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Impact of Liability Rules on Modes of Coordination for Food Safety in Supply Chains

E. Rouvière^{*} and K. Latouche^{}**

Abstract

This article analyzes how the allocation of liability for safety defects could influence coordination in the food supply chain. To do so, we analyzed the strategic reaction of importers and supermarkets who import Spanish fresh produce into France. We considered the implementation and enforcement of the European General Food Law as an exogenous shock for French food operators. In France, depending on the situation, food operators can transfer their liability to someone else in the food supply and imports decisions are crucial indicators. After 2005, supermarkets transferred the liability risk linked to importing sensitive products to importers. We argue that this regulatory change also prompted French importers of fresh produce to develop a horizontal, collective governance structure to monitor the safety of imported produce

Key words: Food Safety, Liability, Coordination

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Introduction

Food safety is a major preoccupation for consumers, food operators, and public authorities. In response to recent food scares, European countries have strengthened their food safety standards and their supervision. Adoption to the 2005 General Food Law at the European level implies convergence of frameworks across Europe (Garcia-Martinez *et al.* 2007). Through mandatory self-monitoring and quality assurance, the European Union has confirmed its willingness to transfer increased responsibility for food quality and food safety to the entire food supply chain (Friant-Perrot *et al.* 2007). The liability rule is the preferred tool to enforce the recently promulgated framework in member states. However, the allocation and transferability of liability within the supply chain differ among member states.

In this article, we focus on how the allocation and the transferability of liability for safety defects influence strategic responses by food operators in the food supply chain. Measuring the impact of a liability rule on coordination is not an easy task. The preferred method would have been finding a natural experiment. However, the development of regulatory schemes is a continuous process and natural experiments such as exogenous shocks do not exist in the regulatory framework. To get round this problem we analyzed the strategic response of supermarkets and importers when they import fresh produce into France. The regulatory change, which occurred in 2005 in France, implied the strict enforcement of the liability rule for food safety defects. Under the French strict liability regime, the first supplier to place products on the domestic market bears the liability. If a safety defect occurs, the first supplier is held liable under criminal law. Import decisions at the French boarder are thus crucial indicators to understand how the allocation of the liability rule shapes the supply chain. At this point of the supply chain, liability is transferable from downstream operators (supermarkets) to upstream suppliers.

We established that the allocation of liability affects the organization of the food supply ensuring a high level of food safety on the market. The import decisions made by French supermarkets determine who bears the liability for imports. When they need imported products in their shelves to satisfy consumer demand, they have two choices: to import themselves (the make option) or to buy the import service. In the make option, they bear the liability. In the buy option, they transfer liability to importers. In this context, we observed their import behavior before and after 2005, 2005 being considered as an exogenous shock. After 2005, we show that supermarkets changed their behavior. By themselves, they import fewer sensitive products than before 2005. For French importers of fresh produce, this change led them to develop and implement a new governance structure to prevent food safety outbreaks. In other words, we have data that suggests that the allocation of liability influences coordination for food safety in the supply chain.

In the food economics literature, only a few authors studied the legal incentives for the provision of food safety (e.g. Buzby and Frenzen 1999; Loureiro 2008). Most research has focused on the development of strategic behavior by food operators to comply with new regulations (Loader and Hobbs 1999; Henson and Holt 2011; Macaulay 1993). Another important strand of literature is based on the seminal work of Garcia-Martinez *et al.* (2007) which provides a framework to deal with co-regulation for food safety. These authors also underline the importance of enforcing co-regulation programs. To our knowledge, few scholars have focused on the issue of transferability of liability in the organization of food chains.

The article is organized as follows: first, we review the literature focused on food safety and liability. Second, we set our analysis in the current European Union regulatory framework for

food safety focusing more specifically on differences in liability rules that are in force in the United Kingdom and France. Third, we highlight the strategic responses of French supermarkets and importers to the 2005 increase in liability implied by the General Food Law. The last section concludes.

1. Food safety, liability and supply chains

In this section, we first describe food safety issues and regulatory tools that involve incentives to food operators to comply with food safety regulations. In particular, we focus on the influence of the liability rule that operates within complex market interactions, linked to the specificities of managing food safety in supply chains. We highlight the fact that the allocation of liability can influence the organization of food supply chains: if food operators can transfer liability, we argue that they may adopt strategic responses to avoid or lessen their liability burden.

1.1. Food safety issues

In the food safety economics literature, asymmetries of information and externalities occur in the use of the term "food safety". Food safety is mostly considered as a credence attribute of food items: because it would be too costly, consumers are not able to check the real nature of the product even after consuming it. Food safety can become an experience attribute for consumers who experience a food-borne illness after eating a particular food product (Henson and Caswell 1999). Consumers need guarantees of the safety of the food items they eat. While this informational asymmetry arises between food operators and consumers, the same also happens in business-to-business relationships. In food supply chains, food safety involves both an adverse selection problem (safety of the product) and a moral hazard (safety of the process) at any stage of the food supply chain. Market failures can be due to the existence of asymmetric information about food safety attributes between producers and consumers or imperfect, symmetric imperfect information for both consumers and producers (Antle 1996).

Hennessy *et al.* (2003) suggest that food supply chains are systemic by nature. As regards food safety, food supply chains produce externalities on each other's activities (Rouvière and Soubeyran 2011). After a food safety outbreak, all food operators in the incriminated industry will suffer from the crisis at different levels. For instance, in May 2012, the "E-coli cucumber outbreak" killed 16 people and infected over 1100 people in Europe. The Spanish Federation of Producers / Exporters (FEPEX) estimates the lost sales at €200 million per week. The cucumber crisis also affected French producers, who, according to the tomato and cucumber producers association, suffered from a 75% fall in sales of French cucumbers¹. As a consequence, food safety issues have had an impact on the structure of the industry because food operators share a collective reputation (Rouvière and Soubeyran 2011).

Such market failures, asymmetries of information and externalities are the main rationale for regulatory intervention in the provision of food safety. But food safety outbreaks have also highlighted the failure of governments to protect consumers. Food safety regulation is consequently a key policy area that has witnessed the increasing alignment of risk and regulation (Garcia-Martinez *et al.* 2013). Food safety is a core concern for food operators and public authorities because they jointly produce food safety. Consequently, food safety regulations operate in a context of complex market interactions. Whatever the source of the problem, when food safety outbreaks occur, they have widespread political and economic

¹ http://www.lemonde.fr/economie/article/2011/06/01/en-france-les-ventes-de-concombres-se-sont-effondrees_1530387_3234.html

consequences (Hennessy *et al.* 2003). Public authorities need to design incentives to encourage all operators in the food supply chain to better monitor and maintain a high level of safety in the food supply chain up to consumers. This need is heightened by economic and reputational interdependencies within the supply chain.

