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PRODUCT RECALLS, IMPERFECT INFORMATION, AND SPILLOVER EFFECTS:
LESSONS FROM THE CONSUMER RESPONSE TO THE 2007 TOY RECALLS

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Product Recalls, Imperfect Information, and Spillover Effects: Lessons from the Consumer
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ABSTRACT

In 2007, the Consumer Product Safety Commission (CPSC) issued 276 recalls of toys and other children's
products, a sizeable increase from previous years. The overwhelming majority of the 2007 toy recalls
were due to high levels of lead content and almost all of these toys were manufactured in China. This
period of recalls was characterized by substantial media attention to the issue of consumer product
safety and eventually led to the passage of the Consumer Product Safety Improvement Act of 2008.
This paper examines consumer demand for toys following this wave of dangerous toy recalls. The
data reveal four key findings. First, the types of toys that were involved in recalls in 2007 experienced
above average losses in Christmas season sales. Second, Christmas sales of infant/preschool toys produced
by manufacturers who did not experience any recalls were about 25 percent lower in 2007 as compared
to earlier years, suggesting industry-wide spillovers. Third, a manufacturer's recall of one type of toy
did not lead to a disproportionate loss in sales of their other types of toys. And, finally, recalls of toys
that are part of a brand had either positive or negative effects on the demand for other toys in the property,
depending on the nature of the toys involved. Our examination of the stock market performance of
toy firms over this period also reveals industry wide spillovers. The finding of sizable spillover effects
of product recalls to non-recalled products and non-recalled manufacturers has important implications
for regulation policy.

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I. Introduction

In the presence of asymmetric information, markets may allocate goods in a less than optimal way. Concern that consumers are imperfectly informed about certain product attributes – in particular, the level of risk posed by a product - has lead to government intervention in the consumer product market in the form of product safety regulation. In this context, government regulation is designed to both remove dangerous products from stores and homes as well as provide firms with incentives to invest in product safety. In the U.S., the majority of consumer products are regulated by the Consumer Product Safety Commission (CPSC). The CPSC relies almost exclusively on a process of standards and recalls - as opposed to other policy options, such as information disclosure requirements or fines.[1] Although both the CPSC as well as other regulatory agencies rely on the recall process, there is very little direct or detailed evidence about whether and how consumers react to recall announcements. Such evidence is important because the extent to which the recall mechanism provides firms with incentives to invest in risk reduction depends, in large part, on the nature of the consumer response.[2]

In this paper, we investigate how consumers responded to a recent wave of toy industry recalls. In 2007, the CPSC issued 276 recalls of toys and other children's products, as compared to 152 such recalls in 2006, 171 in 2005, and 121 in 2004. This series of product recalls is noteworthy for several reasons. First, it represents a greater than 80 percent increase in the number of recalled children's items from 2006 to 2007 and a much larger increase than that which is observed in other

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[1]   Viscussi (1984) provides an institutional overview of the CPSC within the conceptual framework of the economics of product safety regulation.

[2]   Jarrell and Peltzman (1985) describe the multiple ways in which a product recall can lead to capital market losses. These include the direct costs of the recall in terms of inventory losses and refunds; costs of potential litigation; costs of changes in practices to improve quality/repair consumer goodwill; and lost profits due to decreases in consumer demand. All of these can provide incentives for firms to make costly investments in product safety.

product categories over this period.[3] Second, it ultimately resulted in the passage of new federal

legislation – the Consumer Product Safety Improvement Act – in early 2008. Finally, in surveys and

interviews conducted at the time of the recalls, consumers clearly indicated that they intended to

change their buying behavior in response to these recalls.[4]

Using the most comprehensive data available for this industry, we document how these

recalls affected toy sales in the months following the recall announcements. It is important to note

that in contrast to, say, product ratings, recalls do not provide consumers with direct information

about the safety of the products available in the market since any products that are actively selling

when they are recalled are immediately removed from retailers' shelves. Moreover, in many cases,

recalls are issued for products that are no longer active in the marketplace.[5] To the extent that there

is a consumer response to a recall, this response will indicate that consumers are using the

information contained in the recall to update their expectations of the safety of other products in the

market. Thus, any demand response that we measure can be considered a "spillover effect". The

goal of our empirical analysis is to document the level at which these spillover effects are observed

in order to learn about how consumers appear to draw inferences about product safety. [6]

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[3]   For example, the number of recalled household products and sports and recreation items in
2007 both remained similar to their levels in previous years. The number of recalled household
products was 121, 122, 121, and 132 in 2004, 2005, 2006, and 2007, respectively. The number of
recalled sports and recreation items in these four years were 50, 76, 58, and 64.

[4]   In a Harris Poll of 2,565 adults in the United States conducted in October 2007, 33 percent
of respondents said that they would buy fewer toys during the 2007 holiday season due to recent
safety recalls and 45 percent said they would avoid toys from China. The poll also found a high
awareness of recent toy recalls in the U.S., with 91 percent reporting that they had heard about the
issue.

[5]   This is true in our setting. Information contained in the CPSC recall announcements
indicates that 78% of the toys that were recalled in 2007 were not actively selling at the time of their
recall.

[6]   We would have liked to undertake an analysis of consumers' willingness to pay for a
reduction in lead exposure risk, conducting a study similar in spirit to Davis (2004). In this paper,
Davis estimates a hedonic home price function with respect to pediatric leukemia risk. In response
to the revelation of lead paint in children's toys manufactured in China, a potential consumer

Two features of our setting make an examination of spillover effects in this context particularly interesting. First, the majority of the 2007 toy recalls involved risks associated with a common industry practice of producing in China and related specifically to the use of paint with high concentrations of lead. This raises the possibility that consumers took these announcements as information about the safety of an industry-wide practice (rather than as information about the safety of any particular manufacturer's toys) and increases the likelihood that non-recalling firms might also experience demand losses. Second, licensing and branding are extremely common in the toy industry, with licensed products accounting for approximately one quarter of toys in the industry (Clark, 2007). Brands (such as Fisher-Price's "Laugh and Learn" line) and trademarked characters (such as "Dora the Explorer") are often shared across different types of toys as well as across toys produced by different manufacturers. Not only does the prevalence of branding and licensing create another level at which consumers may draw inferences but they also raise the possibility that imperfect information may prevent consumers from accurately acting upon the inferences that they draw. For example, following a recall of certain toys produced by Mattel, consumers may infer that all Mattel toys are less safe. However, if consumers do not know that toys produced under the Fisher-Price brand are, in fact, produced by Mattel, they will not be able to accurately act upon that inference. While we will not be able to test between imperfect information and various levels of inferences as explanations for the patterns we observe, we discuss the implications of each for both policy formulation and firm strategy.

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response is to shift purchases to toys made outside of China, perhaps with a price premium. Unfortunately we do not observe enough toys made outside of China to conduct such an analysis in this paper. It is also possible that consumers shifted purchases to toys that they incorrectly believe to be made outside of China – e.g., toys sold at expensive, boutique-style stores. We are not able to identify such toys in our data.

Our empirical analysis uses data on monthly Infant/Preschool toy sales from January 2005 to December 2007 inclusive.[7] Our empirical approach attempts to account for several important institutional features of the toy industry. In particular, the fact that toy sales are highly seasonal means that any demand response to a recall at any point in the year is most likely to occur at Christmas. However, the fact that the popularity of any particular toy or type of toy may be short-lived means that what is popular one Christmas may not be popular the following year. It is thus very difficult to establish a single appropriate counterfactual level of sales that is clearly superior to alternative counterfactual estimates. We therefore carry out several complementary analysis which, taken together, describe the patterns in the data. We begin by non-parametrically estimating differences between the monthly pattern of sales in 2007 and in 2006. Then, we investigate the relationship between having a recall during 2007 and Christmas 2007 sales. We follow standard industry practice and classify individual toys into "categories" (groupings of similar toys) and "properties" (groupings of toys that share a common brand or trademark) and estimate how recalls affected sales at the level of the manufacturer-category as well as the level of the property-category. Finally, we conclude by carrying out in-depth studies of the largest and most widely publicized recalls from 2007.

Several key findings emerge from our analysis. First, the types of toys that were involved in recalls in 2007 experienced lower 2007 Christmas season sales. The results of our OLS regressions indicate that conditional sales of toys in a manufacturer-category group that had a recall were lower by about 30 percent. In addition, in the three high profile recalls that we investigate in detail, the manufacturer's Christmas season sales in the affected property-category -- where a property is defined as a brand or license -- fell substantially. Thus, consumers appear to be using the

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[7] As we explain in greater detail in Section III, toys are divided into 13 "supercategories" which broadly group similar types of toys together. Infant/Preschool is the largest supercategory

information contained in recall announcements to draw inferences about the safety of similar toys produced by the manufacturer. We consider the role of media coverage and find that newspaper coverage of recalls plays an important role in eliciting a demand response.

Second, conditional Christmas sales of Infant/Preschool toys produced by manufacturers who did not experience any recalls were about 25 percent lower in 2007 than in 2005.[8] Thus, the recalls appear to have had negative spillovers to the industry as a whole. Consistent with consumers' claims in surveys and in the media, this suggests that the specific recalls that took place led consumers to draw inferences about the overall safety of toys in the market.

Third, a manufacturer's recall of one type of toy did not disproportionately decrease its sales of other types of toys. In fact, relative to manufacturers who had no recalls at all, manufacturers who experienced recalls had higher sales in their unaffected categories. This suggests that either consumers do not draw inferences from a manufacturer's recall of one type of toy about the safety of unrelated toys produced by that manufacturer or that they do not know which toys are produced by which manufacturer. Alternatively, consumers might not correctly identify or remember the manufacturer named in a recall. The fact that sales appear to increase in a manufacturer's unaffected categories might indicate that large diversified toy manufacturers are making investments in rebuilding their overall reputation (and thereby offsetting any negative inferences consumers may draw) or taking steps to shift demand to their brands or product lines that were not involved in recalls (and thereby exploiting consumer's imperfect information). We present some descriptive evidence on firm diversification in relation to this conjecture.

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and it experienced the most recalls.

[8]   Contrasting this to changes in other industries – for example, video game sales which increased about 43 percent between 2006 and 2007 and book sales which were essentially flat - suggests that much of this observed decrease in sales reflects an industry-wide decease in demand in response to these recalls and not simply a response to macroeconomic conditions.

Finally, with respect to the role of licensing, we find that recalls of toys that are part of a property may have positive or negative effects on the demand for other toys in the property. We hypothesize that the degree of similarity between the recalled toys and other toys in the property may affect the direction of the response. Specifically, when toys are very similar, consumers are both more likely to draw inferences about the safety of other toys in the property as well as more likely to be imperfectly informed about which toys were actually involved in the recall. In contrast, when the toys are less similar, strong tastes for a particular brand may lead to positive shifting within the property.

Our findings have implications for both policy design as well as firm strategy. The fact that manufacturers experience above average sales losses in the category or category-property that experienced a recall indicates that recalls do impose costs on firms in the form of reduced demand. These costs will provide some incentive for firms to invest in product safety.[9] However, the fact that large diversified manufacturers appear to be able offset demand losses in affected categories with demand increases in other categories suggests that for sufficiently large firms, the demand consequences of a recall may not be very large. The incentives provided by potential demand losses will depend on the extent to which firms have to undertake costly investments to prevent losses on unaffected categories. In addition, the prevalence of branding and licensing may result in consumers being imperfectly informed about which toys are produced by which manufacturer and may attenuate spillover effects at the manufacturer level. This suggests that the current process of recalls may need to be supplemented with additional information provision that enables consumers to better identify which toys are produced by whom. This also suggests that manufacturers may have

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[9] Note that it would be extremely difficult, if not impossible, to empirically demonstrate that market incentives are sufficient to insure the optimal level of quality. Furthermore, once one allows for heterogeneous willingness to pay for risk across consumers, a consideration of what would be

incentives to limit association between their brands and publicize any recalls that do occur under a particular brand rather than the manufacturer name.

This paper contributes to two related literatures. First, it is closely related to an existing – though mostly 20 year old - literature that measures the stock market response to recalls.[10] The stock market response reflects the total costs that recalls impose on firms. Much, though not all, of this literature focuses on drug and automobile recalls due to the high frequency of recalls in these industries. This literature includes Jarrell and Peltzman (1985), Pruitt and Peterson (1986), Hoffer, Pruitt and Reilly (1988), Dranove and Olsen (1994), Barber and Darrough (1996), and Chu, Lin and Prather (2005). With the exception of Hoffer, Pruitt and Reilly (1988), all of the papers find statistically significant negative stock price reactions to the recalls. Several of the papers compare the drop in shareholder wealth in response to the recalls to estimates of the direct costs of the recalls and find that the former exceeds the latter. They speculate that this excess loss is due to a loss of "goodwill"; this provides indirect evidence that the consumer response to recalls may be significant. Crafton, Hoffer and Reilly (1981) and and Reilly and Hoffer (1983) directly measure the demand response to automobile recalls.[11]

Second, this paper is related to a growing empirical literature that investigates the effects of government-mandated information disclosure programs. Information disclosure policies represent

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the optimal level of product safety becomes even more complicated. We explicitly avoid making any such claims.

[10]   There is also a closely related literature that estimates the stock market to airline crashes. This literature includes Chalk (1987), Chance and Ferris (1987), Mitchell and Maloney (1988) Borenstein and Zimmerman (1988), and Bosch, Eckard and Singal (1998). Borenstein and Zimmerman (1988) also investigate the impact of crashes on demand and find little or no effect of an accident on demand.

[11]   Their findings are similar to ours in that they find that following a recall, there is a reduction in demand for the model type subject to the recall as well as to similar sized cars produced by other manufacturers. They do not find evidence of negative demand spillovers to other cars produced by the same manufacturer.

an alternative way to address the problems that arise from informational asymmetries and they take a variety of forms. Economists have studied the impact of information disclosure policies on consumer and firm behavior in a variety of contexts, including restaurant hygiene grade cards (Jin and Leslie, 2003); nutritional labeling requirements (Mathios, 2000); mercury and fish consumption advisories (Shimshack et al. 2007); SEC financial disclosure requirements (Greenstone, Oyer, and Vissing-Jorensen, 2006); and environmental safety contexts, such as requirements on community water suppliers to disclose information on chemicals in drinking water (Bennear and Olmstead, 2008). Fung, Graham, and Weil (2007)and Winston (2008) review and synthesize this research and the conditions under which information disclosure programs affect consumer and/or firm behavior in ways that achieve the underlying policy objectives.[12]

The remainder of this paper is organized as follows. Section II provides relevant background information on the toy industry and the recall process. Section III describes the data. In Section IV, we carry out our empirical analysis of the consumer response to the recalls. In Section V we present additional considerations. Specifically, we present an empirical examination of the stock market response to the 2007 toy recalls. We also take up the question of whether consumers responded to the "Made in China" aspect of the recalled toys. We conclude in Section VI with a discussion of the implications of our findings for both policy formulation and firm strategy.

II. Institutional background

A. Toy Industry Basics

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[12] There is a separate literature on quality certification, both voluntary and mandatory. This mechanism is used to alleviate informational deficiencies in such contexts as educational facilities and child care facilities. Hotz and Xiao (2008) and Xiao (2008) are recent examples from this literature.

In 2005, the U.S. toy industry generated $21.3 billion in retail sales.[13] At both the manufacturer and retailer levels, the industry is dominated by a small number of large firms. At the manufacturer level, Mattel and Hasbro together account for roughly 30 percent of the market.[14] The remaining firms are considerably smaller, with the third largest firm accounting for less than four percent of the market and the tenth largest firm accounting for just over one percent of the market.

For analysis purposes, the toy industry is classified into 11 "supercategories" which are broad groupings of toys with similar uses or purposes. Examples of these supercategories include "Action Figures and Accessories", "Arts and Crafts", "Infant/Preschool" and "Youth electronics". Supercategories are further subdivided into finer categories. The Infant/Preschool supercateogry which we focus on is the largest supercategory in the industry, accounting for slightly more than 14 percent of total industry sales in 2005 (about $3.2 billion). Appendix Table 1 lists the top 30 manufacturers in the Infant/Preschool supercategory based on tabulations of our data (described below), ranked by 2005 unit market share. Appendix Table 2 lists the 13 categories that make up the Infant/Preschool group of toys.

Branding and licensing is quite common in the toy industry. A "property" refers to a set of toys that share a common brand. The property includes all toys produced by the owner of the brand as well as all toys produced by firms who have licensed the rights to use the brand. Broadly speaking, one can distinguish between two types of properties. The first type encompasses a brand

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[13]   For the sake of comparison, in 2005, the U.S. book industry generated $34.59 billion in sales while the apparel industry generated $181 billion. Video game hardware and software, which are not included within the definition of the "traditional" toy industry, generated $10.5 billion in retail sales (Clark, 2007).

