puts producers in a weaker position and thus accept to get a lower share of value added. Second, the risk that if something occurs along the value chain that compromise the products' quality, producers might be held liable.

The extent to which these risk consideration might be among the main elements that condition the participation of developing countries producers into these new types of highly coordinated supply chains is, at the moment, still largely unexplored, but it is certainly an issue of great importance. In any case, what appears to be sufficiently clear is that the possibility for producers to profitably participate in these developments crucially depend on the existing of an effective institutional and legal system to assist in contract design and enforcement, an important role for public policy.

### ***3.5. Fresh fruits, vegetables and flowers for international markets***

Another rapidly growing sector in the global agricultural trade from the South to the North is the one that involves highly perishable products such as fish, meat, fresh fruits and vegetables, cut flowers. Innovations in the technologies for post harvest treatment and in the speed of transport allow these high value perishable products to be shipped to much longer distances than in the past.

Fresh and processed fruits and vegetables, fish and fish products, meat, nuts, spices and floriculture account for about 47 percent of the agricultural export of developing countries (World Bank 2008) p.129).<sup>30</sup> The “production, marketing and trade of fresh and processed fruits and

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<sup>30</sup> This is the case for example for China, whose export of apples towards Europe has been increasing sizably in the recent past, up to the point of triggering alarmed reactions from the European apple industry, or of Morocco, Egypt and other Mediterranean countries, whose export of fresh vegetables in Europe has also increased tremendously. See

Some Latin American countries such as Ecuador, Colombia and African countries as Kenya are gaining large share of the European and US market of fresh cut-flowers such as roses and carnations. Large domestic markets for fresh cut flowers exist in India and China. For a not so recent report on the prospects of the International market for cut flowers see: “The world cut flower industry: Trends and prospects”, by Gijsbert van Liemt, available at: <http://www.ilo.org/public/english/dialogue/sector/papers/ctflower/index.htm>

vegetables” has been defined as “one of the most dynamic segments of developing country participation in world markets” (Minten, Randrianarison and Swinnen 2005) p. 1.

The problems and pressures on supply chain integration posed by this group of products are, to some extent, similar to those analyzed for specialty food, in that the value added is linked to the ability of sellers to diversify products by associating with the product some quality characteristics for which rich consumers are willing to pay. However, as opposed to the cases analyzed in the previous section, in this cases the quality attributes are more of a “search” type, that is, they are easily assessable by the consumers before purchase, and therefore their supply is much less to rely on information and advertisement as it must on things like timing of the delivery, compliance with detectable sanitary and phytosanitary standards, variety of choice, freshness, etc., all things on which producers, above anyone else, have control.

For some relatively more standard fruits, such as bananas and pineapples, the traditionally dominant configuration in the global trade in the past has been vertical integration, with trading companies taking direct control of production through ownership of local plantations. In that context, risk is (almost) fully internalized, and the role of small farmers is inexistent, other than as wage workers in the plantations, often in very weak positions (see for example (Blythmann 2006) on the pineapple industry).

Also because of spread of information on the conditions of workers in the plantations, things have started to change even in the chains of these standardized tropical fruits, with more and more attention to socially responsible practices and certification. At the same time, for other fresh and fruit products which, as opposed to pineapple and bananas need to be handled faster and with more care, the prevailing organization is that of a contractual agreement between independent producers and the traders or retailers. This makes the potential for producers to gain stronger contractual positions within the value chain higher, although the likelihood for individual small holders to participate in the chain can remain low. Individual, uncoordinated producers, in fact, are very unlikely to be able to guarantee the kind of quality that these supply chain requires. Non negligible investments in transport, handling and packaging infrastructure are needed, and these might be available only on larger producers or on producers’ associations.<sup>31</sup>

The most recent experience in fresh vegetables such as fresh tomatoes or French beans, confirms that production and trade tend to maintain their autonomy, and to engage in contractual agreements. The private nature of such contracts has generally prevented, so far, researchers from exploring the price risk sharing mechanisms that are possibly included. It is very likely that the particular type of risks involved, such as those related to quality and timing of delivery, which mandates a more intense control on the production process, creates the conditions for more favourable conditions for producers, whose “reservation price” is the price they can obtain on local markets, which bounds from below the price that retailer may offer in the contract. On the other hand, once retailers have signed contracts establishing quantity and time of

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<sup>31</sup> There are, however, cases where smallholders remains the dominant form of suppliers, as in the Indian spice sector (Jaffee 2005), which however, is largely devoted to the domestic market, or the fresh vegetables in Madagascar (Minten, Randrianarison and Swinnen 2005) where participation in the international export supply chain seems to be driven by social characteristics of the farmers, such as a higher level of education, rather than by farm size.

delivery, they cannot risk that producers decide not to deliver their product to them, and rather sell it through markets.