1.2. Food safety regulatory framework in a context of market interactions

In most developed countries, food safety regulations focus on setting standards that specify how food products should be produced and/or their final safety level (Henson and Caswell 1999). Certification schemes and mandatory informational labeling have also been developed as contributing to direct ex-ante regulation (Caswell and Mojduszka 1996). Another strand of direct ex-ante regulation is now widely used in food industries at least in Europe: co-regulation of food safety. In a very important contribution to food safety economics, Garcia-Martinez *et al.* (2007) pointed out that this regulatory change has created greater opportunities for public and private interaction in providing food safety. They are the first authors to refer to new food safety schemes such as co-regulation of food safety. This confirms the general trend in food safety regulation from a command and control approach to a performance based approach in direct ex-ante regulation (Henson and Caswell 1999). Garcia-Martinez *et al.* (2007) also pointed out that co-regulation programs are more likely to occur in the monitoring and enforcement phases of the regulatory process. In 2013, Garcia-Martinez *et al.* (2013) affirmed that for such programs to be effective, they need to be fully enforced.

Enforcement of regulation is a core issue in the regulatory process. Depending on the institutional environment, offences related to direct ex-ante regulation usually result in sanctions, which are imposed through the allocation of liability and its enforcement. The rule of liability subsequently plays a role in enforcing direct ex-ante food safety regulation (Buzby and Frenzen 1999). Safety standards and ex-post liability rules are frequently used together to encourage firms to comply with regulations (Schmitz 2000). Firms that do not comply are sued by public authorities or injured consumers and are taken to court, which then rules on their liability. Direct ex-ante regulation and ex-post liability rules are considered to be complementary and to reinforce one another, thus increasing the incentive for food operators to deliver safe products (Innes 2004; Kolstad *et al.* 1990). The allocation of liability is a major incentive to comply with food safety regulations.

Only a few authors in the food economics literature have studied the legal incentives for food safety provision. Buzby *et al.* (2001) analyzed economic incentives for firms to produce safer food created by court-awarded compensation following a microbial food borne illness. However, it is worth noting that liability regimes are not always effective since it may be difficult for consumers to prove that the illness was caused by the food (Buzby and Frenzen 1999). The enforcement of liability modifies firms' behavior as the firms take more preventive actions to avoid the liability burden. Loureiro (2008) empirically investigated the impact of the application of a liability regime in the decrease in cases of food contamination in the United States. She shows that the application of the liability decreased the number of food borne outbreaks. Pouliot and Sumner (2008) modelled the effect of an increase in liability-traceability for food safety as an incentive to provide safe food. They show that traceability allowed food operators to establish they are not responsible for harm. In other words, food operators make an effort to avoid or reduce liability. When considering food supply, food operators will also base their decisions on the liability risk they face. In a recent contribution, Baniak and Grajzl (2013) show that, when firms share a collective reputation (as in food supply), market structure, and hence competition policy, this shapes firms' incentives

to invest in product safety. In other words, firms' investments in safety depend on market structure and on the size of the industry.

All these studies are based on an implicit assumption: the allocation of liability and the structure of the supply chain are exogenous and are not linked. Hennessy *et al.* (2001) argue that there may be causes for regulators to assign liability for food safety failures in order to modify the structure of the industry. These authors argue that the allocation of liability would establish a leadership hierarchy in food supply chain. In other words, the food operators who bear liability will make an effort to provide safety in order to protect themselves against the liability burden.

None of these authors consider that liability can be transferred to other food operators in the supply chain. Food chains are both chains of information and chains of products. They are complex to analyze and to understand because they are often very long and involve a large number of food operators. The organization of food chains is characterized by the interconnection between food operators (Hennessy *et al.* 2003). It is now well known that food operators will adopt strategic behavior to adapt to regulatory constraints (Henson and Caswell 1999).

We argue that when liability is transferable, food operators will develop strategic responses to avoid the liability burden. Therefore, there may be a link between the organization of the supply chain and the threat represented by the liability rule, which can represent a very high cost for food operators. We argue that liability allocation may be subject to food operators' strategic responses (transfer of the liability burden - or not) thereby influencing the organization of the food supply chain. Depending on the liability rule that is in force, if food operators can transfer liability to other food operators they will do so to reduce the liability risk. If food operators cannot transfer the liability for food safety defects, they will be the initiator of the coordination for food safety in the supply chain.

2. The European regulatory framework for food safety and the influence of the allocation of liability.

In this section, we place our analysis in the current European Union regulatory framework and focus more specifically on the liability rule for safety defects in force in the United Kingdom and in France.

2.1. The European regulatory framework for food safety

In the European Union, changes in food safety regulations resulted in more involvement of food operators in managing food safety in supply chains. The adoption of the General Food Law at the European level is providing greater opportunities for closer collaboration between regulatory agencies and the private sector in the management of food safety, particularly in relation to enforcement and monitoring (Garcia-Martinez *et al.* 2007).

In the European Union, the General Food Law has modified the food safety regulations of member states. The General Food Law was promulgated in 2002 and has been in force since January 1, 2005. The Law aims to ensure not only a high level of protection for consumers, but also of animal health and welfare, plant health and the environment. It highlights the need for food operators to implement food safety hazard control plans, to trace back their inputs and outputs, and to better monitor the safety of their products. In this context, European food operators have been encouraged to voluntarily implement and manage safety monitoring of their operations (Garcia-Martinez *et al.* 2007).

In the new regulatory framework of the General Food Law, public authorities require food operators to achieve prescribed product quality standards but they do not specify the means to be used to reach such standards. These are left to the discretion of the food operators. One of the key concepts in the General Food Law is that food operators at all stages of the supply chain (production, processing and distribution) are responsible for ensuring the fulfillment of the food safety regulations that are relevant to their activities. The General Food Law has thus established a common basis for food safety regulation in member states and includes common definitions, general provisions and specific requirements. It also created the European Food Safety Authority (EFSA), the EU independent risk assessment body for food safety.

Like all European regulations, the General Food Law must be transposed in member states regulations. Member states shall ensure that official controls are carried out regularly, on a risk basis and with appropriate frequency implementing a risk based approach. They must identify risks associated with food businesses, processes, activities, and the reliability of food operators' own checks. Regulation (EC) No 178/02 also requires member states to enforce food safety regulations. For that purpose, they must develop a system of official controls (Regulation (EC) 882 /2004). They must lay down the rules and penalties applicable to non-compliance with the food law, which must be effective and dissuasive. In all member states, the liability rule for safety defects is part of the enforcement process. However, the allocation of liability differs between countries.