[14]   Our study does not focus on retailers. But for the curious reader, we note that Wal-Mart, the largest toy retailer, accounts for almost 30 percent of toy sales. The top three retailers - Wal-Mart, Toys R Us, and Target - together account for almost 60 percent of sales. As in the case of

that is owned by a toy manufacturer and used on some set of that manufacturer's toys. The manufacturer may license that brand to other toy manufacturers -- but often does not -- and/or may license that brand to firms producing other types of consumer products (for example, bicycles, children's' furniture, or video games). Mattel's "Laugh & Learn" brand is an example of this type of property. Mattel's Fisher-Price division produces approximately 20 different infant toys under the "Laugh & Learn" brand. Mattel does not license the "Laugh & Learn" brand to other toy manufacturers nor does it license it for use on non-toy products. The second type of property encompasses a brand this is owned by a firm *outside* of the toy industry and that is licensed to one or more toy manufacturers. In this case, the property would include *all* toys which use the licensed brand or trademark and may include products from several different manufacturers. Examples include "Spiderman", owned by Marvel Entertainment and "Dora the Explorer", owned by Nickelodeon.

Toy manufacturers license the rights to use these brands on their products. In some cases, a single toy manufacturer may obtain the exclusive rights to a brand; in other cases, the brand will be licensed to several different manufacturers, though the terms of the agreement may stipulate that a manufacturer has the exclusive rights to use the brand on a particular *type* of toy. The top properties in Infant/Preschool toys – based on 2005 unit market shares – are Leappad, Thomas and Friends, Playskool, Little People, and Little Tykes. Appendix Table 3 shows the top 30 Infant/Preschool toy properties and their unit and dollar shares of total industry sales, based on tabulations of our data.

B. Toy Recalls from 2004 to 2007

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manufacturers, the remaining top 10 retailers are quite small in terms of their contributions to industry sales, together accounting for only another 8.5 percent.

The recall process is initiated through one of three channels: a complaint made to the CPSC; a complaint made to the company whose product is in question; or a field sample or investigation.[15] When the CPSC receives a consumer complaint or is notified of a complaint made to a manufacturer, they immediately launch an investigation; if the content of the complaint is confirmed, the agency sends a letter to the company initiating a recall process. Manufacturers, importers, distributors, and retailers are required to report to the CPSC under Section 15 (b) of the Consumer Product Safety Act (CPSA) "within 24 hours of obtaining information which reasonably supports the conclusion that a product does not comply with a safety rule issued under the CPSA, or contains a defect which could create a substantial risk of injury to the public or presents an unreasonable risk of serious injury or death, 15 U.S.C. § 2064(b)."[16]

The large increase in the number of recalled toy and children's products in 2007, as compared to earlier years, is unique to this category of products. Table 1 reports the number of recalls per year in major categories of consumer products from 2004 through 2007. The number of toy recalls was 30, 31, and 38, respectively, for 2004, 2005, and 2006. That number jumped to 82 in 2007. For children's products the numbers are 42, 64, and 56, with a jump up to 130 in 2007. The other categories do not show such a discrete increase in 2007.

We collect details about the toy recalls that took place between 2004 and 2007 from the CPSC website. For each recall, the CPSC website lists the date of the recall, the product name, the number of units recalled, the importer, manufacturer, and/or distributor, a description of the

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[15]   This description of the recall process is based heavily on a description provided to us by a representative of the Consumer Product Safety Commission (CPSC) in a telephone conversation in April 2008.
[16]   All of the CPSC toy recalls that we examined are listed on the CPSC website as "voluntary". Recalls that proceed along the channels described above are considered voluntary. A non-voluntary recall would mean that the agency has to go through the legal system. The CPSC agent we spoke with could think of no such example in the past year of toy recalls. Furthermore, she could think of

hazard, details about any reported incidents or injuries, a description of the product to assist in identifying recalled items, details about where and when the item has been sold, the typical price of the item, where the item was manufactured, what action individuals who have purchased the item should take, contact information for further information about the recall, and a picture of the item. We calculate the "value" of the recall as the price listed times the number of units recalled. In the event a price range is listed, we take the midpoint in determining the recall value. Finally, we categorize hazards as choking, entrapment, fire/burn/explosion, impact, laceration or puncture, lead, magnets, severing, strangulation or suffocation, or toxic (other than lead). Appendix Table 4 lists all of the 2007 recalls and their major features.

Figure 1 depicts the percent of toy recalls in years 2004 through 2007 due to particular safety hazards. About 30 percent of recalls in the full sample are due to a lead hazard and 36 percent are due to a choking hazard. Comparing the earlier and later samples, it is clear that there was a change in this composition in 2007. Prior to 2007 13 percent of recalls were due to lead and 49 percent were due to choking; in 2007, these numbers were 52 percent and 20 percent, respectively.[17] Figure 2 depicts the percent of toy recalls that involved a toy manufactured in China. As the large majority of toys in the U.S. are made in China, it is not surprising that in each year the majority of recalls involve toys made in China. But there is a noticeable increase in the year 2007, when 95 percent of recalls involved toys manufactured in China.

The concern about lead paint in children's toys is in part driven by the concern that young children put toys in their mouth and are thereby exposed to the lead content of paint. Lead is a powerful neurotoxin that interferes with the development of the brain and central nervous system as

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no instance in which a manufacturer initiated a recall of a product for which a violation had not been confirmed.

well as the kidney and blood-forming organs. Young children, including developing fetuses, are considered to be at the greatest risk of adverse health consequences of lead exposure because they absorb more lead from their environment and because their brain and central nervous system are still forming. Lead poisoning in children is generally associated with behavioral problems, learning disabilities, hearing problems and growth retardation.[18] The two primary sources of lead exposure for the average child are leaded gasoline and lead-based paint. The federal legislation enacted in 2008 requires that surface lead, as in paint, must drop below 90 parts per million by August 2009, compared to the existing statutory level of 600 parts per million.[19] A statutory limit is also imposed on internal lead, at 600 ppm by February 2009 and 300 ppm by summer 2009.

III. Data

To investigate the consumer market response to the 2007 toy recalls, we use sales data for toys in the Infant/Preschool toy supercategory over the period January 2005 through December 2007. We purchased this data from the NPD Group, self-described as the "single source for toy market research in the U.S., Europe, and Australia." The NPD data from the U.S. is based on a panel of more than three million consumers.[20] The panel is comprised of two sets of consumers: (1)

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[17]   One important difference between a lead hazard and a choking hazard is that a choking hazard may be discovered through the normal use of the toy while a lead hazard will only be discovered through testing since the effects of lead on children are observed later in life.

[18]   Information on the health risks of lead exposure for children are detailed on the National Safety Commission's webpage, http://www.nsc.org/resources/issues/lead.aspx, most recently accessed on March 9, 2009.

[19]   The lead related recalls in 2007 varied in the extent to which they violated this standard. For example, Mattel's lead related recalls in August and September of 2007 involved toys with lead levels that ranged from just over the 600 ppm limit to 110,000 ppms (almost 200 times the applicable limit).

[20]   The ideal type of data for this project would be scanner or point-of-sale data collected directly from retailers. However, that type of data is no longer collected for the U.S. toy industry. The NPD group previously collected point-of-sale data for the toy industry, but reported to us that in 2001, Wal-Mart and Toys-R-Us stopped participating in this data collection. The loss of the two

an online panel of consumers who are instructed to record all of their purchases; (2) a panel of consumers who have scanners in their homes who are supposed to scan everything they buy. From these two panels, NPD generates a toy level dataset with both actual data from the panels (e.g. the number of transactions observed for each toy each month, the average price paid) as well as projected monthly unit and dollar sales figures (for the country). It is the latter measures that we use in our empirical analysis. After dropping observations for which no manufacturer information is available, our dataset includes data from a total of 156,524 transactions and 10,847 unique items over the full period.

There are three important features of our data. First, the data are generally not reliable at the item level. Because the data are based on a sample of consumer purchases and because the toy industry is highly fragmented at the product level, most of the toys in the dataset are only involved in a small number of transactions (NPD cautions against drawing inferences from cells with fewer than 35 transactions). In fact, the majority of toys have zero transactions in any given month.[21] Because NPD does not keep records of market exit, we are unable to determine whether zero transactions indicates that no consumers chose to purchase that toy in a given month or if the toy was no longer supplied.[22] In the toy industry, new toys are introduced frequently and current toys are either replaced or updated with new features so exit may be an important consideration in this data. For these reasons, we have no choice but to aggregate the item level data over time and/or groups of items. In particular, we focus our empirical investigation on sales at the level of the

biggest retailers essentially negated the usefulness of the scanner data. NPD subsequently switched to a system of collecting data directly from consumers.

[21]   In the raw data, 84% of toy-month observations have zero recorded transactions. 75% of the toys in the data have zero transactions in the final month of our sample suggesting a significant amount of attrition at the item level.

[22]   Note that if a toy is recalled due to a faulty design and pulled completely from store shelves, sales of that particular toy would drop to zero. But in many of the 2007 recalls, only a particular

manufacturer, category, property, and interactions thereof. We examine how the recall of a particular firm's toy affects own-manufacturer sales within and outside the category and property of the recalled toy as well as other manufacturers' sales within and outside the category and property of the recalled toy.

Second, our data does not include consumer level variables. Therefore, though it would be interesting to explore consumer responses by retailer type or consumer demographics, we are unable to do so in this paper. Third, toy sales are highly seasonal. Figure 3 shows the percent of annual sales in dollars in a given month. Roughly half of toy sales occur in the form of Christmas season purchases. An event-study type methodology is thus inappropriate for analyzing this data because the demand response to a recall will not occur immediately. We thus focus our analysis on fourth quarter sales, which include purchases made in October, November, and December of a given year. We consider both Christmas season to Christmas season changes as well as changes in "adjusted" Christmas season sales, where the adjustment is a scaling by sales in earlier quarters of the year. We discuss the advantages and disadvantages of these alternative measures.

IV. How Do Consumers Respond to a Toy Recall?

A. Differences in Seasonal Patterns Across Years

Given the highly seasonal nature of toy sales, the existence of toy fads, and the time-varying popularity of particular properties, it is very difficult to establish a single appropriate counterfactual for the sales that a given manufacturer, category, or property would have experienced at Christmas in 2007 in the absence of the wave of highly publicized lead recalls. We therefore carry out several complementary analysis which, taken together, describe the patterns in the data vis a vis the recalls.

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production batch of the toy was recalled for having contained elevated levels of lead. Other batches of the toy would continue to be available to consumers.

We begin by non-parametrically estimating differences between the monthly pattern of sales in 2007 and in 2006.

Table 2 presents the results of a simple OLS regression of monthly sales at the manufacturer level as a function of calendar month binary indicators, and interactions between the 2005 and 2007 binary year indicators with the calendar month indicators (January 2006 is the excluded group). This straightforward analysis is designed to show the seasonality of sales across months of the year and how that seasonality compares across the three years of data. The regression coefficients show the same patterns as plotted in Figure 3 above. The coefficients reported in column 1, labeled "main month effects", capture the seasonality of year 2006. They indicate a sizeable and statistically significant increase in sales in March, presumably corresponding to Easter and "spring break/vacation" purchases, and an even greater increase in the months of Christmas shopping, November and December in particular. December sales are 164 log points greater than baseline sales (captured by January 2006).

The coefficients on the interaction terms between the 2005 year indicator and the calendar month variables are reported in the second column of Table 2. None of these coefficient estimates is statistically significant. This indicates that the seasonality of toy sales across months is not observably different between 2005 and 2006. In sharp contrast, sales followed a different pattern over the year in 2007. Starting in the spring of 2007, which corresponds to the beginning of the heightened media attention to prominent lead recalls, sales are lower relative to the baseline than in earlier years. Most strikingly, in December 2007, relative sales are down by 37.1 log points, or 45 percent.

We view this as clear evidence of a general, sizable decrease in Infant/Preschool toy sales during Christmas 2007. Our data to not permit us to determine the extent to which this general decrease reflects a causal response to the wave of highly-publicized lead recalls. The fact that sales of

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other consumer products such as books and video games did not decrease suggests to us that there is something more than just macroeconomic conditions at play. Furthermore, given that 33 percent of consumers in the Harris Poll cited above reported that they intended to reduce their toy sales during the Christmas season as a result of the lead recalls, we find it interesting to know that the data do reveal a substantial reduction in infant/preschool toy sales.

B. Evidence from the Consumer Expenditure Survey (CEX)

The most comprehensive data on annual household-level expenditures in the United States is collected by the Consumer Expenditure Survey (CEX), which is conducted annually by the United States Bureau of Labor Statistics (BLS). We utilize data from the 2006 and 2007 Interview Survey files to examine household expenditures on children's items during Christmas season 2007 as compared to fourth quarter expenditures in 2006 and 2005. (The 2006 CEX file contains information about spending in the fourth quarter of 2005.) The CEX interview survey is designed to collect data on major items of expense, household characteristics, and income. Each consumer unit in the sample is interviewed about their previous quarter's expenditures, reported by month, over a 12-month period. We keep as our analysis sample for a given quarter households that have a complete calendar quarter (three months) of expenditures recorded.

The CEX detailed expenditure files include the category "toys, games, arts and crafts, trikes, and battery powered riders". Because expenditure amounts are not separately recorded for toys, as distinct from games, arts and crafts, riders, etc., we can not use this data to look for possible evidence of a shift from toys to these alternative children's products. It is also important to recognize that the CEX provides information about household expenditures on particular categories of goods. Note that this implies that we observe total household spending on products, or categories of products, unadjusted for the number of units purchased or product quality.

Table 3 tabulates mean quarterly expenditures on select categories of spending. Keeping the aforementioned caveats in mind, it is interesting to note that spending on the category *Toys, games, etc.* increases between 2006 quarter 4 and 2007 quarter 4. An increase in expenditures in this category would be consistent with consumers shifting toward more expensive products, while maintaining or even decreasing the total number of toys they purchased. One might conjecture that a shift to more expensive children's products would be more likely among more educated (or higher income) households. To consider this possibility, we look separately at households headed by a college graduate versus an individual with a high school degree or less. Among households with children that are headed by a non-college graduate (not reported), mean quarterly expenditures in the *Toys, games, etc.* category increased 27 percent; among households with children headed by a college graduate, there was a 38 percent increase, from $122 to $168.

Another possibility is that children were gifted more clothing or books during Christmas season 2007 in response to that year's wave of toy recalls. The CEX data do not show an increase in expenditures on children's clothing or a broad reading measure. (The data do not separately identify children's books.) Finally, motivated by the above-cited increase in video game sales over this period, we look at expenditures on television and video equipment. Indeed, the CEX data indicate an increase in spending on this category of goods. This again suggests that the reduction in the number of toy purchases we previously observed in the toy sales data is not driven simply by a reduction in purchases of consumer products during Christmas season 2007.

C. The Impact of the Recalls on Christmas Season Sales

We continue our data investigation by looking at changes in Christmas season sales between 2006 and 2007. Table 4 reports various measures of changes in Christmas season sales for the total Infant/Preschool toy market, the top 10 firms, and the two firms in our data that manufacture

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outside of China and have a sufficient number of transactions. In both Table 4 and our regression analysis below, we focus on changes in the equilibrium number of toys purchased rather than changes in equilibrium spending on toys. We choose to focus on unit changes because this allows us to directly investigate whether consumers purchased *fewer* toys (or fewer toys of a particular type) in Christmas 2007 as was predicted in consumer surveys and in the media. However, because we are also interested in whether consumers explicitly shifted to higher priced toys (perhaps because of a perception of greater safety), in Appendix tables we report sales figures as measured in dollars.

To account for idiosyncratic time trends, Table 4 scales quarter four sales by quarter one sales. We refer to this measure as "adjusted Christmas season sales". This measure is appealing in that certain toys, manufacturers, and/or properties might have been on an upward trend and would have, in the absence of the wave of toy recalls, experienced higher sales in Christmas 2007 as compared to Christmas season 2006.[23] Not allowing for this adjustment implicitly assumes flat year-to-year sales. On the other hand, some readers might be concerned that our estimated losses using adjusted Christmas season sales are driven by a spurious increase in quarter one sales. We thus also present unadjusted quarter four to quarter four differences across years.

The sales figures show several interesting things. First, adjusted 2007 Christmas season sales in the overall Infant/Preschool toy market were down 25 percent as compared to 2006 (unadjusted sales were down almost 13%).[24] Second, firms that did not experience any recalls of their own also sold fewer toys. Third, there is no clear relationship between the number of toy recalls experienced

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[23]   For example, news stories report that RC2 was expecting a strong Christmas season in sales before its highly publicized recall in June 2007. Data on quarter one sales indeed show a strong early year performance in RC2 sales.

[24]   Adjusted dollar sales were down about 17 percent while unadjusted dollar sales were down about 12 percent. The fact that adjusted unit sales fell by more than adjusted dollar sales suggests that while consumers reduced the number of toys they purchased at Christmas 2007, there was also some substitution towards higher priced toys.

and a firm's change in Infant/Preschool sales.[25]   Mattel, by far the largest producer in the Infant/Preschool supercategory, had 12 recalls in 2007; yet their 2007 Christmas season sales decreased only 18 percent relative to Christmas season 2006, adjusting for quarter 1 sales. In fact, of the four Top 10 firms that had recalls -- Mattel, Hasbro, RC2, and Jakks Pacific – only RC2 experienced a loss in sales larger than the general loss for the total market. And some of the companies that did not have any of their own toys recalled – including Tomy, Poof Toy Products, and Russ Berrie – had larger than average losses.

