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Abstract. When financially distressed firms have overwhelming debts, a prominent option for survival is to file for Chapter 11 bankruptcy protection. We empirically study the effect of Chrysler's Chapter 11 bankruptcy filing on the quantity sold by its competitors in the U.S. auto industry. The demand for competitors could increase because they may benefit from the distress of the bankrupt firm (competitive effect). By contrast, competitors could experience lower sales if the bankruptcy increases consumer uncertainty about their own viability (contagion effect). A challenge to measuring the impact of bankruptcies is the coincident decline in economic conditions stemming from the Great Recession and the potential effect of the "cash for clunkers" program (among other confounding factors). To identify the effect of the bankruptcy filing, we employ a regression-discontinuity-in-time design based on a temporal discontinuity in treatment (i.e., bankruptcy filing), along with an extensive set of control variables. Such a design is facilitated by a unique data set at the dealer–model–day level that allows us to compare changes in unit sales in close temporal vicinity of the filing. We find that unit sales for an average competitor decrease by 28% following Chrysler's bankruptcy filing. Several types of evidence suggest that this negative demand spillover effect is driven by a heightened consumer uncertainty about the viability of the bankrupt firm's rivals. For example, we show that the sales of competitors' vehicles that compete within the same segments as the bankrupt firm's vehicles or that provide lower value for money are affected more negatively in response to the Chrysler filing. We also observe more web search activity for Chrysler's competitors after the filing. Our findings are robust to different estimation strategies (global versus local), different functional forms, different estimation windows, the inclusion of various controls (e.g., "cash for clunkers," incentives, advertising, inventory, recalls, price, and consumer confidence), the donut regression discontinuity approach, a potential serial correlation issue, a falsification exercise, and the inclusion of differential trends at various levels. Our study aims to inform policymakers and managers about unintended short-term demand consequences of Chapter 11 bankruptcy.

1. Introduction

When financially distressed firms have overwhelming debt or face large uncertain legal liability, a prominent option for survival is to file for bankruptcy to seek protection from their creditors (Franks and Torous 1989). One of the most extensively used bankruptcy formats by corporations is Chapter 11 bankruptcy, whereby a firm reorganizes its business under court supervision (Altman and Hotchkiss 2010). Between 2008 and 2015, around 10,300 businesses filed for Chapter 11 bankruptcy in the United States alone (www.abi.org).

Surprisingly, scant research exists on the impact of firm debt on marketing outcomes like consumer satisfaction and consumer demand (Malshe and Agarwal 2015), despite the call for studies that examine the interface of the marketing function with other business functions (Kumar 2015). In particular, little is known on how Chapter 11 filing impacts consumer demand for the bankrupt firms' competitors.

Intuitively, when a firm files for Chapter 11 bankruptcy, ceteris paribus, the bankrupt firm could face reduced demand as a result of this negative event. Even

worse, the consumers of the bankrupt firm might switch to its competitors, resulting in a "competitive effect." The literature on the stock price reactions of competitors to bankruptcies implies that the opposite prediction is also possible. Specifically, Warner (1977) argues that if a bankruptcy reveals negative information about the industry, then competitors' outcomes (i.e., stock prices) could be negatively affected, which is referred to as "contagion effect." However, the empirical evidence is inconclusive regarding the interplay between the contagion and competitive effects when it comes to stock price reactions. Consistent with the dominant contagion effect, Lang and Stulz (1992) and Ferris et al. (1997) report that the stock prices of competitors decline in response to bankruptcy announcements. Similarly, using an event study approach, Akhigbe et al. (2005) find a significant contagion effect in terms of stock returns on large and key competitors of World-Com, whose bankruptcy is one of the largest in the U.S. history. By contrast, Cheng and McDonald (1996) show significant contagion effects in the railroad industry, but they find significant competitive effects in the airline industry. Finally, using a sample of bankruptcy filings from a single legal regime, Haensly et al. (2001) do not find support for either a contagion or competitive effect in terms of equity value.

Although the above studies shed important light on several aspects of bankruptcy filings on competitive outcomes, they do not provide a consistent and complete picture. First, as discussed above, the empirical evidence is mixed for stock market reactions regarding which effect outweighs the other in affecting the net outcome of bankruptcy filings for competitors.

Second, it is not clear whether the findings of the aforementioned studies extend to the impact of bankruptcies on competitors' unit sales (as opposed to stock prices). While the stock-price effect reflects investors' response to the bankruptcy, the unit-sales effect is based on consumers' reactions. For investors, a dominant contagion effect in stock prices might arise when a filing conveys negative information about the stock market values of competitors. The stock market value reflects the expected present value of a firm's future cash flows. While cash flows are correlated with sales, there are many other components of cash flows, such as operating costs and the riskiness of future cash flows. Although negative information on these components are taken into account by investors, it is less relevant for consumers, who mainly consider the value of purchasing a product. Thus, the impact of bankruptcy on sales cannot be directly gleaned from its impact on stock prices.

Third, given their focus on stock price reactions, the previous studies in the finance literature examine the effect of bankruptcy announcements at the firm level. However, when it comes to consumer demand response, it is possible that some products of a given competitor are more prone to a dominant contagion or competitive effect than others based on the similarity between the product lines of the bankrupt firm and its competitors. Unfortunately, the current literature does not provide any guidance related to the product-level implications of bankruptcy filings, which is critical for marketing scholars and practitioners.

Fourth, there is little empirical analysis of demand effects of bankruptcies in a durable-good setting (Hotchkiss et al. 2008). In a durable-good context, the consumption stream that the goods provide depends on services like warranties, maintenance, and upgrades. In addition, in industries such as the automobile industry, the items represent one of the most expensive purchases for consumers. For these reasons, consumers have a lot at stake when evaluating options in response to a negative event. Therefore, the magnitude of a dominant contagion or competitive effect could be substantially higher than other industries examined in the literature such as the airline industry.

Collectively, the above research gaps show the need for a better understanding of the influence of Chapter 11 bankruptcy filings on the unit sales of rival firms' products. If the customers in a product category interpret the bankruptcy event as a negative event specific for the bankrupt firm, then one expects that the competitive effect would dominate the contagion effect. If, by contrast, ambiguous information about the bankrupt firm's future promotions, products, and services forces consumers to revise their beliefs about the purchasing environment in general (Shiu et al. 2011), then the contagion effect might dominate. For example, in an experimental study, Roehm and Tybout (2006) provide evidence for the existence of negative perception spillover effects to competitors in the context of brand scandals. Therefore, the direction and magnitude of the impact of Chapter 11 bankruptcy filings on consumer demand for competitors is an empirical question.

In this article, we investigate the temporally local effect of Chapter 11 filing on demand (i.e., quantity sold) for rival firms by analyzing Chrysler's Chapter 11 bankruptcy in the U.S. auto industry. On April 30, 2009, Chrysler filed for Chapter 11 bankruptcy, which is the first bankruptcy filing by a major U.S. carmaker in modern times and the 10th largest bankruptcy in U.S. history.[1] We collect a comprehensive and unique data set at the dealer–model–day level to compare changes in unit sales for the rivals of Chrysler before and after its bankruptcy filing. A challenge to measuring the impact of bankruptcies is the coincident decline in economic conditions in the United States stemming from the Great Recession. To separately identify the bankruptcy effect from the recession effect, our analysis uses a regression-discontinuity-in-time (RDiT) design based on a temporal discontinuity in treatment (i.e., bankruptcy filing), along with an extensive set of control

variables (see Hausman and Rapson 2017 for the details and checklist for the RDiT framework). This approach uses a car model's own unit sales just before the bankruptcy filing as the counterfactual unit sales just after bankruptcy in the absence of the bankruptcy filing, after taking into account other observables such as dealer characteristics and seasonality.[2]

Our subsequent analyses of potential confounding factors such as prices, advertising, and recalls show no substantial change around the bankruptcy filing in general. Another difficulty in identifying the demand effect of Chrysler's bankruptcy is the potential effect of the "cash for clunkers" program—a U.S. federal scrappage program that officially started on July 27, 2009. Specifically, if consumers hold back in anticipation of the program, this may result in a reduction in demand in the period after the Chrysler bankruptcy. Although our RDiT design helps us deal with this issue as well, we also include detailed controls associated with the scrappage program. Additionally, we examine the sales patterns of Chrysler's competitors in Canada—where Chrysler did not file for bankruptcy—around Chrysler's filing to complement our RDiT approach. Furthermore, we report statistics regarding consumer spending on other durable categories and big-ticket items (e.g., houses, motorcycles, etc.) around the filing as well as measures of consumer confidence. These statistics suggest that macroeconomic conditions are largely stable in the proximal temporal vicinity of Chrysler's bankruptcy.

We find that, on average, unit sales for a competitor decrease by 28% in response to Chrysler's bankruptcy filing. This finding suggests that the contagion effect in terms of sales dominates the competitive effect in our context. What this implies for managers and policymakers is that the financial distress experienced by a firm could in fact have harmful short-term demand effects for its rivals in the same industry. The negative demand spillover effect is broadly consistent across an extensive set of checks documented in Hausman and Rapson (2017) and Lee and Lemieux (2010), among others. Specifically, our finding is robust to (1) different estimation strategies recommended for RDiT settings, (2) different functional forms, (3) different estimation windows around the bankruptcy filing, (4) the inclusion of several important controls (i.e., "cash for clunkers," incentives, advertising, inventory, recalls, price, and consumer confidence), (5) the donut regression discontinuity approach, (6) a potential serial correlation issue, (7) a falsification exercise, and (8) the inclusion of differential trends at various levels.

We then explore possible mechanisms for the negative demand spillover such as increased consumer uncertainty about car purchases, decreased cross-traffic from the bankrupt firm's dealers to competitors' dealers, and lower consumer attitude toward the competitors sharing the same country of origin with the bankrupt firm, among others. We find several types of support for the increased consumer uncertainty explanation. First, we provide anecdotal evidence revealing that the news coverage about the bankruptcy not only emphasized the financial distress of the bankrupt firm but also highlighted the widespread auto industry crisis. Second, we show that the sales of competitors' vehicles that are more vulnerable to the uncertainty are affected more negatively following the bankruptcy filing. Specifically, the negative spillover effect is larger for competitors' models that are in the same segments as the bankrupt firm's models and that all competitor brands face sales declines following Chrysler's bankruptcy after taking the cross-segment heterogeneity into account. Additionally, we argue that car models with lower "equity" are more vulnerable to a negative demand spillover, as brands as market signals reduce consumer uncertainty (e.g., Erdem and Swait 1998). Using "overall quality divided by manufacturer suggested retail price" as a proxy for the "perceived quality" measure of equity[3] at the car-model level, we provide evidence that competitors' car models that offer better value for money stand to lose less due to the Chrysler filing. Third, in line with the heightened consumer uncertainty about automobile purchases, we demonstrate that the web search activity associated with the search terms including the brands of Chrysler's competitors increases significantly after Chrysler's bankruptcy filing. Finally, we provide suggestive evidence that the source of consumer uncertainty is the uncertainty about the viability of the bankrupt firm's rivals rather than the uncertainty about competitors' future discounts or availability of spare parts.