2.2. Liability rules for food safety defects in the United Kingdom and France

In the European Union, the UK and Northern Ireland were the first to implement a regulatory change in the provision of food safety, implementing and enforcing the Food Safety Act in 1990. In the United Kingdom, the General Food Regulations (2004) created criminal offences for breaches of Regulation (EC) 178/2002 and amended the Food Safety Act 1990 to bring it in line with Regulation (EC) 178/2002. The legislation is identical in Northern Ireland.

The main feature of the Food Safety Act 1990 was to substitute a 'warranty defense' by a 'due diligence defense'. One consequence is to have shifted the allocation of the liability rule for food safety downstream in the food supply chain (Hobbs *et al.* 2002). The Food Safety Act imposed strict liability on downstream firms against food safety failures. The 'due diligence defense' requires that all food operators implement all the necessary (Hobbs and Kerr 1992; Henson and Northern 1998). In other words, downstream operators can be held liable if unsafe products are found in their shelves regardless of where the food safety problem originated. As a result, the shift in liability significantly affected quality management practices and also significantly modified the structure of the food supply chain (Hobbs and Kerr 1992; Holleran *et al.* 1999). This is in line with all theoretical studies that deal with legal incentives to food safety (e.g. Innes 2004; Koldstad *et al.* 1990).

In this context, many authors claim that the development of private standards owned and imposed by supermarkets was linked to this new allocation of liability to downstream operators. In a study of the influence of private standards in shaping the food system, Fulponi (2006) argues that the Food Safety Act 1990 was the starting point for UK supermarkets to improve their safety management programs and those of their suppliers. In her interviews, Fulponi discovered that the allocation of liability system was considered by 70% of supermarkets interviewed as the impetus for developing private standards. This is in line with the results of Hobbs *et al.* (2002) who conducted an international comparison of the structure of incentives and quality assurance schemes for food safety. Loader and Hobbs (1999) reported that the introduction of the 'due diligence defense' has also modified relationships in the supply chains, leading to more partnerships with upstream suppliers. They point out that

this vertical and closer cooperation was a way to comply with legal requirements and to avoid supermarkets' liability.

Garcia-Martinez and Poole (2004) reported that the Food Safety Act has led to more coordination of the British fresh produce supply chains than in France or Germany. In France, there are legal explanations for the more muted enthusiasm for such vertical relations, the first being the allocation of liability which differs from that in the UK. Under the French rule, liability rests on the first supplier to place a product on the domestic market. In France, the liability rule for safety defects thus applies to the producer of the product.

The French law promulgated on May 19, 1998 was the transposition of a European directive promulgated in 1985 defining the term of 'producers of food items' and hence the allocation of liability, in the case of a food safety defect. According to this Law, there are three types of producers. A producer is i) the manufacturer of a finished product; ii) the producer of any raw material; iii) the manufacturer of any component part of a product.

Food importers who import products into the European Community are thus considered as producers. In this respect, the French Law puts importers in the same category as producers, because they introduce food items in the domestic market. For non-branded products, the producer or the importer of the product bears the liability. For branded products, it is the owner of the brand who bears the liability. Hence, food operators who display their name, trade mark, or other distinctive sign on product are also considered to be the producer.

The newly promulgated General Food Law and its enforcement in 2005 increased the importance of avoiding food safety defects and emphasized potential liability. Since the implementation of the General Food Law, French food operators, named as producers, have been obliged to undertake their own safety controls. In France, food safety regulations are monitored and enforced by a regulatory public agency, the General Service for Consumption, Competition and the Repression of Fraud (DGCCRF). If the DGCCRF identifies an unsafe product, the food operator, namely the producer, will be accused of committing an offence. Sanctions range from a warning letter to prosecution and jail.

In this respect, French supermarkets with their own brand products (*Marques De Distributeurs* (MDD)) combine the role of retailer and manufacturer (or producer) of the product on the domestic market. In this particular case, supermarkets cannot transfer liability to their suppliers or even to their manufacturer. In this case, private standards have become a key tool in the contractual design for managing suppliers of products that will be sold under MDD. As part of the customer-supplier relationships, these private standards may be described as collective legal acts (Friant-Perrot *et al.*, 2007). Private standards certify the competence of the supplier to produce the specified product and also represent a way for supermarkets to reduce their liability. Only certified providers can enter the MDD market.

Liability rules in force in the UK, Northern Ireland and France differ on one point. In the United Kingdom, the last suppliers to the supply chain, namely supermarkets, bear the liability. They cannot transfer the liability to anyone else in the supply chain. In France, the producer, or the first supplier to the domestic market, bears the liability. Such a position in the supply chain can be the target of strategies implemented by food operators. They can choose to bear the liability or to transfer it to someone else. For this reason, we argue that this decision is an important strategic decision for food operators because when choosing their status in the supply chain, they influence the organization of the whole food supply chain.

3. Allocation of liability, transferability and the food supply chain

Under French Law, import decisions at the French border are useful indicators to understand how the allocation of the liability rule in the supply chain can influence coordination for food safety. The regulatory change in 2005 requires stricter enforcement of the liability rule applying to the first supplier, namely the importer.

In this section, we first focus on the import behavior of supermarkets before and after the change in the regulation in 2005 because supermarkets can transfer their liability to importers, thereby increasing the length of the supply chain. Second, we focus on the strategic response of importers who are unable to transfer liability to anyone else.

3.1. Import themselves or purchase services? French supermarkets' strategic response to liability

In this section, we highlight supermarkets' strategic response to the 2005 increase in liability created by the General Food Law: does the increase in liability change their import strategies?

3.1.1 French Supermarkets' imports trade-off

Demand for fresh produce has led to an extension of the assortment of categories and to year-round availability of fresh produce in shelves. In France, more than 70% of sales of fresh produce are made in supermarkets (and hard discounters).² As a consequence, fresh produce shelves have become strategic for supermarkets. Supermarkets have to satisfy increasing demand combined with strict quality requirements from consumers. France is not self-sufficient in fresh fruit and vegetables and must thus import produce to satisfy consumer demand. This has led to an increase in exports from developing countries to the European market.

