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Strategies for the development of brands in the agrifood chains

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[First Draft]

Abstract

This paper develops an original framework to better understand the interaction between the development of brands and the quality of raw materials. We consider different levels of consumers' trust for a brand and we examine the incentive for firms to improve the quality of a processed product by requiering that upstream suppliers adopt a private standard. In contrast to previous litterature, the incentive for firms to develop a more stringent private standard may increase with the level of the regulated minimum quality standard. Moreover, the creation of a private standard can reduce the risk of consumers' dissatisfaction while increasing the marketed quantity. Unexpected positive effects of a high level of a standard then arises, in the sense that both market access for upstream producers and consumers surplus are improved.

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1 Introduction

As in any industrial sector, the brand development by agrifood firms results from the intention to meet consumers demand, while forming the basis of product differentiation from competitors. Moreover, the success of a brand depends both on a specific communication politics towards consumers and on the consumers' trust in firms' statements about the brand (see for example, the seminal works in the marketing literature since Copeland, 1923).

However, the brand success depends, above all, on the strategic manufacturing decisions, which are made according to the technological possibilities offered to firms. Brand development is thus highly depending on upstream raw material's production conditions, from which the final product results. Therefore, the public regulation, which defines the standards concerning raw material, may be sufficient or, on the contrary, insufficient to facilitate this strategy. Hence, firms might be lead to select only the most effective producers or also to encourage their suppliers to upgrade upstream production conditions, through the creation of a private standard. This input's normalization strategy often corresponds to more or less irreversible investments and procedures (suppliers' selection, contracts' setting, norm's development, product's certification, etc.). It also may influence the firms' short term decisions concerning quantity and price to adapt *in fine* to the evolution of demand and competition environment (see for example, Maurer and Drescher, 1996, Ponssard et al., 2005).

This paper shows how a medium-long term strategic choice about the mode of inputs' procurement influences the short-term strategies, which may be developed by the firm to provide the brand's development. By considering different contexts of consumers' trust in the brand, we thus illustrate the reasons why a firm would prefer an upstream production conditions' reinforcement and how this latter is achieved. Moreover, we show that, unlike an accepted idea, this private standard strategy is not necessarily due to a laxity of the autorithies in the definition of Minimum Quality Standards (MQS).

Two examples in the agrifood sector may illustrate how the choice of a brand development strategy is strongly affected by both the level of MQS and the communication provided to final consumers:

i) The wine represents an emblematic example of brand development in the presence of upstream MQS. In this sector, there exists a great number of MQS that – given the issues of sanitary safety or the respect of the region of origin – mainly concern the vine growers, which produce grapes or wine in bulk and sell it to downstream processing and/or retailing firms. Within the European Union, an important part of production concerns Appellations of Origin and some of the well known regional ones (like Bordeaux in France or Rioja in Spain) stand a lack of brand development to compete on the international market.[4] The influence of the production criteria requested for the Appellations of Origin is often considered in explaining this feature.[5] One of the most frequent arguments, which is based on the increasing trend of brands in the "New World" (for example, E&J Gallo in US or Jakob's Creek in Australia), is that too constraining upstream production conditions are dissuasive for improving market strategies. That is the reason why a french firm as Pernod Ricard prefers to invest on a brand development strategy in Australia in order

[4] According to Mora (2006), for several years now, Bordeaux's vineyards have suffered from what would appear to be an interminable crisis. Some analysts view overproduction as the cause. Others blame the product Bordeaux puts out, decrying its lack of adaptation to new consumer expectations. The author argues that Bordeaux producers do not tend to spontaneously adopt a market orientation. See also ViniPortugal, Monitor Group (2003) for an analysis of the wine sector in Portugal and an illustration of strategies to improve competitiveness towards international markets.

[5] The market access conditions for an Appellation of Origin are often considered as MQS in the sense that the production of a wine outside the Appellation does not give access to the same markets and as far as an Appellation of Origin may represent a pertinent market.

to avoid the too constraining regulations concerning grape production.[6] Nevertheless, some vineyard with high international notoriety (like Champagne, Porto or Chianti) have been able to maintain a good reputation towards consumers. In these cases, brands are quite developed and a high intermediary price has allowed the upstream producers to comply with relatively highly demanding production conditions[7].

ii) In the fresh products sector, a large development of high premium labels by retailers has been observed in the last decade. With respect to the wine sector, described above, one of the main interesting issues of the supply chain management is given by the creation of private standards, which reinforce the MQS. These private standards have been usually defined in response to increasing food safety concerns, namely in the meat sector (for example the "Filière Qualité Carrefour", the "Traditional Beef" of Sainsbury or the "Selected Beef" by Mark and Spencer), but also for fruit and vegetables, fish and seafood or cheese (Fearne, 1998). Specifically after the mad cow crisis, and despite the reinforcement of the MQS (such that the prohibition of using bone meal for livestock feeding), the high premium labels in the meat sector have been largely increased in the EU and have involved an increasing number of upstream producers participating in the brand creation[8]. Developed in periods characterized by a crisis of consumers' trust, these strategies have reinforced the public regulation while surprisingly leading to an improvement of upstream producers market access (see for example O'Brien and Diaz Rodriguez, 2004).

The objective of this paper is to illustrate some of these economic mechanisms associated to the brand development. We propose an economic formalization of the creation of a brand, in a context where the upstream production conditions are normalized. We thus refer to the specific case of the agricultural sector, where the upstream supply is fragmented if compared to the downstream processing and retailing sector. In this model, we consider a downstream firm with a monopolist position towards the final market and a monopsonist position towards the upstream atomized supply. Hence, the potential suppliers are numerous and price-taker in their decision whether to participate in the intermediary market. Upstream producers are differentiated according to their equipments' levels, which in turn determine the quality of their supply from the point of view of the consumers. Thus, the implementation of a MQS or a private standard might lead upstream producers to undertake investments in order to join the intermediary market.

In this context, the downstream firm faces a quality-quantity trade-off. That is, for a given level of quantity supplied on the final market, an increase of the standard concerning the raw materials implies a decrease of the "risk"[9] associated to the processed product, whereas, for a given level of standard, an increase of quantity increases the risk for the processed product. As a result, the implementation of a private standard is likely to be necessary to avoid the negative effects of a

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[6] As illustrated by Green et al. (2006), the french group Pernod Ricard has largely invested on the international market, by developing wine brands as Jacob's Creek (Australia), Wyndham Estate (Australia), Etchard (Argentina), Río de la Plata (Argentina), Long Mountain (South Africa). As illustrated by Pomarici et al. (2006) some of the leading Italian wine companies have invested abroad (expecially in US, Argentina and Central-East Europe), see for example the strategy of Antinori with brands like Antica Napa Valley (California), Col Solare (Columbia Valley), Albaclara and Albis (Cile), or developed partnerships with foreign companies (see for example the one between the italian Frescobaldi and the Robert Mondavi Corporation to create the brand "Luce").

[7] See Grazia (2006) for an illustration of the evolution of production conditions in the Chianti (namely, with the creation of the Appellation of Origin "Chianti Classico" in 1996) and a strong increase in intermediate price corresponding to the production conditions' reinforcement.

[8] The Group Carrefour has launched the first FQC in 1992 (la "Boule Bio"). Today, this strategy concerns 245 supply chains (in France) and 74 products and involves 35.500 producers. About 40% of the total number of products concern the fruit and vegetable sector (Le Journal de Carrefour, 2005). With 200 supplier in 1994, the production of the FQC fruit and vegetables has reached today a production of about 50.000 tonnes per year (Gaulet, 2000). See also Aragrande et al. (2005) for an analysis of the european quality assurance schemes and implications on supply chain.

[9] In this paper we use the term "risk" to specify the non-compliance of the processed product with respect to an expected quality. This terminology refers to the notion of "credence qualities" (Darby and Karni, 1973), which is important in the agri-food sector, expecially when the products' normalization concerns the aspects of certification of origin or food safety (see for example, Grunert, 2005 and Loureiro and Umberger, 2007).

high procurement quantity on the risk. Therefore, firms may have different strategies for brand development, which depends both on the level of MQS and on consumers trust in the brand. Namely, if the trust is relatively high the firm has two options: *i)* choosing to select only some of the initially well-equipped producers, when the MQS is sufficiently low (what we denote by a "*Strict selective strategy*"); *ii)* choosing to select the initially well-equiped producers and also help some producers to upgrade their equipments to comply with the MQS, when this latter is higher (what we denote by "*MQS adapting strategy*"). However, if the consumers trust is relatively low, and even if the MQS is relatively high, we show the incentive for the firm to have a proactive role and set a private standard more constraining than the current MQS (what we denote by "*MQS reinforcing strategy*").

