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## **Risk Communication and Market Effects during Foodborne Illnesses: A Comparative Case Study of Bacterial Outbreaks in the U.S. and in Germany**

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### **Abstract**

The study analyzes two cases of *E. coli* outbreaks related to fresh produce, in the U.S. in 2006, and in Germany in 2011. The case analysis built on previous research how media coverage of foodborne illnesses influenced consumers' risk perception. Reports by national newspapers and other targeted media, and official press releases and reports were compared. Market data and consumer purchasing behavior before and after the outbreak were analyzed for vegetables involved. Results show that media coverage and releases by governmental authorities affected consumer purchasing behavior in both cases. Furthermore, consumers seem to trust in official advisories, in both countries.

**Keywords:** consumer purchasing behavior, enterohemorrhagic *E. coli* (EHEC), food safety, fresh produce, fruit and vegetable production, media analysis, qualitative content analysis, risk event, shiga toxin-producing *E. coli* (STEC).

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## Introduction

Worldwide, food safety and consumer trust are frequently at the center of media attention. Foodborne illnesses such as the Bovine Spongiform Encephalopathy (BSE) in 1996, several outbreaks of foot-and-mouth disease after 2000, and the European horse meat issue in 2013 affect entire food supply chains. In addition, outbreaks of foodborne illnesses, many of them caused by bacteria, happen in developed as well as in emerging countries. Many smaller outbreaks go unnoticed. Larger outbreaks trigger public attention, since they show public health vulnerability, and impose high costs on society (Tauxe et al. 2010). Also, media influence the perception of foodborne illnesses by selectively publishing information (Shan et al. 2013), and contributing to increased risk perception of consumers (Chen 2008; Swinnen et al. 2005).

In the past two decades, an increasing number of foodborne illnesses have been associated with the consumption of fresh fruits and vegetables (Calvin 2007; Klonsky 2006). Painter et al. (2013) attribute 46% of foodborne illnesses in the U.S. to fresh produce. A change in eating habits, such as the consumption of raw or lightly processed fruits and vegetables, contributes to the occurrence of outbreaks (Parker et al. 2012). *Escherichia coli* (*E. coli*) is among the pathogens that cause the majority of foodborne illnesses (Calvin 2007).

The study focusses on two cases of *E. coli* outbreaks linked to fresh vegetables, in the U.S. and in Germany. In 2006, 205 people in 26 U.S. states were infected by a Shiga toxin-producing strain of *E. coli* (STEC), later attributed to contaminated spinach. Five years later, in 2011, an STEC outbreak in Germany infected 3,842 consumers and led to 53 deaths, attributed to fenugreek sprouts. Both cases stand out with regard to the number of illnesses and deaths, public attention, and market and industry response, compared to other recent foodborne illness outbreaks linked to fresh produce (Calvin 2007; Saggau 2012).

Both outbreaks also caused substantial economic and reputational damages to vegetable producers, retailers, and governmental authorities. In the U.S., estimated costs to the industry were \$200 million. Many spinach growers ploughed under their fields or stopped planting new produce due to the decrease in demand. Retailers and foodservice buyers cut back orders, or even removed spinach from their assortment for a period (Arnade et al. 2008, 5-6). In the European Union (EU), including Germany, estimated losses to the vegetable sector were over \$1,000 million (1€ = 1.3920 US\$, European Central Bank 2011). To mitigate damages, the EU supported farmers in 22 member states with over \$300 million (European Commission, EC 2011). In both countries, regulations require the recall of all produce identified as cause of an outbreak. Each recall results in high costs to retailers and suppliers, followed by reputational damage, and at times product liability litigation (Onyango et al. 2007; Pouliot and Sumner, 2013). In both cases, outbreaks also had consequences for international trade. Mexico and Canada refused spinach shipments from the U.S. during the outbreak, and Russia banned imports of German fresh produce (EC 2011; Maysenhalder et al. 2007).

The 2006 outbreak raised questions about food safety standards of the entire supply chain in the U.S. (Pouliot and Sumner 2013). Before, producers applied good agricultural practices (GAPs), or other commodity-specific food safety standards on a voluntary basis. In their study of regulatory frameworks regarding food safety, Goldsmith et al. (2003) pointed out how numerous

system failures had occurred in the U.S., without leading to timely reform. Similarly, Labrecque and Charlebois (2006), after comparing the BSE cases 1996 in Britain and 2003 in Canada, claimed that the Canadian beef industry and government failed to learn from the British case. They argued that the Canadian and the U.S. food safety systems were unable to change legislation due to conflicting interests. The 2006 STEC outbreak, triggered the introduction of several additional voluntary food safety programs, such as California Leafy Green Products Handler Marketing Agreement in 2007. In addition, in 2011, the U. S. government legislated the Food Safety Modernization Act with the objective to develop standards required for the safe production and harvest of raw fruits and vegetables (Calvin 2013).

In Germany, comparable food safety standards were already established before the 2011 outbreak (Gay and Schneider 2007; Gawron and Theuvsen 2009). The European food safety framework is based on governmental regulation (Goldsmith et al. 2003). In addition to standards prescribed by law, private standards serve to increase food safety levels. In Europe, more than 300 certification schemes are in use, about 40 in Germany (Gawron and Theuvsen 2009). Market integration in the EU imposes a common approach to food safety, which requires each country to comply with EU regulation (Labrecque and Charlebois 2006). Despite stringent regulatory standards and a wide range of comprehensive certification schemes, the outbreak still occurred.