One possible explanation for this lack of a relationship between recalls and a named manufacturer's total level of Infant/Preschool sales is that firms are diversified across categories to varying degrees. So, if consumers infer that a particular category of toys poses a lead-related safety risk, consumers may substitute from that category to other categories of toys. Firms that are highly concentrated in the affected category will experience large sales losses while firms that are diversified across categories may experience non-losses or even increases in sales in other categories. To be clear, recalls can have both a negative industry spillover effect -- by which consumers reduce their purchases of all toys because of an updated expectation of risk -- and a positive substitution effect, by which consumers substitute away from recalled items/categories to non-recalled items/categories. Put differently, consumers may buy fewer toys altogether, but, when they do buy, shift their purchases to avoid toys or categories that have experienced recalls.   If substitution happens at the level of the category and not the manufacturer, then manufacturers who experience recalls but who are diversified across categories may actually experience smaller than average sales losses. Manufacturers may also be able to encourage this substitution by offering lower prices

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[25]   Note that our sales data are for the infant/preschool supercategory of toys, but the CPSC recall announcements do not specify the category of the recalled toy. We therefore count all recalls in this exercise.

and/or promotions in unaffected categories or by making fixed cost investments in rebuilding their brand name.

We investigate this speculative explanation informally by documenting the diversification across categories among the top producing firms. Table 5 reports the share of a manufacturer's sales across the 13 infant/preschool categories. The bottom row reports the calculated Herfindahl-Hirschman Index, defined as the sum of the squares of shares over categories. The most diversified firms are Mattel (HHI of 1,863), Hasbro (HHI of 1,809), and MGA (HHI of 1,776). Playmobil only produces in the figures and playsets cateogry, yielding an HHI of 10,000. Relevant to the patterns in Table 4, as compared to Mattel, RC2 and Tomy are heavily concentrated in one particular category: preschool vehicles. A potential implication of this is that a shift away from purchases of preschool vehicles (say, following the recall of RC2 Thomas and Friends trains) would mean heavy sales losses for RC2 and Tomy, with no positive substitution into alternative categories to offset these losses.

Appendix Table 5 reproduces Table 4 using dollars rather than units as the sales measure. This table shows a decrease of 12 percent in adjusted quarter 4 sales of infant/preschool toys. This reduction is nearly half the magnitude of the units reduction reported in Table 4. This would be consistent with consumers buying fewer toys, but substituting remaining toy purchases toward more expensive toys. Recall that the CEX data described above showed an increase in household expenditures on the broader category of children's toys, games, arts and crafts products, etc. Together these two findings suggest that consumers reduced the number of infant/preschool toys they purchased, but shifted their maintained purchases to more expensive products.

E. Regression Analysis

To investigate these issues more precisely, we estimate a standard difference-in-difference regression at the level of manufacturer-category. We again focus on Christmas season sales as

measured by quarter 4 (q4) sales. We keep a manufacturer-category in the regression sample if the manufacturer has at least 35 transactions in the fourth quarter of 2005. We additionally require that the manufacturer-category has positive fourth quarter sales in all three years. We make this second restriction because, as mentioned above, we have no way to determine if zero sales in the NPD data reflect no such items being purchased in the NPD sample or item exit from the market.

We estimate the following regression equation, at the level of manufacturer-category:

$$
\begin{aligned}
\text{Log(UnitsQ4)}_{mct} = {} & \beta_0 + \beta_1 (\text{Recall}_{mct} * \text{yr07}_t) + \beta_2 (\text{Recall}_{mt} * \text{yr07}_t) + \\
(4)\quad & \beta_3 (\text{Recall}_{mct} * \text{yr06}_t) + \beta_4 (\text{Recall}_{mt} * \text{yr06}_t) + \beta_5 (\text{Recall}_{mct} * \text{yr05}_t) + \\
& \beta_6 (\text{Recall}_{mt} * \text{yr05}_t) + \beta_7 (\text{yr07}_t) + \beta_8 (\text{yr06}_t) + \mu_{mc} + \varepsilon_{mct}
\end{aligned}
$$

The equation includes indicators for whether the manufacturer-category experienced a recall during the calendar year $-Recall_{mct}$-- and for whether the manufacturer experienced any recall during the calendar year (in any category) $-Recall_{mt}$. We interact the recall indicators with year dummy variables so that the effect of having a recall during the calendar year is allowed to vary by year. We identify a recall as belonging to one of the 13 Infant/Preschool categories if the item in a CPSC recall announcement appears in our sales data. In other words, if a particular item does not appear in the NPD sales data, we make the assumption that it is outside one of these categories. Note that such a recall would still be reflected in the indicator variable for a recall to the manufacturer. The regression controls for mean differences in sales across years with year main effects and mean differences across manufacturer-categories with manufacturer-category fixed effects.

Table 6, panel (a) reports the results. The estimated coefficient on the year 2007 indicator suggests that quarter four sales in 2007 are down 27 percent compared to year 2005. The point estimate on the indicator variable for having a recall at the level of manufacturer-category in 2007 is negative, suggesting that relative to other categories of toys produced by the manufacturer, consumers shift purchases away from the type of toy produced by a manufacturer involved in a

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recall. The estimated effects are statistically significant at the 10 percent level. The conditional effect on having a manufacturer recall outside the category is positive. Consistent with our observation above, this suggests that consumers may be shifting purchases from affected to unaffected categories within a manufacturer. In a similar analysis not reported, we replace the recall indicator variables with counts of the number of recalls to a firm. The count variables are not statistically significant.

The fact that we do not find a negative coefficient on the manufacturer-level recall indicator suggests that consumers are not "punishing" manufacturers who experience recalls by reducing purchases of the manufacturer's items in unaffected categories.[26] This may be because consumers do not infer additional information about dissimilar toys produced by a named manufacturer, beyond what they infer for all toys, or because consumers are simply not aware of which toys are produced by which manufacturer. [27] Indeed, the prevalence of properties increases the likelihood that brand or trademark association may be stronger than manufacturer association in this industry.[28]

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[26] In our baseline specification we do not include an indicator for recalls at the category level because recalls occur in 12 out of 13 of the categories in our data, with infant/plush being the unnamed category; the indicator is thus highly collinear with the 2007 year dummy.

[27] It is also possible that this variable is picking up the large diversified manufacturers such as Mattel and Hasbro and capturing the fact that their categories that did not experience recalls followed different patterns than categories of manufacturers who had no recalls at all (captured by the 2007 dummy). We consider this possibility when we carry out our in-depth analysis of two of Mattel's recalls.

[28] One might worry that are results are confounding demand and supply responses. However, the timing of manufacturers' supply decisions suggests that this is unlikely to be the case. Based on several industry sources, it is apparent that, at least for the large toy manufacturers, development decisions for Christmas season offerings usually begin about one and half years in advance (i.e.: decisions about what toys to offer for Christmas 2007 would have begun in Spring 2006) and retailer orders are usually placed about a year in advance. Actual production of the toys (most of which takes place in China) begins several months later. As a result, it is unlikely that manufacturers could significantly alter their product offerings at Christmas 2007 in response to recalls experienced earlier in the year. While retailers might be able to do some modifications to their offerings in response to

To investigate how consumers respond to recalls that involve items that are branded or trademarked, we estimate property level regressions. We identify recalls that are part of properties if the CPSC recall announcement mentions the property's name in its description of recalled toys. We first estimate the following regression:

$$
\begin{aligned}
(5) \quad \text{Log(UnitsQ4)}_{pct} = {} & \beta_0 + \beta_1 (\text{Recall}_{pct} * \text{yr07}_t) + \beta_2 (\text{Recall}_{pt} * \text{yr07}_t) + \\
& \beta_3 (\text{Recall}_{pct} * \text{yr06}_t) + \beta_4 (\text{Recall}_{pt} * \text{yr06}_t) + \beta_5 (\text{Recall}_{pct} * \text{yr05}_t) + \\
& \beta_6 (\text{Recall}_{pt} * \text{yr05}_t) + \beta_7 (\text{yr07}_t) + \beta_8 (\text{yr06}_t) + \mu_{pt} + \varepsilon_{pct}
\end{aligned}
$$

We keep a property-category in the regression sample if the property-category has positive fourth quarter sales in all three years and the property has at least 35 transactions in quarter 4. There are no recalls of licensed toys in 2005, so those indicators drop out of the estimated regression model.

Table 6, panel (b) reports results at the property-category level. Again the data show a decrease in 2007 quarter four sales as compared to year 2005, although the effect is not statistically significant. The estimated coefficients on the indicator variables for having any recall in the property and in the particular category suggest similar patterns to the manufacturer-category regressions, though the estimates are smaller in magnitude and not precisely estimated. The point estimate on the indicator variable for having a recall in the property-category is negative and the point estimate for having any recall in the property is positive. This would be consistent with consumers shifting away from a particular type of toy (i.e. in the category) in the property after such a toy was recalled, and shifting toward dissimilar toys within the property.

Table 7 considers the role of media coverage in eliciting a consumer response to recalls. We measure news coverage using the LexisNexis database of Major U.S. and World Publications. We count the number of news articles mentioning the name of the company and the words "toy" and

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recent recalls (for example, change how they allocate shelf space across products), this would reflect their expectations of consumer demand and hence be a demand rather than supply response.

"recall" in the 30 days immediately following the occurrence of the recall. We run OLS regressions similar to those described in equation (4) above, but instead of allowing the effect of a recall to vary across years, the specification includes interaction terms of the recall indicator with the level of coverage. Our aim with this specification is to determine whether the manufacturer-category sales reduction associated with a 2007 manufacturer-category recall – seen in Table 6 – is related to the amount of news coverage. Coverage is categorized as low (fewer than 10 news stories), medium (10 to 100 news stories), and high (more than 100). The coefficient on the high coverage indicator is -0.429, with a standard error of 0.182. When the recall indicator is restricted to lead recalls, the estimated coefficient on a high coverage recall is -0.705, with a standard error of 0.217. The reduction in sales at the manufacturer-category level is statistically significant at the 10 percent level for medium coverage recalls. The data do not indicate an effect on sales of low coverage recalls.

The results in this table provide suggestive evidence that the media attention to these lead recalls of 2007 was important in driving the observed consumer response. The bottom of Table 7 indicates cell sizes and reports that there are 8 manufacturer-category observations with a high coverage manufacturer-category recall and 13 manufacturer-category observations with a high coverage manufacturer recall (outside its particular category). As it turns out, these are all Mattel observations. The manufacturer-category observations with medium coverage news stories are all Mattel and RC2 observations. The fact that the observed sales reductions in Table 6 panel (a) seem to be driven in large measure by the high profile recalls to Mattel and RC2 motivates the following section.

F. *An In-Depth Examination of Three High Profile Recalls*

In this section we complement our regression analyses with a detailed examination of the demand response to the three highest profile recalls of 2007. Honing in on particular cases in this

way allows us to consider impacts at the level of manufacturer-category-property. Data limitations preclude us from using regression techniques to estimate with statistical precision impacts at this triple-interaction level. [29]

On June 13, 2007 and September 26, 2007 RC2 announced two separate recalls of Thomas the Tank Engine wooden trains, buildings, and other train set items. The first recall involved 1.5 million toys and the second involved an additional 200,000 toys. Both recalls were a result of excessive levels of lead paint. On August 2, 2007 Mattel recalled 967,000 various figures and other toys sold under the Fisher-Price brand because of excessive lead in the surface paint. Most of the toys involved in the recall were part of the Sesame Street and Dora the Explorer properties. These recalls received significant media attention, as noted in Appendix Table 4. Furthermore, each of these recalls involved an extremely popular property. As Appendix Table 3 indicates, Thomas the Tank Engine is the second largest Infant/Preschool property and Sesame Street and Dora the Explorer are, respectively, the seventh and eighth largest properties in the supercategory.

Table 8 considers the RC2 recalls of toy trains and accessories in the Thomas the Tank Engine railroad property. We start by examining what happened to RC2's sales in the affected category-property: "Vehicles" produced under the "Thomas & Friends" brand. The first column of the table shows that RC2's adjusted Christmas season sales of Thomas vehicles decreased by 58.5 percent in 2007. RC2's non-Thomas vehicles experienced a similar sales decline (column 3) which

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[29]   Appendix Table 4 lists all of the 2007 CPSC toy recalls and indicates which involve toys observed in our NPD infant/preschool data. There are a total of six properties that are named in at least one lead recall in 2007: Thomas and Friends (RC2 recalls, 6/07 and 9/07); Dora the Explorer, Sesame Street, and Go Diego Go! (Mattel recall, 8/07); GeoTrax (Mattel recall, 9/07); and Baby Einstein (Kids II recall, 10/07). In this section, we focus on three of these. We do not include detailed examinations of the other three property recalls for the following reasons: (1) The Go Diego Go! property did not exist in the first half of 2006; (2) Our Lexus-Nexis search finds only three articles mentioning the Kids II Baby Einstein recall; and (3) the GeoTrax property is an exclusive Mattel brand and therefore is not produced by other manufacturers. In addition, the

suggests that consumers substituted away from the RC2 vehicle category and the sales loss in this category is not property specific.[30] In contrast, RC2's sales outside the affected category and affected property (column 4) increased slightly over this period. This is consistent with our findings above that firms are not experiencing sales losses in unaffected categories and may even be experiencing sales increases.

Next we examine how RC2's recalls affected sales to competitors' products within the property and within the category. Column five of the table indicates that adjusted Christmas season sales of Thomas vehicles produced by firms other than RC2 were down 42.9 percent. Sales of Thomas items outside the vehicles category were also down by more than 40 percent. (This contrasts with what we find below following the Mattel recall of Dora products.) Sales of items outside of the manufacturer, category and property (column 8) decrease by 21 percent, which is similar to our findings in our regressions. The data do not show a larger loss in sales for non-RC2/non-Thomas vehicles as compared to non-RC2/non-Thomas sales outside the category (column 7 versus column 8) which suggests consumers are substituting away from toys in the category that are neither produced by RC2 nor produced under the Thomas brand. To summarize, in the case of RC2's recalls, in addition to the direct effect of the recall on the affected manufacturer-category-property, we also see negative effects on sales in the manufacturer-category (outside the property) and on the property (outside the manufacturer, within and outside the category).

This finding that consumers moved away from non-RC2 Thomas items at twice the rate of non-Thomas items suggests that either consumers used RC2's recalls to update their expectations

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GeoTrax recall involved fewer than 100, 000 units. Comparable case study tables for these events are available from the authors upon request.

[30]   There are too few RC2 non-vehicles Thomas toys in the data to permit an examination of spillover effects within the manufacturer and property but outside the category.

about the safety of all Thomas toys or consumers were confused about which Thomas items were included in the recall. While we cannot formally test between these hypotheses, we point out that the RC2 recall is a case where consumer confusion could easily arise because the Thomas items produced by the various different manufacturers sharing the Thomas license are quite similar.

Table 9 conducts a similar exercise for Mattel's recall of Dora the Explorer items. The first column of the table shows that Mattel's adjusted sales of Dora Figures and Playsets decreased by 53 percent. This again provides evidence of a large direct effect of a recall on the affected manufacturer-category-property. As in the RC2 case, Mattel's adjusted sales in the category but outside the property also decrease, in this case by about 38 percent (column 3). Both of these numbers are substantially larger than the overall 17 percent sales decrease that Mattel experienced (from Table 4). However, Mattel's adjusted sales outside the category and outside the property (column 4) fell by only 12 percent. Consistent with what we have found earlier, this again suggests that there is no net negative spillover to the manufacturer's sales outside the category and property.

Perhaps the most interesting patterns in Table 9 appear in columns two and six. These columns look at the change in sales of Dora items outside the Figures and Playsets category, so spillovers across categories within the property.[31] Column two indicates that Mattel's sales of Dora items in unaffected categories did not decrease and actually increased slightly. Column six indicates that rivals' sales of Dora items in unaffected categories increased by more than 40 percent.

These numbers suggest that after Mattel's recall of various Dora Figures and Playsets, consumers did not decrease their purchases of other Dora products, but instead substituted specifically towards other types of Dora toys. Furthermore, this suggests that consumers did not interpret Mattel's recall as providing information about the safety of all Dora items. Nor were they

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[31] It appears that Mattel has exclusive licensing rights to produce figures and playsets in the Dora brand, as there are no sales of Dora figures and playsets made by other manufacturers.

confused by Mattel's Dora recall; rather, they interpreted as providing information about the safety of specific Dora items. Note that these effects contrast with what we found in the case of RC2's recall where we observed that rivals' sales of Thomas items (within and outside the affected category) decreased. Note, however, that there is less heterogeneity in the types of toys produced under the Thomas brand than under the Dora brand. Most Thomas items are trains or train-related accessories. In contrast, the Dora items that were not in the affected Figures and Playsets category included things as diverse as umbrellas, a Dora kitchen, and Dora electronic learning toys. The patterns in this table are not consistent with broad confusion about recall details – i.e., remembering the brand, but not the specific toy -- but they are consistent with (arguably) reasonable inferences about product safety.