Hence, we show that, even if the cost to implement a private standard is null, it is not when the MQS is relatively weak that the firms have interest in substituting to the public authority and implementing a private standard. This result is explained as follows. The implementation of a private standard leads to a reduction of the risk of consumers' dissatisfaction. Hence, the processing firm can benefit from an improvement of demand on the final market and thus increases the marketed quantity of the processed product. We thus show how both consumers and upstream producers may benefit from a reinforcement of a MQS.

We thus provide an original contribution to the existing agricultural economics literature. A large swathe of this literature examines the reasons for the development of private quality and safety standards and the effects of the level of MQS on the incentive for firms to implement private standards. The main idea is that firms will arguably have the greatest incentive to implement private standards where there are missing or inadequate public food safety and/or quality standards; here private standards act as a substitute for missing public institutions (Henson, 2006; Henson and Reardon, 2005). In this spirit, Giraud-Héraud, Rouached and Soler (2006) propose an original model of vertical relationship between producers and retailers which takes into account two supply sources: *i)* a competitive spot market on which the retailers by a MQS product and *ii)* supply contracts aimed at marketing higher quality private labels (PL). The authors take into account the negociation power-sharing between downstream and upstream firms. It is shown that if the MQS is relatively too high, then retailer will not perceive any benefit in developing the PL. Nevertheless, this literature recognizes that even if public standards are well-developed and afford a high level of food safety and/or quality, there may still be an incentive to implement private standards. Then, the main reason to argument the coexistence of private standards with highly demanding public regulation is given by the necessity for the firms to manage exposure to liability, limit exposure to potential regulatory action and/or anticipate future regulatory developments (Lutz et al., 2000). Despite, the incentive for firm to implement a private standard when public regulation is relatively high may result from the strategic behaviour of firms in terms of quality-quantity strategic choices.

Another set of contributions deals with the compliance process of firms to a process standard and, more specifically, with the related issue of producers' capacity to comply with it. Thus, the compliance process represents a long term decision and results in more or less high adaptation costs for firms (Henson and Heasman, 1998). Hence, several contributions examine the economic implications of standards using a cost and benefit analysis, which attempts to measure the cost for firms of implementing (food safety) regulations and compare it to the benefits in terms of the reduced foodborne illness (see for example Caswell and Kleinschmit, 1997; Antle, 1999; Viscusi, 2006). The main argument is that the more the standard is constraining, the higher is the risk of firms' exclusion from the market. Hence, it is shown for example, that the compliance with standards may pose a greater burden on small firms, due to the large investments needed (Henson and Caswell, 1999, Unnevehr and Jensen, 1999). Moreover, even if a standard is not mandatory in

the legal sense, it could be *de facto* mandatory (Henson, 2006). Hence, when a particular set of products or specifications gains market share such that it acquires authority or influence, the set of specifications is then considered a de facto standard (The Nature's Choice standard of Tesco Stores PLC in the UK, that commands a market share of over 30 percent, is arguably an example). Even if standards promulgated by private entities, unless referenced by regulations, can not be legally mandated, through market transactions such standards may become involuntary in practice; firms have little or no option but to comply if they wish to enter or remain within a particular market. However, the strategic behaviour of the dowstream processing or retailing firm, namely the quantity strategy in response to consumers' demand, may be positive for producers, even if the standard is reinforced.

2 Theoretical background

We consider a vertical relationship between J upstream producers and one downstream processing firm. Each of the upstream producers can offer one unit of the good on the intermediary market and the firm (which is both monopsonist on the intermediary market and monopolist on the final market) buys x units of input in order to market a quantity y of output (the "brand"). As the production capacity of each producer is limited, the monopsonist has to contract with different producers. The intermediary price ω (payment to the producers) is the same for all the producers and is fixed by the firm (according to her monopsonist position). The final price depends on the quantity marketed, on the product quality and on the consumers' trust in the brand.

Let us now describe more precisely all the specifications of our model along the vertical relationship.

2.1 Heterogeneity of producers equipments

The upstream producers are differentiated according to their equipment level, which is represented by a one-dimensional parameter e, assumed to be initially uniformly distributed within the interval $[0,1]$, according to the density function $f(e) \equiv 1$. Hence, the quality of each unit of input depends on the producer level of equipment. Then the heterogenety of inputs may lead to a risk of failure for the processed product.

The risk associated to each upstream producer, whose equipment level is e, is given by $\sigma(e)$, where $\sigma(.)$ is a decreasing function of e. For the sake of simplicity, we consider that $\sigma(e) = 1 - e$. We then have $\sigma(0) = 1$ and $\sigma(1) = 0$. Hence, the risk is certain with a producer characterized by the minimum level of equipment and null with a producer characterized by the maximum level of equipment[10].

Indeed, we suppose that, in order to enter the intermediary market, an upstream producer must, at least, reach a certain level of equipment e_s, which corresponds to the standard implemented in the selected market. We assume that the fixed cost for each producer of type e, who wants to participate in the intermediary market with a level of standard e_s, takes a linear form $Max\{0, e_s - e\}$. Then, each producer is assumed to be price taker in his decision to enter or not the intermediary market.

[10] In this paper, we refer to a risk of product failure arising from upstream producers' equipment levels. Referring to the risk of product failure (in the sense of the risk that the product does not meet market requirements), rather than to a concept of quality, which implicitly includes safety attributes, allows us to be more explicit, expecially in considering situations such that safety characteristics are concerned. We start from the idea that the quality offered by the firm is altered by the use of inputs, which do not meet the "ideal" production conditions known by consumers. The gap between some inputs and this "ideal" equipment's quality ($e = 1$) compromises the brand's image. Each input contributes up to $\sigma(e) = 1 - e$ to the loss of value with respect to the ideal variety.

2.2 Processed output

The processing stage may concern processing, preserving, conditioning or packing operations. The firm converts the raw material into a finished product according to a fixed-proportions produnction function. Here, we consider that the downstream processing firm does not influence, within the processing stage, either the risk or the number of product's units offered to consumers. Hence, we consider that the upstream production characteristics (equipements levels of upstream producers) directly affect the risk that the upstream supply does not meet, on average, market quality requirements, which in turn corresponds to the risk of consumers' dissatisfaction on the final product's market. We denote by $\tilde{e}$ the threshold of equipment starting from which producers are offered a contract by the monopsonist. The monopsonist thus buys a quantity x of inputs and converts it to a quantity y of finished product, according to the production function $y=T(x)$. We simply set $T(x)= x$. Hence, we obtain the following expression of the threshold of equipment starting from which the producers are chosen by the monopsonist:

$$\tilde{e} = 1 - \frac{x}{J} \tag{1}$$

We suppose that the monopsonist can always select producers in order to obtain the quantity y with the best levels of equipment within the interval $[0,1]$. As we consider that each producer always supplies the same quantity of product (non-elastic individual supply), the benchmark situation (when $e_s = 0$) is then defined by the following quantity and risk:

$$\begin{cases} y = x \\ \sigma = \int_{\tilde{e}}^{1} \sigma(e) f(e) de = \frac{1}{2}(\frac{y}{J})^2 \end{cases} \tag{2}$$

Expression (2) represents both the quantity bought and sold by the downstream firm and the risk of product failure in the benchmark situation. When the standard e_s is not null, as we will detail in the next section, the contract proposed by the monopsonist may take two different forms according to the relative position of the threshold $\tilde{e}$ with respect to the standard e_s requested on the intermediary market. Namely, this latter will determine whether the monopsonist selects only some of the initially well-equipped producers or remunerates the adaptation effort of some initially not well-equipped producers.

The initial probability of product failure given by (1), can be modified if at least one of the producers changes his equipment over the course of time. Then, the density $f(e)$ will shift to a density $f'(e)$ and change the level of σ given by (1). We will refer to σ as the risk in the rest of this paper.

2.3 Final market and consumers' trust

With respect to the end market, the creation of a brand represents the way the downstream firm signals the level of σ to consumers[11]. In the end market, consumers are identical and risk neutral. We consider that the effectiveness of the communication on the level of σ is a function of the level of consumers trust in firms statements about quality. In other words, we consider that the consumers perception of the level of σ is affected by the degree of trust in the brand. Several factors may affect the trust of the consumers and thus their perception of σ. Namely, consumers trust (and thus risk's perception) may influenced by a strong firm's reputation in the long term (which is likely to increase the reliability of the brand) or, more generally, by the context in which consumers take their consumption decisions or by psychological traits of consumers[12]. As consumers trust in the brand affects the level of perceived σ, it influences in turn consumers' willingness to pay for a given quantity of the product.