This study contributes to the literature on the effect of bankruptcy on market outcomes in two ways. First, unlike prior research that has mainly examined the stock price response of competitors to bankruptcies (Lang and Stulz 1992, Cheng and McDonald 1996, Ferris et al. 1997, Haensly et al. 2001, Akhigbe et al. 2005), we show the existence of a negative spillover effect in terms of consumer demand. Importantly, our negative demand spillover finding implies that comparisons of bankrupt firms' performances with those of nonbankrupt firms to assess the efficiency of Chapter 11 bankruptcies and indirect costs (e.g., as in Aivazian and Zhou 2012) might be misleading because a nonbankrupt firm does not necessarily mean a "control" firm. Second, our product-level analysis allows us to show that the bankruptcy filing has a heterogeneous impact across the products of a given competitor. Previous research cannot speak to such heterogeneous effects because the researchers conduct firm-level analyses to study stock-price responses.

This paper also adds to prior empirical research on spillover effects. Most studies in this literature concentrate on spillover effects in response to potentially positive events (e.g., new product introduction). These

papers show the existence of spillover effects within a brand family in a given category (Balachander and Ghose 2003), within a brand family across categories (Erdem and Sun 2002), and within a given category across competing brands (Janakiraman et al. 2009, Shapiro 2018). Freedman et al. (2012) complement these studies by providing evidence of spillover effects in response to a negative event (i.e., toy recalls) within a given category across competing manufacturers. In a similar vein, Borah and Tellis (2016) concentrate on automobile recalls and find that negative online chatter about a car model raises negative chatter for another model. Using aggregate data at the nameplate–month level, they estimate a panel vector autoregressive model and show that a rise in concerns about a nameplate's nearest competitor reduces the focal nameplate's sales. We extend these studies by (1) documenting a spillover effect within a given category across competing firms in response to a new type of negative event (namely, Chapter 11 bankruptcy) and (2) providing evidence of two significant moderators of the negative spillover effect: (a) the segment overlap between the bankrupt firm's models and competing firms' models and (b) the level of value for money provided by competitors' car models. Unlike Borah and Tellis (2016), we do not find that negative spillover effects are more likely to manifest for car models that share the same country of origin as that of the firm experiencing the negative event. In addition to the aforementioned substantive contributions, this study also adds to the marketing literature methodologically by applying the RDiT approach to examine potential spillover effects (Hausman and Rapson 2017).

2. Institutional Background
2.1. Chapter 11 Bankruptcy
Chapter 11, named after the U.S. Bankruptcy Code 11, is a form of bankruptcy that provides protection to financially distressed debtors (usually a corporation or partnership). Given its complexity and costs, Chapter 11 bankruptcy is mostly preferred by large firms. It affords the bankrupt firm a number of mechanisms to restructure its business so that it can continue operation and emerge from the bankruptcy as a financially healthier firm with less debt. These mechanisms involve debt and capital restructuring, supply and labor contract negotiation, and product-line consolidation.

2.2. Auto Industry Crisis and Chrysler's Chapter 11 Bankruptcy
The automotive industry is an important pillar of the U.S. economy. The "Detroit-Three"—i.e., GM, Ford, and Chrysler—alone employ 880,000 workers (6.6% of the U.S. manufacturing workforce) and contribute approximately 3.6%, or $500 billion, to the total gross domestic product output. In the United States, transactions at automobile dealerships account for a staggering 19% of all retail sales—making it the largest single retail sector and outpacing general-merchandise stores, food and beverage stores, and even gas stations. Given its economic importance and rich institutional features, researchers in marketing have concentrated on the automobile industry to address important issues related to pricing as well as consumer and trade promotions, among others (e.g., Sudhir 2001, Albuquerque and Bronnenberg 2012, Ozturk et al. 2016).

The global recession that started in 2008 sent shock waves through every sector of the economy. The economic meltdown arguably had the swiftest and most disastrous effect on the auto industry, which lost 50% of its sales volume in a single year and slashed 400,000 jobs. The crisis forced auto manufacturers and government regulators to make decisions in real time about how to keep the industry competitive. The unique restrictions that government had placed on this industry hampered its ability to quickly adjust to new marketplace realities. For example, union contracts prevented car manufacturers from closing down factories, and state franchise laws prevented them from closing down dealerships. The only way out was bankruptcy (Lafontaine and Morton 2010).

Following the recommendations from the U.S. Treasury Department, Chrysler filed for Chapter 11 bankruptcy protection—the 10th largest in the U.S. history—on April 30, 2009. Chrysler reemerged as a new entity, "new Chrysler," on June 10, 2009 after the bankruptcy protection period.[4] With this unprecedented bankruptcy filing by a major U.S. carmaker in modern times as our backdrop, in the following sections we study the immediate impact of the Chapter 11 bankruptcy on the unit sales of the bankrupt firm's competitors.

3. Data and Temporal Patterns Around Chrysler's Bankruptcy
3.1. Sales Data and Market Definition
We use the following data sources to examine the effect of Chrysler's bankruptcy filing on consumer demand for rivals: (1) R. L. Polk, (2) Consumer Expenditure Survey, (3) SimplyMap, (4) Chrome, (5) J.D. Power, (6) Autonews.com, (7) Kantar Media, (8) Experian, (9) a major marketing research firm, (10) the Office of Defect Investigation, (11) the Organization for Economic Cooperation and Development (OECD), (12) the World Bank, (13) the Conference Board, (14) the University of Michigan, (15) ABC News, (16) the LexisNexis database, and (17) Google Trends (details of these data sources are provided below). Our primary data set, which contains business-to-consumer new-car transactions for the symmetric 32-week window around Chrysler's filing, comes from R. L. Polk.[5] This data set tracks the census of new-car registrations at the dealer level across 211 designated market areas (DMAs)

spanning 50 states, along with District of Columbia, Guam, Puerto Rico, and Virgin Islands. For each transaction, the data include the vehicle identification number (VIN), make, model, model year, and segment (e.g., passenger minivan, sport utility, etc.) of the vehicle. We exclude "exotic/limited" segments such as prestige sporty and cargo minivan from our analysis. In addition to data on car characteristics, we observe information about dealer characteristics, including the dealer's name and address.

To control for market-level shocks, such as changes in the number of dealers, that may affect vehicle sales, we need to base our analysis on a clear market definition. We follow a similar approach to previous studies such as Olivares and Cachon (2009) and Orhun et al. (2016) to define a geographically isolated market. Specifically, we concentrate on urbanized areas or urban clusters with a population of fewer than 150,000 that have a minimum distance of 30 miles to markets of equal or larger size. To avoid the confounding sales effects of bankruptcy-induced dealer exits, along with other potential dealer entries or exits, we also eliminate markets with *any* entry or exit in 2009. Although excluding markets with market structure changes leads to a reduction in geographic variation, it allows for a clean analysis of the impact of Chapter 11 bankruptcy based on rich temporal variation in unit sales before and after the Chrysler filing.[6]

Because the top seven manufacturers—Chrysler, GM, Ford, Toyota, Nissan, Honda, and Hyundai—account for around 98% of total sales in these isolated markets, we restrict our analysis to the top-six rivals of Chrysler. Because we wish to estimate a model with dealer and car fixed effects to control for many factors that drive the sales of a car, we drop any models that have fewer than a total of 100 sales across all markets. We then exclude any dealer–model combination with fewer than three sales over the entire data period. This leaves us a sample of 369 isolated markets with 850 dealers (defined as a unique combination of dealer

name and address).[7] The resulting sample still contains more than 92% of all original sales in our sample markets. Table 1 provides a summary of our dependent and control variables (discussed later) based on our final sample.[8]

3.2. Other Data Sources

We supplement our primary data set with additional data sources to explore potential drivers of manufacturer sales in the United States. To evaluate the broader macroeconomic conditions around Chrysler's bankruptcy filing, we collect data on household-level expenditures for categories related to vehicles and major household items from the Consumer Expenditure Survey (CEX). We use CEX files for 2009 to tabulate expenditures for various categories based on two samples. The first sample contains all consumer units interviewed. For the second sample, we generate a subsample from the list of all consumer units by selecting the consumer units that reside in markets similar to those in our sales data. This subsample is restricted to (1) the states covered by our estimation sample, (2) urban areas, and (3) primary sampling units with a population size smaller than 329,000.

We also collect data on the demographic characteristics of the local markets included in our analysis from the SimplyMap database (http://geographicresearch.com/simplymap) to assess local economic conditions. This database includes annual information on demographic variables such as median household income, median house value, and percentage of employed population at various geographic levels such as Zip code and city.

To assess any potential trends in consumer preferences, we acquire very detailed car characteristics data from Chrome, an automotive syndicated data provider. The data set provides information on a wide range of car characteristics available at a fine VIN level, which we use to analyze potential trends in consumer preferences. Specifically, we concentrate on product characteristics such as engine size, number of cylinders,

Table 1. Data Summary

Variable	Mean	Standard deviation	Minimum	Maximum
Unit sales	0.048	0.248	0	16
Cash incentive (USD)	1,733	1,122	0	6,000
Financing rate (%)	1.427	2.293	0	6.9
Starting inventory (units)	43,122	49,992	500	251,600
Total advertising (000s of USD)	627.672	919.074	0	10,122
Price (USD)	28,320	9,328	6,631	87,990
Consumer comfort index	−48.839	2.801	−54	−42
Manufacturer-level cumulative recalls (units)	670,316	841,042	0	2,056,435

Notes. Reported statistics are from the largest symmetric (32-week) window around Chrysler's filing that we use for our estimations (excluding two bankruptcy filing days; i.e., April 30 and June 1). The statistics for financing rates are calculated using 1,393,490 observations based on model-day combinations for which there is a financing rate promotion. The statistics for the price variable are calculated using 553,364 observations. All other variables are calculated using 1,497,668 observations.

fuel type, and manufacturer suggested retail price (MSRP). We complement these data on car characteristics by collecting information on the overall quality of car models from J.D. Power.

Data on incentives, inventory, and monthly Canadian and U.S. car sales come from Autonews.com. Incentives data include the dates and details of customer and dealer promotions such as consumer cash, dealer cash, and financing rate promotions for each make-model-model year combination. Inventory data are at the national level and show the unit count of vehicles on hand for each car model at dealerships, factory lots, ports of entry, and in transit at the beginning of each month. These data allow us to adjust for potential supply effects while analyzing the sales effect of the bankruptcy filing. The Canada and U.S. unit sales data contain monthly national sales at the manufacturer–model level. Note that, in our main analysis, we use daily unit sales data for the United States at the dealer–model level based on the R. L. Polk data. We use the national unit sales data for the United States from Autonews.com to assess monthly seasonality in the years prior to our analysis period, which are not available in the R. L. Polk data.

