Kathleen Cleeren, Harald J. van Heerde, & Marnik G. Dekimpe

Rising from the Ashes: How Brands and Categories Can Overcome Product-Harm Crises

Product-harm crises are omnipresent in today's marketplace. Such crises can cause major revenue and market-share losses, lead to costly product recalls, and destroy carefully nurtured brand equity. Moreover, some of these effects may spill over to nonaffected competitors in the category when they are perceived to be guilty by association. The extant literature lacks generalizable knowledge on the effectiveness of different marketing adjustments that managers often consider to mitigate the consequences of such events. To fill this gap, the authors use large household-scanner panels to analyze 60 fast-moving consumer good product crises that occurred in the United Kingdom and the Netherlands and resulted in the full recall of an entire variety. The authors assess the effects of postcrisis advertising and price adjustments on the change in consumers' brand share and category purchases. In addition, they consider the extent to which the effects are moderated by two key crisis characteristics: the extent of negative publicity surrounding the event and whether the affected brand had to publicly acknowledge blame. Using the empirical findings, the authors provide context-specific managerial recommendations on how to overcome a product-harm crisis.

Keywords: product-harm crisis, product recall, defective product, purchase behavior, negative publicity, blame

Product-harm crises are omnipresent in today's marketplace. Recent notable examples include Toyota's worldwide recall of more than seven million cars because of technical problems, the melamine contamination in several Chinese baby-formula brands, and Mattel's toy recalls because of a lead paint hazard. These crises can cause major revenue and market-share losses and destroy carefully nurtured brand equity (Chen, Ganesan, and Liu 2009; Thirumalai and Sinha 2011). Moreover, a product-harm crisis not only may be devastating for the affected brand but can also affect the entire category when other brands are perceived guilty by association (Roehm and Tybout 2006). Because of the increasing complexity of products, more stringent product-safety legislation, and more demanding customers, product-harm crises are expected to occur ever more frequently (Dawar and Pillutla 2000).

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When faced with a product-harm crisis, managers need to make informed decisions on their marketing variables to attenuate the negative impact of the crisis. In summer 2006, several Cadbury chocolate products had to be withdrawn from the U.K. market because of a serious salmonella contamination. While the brand's relative price remained at a comparable level, management dramatically increased its advertising support, leading to 30% more share of voice in the postcrisis year. When Princess, a canned pilchards brand, had to be removed from the shelves because of a packaging fault, it also increased its advertising support substantially. However, it also increased its relative price by more than 25%, perhaps in an attempt to recoup lost revenues. In contrast, when a plastic contamination led to the recall of candy manufacturer Basset's milky-baby lollies, Basset followed an entirely different strategy of decreasing both its advertising share of voice and its relative price. While there is increasing research interest in the impact of product-harm crises, little empirical evidence is available on the relative effectiveness of these different recovery strategies (Liu et al. 2012).

There is an extensive literature stream (which uses mostly experiments and/or surveys) that focuses on how consumers deal with the negative publicity typically surrounding product-harm crises (see, e.g., Ahluwahlia, Burnkrant, and Unnava 2000; Griffin, Babin, and Attaway 1991) and/or how consumers are influenced by blame attributions (e.g., Dutta and Pullig 2011; Klein and Dawar 2004). Research on the impact of these factors is important given that not all companies choose to take the blame in a crisis context, and the amount of negative publicity sur-

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rounding a crisis can be very different. Although both Cadbury and Basset acknowledged that they were to blame, the amount of negative publicity surrounding the crises differed substantially: whereas the Cadbury crisis was covered in all major U.K. newspapers, the recall of Basset's milky-baby candy was only picked up in one. Although previous studies have discussed the impact of both crisis characteristics (blame and publicity) on postcrisis consumer attitudes and behavior, they remain agnostic with regard to what extent managers should adjust their marketing variables depending on these crisis characteristics.

Another set of studies uses empirical purchase and sales data to assess how the effectiveness of advertising and/or price changes due to a crisis (see, e.g., Cleeren, Dekimpe, and Helsen 2008; Van Heerde, Helsen, and Dekimpe 2007; Zhao, Zhao, and Helsen 2011). For example, Van Heerde, Helsen, and Dekimpe (2007) document that the salmonella contamination of an Australian peanut butter brand reduced its advertising effectiveness (from a significant precrisis level to a nonsignificant postcrisis level) but not its price elasticity. Studying the same case, Cleeren, Dekimpe, and Helsen (2008) confirm that postcrisis advertising was ineffective to induce renewed trial of the affected brand, while Zhao, Zhao, and Helsen (2011) report, using a consumer-learning model on the same case again, a significant drop in advertising elasticity of the affected brand along with a slightly decreased postcrisis price sensitivity. Therefore, all three studies cast doubt on the usefulness of increased advertising support following the crisis and report mixed results on the effectiveness of postcrisis price changes.

Still, given that all three studies investigated the same product-harm crisis, little is known about whether the reported postcrisis marketing effectiveness remains idiosyncratic to that specific crisis,[1] whether this generalizes to other settings, or whether crisis characteristics such as the extent of negative publicity and/or the acknowledgment of blame moderate the ultimate effectiveness of different marketing adjustments. If a product recall causes extensive media coverage (e.g., the Cadbury crisis described previously), does this call for more advertising after the product returns to the shelves, or is it better to stay out of the public eye? Similarly, if the company had to take the blame for the recall, does it reduce a firm's ability to raise prices to recoup some of the lost revenues?

In this study, we take a contingency-based view and allow the effectiveness of marketing changes—which often take place in the wake of a product-harm crisis—to depend on both the extent of the negative publicity (which can vary widely from one crisis to another) and whether the firm/brand needed to acknowledge that the crisis was its fault. Apart from its high managerial relevance, developing hypotheses about, and empirically testing the role of, moderators is also important from an academic point of view in that it advances theory development by identifying boundary conditions for existing theory. For example, Whetten (1989, p. 492) argues that "contextual factors set the boundaries of generalizability and, as such, constitute the range of the theory." (For more arguments in support of the role of moderators in theory development, see, e.g., MacInnis 2011, p.144; Yadav 2010, p. 7.) Moreover, in contrast to prior research that has treated marketing adjustments as exogenous, we explicitly account for the endogenous nature of the changes managers make when confronted with a major product-recall situation.

Finally, unlike prior research that has focused almost exclusively on the performance implications for the affected brand(s), we also consider the implications on the category as a whole. Because of the increasing prevalence of product-harm crises, even the most cautious brand may be confronted with a worst-case scenario in which consumers perceive the problem as potentially industrywide when it occurs to one of its (perhaps less cautious) competitors. Again, the effectiveness of postcrisis price and advertising may depend on the type of crisis facing the category.

This study contributes new insights along two dimensions: It develops a contingency framework that (1) bridges research on crisis characteristics and the postcrisis effectiveness of advertising and price, and (2) it studies their main and interactions effects on, respectively, brand share and category purchases. Moreover, given that we empirically test this framework on a unique data set covering 60 full recalls in the fast-moving consumer goods (FMCG) sector, we considerably add to the empirical knowledge base for the phenomenon.

We organize the rest of the article as follows: We first present our conceptual framework. Next, we discuss our modeling approach, describe the operationalization of the variables, and report the results. The final section summarizes the findings and offers managerial implications.