Finally, Table 10 considers Mattel's recall of Mattel Sesame Street figures. As in Table 10, the data indicate that sales of toys by Mattel in the affected category-property fell by 52.4 percent, roughly twice as much as the general decrease in toys and three times as much as Mattel's overall decrease. Mattel has exclusive licensing rights to much of the Sesame Street brand, so there is not much scope to explore broader effects on the property. The data again fail to show any evidence of a net negative spillover to Mattel sales outside the category and property. To the contrary, there is a 27.5 percent increase in Mattel's adjusted infant/preschool toy sales outside the affected categories and property. This observation is consistent with consumers substituting from affected to unaffected categories in a way that favors more diversified firms. The last two columns of the table indicate sales decreases for other manufacturers outside the property that are quite similar to the 25 percent that we have found above.

In summary, these focused case studies show that; (a) in all three cases, there was a large decrease in adjusted sales in the affected manufacturer-category-property; (b) there were negative

spillovers to the manufacturer's sales within the category, but no apparent negative spillover to the manufacturer's sales outside the category or property; and (c) there were negative spillovers to rivals' sales in the affected property when the types of items included in the property are very similar (the Thomas case) but positive spillovers to rivals' sales in the property when the types of items inside the property are dissimilar. These patterns are broadly consistent with consumers drawing reasonable inferences about toy safety.

V. Additional Considerations

A. The Stock Market Response to Toy Recalls

In this section, we investigate the impact of the recalls on the stock market performance of toy manufacturers. We use data on daily stock market prices from the Center for Research in Security Prices (CRSP) accessed through Wharton Research Data Services (WRDS). This database is the standard in the event study literature, providing the most comprehensive information on all US stocks listed on the NYSE, AMEX, and the NASDAQ. We obtain daily end-of-day stock quotes between 2004 and 2007 for all firms identified as toy manufacturers that are listed on any of the three exchanges.[32] To identify toy manufacturers, we use Mergent Online, a database of business characteristics, to collect primary and secondary Standard Industry Classification (SIC) codes for firms. We identify firms as toy manufacturers if any of their SIC codes fall in categories 3942 (Dolls and Stuffed Toys) or 3944 (Games, Toys, and Children's Vehicles, Except Dolls and Bicycles). We identify 18 such firms. Many of the recalls named firms that are not publicly traded, so we cannot conduct our analysis on the full set of toy recalls. Our resulting event sample includes 25 events

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[32] A few of the publicly traded firms named in the CPSC toy recalls are outside this set of toy manufacturers. These tend to be retailers who exclusively sell a recalled toy, for example, J.C. Penney. In one instance Eveready Battery Co. was named in a recall of a child's toy flashlight. We

involving 8 firms; 13 of these recall events occur in 2007. Note that these recalls are not limited to infant/preschool toys; thus, this sample of events and firms does not overlap entirely with our sample of recalls and toys considered in our analysis of sales.

Appendix Table 7 lists the 25 events, the characteristics of the recall announcement, and the named firm in the recall event. We use data on the remaining 11 toy manufacturers who were not named in recalls over this period when we consider spillover effects. With a sample size of only 25 events, we are severely limited in our ability to estimate cross sectional patterns in the stock market effects, such as the average difference in the response to a lead paint related recall and a choking hazard recall.

We begin by plotting the stock market prices of toy producing firms that did and did experience a recall in 2007 along with other stock market indices. Figure 4 plots trends in four stock market indices, two of which are created by Fama and French. These include a market index of all NYSE, AMEX, and NASDAQ firms and an index of firms producing consumer goods. The other two indices we create for toy producers. They are value-weighted indices of the 18 toy manufacturers traded on the three major U.S. exchanges in our data. We separate these into separate indices for the 7 firms that had at least once recall in 2007 and 11 firms that did not. All indices are normalized to one on January 1, 2006.[33]

These raw data show that toy firms that experienced recalls outperformed relative to the market index until mid 2007, and then greatly underperformed relative to the market index, with toy firm stock prices falling drastically while the market showed no break in trend. The index of toy firms with recalls increased 19.6 percent from 1/3/07 to 5/22/07 – the peak – and then fell 25.6 percent from 5/22/07 to 12/31/07. The index of firms without recalls increased 31.1 percent from

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focus on toy manufacturers because the equity value of non-toy manufacturers is unlikely to be affected by a toy recall.

1/3/07 to 5/22/07 and then fell 7.6 percent from 5/22/07 to 12/31/07. In comparison, the stock market performance of consumer good firms moved very closely to the market.

This decline in market performance of toy firms over the third quarter of 2007 coincides with the increasing frequency of toy recalls and two other patterns seen in the description of the recalls in Appendix Table 7. First, eight of the ten recall events in the second half of 2007 were lead related, whereas only one had been prior to this period. Second, this period was characterized by much higher press coverage of recalls. The table reports the number of news articles mentioning the name of the company and the words "toy" and "recall" in the LexisNexis database of Major US and World Publications over the thirty days prior to the recall announcement and the thirty days following the announcement. There had been very few news articles covering earlier recalls, but the 2007 lead paint recalls received large amounts of media coverage. For example, there were 551 articles within 30 days of Mattel's August 14, 2007 recall.

We view the stock price patterns as prima facie evidence that toy firms in general experienced a drop in stock value relative to other sectors during the wave of 2007 toy recalls. Event study analysis will allow us to identify if this decline can be linked to specific recall announcements. We conduct an event study in the spirit of Jarrell and Peltzman (1985) following the methodology laid out by MacKinlay (1997) to quantify how the announcement of a toy recall affects the stock return of the firm named as the manufacturer of the recalled product. To the extent that the information provided by a recall is "news" – that is, not fully expected – then the capital market should respond to that information, and the firm's stock price should adjust to reflect the market's expectations about how the "news" contained in the recall announcement will affect the firm's future cash flows. This has its theoretical foundation in the efficient market hypothesis (Fama 1970).

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[33]   All indices are built from returns that have been adjusted for stock splits and dividends.

The basic strategy of an event study is to estimate the relationship between the affected firm's daily stock return and an index (or set of indices) of market performance over an estimation window, which is a period of time preceding the event. These parameters are used to calculate the predicted returns to the affected firm during the event window, which is a period of time surrounding the event. Abnormal returns are then calculated as the difference between the actual returns and the predicted returns over the event window. Thus, abnormal returns can be thought of as the portion of the affected firm's return that is in excess of its usual relationship with the market. These abnormal returns represent the impact of the event, or the news, on the firm's market value. Summing abnormal returns over a given interval for event i provides an estimate of cumulative abnormal returns (CAR) for that event. We can also average abnormal returns for a given day or cumulative abnormal returns for a given interval across events. This allows us to explore the average effect of a recall and understand how it accumulates over time, both before and after the actual recall, if information about the recall leaked prior to the actual announcement or was accumulated slowly after the announcement. The details of our estimation approach are contained in Appendix 8.

Figure 5 plots average abnormal returns associated with 2007 recalls and their 95% confidence intervals by event day over the period ranging from event day -10 to 10. There are statistically significant negative average abnormal returns on the day of the event but not any other days, consistent with the efficient market hypothesis that all information is immediately incorporated into a firm's market value.

Table 11 presents mean cumulative abnormal returns (CARs) for 2007 recalls and 2004-2006 recalls separately. We do this to allow for a differential effect in 2007, in light of the different nature of these recalls and the heightened media attention. For both sets we report mean CARs for a two day period -- which includes abnormal returns cumulated over the day of the announcement and the

following day -- and a three day period, which includes the day prior to the announcement through the day following the announcement. We include the day following the announcement to account for the possibility that information about the announcement is not incorporated immediately on the announcement date. We include the day prior to the announcement to account for the possibility that information about the recall is leaked prior to the official announcement. Because some recall events occurred close in time to others, we present results from short event windows to minimize confounding effects of nearby recalls.[34]

For 2007, over a two day window, the mean CAR indicates a 0.09 percentage point lower return as a result of a recall announcement; adding the day prior to the recall changes the estimated CAR to a 0.37 percentage point lower return. Neither estimate is statistically significant at the 5% percent level. The point estimates of the two day CARs associated with the thirteen 2007 recalls are more negative than those associated with the twelve recalls between 2004 and 2006. The final column of the table illustrates that more events produced negative CARs in 2007, with 69 percent and 46 percent of events resulting in negative CARs in 2007, depending on the event window, and 50 percent of the 2004-2006 recalls producing negative CARs.

Table 12 reports the estimated abnormal returns separately for each of the 13 firm-recall events in 2007. (For the sake of space, we do not list the 12 firm-recall events in 2006, but none of the 2006 recalls are associated with statistically significant abnormal return estimates.) Looking separately by firm-event, it becomes clear that the mean negative abnormal return shown in Figure 5 is driven by the stock market response to RC2's September 26 recall of Thomas and Friends trains. This event is associated with an estimated abnormal return of -0.091, standard error of 0.023. However, the data suggest some recovery, and the 11 day CAR associated with this event is -0.032,

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[34]   Excluding events with other events occurring in their 2 or 3 day window does not change the qualitative results.

standard error of 0.077. This table also reveals that two events – Hasbro's July 19 recall of Easy-Bake ovens and Mattell's multiple recalls on August 14 both were followed by statistically significant negative CARs, though the estimated day 0 abnormal returns are not statistically significantly different from zero.

It is interesting to consider the possibility of differences in the stock market response to successive recall(s). Consider the following possibility: once Mattel recalls a product, consumers and investors update their belief on the probability that Mattel will announce future recalls.   If subsequent recalls are less of a surprise, the stock market response to these subsequent recalls would be smaller. Another possibility is that the stock market response to a particular firm's recall depends on the cumulative number of recent recalls in the industry. Later recalls would lead to a smaller stock market response if consumers and investors had already updated their expectations about product safety and the profit consequences thereof. We attempted both of these things and the analysis was unable to detect statistically significant differences in estimated abnormal return by calendar time.

Another interesting consideration is the spillover effects of one firm's recall on the stock returns of other firms in the toy industry. If a recall announcement negatively impacts investor expectations for general industry profit – due either to a loss in consumer demand for toys (because of a broad perception of heightened risk) or an expected increase in regulation compliance costs – there will be a negative spillover to other firms' equity value. On the other hand, any expected loss of future profits through these channels could be offset by an expected increase in consumer demand for competing firms' products. Unfortunately, the clustering of toy recalls in 2007 prohibits us from separately identifying the direct effect of an own firm's recall from the spillover effect from another firm's recall. Of the 25 events, 23 have another recall occurring at some point during the 21

day window; 11 have recalls occurring during the 3 day window; and five have events occurring during the 2 day window.[35]

We conclude from our analysis of stock returns that the relative decline in the stock market performance of toy manufacturers over the second half of 2007 is most appropriately characterized as a gradual investor response to a perceived industry wide problem. We cannot discern in this paper whether the investor response reflects expectations about general consumer demand for toys or expectations of higher costs of regulation compliance for the industry as a whole. We can conclude that the loss in shareholder wealth in the toy industry over the second half of 2007 is not characterized by a series of negative abnormal returns to a particular firm following its own recall announcements.[36]

B. *"Made in China"*

A final consideration is the possibility that there was a market response specifically targeted at toy firms producing in China. The above-cited Harris Poll found that 45 percent of respondents

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[35] For the interested reader, we conduct an analysis of spillovers, despite the identification challenges to interpretation. We construct a value-weighted index of the 18 publicly traded toy producers excluding the firm named in the recall event. We run an event study examining the returns to this index of competitors in response to recalls to top 15 toy producers (based on total 2005 unit sales.) The only event that leads to a statistically significant CAR among competitors is Mattel's August 2 recall of Sesame Street, Dora the Explorer, and other children's toys. This is at least partially driven by a large drop in RC2's stock price on the day of the recall announcement. However, we cannot attribute this entire effect to Mattel's recall, because on the same day RC2 announced lower than expected second-quarter earnings.

[36] An interesting method for studying the effect of a gradual revelation of information on stock prices is employed by Ellison and Mullin (2001). These authors use isotonic regression methods to examine the effect of the evolution of President Clinton's health care reform proposal over January 1992 to October 1993 on pharmaceutical stock prices. They use isotonic regression to jointly estimate dates of information incorporation and the impact of this information on prices. Our goal in this paper is a bit different in that we have the dates of pertinent information revelation – i.e., the dates of announced recalls – and we are interested in determining the effect of these particular pieces of information on firm stock returns. An interesting issue for future research is to

indicated they would avoid buying toys manufactured in China. As it turns out, almost all infant/preschool toys in the United States are manufactured in China. So what did consumers actually do when it came to making toy purchases? We could potentially quantify the consumer reaction in three ways: (1) What happened to the percent of toys imported from China?; (2) Was there a stock market reaction in terms of weakening stock returns for toy companies who manufacture in China?; and (3) Did the consumer demand for toys made in China decrease, as evidenced by a reduction in equilibrium price and/or quantity?

With regard to the question of imports, a straightforward analysis conducted by the Federal Reserve Board of San Francisco addresses the question of what happened to imports from China (FRBSF, 2008). Their analysis finds that imports in the toy industry actually *increased* relative to forecasted levels. This suggests that imports of toys from China did not immediately fall in response to the wave of 2007 recalls. Of course, it is too early to determine whether the industry will experience long term changes away from Chinese imports. As to the question of the stock market, one could consider whether investors shifted assets away from toy manufacturers who produce in China. It turns out that all of the top 10 and all but two of the top 30 toy manufacturers produce toys in China. It is thus not a fruitful analysis to pursue.

We attempt a simple investigation of whether consumers shifted toy purchases to toys made outside of China. We look at our toy sales data from 2005 quarter 1 to 2007 quarter 4 to see if there is an increase in the share of toys that are manufactured outside of China. By way of background, in the infant/preschool category of toys, there are a handful of notable toy manufacturers producing outside China, including Playmobil 1-2-3 (Malta, Germany); Haba (Germany); PlanToys (Thailand); Siku (Germany); Vikingtoys (Thailand); and Geomag (Switzerland). Some other manufacturers that

consider the stock market performance in terms of the gradual revelation of information about toys from China having elevated levels of lead through newspaper and media stories.

produce mainly in China advertise specific toy items that are Made in the U.S. We had an undergraduate research assistant explore the websites of the top 50 manufacturers producing toys in our NPD sample of toys to identify toys that are noted as being produced outside China. Under the assumption that when not otherwise noted, a toy was manufactured in China, we calculate that the share of infant/PS toys (measured in units) manufactured outside of China. Figure 6a plots these shares for our sample time period from 2005 quarter 1 to 2007 quarter 7. The share ranges from 2.5 percent to 4.9 percent. In 2007, the share is actually at the lowest end of the range. We also examine directly the share of toy sales to the two biggest non-Chinese producers in our data: American Plastic Toys and Playmobil.[37] As shown in Figure 6b, there is no obvious upward tick in their sales trend. Of course, over a longer term horizon, the picture might prove to be different.

VI. Final Discussion

This paper has provided an examination of the consumer response to the highly publicized wave of 2007 toy recalls, almost all of which involved lead in toys made in China. Our analysis of sales data reveals several interesting patterns. First, consumers responded to this wave of recalls by substituting specifically away from a manufacturer's category of toys that were involved in a recall. This indicates that consumers understood and acted upon the information in these announcements. This finding is important because it speaks to whether the costs of information gathering in potentially confusing contexts are prohibitive to consumer action. We document that in the case of the highly-publicized toy recalls in 2007, the costs of information gathering were not prohibitive to eliciting a consumer response. Our results suggest that newspaper coverage of recalls plays an important role in eliciting a demand response.

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[37]   These are the only two manufacturers producing outside China that have substantial sales in our data. Haba has only 22 toys in our data; Plan Toys has 13; Viking Toys, part of International

Second, we find no evidence that consumers specifically shifted away from other types of toys produced by manufacturers' who were involved in a recall. This may be because consumers did not interpret a manufacturer's recall of a particular toy as providing information about the safety of that manufacturer's other toys, relative to toys in general, or because manufacturer association in this industry is particularly weak. Alternatively, it may be because large, diversified manufacturers took measures to bolster sales of unaffected toy categories. Understanding precisely the mechanism preventing a manufacture-wide above-average loss in sales is important to understanding the incentive effects inherent in the recall process. This is another interesting question for future research.

Third, we observe that recalls involving toys that are part of a property can have positive or negative spillovers to sales of rivals' toys in the same property. This suggests that the existence of shared brands generates externalities much like that which exists between franchisees. Each licensee will have suboptimal incentives to invest in protecting the brand. This has implications for the types of protections that licensees may seek to include in their licensing agreements. In addition, this creates the potential for brands to create confusion about manufacturer identification. Such considerations might suggest that the current process of recalls may need to be supplemented with additional information provision that enables consumers to better identify which toys are produced by which firms. This also suggests that manufacturers may have incentives to limit association between their brands and publicize any recalls that do occur under a particular brand rather than the manufacturer name. Furthermore, manufacturers who produce under a brand that is involved in a recall by another firm clearly have an incentive to inform consumers that it was not *their* branded products that were recalled.

Playthings, has only two toys in our data; and Siku and Geomag do not appear in our data.