To complement the incentive data, we also obtain daily advertising spending data at the designated market area (DMA) level and at the national level that include observations for each manufacturer-make combination from Kantar Media. This data set allows us to evaluate and account for total advertising expenditures (national and local) for the automakers around the Chrysler filing. Similarly, to assess changes in prices before and after bankruptcies, and check the robustness of results to the inclusion of price as a control variable, we obtain two data sets. One of them is from Experian, and it includes transaction prices for the census of all personal purchases across 19 states. Because our sales data cover all states, we have transaction price data for only a subset of our sales observations. The other data set is provided by a major marketing research firm. It contains monthly retail prices at the dealer–VIN level for a subsample of our sales observations.

We rely on the Office of Defect Investigation's database of automobile recalls to measure the level of recall activity for automakers. This database provides information on the number of recalled units by manufacturer, make, model, and model year as well as the date and other details associated with each recall. Using these data, we create the cumulative number of units recalled for a given manufacturer since the beginning of 2009.

We also use data on macroeconomic indicators for the United States and Canada from OECD (stats.oecd .org) and the World Bank (databank.worldbank.org). These indicators provide information on variables such as gross domestic product, unemployment, and consumer price index. Furthermore, we collect data on three consumer confidence measures: the Conference Board's monthly consumer confidence index, the University of Michigan's monthly consumer sentiment index, and the ABC News's weekly consumer comfort index. These measures allow us to assess the varying levels of consumer confidence around the bankruptcy filing.

Finally, to explore potential mechanisms behind our main effect, we rely on the LexisNexis and Google Trends (trends.google.com/trends) databases. Using the LexisNexis database, we extract data on newspaper articles about the auto industry published in the United States during the bankruptcy period to obtain anecdotal evidence regarding the bankruptcy. The Google Trends database allows us to measure web search activity related to the competitors of Chrysler around its bankruptcy filing. Specifically, we obtain daily interest (web search) in the United States for the following search terms using a 60-day window around Chrysler filing: Chrysler, Ford Motor Company, Toyota, Honda, Nissan, General Motors (GM), and Hyundai Motor Company. The interest measure represents search interest relative to the highest point on the chart for a given search term. A value of 100 is the peak popularity for the search term. A value of 50 means that the term is half as popular. A score of 0 means there was not enough data for the search term.

3.3. Rival Sales Around Chrysler's Bankruptcy

As our objective is to explore the effect of Chrysler's bankruptcy filing on the unit sales of its rivals, we first examine whether there are differences in competitor unit sales right before and after the bankruptcy filing. Table 2 reports the total weekly unit sales of Chrysler's rivals just weeks before and after Chrysler filed for bankruptcy. The table shows that the unit sales of Chrysler's competitors were 16% lower in the three-week window following its bankruptcy relative to the three-week window before the bankruptcy. The reduction in sales is even more pronounced based on shorter windows (one week or two weeks) before and after the Chrysler filing. Note that all these time windows around Chrysler filing are before GM filing. We obtain similar changes when we adjust for the day-of-week effects by comparing the same days in the before and after periods.

To see whether these reductions could simply be seasonal, we use monthly U.S. sales data for the years prior to the recession. Since the data are available starting from 2004, we use four years of data (i.e., 2004–2007). As Chrysler declared bankruptcy on April 30, we calculate the average percentage change in unit sales between April and May across these four years to check if seasonality could explain the sales drop after Chrysler filing. The average percentage change in unit sales for Chrysler's competitors is a statistically insignificant increase of

Table 2. Total Unit Sales of Chrysler's Competitors Before and After Chrysler's Bankruptcy

Period	Competitor unit sales
One-week period before/after	3,087/1,739
% Change (Average % Change After Day-of-Week Adjustment)	–43.67% (–45.56%)
Two-week period before/after	5,753/3,923
% Change (Average % Change After Day-of-Week Adjustment)	–31.81% (–30.64%)
Three-week period before/after	7,817/6,563
% Change (Average % Change After Day-of-Week Adjustment)	–16.04% (–16.41%)

Notes. This table reports authors' tabulations of the unit sales for Chrysler's rivals before and after Chrysler's bankruptcy filing based on the estimation sample. *Average % Change After Day-of-Week Adjustment*: We calculate this number by (1) computing the percentage change in the total number of sales for a given day of week (e.g., Monday) in the after period relative to the before period, and (2) taking the average of these percentage differences across seven days of week.

9.3% ($p = 0.16$), between April and May. Therefore, we do not find evidence of substantial seasonality in the years prior to the recession that can explain the reduction in sales for Chrysler's rivals we observe around Chrysler's bankruptcy filing. Although it is difficult to draw any conclusions from these patterns based on raw data, they indicate that Chrysler's filing *may* have had a significant negative effect on its rivals.

3.4. Spending in Other Related Categories Around Chrysler's Bankruptcy

One might argue that the broader macroeconomic environment might underlie the downward sales pattern we observe for Chrysler's rivals after its bankruptcy filing. To check this possibility, we see whether the reduction in spending in the car category extended to other related categories of spending. To do so, using CEX data that contain monthly household-level expenditure information for 2009, we investigate the changes in consumer spending around Chrysler's bankruptcy in various categories including "other vehicles," "furnishings and appliances," as well as "audio and visual equipment." The category "other vehicles" consists of the items in "other vehicles" (OTHVEHCL) that include vehicles other than cars and trucks such as motorcycles. The category "furnishings and appliances" consists of spending data on "major appliances" (MAJAPPL; e.g., washing machine), "small appliances" (SMLLAPPL; e.g., portable heating and cooling equipment), and "furniture" (FURNITUR; e.g., sofas). Finally, the "audio and visual equipment" category contains "audio and visual equipment" (TVAUDIO; e.g., TVs).[9]

Table 3 presents average monthly household expenditures for the above categories. Columns (2) an (3) report tabulations for all consumer units in 2009 CEX files. Columns (4) an (5) provide statistics associated with the closest subsample to our estimation sample as discussed in Section 3.2. The average household

expenditure numbers for the sample with all consumer units indicate that spending was somewhat higher or similar in the months following the bankruptcy filing relative to those preceding the filing. We also formally tested the differences in average expenditures between April and May for all categories using paired *t*-tests, and we found no statistically significant difference. As columns (4) and (5) of Table 3, these patterns remain broadly consistent when we use the closest subsample to our estimation sample.[10] Taken together, our analysis of naturally occurring macro trends suggests that the reduction in competitors' car sales right after the Chrysler filing might not be driven by worsening macroeconomic conditions that would have possibly affected other vehicle categories, durable products, and big-ticket items.

3.5. Other Potential Changes: Local Economic Conditions, Consumer Confidence, and Financing Costs

We consider other potential changes around Chrysler's bankruptcy filing that might be related to the contraction in sales for its competitors in Online Appendix B. Specifically, we examine changes in local economic conditions, consumer confidence, and financing costs. For the most part, these factors are stable around Chrysler's bankruptcy. We formally take into account changes in consumer confidence and the tightening of credit standards by some banks in our subsequent analysis.

4. Consumer Response to Chapter 11 Bankruptcy
4.1. Empirical Strategy

In this section, our goal is to formally evaluate the effect of Chrysler's Chapter 11 filing on the unit sales of its rivals. The key issue in doing so is to find an appropriate counterfactual sales level in the absence of the bankruptcy filing against which to compare the

Table 3. Monthly Household Expenditures (in USD) on Select Expenditure Categories

Expenditure category	All consumer units (CUs)		Closest subsample to our sample	
	April 2009 (before filing)	May 2009 (after filing)	April 2009 (before filing)	May 2009 (after filing)
Other vehicles	6.5 (294.5)	7.5 (312.2)	10.9 (484.0)	8.2 (224.5)
Furnishings and appliances	45.3 (358.0)	53.3 (415.0)	40.6 (384.9)	49.5 (361.5)
Audio and visual equipment	16.2 (122.1)	22.8 (415.9)	13.43 (84.2)	16.5 (105.7)
Sample size	6,957	6,958	2,061	2,037

Notes. This table reports authors' tabulations of the average (standard deviation) of monthly household expenditures based on the Interview Survey Data from Consumer Expenditure Survey (CEX). Columns (2) an (3) show tabulations for all consumer units in CEX files for 2009. Columns (4) an (5) report statistics associated with the closest subsample to our estimation sample. This subsample was obtained from the list of all consumer units by selecting the consumer units that reside in (1) the states covered by our estimation sample, (2) an urban area (i.e., BLS_URBAN = 1), and (3) a Primary Sampling Unit (PSU) with a population size smaller than 329,900 (i.e., POPSIZE = 4 or 5). Note that expenditure levels, especially for vehicles excluding cars and trucks, appear to be low. The reason for this is that not all consumer units purchase an item during the survey period. The less frequently an item is purchased, the larger the difference between the average for all consumer units and the average for those purchasing the item.

unit sales level after the bankruptcy filing. We use a regression-discontinuity-in-time (RDiT) approach based on a temporal discontinuity in treatment (i.e., Chrysler filing) to address this empirical problem.[11]

The RDiT design is an approach to estimate treatment effects in nonexperimental settings where (1) the treatment is determined by a known cutoff time period (c) and (2) there is no cross-sectional variation in treatment status (i.e., a difference-in-differences approach is not applicable).[12] The main idea behind this research design is that the observations for a unit ($i \in N$) just before the temporal cutoff ($t < c$) are good counterfactuals for those just above the cutoff ($t > c$). Thus, in theory, the RDiT design could use two sources of variation for identifying the treatment effect: time-series variation (asymptotics in T) and cross-sectional variation (asymptotics in N). If the researcher uses many units (i.e., large N) and a narrow time window around the treatment for identification, the RDiT design becomes closer to the canonical RD design (e.g., Lee and Lemieux 2010). However, in practice, most RDiT applications (e.g., Davis 2008) examine contexts where data are available at a high temporal frequency (e.g., daily or hourly) over a long time period (e.g., years) with limited (or no) cross-sectional variation (e.g., $N = 1$). Therefore, in RDiT settings, it is important to take into account additional challenges due to the use of time-series variation such as time-varying effects, autocorrelation, and manipulation of behavior near the cutoff, as documented by Hausman and Rapson (2017). In sum, an RDiT approach requires a comprehensive set of analyses validating the key identifying assumption, checking the robustness to various sources of identification and functional-form assumptions (e.g., flexible polynomial time trends), and eliminating potential biases due to the use of time-series variation.

In our context, the RDiT approach estimates the counterfactual unit sales in the absence of the bankruptcy filing based on a narrow time window before the filing. In other words, after adjusting for other observable factors such as dealer fixed effects and seasonality, a car model's own unit sales just before the bankruptcy filing constitute a good comparison with those just after the bankruptcy filing. Then the average differences in unit sales between the pre- and posttime windows around the bankruptcy filing provide a consistent estimate of the average "treatment" effect of the Chrysler bankruptcy (Hahn et al. 2001). The identifying assumption of this approach is that there are no concomitant unobservable factors affecting demand that discontinuously change at the temporal cutoff.[13] To implement the RDiT approach, we employ two different strategies. Because our dependent variable (i.e., quantity sold) is a count variable that takes on the value of zero frequently, we obtain our main results using a fixed-effects Poisson model similar to previous marketing studies with a count dependent variable in an RDiT context (e.g., Busse et al. 2010). We then present results from the augmented local linear strategy proposed by Hausman and Rapson (2017).

