How Did Consumers Respond to the Toy Recalls of 2007?

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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 calls for increased regulation and oversight, eventually leading to the passage of the Consumer Product Safety Improvement Act of 2008. This paper examines the consumer response to year 2007 recalls of infant/preschool toys. The data reveal four key findings: (1) Manufacturers experienced lower 2007 Christmas season sales of the types of toys that were involved in a recall that year; (2) A manufacturer's recall of one type of toy did not lead to demand losses for other types of toys produced by the manufacturer; (3) 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; and (4) The 2007 toy recalls had negative effects on overall industry sales. We also examine data on the stock market performance of toy firms over this period and find evidence of industry wide losses. The patterns of sales movements are generally consistent with consumers upwardly revising their beliefs about general toy safety risk for particular types of toys. We also consider the possibility that consumers imperfectly process the information in recalls. Our findings of sizeable spillover effects to other manufacturers have implications for firm strategy, in particular with regard to diversification and licensing, as well as the optimal level and form of industry regulation.

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Introduction

The optimal amount and type of product safety regulation depends crucially on the extent to which the private market provides incentives for firms to invest in product safety. A recent wave of consumer product recalls in the United States – of toys, in particular – has led to growing concern about the quality of products being offered in the market and widespread calls for increased government regulation of safety standards in the industry.[1] In this context, government regulation involves two goals: (1) notifying consumers about dangerous products and removing these products from stores and homes after they have reached the marketplace; and (2) providing firms with incentives to make costly investments in product safety. It is arguably the case that government involvement is necessary to achieve the first of these goals. But the scope of government regulation required to achieve the second goal depends on whether, and to what extent, the market can be relied on to financially "punish" firms that are revealed to have produced dangerous products.

In this paper, we investigate how the market responded to a recent wave of recalls in one particular industry – toys. In 2007, the Consumer Product Safety Commission (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 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 product categories over this period.[2] We briefly describe the stock market response to these recalls,

[1] Ultimately this wave of toy recalls led to the passage of new federal legislation, the Consumer Product Safety Improvement Act of 2008, signed into law August 14, 2008, with the expressed intent "To establish consumer product safety standards and other safety requirements for children's products and to reauthorize and modernize the Consumer Product Safety Commission" (CPSC). General provisions include the requirement that lead be essentially eliminated from all children's products; toys and other children's products will be required to be tested for safety before they are sold; toxic phthalates will be banned from children's products; CPSC will receive substantial increases in its resources and authority; consumers will have access to a public database to report and learn about hazards posed by unsafe products; and whistleblowers will be granted important protections. (See Public Law 110-314, August 14, 2008)

[2] 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,

but we focus on the consumer demand response. We are particularly interested in what the demand response implies about how consumers are interpreting and acting upon the information contained in these recall announcements.

There is an existing literature on the market response to dangerous product announcements in other contexts, including automobile recalls, pharmaceutical recalls, and airline crashes. This literature tends to focus on the stock market response; some of these papers consider the demand response with an attempt to discern how much of the stock market response it can explain.[3] There are several features unique to the 2007 toy recall setting that makes this specific set of recalls particularly interesting, especially from the perspective of the consumer. 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. This, in turn, increases the likelihood of industry-wide reductions in demand (as well as industry-wide equity losses).[4]

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

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2005, 2006, and 2007, respectively. The number of recalled sports and recreation items in these four years were 50, 76, 58, and 64.

[3] We summarize the related literature in Section II.

[4] 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 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.

different manufacturers. The prevalence of branding and licensing raises the possibility of another level of spillover effects. It also raises the possibility for two types of consumer confusion: (a) consumers might imperfectly process recall information by remembering a brand, as opposed to a manufacturer and (b) consumers might not easily recognize which branded toys are manufactured by a named manufacturer versus another firm.

Our empirical analysis proceeds in stages. Our analysis of the sales response utilizes monthly sales data for Infant/Preschool toys from January 2005 to December 2007 inclusive.[5] We begin with standard OLS regression analyses designed to identify the effect of a 2007 recall on 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). We estimate how recalls affected sales at the level of the manufacturer-category as well as the level of the property-category. We supplement our regression analysis with an in-depth study of the most widely publicized recalls from 2007. Finally, for sake of comparability with the previous literature on recalls, we analyze the investor response to this wave of recalls by examining changes in the equity value of toy manufacturers over the relevant period. We also carry out a formal event study analysis.

Several key findings emerge from our complementary empirical analyses. First, manufacturers experienced lower 2007 Christmas season sales of the types of toys that were involved in a recall that year. While estimated imprecisely, the point estimates suggest that, relative to their sales in categories that didn't experience a recall, sales in categories that did have recalls were lower by about 30 percent. Moreover, in all three of the high profile recalls that we investigate in detail, the manufacturer's adjusted Christmas season sales in the affected category-property fell by over 50 percent. This suggests that consumers both received and acted upon the information contained in the most widely publicized recall announcements.

Second, a manufacturer's recall of one type of toy does not appear to generate decreased demand for other types of toys sold by that manufacturer. We find no evidence of consumers disproportionately reducing their demand for a manufacturer's items that are not related to the toys involved in the recall. This suggests that either consumers do not draw inferences from a manufacturer's recall of one type of toy about the safety of that manufacturer's other toys or consumers do not know which toys are produced by which manufacturer. We speculate that large diversified toy manufacturers may be able to take steps to increase their demand in unaffected categories; for example, by making fixed investments in rebuilding their brand names.

Third, the data suggest that the 2007 toy recalls had negative effects on industry sales as a whole. Regression estimates imply that Christmas season sales of Infant/Preschool toys made by manufacturers who did not experience any recalls were about 25 percent lower in 2007 than 2005.[6] This suggests that consumers interpreted the specific recalls that were issued as providing at least some information about the overall safety of toys in the market. This is not surprising given that the majority of the recalls that took place were involved a common industry practice of manufacturing in China. A similar conclusion emerges from the results of the stock market analyses. We find that the market capitalization of publicly traded toy manufacturers that did *not* experience recalls in 2007 fell by 12 percent from the end of May 2007 to the end of December 2007. One implication of this is that toy 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.

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. Two

[5] 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 and it experienced the most recalls.

[6] 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 we are observing an industry-wide decease in demand in response to these recalls and not simply a response to macroeconomic conditions.

of our "case studies" involve recalls of toys with brands that are also licensed by other toy manufacturers. In one case, we see rivals' sales of toys in the affected property decrease; in the other case, we see them increase. 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 more likely to get "confused" by the information contained in the recall and reduce their purchases of rivals' toys in the same property.

The remainder of this paper is organized as follows. Sections II and III provide relevant background information, including a description of previous literature, the toy industry, and the recall process. Section IV describes the stock market analysis. Section V describes our analyses of the consumer response to the recalls. A final section concludes.

II. Previous studies

There are several existing studies that examine the stock market and/or consumer demand response to news of dangerous products. Jarrell and Peltzman (1985) examine the stock market effects of two types of recalls, FDA drug recalls and auto recalls affecting GM, Ford, and Chrysler. They find that in both types of recalls, the drop in shareholder wealth is much larger than the direct costs of recalling the product. They speculate that this excess loss is due to a loss of "goodwill". The authors further document negative spillovers to other drug and automobile manufacturers, though that finding has been subsequently challenged by Hoffer, Pruitt, and Reilly (1988).

Dranove and Olsen (1994) examine the experience of dangerous drug announcements before and after the passage of the 1962 Food and Drug Administration Amendments to examine the hypothesis that the stock market reaction to drug recalls reflects expectations about an increase in the cost of compliance with new and more stringent drug testing requirements. The patterns in the data are consistent with this hypothesis. They find that dangerous drug announcements in the

1960s were associated with lower share prices for the named manufacturers as well as other manufacturers. However, they find no evidence of sales decreases among the named firms' other drugs nor of substitute drugs produced by other manufacturers. This suggests that loss of consumer demand is not driving the stock market response. Furthermore, they find no evidence of stock market spillovers associated with drug recalls in the 1970s and 1980s, when drug safety regulation was relatively unchanged. And finally, European pharmaceutical firms with little exposure to U.S. drug regulation did not suffer share price declines contemporaneous with recalls.

A number of studies consider the stock market and consumer market response to airline accidents. Chalk (1987) examines the effects of commercial airline accidents on the equity value of the firms that manufactured the aircraft. He finds significant equity value losses following the 23 accidents where the manufacturer may have been at fault, but no significant loss in equity value following the 53 accidents that were attributed to other causes. Chance and Ferris (1987) and Mitchell and Maloney (1988) study the stock market experience following fatal accidents during the 1960s through 1980s. Both studies find statistically significant effects of the crashes on the stock of the affected airline. Chance and Ferris (1987) do not find evidence of spillover effects, but Mitchell and Maloney (1988) find limited evidence of negative spillover effects to other airlines when the crash was determined not to be the airline's fault. Furthermore, this latter study examines the impact of accidents on insurance premiums and concludes that changes in insurance premiums can explain about 34 percent of the loss in equity value.