Finally, we find that consumers reduced overall Infant/Preschool toy purchases in Christmas of 2007. This is consistent with consumers responding to the recalls by updating their beliefs about the safety of toys in general. Our examination of the investor response to a subset of these recalls also reveals industry-wide negative spillovers. At a broad level, the finding that a relatively small number of recalls by a few large manufacturers appears to result in decreased sales – and capital market losses -- for the segment as a whole means that, from an industry perspective, investments in safety are too low. When a shared industry practice is involved, such as production in China in the case of the toy recalls, the potential for spillover effects appears to be especially large. Small manufacturers in particular are likely to bear disproportionate spillover losses in such a context. One implication of this is that manufacturers should have incentives to invest in a set of common industry standards since each is at risk of being "punished" for their rivals' mistakes. The lessons from the toy recalls of 2007 suggest that the institutional features of an industry can influence the extent to which the recall mechanism reduces informational asymmetries and creates incentives for firms to invest in safety.

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Figure 1: Percent of Toy Recalls due to a Particular Hazard
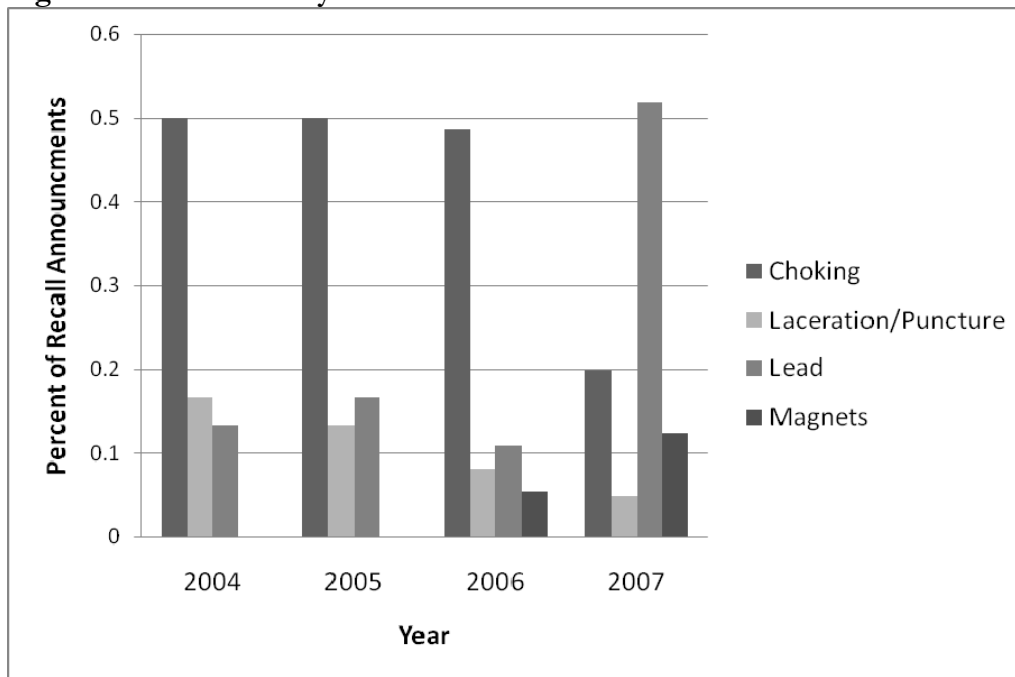
Source: Authors' tabulations of information in recall announcements listed on CPSC website.

Figure 2: Percent of Toy Recalls Involving a Toy Made in China
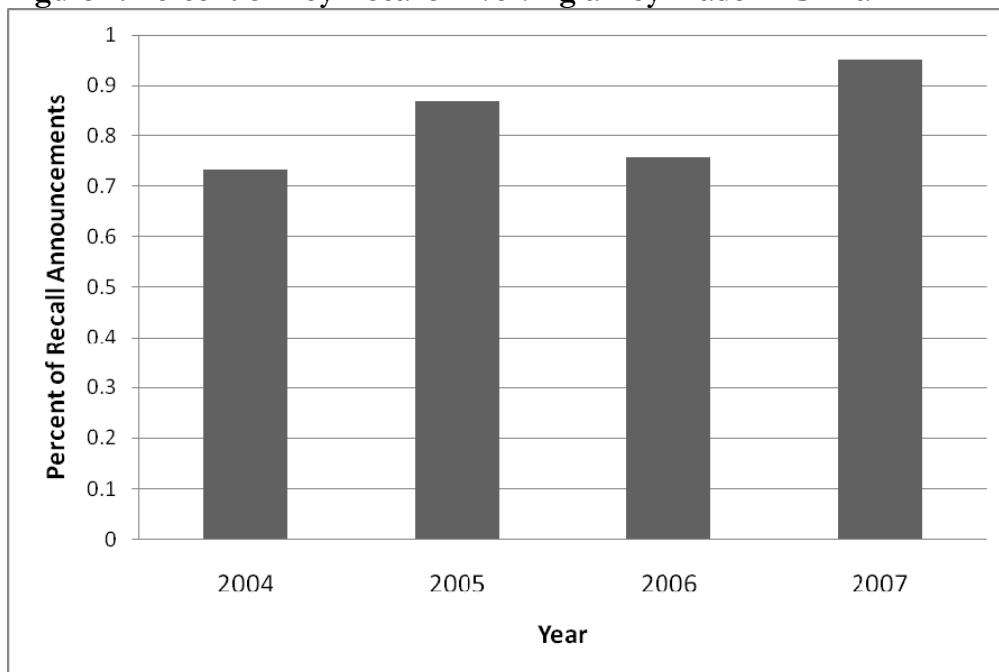
Source: Authors' tabulations of information in recall announcements listed on CPSC website.

Figure 3: Seasonality of Infant/PS Toys

Dollar Share of Infant/PS Toy Sales by Month
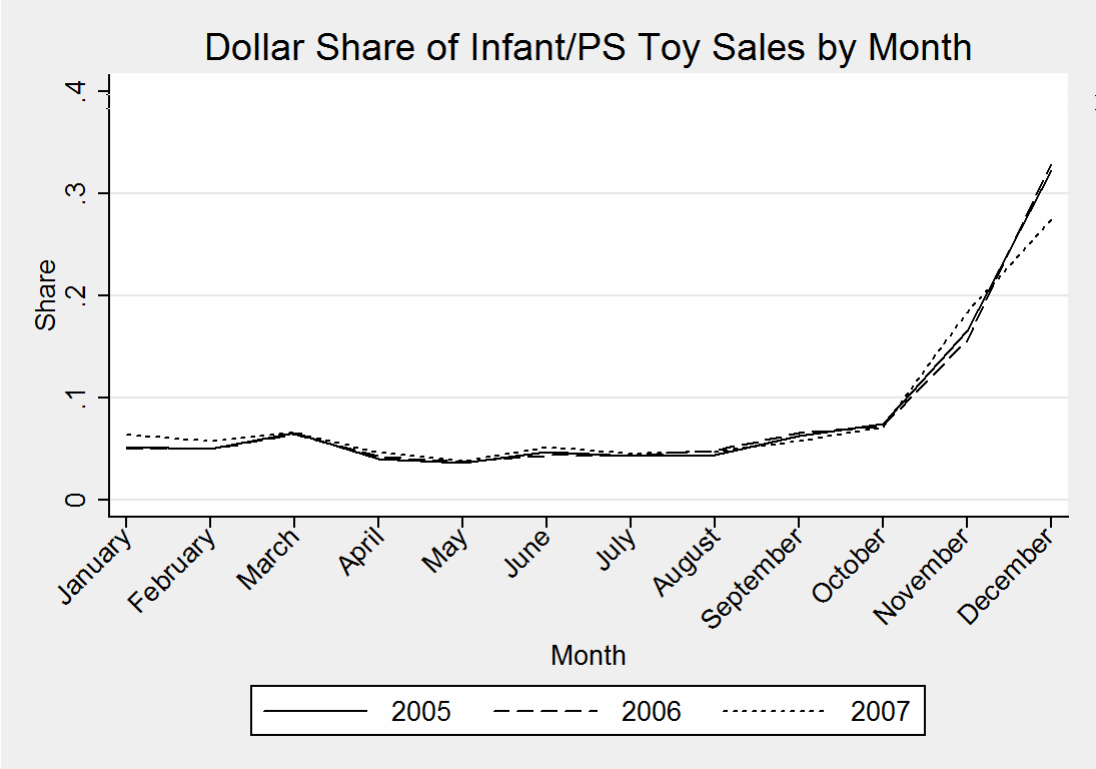
Source: Authors' tabulations of NPD Infant/Preschool toy sales data.

Figure 4: Stock Market Indices of Major Toy Producers Compared to Market Indices
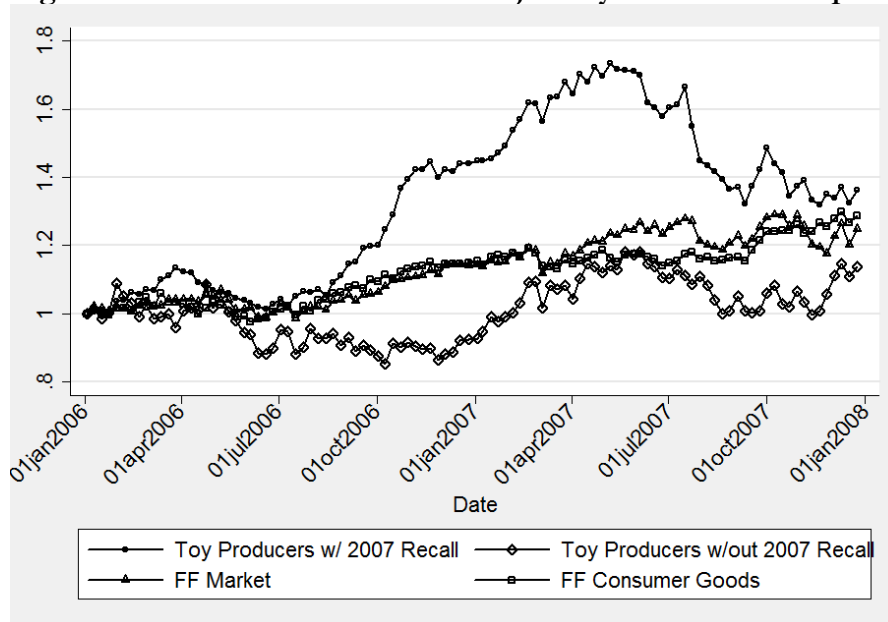
Notes: Toy Producers with and without 2007 recalls are value weighted indices of the 18 firms traded on the NYSE, AMEX, or NASDAQ that have primary or secondary SIC codes indicating toy production. 7 of these firms had a 2007 recall and 11 did not. All other indices are from Kenneth French's website (http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html, last accessed on February 13, 2009). FF Market includes all firms on the three major US exchanges. FF Consumer Goods include firms producing various consumer products.

Figure 5: Average Abnormal Returns in Response to 2007 Recall Announcements, Event Day -10 through 10
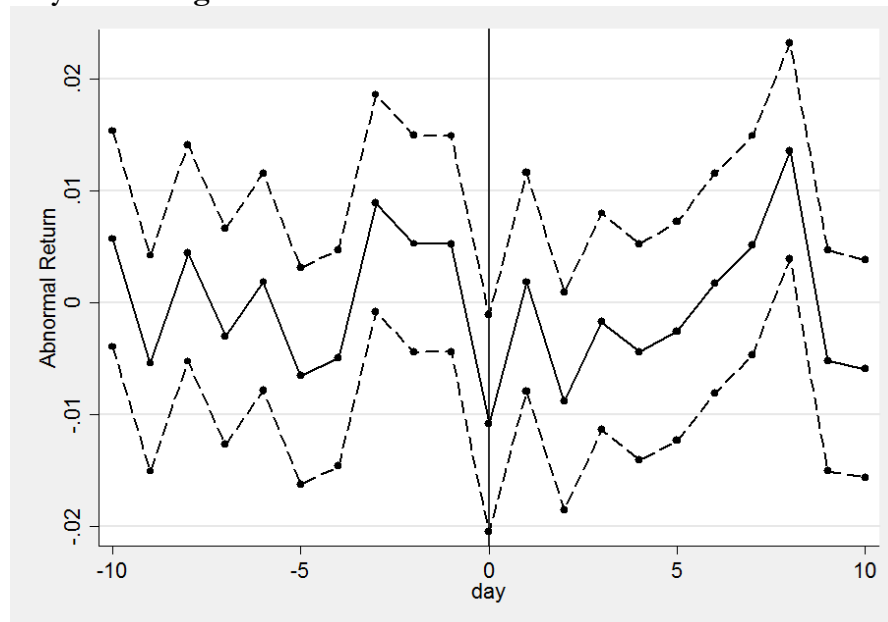
Notes: Solid line represents average abnormal returns to the thirteen 2007 recalls to publicly traded toy manufacturers on day *t*. Dashed lines represent 95% confidence intervals.

Figure 6a: Share of Infant/PS Toys Manufactured Outside of China
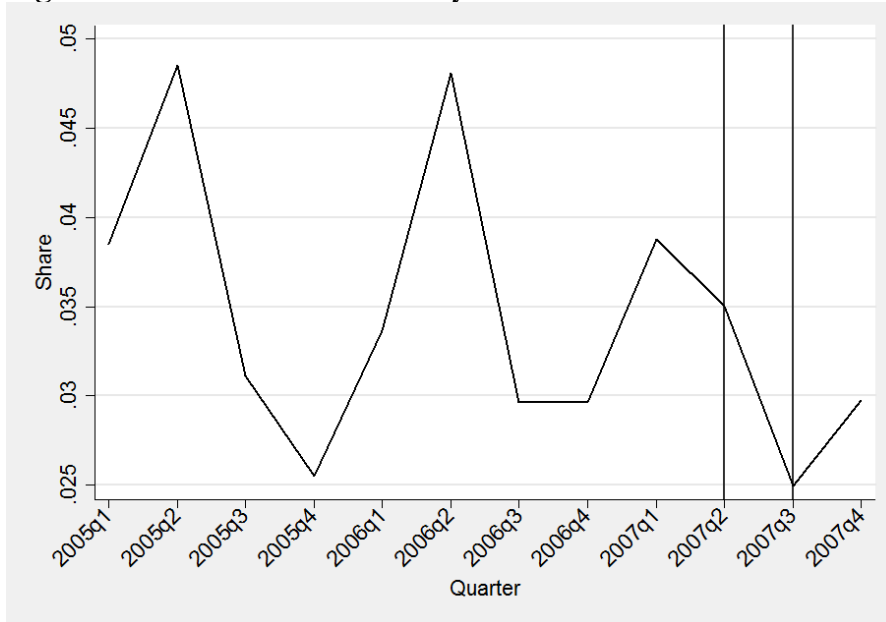
Source: Authors' tabulations on NPD sales data linked to authors' compilation of information on country of production

Notes: Vertical Lines indicate June 13, 2007 RC2 Thomas and August 2 & August 14, 2007 Mattel (including Dora, Sesame Street, etc.), September 4, 2007 Mattel and September 26, 2007 RC2 Thomas, respectively

Figure 6b: Share of Infant/PS Toys by Large Non-Chinese Manufacturers
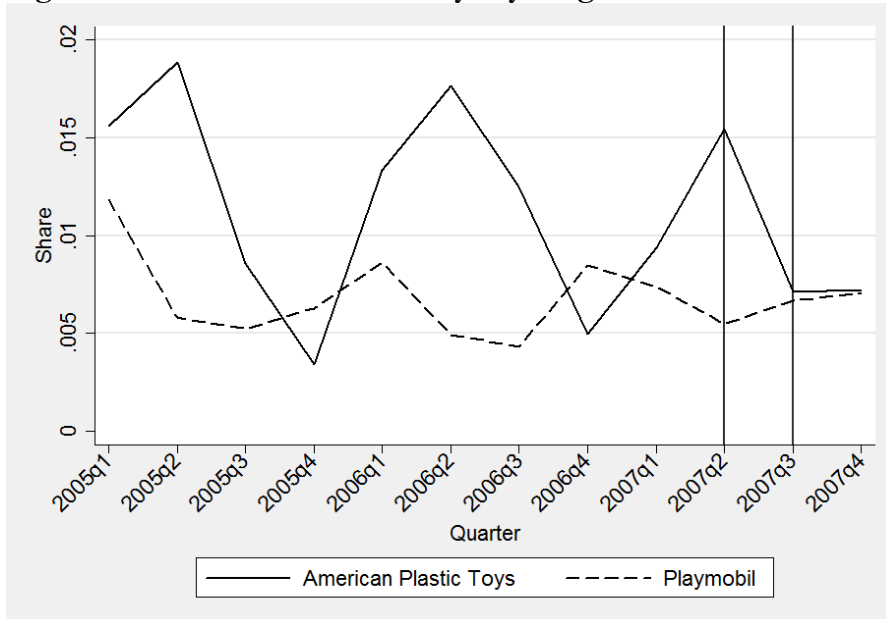
Source: Authors' tabulations on NPD sales data linked to authors' compilation of information on country of production

Notes: Vertical Lines indicate June 13, 2007 RC2 Thomas and August 2 & August 14, 2007 Mattel (including Dora, Sesame Street, etc.), September 4, 2007 Mattel and September 26, 2007 RC2 Thomas, respectively.