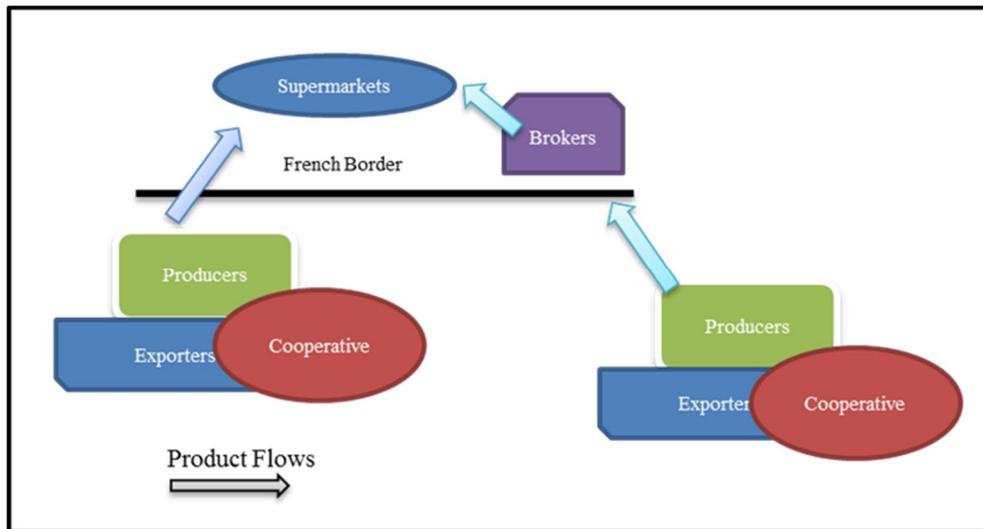
To satisfy consumer demand, supermarkets have two ways of importing fresh produce. They can import directly from foreign producers to their own supply chain: this is the 'make' option. They can also deal with importers/brokers of fresh produce who import for them: this is the 'buy' option. It is worth noting that, for a non-negligible part of their transactions, importers/brokers work with supermarkets, 80% of sales by importers are done with supermarkets (Rouvière *et al.* 2010).

As regards liability, when a supermarket imports directly for its supply chain, it becomes the first supplier to place a product on the domestic market, and hence bears the liability. In the buy option, the supermarket transfers liability to the broker/importer. The broker/importer becomes the first supplier. The broker/importer bears the liability and may be held liable under criminal law if some fresh produce he introduced in the market is found to be unsafe. This is even true if the unsafe product is identified in the final market, i.e., on the supermarket shelves. As producers, first suppliers are liable under criminal law if the imported products do not comply with the regulations in force (Rouvière *et al.* 2010).

Supermarkets face the following trade-off when filling their shelves: costs of fresh produce transactions and costs associated with being held liable versus costs of fresh produce transactions and commissions linked to using brokers (see Figure 1).

Figure 1: Trade-off made by supermarkets when importing fresh produce into France

² <http://www.rungisinternational.com/fr/bleu/enquetesrungisactu/Fruitsetlegumes640.asp>



For supermarkets, using a broker/importer increases the length of the supply chain and consequently transaction costs. But it is also a way to transfer the risk of being held liable if a safety defect occurs. The first supplier to the domestic market is the importer. This implies contractual requirements between the two parties to ensure these transactions that have a high level of asymmetry of information. When the supermarket decides to import directly, it bears the liability. In this case, the supply chain is shorter because the supermarket fulfills the import function, hence reducing transaction costs. For supermarkets, the trade-off between the make or buy options is between transaction costs and the risk of ex-post liability.

3.1.2 Supermarkets' import decisions

In the following, we focus on supermarkets' import strategies from Spain. We chose Spain as a case study because it is the main exporter of fresh produce to France and is responsible for more than 50% (on average) of the total value of fresh fruit and vegetable imported into France.

To support our hypothesis, we used data from French Customs on imports of fresh produce (fresh fruit and vegetables) which document all imports by French firms from foreign countries from 2000 to 2011. We then distinguished between imports flows made by brokers/importers and by supermarkets. Since we wanted to compare supermarkets' behavior before and after 2005, the year of the implementation of the General Food Law in France, our sample included importers and supermarkets who were operating on the market in 2005. Our final sample comprised 190 firms, of which 100 are supermarkets and 90 are importers who traded fresh fruit and vegetables in 2005. This sample is representative since it covers all French supermarkets who imported in 2005 and the exhaustive list of French importers.

Importers and supermarkets are the main importers of fresh produce into France. French custom data for the year 2005 show that importers and retailers (supermarkets) represented 64% of the total value of trade by trade intermediaries (other than supermarkets or pure importers, for instance wholesalers); this represents 37% of total French imports (still in value) whereas other trading firms (873 firms other than importers and supermarkets) represented 21% of the total value of French imports of fresh produce.

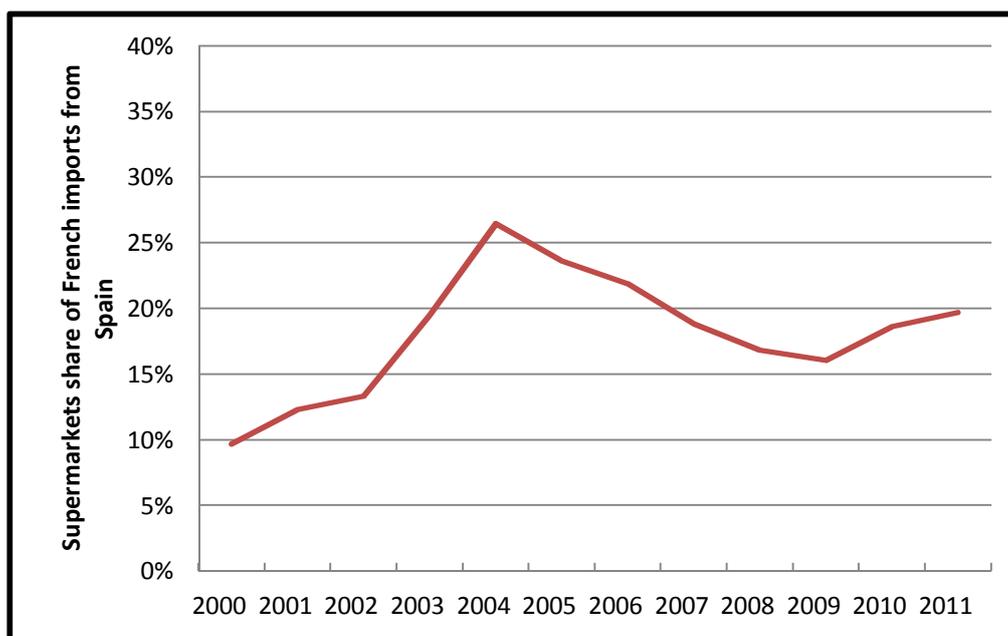
Some products are more risky to import than others. Fresh produce is very perishable. Its quality reaches a peak value at harvest and thereafter the value of the product starts to decline. In our analysis, we used two variables to take product risk into account. (*Perishability*) is a dummy variable which takes the value of 0 when the produce is not perishable (e.g. apples)

and takes 1 when the life of produce is short (between 1 to 14 days after harvest).³ (*Perishability*) approximates the management quality capacities required by supermarkets and importers. In addition, there are also food safety issues. The most common food safety hazard is that related to chemical contamination (e.g. pesticide residues). The foreign producer is the only one able to reduce the risk of excess pesticide residues by implementing good agricultural practices. To approximate the sensitivity to pesticides of fresh produce (*Pesticides*), we refer to the list of products that are less sensitive to pesticides published by the Environmental Working Group (<http://www.ewg.org/>). Using this list, we are able to classify fruit and vegetables according to their sensitivity to pesticides. (*Pesticides*) is a dummy variable that allows us to identify the 15 cleanest products. (*Pesticides*) takes 0 if the product is one of the 15 cleanest and 1 if the product is not one of the 15 cleanest. Our field background is also based on data we gathered during semi-structured interviews conducted with main operators in 2005, 2006, 2010 on imports of fresh produce (public authorities, regulatory agencies, importers, board of importers).