4.2. The Effect of Chapter 11 Bankruptcy on Competitors' Unit Sales

Because our aim is to estimate the impact of Chrysler's bankruptcy on the quantity sold by competitors, we first compute our dependent variable—i.e., unit sales for each dealer(d)–model(m)–day(t) combination (e.g., Tuscaloosa Toyota–Toyota Camry–May 1, 2009). Given that unit sales is a count measure, we employ a fixed-effects Poisson model with cluster (dealer) robust standard errors. The use of a fixed-effects (conditional on dealer) Poisson quasi-maximum likelihood model with clustered standard errors ensures (1) that the estimator is consistent even if there exists under- or overdispersion in the latent variable specification (Cameron and Trivedi 2005) and (2) that we address the issue of serial dependence in residuals (because arbitrary correlation

across time within dealers is allowed for), as has been the norm in the RDiT literature (Hausman and Rapson 2017).

More precisely, we estimate a Poisson regression model with the following log-link specification:

$$log(UnitSales_{dmt}) = \beta_{ChryComp} Chry\,Filing_t + f(t)$$
$$+ \delta_d + \mu_m + \tau_T + \beta_x X_{dmt} + \epsilon_{dmt}. \quad (1)$$

The dummy variable $Chry\,Filing_t$ is equal to 1 after Chrysler's bankruptcy filing, and 0 otherwise. The flexible global polynomial daily time trend $f(t)$ allows for separate trends on either side of the bankruptcy filing date. In our analyses, we run estimations incorporating first- through fourth-order polynomials and choose the polynomial order based on the Bayesian information criterion (BIC) (Hausman and Rapson 2017). We include this flexible polynomial to control for unobserved factors that change smoothly over time. The vector of dealer fixed effects, δ_d, accounts for dealer-specific characteristics such as the location and size of the dealership as well as the demographic composition and the level of competition at the dealer's local market (as we consider markets without any entry or exit during the analysis period). The vector of model fixed effects, μ_m, controls for time-invariant model characteristics such as manufacturer (e.g., GM), brand (e.g., Chevrolet), and nameplate (e.g., Impala). To adjust for time-varying demand conditions common to all car models such as gas prices and seasonality at various levels of aggregation, we also include several time-varying fixed effects—namely, τ_T. These fixed effects consist of day of month, day of week, the last five days of the month, and quarter fixed effects.

The vector of time, dealer, and/or model varying control variables is denoted by X_{dmt}. This vector includes controls for incentives (cash and financing rate), advertising, inventory, recalls, and consumer comfort.[14] It is important to take these factors into consideration because potential changes in them around Chrysler's bankruptcy filing may confound our estimate for the effect of bankruptcy filing on competitor sales. The vector X_{dmt} also includes control variables that account for other important events that happened in our study period and that may have differential effects on manufacturers. These variables consist of the interaction of manufacturer dummies with the indicator variable for periods after Chrysler's emergence from bankruptcy (*manufacturer × Chrysler emergence*), the interaction of manufacturer dummies with the indicator variable for periods after GM's bankruptcy filing (*manufacturer × GM filing*), and the interaction of manufacturer dummies with the indicator variable for periods after GM's emergence from bankruptcy (*manufacturer × GM emergence*). We also take into account different periods associated with the "cash for clunkers" program. Specifically, we include the interaction of manufacturer dummies with the "cash for clunkers" dummy variable, which is equal to 1 starting from the official start date of the program (i.e., July 27). In addition, to account for the possibility that sales might have started to decrease in anticipation of the program even before the official launch, we add detailed controls for important periods related to the program. On June 24, the president signed the program into law. The transactions associated with the program became potentially eligible on July 1, but the final rule was not issued and the processing of claims did not begin until July 24. The program ended on August 25. Based on these event dates, we create three dummy variables associated with the following periods: June 24 to June 30; July 1 to July 24, and July 25 to August 25. We then include the interactions of these three dummy variables with manufacturer dummies in our main specification as well.

The key coefficient of interest in our main specification in Equation (1) is $\beta_{ChryComp}$. This coefficient shows the multiplicative effect of Chrysler's bankruptcy filing on the average number of unit sales across its competitors. For example, if $\beta_{ChryComp}$ is smaller than zero (in the case of a negative bankruptcy effect), the average unit sales for Chrysler's competitors after Chrysler's bankruptcy is $exp(\beta_{ChryComp})$ times the average unit sales before the bankruptcy. Equivalently, the average unit sales for Chrysler's rivals decreases by $100 \times [1 - exp(\beta_{ChryComp})]\%$ after Chrysler's bankruptcy.

Table 4 presents the coefficient estimates based on the Poisson regression model in Equation (1) using three different symmetric windows around Chrysler's bankruptcy filing. Column (1) shows the estimated impact of Chrysler's bankruptcy filing on competitors' unit sales using 14 weeks of observations on either side of the filing date. The coefficient estimate for the effect of Chrysler filing on the mean unit sales of competitors implies that the filing is associated with an average of 28% [1 – exp(–0.330)] reduction in rivals' unit sales. As shown in columns (2) and (3), we continue to find a significant reduction in competitor sales when we use longer symmetric windows around Chrysler's filing. In addition, control variables have expected signs across all three estimations (not reported due to space constraints). Although incentives (cash and financing rate promotion availability), advertising, starting inventory, and consumer comfort are positively related to the unit sales of competitors, recalls are negatively associated with competitor sales.[15]

4.2.1. Robustness to Other Functional Forms. We begin our sensitivity analyses by checking the robustness of our finding to other functional form specifications. First, we estimate new specifications with different orders of polynomial as suggested by Lee and Lemieux (2010) and Hausman and Rapson (2017). Given the issues raised by Gelman and Imbens (2017) about using

Table 4. RDiT Global Strategy: Chrysler's Competitors Lose Sales After Chrysler's Bankruptcy

	Window around Chrysler filing (weeks)		
Variable	(1) 28	(2) 30	(3) 32
Chrysler filing ($\beta_{ChryComp}$)	–0.330*** (0.078)	–0.373*** (0.068)	–0.428*** (0.061)
BIC-chosen polynomial order	4 (separate)	4 (separate)	4 (separate)
Fixed effects (see the notes below)	Yes	Yes	Yes
Controls (see the notes below)	Yes	Yes	Yes
Number of observations	1,309,620	1,403,644	1,497,668
Log-likelihood	–215,808	–233,786	–251,215

Notes. This table reports estimates from three separate Poisson fixed-effects regressions based on daily car model-dealer level sales. The dependent variable is unit sales (for Chrysler's competitors). All specifications include the following fixed effects (not reported): *car model, dealer, day of month, day of week, last five days of month, quarter, manufacturer × cash for clunkers* dummies (separate dummies for different program periods), *manufacturer × Chrysler emergence, GM bankruptcy filing, GM bankruptcy filing × GM dummy*, and *manufacturer × GM emergence.* All specifications include the following control variables (not reported due to space constraints): *cash incentive, financing rate promotion dummy, financing rate promotion dummy × financing rate, total advertising* and its squared term, *starting inventory, manufacturer-level cumulative recalls*, and *consumer confidence index.* Clustered standard errors (dealer) are reported in parentheses for all regressions. The polynomial order is selected using the BIC criterion among global and separate (for pre- and postfiling periods) polynomial specifications with polynomial order ranging from one to four.
    ***$p < 0.01$.

high-order polynomials in RD designs, we concentrate on low-order polynomials. Table 5 shows that our finding of a reduction in competitor sales in response to Chrysler's bankruptcy filing is robust to different orders for the polynomial time trend.

Second, our main specification in Equation (1) consists of a Poisson model with a log-link to model the unit sales as a function of the key independent and control variables. To assess the sensitivity of our results to the overdispersion of unit sales data, we reestimate our model using the negative binomial distribution instead of Poisson. The results for this estimation are reported in the last column of Table 5. The coefficient for the focal bankruptcy variable shows that the

rivals of the bankrupt firm stand to lose sales after the bankruptcy filing. This finding is in line with the fact that our original estimator, which only requires a conditional mean assumption, is consistent under general conditions.

**4.2.2. Robustness to the Augmented Local Linear Strategy.** We complement our analysis above based on the global strategy by conducting the augmented local linear strategy proposed by Hausman and Rapson (2017). The augmented local linear strategy is composed of two steps: (1) save the residuals after estimating the coefficients of control variables (e.g., seasonality) using a large window (e.g., 32 weeks) around the treatment, and

Table 5. RDiT Global Strategy—Robustness to Other Functional Forms

	Poisson [polynomial order (lowest BIC to highest)]				Negative binomial (polynomial order)
Variable	4	2	3	1	4
Chrysler filing ($\beta_{ChryComp}$)	–0.330***	–0.486***	–0.454***	–0.287***	–0.315***
	(0.078)	(0.056)	(0.057)	(0.040)	(0.073)
Fixed effects (see the notes below)	Yes	Yes	Yes	Yes	Yes
Controls (see the notes below)	Yes	Yes	Yes	Yes	Yes
Log-likelihood	–215,808	–215,842	–215,835	–215,865	–214,624
BIC	433,865	433,896	433,910	433,913	429,658

Notes. This table reports estimates from several Poisson and negative binomial fixed-effects regressions based on daily car model-dealer level sales. The dependent variable is *unit sales* (for Chrysler's competitors). All specifications include the following fixed effects (not reported): *car model, dealer, day of month, day of week, last five days of month, quarter, manufacturer × cash for clunkers* dummies (separate dummies for different program periods), *manufacturer × Chrysler emergence, GM bankruptcy filing, GM bankruptcy filing × GM dummy*, and *manufacturer × GM emergence.* All specifications include the following control variables: *cash incentive, financing rate promotion dummy, financing rate promotion dummy × financing rate, total advertising* and its squared term, *starting inventory, manufacturer-level cumulative recalls*, and *consumer confidence index.* Clustered standard errors (dealer) are reported in parentheses for all regressions. All estimations use a 28-week window (1,309,620 observations) around Chrysler filing along with separate polynomial specifications for pre- and post-filing periods.
    ***$p < 0.01$.