Borenstein and Zimmerman (1988) directly examine both the stock market and consumer demand response to airline accidents. Their finding of small and statistically insignificant demand changes leads them to conclude that the documented stock market response to airline accidents is not explained by (expected) losses in consumer demand. In addition, they find little evidence of spillover effects of one airline's accident on the demand for another airline's services. Bosch, Eckard

and Singal (1998) take up the question of spillovers more directly by considering market overlap between the crash airline and its competitors. They speculate that while the crash may lower the demand for air travel in general, rival airlines may benefit from consumers substituting away from the crash airline in overlapping markets. Their analysis of stock prices finds that non-crash airlines with little market overlap with the crash airline lose value while close rivals to the crash airline experience slight gains.

III. Institutional Background

A. Toy Industry Basics

In 2005, the U.S. toy industry generated $21.3 billion in retail sales.[7] At both the manufacturer and retailer levels, the industry is dominated by a small number of large firms. Appendix Table 1 lists the top 30 manufacturers based on tabulations of our data (described below), ranked by 2005 unit market share.[8] At the manufacturer level, Mattel and Hasbro together account for roughly 30 percent of the market. 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

[7] 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).

[8] 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

percent of total industry sales in 2005 (about $3.2 billion). 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 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,

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account for almost 60 percent of sales. As in the case of manufacturers, the remaining top 10 retailers are quite small in

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

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.[9] 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)."[10]

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.

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terms of their contributions to industry sales, together accounting for only another 8.5 percent.

[9] 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.

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

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 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.[11] 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.

[11] 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.

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 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.[12] The two primary sources of lead exposure for the average child are leaded gasoline and lead-based paint (Reyes, 2007).[13] 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. A statutory limit is also imposed on internal lead, at 600 ppm by February 2009 and 300 ppm by summer 2009.

IV. How Do Consumers Respond to a Toy Recall?

A. Sales 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

[12] 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.

[13] Reyes (2007) examines the relationship between the reduction in childhood lead exposure in late 1970s and early 1980s, coming from the removal of lead in gasoline, and violent crime in the 1990s. The proposed mechanism linking the two is that childhood lead exposure can lead to psychological deficits that are strongly associated with aggressive and criminal behavior. She exploits sharp state-specific reductions in lead exposure following the Clean Air Act of 1970 and argues that these reductions are responsible for significant declines in violent crime twenty years later.

panel of more than three million consumers.[14] The panel is comprised of two set of consumers: (1) 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, because the data are based on a sample of consumer purchases, it is generally not reliable at the item level. NPD cautions against using data that is based on cells with fewer than 35 transactions, so the item level data must be aggregated over time and/or groups of items.[15] We therefore focus our empirical investigation on sales at the level of 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

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

[15] Note that if the toy is pulled from the shelf entirely (say, due to a faulty design), sales of that particular toy would drop to zero. But in many of the 2007 recalls, a production batch of the toys was recalled for having contained elevated levels of lead but the toy continued to be available to consumers.

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 quarter 4 sales, which include purchases made in October, November, and December of a given year.

B. The effect of a recall on sales

We begin our examination of the sales data by looking simply at the changes in Christmas season sales between 2006 and 2007. To account for trends, we scale quarter 4 sales by quarter 1 sales. We refer to this is "adjusted Christmas season sales". Table 2 reports changes in adjusted Christmas season sales for the total Infant/Preschool supercategory, the top 10 firms, and the top two firms in our data that manufacturer outside of China. The sales figures show several interesting things. First, sales in the Infant/Preschool toy market were down 25 percent. Second, firms that did not experience any recalls of their own also had lower sales. Third, there is no clear relationship between the number of toy recalls experienced and a firm's change in Infant/Preschool sales.[16] 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.[17] 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. 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. Note that these manufacturers may also be able to encourage this substitution by offering lower prices 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 3 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 2, 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.

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 we

[16] 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.

[17] Note that 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

observe at least 35 transactions in quarter 4 of 2005 and we observe positive sales in all three years. We make this second restriction because 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. NPD does not collect exit information. We are thus unable to explore supply side exit responses.[18]

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

$$\begin{aligned}(4)\quad & \text{Log(UnitsQ4)}_{mct} = \beta_0 + \beta_1(\text{Recall}_{mct} * \text{yr07}_t) + \beta_2(\text{Recall}_{mt} * \text{yr07}_t) + \\ & \beta_3(\text{Recall}_{mct} * \text{yr06}_t) + \beta_4(\text{Recall}_{mt} * \text{yr06}_t) + \beta_5(\text{Recall}_{mct} * \text{yr05}_t) + \\ & \beta_6(\text{Recall}_{mt} * \text{yr05}_t) + \beta_7(\text{yr07}_t) + \beta_8(\text{yr06}_t) + \beta_9(\text{yr05}_t) + \mu_{mc} + \varepsilon_{mct}\end{aligned}$$

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, μ_{mc}.

Table 4 reports the results. The estimated coefficient on the year 2007 indicator suggests that quarter 4 sales in 2007 are down between roughly 20 and 25 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

from recalled items/categories to non-recalled items/categories. Put differently, consumers may buy fewer toys altogether, but, when they do buy, they shift their purchases to avoid toys or categories that have experienced recalls.

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 observations in Table 4, this suggests that consumers may be shifting purchases from affected to unaffected categories within a manufacturer. The right side panel of the Table reports the results when the recall indicator variables are replaced with counts of the number of recalls to a firm. The point estimates show a similar pattern of responses.

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.[19] 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. Indeed, the prevalence of properties increases the likelihood that brand or trademark association may be stronger than manufacturer association in this industry.

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:

$$
\begin{aligned}
\text{Log(UnitsQ4)}_{pct} = {} & \beta_0 + \beta_1(\text{Recall}_{pct} * \text{yr07}_t) + \beta_2(\text{Recall}_{pt} * \text{yr07}_t) + \\
(5) \quad & \beta_3(\text{Recall}_{pct} * \text{yr06}_t) + \beta_4(\text{Recall}_{pt} * \text{yr06}_t) + \beta_5(\text{Recall}_{pct} * \text{yr05}_t) + \\
& \beta_6(\text{Recall}_{pt} * \text{yr05}_t) + \beta_7(\text{yr07}_t) + \beta_8(\text{yr06}_t) + \beta_9(\text{yr05}_t) + \mu_{pt} + \varepsilon_{pct}
\end{aligned}
$$

[18] We eliminate cells with fewer than 35 transactions, per NPD recommendations.

[19] 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. The inclusion of the indicator changes the estimated coefficient on the year 2007 dummy but leaves the estimated b1 and b2 qualitatively unchanged. [TO WHAT?].

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

Table 5 reports the results. The first finding of interest is that again the data show a statistically significant decrease in 2007 quarter 4 sales as compared to year 2005. The estimated coefficients on the indicator variables for having any recall in the property and in the particular property and 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.

C. A closer examination of three high profile recalls

Though we have obtained the most comprehensive available data that exist for this industry, our regressions lack the power to estimate the effects of the recalls with precision.[20] We complement our regression analysis by carrying out a detailed analysis of the demand response to the three highest profile recalls of 2007. Not only does this allow us to focus on the part of our sample where we expect the effects to be the most salient but it also allows us to draw a complete picture of how consumers responded to these recalls – looking simultaneously at changes in the sales of the recalling firm by category and property as well as changes in the sales of rival firms who operated in the same category and/or property.

[20] For example, in the analyses reported in Table 5, there are only 11 manufacturer-category cells with recalls among Top 15 firms in 2007 and 5 in 2006. Note that we would be able to examine a larger number of recalls if we had data for toys in other supercategories but, due to the cost of this data, it is prohibitively expensive for us to do so at this time.

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. We focus on these recalls for several reasons. First, **t**hese recalls involve Top 10 firms and recall values in excess of $400,000. Second, these recalls received significant media attention. (See Table 9.) Finally, 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.

We begin with the RC2 recall which we analyze in Table 6. We start by examining what happened to RC2's sales in the affected category-property: "Vehicles" produced under the "Thomas & Friends" brand. We consider this the "direct" effect of the recall. 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 suggests that consumers substituted away from the RC2 vehicle category and the sales loss in this category is not property specific.[21] 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.

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[21] 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.