Graph 1 shows the respective shares of supermarkets in French imports from Spain. For each year, shares are computed as the value imported by supermarkets out of the total value of French imports from Spain. Supermarkets shares are proportion plotted in Graph 1 as percentage and are thus comprised between 0 and 100%. For instance, in 2005, French Supermarkets imported for 256 015 thousand € of fresh fruit and vegetables from Spain. Out of the 1 082 991 thousand € of Spanish fresh produce imported by France, supermarkets represents 23% of French imports from Spain in 2005.

Graph 1 shows that supermarkets were responsible for an average of 20% of imports from Spain between 2000 and 2011. Up to 2005, supermarkets increased their respective shares of imports from Spain. After 2005, there was clear change in this trend as the supermarkets' share of imports from Spain decreased.

Graph 1: Supermarkets share of Imports Shares in French imports from Spain



³These data come from the UC Davis post-harvest department: <http://postharvest.ucdavis.edu>

We investigate the reasons for this change in the behavior of supermarkets. Three classes of reasons are investigated: i) a decrease in French demand for fresh produce, ii) a switch in strategies by supermarkets, iii) supermarkets delegate their imports to brokers/importers.

The first reason would mean that 2005 represented a change in the consumption of fresh produce in France, thus leading to a continuous decrease in demand in supermarkets since then. However, this reason is not consistent. The year 2005 revealed no differences in terms of the consumption of imported or locally produced fresh produce. In France, the consumption of fresh produce has continued to increase since 1980 and is currently 80 kg per year per French consumer.⁴ The year 2005 is not looked on as the first year of the economic crisis, which could explain a decreasing trend in French consumption. In 2004, France imported 2.7 million tonnes of fresh fruit and vegetables. In 2007, France imported 4.1 million tonnes. There was thus a net increase in French imports of fresh produce which invalidates the hypothesis of a decreasing trend in French consumption.

The second reason could be a switch in strategy by supermarkets, for example, supermarkets imported identical products from another country, namely Morocco. Indeed, Spain and Morocco are complementary producers and both export similar fresh produce to France (tomatoes, eggplants, squash, onions, etc.) (Rouvière *et al.* 2010). This information comes from a quantitative survey made by one of the authors but is validated by French Customs data. In 2005, Morocco challenged Spain by exporting the same products: with Morocco exporting 36 products and Spain exporting 59 products. All Moroccan products are included in the list of Spanish products. The ten first products exported from Morocco to France are tomatoes, squash, strawberries, green beans, cantaloupe melons, citrus, peaches, sweet peppers and potatoes (which represent 99% of exports). Eight of those products are on the list of the top ten items of fresh produce exported by Spain.

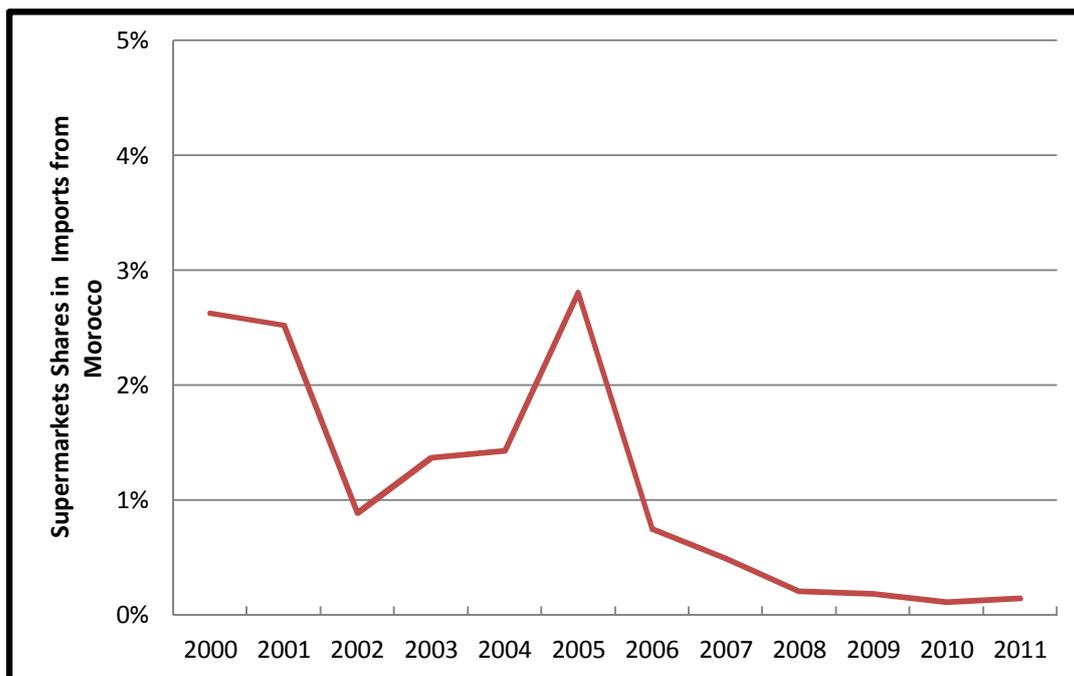
Distance and trade costs could also explain a possible switch in strategies. However, the distance⁵ between France and Morocco is 1816 km and the distance between France and Spain is 1054 km, the products and distance between the two countries of origin are thus almost the same, meaning that the costs of handling, managing post-harvest quality and transport are also almost the same.

Graph 2 shows the respective shares of supermarkets in French imports from Morocco between 2000 and 2011. Graph 2 shows supermarkets rarely include procurements from Morocco (an average of 1% between 2000 and 2011) whereas they do include procurements from Spain. There was no increase in supermarket imports from Morocco after 2005. French supermarkets did not replace fruit and vegetables imported from Spain by fruit and vegetables imported from Morocco.

Graph 2: Supermarkets' share of imports from Morocco

⁴ According to the French National Statistics Institute (INSEE)

⁵ According to the CEPII database.



