Small is beautiful: firm size, prevention and food safety ☆

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ABSTRACT

Food safety crises have led governments to increase food firms' responsibility by asking them to voluntarily implement prevention efforts. In this article, we explore the relationship between food firms' size and their level of prevention efforts. We show that when cross-contamination between units is unlikely, small firms undertake greater prevention efforts than large firms. But when cross-contamination between units is possible, the effort-size curve is an inverted U-shape. Using these results, we discuss food safety laws in Europe and in the US, which differ in how they deal with the size of food firms' operations.

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1. Introduction

The size of food firms concerns both consumers, citizens and public authorities (Alphonce et al., 2014). Concerning consumers, it is worth noting that consumer demand for food that is produced marketed and consumed locally, is increasing. Direct-to-consumer, direct-to-retail food service arrangements are commonly accepted features and typically involve small food firms (Martinez et al., 2010). One of the reasons is consumers' and citizens' increasing awareness of food safety issues (Guptill and Wilkins, 2002; Alphonce et al., 2014). Safety has been one of the main characteristics of food (Alphonce et al., 2014). The multiplication of food safety outbreaks supports their increasing interest in supporting small food firms (Ilbery and Maye, 2005; Buckley, 2015). Behind these facts lies the consumers' belief that shorter supply chains, driven by small food businesses, provide cheaper, better and safer products than large food businesses and longer supply chains. Empirical facts support this belief. Big companies have been at the core of recent food safety outbreaks. For instance, in August 2011, Cargill, the largest privately held food corporation in the US was responsible for one of the largest meat recalls in the country: turkey contaminated with a strain of Salmonella was linked to

at least one death and 79 illnesses across 26 USA states.[1] In 2012, in France, Escherichia coli O 157:H7 was found in minced beef meat sold by Carrefour.[2] In early 2009, Peanut Corporations of America, which is now bankrupt, prompted a recall of 3918-related peanut butter products after nine people died, and 22,500 more people fell sick.[3]

Concerning public authorities, the same trend is emerging in food safety regulations. Recent food safety crises have led governments to increase food firms' responsibility in handling and preventing food safety hazards. All around the world, food firms have been encouraged to implement voluntary preventive safety controls. Voluntary preventive safety controls encompass all means implemented by food firms to avoid the occurrence of food poisoning. In Europe, the General Food Law was passed in 2002 and has been enforced since 2005. In the USA, the FDA Food Safety Modernization Act (FSMA) was passed in 2010. The scope and enforcement of the two laws are nearly the same concerning prevention by food firms. But, while the European General Food Law applies uniformly to all food firms, the Food Safety Modernization Act allows exemptions (Tester-Hagan Amendment) for small food firms who sell local food. One argument in support of the amendment was that regulation was not necessary for producers who

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[1] http://www.cdc.gov/salmonella/2011/ground-turkey-11-10-2011.html.
[2] http://agriculture.gouv.fr/actu-alerte-ecoli-dans-des-steaks-haches.
[3] http://www.nytimes.com/2009/03/06/business/06food.html?_r=2&hp.

have more personal direct oversight of quality control and a more direct relationship with their consumer.[4] In other words, small food firms sell safer products than large ones.

In this article, we question the technical relationship between the size of food firms and their voluntary safety prevention efforts. Although prevention is one of the primary food safety tools, the impact the size of a firm has on the level of prevention effort has received little attention in the food safety literature. Here we report two main results: when cross-contamination is possible[5] due to biological hazards, both large and small firms may invest less prevention effort than medium-size firms (the shape of the effort-size curve is an inverted U). When cross-contamination is highly unlikely, either due to a physical or chemical hazard, small firms invest more in prevention efforts than large firms. These results allow us to discuss the differences in food safety regulations in Europe and in the USA.

The article is organized as follows: in Section 2 we review related literature; in Section 3 we present our model; in Section 4 we set out our two theoretical propositions and our results. In Section 5 we discuss possible exemptions in regulations for small firms because of food safety considerations.