One interesting and very informative case study is analyzed in (Minten, Randrianarison and Swinnen 2005) for French beans production in Madagascar, procured and sold to supermarkets in Europe by one Malagasy company, Lecofruit SA. The results of a survey made on 200 farmers producing vegetables under contracts, selected as to be representative of the about 10,000 farms in the Highlands of Madagascar who produce vegetables for supermarkets in Europe, show that contracting has been very beneficial to farmers, allowing for the reduction of the lean period during which rural households are constrained to reduce their consumption, and that the main reason for their entering the contract was related to the possibility of diversifying income sources and thus provide income insurance.<sup>32</sup>

The detailed description of the contract characteristics in (Minten, Randrianarison and Swinnen 2005) allows also to derive some interesting observations related to the risk implications for the farmers and for the trade company. The first one is the fact that farmers retain most of the production risk, with the additional dimension of quality risk: the contract specifies in facts, that the firm would only pay for the product that fulfils the quality norms set in advance. However, because it is in the interest of the firm to maintain adequate supply, Lecofruit provides technical assistance and training, in addition to monitoring and supervision of the contracted areas.

The presence of an alternative outlet for the product that is not sold to the firm, determines the fact that the purchasing firm must maintain sufficient incentives, in terms of price premiums, to attract farmers and to ensure enforcement of the contract. In facts, contracts in the Malagasy settings needs to be self enforcing, given the fact that, although there is a written agreement, they are seldom legally enforceable in practice, given the poorly developed legal institution and the relatively high transaction cost, compared to the small amount involved in any single individual contract.

Finally, these contracts have appeared to be robust even to one kind of macroeconomic shock that is common in Madagascar: inflation. In regimes of high inflation, the price signed in the contract in nominal terms may result being lower than expected, in real terms, at the moment of delivery. The ability for the firm to possibly profit from the reduction in real purchase price is limited by the threat that farmers might switch to the local market. This has in fact forced the company to adjust their prices when it noticed a significant decrease in the quantity supplied (Minten, Randrianarison and Swinnen 2005, footnote 21).

#### **4. Conclusions**

The fast growing interests that has formed around the concept of value chains in developing countries' agriculture has revealed that there are important opportunities that can be captured,

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<sup>32</sup> The results in Minten, Randrianarison and Swinnen (2005) are derived from analysis of a sample of contract farmers. Additional informative results on the differential impact that contract participation makes could be drawn from crossing the data of Minten, Randrianarison and Swinnen (2005) with those available through more general agricultural survey in the Country, as those analyzed for example in Thomas, Gubert and Henry de Frahan (2008).



in terms of income growth and expanding markets for farmers in these countries. The literature so far has been investigating the challenges that the process of value chain integration will pose in terms of needed innovations and structural adjustment, with an eye to the potential benefits in terms of value added that might reach agricultural producers.

The major lessons that can be derived from the discussion on the many problems related to risk exposure and risk management in the previous pages are the following:

1. **Exposure to uninsured risk**, in general, still determine relevant welfare losses to poor people in developing countries, both directly (through the deterioration of the quality of life caused by the resulting feeling of insecurity) and indirectly (through the economic consequences that the attempts at reducing the exposure to risk have in terms of reducing the income generating capacity). It may well be still one of the major determinants of the observed organization in the agriculture of most developing countries.
2. **Getting involved into value chains** that have, as main objective, that of colonizing new and evolving markets for agri-food products, **does not necessarily reduce the risk exposure** of those who will have less bargaining power within the chain. Product characteristics, such as storability and quality standardization, will likely reduce the ability of farmers in obtaining good effective conditions in the formal and informal contractual agreements that dominate the value chain transactions. **In value chains of products such as grains, or bulk commodities such as coffee, tea, sugar, etc., producers will likely remain fundamentally price takers, thus remaining exposed to price risk exogenous to their decisions. The ability to manage income risk will depend mostly on farmers' access to credit and other financial instruments such as price contingent contracts** (forward sales to intermediaries and, less likely, direct futures trade). As a consequence, the role of public policy will mostly be needed in providing the institutional settings to improve farmers' access to credit and the legal settings for contract enforcements.
3. **For products which have a low degree of storability**, such as fresh fruits and vegetables, fish and meat product, etc., **farmers will have a stronger bargaining power**, especially where objective product quality and timing of delivery is a crucial element to attract high willingness-to-pay consumers, both in domestic urban areas and in export markets. In the value chain organization, farmers will probably retain most of the risk related to variation of quality if their product, despite technical assistance provided by traders and retailers. Also, traceability and other labelling requirement will induce on producers a type of liability risk that was not present in traditional marketing of these products. **The best risk management option in these cases is therefore linked to investments in education and technical innovation, and to the possibility to insure against possible liability risk.** Although the latter possibility is probably still far away to become practical in the conditions of many developing countries, the role of public policies and of international cooperation in promoting the first two is of great relevance.
4. In synthesis, **government intervention remains crucial in assisting agricultural producers in developing countries in managing their risk**, although the major elements of public interventions should be limited to the creation of the infrastructural, institutional and legal background environment aimed at three concurrent objectives: free information sharing, promoting competition, and contract enforcement. If even only one of the objectives is not achieved, small farmers' participation in supply chain may be obstructed, or occurring at the cost of welfare losses.

5. There is an important need for further empirical research on the economics of procurement contracts for non storable products, especially in conditions of asymmetric information and bargaining power. While extensive literature exists that analyzes the issue of contract choice in absence of uncertainty, little has been written concerning how such contracts deals with risk considerations.

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