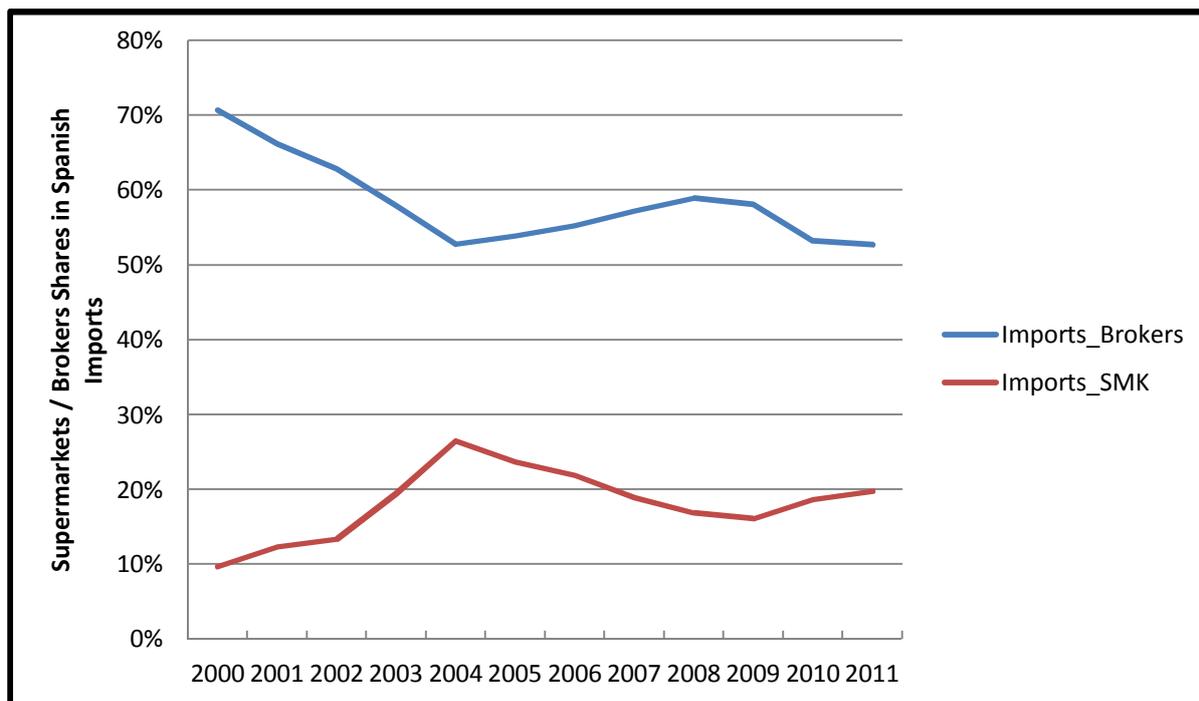
Procurements from Morocco reach the French market in winter. In winter, neither French nor Spanish producers can market their own products, but supermarkets need fresh produce in their shelves. When needed, supermarkets thus import produce from importers/brokers. Importers/Brokers were responsible for an average of 90% of imports from Morocco between 2000 and 2011. Between procurements from Spain and Morocco, there is consequently a clear country effect. Importers/brokers overcome trade costs from small countries outside the EU.

The third reason could be the enforcement of the first supplier liability rule in France in 2005. The regulatory change in 2005 required the strict enforcement of the first importer liability rule and supermarket should have transferred their own imports to importers/brokers.

Graph 3 shows supermarkets' and importers/brokers' shares in imports from Spain to France. We can observe that brokers and supermarkets activities are complementary in terms of products imported from Spain. This is in line with the results for products from Morocco. When the supermarkets' share of imports decreases, the brokers' share of imports increases. In other words, after 2005, supermarkets compensated for their decrease in imports by using brokers to import the necessary products. After 2005, supermarkets imported more products using brokers.

Graph 3: Supermarkets' and brokers/importers' shares of imports from Spain⁶

⁶ Imports_Brokers is computed as the total value imported by brokers out of the total value of fresh imported from Spain into France. The same has been done for supermarkets: Imports_SMK.



In the following, we analyze the regulatory change in liability in 2005 as being an exogenous shock. We can then study an ex-ante/ex-post situation for supermarkets. To this end, we introduce variability in imports that distinguishes between risky imports and no-risk imports. In our analysis, we introduce risk variability in the form of two variables (*Perishability*) and (*Pesticides*).

We observe supermarkets' behavior with respect to products imported from Spain before and after 2005 according to the types of product risk. We have just shown that supermarkets' imports from Spain were not replaced by imports from Morocco. No other exit option was available for supermarkets for products from Spain. Supermarkets imported more using brokers after 2005.

Our empirical strategy is highlighting the potential product effect that could explain this change in behavior with respect to imports. In other words, we analyze whether the substitution between supermarkets and importers remains the same as a function of product characteristics. If the substitution effect is the same between risky and no-risk products, there is no liability effect. If the substitution effect is not identical, we have evidence for the influence of the 2005 enforcement of the liability rule. The importation of no-risk products is considered as counterfactual to enable our analysis.

We use a three step approach:

First, we computed the share of supermarkets and brokers in risky⁷ products vs. no-risk products in the total value of products they import each year from Spain. We obtained four shares: *Brokers_Risky*, *Brokers_no-Risk*, *Supermarkets_Risky*, *Supermarkets_no-Risk*.

For instance, in 2005, the brokers' share of pesticide-sensitive products was 64% (*Brokers_Pesticides*) and the brokers' share of non-sensitive products to pesticides was 5% (*Brokers_NonPesticides*). The supermarkets' share of pesticide sensitive products was 29% (*Supermarkets_Pesticides*) and the supermarkets' share of non-sensitive products to pesticides

⁷ In the following, we replace the term Pesticides and Perishability by Risky as explained above.

was 1% (*Supermarkets_NonPesticides*). This computation gives us the distribution of products between the two agents.

Second, we computed the difference between brokers' and supermarkets' shares according to the type of product. This resulted in two differences:

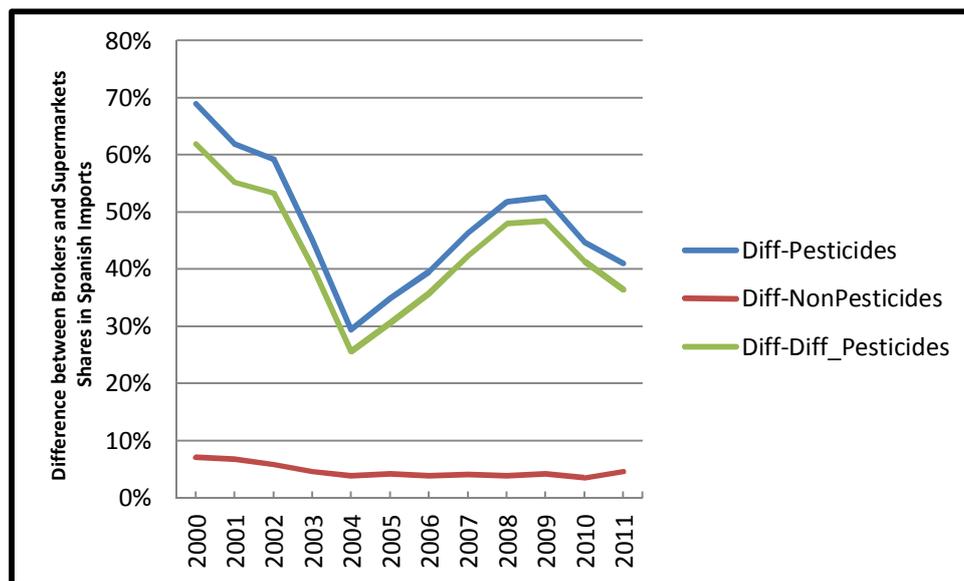
- $Diff_Risky = (Brokers_Risky - Supermarkets_Risky)$
- $Diff_noRisk = (Brokers_noRisk - Supermarkets_noRisk)$.