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 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 7 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 2). 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 7 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.[22] 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 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

[22] 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.

the brand, but not the specific toy -- but they are consistent with (arguably) reasonable inferences about product safety.

Finally, Table 8 considers Mattel's recall of Mattel Sesame Street figures. As in Table 7, 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 examine trends in the performance of toy firm stocks as compared to various stock market indices over the relevant time period. 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.[23] 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 an event study analysis on the full set of toy recalls. Our resulting event sample includes 25 events involving 8 firms; 13 of these recall events occur in 2007.

Table 9 lists the 25 events, the characteristics of the recall announcement, and the named firm in the recall event. We use data on the remaining 10 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 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,

[23] 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

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.

These raw data show that these toy firms 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 market capitalization of toy firms with recalls increased 21.9 percent from 1/3/07 to 5/22/07 – the peak – and then fell 32.2 percent from 5/22/07 to 12/31/07. The market capitalization for firms without recalls increased 53.2 percent from 1/3/07 to 5/22/07 and then fell 12.7 percent from 5/22/07 to 12/31/07. (Sony, which is one of the biggest firms without a recall, experienced an increase of 70 percent during this first period, so their experience is driving the 53.2 percent number.) 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 toy recalls in Table 9. 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. In Table 9 we report 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 ninety days following the announcement. There had been very few news articles covering earlier recalls, but the

named in a recall of a child's toy flashlight. We focus on toy manufacturers because the equity value of non-toy manufacturers is unlikely to be affected by a toy recall.

2007 lead paint recalls received large amounts of media coverage. For example, there were 841 articles within 90 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).

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:

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

R_{it} represents the return to the stock involved in event *i* on day *t*.[24] 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.[25] 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:

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

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

[24] The return, R_{it}, is equal to $(P_{it}-P_{it-1})/P_{it-1}$ where P_{it} is the stock price of the firm involved in event *i* on day *t*.
[25] 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)

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. 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.

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 10 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.[26]

For 2007, over a two day window, the mean CAR indicates a 0.90 percentage point lower return as a result of a recall announcement; adding the day prior to the recall changes the estimated

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

CAR to a 0.65 percentage point lower return. Neither estimate is statistically significant at the 10% percent level. The point estimates 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 42 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 11 reports the estimated abnormal returns separately for each of the 13 firm-recall events in 2007. (For sake of space, we do not list the 12 firm-recall events from 2004-2006, but none of the 2004-2006 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 -0.033, 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. The analysis is 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.[27]

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

[27] 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.

characterized by a series of negative abnormal returns to a particular firm following its own recall announcements[28]

B. "Made in China"

A final consideration is the possibility that there was a market response specifically targeted at toy firms producing in China. More than half of toy recalls in 2007 involved elevated levels of lead, and nearly all of these were made in China. In a Harris Poll of 2,565 U.S. adults conducted online between October 9 and October 15, 2007, 33 percent of respondents reported that they would be buying fewer toys during the upcoming holiday season due to recent safety recalls; 45 percent indicated they would avoid buying toys manufactured in China.[29] 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?

A straightforward analysis conducted by the Federal Reserve Board of San Francisco addresses the question of what happened to imports from China (FRBSF, 2008). The analysis is based on consumer product recall information from the CPSC and U.S. Census Bureau data on monthly U.S. imports by industry and country of origin. It considers the 13 import industries that

[28] 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.

[29] http://www.harrisinteractive.com/harris_poll/index.asp?PID=833, last accessed November 19, 2008.

experienced consumer product recalls. The "toys, baby item" industry and the "furniture, bedding" industry account for the largest shares of total imports from China, claiming more than seven and more than five percent each. In absolute terms, the value of recalled products in 2007 amounted to more than $2.5 billion in each of these industries, representing about 10 percent of monthly toy industry imports from China and 20 percent of monthly furniture industry imports. To determine the effect of recalls on imports, the authors use monthly data between 2000 and the second quarter of 2007 to forecast what imports in these industries would have been in the second half of 2007. A comparison of the forecast to actual imports reveals that imports in the toy industry actually *increased* relative to forecasted levels. On average, the actual imports from industries experiencing recalls fell below the 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.

A second possibility to consider is a stock market reaction to the industry practice of manufacturing in China. For example, 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 produce mainly in China advertise specific toy items that are Made in the U.S. We had two research assistants 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 9a 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.[30] As shown in Figure 9b, 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. Conclusion

The year 2007 saw a substantial increase in the number of recalled toys and children's products. In this paper, we have investigated the consumer response, as well as the investor response, to a subset of these recalls. Our stock market analysis revealed that although the stock prices of toy manufacturers declined substantially over this period, these declines cannot be fully explained by responses to specific recall events. 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. 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 (over and above the information provided about toys in general), or because manufacturer association in

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

this industry is particularly weak. 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. And 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 findings have several interesting implications. First, they suggest that when firms engage in similar processes or practices (such as outsourcing to China), they may have an incentive to invest in a common set of standards since each stands to lose from the other's mistakes. Second, they suggest large diversified firms may be able to offset some of the sales losses associated with a recall with sales increases elsewhere in their product line. Our data indicate that – despite having the largest number of recalls – Mattel experienced below average sales losses. Mattel sales figures suggest that it was able to take steps to actually increase its sales in categories that did not experience recalls – perhaps by adjusting its merchandising strategy or by making fixed investments in rebuilding its brand name. Firms such as RC2 and Tomy which whose sales were highly concentrated in a single category and property that experienced a recall had much larger sales reductions. Finally, our results indicate that when brands are shared across products and firms, there is the potential for consumer confusion about what products are actually affected by the recall. This creates an externality much like that which exists between franchisees. Each licensee will have suboptimal incentives to invest in protecting the brand. This has implications for how the types of protections that licensees may seek to include in their licensing agreements.