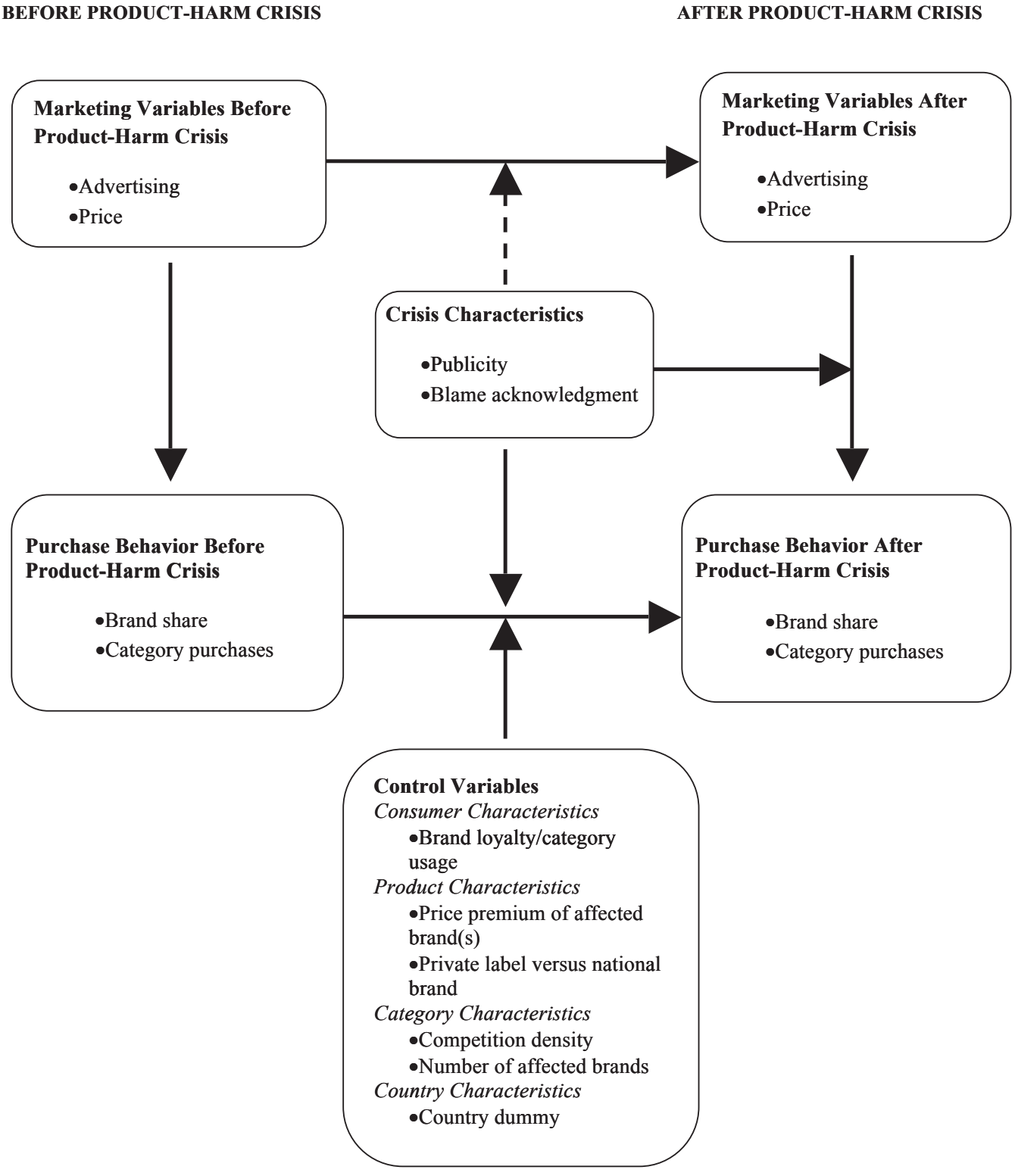
Conceptual Framework

Product-harm crises can seriously hurt a firm's performance (e.g., Chen, Ganesan, and Liu 2009). Apart from the obvious impact on the affected brand, the entire category may be affected when the inadequacy of the production process is perceived as an industrywide problem (De Alessi and Staaf 1994). Therefore, we focus on two key performance metrics: the affected brand's share and the level of category purchases, both at the individual household level. We study crisis characteristics and their moderating impact on the effectiveness of marketing adjustments. We also include several control variables. Figure 1 summarizes our conceptual framework. In what follows, we discuss the rationale of the variables in our framework and develop hypotheses on the interactions between crisis characteristics (negative publicity and blame) and the marketing variables (price and advertising).[2]

[1]A recent exception is Liu and Shankar's (2012) study, which investigates advertising effectiveness and the moderating impact of the severity of the crisis for different recalls in the automobile industry.

[2]Given our main interest in the contingency effects, we develop formal hypotheses for the various interaction effects. For the main effects, we briefly review prior evidence on their impact and include them in our empirical testing. However, we develop no formal hypotheses for the main effects.

FIGURE 1
Conceptual Framework



Notes: A solid arrow indicates an effect that is part of the main model in Equations 1 and 2. The dashed arrow indicates the effect of the crisis on the change in marketing variables. Because we use 2SLS to account for the endogeneity of marketing variables, this effect is part of the first-stage regression of the estimation procedure.

Crisis Characteristics

Negative publicity. Negative publicity is the extent to which the media report on the product-harm crisis. Negative news is weighted more heavily in product evaluations than positive news, because consumers perceive it as more diagnostic and surprising (Herr, Kardes, and Kim 1991). Moreover, negative news is typically broadcast by news media and not by the brand itself, and audiences tend to perceive media as more trustworthy (Wang 2006). Negative publicity has been shown to hurt firm performance in a variety of contexts such as critical movie reviews (Basuroy, Chatterjee, and Ravid 2003) and negative online book reviews (Chevalier and Mayzlin 2006). Moreover, researchers have discussed the potentially detrimental effect of bad publicity in the context of product-harm crises (e.g., Lei, Dawar, and Lemmink 2008).

However, recent research has suggested that negative publicity need not always be bad, in line with the age-old phrase "Any news is good news." Berger, Sorensen, and Rasmussen (2010) find that publicity may increase awareness and accessibility, regardless of the valence of the message. Their reasoning behind this result is that people may forget over time the valence of the information, but the awareness remains, and the product (category) may become more top of mind. Therefore, in the case of negative publicity surrounding product-harm crises, merely mentioning a brand or category may increase its awareness and accessibility in consumers' minds. Prior research has often discussed this phenomenon in the context of book or movie reviews; however, Skurnik et al. (2005) report a similar dissociation of awareness and valence of information in the context of false claims for different noncultural products (e.g., aspirin, corn chips), and Moore and Hutchinson (1985) report the same results for negative advertising.

Blame. Blame accounts for whether the company acknowledges responsibility for the product-harm crisis. When a product fails, consumers are likely to search for attributions of blame (Lei, Dawar, and Gürhan-Canli 2012). Blame attributions can have serious consequences for a company because they can lead to anger toward the company and to negative word of mouth (Folkes 1984, 1988). Because blame attributions can cause a decrease in future purchase intentions (Folkes 1988), we expect that acknowledging blame will affect brand share negatively. With regard to category purchases, it could be argued that consumers will perceive the problem as less diagnostic for the category when one specific company takes the blame for the crisis. This decreases the likelihood of spillover to nonaffected competitors (Roehm and Tybout 2006): it not only reduces the uncertainty with regard to the locus of fault but also implicitly suggests that the others are not to blame. Still, the perception that an industry member was to blame may well be more serious than if a third (outside) party was the culprit, because it may indicate that the industry's (self) regulation was insufficient to prevent the problem from occurring.

The Effectiveness of Marketing Adjustments

Managers often increase advertising support or decrease the price in the wake of a product-harm crisis in an attempt to regain lost consumers (Cleeren, Dekimpe, and Helsen 2008). Competitors in the same category may also boost advertising expenditures or lower their prices to benefit from the misfortune of the affected brand(s). Alternatively, firms may well consider raising their prices in the wake of the crisis. Indeed, research shows that managers very often increase price (p) when demand (q) is unexpectedly low (Marn, Roegner, and Zawada 2003), in an attempt to avoid revenue ($p \times q$) losses (see also Rotemberg and Saloner 1986). We test whether the effectiveness of postcrisis advertising and price adjustments is moderated by the crisis characteristics, that is, the amount of negative publicity surrounding the crisis and whether the affected brand had to acknowledge blame.

Advertising × negative publicity. Traditionally, researchers have posited that negative publicity can damage brand equity (Dawar and Pillutla 2000; Liu and Shankar 2012) and credibility (Erdem and Swait 1998) and thus the effectiveness of brand advertising. More recently, however, Berger, Sorensen, and Rasmussen (2010) have shown that, in some instances, negative publicity can *increase* product awareness. In addition, Dawar (1998) argues that the heightened brand awareness and media attention translates into a higher return on advertising investments than if they were part of routine equity-building activities. Moreover, Wang (2006) shows that inconsistent messages in product publicity versus advertising increase the perceived message believability for advertising because consumers are more motivated to process the information in an attempt to reconcile the differences (Maheswaran and Chaiken 1991). Moreover, because of the media scrutiny, customers may focus their attention on the focal or similarly categorized brands, which could also enhance their ad effectiveness (Rubel, Naik, and Srinivasan 2011). As such, negative publicity can increase advertising effectiveness for the brand and/or category. In line with this reasoning, we expect the following:

H_1: The effectiveness of brand advertising is greater when there is a higher level of negative publicity surrounding the crisis.

H_2: The effectiveness of category advertising is greater when there is a higher level of negative publicity surrounding the crisis.

Price × negative publicity. Apart from a tremendous impact on brand equity (Dawar and Pillutla 2000) and firm credibility (MacKinsey and Lutz 1989), negative publicity may also decrease the perceived differentiation of the affected brand (Ahluwalia, Burnkrant, and Unnava 2000). Indeed, the brand's relative position in the category might have been negatively affected (Leclerc, Hsee, and Nunes 2005) because consumers might subsequently classify it in a lower-quality tier, which could lead to an increase in the

magnitude of its price elasticity (Boulding, Lee, and Staelin 1994). Moreover, the consistency of the brand's quality signal has been affected (Erdem, Swait, and Louviere 2002). Therefore, we expect the following:

H_3: Brand price sensitivity is greater when there is a higher level of negative publicity surrounding the crisis.

Given that negative news may also affect the equity of nonaffected brands (Roehm and Tybout 2006), we expect a similar effect for category price:

H_4: Category price sensitivity is greater when there is a higher level of negative publicity surrounding the crisis.

Advertising × blame. A brand's equity is a function of consumers' confidence in the brand's ability to fulfill expected/promised benefits (e.g., Aaker 1996; Keller 1993). As Gürhan-Canli and Fries (2010) articulate it, branding is about creating and consistently delivering a promise to target customers. The product crisis may lead customers to question this ability (Dutta and Pullig 2011). By acknowledging blame for the product-harm crisis, a firm makes clear that it failed to fulfill its promise (Riordan, Marlin, and Kellogg 1983). Put differently, "concomitant confirmation of guilt should lower trust by making clear that the mistrusted party was to blame" (Kim et al. 2006, p. 51). This reduced trust translates into a lowered postcrisis advertising effectiveness for the brand. Therefore, we hypothesize the following:

H_5: The effectiveness of brand advertising is lower when the affected brand acknowledges blame than when it does not.

If the focal brand admits blame, it means that one of the category members (rather than an external party) is to blame (Siomkos et al. 2010). Moreover, consumers frequently question the motivations of marketing actions. When competitors launch extra advertising campaigns in the aftermath of a crisis, consumers may believe this to be an opportunistic attempt to take advantage of the misfortune of the "wounded" brand (Siomkos et al. 2010), especially when the latter's position has suffered even more because of a forced blame acknowledgment. Given that inferred motivations influence the effectiveness of advertising spending (Campbell 1999; Eagly, Wood, and Chaiken 1978), we hypothesize the following:

H_6: The effectiveness of category advertising is lower when the affected brand acknowledges blame than when it does not.

Price × blame. Confirming guilt makes clear that the mistrusted party is to blame, which lowers a brand's credibility substantially (Kim et al. 2006). Lower brand credibility increases the required information search and processing costs and reduces the perceived quality of the brand (Erdem, Swait, and Louviere 2002), both of which increase its price sensitivity. Thus, we hypothesize the following:

H_7: Brand price sensitivity is greater when the affected brand acknowledges blame than when the brand does not.