Considering the consequences of the two outbreaks, including personal tragedy and death, the study analyzes official press releases, media coverage of the outbreaks, and market reactions in the aftermath. The objective of the analysis is to highlight the commonalities and differences between the media reporting and the consumer reactions in the U.S., a country with emphasis on self-reliance and risk taking, and a legal approach to system failures, and a European country, namely Germany with an emphasis on state-reliance and the precautionary principle (see also Goldsmith et al. 2003). Specifically, the study examines the risk communication of governmental authorities and reporting of different media outlets during both outbreaks. Another objective is to explore consumer reactions to the information released by governmental authorities and media. Despite the use of market data and model-based prior studies for the assessment of market developments, the methodological approach is an explorative, qualitative case comparison.

## **Literature Review**

Earlier studies show a strong relationship between media reporting on food safety issues, consumer perception of risks, trust in food safety, and, in the context of foodborne illnesses, consumers' purchasing behavior. Rowe et al. (2000) researched the link between the nature of newspaper reports and consumers' risk perception. They used three approaches to explain media impact on consumer behavior. The agenda-setting theory proposes that consumer opinion is not directly influenced by the media coverage. Instead the media lead to emphasizing the events. The quantity-of-coverage theory outlines that public opinion is impacted in a negative direction, independent of the nature of the risk reporting itself. The cultivation theory states that media exposure increases consumers' fears of hazardous situations relative to the degree of exposure. The frequency of repeated information increases consumers' risk perception.

De Jonge et al. (2007) measured general consumer confidence in food safety according to two distinct dimensions, optimism and pessimism. Optimism is related to a higher level of

confidence in the safety of specific products, and pessimism to a lower level. When foodborne illnesses occur, consumer optimism decreases, and pessimism increases. However, other factors, such as age, gender, and personality characteristics also influence consumers' risk perception. De Jonge et al. (2010) showed a relationship between newspaper coverage and consumer trust in food safety, depending on the recency of the media coverage. When Dutch newspaper articles from national and daily newspapers had published more recently about food contamination, consumer confidence with respect to food safety was weaker than in cases when some time had passed. It can be concluded that over time, when the release of information decreases, the effects of newspaper coverage on consumer confidence wane. In addition to the amount and novelty of information, factors such as the context in which messages are presented, disagreement between actors in the risk debate, dramatization of risk information, and framing of the message impact consumer reactions. Contrary, Verbeke (2005) found that the provision of a high amount of information can result in consumers' information overload, leading to confusion and the so-called boredom effect (see also Thøgersen 2006).

De Jonge et al. (2010) identified four determinants of consumer confidence in food safety. These are trust in regulators and actors in the supply chain, perceived safety of product groups, consumer recall of food safety incidents, and individual differences. Grunert (2002) considers consumer trust in regulators, producers, and distributors an important driver of consumer confidence in food safety. If consumers perceive producers and distributors as honest and professional, trust in food products is higher. Similarly, Berg (2004) pointed out that important factors in consumer trust in governmental authorities, producers, and distributors are consumers' perception of their expertise and honesty. De Jonge et al. (2010) added that consumers often compensate lack of knowledge regarding food products and food safety with trust in actors responsible for the management of hazards in the supply chain.

Another important aspect in analyzing consumers' risk perception is how media outlets facilitate the communication of important information to the wider community. Rutsaert et al. (2013) concluded that an accurate, fact-based, and timely message represents a potent tool in managing food-related hazards. Moreover, accurate and fact-based communication practices can bring together the knowledge of scientific experts, health practitioners, experts in industry markets, policy makers, and consumers. However, previously shaped information by journalists influence communication practices and can also lead to a number of pitfalls regarding information accuracy, source credibility, and trust. As a result, media reporting also can be the source of unwarranted panic and hysteria. Saghaian and Reed (2007) emphasize the role of media reporting, since consumers learn from previous outbreaks, leading to stronger reactions in future outbreaks. In creating a discourse of reality, media depends to a large extent on the information provided by government officials (Shan et al., 2013). Therefore, governmental authorities play a substantial role in providing objective information to all actors potentially affected by a foodborne illness (Saggau 2012). In addition to the findings discussed above, Nucci et al. (2009) emphasized the power of journalists in structuring the media agenda. Since knowledge about foodborne illnesses comes from specialists in science, medicine, or technology, journalists have a crucial role in shaping the information released, and transmitting it to the wider community.

Several studies analyzed the effects of consumers' risk perception on their consumption. Swinnen et al. (2005) argued that if a food product is perceived as particularly risky, consumers

tend to turn to substitute goods, and temporarily or even permanently avoid the affected food product (see also Saghaian and Reed 2007; Chen 2008). Media and other sources play an essential role in the process of food avoidance (Richards and Patterson 1999; McCluskey et al. 2005; Zhang et al. 2010). While negative information release has instantaneous effects on consumers' risk perception, and therefore leads to consumption losses, positive information on the outbreak status (e.g., identification of actual source, or declaration of the end of an outbreak) have a delayed influence on consumption (Liu et al. 1998; McKenzie and Thomsen 2001). Several studies confirmed that negative information on food safety leads to a decrease in demand in the short term (see Verbeke 2005). In addition, McKenzie and Thomsen (2001) observed a negative impact on price development in case of recalls due to food contamination.

The previous studies showed how media reporting influenced consumers' risk perception during outbreaks of foodborne illnesses. The recency of media coverage contributed to lack of consumer trust in food safety. Also, depending on the information provided by government officials, selective media releases shaped the public perception of food safety. Once a food product was perceived as risky, consumers tended to either temporarily substitute or permanently avoid the affected food product, which led to negative price development. Accordingly, the case study will analyze reporting of media outlets and of governmental authorities. Furthermore, the study will focus on the market situation in both countries before and after the outbreaks, and compare market developments and consumption patterns with the media coverage.