Table 1: Number of Recalls in Consumer Products, 2004 - 2007

Year	Children's Products	Household Products	Outdoor Products	Sports & Recreation Products	Toys
2004	42	121	32	50	30
2005	64	122	28	76	31
2006	56	121	47	58	38
2007	130	132	38	64	82

Source: Authors' tabulation from CPSC website

Table 2: Monthly Patterns of Sales, 2005-2007

Dependent Variable:	(A) Log Units			(B) Log Dollars		
	Main Month Effects	**Month EffectsX2005**	**Month EffectsX2007**	**Main Month Effects**	**Month EffectsX2005**	**Month EffectsX2007**
January	--	-0.080	0.270**		-0.017	0.153
		(0.127)	(0.124)		(0.151)	(0.150)
February	0.022	0.172	-0.052	0.029	0.051	-0.044
	(0.124)	(0.179)	(0.187)	(0.143)	(0.207)	(0.215)
March	0.511**	0.126	-0.376**	0.446**	0.056	-0.334*
	(0.115)	(0.180)	(0.171)	(0.137)	(0.207)	(0.201)
April	0.034	-0.024	-0.477**	-0.102	0.037	-0.466**
	(0.136)	(0.190)	(0.193)	(0.158)	(0.220)	(0.224)
May	-0.132	0.216	-0.429**	-0.245	0.165	-0.400*
	(0.132)	(0.191)	(0.195)	(0.150)	(0.214)	(0.228)
June	0.149	0.098	-0.093	-0.003	0.102	-0.035
	(0.123)	(0.177)	(0.185)	(0.154)	(0.215)	(0.222)
July	-0.109	0.373**	-0.069	-0.249	0.261	-0.027
	(0.131)	(0.184)	(0.196)	(0.162)	(0.223)	(0.231)
August	0.171	-0.102	-0.310*	0.088	-0.158	-0.335
	(0.129)	(0.189)	(0.188)	(0.152)	(0.217)	(0.224)
September	0.435**	-0.017	-0.281	0.362**	-0.054	-0.152
	(0.115)	(0.175)	(0.180)	(0.142)	(0.209)	(0.212)
October	0.075	0.230	-0.221	0.043	0.254	-0.078
	(0.132)	(0.183)	(0.190)	(0.156)	(0.212)	(0.221)
November	0.687**	0.232	-0.032	0.833**	0.228	0.132
	(0.119)	(0.175)	(0.176)	(0.145)	(0.204)	(0.206)
December	1.644**	0.075	-0.371**	1.761**	0.130	-0.194
	(0.116)	(0.167)	(0.167)	(0.138)	(0.194)	(0.195)
Constant	1.096**			3.105**		
	(0.083)			(0.103)		
N	3,496			3,505		

Notes: Sample includes observations at the manufacturer-month level. Manufacturers with fewer than 35 total transactions in a given year are excluded from the sample. Robust standard errors in parentheses. Regressions include manufacturer fixed effects. Coefficients refer to recalls during the calendar year indicated. * Statistically significant at 10% level. ** Statistically significant at 5% level.

Table 3: Quarterly Household Expenditures on Select Categories of Goods: Consumer Expenditure Survey (CEX), Interview Survey data

	All consumer units (CUs)			CUs with child(ren)<18 yrs			CUs with child(ren)<18 yrs, household head college grad		
	2005q4	2006q4	2007q4	2005q4	2006q4	2007q4	2005q4	2006q4	2007q4
Toys, games, etc.									
	54.0	57.1	72.6	110.6	105.0	139.3	123.5	121.9	167.9
	(155.3)	(163.3)	(183.9)	(222.9)	(219.3)	(246.6)	(205.6)	(224.3)	(247.8)
Clothing: children and infants									
	87.0	75.5	74.1	194.7	164.3	158.2	280.5	197.0	187.2
	(306.0)	(177.6)	(167.8)	(475.2)	(235.9)	(209.8)	(794.6)	(270.1)	(228.4)
Reading									
	35.5	31.7	32.8	35.7	28.9	28.9	69.5	56.8	53.8
	(71.4)	(62.3)	(68.9)	(74.7)	(59.6)	(63.0)	(111.2)	(87.3)	(92.5)
TV, video hardware & software, and related equipment									
	273.1	262.1	275.8	344.8	317.8	344.0	437.0	410.1	436.5
	(501.5)	(402.4)	(470.7)	(465.3)	(430.1)	(519.2)	(550.3)	(513.9)	(663.2)
Sample size	2,571	5,579	5,403	871	2,020	1,883	254	557	572

Notes: This table reports mean quarterly expenditures based on authors' tabulations of data from the Bureau of Labor Statistics (BLS) Consumer Expenditure Survey (CEX) Interview Survey files from 2006 and 2007, accessed through ICPSR. Data are aggregated from monthly expenditure data at the UCC level on the MTAB files. The *Toys, games, etc* category is defined to be the UCC code for "toys, games, arts and crafts, trikes, and battery powered riders". Monthly expenditures are CPI adjusted to 2007 dollars using the BLS all urban consumers, all-items series.

Table 4: Unit Sales (000s) for Total Market, Top 10 Firms, and Top 2 Firms Manufacturing Outside China

	Total Market	Mattel	Leapfrog	Hasbro	RC2	Vtech	MGA Ent	Poof Toy Products	Tomy	Jakks Pacific	Russ Berrie	American Plastic Toys	Playmobil
2006 q1 Units Sold	43,176	10,727	4,091	2,342	2,824	1,465	1,081	548	1,089	553	864	577	372
2006 q4 Units Sold	116,356	32,579	11,495	9,888	6,441	7,194	3,670	2,280	2,594	2,448	1,337	578	986
2007 q1 Units Sold	49,937	10,819	4,827	3,037	4,867	2,017	1,267	1,021	1,710	1,225	1,019	468	369
2007 q4 Units Sold	101,640	27,014	8,999	9,632	5,707	7,272	3,319	2,384	1,050	3,378	889	732	717
2007 q4 – 2006 q4	-14,716	-5,565	-2,496	-256	-734	78	-351	104	-1,544	930	-448	154	-269
% Change:													
2007 q4 vs. 2006 q4	-12.65%	-17.08%	-21.71%	-2.59%	-11.40%	1.08%	-9.56%	4.56%	-59.52%	37.99%	-33.51%	26.64%	-27.28%
Adjusted % Change:													
2007 q4/q1 vs.													
2006 q4/q1	-24.47%	-17.79%	-33.65%	-24.88%	-48.59%	-26.58%	-22.84%	-43.88%	-74.22%	-37.71%	-43.62%	56.14%	-26.69%
Transactions 2006q4	22,826	6,623	2,370	1,924	1,411	1,403	701	561	532	465	259	68	175
2007 Recalls		12	0	2	3	0	0	0	0	1	0	0	0

Notes: Based on authors' tabulations of NPD infant/preschool sales data on units sold. The total market column includes total infant/preschool sales based on NPD data.

Table 5: Unit Share by Category for Major Infant/Preschool Toy Producers

Category	Mattel	Leapfrog	Hasbro	RC2	Vtech	MGA Ent.	Poof Toy Products	Tomy	Jakks Pacific	Russ Berrie	American Plastic Toys	Playmobil
Other Infant	27.0%	22.9%	17.5%	8.8%	20.8%	20.7%	0.0%	1.3%	2.8%	25.8%	0.0%	0.0%
Other PS	2.1%	0.0%	29.5%	1.9%	0.0%	14.1%	99.4%	5.4%	0.9%	0.2%	0.2%	0.0%
Bath	3.4%	0.0%	1.0%	4.0%	0.0%	5.3%	0.6%	2.3%	0.0%	47.6%	0.0%	0.0%
Infant Plush	3.7%	4.4%	4.1%	2.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.6%	0.0%	0.0%
Mobiles	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.5%	0.0%	0.0%
PS Electronic Learning	6.2%	72.6%	7.2%	0.0%	79.2%	0.0%	0.0%	0.0%	1.0%	0.0%	0.0%	0.0%
PS Figures & Playsets	28.9%	0.0%	12.4%	0.1%	0.0%	2.1%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
PS Learning	1.0%	0.1%	2.0%	1.2%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
PS Musical Instruments	1.2%	0.0%	0.1%	0.0%	0.0%	12.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
PS Role Playing	6.0%	0.1%	5.1%	2.8%	0.0%	15.2%	0.0%	0.0%	84.0%	0.0%	67.0%	0.0%
PS Talking & Sound	9.3%	0.0%	1.7%	2.8%	0.0%	2.9%	0.0%	0.4%	10.9%	0.0%	0.0%	0.0%
PS Vehicles	10.2%	0.0%	19.3%	72.2%	0.0%	26.6%	0.0%	90.5%	0.4%	0.0%	32.9%	0.0%
Rattles/Toy Teethers	0.9%	0.0%	0.0%	4.0%	0.0%	0.0%	0.0%	0.0%	0.0%	25.2%	0.0%	0.0%
HHI	1,863	5,811	1,809	5,347	6,701	1,776	9,878	8,230	7,182	3,572	5,564	10,000

Note: Authors' tabulations of NPD Infant/Preschool sales data on units sold in quarter 4 of 2006.

Table 6: OLS Difference-in-Difference Analysis of the Impact of a Recall during the Year on Manufacturer-Category and Property-Category Quarter 4 Units Sold

(A) Manufacturer-Category Sample			(B) Property-Category Sample		
Dependent Variable: Log(Units)	**All Firms**	**Top 15 Firms**	*Dependent Variable: Log(Units)*	**All Properties**	**Top 15 Properties**
I(07 Recall to Man/Cat)	-0.328*	-0.385*	**I(07 Recall to Prop/Cat)**	-0.131	-0.183
	(0.189)	(0.212)		(0.249)	(0.272)
I(07 Recall to Manuf)	0.326*	0.432*	**I(07 Recall to Prop)**	0.066	0.005
	(0.182)	(0.239)		(0.212)	(0.272)
I(06 Recall to Man/Cat)	-0.118	0.073	**I(06 Recall to Prop/Cat)**	-0.130	-0.155
	(0.281)	(0.239)		(0.358)	(0.380)
I(06 Recall to Manuf)	-0.058	-0.004	**I(06 Recall to Prop)**	-0.158	-0.184
	(0.160)	(0.224)		(0.255)	(0.280)
I(05 Recall to Man/Cat)	0.529**	0.539**	**I(05 Recall to Prop/Cat)**	-	-
	(0.202)	(0.117)			
I(05 Recall to Manuf)	-0.257*	-0.051	**I(05 Recall to Prop)**	-	-
	(0.145)	(0.171)			
I(2007)	-0.269**	-0.227	**I(2007)**	-0.110	0.095
	(0.099)	(0.144)		(0.129)	(0.204)
I(2006)	-0.080	-0.008	**I(2006)**	0.088	0.213
	(0.097)	(0.169)		(0.104)	(0.132)
Constant	11.447**	12.296**	**Constant**	11.559**	12.081***
	(0.066)	(0.089)		(0.075)	(0.094)
N	609	258	**N**	483	201
r2	0.879	0.914	**r2**	0.838	0.906
# of Manuf/Categories	203	86	**# of Props or Prop/Cats**	161	67
# I(07 Recall to Man/Cat)	13	11	**# I(07 Recall to Prop/Cat)**	12	11
# I(07 Recall to Manuf)	56	45	**# I(07 Recall to Prop)**	44	34
# I(06 Recall to Man/Cat)	6	5	**# I(06 Recall to Prop/Cat)**	2	2
# I(06 Recall to Manuf)	59	52	**# I(06 Recall to Prop)**	23	23
# I(05 Recall to Man/Cat)	2	1	**# I(05 Recall to Prop/Cat)**	0	0
# I(05 Recall to Manuf)	26	13	**# I(05 Recall to Prop)**	0	0

Notes: Firm and property ranks determined by total units sold in 2005. Robust standard errors in parentheses. Regressions include manufacturer-category fixed effects in Panel A and property-category fixed effects in Panel B. Coefficients refer to recalls during the calendar year indicated. * Statistically significant at 10% level. ** Statistically significant at 5% level.

Table 7: OLS Difference-in-Difference Analysis of the Impact of a Recall during the Year on Manufacturer-Category Quarter 4 Units Sold by Level of News Coverage

Dependent Variable: Log(Units)	All	Exclude Non-Lead Recalls
I(Low Coverage Man/Cat)	0.178	0.496
	(0.179)	(0.319)
I(Low Coverage Man)	-0.089	-0.030
	(0.130)	(0.278)
I(Medium Coverage Man/Cat)	-0.533*	-0.141
	(0.282)	(0.476)
I(Medium Coverage Man)	0.429*	0.637
	(0.261)	(0.488)
I(High Coverage Man/Cat)	-0.429**	-0.705**
	(0.182)	(0.217)
I(High Coverage Man)	0.835**	1.208**
	(0.345)	(0.542)
I(2007)	-0.220**	-0.300**
	(0.089)	(0.106)
I(2006)	-0.093	-0.128
	(0.081)	(0.103)
Constant	11.396**	11.297**
	(0.061)	(0.073)
N	609	517
r2	0.879	0.874
# I(Low Coverage Man/Cat)	11	2
# I(Low Coverage Man)	68	15
# I(Medium Coverage Man/Cat)	2	1
# I(Medium Coverage Man)	60	22
# I(High Coverage Man/Cat)	8	8
# I(High Coverage Man)	13	13

Notes: News coverage measured by counting the number of articles mentioning the name of the company and the words "toy" and "recall" in the LexisNexis database of Major US and World Publications in the 30 days following the recall. Low news coverage corresponds to recalls with less than 10 articles, medium to recalls with 11 to 100 articles, and high coverage to recalls with more than 100 articles. If a manufacturer-category is effected by more than one recall in the preceding year, the number of articles are summed over all recalls. Robust standard errors in parentheses. Regressions include manufacturer-category fixed effects. Coefficients refer to recalls during the calendar year indicated. * Statistically significant at 10% level. ** Statistically significant at 5% level.

Table 8: RC2 Recall of "Thomas and Friends" - June 2007 & September 2007
Quantity Changes (000s of units)

	RC2				Non-RC2			
	Thomas & Friends		Non-Thomas & Friends		Thomas & Friends		Non-Thomas & Friends	
	Vehicles	Non-Vehicles	Vehicles	Non-Vehicles	Vehicles	Non-Vehicles	Vehicles	Non-Vehicles
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
2006 q1 Units Sold	1,452	-	377	989	1,213	160	2,622	36,357
2006 q2 Units Sold	1,319	-	358	785	1,242	122	2,577	31,214
2006 q3 Units Sold	1,785	-	320	718	1,034	163	3,111	35,877
2006 q4 Units Sold	3,860	-	790	1,726	2,738	603	9,230	97,344
2007 q1 Units Sold	3,097	-	900	861	1,787	290	3,099	39,894
2007 q2 Units Sold	2,291	-	645	819	1,063	363	2,566	29,814
2007 q3 Units Sold	2,005	-	554	1,039	1,200	158	2,305	34,210
2007 q4 Units Sold	3,420	-	736	1,535	2,303	566	8,705	84,359
2007 q4 – 2006 q4	-440	-	-54	-191	-435	-37	-525	-12,985
% Change:								
2007 q4 vs. 2006 q4	-11.40%	-	-6.84%	-11.07%	-15.89%	-6.14%	-5.69%	-13.34%
Adjusted % Change:								
2007 q4/q1 vs. 2006 q4/q1	-58.46%	-	-60.97%	2.16%	-42.91%	-48.21%	-20.20%	-21.02%
Transactions 2006q4	866	6	182	357	520	141	1,881	18,873

June 13, 2007 & September 26, 2007: Lead related recall of "Various Thomas and Friends™ Wooden Railway Toys"; 1,500,000 units worth $60,000,000 and 200,000 units worth $5,000,000, respectively. Figures are not calculated for cells with fewer than 35 transactions.

Table 9: Mattel's Dora Recall (August 2007)
Quantity Changes (000s of units)

	Mattel				Non-Mattel			
	Dora the Explorer		Non-Dora the Explorer		Dora the Explorer		Non-Dora the Explorer	
	Figures & Playsets	Non-Figures & Playsets	Figures & Playsets	Non-Figures & Playsets	Figures & Playsets	Non-Figures & Playsets	Figures & Playsets	Non-Figures & Playsets
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
2006 q1 Units Sold	872	431	2,430	6,994	-	225	1,217	31,007
2006 q2 Units Sold	856	288	1,951	5,413	-	178	732	28,201
2006 q3 Units Sold	425	280	2,459	7,565	-	150	791	31,339
2006 q4 Units Sold	1,246	1,071	8,163	22,099	-	820	3,217	79,740
2007 q1 Units Sold	486	470	2,576	7,287	-	216	1,365	37,537
2007 q2 Units Sold	243	357	1,298	6,400	-	146	575	28,542
2007 q3 Units Sold	344	301	1,511	6,849	-	317	800	31,353
2007 q4 Units Sold	329	1,192	5,336	20,157	-	1,113	1,898	71,615
2007 q4 – 2006 q4	-917	121	-2,827	-1,942	-	293	-1,319	-8,125
% Change:								
2007 q4 vs. 2006 q4	-73.60%	11.30%	-34.63%	-8.79%	-	35.73%	-41.00%	-10.19%
Adjusted % Change:								
2007 q4/q1 vs. 2006 q4/q1	-52.62%	2.06%	-38.34%	-12.46%	-	41.39%	-47.40%	-25.81%
Transactions 2006q4	215	198	1,800	4,410	0	135	579	15,489

August 2, 2007: Lead related recall of "Sesame Street, Dora the Explorer, and other children's toys"; 967,000 units worth $21,800,000. Figures are not calculated for cells with fewer than 35 transactions.