As we mentioned previously, one brand's acknowledgment of blame may taint competitors by association (Siomkos et al. 2010). Thus:

H_8: Category price sensitivity is greater when the affected brand acknowledges blame than when the brand does not.

Control Variables

Consumer heterogeneity. To account for heterogeneity across consumers, we control for a household's precrisis brand loyalty and category usage. Arguments can be formulated for both a positive and a negative impact of brand loyalty and category usage on how consumers react to a crisis. On the one hand, not only are consumers with positive attitudes toward a target likely to resist counterattitudinal crisis information, but they also weigh this information less in their product evaluations (Ahluwalia, Burnkrant, and Unnava 2000). Thus, they may react less negatively to the crisis. On the other hand, research has shown that extremely negative information is highly diagnostic (Herr, Kardes, and Kim 1991) and might therefore be difficult to refute (Ahluwalia, Burnkrant, and Unnava 2000). Moreover, Grégoire and Fisher (2008) show that customers who are treated poorly by a firm with which they feel a strong connection can feel even more disconcerted and hurt than others because of a greater sense of betrayal. When a similar "love becomes hate" effect happens in a product-harm crisis, brand loyalty and category usage will have a negative impact on brand share and category purchases.

Price premium. Brands with a high price premium tend to have a higher brand equity and thus typically have very committed consumers (Aaker 1996). This may offer resilience in the face of misfortune (Hoeffler and Keller 2003). Indeed, on the one hand, committed consumers are more likely to counterargue with negative information (Ahluwalia, Burnkrant, and Unnava 2000), while they attempt to confirm prior expectations (Dawar and Pillutla 2000). On the other hand, the likelihood that the crisis is noticed is greater for high-equity brands given that they receive more media attention and that consumers tend to pay more attention to, and retain more information on, familiar brands (Hoeffler and Keller 2003). In addition, the category may suffer more from a crisis affecting a premium brand, given that negative information on these brands generates more attention (Hoeffler and Keller 2003). Therefore, product harm for a premium brand is more likely to spill over to the category (Roehm and Tybout 2006).

Number of affected brands. A particular product-harm crisis may affect multiple brands because of, for example, a shared manufacturer or ingredients' supplier. The effect on category purchases of a crisis including multiple brands is likely to be larger, as it becomes more likely that the crisis reflects an industrywide (production) problem (Roehm and Tybout 2006). Furthermore, a larger fraction of the customer base will find their most preferred brand taken from the shelves, making them more likely to defect from the category (Campo, Gijsbrechts, and Nisol 2003). In contrast, we expect the impact on the share of each individual brand to be smaller because the attention will be focused less on any single brand and also because the set of unaffected brands to which consumers can switch becomes smaller.

Private label versus national brand. Consumers view store brands as inferior in quality to national brands (Ailawadi, Neslin, and Gedenk 2001; Steenkamp, Van Heerde, and Geyskens 2010). Therefore, quality expectations for private labels are lower, and a product-harm crisis will be less likely to be perceived in conflict with the quality signal of the brand (Zhao, Zhao, and Helsen 2011). We thus expect the loss in brand share after a crisis to be smaller for private labels. In addition, the distribution of private labels is more limited than that of national brands. Therefore, we expect the impact of a private-label recall on category purchases to be smaller.

Competition density. To account for differences in category structure across product-harm crises, we control for precrisis competition density. In the literature, researchers have shown that the extent of concentration of the brands in the market is an important antecedent of market conduct and outcomes (Steenkamp, Van Heerde, and Geyskens 2005). Finally, we control for differences between the (two) countries we study by including a country dummy.

Model

As argued previously, a product-harm crisis might affect not just the brand itself but also the entire category. Therefore, our key focus is on the changes in households' brand shares and category purchases across a large panel of households. To adequately capture both dependent variables, our modeling approach should address four issues. First, the model should account for heterogeneity across households. Second, the model should account for the potential endogeneity of the marketing variables. Third, the approach should allow for potential correlations between (1) observations of the same household across different product-harm crises and (2) observations of different households within the same product-harm case. Finally, the measures should capture enough purchases for reliable estimation of brand shares and category purchases.

Next, we discuss how we address each of these issues. First, individual-level consumption is influenced by several fixed consumer characteristics. To control for this source of heterogeneity across households, we use a difference approach and model the difference between a household's post- and precrisis brand share and category purchases. This approach is similar in spirit to a fixed-effect approach that controls for unobserved time-invariant effects of the cross-sectional units (indeed, by differencing, the time-invariant or fixed effects disappear). Ailawadi, Lehmann and Neslin (2001), for example, follow this approach to control for brand-specific fixed effects while examining the impact of a major policy change. Because we consider full (all batches across the entire country) product recalls, no control group can be considered, precluding the difference-in-difference approach Ailawadi et al. (2010) use.

Second, omitted variables may cause the marketing variables to be correlated with the error terms for both the brand-share and category-purchase models. Indeed, managers may base their advertising and pricing response on factors they observe but not the researcher. To accommodate potential endogeneity of advertising, price, and all interaction effects involving these marketing variables, we use a two-stage least squares (2SLS) estimation technique (for a recent review on endogeneity issues in marketing, see, e.g., Ebbes, Papies, and Van Heerde 2011). As a by-product of the estimation, we obtain the first-stage regression results for the endogenous regressor's price and advertising. Although these first-stage regressors are not of primary interest, they do give some insights into the dynamic price and advertising responses in the wake of a product-harm crisis (for the recommended use of 2SLS for an endogenous mediator, see Shaver 2005, pp. 338–39; for recent marketing applications of this procedure, see Ataman, Mela, and Van Heerde 2008; Ataman, Van Heerde, and Mela 2010; Leenheer et al. 2007). We discuss these effects in the "Results" section.

Third, we measure both the changes in brand share and category purchases for a given crisis and household. One particular household is likely to be observed in multiple crisis cases, while each crisis case affects multiple households. In line with Mizik and Jacobson's (2009) recommendation, we use a robust clustered error-term estimation. Specifically, we adopt the procedure Lin (1994) proposes and Cameron, Gelbach, and Miller's (2011) extension to two-way clustering to estimate robust standard errors.

Finally, to obtain reliable measures for the changes in brand share and category purchases, we must use a sufficiently long period before and after the crisis to ensure that we observe enough purchases in both periods. In line with Gielens and Steenkamp (2007) and given that we study frequently purchased consumer goods with differing interpurchase times, we use an observation period of one year before and one year after the crisis. Moreover, prior research on product-harm crises (e.g., Van Heerde, Helsen, and Dekimpe 2007) has shown that the dust inherently surrounding such crisis situations has settled well within a year after the crisis. We offer more details on the exact operationalizations of the variables in the "Data" section.

Model Specification

Following an established tradition in the market-response literature (see, e.g., Leeflang et al. 2000, p. 167), we decompose sales into primary demand (category purchases) and selective demand (brand share). We use a regression framework to assess the impact of crisis characteristics, marketing variables, control variables, and the interaction effects. We model the (transformed[3]) change in brand share for household i and crisis j as follows:

$$
\begin{aligned}
(1)\ \Delta BS_{ij}^{*} = {} & \beta_0^{BS} + \beta_1^{BS}\,\text{Publicity}_j + \beta_2^{BS}\,\text{Blame}_j \\
& + \beta_3^{BS}\,\Delta\text{Relative brand advertising}_j \\
& + \beta_4^{BS}\,\Delta\text{Relative brand price}_j \\
& + \beta_5^{BS}\,\Delta\text{Relative brand advertising}_j \times \text{Publicity}_j \\
& + \beta_6^{BS}\,\Delta\text{Relative brand price}_j \times \text{Publicity}_j \\
& + \beta_7^{BS}\,\Delta\text{Relative brand advertising}_j \times \text{Blame}_j \\
& + \beta_8^{BS}\,\Delta\text{Relative brand price}_j \times \text{Blame}_j + \beta_9^{BS} X_{1ij} + \varepsilon_{ij}^{BS},
\end{aligned}
$$

[3]To account for the bounded range of this variable, we use a logit-type transformation, as explained in the "Data" section.

where the X_{1ij} vector includes the control variables—that is, brand loyalty, price premium, number of affected brands, a private-label dummy, competition density, and a country dummy variable (1 = the Netherlands, 0 = United Kingdom). Similar to the brand-share model, the (transformed[4]) change in category purchases for household i and crisis j is specified as follows:

$$\begin{aligned}(2)\ \Delta CP_{ij}^{*} = {} & \beta_0^{CP} + \beta_1^{CP}\,\text{Publicity}_j + \beta_2^{CP}\,\text{Blame}_j \\ & + \beta_3^{CP}\Delta\text{Category advertising}_j + \beta_4^{CP}\Delta\text{Category price}_j \\ & + \beta_5^{CP}\Delta\text{Category advertising}_j \times \text{Publicity}_j \\ & + \beta_6^{CP}\Delta\text{Category price}_j \times \text{Publicity}_j \\ & + \beta_7^{CP}\Delta\text{Category advertising}_j \times \text{Blame}_j \\ & + \beta_8^{CP}\Delta\text{Category price}_j \times \text{Blame}_j + \beta_9^{CP}X_{2ij} + \varepsilon_{ij}^{CP},\end{aligned}$$

where X_{2ij} are the control variables category usage, price premium, number of affected brands, the private-label dummy, competition density, and the country dummy.

Model Estimation

To accommodate the potential endogeneity of advertising, price, and the interaction effects involving these marketing variables, we estimated Equations 1 and 2 with 2SLS. We use five broad categories of instrumental variables (IVs). Table 1 summarizes the main IVs used for each model and indicates the operationalization and data source.