## Methods

The study follows a qualitative research approach and is of an explorative nature. Qualitative research approaches are applied for different research purposes, such as description and interpretation of new or not well-researched topics, theory development, evaluation, policy advice and action research, and in research that is oriented towards future issues. Qualitative approaches also serve to add new perspectives to well researched topics, and qualify or correct existing theories (Bitsch 2005; Bitsch and Hogberg 2005). Case studies are particularly suitable for analyzing contemporary events (Westgren and Zering 1998; Kennedy and Luzar 1999). Since the 1990s, case study research has seen a renaissance in agribusiness research, and has been more widely used (e.g., Sterns et al. 1998; Mugeru and Bitsch 2005; Bitsch and Yakura 2007).

The STEC outbreaks 2006 in the U.S. and 2011 in Germany were both linked to fresh produce, and, as discussed in the introduction, had a substantial toll in human suffering, as well as negative economic impacts on the vegetable sectors in the U.S. and the EU. Both outbreaks happened relatively recent, were large in scope and subject to extensive media coverage. In both cases, media reporting contributed to unwarranted panic and hysteria of consumers (Rutsaert et al. 2013), and as a consequence led to decreased retail orders and farm production.

To establish the basic timeline of events and to better understand the relationship between the reporting of the governmental authorities and the media reporting, the study examined press releases, advisories, and reports by governmental authorities, namely the U.S. Food and Drug Administration (FDA) and the Federal Institute for Risk Assessment (FIRA) in Germany. Institutions were chosen based on their duty to report to the public, and to inform about the process of outbreaks and ongoing hazardous situations. FDA and FIRA released information

during the entire period of the outbreak. FDA and FIRA web sites were used as sources of press releases, advisories, and official reports; these were compared to the selected media outlets.

To allow the cross country comparison, comparable media outlets needed to be determined for both countries. For the U.S., *USA Today*, an elite national newspaper (An and Gower 2009) was chosen to analyze media reporting on the outbreak. For Germany, *Die Welt* was selected as a comparable media outlet. *Die Welt* is a German national newspaper covering diverse fields of the economy, similar to *USA Today*. Media targeted at producers and production-related communities may report on outbreak events differently than national newspapers targeting the general public. Therefore, *The Sacramento Bee*, a local newspaper published in the region of California, where the source of the STEC was detected, was chosen in the U.S. for comparison. Because similar newspapers do not exist in Germany, *Gabot.de*, an online portal targeted at horticultural producers, was deemed sufficiently comparable.

The date frame of reporting in the U.S. started with *The Sacramento Bee*, September 16, 2006 until September 2, 2007. *USA Today* started to release information regarding the outbreak two days later, September 18, 2006, and ended on September 21, 2007. The majority of articles were released in 2006. Differently, the German reporting date frame started with the national newspaper, *Die Welt*, on May 21, 2011 and ended on May 3, 2013. The case analysis includes articles released in 2011, because afterwards only follow-up reports were published. *Gabot.de* started reporting four days later, on May 25, 2011, and ended reporting on September 20, 2011. Archives of the selected media outlets, accessible online, served as sources of relevant articles. Articles were selected based on their titles. Keywords used for the article search were *E. coli*, respectively, EHEC (in Germany, STEC are referred to as enterohemorrhagic *E. coli* or EHEC). The search was then narrowed to the years of the outbreak and the period afterwards; in the U.S., the articles retained covered 2006-7 and in Germany, 2011.

All articles were examined using qualitative content analysis. As the first step of the analysis, chain actors (i.e., consumers, farmers, retailers, and governmental authorities), and their concerns were identified. In order to explore the context and relationships among chain actors, four researchers read the relevant articles and coded the content. During the initial open coding process and discussion among the researchers, five categories, process, politics, source, value chain, and medicine, were established. The category process refers to the process of the outbreak and covers information concerning cases of illness and death, as well as the spread of the disease. The category politics includes reports on governmental institutions, and administrative bodies, such as FDA and FIRA. The category source addresses the origin of the outbreak and suspected sources. The category value chain comprises all actors in the chain from production to retail, including payments and support for farmers, litigation, and trade activities. The category medicine comprises information related to health issues and results by medical research organizations, such as new forms of therapy against STEC. To understand to what extent media reporting and official governmental reporting influenced each other, for each day of the outbreak, official press releases, and in the German case FIRA's timeline of the outbreak, were contrasted with the categories found in the media reporting.

U. S. market data on spinach and related produce served to describe how the outbreak impacted consumer purchasing. Because the U. S. Department of Agriculture (USDA) does not collect