Hence, following Polinsky and Rogerson (1983), we define by $(1-\lambda)\sigma$ each consumer's perception of σ, this latter representing the true probability of product failure as above-defined. The parameter λ is interpreted as a measure of the extent of consumers' trust in the brand, with $\lambda \in [-1,1]$. On the one hand, larger values of λ correspond to stronger levels of trust and they thus result in lower perceptions of the risk of dissatisfaction associated to the brand. On the other hand, lower values of λ correspond to weaker level of trust and they thus result in higher perceptions of the risk of dissatisfaction. Hence, the aggregate inverse demand for the product, when the perceived risk is $(1-\lambda)\sigma$, is given by:

$$p(\alpha,\lambda,\sigma,x) = \alpha - (1-\lambda)\sigma l - x \tag{3}$$

The final price depends both on the true probability of product failure and on the extent of consumers' trust, which jointly determine the perception of the risk of dissatisfaction in the end market and thus influence consumers' willingness to pay for a given level of quantity. Hence, both the information about the risk of product failure (communicated by the brand or by a third party) and the consumers' trust influence consumers' willingness to pay. Namely, the higher is the trust, the lower is the perceived risk of dissatisfaction and thus the higher is the willingness to pay of consumers for a given quantity of the product[13]. In equation (3), the parameter l represents the monetary loss for consumers for each unit of the product that fails.

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[11] The actual final product's attributes are signalled to consumers through a communication based on the product's average quality (and thus on the risk σ of not finding the attributes of the expected ideal variety). This information is provided either by the firm or by third parties, which guarantee the validity of this information (certifiers, consumer guides, etc.).

[12] As illustrated in the literature, consumers' purchase decisions are influenced both by the extent to which consumers perceive the risk of product failure and by the trust in the quality signals. As illustrated by Lobb, Mazzocchi, Traill (2007) in the specific case of food safety, the consumers' purchasing decisions are affected by the trust in food safety information. Consumers' perception of the risk can be interpreted as a psychological trait of consumers. Hence, consumers may underestimate or overestimate the risk according to several determinants. Namely, consumers' perception of the risk may be influenced by perceived product's consistency, interest in cooking, interest in the product, experience and confidence in purchase location (McCarthy and Henson, 2005), health loss, followed by psychological, financial, time and taste losses (Yeung and Yee, 2002). Moreover, advertisement and communication campaigns potentially influence risk perceptions (Costa-Font and Mossialos, 2007).

[13] In this paper, we assume that the extent of trust in the brand is exogenously given. However, if the level of λ would exclusively depend on the action of the firm, that is the firm could choose λ, then the firm would choose $\lambda = +1$, which corresponds to the level of trust that maximizes consumers willingness to pay for a given quantity. A different result may arise if the firm faces positive costs associated to the construction of λ.

2.4 The game

Let us assume that the level e_0 of the minimum quality standard (MQS) set by the public authority taken as given, the downstream firm decides whether to implement or not a private standard which reinforces this MQS. Namely, if the downstream firm does not reinforce the MQS, then only the MQS is operational on the market. If the dowstream firm dedices to implement a private standard by reiforcing the MQS, then it substitutes itself to the public authority and the MQS becomes implicitly non-operational.

The MQS e_0 taken as given, let us consider the following game.

Stage I. The firm chooses a level e_1 of private standard ($e_1 \geq e_0$).

Stage II. The firm decides the quantity *x* of raw material to purchase in the contract market (stage II.1). Then the firm chooses *N* upstream producers ($N \leq J$) and propose them a take it or leave it contract, setting an intermediairy price ω in order to obtain the quantity x (stage II.2). Then, the *N* producers accept or reject the contract and upgrade their equipments if necessary (stage II.3).

Stage III. The firm converts the obtained inputs into a finished product and markets the brand.

Given this game, we consider that the standard e_s required on the intermediary market may be either a MQS (when $e_1 = e_0$) defined by the public authority or a private standard implemented by the firm (when $e_1 > e_0$). As only one product is sold on the final market, only one standard can be operational on the intermediary market. Hence, the MQS and the private standard are substitutes and not complements on the market. Given the standard e_s, the risk assessment on the market corresponds to the knowledge of the relative position of $\tilde{e}$ and e_s, which is determined by the strategic choice of quantity of the downstream firm. As a result, the level of risk is affected by the quantity choice of the firm, which in turn determines the number of upstream producers selected according to (2). As a result, the strategic choice of quantity in the short-term, may affect (and compromise) the long-term quality investments by affecting the level of risk.

The game is solved using backward induction. We firstly analyze the firms quantity/price choice in the short term, given a standard e_s. In this sense, we place the analysis in the context of the traditional literature on MQS which aims at analyzing the effects of MQS on the firm's strategic behaviour (see for example Ronnen, 1991; Crampes and Hollander, 1995; Scarpa, 1998) by considering that the MQS is exogenous, rather than explicitly endogenizing the choice of a MQS which maximizes social welfare[14]. Hence, we illustrate the effects of a standard on the strategic behaviour of the firm in terms of quantity/price and the related effects on the risk. Turning to the first stage, we then examine the decision of the firm whether to implement or not a private standard which reinforces the MQS set by the public authority[15].

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[14] Even if a few contributions endogenize the choice of the MQS (see for example, Ecchia and Lambertini, 1997), the choice of the criterion for determining the MQS is a very complex issue. Hence, there exist several criteria for the definition of a MQS, especially in the agricultural sector. In addition to the traditional criteria of maximization of social welfare, other criteria could represent the public authority's concerns, as for example the minimization of the risk, expecially in the case of product's safety, or the minimization of upstream producers' exclusion. Following the main swathe of the economic literature on MQS, we thus examine the effects of the level of MQS on the firm's strategic behaviour, on the average quality provided on the market and on the surplus of the other economic agents, without specifing the criterion of choice of the MQS.

[15] In this sense, we refer to the literature dealing with the analysis of the incentive for firms to implement private standards, according to the level of MQS (see for example, Henson, 2006; Henson and Reardon, 2005).

The paper is organized as follows. In section 3 we analyze the firms quantity/price choice in the short term, given the standard e_s requested on the intermediary market. In section 4, we examine the decision of the firm whether to implement or not a private standard which reinforces the MQS set by the public authority.

3 Procurement strategy : consumer trust and quantity-quality trade-off

In this section, we analyze the short term monopsonist's quantity/price choice and the related effects both on the level of risk, on upstream producers' participation in the market, on final price and on consumers' surplus, when the standard requested on the intermediary market is given by e_s.

3.1 Producers'adaptation with endogeneous risk

Let us denote by $\hat{x} = J(1 - e_s)$, the quantity asked by the monopsonist, such that all the initially well-equipped producers are selected (that is $\tilde{e} = e_s$). Using (2), we verify that $\tilde{e} \geq e_s$ if and only if $x \leq \hat{x}$. The quantity choice of the firm (that is the relative position of x with respect to $\hat{x}$), thus determines the relative position of $\tilde{e}$ with respect to the standard e_s. Given that, the firm's quantity choice (which in turn determines the number of upstream producers selected $\tilde{e}$) may result into the following two scenarios (two types of contract proposed to the selected $\tilde{e}$ producers), according to whether the firm requests or not, through the quantity choice, an upgrade of upstream production characteristics.

On the one hand, if the quantity selected by the firm is relatively low, that is $x < \hat{x}$, then the firm selects only the initially highest-equipped producers ($\tilde{e} \geq e_s$), while refuses some of the initially-well equipped ones, namely the producers located between e_s and $\tilde{e}$. Hence, in this case, no selected producer has to modify his equipment in order to supply the intermediary market. As a consequence, the statistical distribution of producers' equipments on the support $[\tilde{e},1]$ is unchanged (with $f(e) \equiv 1$).

On the other hand, if the quantity selected by the firm is relatively high, that is $x > \hat{x}$, then the firm selects also some initially not well-equipped producers ($\tilde{e} < e_s$). In this case, the producers which are initially located between $\tilde{e}$ and e_s have to upgrade their equipment in order to supply the intermediary market. As a result of the equipment's upgrading for producers such that $\tilde{e} \leq e \leq e_s$, the statistical distribution of the producers' equipment on the support $[\tilde{e},1]$ changes with respect to $f(e)$ and is given by $f'(e)$:

$$f'(e) = \begin{cases} 0 & \text{if } \tilde{e} \leq e < e_S \\ e_S - \tilde{e} & \text{if } e = e_S \\ 1 & \text{if } e_S < e \leq 1 \end{cases} \tag{4}$$

By affecting the relative position of $\tilde{e}$ with respect to the standard e_s, the strategic choice of the quantity has an influence on the risk. Let us denote by $\bar{\sigma}(e_s, x) = \int_{\tilde{e}}^{1} \sigma(e) f(e) de$ the risk for a given level of standard e_s and for a quantity x demanded by the monopsonist on the intermediary market. Using (2) and (4), we then obtain :

$$\bar{\sigma}(e_s, x) = \int_{\tilde{e}}^{1} \sigma(e) f(e) de = \begin{cases} \frac{1}{2}(\frac{x}{J})^2 & \text{if } x \le \hat{x} \\ (1 - e_s)[\frac{x}{J} - \frac{1}{2}(1 - e_s)] & \text{if } x > \hat{x} \end{cases} \quad (5)$$

As illustrated by (5), if only the initially highest-equipped producers are selected by the firm ($x \le \hat{x}$), the risk $\bar{\sigma}(e_s, x)$ given by (5) does not depend on the level of the standard e_s, as the firm only selects producers with a level of equipment higher than e_s and does not have any influence on upstream supply characteristics. Conversely, if also some initially not well-equipped producers are selected ($x > \hat{x}$), then producers with a level of equipment lower than e_s have to upgrade their equipment levels in order to comply with the standard e_s. Hence, as the firm has an action on upstream supply characteristics, the risk $\bar{\sigma}(e_s, x)$ is affected by the level of the standard e_s. Hence, the expression (5) illustrates the existence of a quantity-risk trade off in the following sense. For a given level of quantity x, an increase of the standard e_s implies a reduction of the risk, as far as the firm has an action on the risk. For a given level of standard e_s, an increase of quantity results in an increase of the risk. The reasons is that an increase of the quantity demanded on the intermediary market implicitly leads to an increase of the number of producers involved and namely to the involvement of producers which are more and more under-equipped with respect to the level of standard.