In line with Villas-Boas and Winer (1999) and Dhar and Hoch (1997), we use the lagged changes in the marketing variables as a first set of IVs. Given that the marketing variables measure the change in the year following the crisis when compared with before the crisis, the IVs capture the corresponding change in the two years preceding the crisis. Second, we include the lagged changes in the relevant performance metrics (i.e., change in brand share for the affected brand-share model and change in category purchases for the category-purchases model). These IVs capture the distinction that the main drivers of marketing changes are demand based (Srinivasan, Pauwels, and Nijs 2008). In the third set of IVs, we use several variables to capture the evolution in the overall production costs, following Luan and Sudhir's (2010) recommendation. To that extent, we account for changes in the overall consumer price index, fuel prices (for the importance of this factor in the marketing adjustments of retailers, see, e.g., Ma et al. 2011), labor costs, and rental prices. Fourth, in line with Ma et al. (2011), we include a fixed-effects correction to account for systematic differences between major groups not yet captured by the previous sets of IVs. Following Steenkamp, Van Heerde, and Geyskens (2010), we control for differences between beverages and other categories. As a final set of IVs, we include the interaction effects of all IVs identified previously with negative publicity and blame. Following Wooldridge (2002, pp. 121–22) and Luan and Sudhir (2010), we include these IVs because the models include interactions between exogenous variables (the two crisis characteristics) and endogenous variables (advertising and price). In the "Results" section, we report tests that confirm the strength and validity of the IVs.

[4]To make the measure comparable across categories, we divided the change in category purchases by the average of the pre- and postcrisis purchases. To overcome the bounded range of this variable, we again used a logit-type transformation, as explained in the "Data" section.

Data

To calibrate the models, we collected a unique and comprehensive data set. We study all major FMCG product-harm crises that occurred in the United Kingdom and the Netherlands between 2000 and 2007. We define "major" in the sense that all units of at least one variety were fully recalled. Thus,

TABLE 1
Operationalizations and Data Sources of IVs

IV	Operationalization	Data Source
Lagged advertising change	Change in relative brand advertising/total category advertising between one and two years before the crisis	AC Nielsen advertising data
Lagged price change	Change in relative brand price/total category price between one and two years before the crisis	TNS UK/ GfK Netherlands household-panel data
Lagged brand share/ category sales	Change in brand share of the affected brands/category purchases between one and two years before the crisis (based on the full panel)	TNS UK/ GfK Netherlands household-panel data
Change in consumer price index	Change in country-specific consumer price index between the year of the crisis and one year before	Organisation for Economic Cooperation and Development statistics
Change in fuel prices	Change in country-specific fuel price between the year of the crisis and one year before	International Labor Organization
Change in rental prices	Change in country-specific rental prices between one year and two years before the crisis	International Labor Organization
Change in labor costs	Change in country-specific unit labor costs between the year of the crisis and one year before	Organisation for Economic Cooperation and Development statistics
Category dummy	Dummy variable that indicates whether the category is a beverage	TNS UK/ GfK Netherlands household-panel data

we exclude cases in which only certain batches are recalled. Using the recall records of governmental and consumer organizations,[5] we identified 60 major (voluntary) product recalls in this period, of which 36 took place in the United Kingdom and 24 in the Netherlands. We study a large range of product-harm crises, ranging from cereals to ice cream and from mineral water to liquor. Examples of cases include salmonella-contaminated Cadbury dairy milk chocolate, the detection of glass inside Olvarit baby food, pieces of plastic in Basset's milky babies (lollies), and bursting bottles of Bacardi Breezer premixed spirits. Because several of these product-harm crises affect the same category, we identify 40 unique cases for the category-purchase model. The Appendix provides a description of all cases.

We combined data from different sources. We obtained household scanner data for these crises from TNS UK (gross panel size = 25,000 households) and GfK Netherlands (gross panel size = 6000 households). We purchased advertising expenditure data for all relevant brands and categories from ACNielsen UK and the Netherlands. Furthermore, we obtained information on crisis characteristics from the recall announcements and through an extensive media search on the specific crisis cases in the top newspapers using the Lexis Nexis (the Netherlands) and Factiva (United Kingdom) databases.[6] We gathered all variables during the period of one year before and one year after the crisis. In line with Cleeren, Dekimpe, and Helsen (2008), the beginning of the crisis is the date mentioned on the official recall announcement, and the end of the crisis is the date of the first purchase of the affected variety in the household panel after the beginning of the crisis. In all cases, all batches of the affected variety were recalled at the same time. As such, the beginning of the crisis could easily be identified, and it applied to all panel members.

Dependent Variables

The change in category purchases for household i in crisis j is the difference between a household's category-purchase volume in the year after versus the year before the crisis. The difference approach controls for potential heterogeneity across households (e.g., Ailawadi, Lehmann, and Neslin 2001; Cameron and Trivedi 2005). To make our purchase measure comparable across categories, we divide the change by the average of the category purchases (CP) before and after the crisis[7]:

$$\Delta CP_{ij} = \frac{CP_{ij}^{AFTER} - CP_{ij}^{BEFORE}}{\left(CP_{ij}^{BEFORE} + CP_{ij}^{AFTER}\right)/2}. \quad (3)$$

For the category-purchase model, our sample consists of all households that made at least three purchases in the category during the total observation period (one year before until one year after the crisis). This ensures that we exclude the very light or accidental users of the category. It is evident that not every customer was "active" (i.e., had three purchases in the observation period) in every category (indeed, only households with small children will buy baby food, and not every household will have three purchases of a particular type of liquor). On average, panelists were active in seven categories. Per category, an average of approximately 10,300 households was available, leading to a total number of 411,266 observations for the category-purchase model (Equation 2).

For the brand-share model, we selected households that made at least three purchases of the affected brand within the observation period of two years (one year prior and one year after). Again, we did this to exclude very light or accidental brand buyers. Because not every consumer in a category will buy the affected brands, the sample sizes are lower in the brand-share equation. On average, panelists contributed two observations to the brand-share equation. Approximately 746 observations were available for each of the 60 affected brands, for a total of 44,743 observations for the brand-share equation (Equation 1).

We define the change in affected brand share for household i and crisis case j as the difference between the volume share of the affected brand in the category purchases during one year after and one year before the crisis[8]:

$$\Delta BS_{ij} = BS_{ij}^{AFTER} - BS_{ij}^{BEFORE}. \quad (4)$$

[5]For the United Kingdom, we investigated the archives of the Food Standards Agency and the Trading Standards Institute. For the Dutch recall cases, we consulted the archives of the *Voedsel Waren Autoriteit* (*Food Products Authority*) and the *Consumentenbond* (*Consumer Reports*).

[6]We limited our media search to newspapers with a circulation of at least 1% of the population. This includes, for the United Kingdom, both the weekly and Sunday editions of (in alphabetical order) *Daily Express*, *Daily Mail*, *Daily Mirror*, *Daily Star*, *The Daily Telegraph*, *The Independent*, *News of the World*, *The People*, *The Sun*, and *The Times*, for a total of 17 newspapers. For the Netherlands, we included *Algemeen Dagblad*, *de Telegraaf*, *NRC Handelsblad*, and *De Volkskrant*. Free newspapers are not part of the electronic databases, and thus, we could not include them in the media search.

[7]ΔCP_{ij}, as specified in Equation 3, is constrained to the interval [–2, 2]. To account for the bounded nature of this measure, we apply the logit-type transformation Lesaffre, Rizopulos, and Tsonaka (2007) describe for a response U that is limited to the interval (a, b): $Z = \ln[(U - a)/(b - U)]$. Given that ΔCP_{ij} is limited to the interval [–2, 2], we add a small amount to a and b to avoid the expression taking the log of zero (cf. Bass et al. 2009). The transformation results in the following dependent variable:

$$\Delta CP_{ij}^{*} \equiv \ln\left(\frac{\Delta CP_{ij} + 2.01}{2.01 - \Delta CP_{ij}}\right).$$

[8]Because brand share is a ratio, this measure is already comparable across categories. Because this variable is constrained to [–1, 1], we again apply the logit-type transformation Lesaffre, Rizopulos, and Tsonaka (2007) describe:

$$\Delta BS_{ij}^{*} \equiv \ln\left(\frac{\Delta BS_{ij} + 1.01}{1.01 - \Delta BS_{ij}}\right).$$

Note that this measure becomes zero if the household never switches brands.

Table 2 provides the definitions and summary statistics for the dependent and independent variables.

Crisis Characteristics

Crisis characteristics are based on the media search we conducted. We measured negative publicity as the fraction of newspapers among the (country-specific) considered set that reported on the crisis. All 17 newspapers in the research set covered the salmonella contamination in Cadbury chocolate, whereas only one newspaper covered the bursting Bacardi Breezer bottles. Blame is a dummy variable, indicating whether the company acknowledged the blame for the crisis either in the recall announcement or in the surrounding publicity. For example, whereas Bacardi-Breezer's recall announcement attributed the blame of the bursting bottles to its packaging supplier, Cadbury acknowledged that the salmonella contamination in its chocolate was due to a problem in its own production process.