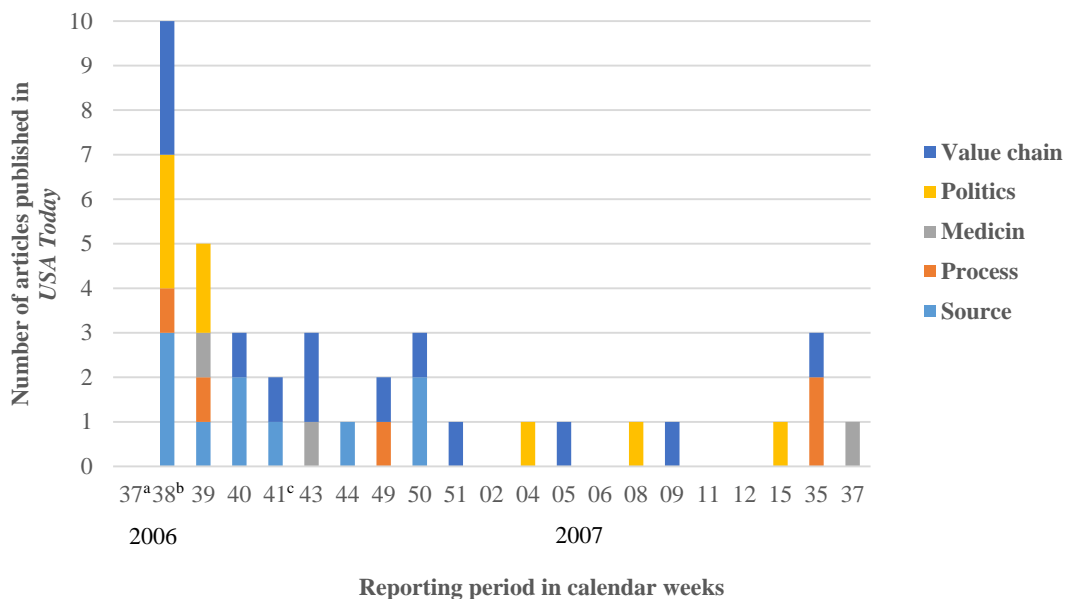
comprehensive data on bagged spinach and salads (see Calvin, 2007), previous studies based on scanner data served as data sources (Arnade et al. 2010; Calvin 2007). For Germany, weekly, monthly, and annual market data on household purchasing, and retail prices of cucumbers were analyzed (provided by Behr, Agricultural Market Information Inc., AMI, 2013). The analysis focuses on cucumbers, because cucumbers were most affected during the outbreak. Cucumbers were among the vegetables, such as tomatoes and lettuce that had been falsely accused to be the source of the STEC outbreak before fenugreek sprouts were identified. Market data on fenugreek (or other) sprouts are not currently collected on such a differentiated level. Accordingly, a direct comparison of primary market data for the U.S. and for Germany was not possible.

## Results and Discussion

The result section consists of three parts. The first part presents U. S. media reporting, and market development during the 2006 STEC outbreak. The second part focuses on the German case. Finally, both countries are compared in the third part.

### U.S. Media Reporting and Market Developments

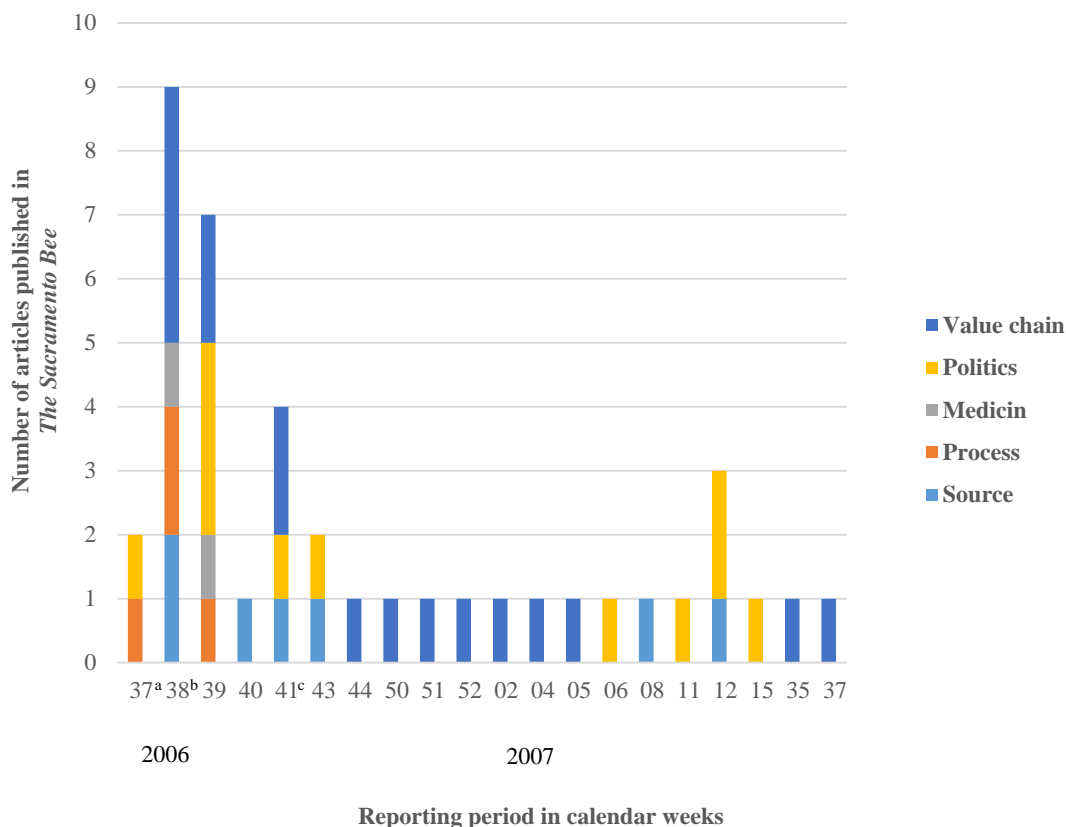
In the U.S., *USA Today* (Figure 1) and *The Sacramento Bee* (Figure 2) released 80 articles (39 and 41, respectively) during the reporting period. The highest number of articles appeared during the first three weeks of the outbreak, weeks 37, 38, and 39 of 2006. During that period, *USA Today* released 15 articles and *The Sacramento Bee* released 17 articles. Articles focused on the categories politics, source and value chain. Relatively little attention went to the categories process and medicine. Since governmental authorities reported on the state of the outbreak and advised the public, the categories policy and source also appeared more frequently in the media.



**Figure 1.** *USA Today* reporting on STEC outbreak in 2006

<sup>a</sup>W37: Outbreak occurred, <sup>b</sup>W38: First recalls, <sup>c</sup>W41: Source found

In calendar week 41, the source of the outbreak was identified. In weeks 40 and 41 the number of articles decreased in both outlets, and the focus of reporting changed. *USA Today* focused on the categories value chain and source; *The Sacramento Bee* focused on the categories source, value chain and politics. The additional focus on politics of *The Sacramento Bee* is explained by its audience including producers affected by the STEC outbreak and their communities.



