Responses to Rival Exit:
Product Variety, Market Expansion, and Preexisting Market Structure*

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Abstract

Research Summary

This study investigates incumbent responses to a main rival's exit. We argue that long-time rivals have developed an equilibrium by offering a mix of overlapping and unique products and by choosing geographic proximity to each other. A rival's exit, however, disrupts this equilibrium and motivates surviving firms to expand in both product and geographic spaces to seek a new equilibrium. Using data from all U.S. Best Buy stores before and after the exit of Circuit City, we find that Best Buy uses product variety expansion as its major response in markets where Circuit City was colocated, but it more often responds by opening new stores in non-colocated markets. Regardless of preexisting market structures, the magnitude of product variety expansion decreases with the opening of new stores.

125 words

Managerial Summary

How do surviving firms respond to a major rival's exit? By studying Best Buy's responses to Circuit City's withdrawal, we find the survivor expands in both product space (increasing product variety) and geographic space (opening new stores), due to two motives. First, the survivor strives to fill in "holes" left in the market. Second, the survivor experiences uncertainty in the postexit world wherein its reference point is gone, threat of potential entry looms, and it lacks information about new entrants. Thus, it must deter potential entry *ex ante by* preempting many prime product and geographic locations. Best Buy also responds according to preexisting market structures, primarily through product variety expansion in markets wherein Circuit City was colocated and through opening new stores in non-colocated markets.

125 words

Key words: Incumbent responses, product variety, market expansion, rival exit, competition, colocation, market structure

Firm exit is a common phenomenon across all industries (Porter, 1976). For example, in manufacturing industries, about 8.5 to 10 percent of firms exit in an average year (Dunne, Roberts, and Samuelson, 1988). The rate is found to be higher in banking (Wu and Knott, 2006) and substantially higher in retail trade (Jarmin, Klimek, and Miranda, 2004). In recent years, the retail industry has witnessed an escalation of exits, including those of well-known names such as Borders, Blockbuster Video, Circuit City, and Linens 'n Things. Like market entry, the departure of major players from a market—especially a concentrated one in which only a few firms dominate—often causes dramatic changes in the competitive landscape and has strategic implications for surviving incumbents. Despite the prevalence and importance of market exit, however, extant literature has remained relatively silent on the subject, and no study has ever addressed how surviving firms respond to the exit of a main rival. Existing studies that examine market exit usually focus on exit decisions and their determinants (Chang, 1996; Chang and Wu, 2014; Lieberman, 1990; Lieberman, Lee, and Folta, 2016).

This lack of investigation into firm responses to rival exit is surprising, especially in light of the enormous body of adjacent literature on incumbent responses to market entry (Du, Li, and Wu, 2018; Geroski, 1995; Seamans and Zhu, 2013; Wang and Shaver, 2014). Notwithstanding the useful insights extant research offers on incumbent strategies in response to entry, we feel the special nature of exit requires the development of additional theory and insights because exit is not just a mirror image of entry. While most literature views entry as a threat to incumbents' market share and profitability (for an exception, see McCann and Vroom, 2010), we cannot assume exit provides only opportunities for surviving incumbents. There is no question that a rival's exit offers a chance for surviving firms to capture the departing rival's customers, employees, suppliers, facilities, geographic locations, and even complex knowledge or innovations (Hoetker and Agarwal, 2007).

However, rival exit can also pose a significant threat to surviving incumbents: the uncertainty associated with the disruption of an interdependent equilibrium. When rival firms have long-term and frequent interactions in a market, they serve as each other's reference points in their competitive space and resemble each other closely in their actions (Fiegenbaum and Thomas, 1995), thereby developing an interdependent equilibrium relationship. In particular, firms strive to achieve equilibrium by offering a certain mix of overlapping and unique products (Ren, Hu, Hu, and Hausman, 2011; Seamans and Zhu, 2013) and by locating close to or far from each other (Chung and Kalnins, 2001; McCann and Vroom, 2010). The equilibrium that rival firms develop with each other reinforces their competitive positions and creates barriers to entry (Lieberman and Asaba, 2006).