Figure 1. (Color online) RDiT Graphs for Chrysler's Competitors Around Chrysler Bankruptcy Filing
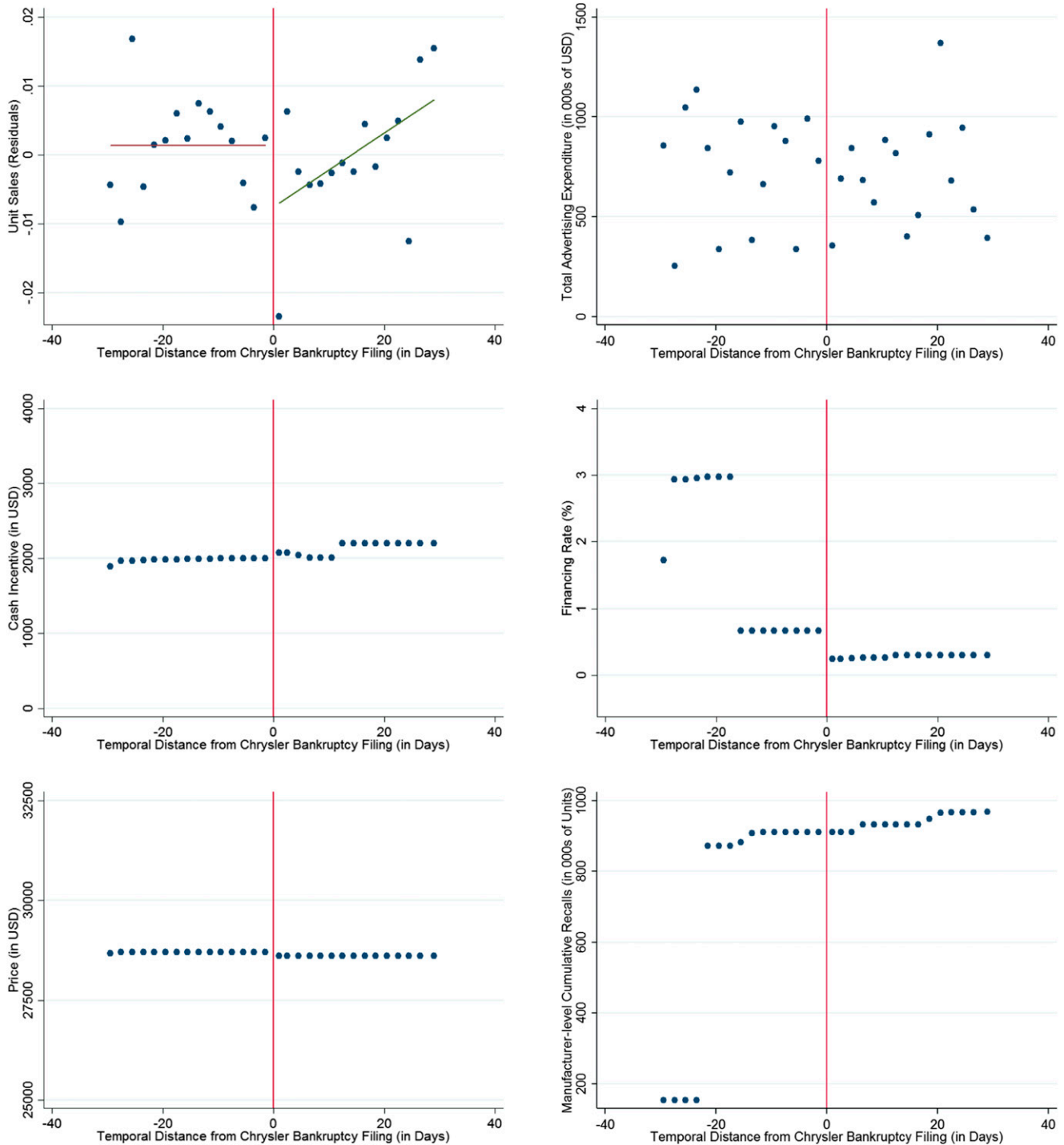
Notes. These figures show the regression-discontinuity-in-time plots for the unit sales residuals as well as for several control variables using 30 days of observations for Chrysler's competitors on either side of Chrysler's bankruptcy filing and a bin width of two days with rectangular kernel. The plot for unit sales residuals are based on the two-step augmented local linear approach proposed by Hausman and Rapson (2017).

(2) estimate a local linear specification using just the residuals within a narrow window around the treatment (e.g., 30 days on either side of the treatment). Following the recommendation by Lee and Lemieux (2010) and the approach in Hausman and Rapson (2017), in the top-left

part of Figure 1, we depict the residuals from our outcome variable (i.e., unit sales) based on a two-step augmented local linear approach using 30 days of observations on either side of the bankruptcy filing. This graph shows a noticeable decline in unit sales

Table 6. RDiT Augmented Local Linear Strategy

Kernel/bandwidth	(1) 30 days	(2) 60 days	(3) 90 days
Rectangular	−0.009***	−0.002***	−0.003***
	(0.0014)	(0.0008)	(0.0006)
Triangular	−0.004***	−0.004***	−0.003***
	(0.0014)	(0.0009)	(0.0008)
Epanechikov	−0.004***	−0.004***	−0.002***
	(0.001)	(0.0009)	(0.0008)

Notes. Dependent variable: Unit sales residuals based on the two-step augmented local linear approach proposed by Hausman and Rapson (2017). This table reports the coefficient (bootstrapped standard error) of the *Chrysler filing* dummy from 9 separate augmented local linear regressions (Hausman and Rapson 2017). In columns (1), (2), and (3), the treatment effects are estimated with 30, 60, and 90 days of observations on either side of the cutoff, respectively. These three windows contain 402,960, 799,204, and 1,202,164 observations, respectively. Our qualitative finding remains robust when we use the bandwidth based on an integrated mean square error (i.e., 24.6 days), however the estimates become less precise due to using a short window around the filing.
   ***$p < 0.01$.

residuals around the filing date.[16] We provide the formal estimates based on the augmented local linear strategy in Table 6. This table shows estimates for bandwidths of 30, 60, and 90 days around the filing date with rectangular, triangular, and Epanechikov kernels. The results continue to indicate that the bankrupt firm's competitors lose sales after the bankruptcy filing, providing further support for our original finding of negative demand spillover.

4.2.3. Potential Anticipatory Behavior and Robustness to Donut RD. One concern about our analyses so far is that the competitors of Chrysler may have anticipated its bankruptcy and acted in response. This concern about anticipatory behavior near the cutoff is especially relevant when time is the running variable in an RD setting and when competitors can *precisely* anticipate the discontinuity and have clear expectations about the potential impact of the bankruptcy to act accordingly. This is possibly not the case in our context for several reasons. First, Chrysler's way out of financial distress was determined by a multiparty negotiation—that began in March 2009—among Chrysler, the United Auto Workers (UAW), Fiat, and the government of Canada. Bankruptcy was not the only option on the table, and Chrysler was not the only decision maker. The "furious nonstop negotiations" among the parties "did not end until shortly before Chrysler's Chapter 11 filing" (Selbst 2009, p. 4). As a result, it was difficult for Chrysler's competitors to precisely anticipate the date of the bankruptcy filing. Second, Chrysler's bankruptcy was the first corporate bankruptcy in the auto manufacturing industry in modern times. Therefore, competitors might have not had unambiguous predictions about the potential implications of the filing, and thus they might have adopted a "wait-and-see" policy. In line with these reasons, data trends in the close temporal vicinity of Chrysler's bankruptcy filing suggest that the majority of

the variables under Chrysler's competitors' control remain stable around the filing date (Figure 1).[17]

To further address the potential anticipatory behavior concern, following the recommendation of Hausman and Rapson (2017), we assess the sensitivity of our results to observations close to the filing date. Specifically, we estimate three additional augmented local linear estimations using 30 days of observations on either side of the cutoff by removing (1) one week from center, (2) one week from the prefiling period, and (3) one week from the postfiling period (see Barreca et al. 2011 for a similar approach). In Table 7, consistent with our previous results, we find evidence of a demand decline for Chrysler's competitors after Chrysler's bankruptcy filing.[18]

4.2.4. Potential Serial Correlation in Unit Sales. In an RDiT context, it is important to take into account the time-series properties of the data as well. Accordingly, following the suggestion by Hausman and Rapson (2017), we test for the presence of autocorrelation in the outcome variable of interest—i.e., unit sales—using preintervention data. Our data could not reject the null hypothesis that

Table 7. RDiT Sensitivity Analysis: Donut-RD Estimates

	Chrysler filing dummy
Remove one week from center	−0.011***
	(0.001)
Remove one week from pre-filing	−0.018***
	(0.002)
Remove one week from post-filing	−0.012***
	(0.002)

Notes. Dependent variable: *unit sales residuals*. This table reports the coefficient (bootstrapped standard error) of the *Chrysler filing* dummy from three separate augmented local linear regressions (Hausman and Rapson 2017). The treatment effects are estimated using a rectangular kernel with 30 days of observations on either side of the cutoff.
   ***$p < 0.01$.

there is no autocorrelation (*p*-value = 0.708). As an additional check, we include the lagged unit sales as a regressor in our augmented local linear estimation (not reported). We found that our negative spillover finding is robust, in line with the autocorrelation test result.

4.2.5. Time-Varying Effects. We also consider potentially time-varying effect of Chrysler's bankruptcy filing. Given that GM declared bankruptcy one month after Chrysler, we concentrate on the four-week period after the Chrysler filing to see whether the negative demand spillover effect is persistent. In doing so, we include five additional variables to our main specification in Equation (1). Specifically, we add the PrePost Chrysler filing dummy that takes value 1 if an observation occurs within the four-week pre- or postperiod around the Chrysler filing as well as the interactions of the pre/post Chrysler filing dummy with four dummy variables that indicate one week, two weeks, three weeks, and four weeks after the Chrysler filing. As a result, the coefficients associated with the interactions show the change in demand in a given week after the

Table 8. Time-Varying Effect of Chrysler's Bankruptcy Filing

Variable	Coefficient (SE)
Pre/Post Chrysler filing × one week after filing	–0.413***
	(0.070)
Pre/Post Chrysler filing × two weeks after filing	–0.537***
	(0.089)
Pre/Post Chrysler filing × three weeks after filing	–0.634***
	(0.096)
Pre/Post Chrysler filing × four weeks after filing	–0.601***
	(0.100)
Fixed effects (see the notes below)	Yes
Controls (see the notes below)	Yes
Log-likelihood	–215,782

Notes. This table reports estimates from a Poisson fixed-effects regression based on daily car model-dealer level sales. The dependent variable is unit sales (for Chrysler's competitors). The specification uses a 28-week window (1,309,620 observations) around Chrysler filing along with separate fourth-order polynomials for pre- and postfiling periods, and it includes the following fixed effects (not reported): *car model, dealer, day of month, day of week, last five days of month, quarter, manufacturer × cash for clunkers* dummies (separate dummies for different program periods), *manufacturer × Chrysler emergence, GM bankruptcy filing, GM bankruptcy filing × GM dummy,* and *manufacturer × GM emergence.* The specification also includes the following control variables: *Pre/Post Chrysler filing dummy, cash incentive, financing rate promotion dummy, financing rate promotion dummy × financing rate, total advertising and its squared term, starting inventory, manufacturer-level cumulative recalls,* and *consumer confidence index.* Clustered standard errors (dealer) are reported in parentheses. The *Pre/Post Chrysler filing dummy* takes the value 1 if an observation occurs within the four-week pre- or postperiod around the Chrysler filing. *One week after dummy* takes the value 1 if an observation occurs within the first week after Chrysler filing. Dummy variables *two/three/four weeks after filing* are defined similarly.
    ***p < 0.01.

filing relative to the four-week period before Chrysler filing (see Busse et al. 2010 for a similar approach). The estimates in Table 8 suggest that the negative demand spillover persists over the four-week period following Chrysler's bankruptcy.[19]

4.2.6. Other Robustness Checks. We conduct additional robustness checks related to remaining, if any, time-varying omitted variables in Online Appendix C. These sensitivity analyses, including a "falsification" test along with robustness to differential trends at various levels, indicate that it is unlikely that the reduction in unit sales for Chrysler's rivals after the bankruptcy is driven by concurrent unobserved factors that are not taken into account in our specification.