2. Food firms' size matters

From an economic perspective, the existence of market failures is the central rationale for regulatory intervention in the provision of food safety. Market failures are due to the existence of asymmetric information about food safety attributes between producers and consumers or imperfect symmetric information for both consumers and producers (Antle, 1996). But the regulation of food safety has also been justified by negative externalities related to the occurrence of a bad event in other components of the supply chain (Rouvière and Soubeyran, 2011; Peake et al., 2014). These two facts justify the need for oversight in the food supply chain. Oh and Hennessy (2014) underline that information asymmetries and negative externalities in food chains lead to poor alignment between private incentives and social welfare. In the literature, the relationship between food firms' size and the influence of regulation is widely debated (see Buckley (2015) for a recent survey on main reasons). Some authors argue that regulation may burden small firms and standardize their operations (Sage, 2003; Worosz et al., 2008). One main argument is that costs linked to regulatory compliance might be disproportionate to the size of operations (Fairman and Yapp, 2005). This literature provides evidence for the need for differentiated regulations according to the size of the firms (Fairman and Yapp, 2005). Small firms should benefit from dedicated but less strict regulations than large food firms. Other authors argue that dedicated regulations or exemptions might count against large firms. For instance, Pouliot (2011) compared situations with and without exemptions for small firms from complying with Food Safety Modernization Act (hereafter referred to as FSMA). He showed that, when competing on the same product, small firms benefit from exemption at the expense of large firms, which have to comply with the law. At this point, we can argue that the size of a firm is thus an important aspect for both public authorities and for food firms since it enables them (or not) to benefit from exemption from the regulation. It seems to us there no persuasive clear technical and theoretical arguments have been put forward either in favor of or against these empirical results. In a recent article, Buckley (2015) argue it would have been important to consider policy accommodation exemptions that are currently popular to small-scale processing in the US. She shows that exempted processors fail to gain from the assistance and specialized oversight that official inspectors offer. In this article, we provide strong analytical insights into food firms' decision making that could help public authorities tackle the issue of the size of food firms' operations on a technical basis.

To our knowledge, the literature on quality management in supply chains has not yet analyzed the link between a firm's size and its level of prevention effort. Scholars have mostly focused on the design of contracts and inspection policies (see Reyniers and Tapiero, 1995a,b; Baiman et al., 2000; Starbird, 2005) for a single product in the presence of moral hazard. Other authors analyze the regulator's option to encourage prevention by food firms. Marette et al. (2005) provide a framework in which the effort firms invest is influenced by liability regulations in force and the ability of firms to pay damages. Pouliot and Sumner (2008) show how a mandatory food traceability system becomes an incentive to avoid liability costs. Cho and Hooker (2007) provide a game-theory framework that takes into account food firms with heterogeneous costs. They deal with an efficient regulatory instrument (voluntary or mandatory) to maintain the level of food safety in the market. Other research focuses on strategic interactions on prevention shared by consumers and industry (Roe, 2004; Oh and Hennessy, 2014). Marette et al. (2012) analyze how social welfare would be affected by consumer and industry responses to vaccines against foodborne pathogens. Roe (2004) and Marette et al. (2012) show a moral hazard effect in theses preventive actions, one agent's efforts reduces the marginal effectiveness of the other agent's efforts. Ochieng and Hobbs (2016) provide an interesting study on the incentives for cattle producer to adopt an *E. coli* vaccine (Econiche) to reduce *E. coli* contamination in the food supply system and in the environment. However, they do not analyze the individual technical trade-off of the firm relatively to their own prevention effort whereas they underline that a "one fit all" policy might be challenging.

Some empirical articles have established a clear link between the size of the operations and prevention effort and the length of the supply chain. Rouvière et al. (2010) empirically highlighted the negative link between safety effort, firm size and the organization of the supply chain. In the context of French imports of fruit and vegetables, they investigated why French importers of fresh produce invested in different safety efforts by analyzing the situation of a risk averse importer who is uncertain about the safety of the fresh produce he markets. The importer consequently decides to monitor some boxes to be sold. To this end, he conducts laboratory analyses to check the level of pesticide residues in the produce. They established that the larger the firm, the less safety efforts they invest. They tested this prediction using primary data collected in 2006 on importers of fresh produce and estimate the determinants of their safety effort according to several characteristics of the firms (size, supplier, customers, etc.). These empirical data validated the negative link between the size of the firm and the level of safety effort. Moreover, they showed that importers who are directly supplied by foreign producers implement more safety effort than importers who are involved in longer supply chains.

To our knowledge, this contribution represents one of the first quantitative assessments of the determinants of safety efforts, size, and the length of the supply chain. The results are consistent with those of other studies that also showed a link between the size of a food firm, its prevention effort and the safety issue the industry faces. For example, Colatore and Caswell (1999) found that firms' size impacts the safety effort in the North American seafood industry.

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[4] Johnson Renee, Cong. Research Serv., Rl 34612, Food Safety On The Farm: Federal Programs And Legislative Action 17 (Jan. 18, 2011).

[5] Food safety hazards can be classified in two broad categories: (i) cross-contamination between units (batches) is possible (biological contamination) and (ii) cross-contamination is highly unlikely (chemical or physical contamination).