TABLE 2
Variable Definitions and Summary Statistics

	Description	M	SD
Dependent Variables			
Change in brand share (N = 44,743)	Difference in the postcrisis (one year) and precrisis (one year) volume share of the affected brand (Equation 4)	–.34	.34
Change in category purchases (N = 411,266)	Difference in the postcrisis (one year) and precrisis (one year) category-purchase volume of the household (Equation 3)	.26	1.38
Independent Variables			
Crisis Characteristics (N = 60)			
Publicity	Fraction of newspapers that reported on the crisis during a time span of three months before and one year after the recall announcement	.23	.34
Blame[a]	Dummy for whether the company acknowledged the blame for the crisis either in the recall announcement or in the surrounding publicity	20%	40%
Marketing Variables			
Change in relative brand advertising (N = 60)	Difference in the post- and precrisis share of voice, expressed relative to the expenditures of the five largest nonaffected competitors and the brand itself	–.03	.12
Change in relative brand price (N = 60)	Difference in the post- and precrisis average (per volume unit) brand price, relative to the weighted average price of the five main competitors	–.02	.23
Change in category advertising (N = 40)	Difference in the post- and precrisis total advertising expenditures of all affected brands and the five largest nonaffected competitors, normalized by the average of their total advertising expenditures before and after	.10	.86
Change in category price (N = 40)	Difference in average category price (per volume unit) of all affected brands and the five largest nonaffected competitors, normalized by their average price before and after	.01	.05
Control Variables			
Brand loyalty (N = 44,743)	Precrisis within-household market share (in volume)	.39	.35
Category usage (N = 411,266)	Precrisis total volume purchased by the household in the category, normalized by category average across households	1.00	1.55
Price premium[b]:	Difference in the precrisis (weighted) average price of the affected brand(s) and the cheapest private label in the category, normalized by the precrisis (weighted) average price of the affected brand(s)		
•Brand-share model (N = 40)		.46	.30
•Category-purchase model (N = 60)		.42	.30
Number of affected brands (N = 60)	Number of brands that were recalled in the crisis	5.17	6.14
Private-label dummy[a] (N = 60)	Dummy for private label (= 1) or national brand (= 0)	72%	45%
Competition density (N = 60)	Sum of market shares of the largest four players in the market	.73	.15
Country dummy[b] (N = 60)	Dummy: 1 for the Netherlands, 0 for United Kingdom	40%	49%

[a]For these, dummy variables, we report the percentage of observations having the value of 1.

[b]The price premium for the brand-share model (vs. the category-purchase model) is based on the difference in average price between the brand under inspection (vs. all affected brands in the category) and the cheapest private label in the category. Therefore, we obtain slightly different summary statistics.

Notes: We report the statistics for the dependent variables before the logistic transformation and for the independent variables before mean-centering. The sample size for the brand-level variables is lower than the sample size of the category variables, because there are fewer households buying a certain brand than households buying in the category. At the brand level, there are 60 unique cases; at the category level, there are 40 unique cases.

Marketing Variables

For the marketing variables in the brand-share equation (Equation 1), we use the change in relative advertising and relative price (see, e.g., Leeflang et al. 2000; Zenor, Bronnenberg, and McAlister 1998). The change in relative brand advertising is specified as the difference between the post- and precrisis share of voice, expressed relative to the expenditures of the five largest nonaffected competitors and the brand itself.[9] We define the change in relative brand price as the difference between the relative brand price (per volume unit) after and before the crisis, expressed in relation to the weighted average price of the five main nonaffected competitors. Given that the recorded prices are net prices, they also reflect the discounts that brands may have offered after the crisis.

For the category-purchase equation (Equation 2), we use the change in total category advertising expenditures (Schultz and Wittink 1976) and average category price (Nijs et al. 2001) per volume of all affected brands and the five largest nonaffected competitors. To make these measures comparable across categories, we divided them by the average of total advertising expenditures before and after and average price before and after, respectively.

Control Variables

We measured the price premium as the difference between the (weighted) average price of the affected brand(s) and the least expensive private label in the category (for a similar procedure, see Ailawadi, Lehmann, and Neslin 2003). To standardize the measure over the different categories, we divided this difference by the affected brand's price before the crisis. Because of potentially different effects of crises involving multiple brands, we account for the number of affected brands in the crisis. We account for the effect of private label with a dummy variable that indicates whether the affected brand was a private label (PL).

Our measures for household heterogeneity ([brand] loyalty and [category] usage) are based on the household-panel scanner data during the initialization period (one year before the crisis). We explicitly chose to measure these household characteristics before the crisis to avoid a confound with the dependent variable brand share and category purchases. In line with Cleeren, Dekimpe, and Helsen (2008), we specify precrisis (behavioral) loyalty to the affected brand as its within-household market share (in volume), while we operationalize category usage as the precrisis total volume purchased in the category (normalized by the category average across households). Finally, in line with Moorman et al. (2012), we control for the competition density within the affected category with the sum of market shares of the largest four players in the market (C4) and include a country dummy for the Dutch cases to control for potential differences between the two examined countries (i.e., the United Kingdom and the Netherlands). Following Steenkamp, Van Heerde, and Geyskens (2010), we group mean-centered the household characteristics (within crisis cases) and grand mean-centered all other continuous independent variables (across crisis cases).

[9]We identified the largest nonaffected competitors using the total volume sold during the year before the crisis.

Results

We first tested the extent of multicollinearity in the models. In Table 3, we report the correlations between the different crisis characteristics, which are all .62 or less, well below .8 (Judge et al. 1998, p. 868). The maximum variance inflation factor value for the brand-share model is 5.68 and 2.38 for the category-purchase model. Both values are well below 10 (Hair et al. 2010, p. 204), mitigating multicollinearity concerns.

In addition, we tested both the strength and validity of our IVs (in line with Bascle's [2008] recommendations). To check for the strength of the IVs, we used the Angrist-Pischke (2009, pp. 217–18) multivariate F-statistic, which is recommended in applications with multiple endogenous variables. In both the market-share and category-purchase models, the *p*-values corresponding to the multivariate F-statistic in all first-stage regressions are smaller than .01, rejecting the null hypothesis that the IVs do not explain the endogenous variables. In other words, the IVs are sufficiently strong. As for the validity condition, the Hansen J test (which is robust

TABLE 3
Correlation Matrix

	Publicity	Blame	Price Premium	Number of Affected Brands	Private-Label Dummy	Advertising	Price	Competition Density
Publicity								
Blame	.17							
Price premium	–.03	–.34***						
Number of affected brands	.08	–.32**	.28**					
Private label dummy	–.12	–.61***	.38***	.27**				
Advertising	–.09	–.07	–.14	.16	.11			
Price	–.10	.07	–.36***	–.37***	–.17	–.05		
Competition density	.27**	.14	–.53***	–.33**	–.22*	.10	.17	
Country (the Netherlands = 1)	.62***	.02	.11	.55***	–.02	.06	–.29**	.13

*Correlations significant at 10%.
**Correlations significant at 5%.
***Correlations significant at 1%.
Notes: The matrix shows the correlations between the crisis characteristics (N = 60).

to clustered error terms) is not significant for both models ($p > .15$). This indicates that the null hypothesis, that the IVs are uncorrelated with the error term, cannot be rejected. In other words, the IVs are sufficiently valid. Tables 4 and 5 show the parameter estimates for the brand-share (Equation 1) and category-purchase (Equation 2) equations.

Crisis Characteristics

While the impact on the affected brand's share is not significant ($\beta = .079$, $p > .1$), the category benefits from blame acknowledgment by the affected brand ($\beta = 1.173$, $p < .01$). By acknowledging blame, the other brands in the category have been moved out of harm's way. However, the extent of negative publicity has no significant main effect on either the change in brand share ($\beta = .001$, $p > .1$) or category purchases ($\beta = .423$, $p > .1$). The inherent negative impact of the bad news surrounding the crisis (Herr, Kardes, and Kim 1991) may be nullified by the increase in awareness caused by the mere mention of the brand or category (Berger, Sorensen, and Rasmussen2010).

Marketing Variables and Interactions

The change in relative brand advertising has the expected positive impact on the change in brand share ($\beta = .535$, $p <$

TABLE 4
Empirical Results for the Brand-Share Model

		Hypotheses
Intercept	–.112 (.098)	
Crisis Characteristics		
Negative publicity	.001 (.056)	
Blame	.079 (.111)	
Marketing Variables		
ΔRelative brand advertising	.535*** (.190)	
ΔRelative brand price	.292 (.292)	
Interaction Effects		
ΔRelative brand advertising × negative publicity	1.221* (.661)	H_1(+): supported
ΔRelative brand price × negative publicity	.006 (.878)	H_3(–): not supported
ΔRelative brand advertising × blame	–.456** (.200)	H_5(–): supported
ΔRelative brand price × blame	–.962* (.574)	H_7(–): supported
Control Variables		
Brand loyalty	–1.838*** (.072)	
Price premium of affected brand	–.138 (.162)	
Number of affected brands	–.002 (.005)	
Private-label dummy (1 for private label, and 0 for national brand)	.141* (.084)	
Competition density	–.257** (.129)	
Country dummy (the Netherlands = 1)	–.025 (.067)	
Number of observations	44,743	
R-square	.277	

*Significant two-tailed result at 10% significance level.
**Significant two-tailed result at 5% significance level.
***Significant two-tailed result at 1% significance level.
Notes: Robust standard errors are in parentheses.

TABLE 5
Empirical Results for the Category-Purchase Model

		Hypotheses
Intercept	–.315 (.194)	
Crisis Characteristics		
Negative publicity	.423 (.290)	
Blame	1.173*** (.267)	
Marketing Variables		
ΔCategory advertising	.813*** (.238)	
ΔCategory price	–5.827* (3.580)	
Interaction Effects		
ΔCategory advertising × negative publicity	3.373* (1.865)	H_2(+): supported
ΔCategory price × negative publicity	–13.154** (6.128)	H_4(–): supported
ΔCategory advertising ×blame	–2.053*** (.537)	H_6(–): supported
ΔCategory price × blame	5.158 (4.478)	H_8(–): not supported
Control Variables		
Category usage	–.728*** (.035)	
Price premium of affected brand	–.081 (.334)	
Number of affected brands	.025 (.018)	
Private-label dummy (1 for private label, and 0 for national brand)	1.125*** (.184)	
Competition density	–.686 (.639)	
Country dummy (the Netherlands = 1)	–.506** (.223)	
Number of observations	411,266	
R-square	.138	

*Significant two-tailed result at 10% significance level.
**Significant two-tailed result at 5% significance level.
***Significant two-tailed result at 1% significance level.
Notes: Robust standard errors are in parentheses.