**Figure 2.** *The Sacramento Bee* reporting on STEC outbreak in 2006

<sup>a</sup>W37: Outbreak occurred, <sup>b</sup>W38: First recalls, <sup>c</sup>W41: Source found

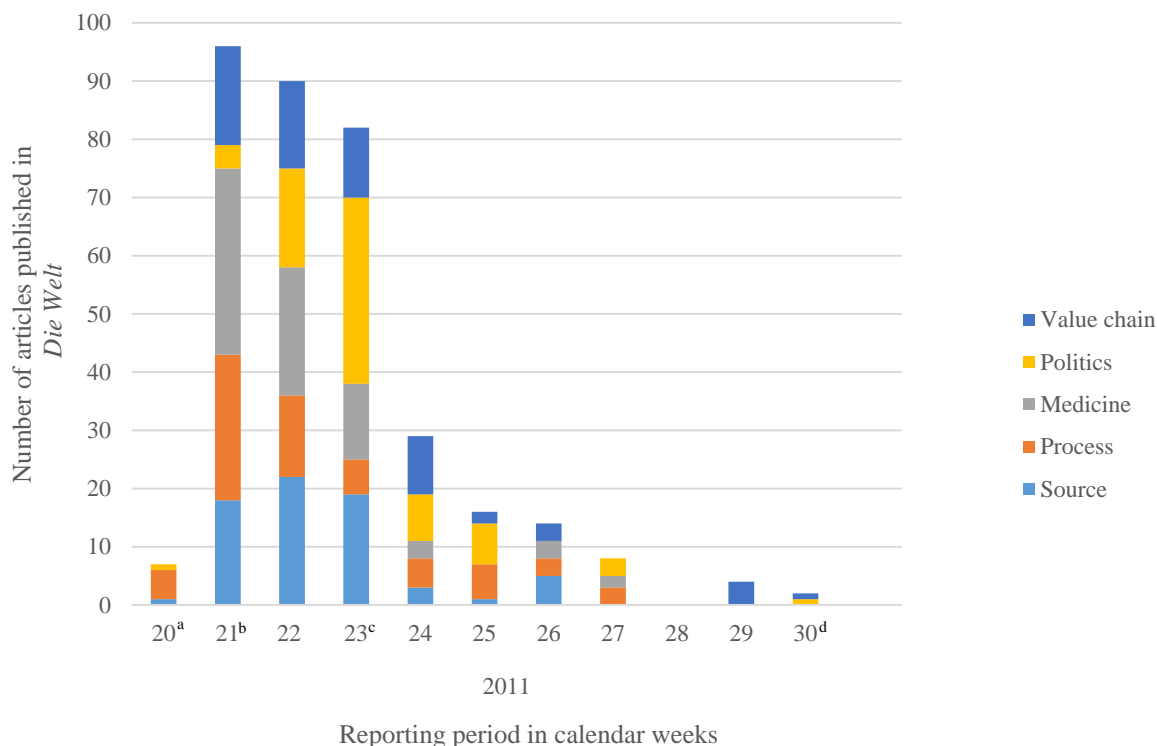
From calendar week 44 in 2006 to week 05 in 2007 differences in reporting appear. *USA Today* released articles on the value chain, the source of the outbreak, politics, and process. *The Sacramento Bee* released articles on the value chain, only. The focus on the value chain and the source is likely due to a second STEC outbreak involving lettuce and food services. From weeks 06 to 37 in 2007, *USA Today* released articles addressing the value chain, politics, process, and medicine. During that period, *The Sacramento Bee* addressed politics, the source of the outbreak, and the value chain. Finally, articles published in week 35 and 37 of 2007 recaptured events, due to the one-year anniversary of the outbreak. Each week, FDA press releases addressed similar topic: states affected by the outbreak, symptoms of STEC, consumer advice, laboratory findings, and recalls. The content of FDA releases and media reporting showed limited matching in the beginning of the outbreak. During the initial weeks, media reporting covered a broad range of topics. Therefore, matching may even have occurred accidentally.



U.S. market data show that sales of fresh-bagged spinach decreased after the recalls in 2006. After the FDA advised consumers to avoid bagged spinach, consumers started avoiding all types of spinach and other bagged salads in the short term (Arnade et al. 2008; Calvin 2007; Klonsky 2006). In addition, the spinach market closed down (Calvin 2007). Also, Calvin outlined that consumers changed their consumption habits within the leafy green category, substituting salads, such as head lettuce and Romaine, for bagged spinach. All other types of bulk leafy greens, except bulk iceberg lettuce, increased in sales (Arnade et al. 2008). After the FDA announced the end of the outbreak, sales of bagged spinach increased only slowly. Five months after the outbreak, retail sales of bagged spinach were still 27% lower than in the same period of the previous year (Calvin 2007). These findings are confirmed by Arnade et al. (2008) who stated that some retailers did not sell spinach for months after the outbreak. The lower sales can be attributed to a reduction in demand, as well as a decrease in production. However, the overall purchasing behavior shows that consumers trust in advisories of governmental authorities.

*German Media Reporting and Market Developments*

In Germany, *Die Welt* and *Gabot.de* released 505 articles (399 and 106, respectively) during the reporting period. The STEC outbreak occurred in week 20 of 2011. In this week, *Die Welt* started reporting on the categories process, source, and politics (Figure 3).