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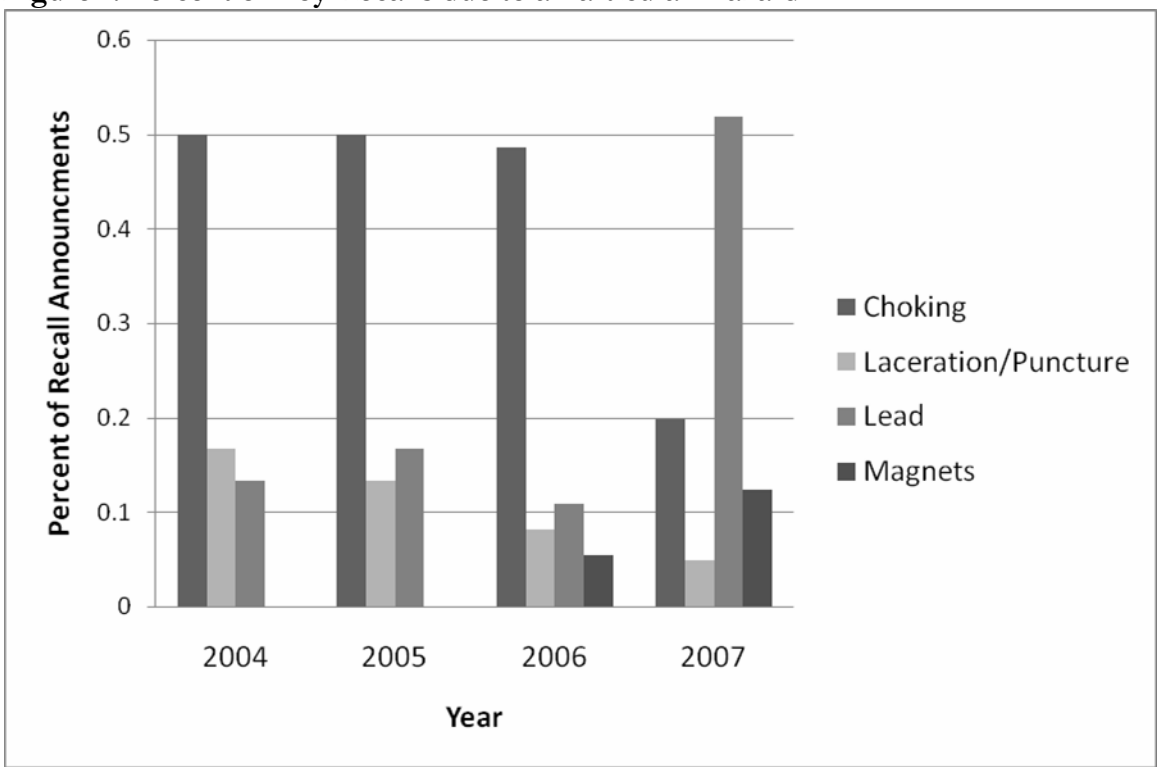
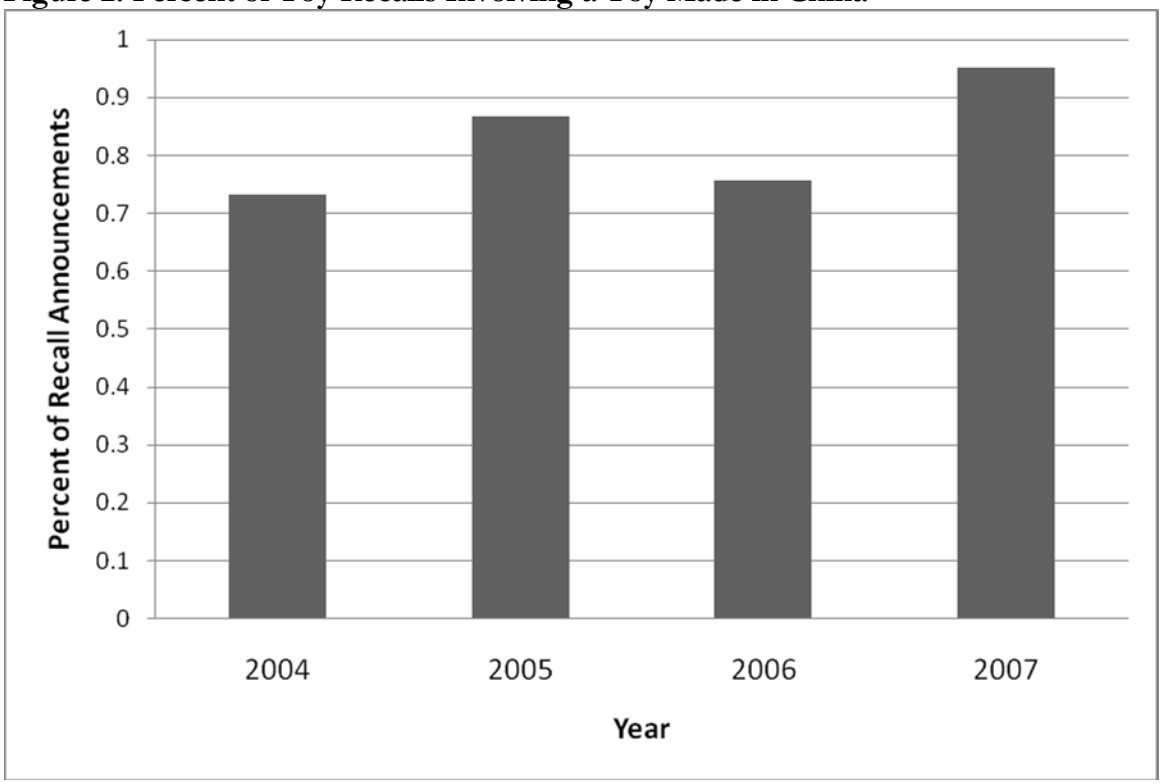
Figure 1: Percent of Toy Recalls due to a Particular Hazard



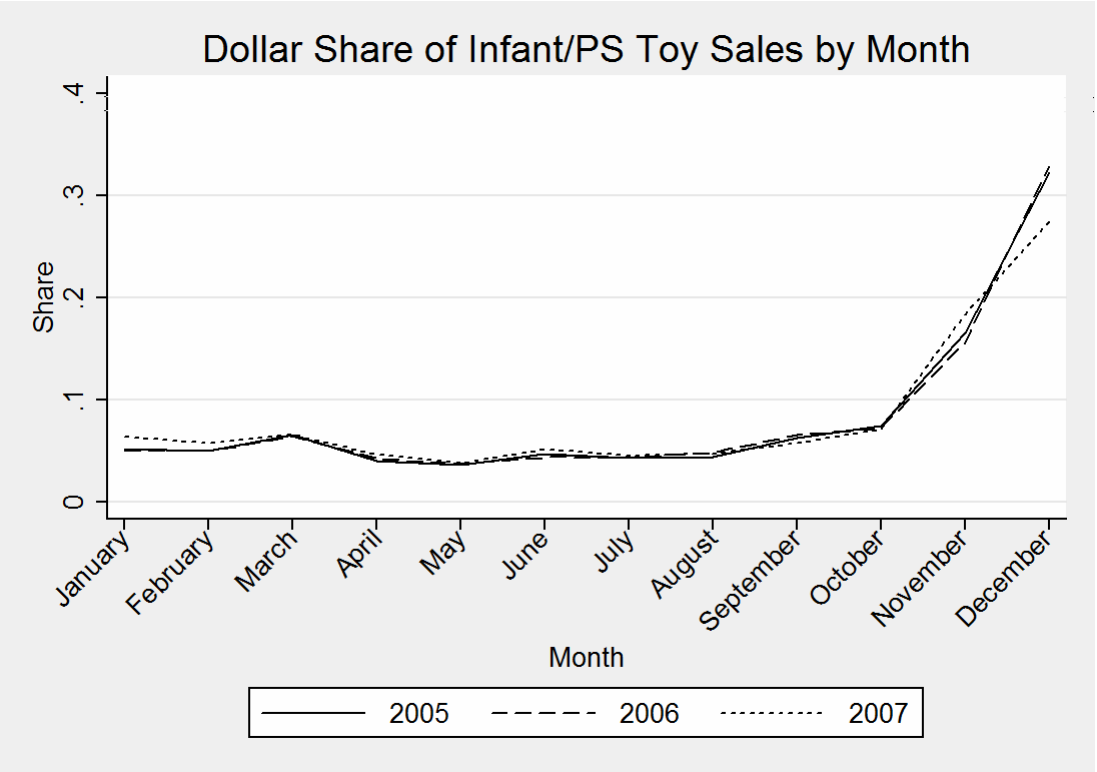
Source: Authors' tabulations of information in recall announcements listed on CPSC website.

Figure 2: Percent of Toy Recalls Involving a Toy Made in China



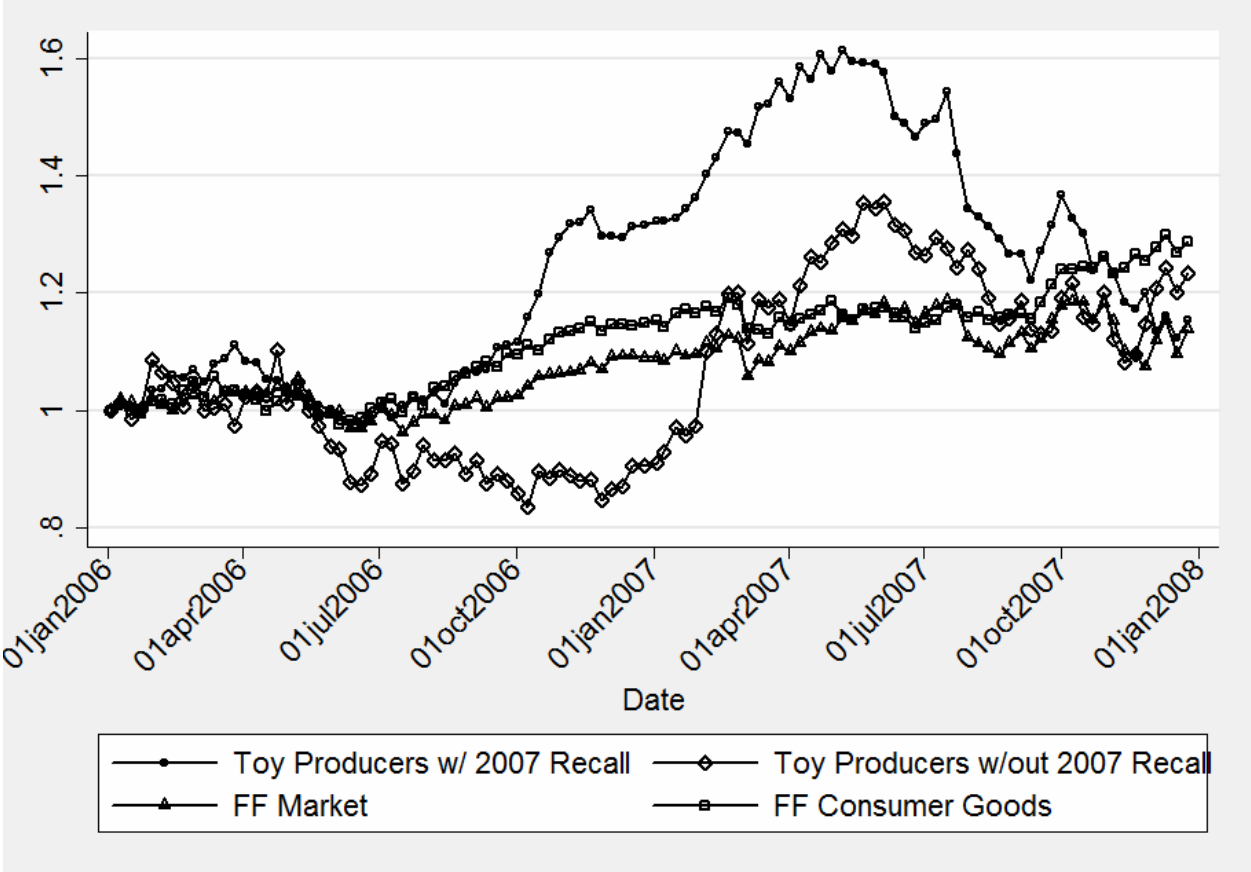
Source: Authors' tabulations of information in recall announcements listed on CPSC website.