Table 10: Mattel's Sesame Street Recall (August 2007)
Quantity Changes (000s of units)

	Mattel				Non-Mattel			
	Sesame Street		Non-Sesame Street		Sesame Street		Non-Sesame Street	
	Recalled Categories	Non-Recalled Categories	Recalled Categories	Non-Recalled Categories	Recalled Categories	Non-Recalled Categories	Recalled Categories	Non-Recalled Categories
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
2006 q1 Units Sold	965	-	8,557	1,115	88	-	26,377	5,982
2006 q2 Units Sold	805	-	6,874	775	38	-	22,805	6,264
2006 q3 Units Sold	762	-	8,752	1,179	63	-	25,862	6,332
2006 q4 Units Sold	3,141	-	26,829	2,511	232	-	66,984	16,309
2007 q1 Units Sold	1,298	-	8,680	809	68	-	31,105	7,890
2007 q2 Units Sold	794	-	6,627	851	43	-	22,836	6,365
2007 q3 Units Sold	851	-	7,334	810	53	-	25,155	7,237
2007 q4 Units Sold	2,011	-	22,636	2,322	195	-	58,159	16,208
2007 q4 – 2006 q4	-1,130	-	-4,193	-189	-37	-	-8,825	-101
% Change:								
2007 q4 vs. 2006 q4	-35.98%	-	-15.63%	-7.53%	-15.95%	-	-13.17%	-0.62%
Adjusted % Change:								
2007 q4/q1 vs. 2006 q4/q1	-52.40%	-	-16.82%	27.45%	8.77%	-	-26.37%	-24.65%
Transactions 2006q4	562	30	5,468	563	52	35	12,412	3,704

August 2, 2007: Lead related recall of "Sesame Street, Dora the Explorer, and other children's toys"; 967,000 units worth $21,800,000. Recalled Categories include All Other Infant Toys, Bath Toys, Electronic Learning, Figures & Playsets, Learning Toys, Role Playing, Talking & Sound, and VehiclesFigures are not calculated for cells with fewer than 35 transactions.

Table 11: Average CARs in Response to Toy Recall Announcements

Sample	Window	Mean CAR	N	% < 0
2004 - 2006	[0,1]	0.0014	12	50%
		(0.0057)		
2004 - 2006	[-1,1]	-0.0069	12	50%
		(0.0070)		
2007	[0,1]	-0.0089	13	69%
		(0.0070)		
2007	[-1,1]	-0.0037	13	46%
		(0.0086)		

Notes: This table presents average cumulative abnormal returns for 2-Day and 3-Day windows for recalls to publicly traded toy producers. Standard errors are in parentheses. * Statistically significant at 10% level. ** Statistically significant at 5% level.

Table 12: Abnormal and Cumulative Abnormal Returns by Toy Recall Announcement

| Firm | Event Date | Abnormal Return | | | CAR |
		Day -1	Day 0	Day 1	(0, 10)
Hasbro (Easy-Bake)	2/6/07	0.0016	-0.0047	0.0052	0.0010
		(0.0107)	(0.0108)	(0.0108)	(0.0358)
Jakks Pacific	2/13/07	0.0099	0.0196	0.0197	0.1679*
		(0.0257)	(0.0258)	(0.0260)	(0.0860)
Mattel (Fisher-Price)	2/15/07	0.0019	-0.0033	-0.0155	-0.0140
		(0.0146)	(0.0145)	(0.0144)	(0.0484)
RC2	6/13/07	-0.0114	-0.0097	-0.0242	-0.0636
		(0.0184)	(0.0186)	(0.0183)	(0.0610)
Hasbro (Easy-Bake)	7/19/07	-0.0053	-0.0061	0.0014	-0.1125**
		(0.0131)	(0.0132)	(0.0132)	(0.0439)
Mattel (Fisher-Price)	8/2/07	0.0256*	-0.0234*	-0.0025	-0.0534
		(0.0135)	(0.0135)	(0.0142)	(0.0465)
Mattel#	8/14/07	0.0263**	-0.0099	-0.0085	-0.0910**
		(0.0116)	(0.0116)	(0.0116)	(0.0385)
Mattel (Fisher-Price)#ψ	9/4/07	-0.0126	0.0056	0.0090	0.0471
		(0.0120)	(0.0120)	(0.0120)	(0.0399)
RC2#	9/26/07	-0.0199	-0.0910**	0.0469**	-0.0320
		(0.0232)	(0.0230)	(0.0231)	(0.0767)
Mattel (Fisher-Price)	10/25/07	-0.0197	-0.0051	0.0024	-0.0194
		(0.0125)	(0.0124)	(0.0125)	(0.0418)
Henry Gordy	10/31/07	0.0057	0.0142	-0.0072	-0.0806
		(0.0325)	(0.0326)	(0.0333)	(0.1097)
Mattel (Fisher-Price)	11/6/07	0.0430**	-0.0106	-0.0051	-0.0049
		(0.0124)	(0.0125)	(0.0127)	(0.0420)
Marvel	11/8/07	0.0233	-0.0157	0.0026	0.0350
		(0.0154)	(0.0160)	(0.0157)	(0.0510)

Notes: This table presents Abnormal Returns and Cumulative Abnormal Returns for each 2007 toy recall announcement to a publicly traded firm. Standard errors are in parentheses. No recall announcements prior to 2007 are associated with statistically significant losses. # These events involved multiple recalls by the same firm on the same date. ψ Two recalls named Fisher-Price and one named Mattel directly on this day. * Statistically significant at 10% level. ** Statistically significant at 5% level.

Appendix Table 1: Top 30 Infant/PS Toy Manufacturers by Units and Dollars Sold in 2005

Manufacturer	Units			Dollars		
	Units	Share	Rank	Dollars	Share	Rank
MATTEL	63,681,000	27.33%	1	836,217,397	29.37%	1
LEAPFROG	23,930,000	10.27%	2	502,905,600	17.66%	2
HASBRO	15,302,000	6.57%	3	189,462,406	6.66%	4
RC2	12,853,000	5.52%	4	128,961,996	4.53%	5
VTECH	8,005,000	3.44%	5	219,253,221	7.70%	3
MGA ENT	7,502,000	3.22%	6	105,304,050	3.70%	6
POOF TOY PRODUCTS	4,639,000	1.99%	7	8,929,509	0.31%	30
TOMY	3,718,000	1.60%	8	42,732,899	1.50%	7
JAKKS PACIF	3,510,000	1.51%	9	42,147,529	1.48%	8
RUSS BERRIE	3,383,000	1.45%	10	18,518,206	0.65%	14
KIDS II	3,315,000	1.42%	11	23,111,444	0.81%	11
POP ROCKET	3,218,000	1.38%	12	16,093,219	0.57%	20
SHELCORE	2,479,000	1.06%	13	21,561,458	0.76%	13
KEENWAY INDUSTRIES	2,137,000	0.92%	14	16,436,665	0.58%	19
AMERICAN PLASTIC TOYS	2,085,000	0.89%	15	16,499,829	0.58%	18
BATTAT	2,077,000	0.89%	16	15,251,688	0.54%	21
DISCOVERY TOYS	1,728,000	0.74%	17	17,414,861	0.61%	15
PLAYMOBIL	1,649,000	0.71%	18	22,632,581	0.79%	12
KID DESIGNS	1,605,000	0.69%	19	35,076,591	1.23%	9
BRIO	1,554,000	0.67%	20	17,158,077	0.60%	16
BLUE BOX	1,544,000	0.66%	21	12,544,836	0.44%	24
INTERNATIONAL PLAYTHINGS	1,435,000	0.62%	22	9,718,014	0.34%	29
LIGHTS CAMERA INTERACTION	1,383,000	0.59%	23	16,578,241	0.58%	17
PLAY HUT	1,371,000	0.59%	24	23,907,704	0.84%	10
PROCESSED PLASTIC	1,318,000	0.57%	25	12,575,435	0.44%	23
JAK PAK	1,317,000	0.57%	26	2,850,310	0.10%	77
PLAYWELL TOYS	1,231,000	0.53%	27	7,162,105	0.25%	35
MUNCHKIN	1,211,000	0.52%	28	6,567,005	0.23%	36
LEARNING RESOURCES	1,132,000	0.49%	29	8,192,881	0.29%	33
BABYKING/REGENT BABY PROD	1,117,000	0.48%	30	2,688,862	0.09%	81

Source: Authors' tabulations of NPD Infant/Preschool toy sales data.

Appendix Table 2: Infant/PS Toy Categories by Units and Dollars Sold in 2005

Category	Units			Dollars		
	Units	Share	Rank	Dollars	Share	Rank
ALL OTHER INFANT TOYS	41,046,000	17.62%	1	546,430,267	19.19%	2
PS ELECTRONIC LEARNING	33,346,000	14.31%	2	722,107,347	25.36%	1
PS VEHICLES	30,381,000	13.04%	3	356,286,556	12.51%	3
PS FIGURES & PLAYSETS	26,035,000	11.17%	4	301,424,560	10.59%	4
PS ROLE PLAYING	22,581,000	9.69%	5	286,944,410	10.08%	5
ALL OTHER PS TOYS	21,873,000	9.39%	6	190,159,517	6.68%	6
BATH TOYS	16,650,000	7.15%	7	82,159,384	2.89%	8
PS LEARNING TOYS	11,420,000	4.90%	8	78,008,172	2.74%	10
PS TALKING & SOUND	10,437,000	4.48%	9	91,937,048	3.23%	7
INFANT PLUSH	7,315,000	3.14%	10	82,137,614	2.89%	9
RATTLES/TOY TEETHERS	6,768,000	2.90%	11	27,393,000	0.96%	12
PS MUSICAL INSTRUMENTS	4,113,000	1.77%	12	62,552,445	2.20%	11
MOBILES	1,047,000	0.45%	13	19,371,853	0.68%	13

Source: Authors' tabulations of NPD Infant/Preschool toy sales data.

Appendix Table 3: Top 30 Infant/PS Properties by Units and Dollars Sold in 2005

Property	Units		Dollars	
	Units	Rank	Dollars	Rank
LEAPPAD	12,136,000	1	217,502,842	1
THOMAS AND FRIENDS	11,954,000	2	142,400,779	4
PLAYSKOOL	10,722,000	3	139,057,960	5
LITTLE PEOPLE	8,790,000	4	119,561,012	6
LITTLE TIKES	7,640,000	5	106,935,615	7
V SMILE	6,065,000	6	187,978,671	2
SESAME STREET	5,453,000	7	60,295,147	10
DORA THE EXPLORER	5,238,000	8	72,189,046	9
LEAPSTER	4,919,000	9	153,090,041	3
LAUGH & LEARN	3,674,000	10	75,907,197	8
IMAGINEXT	3,621,000	11	38,746,552	15
BRILLIANT BASICS	3,518,000	12	30,983,486	21
WINNIE THE POOH & FRIENDS	3,449,000	13	40,206,644	14
PEEK-A-BLOCKS	3,369,000	14	47,563,663	11
GEOTRAX	3,325,000	15	44,790,508	12
RESCUE HEROES	3,186,000	16	33,460,107	19
CRAYOLA	2,924,000	17	12,393,700	38
POWERTOUCH	2,875,000	18	37,245,521	17
TONKA	2,855,000	19	38,697,565	16
MR. POTATO HEAD	2,688,000	20	22,785,995	22
ROLL-A-ROUNDS	2,280,000	21	32,133,266	20
DISNEY PRINCESS	2,259,000	22	35,971,208	18
SEE N SAY	2,041,000	23	18,659,423	28
LINK-A-DOOS	1,771,000	24	19,208,461	27
STAR WARS	1,756,000	25	15,910,056	29
PLAYMOBIL	1,649,000	26	22,632,581	23
BARBIE	1,632,000	27	41,097,587	13
FISHER PRICE	1,383,000	28	14,139,997	36
MICKEY & FRIENDS	1,349,000	29	15,336,553	32
SPIDERMAN	1,321,000	30	19,434,526	26

Source: Authors' tabulations of NPD Infant/Preschool toy sales data.

Appendix Table 4: Characteristics of 2007 Toy Recalls

Manufacturer	Announce. Date	Product	Product Price	Units Recalled	Lead	News Articles: Day 1-30	Manuf in Stock Data	Manuf in Sales Data	Item in Sales Data
Geometrix International LLC	1/18/07	MagneBlocks™ Magnetic Construction Toys	$20 - $120	40,000		1			
Target	1/18/07	Plush Baby Rattles and Photo Frame Ornaments	$1	450,000		0		X	
Hasbro (Easy-Bake)	2/6/07	Easy-Bake Ovens	$25	985,000		5	X	X	
JAKKS Pacific Inc.	2/13/07	Battery Packs for Toy Vehicles	$30 - $90	245,000		1	X	X	
Mattel Inc. (Fisher-Price Inc.)	2/15/07	Learning Bunny Toys	$15	500,000		19	X	X	X
Jazwares, Inc.	2/15/07	Link-N-Lite™ Magnetic Light-Up Puzzles	$15	30,000		0			
Sportcraft Ltd.	2/27/07	Bounce Houses	$200 - $300	2,600		0			
Toys R Us Inc.	3/13/07	Toy Sets	$15 - $30	128,700	X	5		X	
Estes-Cox Corp.	3/27/07	Radio Control Model Airplanes with Lithium Polymer Batteries	$30 - $35	66,000		0			
Regent Products Corp.	3/28/07	Stuffed Fun Balls	$1	7,200	X	0		X	
OKK Trading Inc.	4/4/07	dolls	$1	3,500		1			
Target	4/4/07	Little Tree Wood Activity Cart Toys	$20	18,500		0		X	
Small World Toys	4/11/07	Puzzle	$16	78,500		1		X	
Mega Brands America, Inc. (Magnetix)	4/19/07	Magnetix Recall Expanded	$20 - $60	4,000,000		17		X	

Manufacturer	Announce. Date	Product	Product Price	Units Recalled	Lead	News Articles: Day 1-30	Manuf in Stock Data	Manuf in Sales Data	Item in Sales Data
Graco Children's Products Inc.	5/2/07	Soft Blocks Tower Toys (on Graco® Baby Einstein® discover and play™ Activity Centers)	$80	40,000		1		X	
HaPe International Ltd.	5/2/07	Anima - Bamboo Collection Games	$10	5,000	X	0			
Battat Inc.	5/3/07	Parents® Magazine Record-A-Voice Toy Cell Phones	$8	14,000		1		X	X
Small World Toys	5/3/07	IQ Preschool™ Take-Apart Townhouse	$21	8,800		1		X	
Bookspan	5/17/07	Discovery Bunny Books	$8 - $16	16,000		1			
Bookspan	5/17/07	Baby Buddy Clip-on Books	$17 - $27	9,500		1			
AAFES	5/23/07	Invincibles Transport Converters Toy Sets	$20	3,000	X	1			
Tri-Star International Inc.	5/23/07	Ball Rattles, Wrist Rattles, Wind-Up Toys	$1	2,000		0		X	
The Boyds Collections Ltd.	5/30/07	Eli's Small Drums and Liberty's Large Drums	$15	4,500	X	1			
Gemmy Industries Corp.	6/7/07	Floating Eyeballs	$3	500		1			
RC2 Corp.	6/13/07	Various Thomas and Friends™ Wooden Railway Toys	$10 - $70	1,500,000	X	28	X	X	X
Target	6/28/07	Play Wonder Toy Barbeque Grills	$20	2,300		0		X	
Dorel (Infantino)	7/3/07	Shape Sorting Toy Castles	$12	68,000		0		X	X
Kipp Brothers	7/5/07	Mag Stix Magnetic Building Sets	$3	800		2			