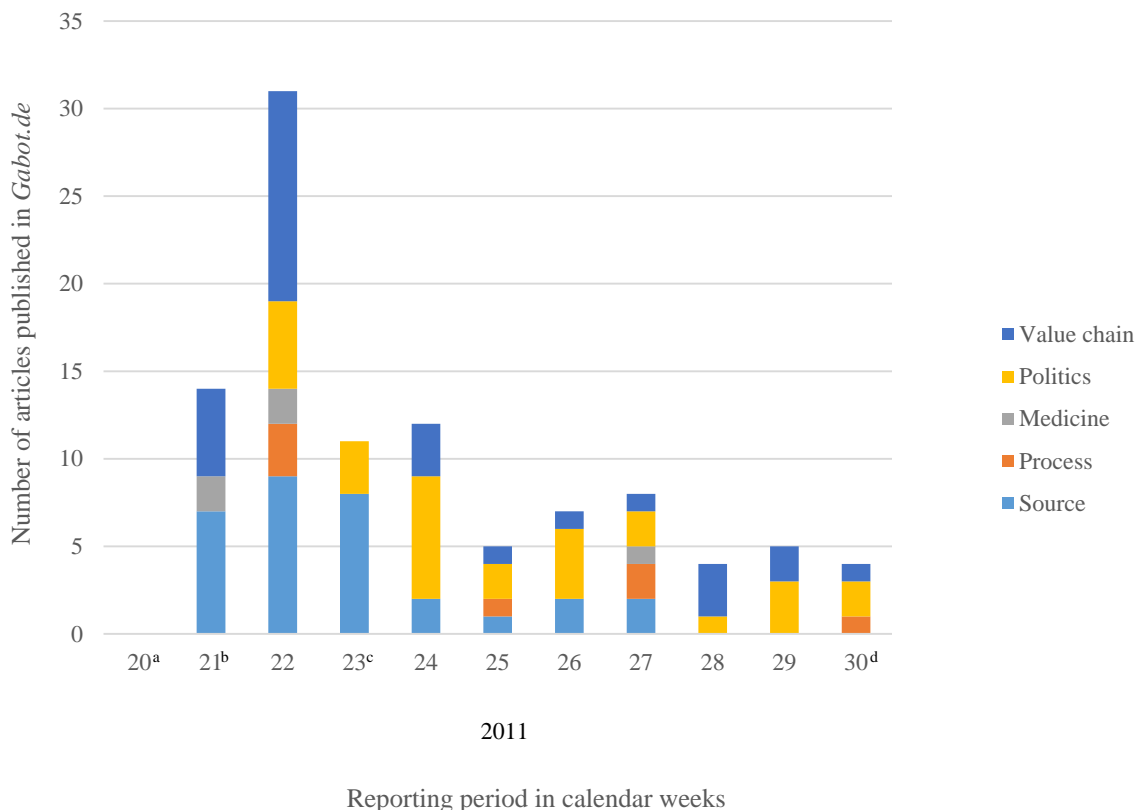
**Figure 3.** *Die Welt* reporting on STEC outbreak in 2011

<sup>a</sup>W20: Outbreak occurred, <sup>b</sup>W21: First recalls, <sup>c</sup>W23: Source found, <sup>d</sup>W30: Outbreak ends

As the number of articles increased during the following three weeks, all categories were addressed, in keeping with the mission of *Die Welt* as a national newspaper that covers all fields

of the economy. After the source of the STEC outbreak was identified in week 23, *Die Welt* decreased the number of published articles. The number of articles gradually decreased until week 30, when governmental authorities officially declared the end of the outbreak. In week 24 all categories were still present. In the following three weeks, *Die Welt* informed mostly on process, source of the outbreak, and the value chain. By the end of the outbreak, actual damages incurred by members of the value chain could be calculated. Moreover, the EU supported farmers in 22 states to mitigate the damages. Therefore, *Die Welt* reported about the categories value chain and politics in the last articles on STEC in 2011.

*Gabot.de* started to inform its audience four days after the outbreak occurred, in week 21 (Figure 4). During first two weeks of reporting, weeks 21 and 22, the portal released the highest number of articles, and informed on all categories. During the entire reporting period, the categories value chain, politics, and source of the outbreak were present. *Gabot.de* mostly addresses horticultural producers, which explains the focus on these categories. Information on the cause of the outbreak, damage incurred by value chain actors, and governmental support to farmers were central points of reporting. The number of articles decreased only slightly after week 24.



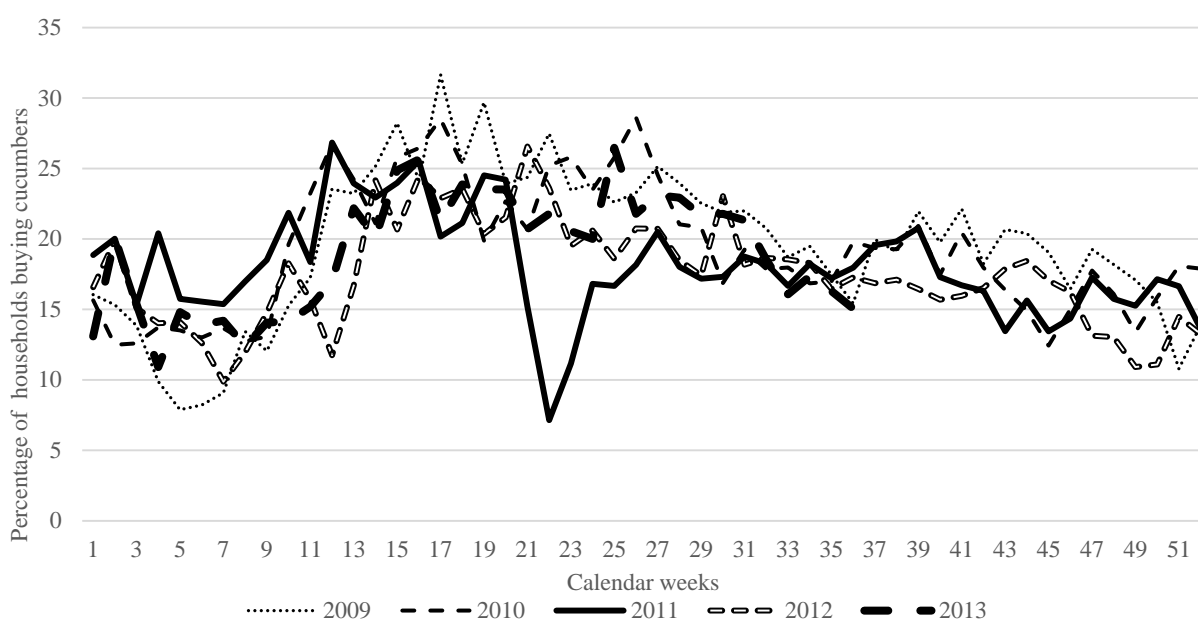
**Figure 4.** *Gabot.de* reporting on STEC outbreak in 2011