4.3. Car Sales in Canada Around Chrysler's Bankruptcy

In our estimations so far, we have used a car model's own unit sales just before Chrysler's filing as the counterfactual for those just after the bankruptcy filing, after controlling for other factors. Another approach for addressing the issue of time-varying omitted variables is to find a "control" group and compare the changes in unit sales that we observe for our "treatment" group around the Chrysler bankruptcy to those from the "control" group. As Chrysler's bankruptcy occurred in the United States, all markets in the United States fall into the "treatment" group. This means that we need another market that is similar to the U.S. market but that is not "treated" by a bankruptcy filing. Because Chrysler Canada did not file for bankruptcy in Canada, consumers in Canada did not face the same situation experienced by consumers in the United States due to Chrysler's bankruptcy in the United States. Thus, the Canadian market could serve as a control market. Ideally, if we had Canadian sales data at the same disaggregate level as our U.S. data (i.e., dealer-model-day), we could have estimated the impact of Chrysler's filing using a difference-in-difference approach as an additional robustness check. However, we only observe national monthly unit sales for Canada. As a result, we will informally investigate how Canadian sales evolved around the Chrysler bankruptcy in the United States.[20]

Table 9 reports unit sales for Chrysler's competitors in the months preceding and following the Chrysler's filing in the United States. The unit sales of Chrysler's competitors increase by 9.3% in Canada, where Chrysler did not declare bankruptcy. This finding is in contrast with the sales reduction that Chrysler's competitors faced in the United States. As a result, the depressed sales we observe for Chrysler's rivals in the United States may not simply be explained by a poor global macroeconomic environment and seasonal variation in automobile sales. The pattern in unit sales for the competitors of Chrysler in Canada gives more support to the view

Table 9. Car Sales for Chrysler's Competitors in Canada Around Chrysler's Bankruptcy

Period around Chrysler filing in the United States	Competitor sales
April 2009 units sold (before Chrysler filing in the United States)	161,606
May 2009 units sold (after Chrysler filing in the United States)	176,551
May 2009 % change relative to April 2009	*9.25%*

Note. This table reports authors' tabulations of monthly Canadian sales data from Autonews.com.

that Chrysler's bankruptcy filing may have negatively affected the competitors of the bankrupt firm.

5. Possible Mechanisms

In the preceding section, we found that the competitors of the bankrupt firm experienced a significant reduction in unit sales in response to the Chapter 11 filing. This result implies that the contagion effect dominates the competitive effect when it comes to the consumer demand response for competitors, which is in line with the dominant contagion effect for the stock price reactions reported in the finance literature (e.g., Lang and Stulz 1992). This section explores potential mechanisms for the negative demand spillover due to the bankruptcy. Specifically, we argue that the negative sales effect for the bankrupt firm's competitors is due to the increased consumer uncertainty about automobile purchases. We then provide suggestive evidence that the source of consumer uncertainty is the uncertainty about the viability of the bankrupt firm's competitors rather than the uncertainty about competitors' future discounts or availability of parts.

5.1. Increased Consumer Uncertainty Mechanism

Chapter 11 bankruptcy creates ambiguity about the bankrupt firm because its future becomes unclear. When consumers encounter ambiguous information about the bankrupt firm's future promotions, products, and services (e.g., availability of future brands as well as nearby dealers for convenient maintenance and repairs), it will be harder for them to make judgments among a set of choices, leading to a state of choice uncertainty (Weick 1979, Cutcher-Gershenfeld et al. 2015). This, in turn, is likely to force consumers to reassess and revise current beliefs or assumptions not only about the products of the bankrupt firm but also about the purchasing environment in general (Shiu et al. 2011), especially when their choices are irreversible for a long period of time. The increase in consumer uncertainty about the purchasing environment could be related to the viability of bankrupt firm's competitors, if consumers consider the possibility that the financial distress of the bankrupt firm reflects an industry-wide financial trouble (Shleifer and Vishny 1992). Other potential sources of an increased consumer uncertainty might include the availability of price discounts and spare parts in the future. The increase in

consumer uncertainty due to a bankruptcy filing will then heighten the value of waiting for consumers until the uncertainty about the future alternatives (including all product attributes such as brands, models, services, promotions, etc.) is resolved (see Bernanke 1983 for a similar reasoning for why a temporary uncertainty might reduce consumer spending). As such, consumers' search intention may increase (Shiu et al. 2011), and they may delay decision making in the automobile category to search for more information before finalizing their choice (Greenleaf and Lehmann 1995).

In the following subsections, we provide four types of evidence that support an increased consumer uncertainty-driven negative spillover effect. First, we present anecdotal evidence suggesting that the news coverage about the bankruptcies emphasized the widespread auto industry crisis along with the financial distress of the bankrupt firms. Second, we show that the negative spillover effect is greater for competitors' models that are in the same segments as the bankrupt firm's models and that all competitor brands suffer due to the bankruptcy filing after controlling for the segment. Third, we demonstrate that competitors' car models that offer better value for money (i.e., overall quality divided by manufacturer suggested retail price) are affected less adversely by Chrysler's bankruptcy filing. Fourth, we provide evidence that web search activity for Chrysler as well as Chrysler's competitors goes up significantly after Chrysler's bankruptcy filing in line with the heightened consumer uncertainty about car purchases. In particular, we show that while the web search activity for the "bankruptcy" search term for Chrysler's competitors increases after the filing, the web search activity for "discount" and "parts" search terms does not change significantly.

5.2. Anecdotal Evidence for the Increased Consumer Uncertainty Mechanism

Although our previous analysis shows that overall consumer confidence in the economy cannot explain the sharp drop in rival sales, Chrysler's bankruptcy filing may have affected the confidence in purchasing decisions in the automobile industry. In other words, the negative demand spillover finding could be indicative of a lowered confidence among car buyers. According to this explanation, consumers should be aware of the Chrysler bankruptcy and should perceive

the bankruptcy as evidence of the widespread auto industry crisis. A Gallup Poll conducted June 9–10 suggests that 74% of Americans correctly identified Chrysler as having declared bankruptcy.[21] Additionally, in the Pew Research Center report on top news stories of 2009, the news story titled "U.S. Auto Industry Woes" during the bankruptcies period was listed as one of the top news stories where public interest exceeded coverage.[22]

To investigate the news media coverage of the two bankruptcies in detail, we examine the newspaper articles in the LexisNexis database between April 30 and July 9 ("during bankruptcies" period). More precisely, we search for articles published in the United States, and we use "automaker bankruptcies," "chapter 11," and "insolvency" as search terms and "automotive industry" as a filter. Our search resulted in 133 articles. We next calculate the percentage of articles that contain a specific keyword. Here is the list of keywords and the associated coverage percentage: debt 38%, industry 38%, automotive 25%, automakers 19%, Ford 17%, Toyota 11%, crisis 8%, and Nissan 7%. These statistics reveal that the news media coverage of the bankruptcies was not limited to the bankruptcy protection for Chrysler. In addition, the news coverage around debt and crisis in the industry might have resulted in heightened concerns about the auto industry. For example, one of the articles mentions a West Covina councilman who said, "We clearly are concerned, in general, about the auto business for all of our dealers." Similarly, another article talks about a Toyota dealership owner who said, "The shoppers aren't shopping. When the total industry is off 43%, they are not running over to Toyota, Honda and Nissan products. They are sitting on their hands." These individual comments are in line with the Gallup Poll that finds that "Americans are, for the most part, not currently shopping for new cars." Overall, the anecdotal evidence offers support for the idea that the negative demand spillover might be due to increased consumer uncertainty about automobile purchases in general.

5.3. Greater Negative Spillover for Models with Segment Overlap with Bankrupt-Firm Models

While deciding which car to buy, consumers are more likely to search among alternatives within a given segment (i.e., car type) than across different segments (Albuquerque and Bronnenberg 2008). Consumers will face more uncertainty due to a bankruptcy filing if the segment they consider includes the bankrupt firm's car models. Thus, the sales of competitors' car models that compete with the bankrupt firm's models in the same segment are expected to be more negatively affected by the bankruptcy-induced consumer uncertainty and the associated delay in decision making.

This prediction is also supported by the studies in the finance literature arguing that rivals that are similar to those of the bankrupt firms are better candidates for a dominant negative spillover effect (e.g., Ferris et al. 1997). These studies hold that rival firms that have similar cash flow structures to that of the bankrupt firm might be more adversely affected by the bankruptcy compared with rival firms with dissimilar cash flow structures. For example, if the bankruptcy reveals negative information regarding cash flows from investing activities of the bankrupt firm, the rivals that have overlapping investment portfolios with the bankrupt firm are expected to experience similar problems. This, in turn, may result in stock price reductions for those rival firms. Just as investors take into account the uncertainty in future firm cash flows, automobile buyers consider the uncertainty in the future value of their car choice, since the purchase decision is irreversible for a long period of time for durables. If the negative sales effect of the bankruptcy on rivals is the result of increased consumer uncertainty due to negative bankruptcy information, then products of rivals that are perceived as more similar to those of the bankrupt firm should be affected more negatively by the bankruptcy filing.