Our example gives 2005 $Diff_Pesticides = 0.69 - 0.29 = 0.30$ and $Diff_NonPesticides = 0.04$. This computation allows us to consider the volume effect since importers import more than supermarkets.

Third, we computed the difference in difference: $Diff_Diff_Risky = Diff_Risky - Diff_noRisk$. The 2005 example gives: $Diff_Diff_Pesticides = 0.26$. Comparing this difference in each year allows us to take time into account.

For our analysis, if the expression ($Diff_Diff_Risky$) always shows the same trend over time, there is no substitution effect between risky and no-risk products. The substitution effect is identical in both types of products. If the ($Diff_Diff_Risky$) trend is not stable over time, then there is a substitution effect between risky and no-risk products. Graph 4 plots the three differences according to the sensitivity of the product to pesticides.

Graph 4: Influence of 2005 on supermarkets' import behavior concerning pesticide sensitive products⁸



Graph 4 shows a decrease in $Diff_Diff_Pesticides$ before 2005 indicating that supermarkets increased their imports of such products before 2005. After 2005 there was an increase in $Diff_Diff_Pesticides$: supermarkets decreased their own imports relative to imports by brokers. Concerning products that are not sensitive to pesticides, no clear change is apparent. This explains the trend of the $Diff_Diff_Pesticides$ curve. From our analysis, we can argue that

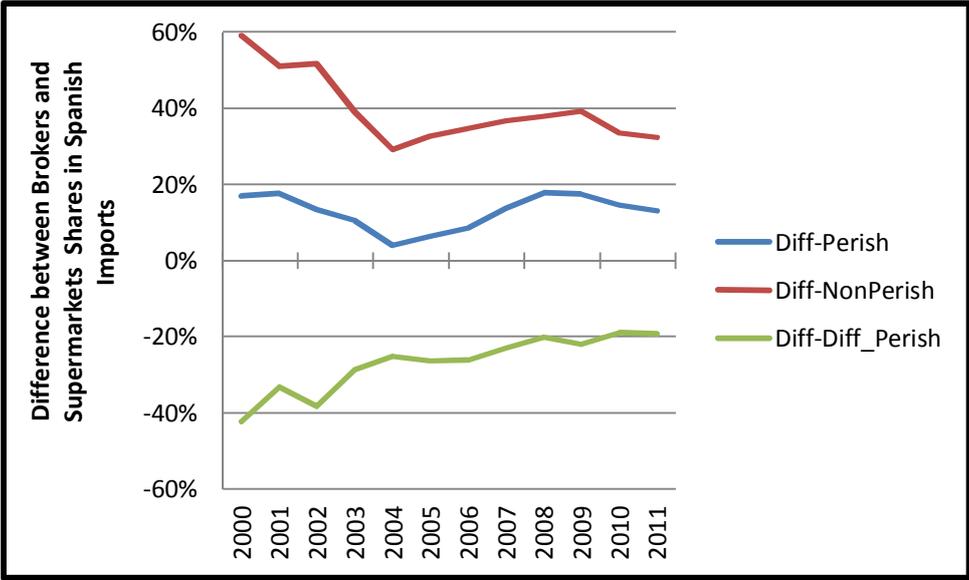
⁸ $Diff_Pesticides = (Brokers_Pesticides - Supermarkets_Pesticides)$; $Diff_NonPesticides = (Brokers_NonPesticides - Supermarkets_NonPesticides)$; with $Brokers_Pesticides / Supermarkets_Pesticides$, $Brokers_NonPesticides / Supermarkets_NonPesticides$ being the shares of imports made by brokers and supermarkets in pesticide sensitive products and non-pesticide sensitive products. $Diff_Diff_Pesticides = Diff_Pesticides - Diff_NonPesticides$

there is a clear substitution effect. In 2005, supermarkets started to transfer imports of sensitive products to brokers, at the same time transferring the risk of being held liable.

Contracting on safety is difficult and generally leads to very incomplete contracts. Producers are far away and products are very sensitive and might be risky for the importer. Supermarkets need to preserve their reputation and wish to avoid being held liable. Whereas contractual design could help to reduce transaction costs, supermarkets prefer to transfer both the liability and the procurement to importers. The risk of being held liable and the transaction costs prevent supermarkets from incorporating this procurement and encourage them to work with importers. Transferring liability increases the length of the supply chain.

Graph 5 plots the three differences according to (*Perishability*). In Graph 5, *Diff-Perish* and *Diff-NonPerish* show the same trend (a decreasing trend before 2005 and an increasing trend thereafter). An effect of 2005 is apparent; the two curves follow the same pattern, i.e. a decreasing trend showing that supermarkets increase their procurement of both types of products. After 2005, the two curves increase, illustrating that the share of imports of supermarkets becomes smaller (relatively to that of importers/brokers).

Graph 5: Influence of 2005 on supermarkets' behavior in importing perishable products⁹



However, the *Diff-Diff_Perish* curve shows a stable trend over time. We can argue that there is no 2005 effect in this case. Indeed, the *Diff-Diff_Perish* curve keeps the same trend over time i.e. presents no subsequent changes. There is no substitution between perishable and non-perishable products provided by supermarkets to consumers. We can explain this result by the fact that perishability is at least more observable and manageable than safety. In other words, while still important, the risk of perishability is avoidable for supermarkets. Bad quality products are eliminated before being marketed. This option remains costly but could help supermarkets preserve their reputation and prevent them from being held liable for quality defects. This is not the case of product safety attributes.

⁹ $Diff_Perish = (Brokers_Perish - Supermarkets_Perish)$; $Diff_NonPerish = (Brokers_NonPerish - Supermarkets_NonPerish)$; $Diff_Diff_Perish = Diff_Perish - Diff_NonPerish$ with $Brokers_Perish/Supermarkets_Perish, Brokers_NonPerish/Supermarkets_NonPerish$ being the shares of imports made by brokers and supermarkets in perishable products and non-perishable products.