Manufacturer	Announce. Date	Product	Product Price	Units Recalled	Lead	News Articles: Day 1-30	Manuf in Stock Data	Manuf in Sales Data	Item in Sales Data
AAFES	7/18/07	Soldier Bear Brand Toy Sets	$5 - $15	13,000	X	2			
Hasbro (Easy-Bake)	7/19/07	Easy-Bake Ovens	$25	1,000,000		25	X	X	
Estes-Cox Corp.	7/24/07	Sky Rangers Park Flyer Radio Control Airplanes	$20 - $40	21,000		1		X	
Mattel Inc. (Fisher-Price Inc.)	8/2/07	Sesame Street, Dora the Explorer, and other children's toys	$5 - $40	967,000	X	513	X	X	X
The Orvis Company	8/3/07	Stuffed Plush Horse/Pillows and Fairy Dolls	$70	1,520		1			
Mattel Inc.	8/14/07	Various Polly Pocket dolls and accessories with magnets	$15 - $30	7,300,000		551	X	X	
Mattel Inc.	8/14/07	Doggie Day Care™ play sets	$4 - $20	1,000,000		551	X	X	
Mattel Inc.	8/14/07	Barbie and Tanner™ play sets	$16	683,000		551	X	X	
Mattel Inc.	8/14/07	die cast toy cars	$7 - $20	253,000	X	551	X	X	
Mattel Inc.	8/14/07	Batman™ and One Piece™ magnetic action figure sets	$11	345,000		551	X	X	
Hampton Direct	8/21/07	Magnetic Toy Train Sets	$30	27,000	X	2			
Schylling Associates Inc.	8/22/07	Spinning Tops and Tin Pails	$6 - $13	70,700	X	7		X	
Mattel Inc. (Fisher-Price Inc.)	9/4/07	Big Big World 6-in-1 Bongo Band toys	$20	8,900	X	254	X	X	
Mattel Inc. (Fisher-Price Inc.)	9/4/07	Geo Trax Locomotive Toys	$3 - $16	90,000	X	254	X	X	X
Mattel Inc.	9/4/07	Various Barbie Accessory Toys	$10	675,000	X	254	X	X	
Guidecraft Inc.	9/26/07	Floor Puppet Theaters	$90	10,000	X	3		X	
Jo-Ann Stores Inc.	9/26/07	Children's Toy Rake	$7	16,000	X	3			
RC2 Corp.	9/26/07	Series Toys	$8	800	X	20	X	X	

Manufacturer	Announce. Date	Product	Product Price	Units Recalled	Lead	News Articles: Day 1-30	Manuf in Stock Data	Manuf in Sales Data	Item in Sales Data
RC2 Corp.	9/26/07	Various Thomas and Friends™ Wooden Railway Toys	$10 - $40	200,000	X	20	X	X	X
Target	9/26/07	Happy Giddy Gardening Tools and Children's Sunny Patch Chairs	$3 - $10	350,000	X	0		X	
Lan Enterprises	9/28/07	Mini Zooper Doll Strollers	$50	21,000		0			
CKI Toys	10/4/07	Children's Toy Decorating Set	$10	15,000	X	29			
Eveready Battery Co.	10/4/07	"Pirates of the Caribbean" Medallion Squeeze Lights	$6	79,000	X	3		X	
Mykids	10/4/07	Wooden Pull-Along Alphabet & Math Blocks Wagons, Wooden Pull-Along Learning Blocks Wagons, 10-in-1 Activity Learning Carts, and Flip-Flop Alphabet Blocks	$7 - $30	10,000	X	4		X	X
Kids II Inc.	10/4/07	Baby Einstein Discover & Play Color Blocks	$10 - $13	35,000	X	3		X	X
JCPenney	10/11/07	Disney™ Deluxe Winnie-the-Pooh 23-Piece Play Sets	$40	49,000	X	2		X	
Kipp Brothers	10/11/07	Bendable Dinosaur Toys	$10	10,000	X	2			
Dunkin' Donuts LLC	10/17/07	Pink and Orange Glow Sticks (free giveaway w/ donuts)	Free	1,000,000		1			
The Gymboree Corp.	10/18/07	Toy Pirate Swords	$15	6,000		1			
Mattel Inc. (Fisher-Price Inc.)	10/25/07	Go Diego Go Animal Rescue Boats	$15	38,000	X	116	X	X	X
Jo-Ann Stores Inc.	10/25/07	Children's Toy Gardening Tools	$7	97,000	X	2			

Manufacturer	Announce. Date	Product	Product Price	Units Recalled	Lead	News Articles: Day 1-30	Manuf in Stock Data	Manuf in Sales Data	Item in Sales Data
Henry Gordy International Inc.	10/31/07	"Galaxy Warriors" Toy Figures	$1	380,000	X	1	X		
SimplyFun LLC	10/31/07	Ribbit Board Games	$18	1,500	X	1			
Toys R Us Inc.	10/31/07	Elite Operations Toys	$10 - $30	16,000	X	41		X	
Mattel Inc. (Fisher-Price Inc.)	11/6/07	Laugh & Learn™ Learning Kitchen™ Toys	$70	155,000		101	X	X	X
Swimways Corp.	11/6/07	"Skippy" Pool Toys	$10	31,000		1		X	
Dollar General	11/7/07	Pull-Back Action Toy Cars	$1	380,000	X	7			
International Sourcing Ltd.	11/7/07	Dragster and Funny Car		7,500	X	0			
Schylling Associates Inc.	11/7/07	Robot 2000	$25	2,600	X	1		X	
Schylling Associates Inc.	11/7/07	Dizzy Ducks Music Box	$12	1,300	X	1		X	
Schylling Associates Inc.	11/7/07	Winnie-the-Pooh Spinning Top	$12	3,600	X	1		X	
Schylling Associates Inc.	11/7/07	Duck Family Collectable Wind-Up Toy	$8	3,500	X	1		X	
Spin Master Toys	11/7/07	Aqua Dots	$17 - $30	4,200,000		17		X	
Marvel Toys	11/8/07	Curious George Plush Dolls	$15	175,000	X	3	X		
Paricon Inc.	11/21/07	Snow and Sand Castle Kit	$30	800		0			
Bell Racing	12/5/07	Collectible Mini Helmets	$40	1,400	X	0			
Far East Brokers and Consulting Inc.	12/12/07	Fishing Games	$10	14,000	X	1			
Dollar Tree	12/13/07	Baby Toys Baby Bead & Wire Toys and Speed Racer Pull Back & Go Action! Cars	$1	300,000	X	1			

Manufacturer	Announce. Date	Product	Product Price	Units Recalled	Lead	News Articles: Day 1-30	Manuf in Stock Data	Manuf in Sales Data	Item in Sales Data
Jo-Ann Stores Inc.	12/13/07	Children's Robbie Ducky Holiday Water Globes	$5	60	X	2			
AAFES	12/19/07	Soldier Bear Toys	$5-$20	11,400	X	1			
Victoria's Secret	12/19/07	Holiday Cosmetics Stuffer Bears	$8	80		1			
Man's Trading Company	12/21/07	Super Magnets	$1	2,800		0			
eeBoo Corp.	12/27/07	Tot Tower toy blocks	$20	170,000		2		X	X

Source: Recall announcements listed on CPSC website. Parentheses indicate division or subsidiary directly named in recall announcement. Lead indicates that the recall was due to the finding of lead in the item. Shaded rows indicate recalls analyzed in case studies (Tables 8-10). News articles indicate the number of articles mentioning the name of the company and the words "toy" and "recall" in the LexisNexis database of Major US and World Publications.

Appendix Table 5: Dollar Sales (000s) for Total Market, Top 10 Firms, and Top 2 Firms Manufacturing Outside China

	Total Market	Mattel	Leapfrog	Hasbro	RC2	Vtech	MGA Ent	Poof Toy Products	Tomy	Jakks Pacific	Russ Berrie	American Plastic Toys	Playmobil
2006 q1 Units Sold	474,128	135,382	80,446	27,698	27,713	30,810	15,990	1,164	10,043	4,502	4,038	3,218	3,879
2006 q4 Units Sold	1,610,731	479,136	244,539	130,786	72,380	166,765	53,418	2,804	34,685	26,238	6,087	10,083	12,425
2007 q1 Units Sold	499,771	129,156	75,319	32,483	40,343	37,225	17,701	1,241	15,191	8,078	5,420	2,566	5,017
2007 q4 Units Sold	1,416,610	426,201	182,973	118,526	68,544	150,724	63,093	4,803	10,897	39,559	7,043	10,167	11,800
2007 q4 – 2006 q4	-194,120	-52,935	-61,566	-12,261	-3,836	-16,041	9,675	1,999	-23,788	13,321	956	84	-625
% Change:													
2007 q4 vs. 2006 q4	-12.05%	-11.05%	-25.18%	-9.37%	-5.30%	-9.62%	18.11%	71.30%	-68.58%	50.77%	15.71%	0.83%	-5.03%
Adjusted % Change:													
2007 q4/q1 vs.													
2006 q4/q1	-16.56%	-6.76%	-20.08%	-22.73%	-34.95%	-25.19%	6.70%	60.59%	-79.23%	-15.98%	-13.79%	26.44%	-26.57%
Transactions 2006q4	22,826	6,623	2,370	1,924	1,411	1,403	701	561	532	465	259	68	175
2007 Recalls		12	0	2	3	0	0	0	0	1	0	0	0

Notes: Based on authors' tabulations of NPD infant/preschool sales data on dollars sold. The total market column includes total infant/preschool sales based on NPD data.

Appendix Table 6: OLS difference-in-difference analysis of the impact of a recall during the year on manufacturer-category and property-category quarter 4 sales

(A) Manufacturer-Category Sample			(B) Property-Category Sample		
Dependent Variable: Log(Dollar Sales)	**All Firms**	**Top 15 Firms**	*Dependent Variable: Log(Dollar Sales)*	**All Properties**	**Top 15 Properties**
I(07 Recall to Man/Cat)	-0.342	-0.372	**I(07 Recall to Prop/Cat)**	0.202	0.120
	(0.225)	(0.231)		(0.398)	(0.434)
I(07 Recall to Manuf)	0.464**	0.451*	**I(07 Recall to Prop)**	0.055	0.070
	(0.199)	(0.251)		(0.224)	(0.296)
I(06 Recall to Man/Cat)	0.109	0.315	**I(06 Recall to Prop/Cat)**	0.373	0.358
	(0.299)	(0.276)		(0.436)	(0.462)
I(06 Recall to Manuf)	-0.028	0.017	**I(06 Recall to Prop)**	-0.280	-0.385
	(0.186)	(0.251)		(0.279)	(0.335)
I(05 Recall to Man/Cat)	0.447*	0.595**	**I(05 Recall to Prop/Cat)**	-	-
	(0.244)	(0.249)			
I(05 Recall to Manuf)	-0.144	-0.005	**I(05 Recall to Prop)**	-	-
	(0.195)	(0.210)			
I(2007)	-0.272**	-0.230	**I(2007)**	-0.183	-0.005
	(0.114)	(0.160)		(0.134)	(0.214)
I(2006)	-0.058	-0.047	**I(2006)**	0.098	0.291
	(0.117)	(0.189)		(0.118)	(0.200)
Constant	13.579**	14.575**	**Constant**	14.003**	14.562***
	(0.080)	(0.107)		(0.085)	(0.127)
N	615	261	**N**	492	207
r2	0.872	0.911	**r2**	0.843	0.880
# of Manuf/Categories	203	86	**# of Props or Prop/Cats**	164	69
# I(07 Recall to Man/Cat)	13	11	**# I(07 Recall to Prop/Cat)**	13	12
# I(07 Recall to Manuf)	57	46	**# I(07 Recall to Prop)**	46	36
# I(06 Recall to Man/Cat)	6	5	**# I(06 Recall to Prop/Cat)**	2	2
# I(06 Recall to Manuf)	60	53	**# I(06 Recall to Prop)**	23	23
# I(05 Recall to Man/Cat)	2	1	**# I(05 Recall to Prop/Cat)**	0	0
# I(05 Recall to Manuf)	26	13	**# I(05 Recall to Prop)**	0	0

Notes: Firm and property ranks determined by total units sold in 2005. Robust standard errors in parentheses. Regressions include manufacturer-category fixed effects in Panel A and property-category fixed effects in Panel B. Coefficients refer to recalls during the calendar year indicated. * Statistically significant at 10% level. ** Statistically significant at 5% level.

Appendix Table 7: Recalls to Publicly Traded Toy Producers, 2004 – 2007

Event #	Firm	Event Date	Recall Value ($)	Lead	Magnets	Made in China	News Articles: Day -30-0	News Articles: Day 1-30	Market Cap on 1/2/04 ($1,000)
1	Hasbro	1/30/04	2,940,000			X	1	4	3,667,633
2	Mattel	4/14/04	8,478,000			X	0	5	8,296,800
3	Hasbro	9/9/04	6,900,000			X	0	4	3,667,633
4	Mattel (Fisher-Price)#	5/10/05	5,322,000			X	0	0	8,296,800
5	Sony	9/13/05	126,450,000			X	5	13	4,144,605
6	Mattel (Fisher-Price)	1/18/06	16,578,000			X	5	3	8,296,800
7	Hasbro (Milton Bradley)	2/23/06	11,525,000			X	1	3	3,667,633
8	Mattel (American Girl)	3/30/06	1,800,000	X			2	4	8,296,800
9	LeapFrog	9/7/06	11,160,000			X	0	4	813,226
10	Hasbro	9/22/06	8,925,000				1	12	3,667,633
11	RC2	11/2/06	1,650,000			X	0	1	364,306
12	Mattel	11/21/06	54,000,000		X	X	2	16	8,296,800
13	Hasbro (Easy-Bake)	2/6/07	24,625,000			X	0	5	3,667,633
14	Jakks Pacific	2/13/07	14,700,000			X	0	1	324,514
15	Mattel (Fisher-Price)	2/15/07	7,500,000			X	2	19	8,296,800
16	RC2	6/13/07	60,000,000	X		X	0	28	364,306
17	Hasbro (Easy-Bake)	7/19/07	25,000,000			X	5	25	3,667,633
18	Mattel (Fisher-Price)	8/2/07	21,757,500	X		X	9	513	8,296,800
19	Mattel#	8/14/07	194,388,500	X	X	X	119	551	8,296,800
20	Mattel (Fisher-Price)#ᴪ	9/4/07	7,783,000	X		X	455	254	8,296,800
21	RC2#	9/26/07	5,006,400	X		X	16	20	364,306
22	Mattel (Fisher-Price)	10/25/07	570,000	X		X	131	116	8,296,800
23	Henry Gordy	10/31/07	380,000	X		X	0	1	40,086
24	Mattel (Fisher-Price)	11/6/07	10,850,000				130	101	8,296,800
25	Marvel	11/8/07	2,625,000	X		X	0	3	2,082,783

Notes: Recall Value refers to the price of the item recalled times the number of units recalled (summed if multiple recalls on same date); Lead indicates that the recall was due to the finding of lead in the item; Made in China indicates that the recalled items were produced in China. News articles indicate the number of articles mentioning the name of the company and the words "toy" and "recall" in the LexisNexis database of Major US and World Publications. Market cap refers to the stock price times the number of outstanding shares on January 2, 2004. Parentheses indicate division or subsidiary directly named in recall announcement. # These events involved multiple recalls by the same firm on the same date. ᴪ Two recalls named Fisher-Price and one named Mattel directly on this day.

Appendix 8: Details of the Event Study Estimation

The basic strategy of an event study is to estimate the relationship between the affected firm's daily stock return and an index (or set of indices) of market performance over an estimation window, which is a period of time preceding the event. These parameters are used to calculate the predicted returns to the affected firm during the event window, which is a period of time surrounding the event. Abnormal returns are then calculated as the difference between the actual returns and the predicted returns over the event window. Thus, abnormal returns can be thought of as the portion of the affected firm's return that is in excess of its usual relationship with the market. These abnormal returns represent the impact of the "news" on the firm's market value.

More formally, over the estimation window we estimate the following market model for each event:

$$(1) \qquad R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it}$$

R_{it} represents the return to the stock involved in event i on day t minus the risk-free rate on day t.[38] R_{mt} is a vector of market returns on day t. In our baseline specification we use the three factor model suggested by Fama and French (1993). These three market factors include the market portfolio which is the value-weighted return to all NYSE, NASDAQ, and AMEX stocks minus the risk-free rate, the High-Minus-Low portfolio and the Small-Minus-Big portfolio.[39] In our baseline specification, we use the 255 trading days (one year) leading up to 10 days prior to the recall date as our estimation window. In other words, in event time, our estimation window is estimated over the interval t in [-265, -11].

Over the event window we use the parameter estimates from equation 1 to calculate the abnormal return to the firm involved in event i at time t as:

$$(2) \qquad AR_{it} = R_{it} - \hat{\alpha}_i - \hat{\beta}_i R_{mt}$$

These abnormal returns can be aggregated over time and across events. Summing abnormal returns over a given interval for event i provides an estimate of cumulative abnormal returns (CAR) for that event. We can also average abnormal returns for a given day or cumulative abnormal returns for a given interval across events. This allows us to explore the average effect of a recall and understand how it accumulates over time, both before and after the actual recall, if information about the recall leaked prior to the actual announcement or was accumulated slowly after the announcement. We derive estimates for the standard errors for abnormal, cumulative abnormal, mean abnormal, and mean cumulative abnormal returns based on the variance of the error term in equation 1, assuming independence of returns and a long event window, following the procedures outlined in MacKinlay (1997).

In practice we use the dummy variable method to estimate abnormal returns and their standard errors. This method provides identical estimates to the method outlined above (Karafiath 1988). We estimate a single regression for each event i over the time period starting 265 days prior to the recall announcement and ending 10 days after the announcement. This regression looks similar to equation 1, but we also include dummy variables for each day during the event window.

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[38]   Daily returns collected from CRSP are adjusted for dividends and splits
[39]   Data on these three indexes are obtained from Kenneth French's website:
http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html (last accessed on February 13, 2009)

The coefficients of these 21 dummy variables reflect the abnormal returns on each of these 21 days, and their standard errors represent the standard errors of the abnormal returns.