We use our data to see whether the car models of competitors that serve the same segments (based on the definitions in the R. L. Polk database) as those of the bankrupt firm suffer more in response to the Chapter 11 filing. For instance, whereas Toyota Camry competes with Chrysler 300 in the "upper middle" segment, Toyota Tacoma does not face such competition from Chrysler in the "compact pickup" segment.[23] To examine the heterogeneity based on segment overlap, we create the *Chrysler segment overlap* dummy, which is equal to 1 if the segment of a given car model is one of those served by the bankrupt firm (i.e., Chrysler) and 0 otherwise. For instance, given the information above, *Chrysler segment overlap* is equal to 1 for Toyota Camry, but it is equal to 0 for Toyota Tacoma. To evaluate increased consumer uncertainty mechanism based on segment similarity, we include *Chrysler filing × Chrysler segment overlap* in our main specification. The coefficient estimates for this specification are reported in column (1) of Table 10. In line with the increased consumer uncertainty mechanism, the negative coefficient for *Chrysler filing × Chrysler segment overlap* indicates that the sales reduction for competitors' car models that compete with Chrysler models in the same segment is significantly more negative than those without competing Chrysler models.[24]

To further check the increased consumer uncertainty explanation, we see whether there is any cross-brand heterogeneity (e.g., Ford versus Toyota) after controlling for the segment (e.g., sport utility). If the mechanism is through increased uncertainty about the automobile purchases in general, we expect that all brands suffer to some extent after taking into account

Table 10. Possible Mechanisms for the Negative Demand Spillover Due to Chrysler's Bankruptcy

Variable/specification	(1) Segment overlap	(2) Other mechanisms	(3) Country of origin
Chrysler filing	−0.256***	−0.364***	−0.538***
	(0.078)	(0.119)	(0.121)
Chrysler filing × Chrysler segment overlap	−0.112***	Dropped	Dropped
	(0.020)		
Chrysler filing × GM dummy	—	−0.072	—
		(0.045)	
Chrysler filing × Honda dummy	—	−0.363***	—
		(0.067)	
Chrysler filing × Hyundai dummy	—	−0.154**	—
		(0.077)	
Chrysler filing × Nissan dummy	—	−0.124**	—
		(0.051)	
Chrysler filing × Toyota dummy	—	−0.170***	—
		(0.049)	
Chrysler filing × model-level equity	—	0.056**	0.052**
		(0.025)	(0.025)
Chrysler filing × same ZIP Chrysler competitor	—	−0.001	−0.008
		(0.026)	(0.026)
Chrysler filing × same country of origin	—	—	0.143***
			(0.034)
Chrysler filing × segment fixed effects	—	Yes	Yes
Fixed effects (see the notes below)	Yes	Yes	Yes
Controls (see the notes below)	Yes	Yes	Yes
Number of observations	1,309,620	1,309,620	1,309,620
Log-likelihood	−215,787	−215,686	−215,698

Notes. This table reports estimates from three separate Poisson fixed-effects regressions based on daily car model-dealer level sales. The dependent variable is unit sales (for Chrysler's competitors). All specifications include the following fixed effects (not reported): *car model, dealer, day of month, day of week, last five days of month, quarter, manufacturer × cash for clunkers* dummies (separate dummies for different program periods), *manufacturer × Chrysler emergence, GM bankruptcy filing, GM bankruptcy filing × GM dummy,* and *manufacturer × GM emergence.* All specifications include the following control variables: *cash incentive, financing rate promotion dummy, financing rate promotion dummy × financing rate, total advertising and its squared term, starting inventory, manufacturer-level cumulative recalls,* and *consumer confidence index.* All specifications include separate fourth-order polynomials for pre- and post-filing periods. The base category for manufacturer brand interactions is Ford. The *Chrysler filing × Chrysler segment* overlap interaction is dropped in specifications (2) and (3) because we control for *Chrysler filing × segment fixed effects.* Clustered standard errors (dealer) are reported in parentheses for all regressions.
    **$p < 0.05$; ***$p < 0.01$.

the segment.[25] We test this prediction by interacting manufacturer brand dummies with the *Chrysler filing* dummy and controlling for the interactions between segment dummies with the *Chrysler filing* dummy (among other controls). The estimates in column (2) of Table 10 indicate that all manufacturer brands, including the baseline brand (Ford), faced a decline in their unit sales after Chrysler's bankruptcy filing.

5.4. Lower Negative Spillover for Models Offering Better Value for Money

Previous literature in finance suggests that firms with special strengths such as strong reputation or valuable trademarks (i.e., equity) are more "able to withstand the signaled industry-wide troubles" than are firms without such strengths (Laux et al. 1998, p. 7). In addition, earlier studies in marketing indicate that brands as market signals enhance consumer perceptions about

brand attribute levels and decrease consumer uncertainty and perceived risk (Erdem and Swait 1998). Because our analysis is at the model level rather than at the firm or brand level, we translate this reasoning to the car model level. In doing so, we rely on one of the measures of brand equity—namely, perceived quality—that fall under the associations dimension in Aaker (1996). We proxy the "perceived quality" measure of equity at the car-model level by calculating "overall quality/MSRP," based on J. D. Power's measure of overall quality. This variable measures whether the car model provides good quality for the money. The coefficient estimate for the interaction of this *Model-level equity* variable with the *Chrysler filing* dummy is reported in column (2) of Table 10. The positive and statistically significant interaction estimate suggests that rivals' models that offer better quality for money are affected significantly less negatively by the filing.

Table 11. Web Search for the Bankrupt Firm's Competitors Increases After Chrysler Filing

	(1) All seven manufacturers	(2) Chrysler's competitors only
Chrysler filing	8.946***	7.871***
	(1.138)	(1.167)
Day of week fixed effects	Yes	Yes
Day of month fixed effects	Yes	Yes
Manufacturer brand fixed effects	Yes	Yes
Number of observations	420	360
R^2	83.4%	84.3%

Notes. Dependent variable: Daily web search (interest) by manufacturer brand obtained through Google Trends. All specifications use OLS based on a 60-day window around Chrysler's Chapter 11 bankruptcy filing.
***$p < 0.01$.

5.5. Greater Web Search for Competing Brands After Chrysler Filing

Earlier studies about the consequences of consumer uncertainty predict higher search intention in response to an increase in choice uncertainty (Shiu et al. 2011). Following this prediction, we collect additional data on web search activity using search terms associated with the bankrupt firm and the six rival manufacturers in our analysis. Specifically, we obtained daily interest (web search) in the United States for the following search terms via Google Trends (https://trends.google .com/trends) using a 60-day window around Chrysler filing: Chrysler, Ford Motor Company, Toyota, Honda, Nissan, General Motors, and Hyundai Motor Company.

Table 11 presents the ordinary-least-squares (OLS) estimates for several specifications using daily interest by manufacturer brand as the dependent variable and the Chrysler filing dummy as the key independent variable. Column (1) shows that, on average, web search activity for automobile manufacturers increased significantly following Chrysler's filing relative to the prebankruptcy period. This finding supports the increased consumer uncertainty explanation for the

negative demand spillover effect. However, because the analysis in column (1) includes the web search activity for the bankrupt firm itself (i.e., Chrysler) along with its competitors, one may argue that the increase in web search after the filing could be mainly driven by the heightened search for the bankrupt firm. We check this in column (2) by removing the bankrupt firm from our sample. The coefficient for the Chrysler filing dummy is still positive and statistically significant for this sample that includes only Chrysler's competitors. This indicates that search activity for competing brands went up significantly after the Chrysler filing.[26] This general increased search activity is consistent with heightened consumer uncertainty (and the associated need to resolve this uncertainty) about automobile purchases following Chrysler's bankruptcy.

To sharpen the consumer uncertainty mechanism, we check if there is any evidence regarding the source of the uncertainty. In particular, we analyze the daily interest in three specific search terms: "bankruptcy," "discount," and "parts" for each manufacturer. Table 12 shows the OLS estimates by search term for all manufacturers and for Chrysler's competitors only.

Table 12. Web Search for the Bankruptcy Keyword for Competitors Increases After Chrysler Filing

	Search term: Bankruptcy		Search term: Discount		Search term: Parts	
	(1) All seven manufacturers	(2) Chrysler's competitors only	(3) All seven manufacturers	(4) Chrysler's competitors only	(5) All seven manufacturers	(6) Chrysler's competitors only
Chrysler filing	10.315***	9.929***	1.713	0.769	−1.060	−1.770
	(2.439)	(2.772)	(2.062)	(2.286)	(1.399)	(1.485)
Day of week fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Day of month fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Manufacturer brand fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	420	360	420	360	420	360
R^2	19%	18.8%	29.2%	22.8%	32.7%	30.7%

Notes. Dependent variable: Daily web search (interest) by manufacturer brand-search keyword (e.g., Ford bankruptcy) combination obtained through Google Trends. All specifications use OLS based on a 60-day window around Chrysler's Chapter 11 bankruptcy filing.
***$p < 0.01$.

The estimates suggest that the search activity involving the "bankruptcy" search term increases significantly for Chrysler's competitors following Chrysler's filing.[27] However, the search activity related to the "discount" and "parts" search terms does not change significantly after the filing. These findings imply that the source of consumer uncertainty appears to be the uncertainty about the viability of Chrysler's rivals, rather than the uncertainty about future promotions or availability of parts.

5.6. Alternative Mechanisms
5.6.1. Cross-Traffic Effects. Another possible explanation for the negative spillover effect is that there might be a positive cross-elasticity between Chrysler visits and visits to other dealers.[28] For instance, a customer searching for a Jeep Grand Cherokee in the sport-utility vehicle (SUV) segment might first go to a Chrysler dealer but then visit a GM dealer to look for a similar vehicle (e.g., Chevrolet TrailBlazer). If that is the case, the decreased Chrysler traffic might have led to a decreased cross-traffic to competitors' dealers, and thus to a negative demand spillover. To check whether this "cross-traffic effects" mechanism is operative, we create an indicator variable that equals one for competitors that have a Chrysler dealer in the same ZIP code. We then add the *Chrysler filing × Same ZIP Chrysler competitor* interaction in our model. If the "cross-traffic effects" mechanism is at work, we expect that competitors with nearby Chrysler dealers suffer more than those without—i.e., a significant negative coefficient for the interaction term. The results reported in column (2) of Table 10 show a negative but insignificant coefficient for the *Chrysler filing × Same ZIP Chrysler competitor* interaction. Therefore, we do not find strong support for the "cross-traffic effects" mechanism.

5.6.2. Country-of-Origin Overlap. Previous literature has shown that consumers use country image as a summary construct while forming attitudes about brands (Han 1989) and negative spillover effect (in terms of online chatter) is most prominent between brands of the same country (Borah and Tellis 2016). Chrysler's bankruptcy might have adversely affected consumers' beliefs about American automakers in general, which, in turn, may have resulted in a more negative attitude toward American brands. Therefore, one possible explanation for the heterogeneous sales effects of the bankruptcy filing on competitors reported so far is that rivals that have the same country of origin as the bankrupt firm are better candidates for a strong contagion effect. According to this explanation, rivals with the same country of origin as the bankrupt firm tend to compete in similar segments. Thus, the negative sales effect we find when there is a segment overlap with the bankrupt firm simply reflects the similarity

between the bankrupt firm and its competitors in terms of country of origin. To address this issue, in column (3) of Table 10, we control for *Chrysler filing × Same country of origin*. The coefficient estimate for this interaction is significant but in the opposite direction of the alternative mechanism discussed above.[29] Thus, we find no support for the country-of-origin mechanism for the negative demand spillover effect.

6. Conclusion
In this study, we empirically examine the immediate influence of a firm's Chapter 11 bankruptcy filing on the consumer demand for its competitors in the U.S. auto industry. We document the adverse effect of Chrysler's filing on its rivals' unit sales. Specifically, we find that unit sales for an average competitor goes down by 28% following Chrysler's filing. We interpret this result to suggest that the contagion effect for rivals dominates the competitive effect of Chapter 11 bankruptcy in terms of consumer demand. This negative demand spillover effect is robust to (1) different estimation strategies (global versus local), (2) different functional forms (various polynomial time trends as well as Poisson, negative binomial, and augmented local linear specifications), (3) different estimation bandwidths around the bankruptcy filing, (4) the inclusion of several important controls (i.e., "cash for clunkers," incentives, advertising, inventory, recalls, price, and consumer confidence), (5) the donut regression discontinuity approach, (6) a potential serial correlation issue, (7) a falsification exercise, and (8) the inclusion of differential trends at various levels. Importantly, we also investigate the mechanism behind the negative demand spillover effect, and we provide a variety of analyses that support an explanation based on the increased consumer uncertainty about the viability of the bankrupt firm's competitors. While these substantive findings contribute to the streams of literature on the effect of bankruptcies on market outcomes and spillover effects, our application of the RDiT approach adds to the marketing literature that employs quasi-experimental methods.