Figure 3: Seasonality of Infant/PS Toys



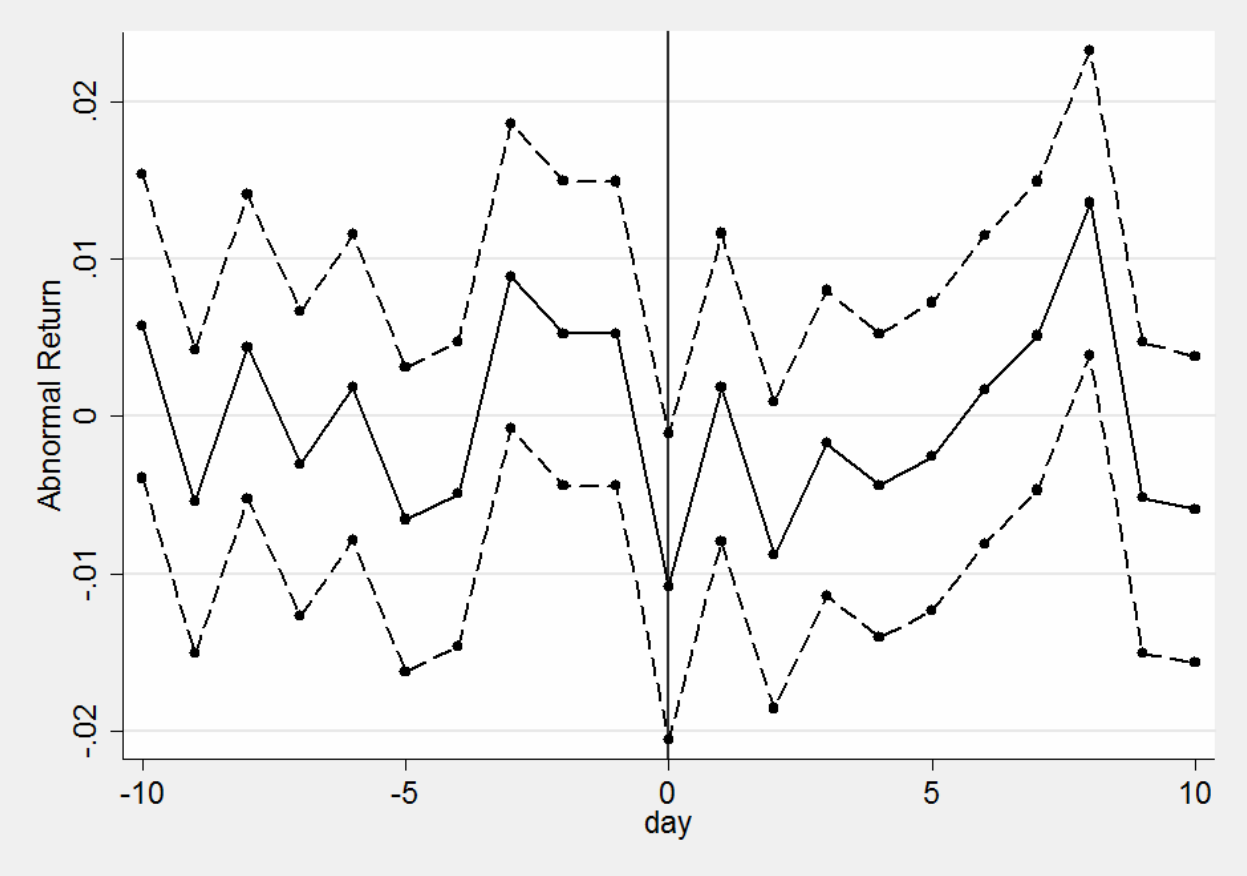
Source: Authors' tabulations of NPD Infant/Preschool toy sales data.

Figure 4: Stock Market Indices of Major Toy Producers Compared to Market Indices



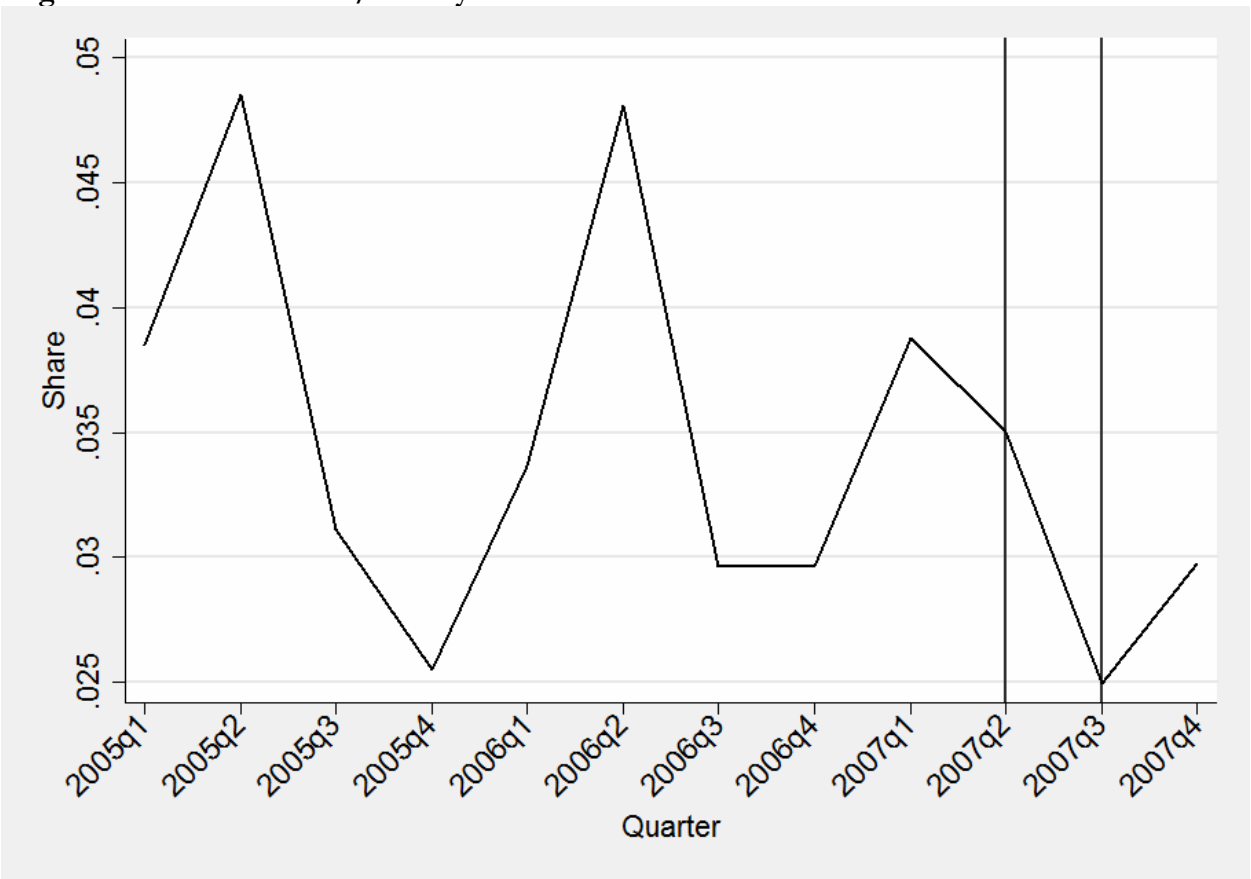
Notes: Toy Producers with and without 2007 recalls are value weighted indices of the 18 firms traded on the NYSE, AMEX, or NASDAQ that have primary or secondary SIC codes indicating toy production. 7 of these firms had a 2007 recall and 11 did not. All other indices are from Kenneth French's website (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.