These two results indirectly emphasize that product characteristics influence the decision of supermarkets to vertically integrate (or not) the function of importing and thus affect the length and the shape of the supply chain. When the risk of being liable is too high, the food supply chain is longer than when the product is not risky. In the latter case, products can be imported directly by supermarkets.

Based on the Spanish case, we can conclude that the enforcement of the liability rule in 2005 has an impact on the shape of the supply chain because it influences the strategic decision of supermarkets when importing fresh produce that is sensitive to pesticides from Spain. We have thus established that the newly enforced regime of liability influenced the supermarkets decision to integrate upstream transactions. In food supply, food operators do not only consider the magnitude of transaction costs when incorporating upstream functions. We have established that product characteristics and the liability regimes may play a major role in organizing safe food supply.

3.2. Importers and horizontal coordination for food safety.

Since the implementation of the General Food Law, French importers of fresh fruit and vegetables have been obliged to undertake their own safety controls. These controls aim to ensure that imported fruit and vegetables respect the Maximum Residue Limits (MRL) for pesticides as defined by the European Law (Regulation (EC) No 396/2005). However, the newly promulgated European framework underlines that importers as producers must implement due care to guarantee that produce imported are safe. In this case, importers cannot strategically transfer liability to another food operator in the supply chain.

To comply with this new regulation, French importers of fresh produce chose to implement on-site inspections. Horizontal safety schemes were thus developed in the two main import markets of fresh produce. The *Démarche Qualité*¹⁰ (Quality approach) was designed and proposed by importers of fresh produce located in Perpignan. The *FEL Partenariat*¹¹ (FEL Partnership) was proposed by importers located in the Rungis market. These horizontal safety schemes appeared as a new governance structure that was negotiated between public authorities (DGCCRF) and a group of importers. The implementation of the General Food Law gives legitimacy to these public-private partnerships for food safety, which are defined as co-regulation (Garcia-Martinez *et al.* 2013; Rouvière and Caswell 2012). It also highlights horizontal coordination among importers. They compete on the market but they collaborate to provide safe fresh produce.

Those new horizontal coordination schemes were developed to better comply with the new European food safety regulation. However, the French regulation remains in force and importers must continue to abide by the performance standard irrespective of any other efforts they have introduced to monitor safety. Importers are still liable under criminal law if a safety defect is found. The goal of this safety scheme is to achieve better levels of safety in fresh produce entering the French market. In the event of a safety failure, an importer that subscribes to the program will be considered by public authorities as having acted in good faith and the negligence based liability rule will apply.

In other words, for importers in the program, there is a gap between the Letter of the Law and its enforcement. This was the main commitment of DGCCRF in recognizing the program: participants can be held liable (under a strict liability rule) if and only if they have failed to

¹⁰ <http://www.saintcharlesinternational.com/Pages/demarche%20qualite.aspx>

¹¹ <http://www.csif.eu/sites/fr/notre-savoir-faire/fel-partenariat>

take due care (no analysis). The liability rule thus moved from a strict liability rule to negligence based liability rule. Under strict liability, an injurer will be found liable whenever an injury has occurred. Under the negligence rule, the injurer will be found liable if and only if he/she failed to take due care.

Membership in the program thus provides importers with an assurance scheme against food safety hazards that may occur in the fresh produce they import. According to interviews conducted by one of the authors with representative of importers and with public authorities, the enforcement of the liability rule for safety defect was one of the most important reasons for designing and implementing the horizontal safety schemes.

The General Food Law and its implementation led to effective enforcement of the liability rule for safety defects, at least for French imports of fresh produce. We can infer from this case that the new enforcement of the rule of liability led to a change in the behavior of both importers and public authorities. Importers are liable under criminal law if the product they import is not safe. Importers understood that the regime of liability could create risks. In response, they conceived, developed and enforced, through their representatives, a new governance structure to ensure the safety of imported product. These safety schemes have modified the behavior of importers as regards safety effort and monitoring (Rouvière *et al.* 2010). Importers also cooperate in order to provide a high level of safety for imported fresh produce. It has also generated a new way for public authorities to enforce the liability rule that applies to this market. Historically speaking, the mission of the public authorities was to check public standards with the frequent use of sanctions. The introduction of this safety scheme has caused its function to change to a more preventive role (Rouvière and Caswell 2012).

Last but not least, the negotiation has also softened the regime of liability since a negligence based rule has been accepted for importers within the group. However, the liability regime for importers remains a strict liability regime. This is in line with theoretical arguments on legal incentives for the provision of food safety. Because they bear the liability, importers collectively initiated and developed an original food safety scheme. Coordination for food safety can be assumed as a collective strategic response for food operators to adapt to regulatory changes and reduce the liability burden. Such a response also influenced the organization of the supply chain.

Concluding Remarks

This article analyzes the influence of the allocation of liability for safety defects on the organization of food supply. We frame our analysis in the current European regulatory framework which, in 2005, led to better enforcement of the French strict liability regime. We show that, because of this liability regime, supermarkets prefer to transfer the liability risk rather than to incorporate the importing function. In other words, we argue that, in food supply, when liability is at stake, reducing transaction costs is not the only criterion taken into consideration when deciding whether to vertically incorporate upstream transactions. Product characteristics with respect to safety and liability regimes may also play an important role. The latter has an impact on the organization of the food supply chain. Second, we argue that this shock generated the development of a new governance structure among importers to ensure quality and safety.

From these two case studies, we can conclude that the liability rule directly and indirectly shapes (through supermarkets influence) the supply chain, at least concerning French imports

of fresh produce. These results should provide some insights for public authorities when designing rules of liability and thinking about their enforcement in food supply.

For instance, the same trend of regulation appeared in the USA, with the Food Drug Administration (FDA) and the Food Safety Modernization Act (FFSMA) of 2010. The FFSMA requires all food processors, manufacturers, packers and handlers to identify and implement preventive efforts to minimize and prevent food safety hazards. The promulgation and implementation of the (FFSMA) prompted a discussion on the safety of imported food and the liability regime of importers (Koenig 2011). Our results highlight the fact that decisions concerning liability regimes are important issues. Indeed, depending on the allocation of the liability, the consequences will not be the same for the organization of the food supply chain.

Depending on its design and its allocation, the liability rule will change the structure of the industry. It will modify relationships between food operators, and hence modify market interactions between food operators. This implies that the economic structure and market incentives can also change. For instance, it may exclude some foreign producers or open the way for the development of new markets ó for instance a certification market. Further research will focus on these interactions between liability regimes, market forces and interactions and their influence in shaping horizontal and vertical coordination schemes for food safety between food operators, and thus in shaping the food supply chain.

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