.01), while the change in relative brand price is not significant ($\beta = .292$, $p > .1$). With regard to the category, we find that both category advertising ($\beta = .813$, $p < .01$) and category price ($\beta = -5.827$, $p < .1$) have the expected significant effects.

Advertising × negative publicity. Negative publicity increases the brand's advertising effectiveness ($\beta = 1.221$, $p < .1$), consistent with the heightened brand awareness identified in Berger, Sorensen, and Rasmussen (2010). It also enhances category advertising effectiveness ($\beta = 3.373$, $p < .1$). These findings are consistent with H_1 and H_2, confirming Dawar's (1998) proposition that increased media attention in a crisis context might not be all bad for companies, given that it could translate into a higher return on advertising investments.

Price × negative publicity. Negative publicity has no significant effect on the price sensitivity of brand share ($\beta = .006$, $p > .1$), thus rejecting H_3. However, we do find support for H_4, because the price sensitivity of postcrisis category purchases increases with the extent of negative publicity ($\beta = -13.154$, $p < .05$). This finding corroborates the notion that the crisis causes a loss in equity for the category as a whole (Roehm and Tybout 2006), making consumers more price sensitive.

Advertising × blame. When the affected brand takes the blame for the crisis, its advertising effectiveness decreases ($\beta = -.456$, $p < .05$), in support of H_5. This finding is consistent with a loss in trust in the brand's ability to fulfill its promises (Aaker 1996; Keller 1993). We also find that category advertising becomes less effective when the affected brand has taken the blame for the crisis ($\beta = -2.053$, $p < .01$), in support of H_6. When a category member (rather than an outside party) was responsible for the crisis, the credibility for the whole category may be affected; in addition, the underlying motive for competitors' advertising may be questioned.

Price × blame. Price sensitivity increases following blame acknowledgement ($\beta = -.962$, $p < .1$), in support of H_7. When a brand acknowledges guilt in a crisis, brand credibility decreases (Kim et al. 2006), producing a negative impact on the effectiveness of both marketing variables (Erdem, Swait, and Louviere 2002). Notably, category price sensitivity is not influenced by blame acknowledgment ($\beta = 5.158$, $p > .1$), which is at odds with H_8.

Control Variables

The household characteristics brand loyalty and category usage have significant negative effects on the change in brand share ($\beta = -1.838$, $p < .01$) and category purchases ($\beta = -.728$, $p < .01$). Thus, the decrease in brand share is especially strong for brand-loyal consumers when a product-harm crisis strikes. Similarly, the category purchases by heavy users are especially vulnerable to such a crisis. These results are in line with Grégoire and Fisher (2008), who show that consumers with a strong connection to a brand or category feel a stronger sense of betrayal and hurt when treated poorly.

While both the price premium and the number of affected brands have no significant effect on either the change in brand share (respectively, $\beta = -.138$, $p > .1$ and $\beta = -.002$, $p > .1$) and category purchases (respectively, $\beta = -.081$, $p > .1$ and $\beta = .025$, $p > .1$), the type of brand matters in both models. Indeed, private labels suffer less from product harm ($\beta = .141$, $p < .1$), in line with their lower quality expectations (Zhao, Zhao, and Helsen 2011), while the spillover to the category is reduced, in line with the more limited distribution of private labels ($\beta = 1.125$, $p < .01$). Although brands suffer more when the category is more concentrated ($\beta = -.257$, $p < .05$), competition density has no significant impact on the category ($\beta = -.686$, $p > .1$). In highly concentrated markets, each of the competing (nonaffected) brands is more powerful (Nijs et al. 2001) and better able to take advantage of the weakened position of the affected brand. This may explain the higher brand-share loss in concentrated settings. Finally, while the change in brand share is not significantly different in the two included countries ($\beta = -.025$, $p > .1$), category purchases decrease more in the Netherlands ($\beta = -.506$, $p < .05$).

First-Stage Regression Results

We obtained first-stage regression results for the endogenous price and advertising variables as a function of the exogenous variables, including characteristics of the product-harm crisis, and the IVs. Although these auxiliary results are not of primary interest, they do provide insights into the dynamics of price and advertising responses in the wake of the crisis.[10] We find that brands increase their advertising in case they are to blame for the crisis ($p < .05$), which supports the idea that firms believe that a stronger corrective action is required in such instances (Chen, Ganesan, and Liu 2009). Moreover, an affected brand reacts less in concentrated markets both in terms of advertising ($p < .01$) and price cuts ($p < .10$). In concentrated markets, profit margins tend to be higher (Steenkamp et al. 2005), and companies may be less motivated to cut prices because this could cause these attractive high margins to dissipate (Ramaswamy, Gatignon, and Reibstein 1994). In contrast, brands use more price cuts to differentiate themselves more from other affected brands in case several of them are affected ($p < .05$).

We find that competitors chose not to retaliate with advertising when there is a great deal of publicity surrounding the crisis ($p < .01$) or when the affected brand is strong, as evidenced by a high price premium ($p < .01$). Indeed, the

[10]For the sake of readability, we focus on the effects of the exogenous variables on the change in relative brand/category advertising and price. We do not report the effects of the IVs, because (1) their substantive managerial relevance is much lower and (2) their large number prohibits us from doing so. For example, for the endogenous variable category advertising in the category-purchases model, we include main effects for eight IVs and $2 \times 8 = 16$ interaction effects, for a total of 24 effects involving IVs for one endogenous variable alone. Across all endogenous variables in both the brand-share and category-purchase models, there are 192 main and interaction effects involving IVs. The full set of first-stage regression results is available on request from the first author.

damage to the category in these cases may be so severe that advertising messages may no longer be able to restore the lost trust, and companies may deem it better to stay out of the public's eye. In addition, in highly concentrated markets, competitors are less likely to react with advertising ($p < .05$). Moreover, competitors especially try to attack affected private labels with price cuts ($p < .01$) but do so less when the crisis involves more affected brands ($p < .01$).

Additional Model Checks

We now report on several additional model checks to demonstrate the robustness of our results to our modeling choices. First, we determined the correlation between the error terms ε_{ij}^{BS} and ε_{ij}^{CP} of the brand-share (Equation 1) and the category-purchase (Equation 2) equations, respectively. Because the sample sizes for the estimation of these equations differ (N = 44,743 for the brand-share equation and N = 411,266 for the category-purchase equation), we can only calculate the correlation across the overlapping observations. The error correlation is ultimately small: –.109. Thus, the potential for efficiency gains (lower standard errors) from estimating the two equations simultaneously with a seemingly unrelated regressions–type of approach is limited (for similar reasoning, see Chandrashekaran and Sinha 1995, p. 446).

As a second robustness check, we determined how brand share and category purchases are affected by other potential drivers, such as the length of the recall period, the year of the crisis, and the underlying cause of the crisis. On the one hand, consumers may use the length of the recall period as a sign of the severity of the problem given that companies may need a longer time to overcome more serious problems. On the other hand, short recall periods may also be perceived as untrustworthy. We find no evidence for such effects in that neither the recall period nor its square is significant ($p > .1$). Furthermore, we controlled for the year of the crisis. The number of crises has increased every year (PWC 2006), which may cause different consumer reactions to recent recalls compared with older cases. However, the year of the crisis did not have a significant effect on the change in brand share or category purchases ($p > .1$).

We also tested whether yet another indicator of the severity of the crisis (in addition to the ones that are already in the model) has an impact on consumer decisions. We identified three types of crises: (1) content-related problems, (2) labeling mistakes, and (3) package failures. To test for the impact of the type of the crisis, we added two dummy variables indicating whether the crisis was of type 1 and type 2. None of the dummy variables was significant in either of the models ($p > .1$).

Third, we zoomed in on our operationalization of the marketing variables. Marketing activities of the five leading nonaffected brands are reflected in our current operationalizations. Indeed, in the brand-share model, competitive advertising and price are captured in the denominator of the relative variables, while for category purchases, we use the combined (i.e., the sum or average) marketing efforts of the affected and five largest nonaffected brands. An alternative (but less parsimonious) specification is one in which the own effect is modeled separately from the cross effects. We estimated a (main-effects-only) model with separate endogenous own and (combined across all competitors) cross effects.[11] Splitting the own and cross effects leads to an increase in the root mean square error from .901 to .902 for the brand-share model and from 3.508 to 3.515 for the category-purchases model; thus, this operationalization did not result in an improved fit relative to our specification.

In the absence of a control group, we cannot assess what would have happened if the product-harm crisis had not taken place. Still, to approximate this scenario, we reran our models while controlling for the t-values of precrisis trends in brand share and category purchases (for a similar practice, see Pauwels and Hanssens 2007). These t-values capture the direction and extent of precrisis tendencies in brand share and category purchases. None of these trend terms was significant ($p > .1$).[12]

Conclusions

Product-harm crises occur ever more frequently in today's marketplace, and they can seriously damage both the affected brand and the category as a whole. Managers of both affected and nonaffected brands often increase their advertising support or decrease their price substantially in the wake of a product-harm crisis in an attempt to regain lost customers or to benefit from the misfortune of their competitor(s). An alternative strategy is to hike prices in an effort to safeguard the brands' revenues. However, little is known about the relative effectiveness of these strategies. Indeed, prior studies that have quantified the postcrisis effectiveness of marketing adjustments using actual consumer purchase data following a real-life crisis (rather than stated intentions following a description of a hypothetical crisis) primarily focused on one single crisis, namely, a peanut-butter contamination case in Australia. As such, generalizable knowledge on the phenomenon is still missing, especially on the moderating impact of crucial crisis characteristics such as the amount of negative publicity and blame acknowledgment.