3.2 Intermediary price

We assume that the downstream firm has a monopsonist's position towards upstream producers and a monopolist's position towards the final market. Hence, the firm has complete negotiation power towards upstream producers in the definition of the intermediary price ω. Following Xia and Sexton (2004), the monopsonist set the quantity x by anticipating the price at which upstream producers will accept to supply this quantity. In other words, if the monopsonist chooses to sell the quantity x to the end market, then he determines a level of the intermediary price, so as to involve the number of producers required to get and sell the quantity x. Let us detail the choice of the intermediary price by the firm.

The firm always selects the producers characterized by equipments between $\tilde{e}$ and 1. However, if $x \le \hat{x}$, there is no producer which modifies his equipment ($\tilde{e} \ge e_s$), thus producers can accept a null intermediary price in order to supply the quantity x to the intermediary market. Conversely, if $x > \hat{x}$, the producers which are initially located between $\tilde{e}$ and e_s have to invest in a higher equipment ($\tilde{e} < e_s$). In particular, the producer located in $\tilde{e}$ is the last (less equipped) producer which upgrades his equipment by investing $e_s - \tilde{e}$. Hence, he does not participate in the market if the intermediary price is lower than $e_s - \tilde{e}$. Then, using (2), the intermediary price $\omega(e_s, x)$ is given by:

$$\omega(e_s, x) = \begin{cases} 0 & \text{if } x \le \hat{x} \\ \frac{x}{J} - (1 - e_s) & \text{if } x > \hat{x} \end{cases} \quad (6)$$

Let us underline that if $x \le \hat{x}$, then all the producers located within the interval $[e_s, 1]$ would agree to enter the intermediary market. Nevertheless, the monopsonist selects only the highest

equipments in order to get the quantity x. Thus, there exists a context such that some initially well-equipped producers are excluded from the intermediary market.

Otherwise, if $x > \hat{x}$, then the monopsonist chooses an intermediary price $\omega(e_s, x)$ such that all the producers between $\tilde{e}$ and 1 accept to join the intermediary market, namely the producers which are initially located between $\tilde{e}$ and e_s can upgrade their equipment levels by investing $e_s - \tilde{e}$.

3.3 Standardization, optimal quantity and effect on the risk

Let us now characterize the monopsonist's expected profit $\pi_\lambda(e_s, x, \omega(e_s, x))$. When the consumers' risk misperception (trust in the brand) is λ, the standard requested on the intermediary market is given by e_s, the quantity demanded by the monopsonist on the intermediary market and sold to the end market is given x, the intermediary price paid for that quantity is $\omega(e_s, x)$ given by (6), the monopsonist's expected profit $\pi_\lambda(e_s, x, \omega(e_s, x))$ is then given by :

$$\pi_\lambda(e_s, x, \omega(e_s, x)) = [\alpha - (1-\lambda)\bar{\sigma}(e_s, x)l - x - \omega(e_s, x)]x \tag{7}$$

As illustrated by (7), the quantity choice affects the monopsonist's expected profit by different ways. On the one hand, the quantity directly affects the inverse demand function. On the other hand, the quantity affects the risk $\bar{\sigma}(e_s, x)$ on the final market. As a result, the quantity has an indirect effect on the inverse demand function (by affecting the reservation price), whose magnitude depends both on the actual level of risk, communicated to consumers by the brand, and on the consumers' trust in the brand.

By substituting (5) and (6) in (7) and maximizing the firm's expected profit $\pi_\lambda(e_s, x, \omega(e_s, x))$ with respect to the quantity, given the standard required on the intermediary market, we then determine the optimal quantity chosen by the monopsonist as a function of the level of the standard e_s. For every degree of trust λ, there exist two levels of standard, $\underline{e}$ and $\bar{e}$, decreasing in λ, such that the optimal quantity $x^*_\lambda(e_s)$ chosen by the monopsonist, when the standard is e_s, is given by:

$$x^*_\lambda(e_s) = \begin{cases} J[1-\underline{e}] & \text{if } e_s \le \underline{e} \\ J[1-e_s] & \text{if } \underline{e} \le e_s \le \bar{e} \\ J\Psi_\lambda(e_s) & \text{if } e_s \ge \bar{e} \end{cases} \tag{8}$$

setting :

$$\Psi_\lambda(e_s) = \frac{1}{4}\left[\frac{(1-\lambda)l(1-e_s)^2 + 2(\alpha + 1 - e_s)}{(1-\lambda)l(1-e_s) + (J+1)}\right] \tag{9}$$

We can verify that $\Psi_\lambda(\bar{e}) = 1 - \bar{e}$ which allows to verify that the optimal quantity choice of the monopsonist is continuous in e_s.

Starting from the monopsonist's optimal quantity choice, given the level of standard e_s, and by comparing it to the quantity $\hat{x} = J(1-e_s)$, we illustrate in Proposition 1 the effects of the standard in terms of quantity selected by the monopsonist and related effects on the level of risk.

Proposition 1

There exists $\underline{e}$ *and* $\overline{e}$*, with* $0 \le \underline{e} \le \overline{e} \le 1$*, such that :*

If $e_S \le \underline{e}$*, then the monopsonist selects only some of the initially well-equipped producers and neither quantity nor risk are affected by the level of standard;*

If $\underline{e} \le e_S \le \overline{e}$*, then the monopsonist selects all the initially well-equipped producers and both quantity and risk are decreasing in the level of standard;*

If $e_S > \overline{e}$*, then the monopsonist selects also some initially not well-equipped producers. The risk does not necessarily decrease if the standard is reinforced.*

As illustrated by Proposition 1, a perverse effect associated to the reinforcement of the standard may arise. Indeed the objective of risk reduction is not necessarily achieved by an improvement of the standard. Namely, for relatively strong levels of standard required on the intermediary market ($e_S > \overline{e}$), the firm selects also initially not well-equipped producers and the risk may increase in the level of standard[16].

If the level of standard is relatively weak ($e_S \le \underline{e}$) the quantity choice of the firm implies that upstream equipments levels are not modified. Thus, as only the initially highest-equipped producers are selected, no equipments' upgrading is required for producers to participate in the market. Furthermore, if no specific production conditions are required to access the market (that is, in the Benchmark situation), then the exceeding supply reinforces the monopsonist's negotiation power. Hence, the intermediary price equals zero. In this context, an improvement of the standard such that the standard remains lower than the threshold $\underline{e}$, does not affect either the monopsonist's optimal quantity choice or the risk, regardless of the degree of trust. From this point of view, weak levels of standard result in the same effects which would arise in the Benchmark situation.

In the same way, moderate levels of standard ($\underline{e} \le e_S \le \overline{e}$) do not affect the upstream equipments levels. Indeed, the monopsonist selects all the initially well-equipped producers and does not pay them any remuneration. However, the level of risk is lower with respect to the context of weak levels of standard. Moreover, a further reinforcement of the standard – within the context such that $\underline{e} \le e_S \le \overline{e}$ – affects the monopsonist's strategic behaviour, which in turn determines a risk reduction. Indeed, if the standard is reinforced, the risk decreases. This result can be explained as follows. As the standard increases, the monopsonist anticipates that by switching to a quantity higher than $\hat{x}$, he could have an action on the reservation price (through an action on the risk), but he would have to pay a positive remuneration to the upstream producers (given by (6)). Moreover, this remuneration would increase in the level of standard. Then, in the context $\underline{e} \le e_S \le \overline{e}$, the monopsonist voluntary constraints the quantity supplied on the market with respect to weak levels of standard. The more the standard is demanding, the more the monopsonist voluntary constraints the quantity supplied. Indeed, he prefers to improve demand by reducing the supplied quantity, rather than by choosing a quantity higher than $\hat{x}$ and thus paying the producers a positive remuneration. As quantity decreases in the standard, risk decreases.