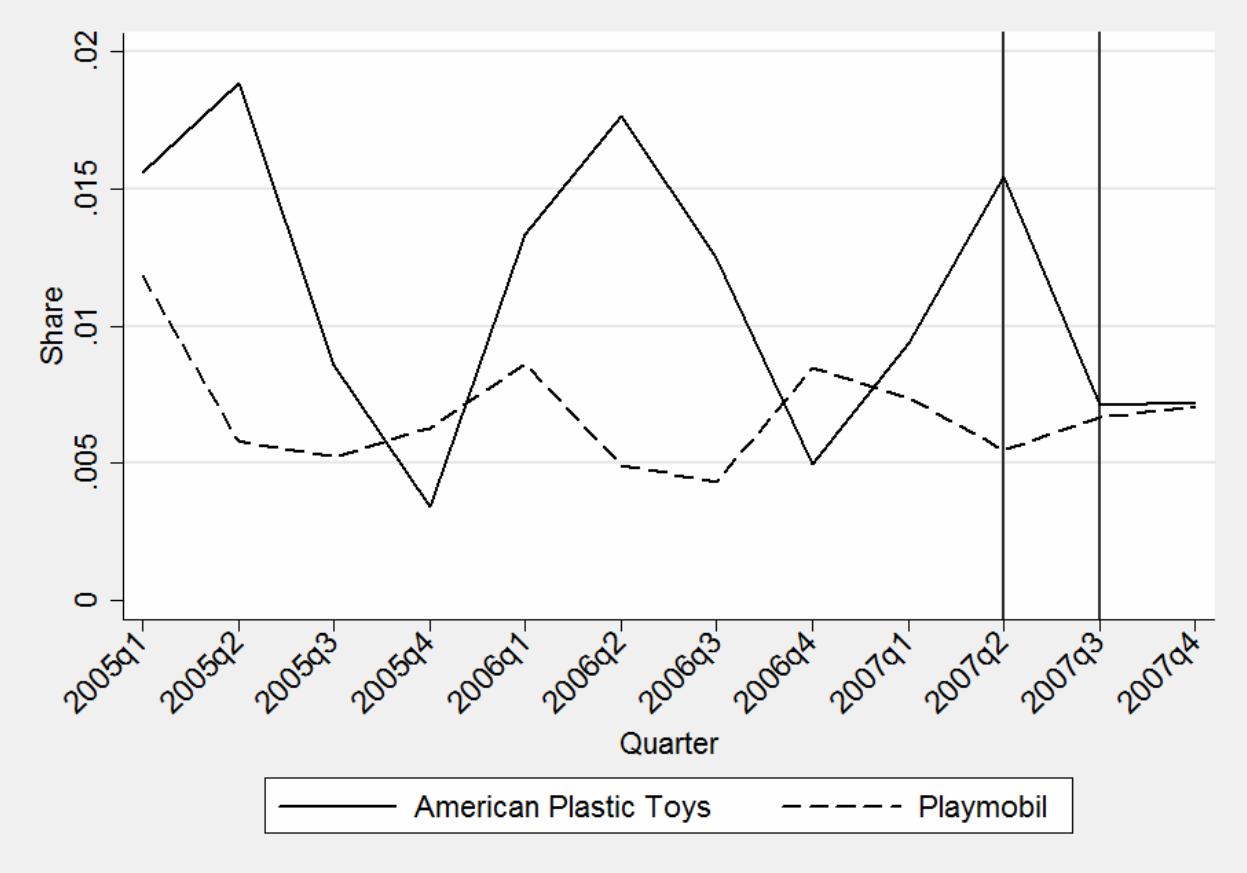
Figure 6a: Share of Infant/PS Toys Manufactured Outside of China



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: Unit Sales Changes for Total Market, Top 10 Firms, and Top 2 Firms Manufacturing Outside China

	Total Market	Mattel	RC2	Vtech	MGA Entertainment
2006 q1 Units Sold	43,176,000	10,727,000	2,824,000	1,465,000	1,081,000
2006 q4 Units Sold	116,356,000	32,579,000	6,441,000	7,194,000	3,670,000
2007 q1 Units Sold	49,937,000	10,819,000	4,867,000	2,017,000	1,267,000
2007 q4 Units Sold	101,640,000	27,014,000	5,707,000	7,272,000	3,319,000
% Change:					
2007 q4/q1 vs. 2006 q4/q1	-24.47%	-17.79%	-48.59%	-26.58%	-22.84%
Transactions 2006q4	22,826	6,623	1,411	1,403	701
Market Cap Change					
1/3/07 – 5/22/07	32.42%	30.35%	2.03%		
5/22/07 – 12/31/07	-24.65%	-39.05%	-43.78%		
2007 Recalls		12	3	0	0

	Tomy	Jakks Pacific	Russ Berrie	American Plastic Toys	Playmobil
2006 q1 Units Sold	1,089,000	553,000	864,000	577,000	372,000
2006 q4 Units Sold	2,594,000	2,448,000	1,337,000	578,000	986,000
2007 q1 Units Sold	1,710,000	1,225,000	1,019,000	468,000	369,000
2007 q4 Units Sold	1,050,000	3,378,000	889,000	732,000	717,000
% Change:					
2007 q4/q1 vs. 2006 q4/q1	-74.22%	-37.71%	-43.62%	56.14%	-26.69%
Transactions 2006q4	532	465	259	68	175
Market Cap Change					
1/3/07 – 5/22/07		15.99%	2.49%		
5/22/07 – 12/31/07		-5.82%	5.29%		
2007 Recalls	0	1	0	0	0

Notes: Top portion of table 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. Market Cap Change calculated from CRSP stock price database. The total market column includes all 18 firms with a primary or secondary SIC code indicating toy manufacturing. 5/22/07 is the day that the index of publicly traded toy firms peaked

Table 3: Unit Share by Category for Major Infant/Preschool Toy Producers

Category	Mattel	Leapfrog	Hasbro	RC2	Vtech	MGA Entertainment	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 4: OLS difference-in-difference analysis of the impact of a recall during the year on manufacturer-category quarter 4 sales

	All	Top 15	Top 30		All	Top 15	Top 30
I(07 Recall to Man/Cat)	-0.332*	-0.384*	-0.321	**# 07 Recall to Man/Cat**	-0.016	-0.016*	-0.016*
	(0.193)	(0.223)	(0.210)		(0.010)	(0.009)	(0.010)
I(07 Recall to Manuf)	0.317*	0.414*	0.277	**# 07 Recall to Manuf**	0.008	0.010	0.010*
	(0.173)	(0.227)	(0.190)		(0.005)	(0.006)	(0.006)
I(06 Recall to Man/Cat)	-0.015	0.178	-0.016	**# 06 Recall to Man/Cat**	-0.016	-0.014	-0.017
	(0.302)	(0.259)	(0.299)		(0.013)	(0.014)	(0.014)
I(06 Recall to Manuf)	-0.110	-0.061	-0.036	**# 06 Recall to Manuf**	0.028	0.039	0.040
	(0.170)	(0.221)	(0.190)		(0.023)	(0.027)	(0.025)
I(05 Recall to Man/Cat)	0.526**	0.548**	0.456**	**# 05 Recall to Man/Cat**	0.060**	0.058**	0.052**
	(0.195)	(0.125)	(0.209)		(0.020)	(0.014)	(0.020)
I(05 Recall to Manuf)	-0.282*	-0.088	-0.204	**# 05 Recall to Manuf**	0.041	0.062	0.058
	(0.148)	(0.183)	(0.184)		(0.039)	(0.044)	(0.041)
I(2007)	-0.271**	-0.228	-0.250**	**I(2007)**	-0.185**	-0.082	-0.168*
	(0.099)	(0.144)	(0.115)		(0.087)	(0.125)	(0.100)
I(2006)	-0.077	0.009	-0.136	**I(2006)**	-0.084	-0.045	-0.159
	(0.093)	(0.148)	(0.117)		(0.085)	(0.129)	(0.103)
Constant	11.465**	12.336**	11.928**	**Constant**	11.381**	12.158**	11.795**
	(0.066)	(0.088)	(0.077)		(0.078)	(0.146)	(0.104)
N	609	258	405	**N**	609	258	405
r2	0.882	0.918	0.900	**r2**	0.881	0.916	0.900
# of Manuf/Categories	203	86	135				
# I(07 Recall to Man/Cat)	13	11	12				
# I(07 Recall to Manuf)	56	45	52				
# I(06 Recall to Man/Cat)	6	5	6				
# I(06 Recall to Manuf)	47	40	47				
# I(05 Recall to Man/Cat)	2	1	2				
# I(05 Recall to Manuf)	26	13	20				

Notes: 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 5: OLS difference-in-difference analysis of the impact of a recall during the year on property or property-category quarter 4 sales

	Property/ Category Level
I(07 Recall to Prop/Cat)	-0.131
	(0.249)
I(07 Recall to Prop)	0.066
	(0.212)
I(06 Recall to Prop/Cat)	-0.130
	(0.358)
I(06 Recall to Prop)	-0.158
	(0.255)
I(2007)	-0.110
	(0.129)
I(2006)	0.088
	(0.104)
Constant	11.559**
	(0.075)
N	483
r2	0.838
# of Props or Prop/Cats	161
# I(07 Recall to Prop/Cat)	12
# I(07 Recall to Prop)	44
# I(06 Recall to Prop/Cat)	2
# I(06 Recall to Prop)	26
# I(05 Recall to Prop/Cat)	0
# I(05 Recall to Prop)	0

Notes: Robust standard errors in parentheses. Column 1 includes property fixed effects and column 2 includes property-category fixed effects. Coefficients refer to recalls during the calendar year indicated. * Statistically significant at 10% level. ** Statistically significant at 5% level.