<sup>a</sup>W20: Outbreak occurred, <sup>b</sup>W21: First recalls, <sup>c</sup>W23: Source found, <sup>d</sup>W30: Outbreak ends

Comparing the reporting of both media outlets, some differences stand out. *Die Welt* released a higher number of articles overall, 399 articles compared to 106 articles released by *Gabot.de*. The reasons behind the difference are the frequency of updating and broader range of topics

covered. *Die Welt* reported almost equally on all categories, while *Gabot.de* informed mostly on topics deemed important to horticultural producers, e.g., source of the outbreak, vegetables linked to the pathogen, and the effects on the sector and on policy issues.

During the same period, FIRA informed the public about the official state of the STEC outbreak. The analysis showed that a certain matching between the reporting of *Die Welt* and FIRA exists, especially until the source of the outbreak was identified in week 23. The high number of articles released by the national newspaper partially contributed to the information matching. Once *Die Welt* reduced the number of articles released, the relationship between news reporting and the official reporting decreased. Moreover, *Gabot.de* showed similar matching with the information content released by FIRA in the period before the source of the outbreak was identified. This is in line with findings by Shan et al. (2013) who reported that media depends to a large extent on information provided by government officials. However, the reasons behind the mismatching between reporting of governmental authorities and media outlets after the source was identified remain unclear.



**Figure 5.** Percentage of households buying fresh cucumbers (week 1-2009 to week 36-2013)

**Data source.** AMI (2013)

Market data (i.e., percentage of households buying fresh cucumbers, and average retail unit prices for cucumber) show that media reporting impacted consumer purchasing behavior (Figure 5). The outbreak occurred in week 20, when the percentage of households buying fresh cucumbers started to decrease sharply. Recovery started only after the source of the outbreak was positively identified in week 23. In the following weeks, consumption increased, at times reaching higher levels than in 2009 and 2010. By the end of the year, consumption followed the tendency of previous years, meaning that the STEC outbreak had no impact on cucumber purchases in 2012 and 2013.

Analyzing retail prices for cucumbers between 2009 and 2013 shows a similar tendency. In 2011, the average retail price per unit reached the lowest level, with \$0.65 (AMI, 2013).

Afterwards, prices recovered slowly, but continued to climb in 2013. The price development is in line with findings by McKenzie and Thomsen (2001) of a significant and negative price response to adverse product safety information. However, the STEC outbreak contributed only partially to the low price level in Germany in 2011, since unit prices were already low in the beginning of the year, caused by an unusual coinciding of production periods in different European regions.

### *Country Comparison*

The number of articles released by media outlets in both countries differs. The U.S. media outlets covered the STEC outbreak with a lower number of articles, compared to the German outlets. One explanation is likely the frequency of publishing, *USA Today* (39 articles during the observed period) releases articles only during weekdays, and *Die Welt* (399 articles during the observed period) reports several times per day, including weekends. Also, the outbreak in Germany led to a much higher number of illnesses and deaths, which triggered even more media attention. The same explanation holds for *The Sacramento Bee* (41 articles during the observed period) and *Gabot.de* (106 articles during observed period), but to a lesser extent.

Orientation and target audiences impacted the focus of the reporting of the examined media outlets in both countries. *USA Today* and *Die Welt*, elite national newspapers, showed a broad scope, informing the public about all categories. The Californian newspaper *The Sacramento Bee* and the online portal *Gabot.de* more specifically addressed producers' interests. As expected, the categories value chain, politics, and source of the outbreak were more frequently the focus of reporting for these outlets. After the respective sources of the outbreaks were identified, media outlets in both countries reduced the number of articles. An explanation could be the boredom effect, since the media had released a high amount of information for weeks. Particularly, in the German case, where media outlets had published information on vegetables falsely determined as sources of the outbreak. Also, De Jonge et al. (2010) found that over time when the release of information decreases, and the effect of newspaper coverage on consumers' memory fades.

Saggau (2012) argued that governmental authorities have crucial responsibilities in reducing negative effects on consumers and the wider society during events of foodborne illnesses. In both cases, FDA and FIRA reported on the state of the STEC outbreaks frequently. However, the analysis showed premature proclamations of the authorities in Germany. While in the U.S. consumers misinterpreted the official advisory, in Germany, the official advisories contributed to public confusion, which resulted in consumers not purchasing cucumbers and other vegetables. Findings of Calvin (2007) and Arnade et al. (2008), as well as the German purchasing data (Figure 5) show that once the actual source of the outbreak was positively identified, purchases started to recover. When comparing the content of reporting by governmental authorities (i.e., FDA and FIRA), and the selected media outlets, only limited matching occurred. Nucci et al. (2009) argue that journalists have the crucial role in shaping the information released. In addition, Imtihani and Mariko (2013, p. 944) found that reporters frame the news content according to their viewpoint, which is not always in an objective manner.