[16] The possible quality-reducing effect of a standard as been widely illustrated by the literature on MQS. See for example Scarpa (1998), which shows that if a MQS is introduced in a vertically differentiated market with three firms, then the maximum quality level, the average quality consumed as well as the profit levels of all firms decrease. In this spirit, Maxwell (1998) illustrates that a MQS may reduce firm incentives to innovate – when the innovating firm correctly anticipates that a regulator will raise the minimum standard once an innovation has been discovered – leading to a lower level of social welfare under regulation. Furthermore, the introduction of "innocuous" minimum quality standards, namely below the lowest quality level in a market, may reduce the incentive to invest in R&D by the quality-leading firm (Garella, 2006).

As illustrate above, for strong levels of standard ($e_s > \bar{e}$), the monopsonist selects also initially not well-equipped producers and pay them a positive remuneration, in order to support their equipments' upgrading to participate in the intermediary market. As a result, the monopsonist has an action on the risk (by his action on the upstream supply characteristics) and thus on reservation price. We show that, in this context, quantity may increase in the level of standard and thus the level of risk is not necessarily decreasing in the standard. The monopsonist's quantity reaction to a reinforcement of a strong level of standard (that is, within the context $e_s > \bar{e}$) is affected by the degree of trust. Namely, as illustrated by Figure 1, the improvement of the standard implies an increase of quantity when trust is relatively low.

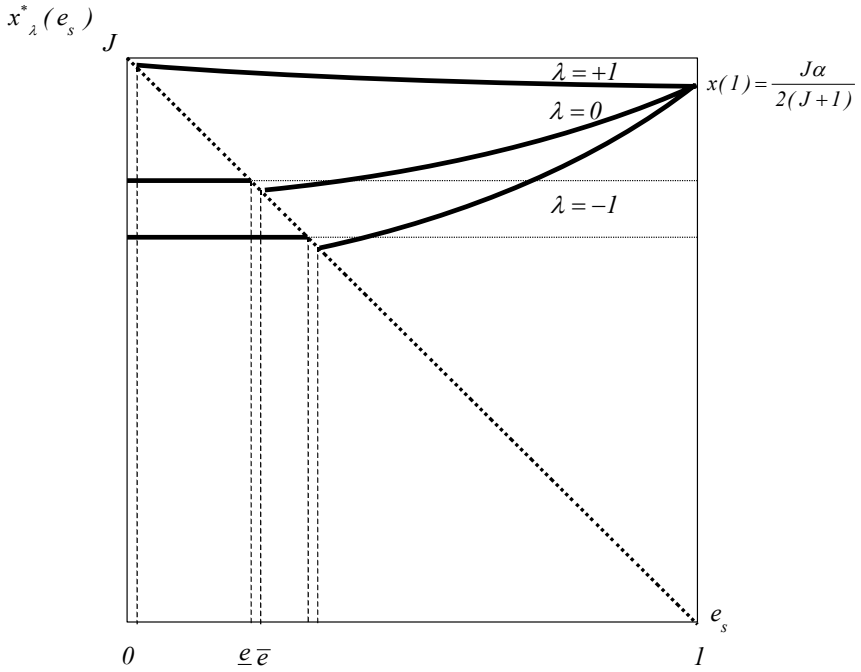

Figure 1 - *Effects of the standard on the monopsonist's quantity choice*

Let us explain this result. If the standard is such that $e_s > \bar{e}$, the effect of a further reinforcement on the optimal quantity depends on two key-factors. One the one hand, as the intermediary price is increasing in the standard, then the monopsonist has an incentive to decrease the quantity if the standard becomes more demanding. On the other hand, as the reservation price increases in the standard (through the decrease of the risk), the monopsonist has an incentive to increase the quantity supplied on the market if the standard increases, in order to benefit from the improvement of demand. The degree of consumers' trust strongly affects this monopsonist's trade-off. Namely, the lower is the trust, the higher is the increase of reservation price which can be obtained through a reduction of the risk (marginal effect). As a result, when trust is relatively low, the second effect dominates the first one. Thus, the monopsonist's may have a strategic behaviour such that the quantity increases in response to an improvement of the standard. Conversely, as the trust is relatively high, then the second effect does no longer dominate the first one and quantity decreases in the standard, even if the action of the monopsonist on the risk might improve reservation price. Moreover, in the particular case such that trust is maximal, that is maximal underestimation of risk of product failure ($\lambda = +1$), then the second effect completely disappears.

That is, the monopsonist has no longer the possibility to improve demand by having an action on the risk and thus decreases quantity as the standard increases.

We show that for degrees of trust such that the supplied quantity increases in the standard, the risk may increase as the standard is reinforced. Hence, for relatively low degree of trust, such that quantity is increasing in the standard, we show that two different levels of standard may exist (within the context $e_s > \bar{e}$) such that the same risk arises. In order words, the same level of risk may be achieved with the lowest of these two levels of standard. Hence, when the trust is relatively low, the strategic behaviour of the firm may result in an increase of the quantity supplied on the market, which in turn implies that an increase of the standard may have a contradictory effect with respect to the objective of the reduction of risk; namely when the degree of risk's misperception is relatively low (see Figure 2).

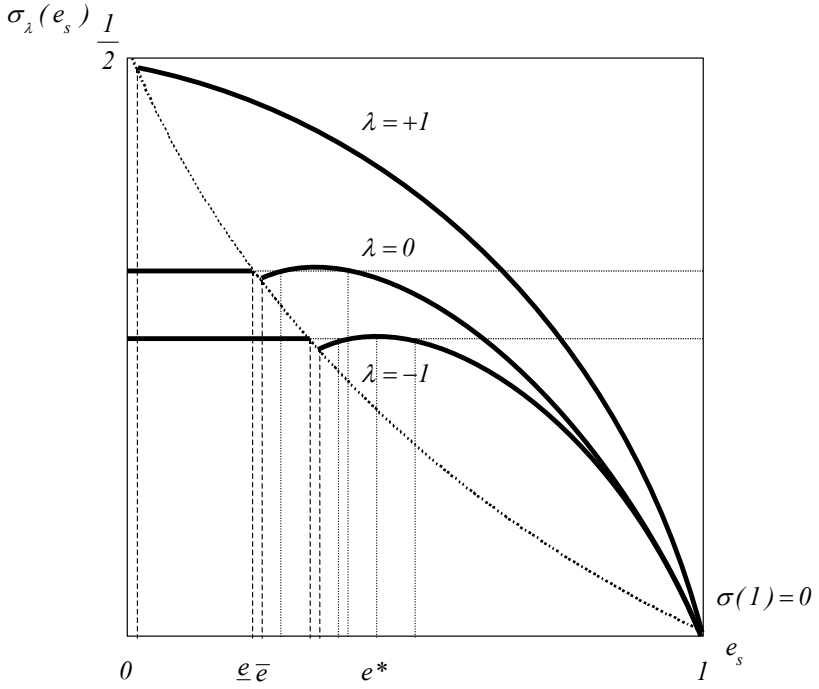

Figure 2 *- Effects of the standard on the risk*

3.4 Standardization and market access

In a context of a vertical relationship such that the downstream firm has a monopsonist's position towards upstream producers, the quantity reaction of the monopsonist to the level of standard directly influences upstream producers participation in the market. Let us now detail this mechanism. Using (2) and (8)-(9), we verify that, for a given level of standard, the monopsonist's optimal quantity choice $x^*_\lambda(e_s)$ determines *de facto* the number of upstream producers involved in the market (see Appendix for details). Let us thus denote by $\tilde{e}_\lambda(e_s)$ the threshold equipment starting from which upstream producers are selected by the monopsonist, when the level of misperception is λ and the standard is given by e_s.

For a given level of standard e_S, the quantity supplied by the monopsonist increases in the degree of trust, as a result of an improvement of demand. As a consequence, relatively high degrees of trust favour the choice of a standard such that producers' exclusion is relatively low.

If the standard is relatively low ($e_S \leq \underline{e}$), then the number of participating producers is not affected by the level of standard, as the quantity demanded by the monopsonist is constant in e_S. A relatively great reinforcement of the standard (switching from $e_S \leq \underline{e}$ to $\underline{e} \leq e_S \leq \bar{e}$) does not affect the monopsonist's selecting strategy towards upstream producers: the monopsonist continues to exert his negotiation power towards upstream producers and pay them a null remuneration, even if the standard has been improved. In addition, as the monopsonist improves demand by decreasing the quantity supplied on the market, then the number of producers participating in the market decreases (increase of exclusion), regardless of the degree of trust.