Table 6: RC2 Recall of "Thomas and Friends" - June 2007 & September 2007
Quantity Changes

	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	1,452,000	-	377,000	989,000	1,213,000	160,000	2,622,000	36,357,000
2006 q4 Units Sold	3,860,000	-	790,000	1,726,000	2,738,000	603,000	9,230,000	97,344,000
2007 q1 Units Sold	3,097,000	-	900,000	861,000	1,787,000	290,000	3,099,000	39,894,000
2007 q4 Units Sold	3,420,000	-	736,000	1,535,000	2,303,000	566,000	8,705,000	84,359,000
% 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 7: Mattel's Dora Recall (August 2007)
Quantity Changes

	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	872,000	431,000	2,430,000	6,994,000	0	225,000	1,217,000	31,007,000
2006 q4 Units Sold	1,246,000	1,071,000	8,163,000	22,099,000	0	820,000	3,217,000	79,740,000
2007 q1 Units Sold	486,000	470,000	2,576,000	7,287,000	0	216,000	1,365,000	37,537,000
2007 q4 Units Sold	329,000	1,192,000	5,336,000	20,157,000	0	1,113,000	1,898,000	71,615,000
% 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: Dora the Explorer and Sesame Street; 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 8: Mattel's Sesame Street Recall (August 2007)
Quantity Changes

	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	965,000	-	8,557,000	1,115,000	88,000	-	26,377,000	5,982,000
2006 q4 Units Sold	3,141,000	-	26,829,000	2,511,000	232,000	-	66,984,000	16,309,000
2007 q1 Units Sold	1,298,000	-	8,680,000	809,000	68,000	-	31,105,000	7,890,000
2007 q4 Units Sold	2,011,000	-	22,636,000	2,322,000	195,000	-	58,159,000	16,208,000
% 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: Dora the Explorer and Sesame Street; 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 9: 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 1-90	Market Cap on 1/2/04 ($1,000)	Top 15 Toy Sales
1	Hasbro	1/30/04	2,940,000			X			3,667,633	X
2	Mattel	4/14/04	8,478,000			X			8,296,800	X
3	Hasbro	9/9/04	6,900,000			X			3,667,633	X
4	Mattel (Fisher-Price)#	5/10/05	5,322,000			X			8,296,800	X
5	Sony	9/13/05	126,450,000			X			4,144,605	
6	Mattel (Fisher-Price)	1/18/06	16,578,000			X	0	3	8,296,800	X
7	Hasbro (Milton Bradley)	2/23/06	11,525,000			X	2	4	3,667,633	X
8	Mattel (American Girl)	3/30/06	1,800,000	X			0	3	8,296,800	X
9	LeapFrog	9/7/06	11,160,000			X	0	4	813,226	X
10	Hasbro	9/22/06	8,925,000				1	18	3,667,633	X
11	RC2	11/2/06	1,650,000			X	0	1	364,306	X
12	Mattel	11/21/06	54,000,000		X	X	0	26	8,296,800	X
13	Hasbro (Easy-Bake)	2/6/07	24,625,000			X	0	7	3,667,633	X
14	Jakks Pacific	2/13/07	14,700,000			X	0	1	324,514	X
15	Mattel (Fisher-Price)	2/15/07	7,500,000			X	1	16	8,296,800	X
16	RC2	6/13/07	60,000,000	X		X	0	113	364,306	X
17	Hasbro (Easy-Bake)	7/19/07	25,000,000			X	6	77	3,667,633	X
18	Mattel (Fisher-Price)	8/2/07	21,757,500	X		X	4	821	8,296,800	X
19	Mattel#	8/14/07	194,388,500	X	X	X	109	841	8,296,800	X
20	Mattel (Fisher-Price)#♄	9/4/07	7,783,000	X		X	396	433	8,296,800	X
21	RC2#	9/26/07	5,006,400	X		X	22	45	364,306	X
22	Mattel (Fisher-Price)	10/25/07	570,000	X		X	118	140	8,296,800	X
23	Henry Gordy	10/31/07	380,000	X		X	0	2	40,086	
24	Mattel (Fisher-Price)	11/6/07	10,850,000				103	109	8,296,800	X
25	Marvel	11/8/07	2,625,000	X		X	10	10	2,082,783	X

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. ♄ Two recalls named Fisher-Price and one named Mattel directly on this day.

Table 10: Average CARs in Response to Toy Recall Announcements

Sample	Window	Mean CAR	N	% < 0
2004 - 2006	[0,1]	0.0015	12	50%
		(0.0057)		
2004 - 2006	[-1,1]	-0.0068	12	50%
		(0.0069)		
2007	[0,1]	-0.0090	13	69%
		(0.0070)		
2007	[-1,1]	-0.0065	13	42%
		(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 11: Abnormal and Cumulative Abnormal Returns by Toy Recall Announcement

			Abnormal Return			CAR
Event #	**Firm**	**Event Date**	**Day -1**	**Day 0**	**Day 1**	**(0, 10)**
13	Hasbro (Easy-Bake)	2/6/07	0.0016	-0.0047	0.0052	0.0012
			(0.0107)	(0.0108)	(0.0108)	(0.0358)
14	Jakks Pacific	2/13/07	0.0099	0.0196	0.0197	0.1680*
			(0.0257)	(0.0258)	(0.0260)	(0.0860)
15	Mattel (Fisher-Price)	2/15/07	0.0019	-0.0033	-0.0155	-0.0138
			(0.0146)	(0.0145)	(0.0144)	(0.0484)
16	RC2	6/13/07	-0.0114	-0.0097	-0.0243	-0.0637
			(0.0184)	(0.0186)	(0.0183)	(0.0610)
17	Hasbro (Easy-Bake)	7/19/07	-0.0053	-0.0061	0.0014	-0.1126**
			(0.0131)	(0.0132)	(0.0132)	(0.0439)
18	Mattel (Fisher-Price)	8/2/07	0.0256*	-0.0234*	-0.0025	-0.0535
			(0.0135)	(0.0135)	(0.0142)	(0.0465)
19	Mattel#	8/14/07	0.0263**	-0.0099	-0.0085	-0.0912**
			(0.0116)	(0.0116)	(0.0116)	(0.0385)
20	Mattel (Fisher-Price)#ψ	9/4/07	-0.0126	0.0056	0.0090	0.0468
			(0.0120)	(0.0120)	(0.0120)	(0.0399)
21	RC2#	9/26/07	-0.0199	-0.0911**	0.0469**	-0.0325
			(0.0232)	(0.0230)	(0.0231)	(0.0767)
22	Mattel (Fisher-Price)	10/25/07	-0.0197	-0.0052	0.0023	-0.0199
			(0.0125)	(0.0124)	(0.0125)	(0.0418)
23	Henry Gordy	10/31/07	0.0056	0.0142	-0.0072	-0.0810
			(0.0325)	(0.0326)	(0.0333)	(0.1097)
24	Mattel (Fisher-Price)	11/6/07	0.0430**	-0.0107	-0.0051	-0.0053
			(0.0124)	(0.0125)	(0.0127)	(0.0420)
25	Marvel	11/8/07	0.0232	-0.0158	0.0026	0.0347
			(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

	Units				Dollars		
Manufacturer	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

	Units				Dollars		
Category	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