## Conclusions

Both cases can be interpreted as indications of the cultivation theory. As proposed by Rowe et al. (2000), consumers show reduction of purchases or avoidance of implicated products, in the wake of governmental authorities' press releases and elevated frequency of media reporting. However, increased risk awareness due to frequency of reporting is not the only determinant of consumer behavior. For the products implicated in the outbreaks, but not the actual source, the findings show that the STEC outbreak analyzed had only short-term effects on consumer purchasing behavior. Nevertheless, for the product both implicated and identified as the source of the outbreak, namely bagged spinach, the situation developed differently. Sales of bagged spinach in the U.S. required a longer recovery period, while bunched spinach recovered quickly after the outbreak. In Germany, the market for cucumbers recovered shortly after the actual source of the outbreak was identified. Moreover, lower retail prices for cucumbers cannot be attributed to the outbreak alone. However, data on consumer behavior regarding the actual source of the outbreak in Germany (i.e., fenugreek sprouts) was not available, therefore a direct comparison with the U.S. market data was not possible.

In both cases, consumers trusted the governmental authorities, and followed their recommendations during the outbreaks of the foodborne illness. Therefore, with regard to purchasing implicated produce, we found no evidence that U.S. consumers are more risk-taking, and less state-reliant than Germans. During both outbreaks, consumers avoided implicated products, and turned back to consume them quickly after the actual source of the foodborne illness was identified. However, this holds only for falsely accused products. The actual source of the outbreak, bagged spinach in the U.S., showed a much longer recovery period. Accordingly, neither case of a large outbreak of foodborne illness analyzed, provides an indication of the quantity-of-coverage theory, which would propose that consumers avoided related products independent of the nature of press releases and reporting. In addition, after the initial confusion, consumers in both countries showed rather differentiated risk perception with their purchasing behavior. Finally, the long recovery period of bagged spinach sales in the U.S. and similar anecdotal evidence regarding sprout sales in Germany show that consumers, do not forget as quickly as some authors and industry actors seem to assume (see also Arnade et al. 2010).

In both countries, content and amount of media releases depend on the orientation of the media outlet (i.e., focus on the wider public, or focus on producers). Media reporting contributed to consumer distrust in food safety and influenced their purchasing behavior. Consumers showed distrust in food safety only in the short-term, and restored their previous consumption patterns with respect to similar products when the source of the outbreak was identified. The study also supports the findings of Nucci et al. (2009) that journalists have a crucial role in shaping the information released and transferring the information to the wider community.

Insights into the concept of media influence on consumer trust in food safety in both cases give rise to questions of risk communication during foodborne illnesses. Particularly, the limited matching between press releases and reports of governmental authorities and media outlets during the STEC outbreaks led to problems regarding information accuracy, source credibility, and consumer trust (see also Rutsaert et al. 2013). Better exchange and synchronization of

information between governmental authorities and media outlets can improve the trust of supply chain actors, depending on that information. This is especially important due to the fact that negative information release immediately impacts consumers' risk perception, and therefore their purchasing behavior, while positive information on the outbreak status leads to delayed influence on purchasing (Liu et al. 1998; McKenzie and Thomsen 2001). Another strategy suggested by Saghaian and Reed (2007), could be governmental marketing campaigns promoting the safety of products.

Since several vegetables were affected during the STEC outbreaks in both countries, entire food supply chains need to clearly communicate improvements in safety practices and standards. Duration of time until market recovery, as well as reputational damage, and economic losses can be reduced if the actors of the entire supply chain managed a coordinated response to outbreaks. They need to acknowledge previous problems and communicate how they were overcome. As de Jonge et al. (2010) stated, among determinants of consumer confidence in food safety are trust in regulators and actors in the supply chain. According to Labrecque and Charlebois (2006), the food system becomes more prone to risk events due to globalization, requiring the implementation of rigorous traceability systems among supply chain members. However, Nganje and Skilton (2011) argued that trust and transparency in supply chains may reduce perception of risk without reducing the actual risk. Therefore, these cannot be substitutes for inspection and prevention measures.

Further research should investigate how social media reporting impacts public behavior during foodborne illnesses, especially considering the increased influence of social media compared to traditional media. Additional information outlets to investigate are news on radio and television. As many consumers decide to eat raw vegetables, such as spinach and sprouts, due to health benefits, medium and long-term purchasing and consumption decisions may be less impacted than regarding other products, such as meat or eggs, where raw and undercooked consumption is due to taste preferences. Research on other food products may therefore lead to different results.

The study showed that both outbreaks impacted consumer purchasing behavior mostly in the short-term. In addition, producers and retailers had to bear reputational damage, and product litigation. Therefore, another venue for future research would be the incentives to invest in food safety technologies and practices among the supply chain actors. Future research could build on findings of Richards et al. (2009) who argued that actors along the U.S. food supply chain appear reluctant to undertake such investments, due to hysteresis effects and free riding. On the other hand, Calvin (2007) emphasized that the application of additional food safety standards still bears incentives, such as the protection of sales, reputation, and assets. The German case is of particular interest, since food safety standards have been applied for over a decade, and upgraded over time, but foodborne illnesses still occur (see also Gawron and Theuvsen 2009; Gay and Schneider 2007). Further incentives for improving food safety in Germany should be explored, since lawsuits related to the STEC outbreak in 2011 were not successful and farmers were compensated by the European Commission.

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