We show that if $e_S > \bar{e}$, then the number of participating producers increases (decreases) in the standard when the degree of trust is relatively low (high). Hence, a further reinforcement of a strong level of standard (within the context $e_S > \bar{e}$) may determine an increase in the number of upstream producers involved, namely when the degree of trust is relatively low. This result directly arises from the monopsonist's strategic behaviour (quantity choice). Indeed, by choosing quantity, the monopsonist determines *de facto* the number of upstream producers involved in the market. Hence, an unexpected effect of a reinforcement of the standard arises such that the participation of upstream producers may increase in the level of standard, in a context where the intermediary price is always increasing in the level of standard. Hence, surprisingly both the remuneration of upstream producers and the number of participating producers may increase in the level of the standard. As illustrated above, for degrees of trust such that the quantity (and the number of participating producers) increases in the standard, two levels of standard may exist such that the same level of risk is achieved. In this context, surprisingly, the highest upstream producers participation may be obtained if the most demanding standard is operational on the market (see Figure 2).

As a result, when trust is relatively low, strong levels of standard such that $e_S > \bar{e}$ do not necessarily imply a higher exclusion with respect to weak ones ($e_S \leq \underline{e}$). In addition, we verify that starting from a relatively high level of standard (within the context $e_S > \bar{e}$), the participation of upstream producers is higher than in the case of weaker ones ($e_S \leq \underline{e}$). Hence, if the level of standard is sufficiently demanding, upstream producers' exclusion may be lower that in the case of a weak (or null) standard.

3.5 Standardization and consumers's surplus

Let us consider the effect of the standard on the final price. For a given level of standard e_S, relatively low degrees of trust imply lower levels of quantity (Figure 1) and higher levels of final price. However, when the degree of trust is relatively low, a strong level of standard ($e_S > \bar{e}$) does not necessarily imply a higher price, with respect to a weaker one ($e_S \leq \underline{e}$). Moreover, a strong level of standard may determine a quality improvement and – at the same time – a lower final price. If trust is maximal ($\lambda = +1$), then the implementation of a standard implies a greater quantity restriction on the end market with respect to the absence of standard (Figure 1). Moreover, as the quantity restriction increases in the standard, then the final price increases if the standard becomes more demanding. As a result, when underestimation is maximal, raising the standard determines an increase of final price.

Using (8) and (9), we can compute the consumers' surplus $S_\lambda(e_s)$:

$$S_\lambda(e_s) = \begin{cases} \frac{J^2}{2}[1-\underline{e}]^2 & \text{if } e_S \leq \underline{e} \\ \frac{J^2}{2}(1-e_S)^2 & \text{if } \underline{e} \leq e_S \leq \overline{e} \\ \frac{J^2}{2}\Psi^2{}_\lambda(e_S) & \text{if } e_S \geq \overline{e} \end{cases} \tag{10}$$

Using the expression of the optimal quantity $x^*_\lambda(e_s)$, given by (8)-(9), we can examine the effects of the standard e_s on quantity, risk, upstream producers' participation and surplus of the different agents.

Namely, it is shown that a reinforcement of the standard does not necessarily have a consumers' surplus-improving effect. Hence, as the standard is relatively low (that is $e_s \leq \underline{e}$), then consumers' surplus is not affected by the level of standard. A reinforcement of the standard (switching from $e_s \leq \underline{e}$ to $\underline{e} \leq e_s \leq \overline{e}$) always decreases consumers' surplus, regardless of the degree of trust, as the quantity supplied on the market decreases in the standard.

If the standard is relatively high ($e_s > \overline{e}$), a further reinforcement of the standard may have a negative effect on consumers' surplus, namely when the quantity supplied on the market decreases in the level of standard. More precisely, we show that the higher is consumers' trust, that is the higher is the willingness to pay for a given level of quantity, the stronger is the incentive for the firm to decrease quantity as the standard increases. The reason is that, when the trust is relatively high the standard's improving-effect with respect to willingness to pay is weaker. At the same time, the firm has to pay an increasing intermediary price as the standard is improved. As a result of these two effects, the firm has interest in improving demand by reducing the level of quantity supplied on the market and thus consumers' surplus decreases. On the other hand, as consumers' trust is relatively low, the increase of quantity resulting from a reinforcement of the standard (see Proposition 1) determines an increase of consumers' surplus. Moreover, a relatively high level of standard, within the context $e_s > \overline{e}$ may improve consumers' surplus with respect to the context of absence of standard ($e_s \leq \underline{e}$) when trust is relatively low. Hence, the introduction of a relatively high MQS (with respect to the absence of standard) may be positive for consumers when the level of trust is relatively low, that is willingness to pay for a given level of quantity is relatively low but strongly reacts to a standard's reinforcement[17].

[17] This results directly arises from the strategic behaviour of the downstream firm towards upstream producers. Namely, it results from the incentive of the firm to increase the supplied quantity as the standard is reinforced, even if the intermediary price paid for that quantity increases. This result departs from the traditional literature on MQS. Many contributions show that the introduction of the MQS may lead to a decrease of consumers' surplus for the consumers characterized by the lowest willingess to pay. In a model of multiproduct monopolist with continuous array of quality levels, Besanko et al. (1987) show that some consumers might no longer purchase the product as a result of the MQS policy, because the introduction of the MQS may lead to an increase in price and a reduction in variety. In a competitive context, Cramps and Hollander (1995) show that when the cost of quality are variable costs and firms compete in price, for intermediate levels of the standard, consumers with the little appreciation of quality will lose. Valletti (2000) shows that, in a duopolistic market with Cournot competition, the consumers with the lowest willingness to pay are excluded from the market. In our analysis, it is when consumers willingness to pay is relatively low that consumers may be better off as a relatively high MQS is introduced. This result directly arises from the incentive of the firm to increase the quantity in the level of standard when the consumers' willingness to pay strongly reacts to a standard improvement.

4 Optimal strategy for the development of brands

In this section we examine the choice of the firm's strategy for brand development and the extent to which this long term choice is affected both by the level of the minimum quality standard (MQS) defined by the public authority and on the level of consumers' trust. The possible strategies that firm may select are illustrated by the following definition.

Definition 1. A strategy for brand's developement is denoted "*Strict Selective*" strategy if the firm selects only the initially highest-equipped producers.

Definition 2. A strategy for brand's developement is denoted "*MQS-adaptive strategy*" if the firm simply complies with the level of MQS set by the public authority.

Definition 3. A strategy for brand's developement is denoted "*MQS-reinforcing*" strategy if the firm substitutes a more demanding private standard to the MQS.

As illustrated by the Definition 1-3, the firm may select only the initially highest-equipped producer, being implicitly more demanding than the public authority, but without remunerating an upgrading of upstream supply characteristics. On the other hand, firm may be prompted to support an equipments' upgrading of upstream producers, with or without reinforcing the level of MQS. Hence, the firm may simply comply with the level of MQS, by supporting the adaptation process of the initially not well-equipped producers with a positive remuneration, or be explicitly more demanding than the public authority by implementing a private standard. As specified in section 1, the MQS and the private standard are substitutes on the intermediary market, as only one product is sold to the end market. Hence, if a MQS-adaptive strategy is implemented, only the MQS is operational on the intermediary market, whereas if a MQS-reinforcing strategy is implemented, then only the private standard (more demanding than the MQS) is operational in the market.

Given the optimal quantity chosen by the monopsonist (defined in the previous section), we now detail the conditions – both in terms of consumers' trust and level of MQS set by the public authority – such that the firm has interest in developing the strategies for brand's development illustrated in Definitions 1-3 and assuming that the cost for the firm to implement a private standard more demanding than the MQS is null or sufficiently low. We then have the following proposition.

Proposition 2

The incentive for the firm to implement a strict selective strategy increases as consumers' trust increases and MQS is sufficiently low.

The incentive for the firm to implement a MQS-adaptive strategy increases as consumers' trust increases and MQS is relatively high.

The incentive for the firm to implement a MQS-reinforcing strategy increases as consumers' trust decreases and MQS is relatively high.

The Proof of Proposition 2 as well as a detailed illustration of conditions are provided in the Appendix. According to Proposition 2, even if the cost to implement a private standard is null, the monopsonist does not necessarily have interest in reinforcing the MQS set by the public authority by implementing a more demanding private standard. Namely, the firm may select only the initially highest equipped producers or implement either a MQS-adapting or an MQS-reinforcing strategy. The strategic choice of the firm is strictly depending on how the profit varies according to the level of standard and consumers' trust (Figure 3).