These findings have important implications for managers and policymakers. From the firms' perspective, our results show that not only the bankrupt firm is vulnerable to a negative reaction in consumer demand, but also its competitors. In addition, our findings suggest that some competitors—those that compete for similar segments as the bankrupt firm—are better candidates for a negative spillover effect. Moreover, within a competitor's product line, some products (e.g., those offer less value for money) might be more prone to a negative spillover effect than others. This is a novel insight as previous finance studies on the contagion effects of bankruptcies are based on a firm-level analysis as opposed to a product-level analysis.

Our results also inform policymakers as Chrysler filed for Chapter 11 bankruptcy under government supervision. Through the major automaker bankruptcies, the U.S. government aimed to avoid a potential collapse of the U.S. auto industry. On the one hand, our findings suggest unexpected negative demand consequences of bankruptcy filing for the competitors of the bankrupt firm. On the other hand, our results indicate, contrary to the conventional wisdom, that U.S. competitors might not necessarily be at a disadvantageous position compared with foreign competitors after Chrysler's bankruptcy. In our setting, it appears that the adverse effect of the bankruptcy on competitors is greater when there is segment overlap, but not when there is country-of-origin overlap.

Despite its contribution to the aforementioned literatures, our study has several limitations. Although we interpret our findings to suggest a negative demand spillover effect, "readers should evaluate the evidence as they would [in] any quasi-experimental paper" (Hausman and Rapson 2017, p. 30). Our analysis relies on a government-supported Chapter 11 bankruptcy filing of one major manufacturer in a single sector. Note that GM also filed for Chapter 11 bankruptcy one month after Chrysler's filing. While we take into account the potential impact of GM's filing in measuring the effect of Chrysler filing on competitor demand, our focus in this paper is on Chrysler's filing. The reason for this is that GM's filing context is less conducive to a causal interpretation due to the increased potential for anticipation (as GM's filing follows that of Chrysler) and the existence of other events in the close temporal vicinity (e.g., Chrysler's emergence from bankruptcy). That said, we provide an additional analysis on the relationship between GM's filing and competitors' unit sales in Online Appendix C. In line with our previous negative spillover results, we find that the GM filing is associated with a 24% reduction in competitors' unit sales. However, given the aforementioned caveats, the reader should be especially cautious in interpreting this result as causal. We hope that future research will shed further light on the generalizability of our results by studying the impact of bankruptcy filings on firm sales in other industry settings. Furthermore, we do not observe the long-term sales of the manufacturers in our data set. More empirical research on the long-term effect of Chapter 11 bankruptcies on market outcomes would enhance our understanding. Finally, as we do not observe firm costs, our analysis cannot speak to the profitability implications of bankruptcy filings, which is another fruitful direction for future research.

Acknowledgments

Endnotes

[1] http://www.bankruptcydata.com/largest.asp.

[2] As we detail in the subsequent sections, our analysis controls for variables related to seasonality such as day of week and day of month. Although we do not have daily data for the years preceding the bankruptcy to control for the same days for different years, our analysis in Section 3.3 shows that the average percentage change in unit sales for Chrysler's competitors is a statistically insignificant *increase* of 9.3% for the same months in the 2004–7 period. In line with this, Canadian data (discussed later) show that Chrysler's competitors increase their sales (9.25%) in Canada—where Chrysler did not declare bankruptcy—around Chrysler's filing in the United States.

[3] Note that this measure is part of the 10 sets of measures of brand equity discussed by Aaker (1996). This aspect is different from other brand equity aspects such as the loyalty aspect, which is measured by "price premium" akin to the brand equity definition in Keller (1993).

[4] The timeline for Chrysler's bankruptcy along with other major events, including GM's bankruptcy, is presented in Figure A.1 in Online Appendix A.

[5] In 2009, around 90% of all new-car transactions (excluding leases) consists of business-to-consumer transactions.

[6] To evaluate the generalizability of our main finding (potentially at the expense of weaker identification), we also generated a random sample of urban areas and urban clusters across the United States. The analyses based on this random sample reported in Online Appendix A show that our finding is robust. A separate analysis only on the nonisolated urban markets (reported in Table A.5) shows a qualitatively similar negative spillover effect.

[7] Figure A.2 in Online Appendix A provides a map of the resulting dealer locations.

[8] We provide a comparison of unit sales between our final sample and the U.S. market for our analysis period in Online Appendix A. Chrysler, Ford, and GM have somewhat larger market shares in our sample compared with the U.S. market as shown in Table A.1. The higher market shares for the "Big Three" come at the expense of manufacturers such as Toyota, Honda, Hyundai, and BMW. These market share differences are expected as we concentrate on isolated markets where the demand for light trucks (e.g., F-series, Silverado, Ram, etc.) are higher relative to excluded markets as reported in Table A.2.

[9] Detailed item lists for each category can be found at http://www.bls.gov/cex/pumd/2009/csxintstub.txt.

[10] One could still claim that the negative macroeconomic situation might have a more adverse effect on big-ticket durables such as cars and houses than relatively inexpensive durables such as furnishings and appliances. To assess whether this is the case, we collected census data on monthly home sales in the United States. Table B.1 in Online Appendix B reports thousands of houses sold in the United States and across four regions within the United States around the Chrysler bankruptcy. The national and regional sales numbers indicate, in line with monthly expenditure statistics for other categories, that home sales are similar after the bankruptcy filing compared with pre-bankruptcy months. When we test the mean difference in home sales across regions between April and May, we find an insignificant increase of 1,000 at the 5% significance level.

[11] We thank an anonymous reviewer for bringing the paper of Hausman and Rapson (2017) to our attention.

[12] Hausman and Rapson (2017) provide a detailed comparison of the RDiT design with the canonical regression discontinuity (RD) design as well as other approaches such as the pre/post design, the interrupted time-series design, and event studies.

[13] A complementary way of generating counterfactual sales levels is to use sales levels from markets that are not affected by the bankruptcy filing. In our data, we observe daily sales from isolated geographic markets in the United States, which are all "treated" by the bankruptcy filing. Therefore, we need to find another market that is similar to our U.S. markets and that is not affected by the bankruptcy filing. Canada could be a good candidate, but we only have access to national sales at the monthly (as opposed to daily) level for Canada. Therefore, we are only able to informally examine how U.S. sales evolve compared with Canada sales in Section 4.3. Our informal analysis is in line with our formal RDiT analysis.

[14] We do not include the other two measures of consumer confidence—namely, the consumer confidence index and the consumer sentiment index—because the other control variables and fixed effects in our specification explain 94% and 97% of the variation in those measures, respectively.

[15] The marginal significance of advertising coefficients is due to the rich set of controls (including different incentives), the flexible global polynomial daily time trend, and the fixed effects to capture seasonality. Additionally, we left the price control out from our full model, because we lose many observations after adding it (as we observe prices only for a subsample). We show that our results do not change after adding price to our main specification in column (2) of Table C.3 in Online Appendix C.

[16] In Figure C.1 in Online Appendix C, we present RDiT graphs for the residuals from our outcome variable using different numbers of bins and bin sizes. These figures reveal a decline in unit sales around the filing date as well.

[17] Although, there is somewhat of a reduction in the financing rate, we do not observe a discontinuous change around Chrysler's filing for the majority of these variables. Of additional note is that the effect of the change in financing rate around the filing, if any, would work in the opposite direction of finding a negative demand spillover effect. To complement this graphical analysis, we also explore the sensitivity of our findings to the inclusion of these covariates (as suggested by Lee and Lemieux 2010). Table C.3 in Online Appendix C shows that our findings are similar with and without these competitor marketing covariates.

[18] To complement the donut RD approach, we also followed the split-sample approach presented in Card et al. (2008) using the fixed-effects threshold model (Hansen 1999). The identified break and the estimated effect are similar to those in our earlier analyses. We thank an anonymous reviewer for suggesting the split-sample approach.

[19] A similar analysis using the augmented local linear strategy provides broadly consistent results except for the last week of the four-week postbankruptcy period. In addition, note that the coefficients reported in Table 8 are not directly comparable with the raw data on total unit sales in Table 2 for two reasons. First, their calculations depend on different comparisons. More precisely, for example, while the two-week period before/after change reported in Table 2 compares the combined unit sales within the two weeks after the filing (week 1 sales + week 2 sales) relative to the two weeks before the filing (week −1 sales + week −2 sales), the coefficient estimate for the *"Pre/Post Chrysler filing × two weeks after filing"* variable compares the counterfactual unit sales in the second week after the filing (week 2 sales) with that in the four-week prefiling period. Second, whereas the numbers in Table 2 present model-free evidence for the negative demand spillover effect, the coefficients in Table 8 are obtained after adjusting for many additional control variables that are not taken into account in Table 2, especially the flexible polynomial time trend and day-of-month fixed effects.

[20] In Online Appendix D, we show that macroeconomic indicators and trends are comparable between the United States and Canada during our analysis period.

[21] http://www.gallup.com/poll/120842/Disapprove-Majority-Government-Ownership.aspx?g_source=auto+industry &g_medium=search&g_campaign=tiles.

[22] http://www.people-press.org/2009/12/29/top-stories-of-2009-economy-obama-and-health-care.

[23] Some other segments that are served by Chrysler in our analysis period include: "basic sporty" (Dodge Caliber), "full-size pickup" (Dodge Ram), and "sport utility" (Jeep Grand Cherokee). Other segments that are not served by Chrysler include segments such as "basic economy," "basic luxury," "lower middle," and "traditional large."

[24] We checked the robustness of the segment overlap result to unobserved cross-market differences by controlling for *Chrysler filing × Market fixed effects* interactions; the coefficient for the *Chrysler filing × Chrysler segment overlap* coefficient remained very similar.

[25] We thank the associate editor for suggesting this prediction.

[26] We also conducted estimations by each manufacturer separately but do not report them because of space constraints. These estimations reveal that the Chrysler filing coefficient is positive for all manufacturers, and it is statistically significant for five of the seven manufacturers.

[27] This result is robust even if we drop GM from the sample of competitors.

[28] We thank the associate editor for suggesting this alternative mechanism.

[29] This result implies that although carmakers that share the same country of origin with the bankrupt manufacturer suffered from the filing, on average, they experienced a lower reduction in unit sales relative to the competitors with different countries of origin. This could be partially explained by the fact that Ford benefited from an improved public perception and enhanced consumer respect since it chose not to use a federal bailout to continue its business. A survey by AutoPacific reported that 72% of participants would be more likely to buy a Ford car because the company did not take government loans (https://www.cnbc.com/id/30134908).

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