In the current study, we extend the existing knowledge base considerably, as we analyze, using large household-scanner data sets, 60 major FMCG product-harm crises that recently occurred in the United Kingdom and the Netherlands. We examine, at the individual-household level, how brand share and category purchases change in the year after the crisis compared with the year before and relate this

[11]We thus estimated four (rather than two) endogenous variables per model and also adapted the IVs accordingly. As such, for brand share, we used the change between period t* – 1 and t* – 2 in both own brand advertising (price) and the advertising (price) of the five largest nonaffected competitors, rather than a single change in relative brand advertising (price) during the same period. For category purchases, the included IVs are the change between period t* – 1 and t* – 2 in both the advertising (price) of the affected brands and the combined advertising (price) of the five largest nonaffected competitors, rather than the single sum across affected and nonaffected brands.

[12]Detailed results for all robustness checks are available on request from the first author.

change to crisis characteristics (i.e., negative publicity and blame acknowledgment), marketing variables (i.e., price and advertising), and their interaction effects. We thus obtain a contingency framework indicating what marketing actions work more or less effectively under what type of crisis. This framework not only contributes to the theoretical knowledge base on product-harm crises by exploring various boundary conditions to previous main-effects-only results but also makes the recommendations for managers confronted with a specific crisis scenario much more actionable.

Our empirical findings show that the effects are much more intricate than a sole focus on the main effects would suggest. Considering the main effect of blame acknowledgment only, we might recommend acknowledging blame: we observed no negative main effect on the acknowledging brand's market share, and the category as a whole benefits. However, taking the interaction effects into account indicates that there is no such thing as a free lunch. Van Heerde, Helsen, and Dekimpe (2007) point out two additional jeopardies that brand managers face when their brand is involved in a product-harm crisis: a decrease in advertising effectiveness (making it more difficult to recover lost market positions) and an increased price sensitivity (making it more difficult to raise prices to safeguard revenues). Our results show that these additional jeopardies become particularly pronounced when the brand was to blame. Although managers may feel an even stronger urge to increase their advertising support when the crisis was their firm's fault, the effectiveness of that marketing variable is more seriously damaged if blame must be acknowledged. Thus, the risk of "spoiled arms" (Leeflang and Wittink 1996; Steenkamp et al. 2005) increases considerably when blame must be taken.

In addition, for competitors, increasing their advertising may be a double-edged sword. Some nonaffected competitors might view the crisis as an opportunity and ramp up their advertising. For example, Michelin North America hiked up its advertising budget to run a print campaign emphasizing tire safety and quality following Bridgestone/Firestone's 2000 recall of 6.5 million tires following accidents involving defective tires (Dodosh 2000). More recently, GM launched a campaign offering Toyota owners an extra $1,000 rebate to switch following Toyota's repeated recalls (Valdes-Dapena 2010). Our findings show that such a strategy will not work and may even backfire, if the affected brand must publicly acknowledge blame. Indeed, the effectiveness of category advertising under the blame condition is significantly reduced. Thus, consumers may view the competitors' strategy of "chasing ambulances" as being overly opportunistic.

The findings involving the negative publicity surrounding product-harm crises are also intriguing. Prior studies often have not distinguished the extent of negative publicity surrounding the event. For example, Dawar and Pillutla (2000) and Van Heerde, Helsen, and Dekimpe (2007) both define product-harm crises as *well-publicized events* wherein products are found to be defective or even dangerous (italics added). However, the extent of this negative publicity may differ widely across crises. For example, whereas Morrison's recall of its tin-contaminated tomato soup was only covered in 18% of the major U.K. newspapers, the glass particles in Olvarit's baby food attracted the attention of all major Dutch newspapers. Notably, this differential coverage affects the effectiveness of the response strategies. Increased media scrutiny increases the price sensitivity of the category, making across-the-board price hikes to protect sales revenue more likely to backfire. However, in line with Berger, Sorensen, and Rasmussen's (2010) theorizing, we find that an increase in postcrisis advertising becomes a more attractive option, for both the affected brand and the category as a whole. Our finding of an increase in advertising effectiveness with more publicity is in line with the idea that the heightened awareness caused by the media attention tends to be more persistent than the negative valence of its content.

Table 6 offers recommendations based on our results for brands and categories faced with a product-harm crisis. It indicates that the relative attractiveness of changes in the decision variables price and advertising under different crisis settings. Managers should hope to never be confronted with a product-harm crisis. However, if they are, they would prefer that the blame is not theirs and that the crisis does not generate a great deal of negative publicity. We use this scenario as our base case (first line in Table 6) and evaluate how to use advertising and price in different circumstances. Advertising appears to be a tool that indeed can be used to stimulate both primary and secondary demand (given the significance of the respective parameters). A price decrease, however, represents spoiled arms (Leeflang and Wittink 1996; Steenkamp et al. 2005), given that it will not lead to a corresponding increase in brand share. However, in the base case, price is ultimately an effective instrument to protect/stimulate category consumption.

When the brand must acknowledge blame and/or when the extent of publicity changes, the recommendations may change, as summarized in Cases 2–4 of Table 6. Table 6 identifies settings in which advertising becomes more or less effective and price decreases may be used as an additional instrument to protect the brand or category. For example, in a low-publicity product-harm case in which blame must be admitted, brands and categories are not advised to increase advertising, because the instrument becomes considerably less effective for both performance metrics. However, in the opposite case (high publicity, no blame), we definitely recommend an advertising increase. As for price, brand price decreases are only recommended when blame must be acknowledged, whereas category price decreases are recommended in all cases and even more so in case of high publicity.

While the focus of our analysis is on the actionable interaction effects between crisis characteristics and marketing adjustments, the control variables lead to some additional, managerially relevant insights. First, our results warn managers to not take their most valuable customers for granted (i.e., the ones that showed most behavioral loyalty before the crisis and/or those that have a higher category usage). Indeed, these customers show a more negative reaction to the crisis, supporting the notion (e.g., Grégoire and Fisher 2008) that these customers feel particularly dis-

TABLE 6
How Brands and Categories Can Overcome Product-Harm Crises

Type of Product-Harm Crisis			Postcrisis Recommendations for the Brand		Postcrisis Recommendations for the Category	
Case	Extent of Negative Publicity	Blame Must Be Acknowledged	Advertising	Brand Price	Category Advertising	Category Price
1 (base)	Low	No	Increase brand advertising: effective instrument	Keep brand price: spoiled arms	Increase category advertising: effective instrument	Decrease category price: effective instrument
2	Low	Yes	Do not increase advertising: less effective than in base case	Decrease price: more effective than in base case	Do not increase advertising: less effective than in base case	Decrease price: as effective as in base case
3	High	No	Increase advertising even more: more effective than in base case	Keep price: spoiled arms	Increase advertising even more: more effective than in base case	Decrease price even more: more effective than in base case
4	High	Yes	Increasing advertising might be attractive, depending on the net impact of the two opposing forces on advertising effectiveness	Decrease price more: more effective than in base case	Increasing advertising might be attractive, depending on the net impact of the two opposing forces on advertising effectiveness	Decrease price even more: more effective than in base case

concerted because of the crisis. Lost trust is notoriously difficult to recover (Nooteboom, Berger, and Noorderhaven 1997); therefore, it may well take a prolonged effort.

Our results also provide additional insights into the ongoing battle between private labels and national brands. A great deal of crises in our sample involved private labels that had to be taken off the shelves. It is unclear whether this is due to an inherently lower quality (which makes them more prone to product-harm crises) or because it is logistically easier to recall all items from a single retailer than from multiple retailers (as would be the case when national brands are affected). Still, given the increasing presence of private labels and the danger of spillover effects to the rest of the category (see also Szymanowski and Gijsbrechts 2012), this should be an additional concern to national-brand manufacturers: not only do private labels increasingly gain market share, frequent quality problems requiring a recall may undermine the consumers' confidence in the category and thus erode category sales. This concern is mitigated somewhat, in that we find that both the brand and the category are hurt less when the affected brand is a private label. This latter finding could be due to the more limited distribution of the private-label brands (so that only a smaller fraction of customers is exposed to the crisis), but it could also be driven by consumers a priori expecting lower quality with private labels (which reduces the signaling value of the crisis). However, given their higher frequency, private-label-induced product-harm crises may well contribute considerably to the war chest national-brand managers should put together in anticipation (for an in-depth discussion on this issue, see Rubel, Naik, and Srinivasan 2011) of a crisis hitting their category, which is hardly a comforting thought.

While we provide new, actionable insights into how to overcome a product-harm crisis, this research is subject to some limitations that offer opportunities for further research. One limitation is that we study product-harm crises in the context of FMCGs. The frequent-purchase nature of these goods allows consumers to adjust their purchase behavior rapidly, which can be readily observed in the type of household scanner panels we used for this study. The question remains, however, whether purchase behavior for recalled products with longer interpurchase times (e.g., durables such as Toyota automobiles) shows a similar adjustment pattern and the same sensitivity to the drivers as we observed (for recent research on the impact of recalls in the automobile and medical-device industries, respectively, see Liu and Shankar 2012; Thirumalai and Sinha 2011).

Moreover, our sample of crises consisted of cases in which at least one variety was fully recalled, and the recall was voluntary in all instances. We thus excluded from our analyses cases that were more limited in extent and potentially issued in different batches. In addition, because our sample solely consisted of voluntary recalls, we were not able to examine the difference between voluntary and forced recalls. Insights for these types of crises might be different, which may also be the case if the crisis was so extreme that it led to (multiple) casualties.

In line with previous research in the marketing-mix effectiveness arena (for a review, see Leeflang et al. 2000), we investigated both primary and selective demand. However, other sales decompositions could be considered as well. For example, researchers could incorporate intervention (crisis) dummies in the modeling framework of Bucklin, Gupta, and Siddarth (1998) to assess whether marketing's influence as a driver of consumers' category incidence,

brand choice, and quantity decisions changes when faced with a product-harm scenario.