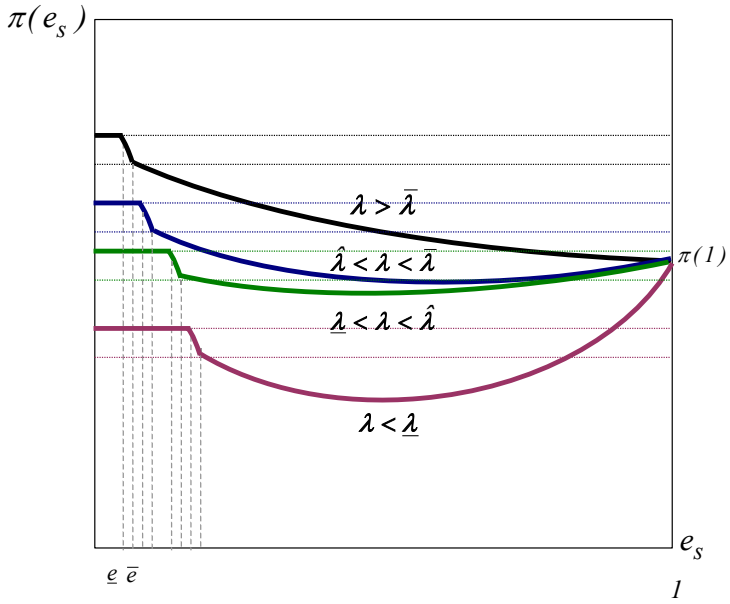

Figure 3 *– Optimal brand strategy according to the degree of consumers' misperception*

If $e_S = 0$ (or lower than the threshold $\underline{e}$) the monopsonist has a relatively high profit as he does not constraint the quantity supplied on the market, regardless of the level of standard (within the context $e_S < \underline{e}$). Indeed, starting from the threshold $\underline{e}$, as the level of the standard increases (within the context $\underline{e} < e_S < \bar{e}$), the profit decreases as the monopsonist reduces the supplied quantity in order to continue to pay a null remuneration to upstream producers, even if the standard increases. According to Proposition 1, the monopsonist improves demand by voluntary constraining the quantity supplied on the market, rather than remunerating upstream producers and having an action on the risk. Until the standard remains at a level $e_S < \underline{e}$, the firm does not constraint quantity, with respect to the context $\underline{e} < e_S < \bar{e}$, and obtains a relatively high profit. As the standard increases and becomes higher than the threshold $\bar{e}$, the monopsonist's quantity strategy with respect to an improvement of the standard (and the related profit) strictly depends on the degree of consumers' trust, as illustrated above (see Proposition 1). The degree of trust thus influences the monopsonist's strategic choice.

Let us now details the conditions such that the three strategies arises.

Strict selective strategy. The higher is trust (and provided that the level of MQS is sufficiently low), the more the firm is incentivated to choose a strict selection strategy. On the one hand, the higher is the trust, the lower is the effect of an increase of the standard on the risk (and thus on demand), for a given level of quantity. Thus, the monopsonist has a relatively weak possibility to improve demand by having an action on the risk. Indeed, consumers' reaction to a risk's reduction (in terms of reservation price) is relatively low. Hence, the higher is trust, the less the monopsonist has an incentive to increase the quantity supplied on the market as the standard is reinforced (as he has to pay an intermediary price increasing in the standard). On the other hand, the higher is the trust, the higher is the profit that the monopsonist may obtain by simply selecting the highest-equipped producers. By anticipating it, the monopsonist does not have interest in improving the MQS. Nevertheless, provided that this latter is sufficiently low, the monopsonist will be implicitly more demanding by selecting the highest-equipped producers.

MQS-adaptive strategy. The MQS-adaptive strategy arises for relatively high degrees of trust and provided that the MQS is not too low. Namely, it arises either when the MQS is not sufficiently low to implement a selection strategy or when it is not sufficiently high to reinforce it with a more demanding private standard. When both trust and MQS are relatively high, the firm may be incentive to simply adapt to the level of MQS by remunerating the upstream producers' adaptation effort, given that the consumers' willingness to pay for the brand is relatively high. Hence, even if a further improvement of the MQS arises (with a consequently higher intermediary price), the firm may be incentivated to highly remunerate upstream producers, as the relatively high trust positively affects consumers' willingness to pay.

MQS-reinforcing strategy. For relatively very low degrees of trust, the firm always reinforces the MQS with a more demanding private standard. On the other hand, the firm does never have interest in implementing this strategy when trust is relatively high. For intermediate level of trust such that the firm's choice is directly affected by the level of MQS, the firm reinforces the MQS only when this latter is relatively high. Then, it is not when the level of MQS is sufficiently weak that the downstream firm has interest in reinforcing it[18]. Hence, both a relatively low trust and a relatively high level of MQS contribute to the incentive for the firm to reinforce the MQS. From Proposition 1, we know that the lower is the trust, the lower is the quantity supplied for a given level of standard. On the other hand, the lower is the trust, the higher is the reaction of consumers' to a standard improvement, for a given level of quantity. Hence, the firm sets the standard at its maximum level (long term decision) and minimizes the risk, by anticipating that an increase of the MQS would imply an increase of the supplied quantity.

Let us detail the role of the level of MQS in determining the firm's choice. For intermediate degrees of misperception ($\underline{\lambda} < \lambda < \bar{\lambda}$), there exists a switching MQS ($\hat{e}_0$), such that the monopsonist chooses to implement his own private standard if the MQS is higher than $\hat{e}_0$. Thus, starting from $\hat{e}_0$, the downstream firm adopts the most demanding and risk-minimizing standard. Hence, the monopsonist does not have interest in reinforcing the MQS when this latter is weak and, conversely, has interest in substituting it with a more demanding private standard, when the public authority adopts a relatively high but not risk-minimizing level of MQS. In any case, a deviation from the optimal strategy implies a decrease in profit. Namely, in the former case, implementing a private standard would reduce firm's profit; in the latter case, simply adapting to the MQS or selecting would prevent the firm to have access to a higher profit. Furthermore, as the switching MQS increases in the degree of trust, this means that, the lower is the degree of trust, the higher is the incentive for the monopsonist to choose the most demanding private standard. Hence, in the context where consumers' misperception is intermediate ($\underline{\lambda} < \lambda < \bar{\lambda}$), both reinforcing the MQS and not reinforcing it have own virtues, which characterize the "positional" value of each strategy for the monopsonist. In this context, the public authority strongly influences the private strategy only when the MQS is relatively weak.

[18] This result is in contrast with the empirical evidence such that private standards are mainly developed when the level of public regulation is weak. According to Henson (2006), Reardon et al. (2001) and Henson and Reardon (2005), firms will arguably have the greatest incentive to implement private standards where there are missing or inadequate public food safety and/or quality standards; here private standards act as a substitute for missing public institutions. Secondly, where the private standard is signalized to consumers, there may be very strong incentives for leading firms to promulgate private standards to differentiate themselves from competitors that operate at or near the minimum food safety and/or quality standards laid down by public regulations. In addition, where public standards are well-developed and afford a high level of food safety and/or quality, there may still be an incentive to implement private standards, for example as a means to manage exposure to liability, limit exposure to potential regulatory action and/or anticipate future regulatory developments (Lutz et al., 2000).

Let us summerize the main results by considering Figure 1. Let us suppose to start from an initial situation such that consumers' trust is maximal (no risk of dissatisfaction is perceived). In this context, as consumers do not perceive any risk, whatever the level of actual risk, consumers act as the risk were null. That's the reason why we refer to this context as an "ideal situation" in which the reservation price reaches its maximum level (α) and inverse demand function as well ($\alpha - x$), for any given level of quantity. If the firm could choose the level of λ, then $\lambda = +1$ would be chosen. Indeed, for a given level of quantity, a decrease of consumers' trust determines a shift-down of the demand function, thus a move the "ideal situation". As illustrated in Figure 1, a decrease of consumers' trust produces two types of "movements" in the optimal quantity choice of the monopsonist. At first, we observe a shift from up to down of the optimal quantity. Hence, for any given level of standard, a decrease of the trust implies a reduction of the supplied quantity. This is a consequence of the shift-down of the inverse demand function when consumers do not treat the product anymore as if it the risk were null. Secondly, a decrease of trust, implies a movement from the left to the right with a more and more increasing trait of the curve in the context $e_s > \bar{e}$. Hence, the lower is the trust, the higher is the incentive for the firm to increase the supplied quantity as the standard increases, within the context such that the firm as an action on the risk and thus on demand (see Proposition 1). Regardless of the trust, the quantity supplied if $e_s = 1$ is the always the same, as if $e_s = 1$, the risk is null and the inverse demand function is given by $\alpha - x$. Hence, the "ideal situation" can exist either when trust is maximal, regardless of the level of risk, or when the actual risk is null as a result of the implementation of the maximum level of standard. Hence, it is when the trust is relatively low (and the inverse demand function is relatively low with respect to the "ideal situation") that the firm has the highest incentive to substitute itself to the public authority and implement a private standard (at the most demanding level) in order to minimize the risk and thus supply the same quantity (and obtain the same profit) as in the "ideal situation".

The firm's choice of a more demanding standard than the MQS has a positive effect both on consumers' surplus and on participation of upstream producers, which is illustrated by the following Corollary (see Appendix for proof and details).

Corollary 1

At the conditions such that the monopsonist chooses $e_I^* = 1$, both quality and quantity are improved.