The exit of a main rival breaks this equilibrium. In the absence of a familiar "roommate" (Barnett, 2006) who shares the market and a history of repeated interactions, the surviving incumbent must face the uncertainty of having to deal with a possible new "roommate" who might be a total stranger. How, then, do surviving incumbents respond to rival exit? In this paper, we focus on the retail industry and examine both theoretically and empirically how surviving firms respond to this disruption with two non-pricing strategies: product variety and market expansion. Product variety has become an increasingly important strategy, which is especially true in the retail industry wherein the prevalence of price-match guarantees constrains retailers from using price reductions to attract consumers (Hess and Gerstner, 1991). Despite the cost of expanding product variety (Randall and Ulrich, 2001; Zhou and Wan, 2017a), a greater variety allows firms to serve heterogeneous customer preferences better (Sorenson, 2000), prevent customers from switching to competitors (Klemperer, 1995), and preempt competitive entry (Lancaster, 1998). Market expansion through the opening of new stores[1] incurs higher fixed costs and may cannibalize the sales of existing stores (Kalnins, 2004), yet retailers still commonly use this strategy to gain market share and increase profits (Helfat and Lieberman, 2002). Moreover, by preemptively occupying prime geographic locations, expansion limits the amount of space for subsequent entrants and helps deter competitive entry (Lieberman and Montgomery, 1988).

We posit that in response to its rival's exit, a surviving firm expands in product space by increasing its product variety and in geographic space by opening new stores. The motives for the expansion are twofold. One motive is opportunity. Consistent with extant literature that emphasizes incumbent responses involving the pursuit of new opportunities (de Figueiredo and Silverman, 2007; Greve, 1995), the survivor is tempted to exploit the opportunity created by the withdrawal of the rival by filling in the "holes" left in the market. The other motive is uncertainty, which is a unique feature of the rival-exit setting. The survivor is temporarily situated in a postexit world wherein its reference point is gone, threat from potential entry is looming, and it has little information about how the new entrants will behave. Out of this uncertainty and fear of the unknown, the survivor needs to preempt many locations in product and geographic spaces to deter potential competitors' entry *ex ante*.

We further posit that a surviving firm's postexit expansion is contingent upon the preexisting market structures it developed with the rival, because the benefits and costs associated with implementing each strategy vary when preexisting market structures are in place. We categorize a preexisting local market as either a colocated market or a non-colocated market, according to whether the nearest rival is colocated (i.e., within walking distance) or not. In the retail

[1] A retail chain's market entry strategy may include adding stores in a geographic market in which it is an incumbent, or in new geographic markets. Chevalier (1995) labels the former as expansion and the latter as *de novo* entry into a local market. Compared with de novo entry, expansion requires less time and planning (Chevalier, 1995), and it represents most of the store-opening cases in the context under investigation. We thus focus on expansion in this research.

industry, direct rivals such as CVS and Walgreens, Best Buy and Circuit City, and Home Depot and Lowe's often locate their stores in the same shopping plaza or in very close proximity (e.g., across the street). Such colocation indicates the availability of customer-rich locations in a market (Wang and Shaver, 2014) and may affect the preexisting pattern of product offerings "coordinated" by rivals (Ren *et al*., 2011). We argue that while the costs of offering more product variety are comparable across market types, the benefits of doing so are higher in colocated markets. In non-colocated markets, opening new stores brings more revenue to the surviving firm by covering the other side of the market, while it incurs significantly lower cannibalization costs. We thus predict that product variety expansion is a more appealing strategy within colocated markets, while opening new stores is a more optimal strategy within non-colocated markets.

We have formalized these arguments by developing a simple analytical model that allows us to consider the benefits and costs of both strategies in different market structures. Based on this model, we have developed a set of hypotheses and tested them using data from the two specialty consumer electronics retail chains in the United States: Best Buy and Circuit City. This research setting is excellent for three reasons. First, both chains provided price-match guarantees, so their competition focused less on pricing than on non-pricing dimensions. Second, we have appropriate and reliable data for use in our analysis. To facilitate consumer search, both Best Buy and Circuit City released their local store inventory information online and updated it in a timely manner (Levinson, 2005). As a result, the in-store product variety data of both chains was readily available. Advanced computer search and data collection techniques allowed us to retrieve and compile the information with enhanced accuracy as compared to manually collected data. Third, and perhaps most importantly, Circuit City's rapid and nonselective exit from all geographic markets gave rise to exogenous changes in the structure of all of these markets,[2] which significantly alleviates the empirical concern that market structure changes might be endogenous (Berry and Waldfogel, 2001). This enables us to not only study Best Buy's actions over a period of time spanning before and after Circuit City's demise, but also to explore cross-sectional variations across geographic markets.