Moreover, it would be worthwhile to study the origin of the product-harm crisis. When different brands (e.g., private labels and national brands) are manufactured in the same plant, this may affect the magnitude of spillover effects. However, it is difficult (if not impossible) to control for this phenomenon in the empirical analysis. For example, retailers and national brand manufacturers are very secretive as to who is involved in private label production (Gomez-Arias and Bello-Acebron 2008; Kumar and Steenkamp 2007). Because this information is also unavailable to the population at large, there is little a priori reason to expect spillover effects between specific national brands and private labels on the assumption that they could be produced in the same plant.

More research is also needed on how national-brand manufacturers should react to a product-harm crisis with private labels. Given that retailers are both customer and competitor to national-brand manufacturers, even more care should be exercised not to display a too opportunistic behavior in the case of private-label misfortune. Conversely, national-brand recalls have a strong positive impact on the private-label share in the category. Using an independent-sample t-test, we found evidence of a more pronounced growth in private-label share after a crisis with a national brand ($t = 2.509$, $p = .017$, d.f. = 58). The product-harm crisis may induce some national-brand consumers to try out the private label, and subsequently, some of them may remain with the private label even when the national brand becomes available again. Lamey et al. (2007) document a similar phenomenon following an economic crisis. More research is needed on this phenomenon.

Our study determines the effects of product-harm crises on both the core (the affected brand) and the next layer (the category). In theory, it is possible that the crisis within one category causes spillover effects onto other categories because of umbrella branding, complementarity or substitutability of categories, comparable interpurchase times, common use of ingredients, and/or similarities in manufacturing procedures. The effects on this further layer, however, are arguably smaller than the more focal effects, whereas the number of potential intercategory effects is potentially very large.

We concentrate on the impact of the crisis on the category as a whole; future researchers could investigate potential differences in the after-crisis performance of specific nonaffected competitors. Depending on the initial positioning (e.g., because of a perceived similarity to the affected brand), some brands may be affected disproportionately. Because of the crisis, individual brand shares may shift substantially, which may, in turn, lead to changes in competitive structure.[13] Finally, rather than focusing on the result in the year following the crisis, researchers could consider the more detailed (e.g., weekly) adjustments that take place shortly after the crisis to capture in more depth the dynamic interplay between different demand- and supply-side mechanisms.

Despite these limitations, we believe that our study offers several new empirical generalizations about how product-harm crises affect consumer behavior. We hope that firms and categories that face the challenge to overcome a product-harm crisis benefit from our recommendations.

[13]In a follow-up analysis, we regressed the change in competition density (C4) on various crisis characteristics. We found that the market becomes more concentrated when the crisis affects a stronger brand. In addition, Dutch categories become less concentrated after a crisis than UK categories. Given our limited sample of affected categories (N = 40), we were not able to explore this further.

APPENDIX
Product-Harm Crisis Descriptions, Listed Chronologically per Country

Product-Harm Crisis	Date	Number of Affected Brands (Number of Brands Included in Brand-Share Equation)
Sauerkraut (NL): Albert Heijn had to recall its canned sauerkraut (520g) because of glass contamination.	01/11/2000	1 (1)
Liquor (NL): Bacardi-Breezer orange and lemon bottles (70 cl) were recalled because of reported bursts.	10/07/2003	1 (1)
Sugar (NL): Caribbean Gold had to recall the 1kg packages and 500g cubes packages of cane sugar because of chemical contamination.	07/13/2004	1 (1)
Baby food (NL): All varieties of Olvarit and Bebirix baby food needed to be recalled because of glass contamination.	12/22/2005	2 (2)
Fruit for babies (NL): Olvarit and Bebirix recalled different flavors of their baby fruit gamma because of glass contamination.	12/22/2005	2 (2)
Filet d'Ardenne (NL): Filet d'Ardenne of Albert Heijn was recalled due to incorrect label information.	01/06/2006	1 (1)
Yorkham (NL): Albert Heijn recalled all packages of Yorkham because of mislabeling.	01/06/2006	1 (1)
Chicken rolled meat (NL): All packages of chicken rolled meat were recalled by Albert Heijn because of label errors.	01/06/2006	1 (1)
Minced meat (NL): Albert Heijn recalled all packages of AH minced meat because of wrong label information.	01/06/2006	1 (1)

APPENDIX
Continued

Product-Harm Crisis	Date	Number of Affected Brands (Number of Brands Included in Brand-Share Equation)
Syrup (NL): Sixteen private label brands had to recall different varieties of syrup because of the detection of particles of glass inside. We observe purchases of Albert Heijn, Edah, Etos, Kruidvat, Markant, O'Lacy's, Perfekt, Plus, Spar, Vitafit (Lidl), C1000, Dixap (Covelt), and Super de Boer.	11/29/2006	16 (13)
Chicken nuggets (UK): Sainsbury recalled its 18 fresh nuggets variety (312g) because of quality defects.	04/21/2000	1 (1)
Canned pilchards (UK): The Namibian South Atlantic pilchards in tomato sauce (425g) of the brands Glenryck and Princes had to be recalled because of a fault in the manufacture of the can.	06/14/2000	2 (2)
Tomato soup (UK): 15 private labels had to recall their cans of tomato soup (410g) because of elevated levels of tin. We only include Morrisons in our analysis because it was the only brand that had to fully recall this variety.	11/16/2000	15 (1)
Butter (UK): Kerrygold spreadable butter was recalled because of glass contamination.	07/28/2001	1 (1)
Flavored mineral water (UK): Sainsbury recalled its strawberry-flavored Caledonian still water (2 l) because of deficient quality.	08/10/2001	1 (1)
Custard (UK): Ambrosia Devon had to recall all custard varieties of 1kg and 500g because of deterioration before use-by date.	08/24/2001	1 (1)
Spring water (UK): Chiltern Hills and Ashridge Spring recalled their bottles of water after they were found to be contaminated with feces. Ashridge Spring was not observed in the purchase database, so it is not included in our analysis.	11/23/2001	2 (1)
Dairy-free iced dessert (UK): Sainsbury dairy-free chocolate iced dessert (500 ml) was recalled because of the detection of traces of milk even though it was labeled milk-free.	12/10/2001	1 (1)
Profiteroles (UK): Co-op's frozen dairy cream profiteroles (280g) were recalled because of the detection of traces of nut even though it was labeled nut-free.	07/18/2002	1 (1)
Baby Food (UK): Heinz recalled different varieties of baby food because they were incorrectly labeled as milk-free.	08/29/2002	1 (1)
Canned soup (UK): Sainsbury had to recall its cream of potato and leek canned soup (400g) because of bursting cans and evidence of spoilage.	03/14/2003	1 (1)
Liquor (UK): Bacardi Breezer and Coomira Coast recalled all 70cl bottles because of bursting bottles. We focus on Bacardi Breezer because Coomira Coast was not observed in the purchase database.	10/08/2003	2 (1)
Pesto Sauce (UK): Different brands of pesto sauce were recalled after the cancer-causing chemical Sudan 1 was discovered. We include only the Bertolli brand in the analysis because Safeway and Sainsbury's only recalled parts of their varieties and the Al Cirio brand was not observed in the purchase database.	09/16/2003	4 (1)
Muffins (UK): Six private labels brands of white muffins had to be recalled because of mislabeling. Only Asda recalled the entire variety.	10/28/2004	6 (1)
Cookies (UK): Sainsbury freefrom coconut and raspberry cookies (200g) were recalled because of mislabeling.	01/28/2005	1 (1)
Ice cream (UK): Sainsbury recalled its frozen freefrom raspberry iced dessert (500 ml) because of mislabeling.	04/28/2005	1 (1)
Pasta salad (UK): Sainsbury recalled its tuna and sweet corn pasta salad (300g) because of inconsistencies between the allergy information on the package and the ingredient list.	09/23/2005	1 (1)
Candy (UK): Basset's milky babies (165 and 200g) had to be recalled because of the presence of pieces of plastic in the candy.	10/05/2005	1 (1)
Chocolate (UK): The basic plain chocolate (100g) variety of Sainsbury was taken off the shelves because of mislabeling.	10/06/2005	1 (1)
Toothbrushes (UK): Boots smile toothbrushes were recalled because of choking hazard linked to potential breaks of the product.	10/27/2005	1 (1)
Yogurt (UK): Brooklea (Aldi) thick and creamy strawberry yogurt (150g) was recalled because of glass contamination.	02/06/2006	1 (1)

APPENDIX
Continued

Product-Harm Crisis	Date	Number of Affected Brands (Number of Brands Included in Brand-Share Equation)
Bread slices (UK): Iceland and Morrisons recalled the frozen 6 cheese & garlic slices because of contamination with plastic. We only observe purchases for the Iceland brand.	02/09/2006	1 (1)
Beef paste (UK): Morrisons and Co-op beef paste jars (75g) were recalled because of incorrect label information.	03/13/2006	2 (2)
Chocolate (UK): Cadbury had to recall different dairy milk chocolate flavors because of contamination with salmonella.	06/23/2006	1 (1)
Pasta sauce (UK): Aldi had to recall its Romano pasta sauce (470g) because of the detection of particles of glass inside.	08/15/2006	1 (1)
Porridge (UK): Asda recalled its simply porridge variety (500g) because of the detection of traces of nut even though it was labeled nut-free.	11/01/2006	1 (1)
Crisps (UK): Sainsbury's and Co-op had to recall its multipack sausage and tomato flavor crisps (6 times 25g) and ready salted crisps multipack (6 times 25g), respectively, because of a label error.	11/16/2006	2 (2)
Seafood (UK): The Northern Catch 15 seafood sticks (250g) of Aldi were recalled because of a microbiological problem.	11/16/2006	1 (1)
Cereals (UK): Marks and Spencer had to recall its strawberry and almond crunch cereals because of mislabeling.	12/06/2006	1 (1)
Crackers (UK): Prawn crackers (50g) of six private label brands were recalled because of incorrect label information. We only observe purchases for Spar, Asda, Sainsbury's, and Tesco.	03/19/2007	6 (4)

Notes: NL = the Netherlands, and UK = United Kingdom.

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