When the monopsonist chooses the most demanding private standard he has an action both on risk and on quantity. Namely, as illustrated by Corollary 1, at the conditions (on MQS and trust) such that the monopsonist chooses to implement his own private standard, he reduces the level of risk (to zero) and at the same time increases quantity with respect to the quantity which would have been supplied in the case of simply adaptation to the MQS. The increase of quantity corresponding to the choice of the MQS-reinforcing strategy implies an increase of upstream producers' participation and at the same time an increase of consumers' surplus.

Let us now detail the conditions such that there is compatibility between the interests of consumers and the strategic choices of the firm.

Proposition 3

Consumers prefer $e_s^* = 1$ if trust is relatively low and $e_s^* \in [0, \underline{e}]$ conversely.

If trust is sufficiently low, then the monopsonist' strategic behaviour meets consumers' requirements, regardless of the level of MQS set by the public authority.

Consumers have two opposite preferences. They prefer either the most demanding standard (if the degree trust is relatively low, that is $\lambda < \tilde{\lambda}$) or the absence of standard. Hence, as the monopsonist, consumers do not have "intermediate" preferences. Indeed, both $e_s = 0$ ($e_s < \underline{e}$) and $e_s = 1$ have own virtues, which characterize the "positional" value of each level of standard (see Figure 4).

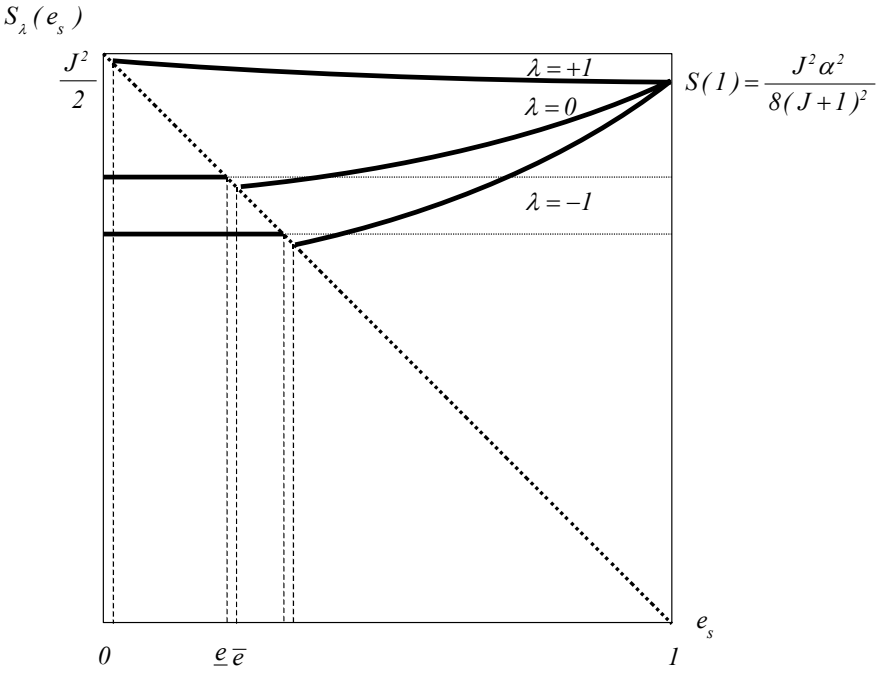

Figure 4 *- Effects of the standard on consumers' sur**plus***

Consumers' surplus is affected both by quantity and risk. On the one hand, if $e_s = 0$, then consumers benefit from a relatively high quantity as the monopsonist does not constraint it to improve demand by exerting his negotiation power. On the other hand, if $e_s = 1$, consumers are better off as the risk is minimized ("ideal situation"). Hence, for any given level of price or quantity, consumers' surplus is maximized in the "ideal situation" (zero risk and/or maximal underestimation). When trust is relatively low, then consumers prefer the most demanding standard, which minimizes the level of risk. Hence, the lower is the trust (that is the higher is the distance from the "ideal situation") the higher is the importance of a risk-minimizing standard, from the point of view of consumers.

Let us now consider the compatibility between the strategic choice of the monopsonist and the interests of consumers.

For the reasons explained above, when the degree of misperception is relatively low, such that $\lambda < \underline{\lambda} < \tilde{\lambda}$, then consumers are better off when the most demanding standard is implemented. Moreover, the monopsonist chooses the most demanding standard $e_1^* = 1$ (see Proposition 2), regardless of the level of MQS. Hence, the monopsonist's strategic behaviour naturally meets consumers' requirements, regardless of the level of MQS implemented by the public authority.

For $\underline{\lambda} < \lambda < \tilde{\lambda}$, then consumers continue to be better off when the most demanding standard is implemented, *but* the monopsonist chooses the most demanding standard $e_1^* = 1$ (and meet consumers' interests) if and only if the MQS is sufficiently high ($e_0 > \hat{e}_0$). Hence, a relatively high MQS set by the public authority ($e_0 > \hat{e}_0$) is required for the monopsonist to meet consumers' requirements.

When the degree of misperception is relatively (but not sufficiently) high ($\tilde{\lambda} < \lambda < \bar{\lambda}$), then consumers are better off when the less demanding standard is implemented ($e_s^* \in [0, \underline{e}]$), *but* the monopsonist might choose the most demanding standard $e_1^* = 1$ (and do not meet consumers' interests), namely if the MQS is sufficiently high ($e_0 > \hat{e}_0$). Then, a relatively low MQS set by the public authority (namely lower than $\underline{e}$) is sufficient to meet consumers' requirements. When the degree of misperception is sufficiently high ($\lambda > \bar{\lambda}$), then consumers continue to be better off when the less demanding standard is implemented ($e_s^* \in [0, \underline{e}]$), hence a relatively low level of MQS is sufficient to meet consumers' requirements.

5 Final remarks

Our paper provides an original contribution as we explicilty consider how both public and private policies are affected by consumers' information about the average quality provided on the market.

We have studied the incentive for the firm to develop private standards, more constraining that the minimum quality standard set by the public authority, in a context where product's attributes are signalled to consumers (either by the firm or by third parties) through a communication based on the product'average quality. We have shown that when consumers' trust is relatively low and even if the MQS is relatively high, the firm has interest in developing a more constraining private standard, in order to benefit from a demand's improvement and increase the supplied quantity. In addition, empirical evidence shows an increasing use of global business to business (B2B) standards in procurement from suppliers and as a governance tool in the food system, which are not communicated directly to consumers. In general, investments in quality or quality control mechanisms are seen as a way to build consumer trust and increase the value of a firm's reputation, once signalled to consumers. But why do firms exceed the legal MQS, when quality signals are not transmitted to consumers, such as use of EurepGap, or GFSI standards? Some reasons may be put forward. At first, providing consumers with products that meet consistent quality and safety standards that go beyond the minimum requirements builds reputation, the key asset for current and future earnings flows (Fulponi, 2006). Secondly, major processors and retailers implement private standards as instruments for the coordination of supply chains by standardizing product requirements over suppliers (Henson and Reardon, 2005). This becomes of greater importance as supply chains become more global and cut across differing regulatory, economic and regulatory environments. Private standards may thus be implemented in order to reduce the transaction costs and risks associated with procurement. Thirdly, firms may be prompted to develop private standards in order to limit exposure to potential regulatory action and/or anticipate future regulatory developments (Lutz et al., 2000) and manage exposure to liability. Our analysis could thus be extended by considering that the public authority jointly uses ex-ante regulation (MQS) and ex-post liability rules. The existence of an expected sanction associated with product's failure and the consequenlty risk of market share erosion in the long term is thus likely to incentive firms to

implement private standards, even if they are not signalled to consumers (Fulponi, 2006, Henson, 2006).

Moreover, in this paper we explicitly takes into account the dimension of vertical relationships, by considering that the MQS is applied to the upstream firms, whereas the downstream firm maintains the strategic flexibility to choose both quantity and quality, given that the upstream supply complies with the MQS. Hence, empirical evidence shows that MQS often concern intermediate products[19]. In a context where the risk arises both from the upstream production conditions and from the strategic behaviour of the downstream firm, the MQS may have different effects whether it is applied to the upstream suppliers or to the downstream firm. This extends our analysis in the larger debate about the optimal public policy between "obligation of means" and "obligation of results". In the latter case, the MQS is applied to the downstream firm, which is thus constrained in the quality-quantity choice by a level of average quality fixed by the public authority. The question raised is thus whether the firm has interest in developing a private standard and which are the effects of the different policy instruments on social welfare.

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[19] To the best of our knoledge, the existing literature of minimum quality standards does not take into account the dimension of vertical relationships and almost uniquely deals with MQS concerning final products markets: obligation for a car producer to install airbags, safety standards for pharmaceutical products (Boom, 1995), service quality in the market of local cable television subscription (Besanko et al., 1987) or licesing standards for medical services (Leland, 1979).

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