	Units			Dollars	
Property	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	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			
Target	1/18/07	Plush Baby Rattles and Photo Frame Ornaments	$1	450,000		X	
Hasbro (Easy-Bake)	2/6/07	Easy-Bake Ovens	$25	985,000	X	X	
JAKKS Pacific Inc.	2/13/07	Battery Packs for Toy Vehicles	$30 - $90	245,000	X	X	
Mattel Inc. (Fisher-Price Inc.)	2/15/07	Learning Bunny Toys	$15	500,000	X	X	X
Jazwares, Inc.	2/15/07	Link-N-Lite™ Magnetic Light-Up Puzzles	$15	30,000			
Sportcraft Ltd.	2/27/07	Bounce Houses	$200 - $300	2,600			
Toys R Us Inc.	3/13/07	Toy Sets	$15 - $30	128,700		X	
Estes-Cox Corp.	3/27/07	Radio Control Model Airplanes with Lithium Polymer Batteries	$30 - $35	66,000			
Regent Products Corp.	3/28/07	Stuffed Fun Balls	$1	7,200		X	
OKK Trading Inc.	4/4/07	dolls	$1	3,500			
Target	4/4/07	Little Tree Wood Activity Cart Toys	$20	18,500		X	
Small World Toys	4/11/07	Puzzle	$16	78,500		X	
Mega Brands America, Inc. (Magnetix)	4/19/07	Magnetix Recall Expanded	$20 - $60	4,000,000		X	
Graco Children's Products Inc.	5/2/07	Soft Blocks Tower Toys (on Graco® Baby Einstein® discover and play™ Activity Centers)	$80	40,000		X	
HaPe International Ltd.	5/2/07	Anima - Bamboo Collection Games	$10	5,000			
Battat Inc.	5/3/07	Parents® Magazine Record-A-Voice Toy Cell Phones	$8	14,000		X	X
Small World Toys	5/3/07	IQ Preschool™ Take-Apart Townhouse	$21	8,800		X	
Bookspan	5/17/07	Discovery Bunny Books	$8 - $16	16,000			
Bookspan	5/17/07	Baby Buddy Clip-on Books	$17 - $27	9,500			
AAFES	5/23/07	Invincibles Transport Converters Toy Sets	$20	3,000			

Manufacturer	Announce. Date	Product	Product Price	Units Recalled	Manuf in Stock Data	Manuf in Sales Data	Item in Sales Data
Tri-Star International Inc.	5/23/07	Ball Rattles, Wrist Rattles, Wind-Up Toys	$1	2,000		X	
The Boyds Collections Ltd.	5/30/07	Eli's Small Drums and Liberty's Large Drums	$15	4,500			
Gemmy Industries Corp.	6/7/07	Floating Eyeballs	$3	500			
RC2 Corp.	6/13/07	Various Thomas and Friends™ Wooden Railway Toys	$10 - $70	1,500,000	X	X	X
Target	6/28/07	Play Wonder Toy Barbeque Grills	$20	2,300		X	
Dorel (Infantino)	7/3/07	Shape Sorting Toy Castles	$12	68,000		X	X
Kipp Brothers	7/5/07	Mag Stix Magnetic Building Sets	$3	800			
AAFES	7/18/07	Soldier Bear Brand Toy Sets	$5 - $15	13,000			
Hasbro (Easy-Bake)	7/19/07	Easy-Bake Ovens	$25	1,000,000	X	X	
Estes-Cox Corp.	7/24/07	Sky Rangers Park Flyer Radio Control Airplanes	$20 - $40	21,000		X	
Mattel Inc. (Fisher-Price Inc.)	8/2/07	Sesame Street, Dora the Explorer, and other children's toys	$5 - $40	967,000	X	X	X
The Orvis Company	8/3/07	Stuffed Plush Horse/Pillows and Fairy Dolls	$70	1,520			
Mattel Inc.	8/14/07	Various Polly Pocket dolls and accessories with magnets	$15 - $30	7,300,000	X	X	
Mattel Inc.	8/14/07	Doggie Day Care™ play sets	$4 - $20	1,000,000	X	X	
Mattel Inc.	8/14/07	Barbie and Tanner™ play sets	$16	683,000	X	X	
Mattel Inc.	8/14/07	die cast toy cars	$7 - $20	253,000	X	X	
Mattel Inc.	8/14/07	Batman™ and One Piece™ magnetic action figure sets	$11	345,000	X	X	
Hampton Direct	8/21/07	Magnetic Toy Train Sets	$30	27,000			
Schylling Associates Inc.	8/22/07	Spinning Tops and Tin Pails	$6 - $13	70,700		X	
Mattel Inc. (Fisher-Price Inc.)	9/4/07	Big Big World 6-in-1 Bongo Band toys	$20	8,900	X	X	
Mattel Inc. (Fisher-Price Inc.)	9/4/07	Geo Trax Locomotive Toys	$3 - $16	90,000	X	X	
Mattel Inc.	9/4/07	Various Barbie Accessory Toys	$10	675,000	X	X	
Guidecraft Inc.	9/26/07	Floor Puppet Theaters	$90	10,000		X	
Jo-Ann Stores Inc.	9/26/07	Children's Toy Rake	$7	16,000			
RC2 Corp.	9/26/07	Series Toys	$8	800	X	X	

Manufacturer	Announce. Date	Product	Product Price	Units Recalled	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	X	X
Target	9/26/07	Happy Giddy Gardening Tools and Children's Sunny Patch Chairs	$3 - $10	350,000		X	
Lan Enterprises	9/28/07	Mini Zooper Doll Strollers	$50	21,000			
CKI Toys	10/4/07	Children's Toy Decorating Set	$10	15,000			
Eveready Battery Co.	10/4/07	"Pirates of the Caribbean" Medallion Squeeze Lights	$6	79,000		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	X
Kids II Inc.	10/4/07	Baby Einstein Discover & Play Color Blocks	$10 - $13	35,000		X	X
JCPenney	10/11/07	Disney™ Deluxe Winnie-the-Pooh 23-Piece Play Sets	$40	49,000		X	
Kipp Brothers	10/11/07	Bendable Dinosaur Toys	$10	10,000			
Dunkin' Donuts LLC	10/17/07	Pink and Orange Glow Sticks (free giveaway w/ donuts)	Free	1,000,000			
The Gymboree Corp.	10/18/07	Toy Pirate Swords	$15	6,000			
Mattel Inc. (Fisher-Price Inc.)	10/25/07	Go Diego Go Animal Rescue Boats	$15	38,000	X	X	X
Jo-Ann Stores Inc.	10/25/07	Children's Toy Gardening Tools	$7	97,000			
Henry Gordy International Inc.	10/31/07	"Galaxy Warriors" Toy Figures	$1	380,000	X		
SimplyFun LLC	10/31/07	Ribbit Board Games	$18	1,500			
Toys R Us Inc.	10/31/07	Elite Operations Toys	$10 - $30	16,000		X	
Mattel Inc. (Fisher-Price Inc.)	11/6/07	Laugh & Learn™ Learning Kitchen™ Toys	$70	155,000	X	X	X
Swimways Corp.	11/6/07	"Skippy" Pool Toys	$10	31,000		X	
Dollar General	11/7/07	Pull-Back Action Toy Cars	$1	380,000			
International Sourcing Ltd.	11/7/07	Dragster and Funny Car		7,500			
Schylling Associates Inc.	11/7/07	Robot 2000	$25	2,600		X	
Schylling Associates	11/7/07	Dizzy Ducks Music Box	$12	1,300		X	

Manufacturer	Announce. Date	Product	Product Price	Units Recalled	Manuf in Stock Data	Manuf in Sales Data	Item in Sales Data
Inc.							
Schylling Associates Inc.	11/7/07	Winnie-the-Pooh Spinning Top	$12	3,600		X	
Schylling Associates Inc.	11/7/07	Duck Family Collectable Wind-Up Toy	$8	3,500		X	
Spin Master Toys	11/7/07	Aqua Dots	$17 - $30	4,200,000		X	
Marvel Toys	11/8/07	Curious George Plush Dolls	$15	175,000	X		
Paricon Inc.	11/21/07	Snow and Sand Castle Kit	$30	800			
Bell Racing	12/5/07	Collectible Mini Helmets	$40	1,400			
Far East Brokers and Consulting Inc.	12/12/07	Fishing Games	$10	14,000			
Dollar Tree	12/13/07	Baby Toys Baby Bead & Wire Toys and Speed Racer Pull Back & Go Action! Cars	$1	300,000			
Jo-Ann Stores Inc.	12/13/07	Children's Robbie Ducky Holiday Water Globes	$5	60			
AAFES	12/19/07	Soldier Bear Toys	$5-$20	11,400			
Victoria's Secret	12/19/07	Holiday Cosmetics Stuffer Bears	$8	80			
Man's Trading Company	12/21/07	Super Magnets	$1	2,800			
eeBoo Corp.	12/27/07	Tot Tower toy blocks	$20	170,000		X	X

Source: Recall announcements listed on CPSC website. Parentheses indicate division or subsidiary directly named in recall announcement.