We found that after the exit of Circuit City, Best Buy increased its store-level product variety, and the magnitude of increase was greater in colocated than in non-colocated markets. We also found that Best Buy was more likely to expand its market coverage by opening new stores, and that it engaged in such market expansion more aggressively in non-colocated markets than in colocated ones. Furthermore, regardless of preexisting market structures, the magnitude of product variety expansion decreases when new stores open. This suggests that while both product variety and convenient new store locations are effective strategies to attract consumers and fend off new entrants, there is a substitutive relationship between them.

This study makes four major contributions. First, it provides the only comprehensive analysis of incumbent responses to rival exit that has yet been conducted. We highlight the importance of market exit as a strategic phenomenon that offers unique challenges and opportunities for surviving firms. Extant research on entry, which represents the most adjacent stream of work, has advanced our understanding of when and how incumbents will respond to market entry. The major insights from recent studies in this area include that incumbent responses to entry depend on characteristics of the market (Seamans and Zhu, 2013; Wang and Shaver, 2014), characteristics of incumbents (Semadeni, 2006; Simon, 2005), or characteristics of entrants (McCann and Vroom,

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[2] Best Buy and Circuit City had long been perceived as duopoly competitors since the 1990s. However, due in part to waning consumer spending, tight credit markets, and the economic crisis, Circuit City filed for bankruptcy in November 2008 (Rosenbloom, 2009). Many bankrupt retailers close stores gradually or in select markets. Circuit City instead shut down its retail stores quickly and relatively indiscriminately in all geographic markets; its last brick-and-mortar store closed on March 8, 2009.

2010; Seamans, 2013). Above all, response to entry is a *defense* story in that incumbents are incentivized to defend their current market share, positioning, and profitability. In contrast, incumbent response to rival exit is a story of *expansion and preemption*. Surviving incumbents expand to pursue new opportunities, as suggested by extant literature (de Figueiredo and Silverman, 2007; Greve, 1995; Wang and Shaver, 2014). They may expand excessively by preempting many prime locations in product and geographic spaces, driven by the uncertainty associated with the disappearance of a reference point, threat from potential entrants, and lack of knowledge of future competitors' strategies and actions.

Second, among the various strategic options that firms may pursue in response to a rival's exit, we deviated from examining pricing response, which has been the traditional focus of competitive strategy scholars, to join a recent stream of work (Bennett, Pierce, Snyder, and Toffel, 2013; Simon, 2005) that explores non-pricing responses. Moreover, similar to Casadesus-Masanell and Zhu (2010), we selected multiple non-pricing responses that involve different levels of commitment and allowed them to interact. The substitutive relationship we found between the two responses—increasing product variety and opening new stores—provides further evidence of the limits of firms' coordination capacity (Zhou, 2011; Zhou and Wan, 2017b).

Third, we emphasized the role of preexisting market structures in determining a firm's postexit responses. Our theory and empirical evidence demonstrates that market structure distinguished by geographic proximity has a strong influence on how firms respond to a competitor's exit: The surviving firm tends to resort to product variety expansion as its primary response in colocated markets, but it will more likely respond by opening new stores in non-colocated markets. Prior studies have argued that incumbent responses to entry are affected by the distribution of customer preferences (Seamans and Zhu, 2013; Wang and Shaver, 2014). Our findings suggest the possibility that preexisting market structures can be used to infer the distribution of customer preferences in geographic spaces. We also extended the work by Ren *et al.* (2011) by uncovering an important factor driving postexit product variety expansion: the equilibrium a firm has developed with its rivals in preexisting market structures.

Fourth, by focusing on drastic changes in market structure, our study adds important insights to the multidisciplinary literature pertaining to the relationship between market structure and product variety. Despite some relatively abundant theoretical contributions relating to structure and variety (Lancaster 1990; 1998), empirical research remains scant, perhaps due to the endogeneity of market structure. Recent research (Olivares and Cachon, 2009; Watson, 2009) within this domain focuses on cross-sectional variations. Berry and Waldfogel's (2001) study of radio broadcasting stations is the only empirical investigation that addresses how a radical change in market structure affects product variety. We have extended their pioneering research by exploring rival exit as another trigger of market structure change (versus exogenous policy change, which their study deals with) and by focusing on store-level product variety (versus market-level variety, as their study explores). We will detail all four contributions in the "Discussion and Conclusions" section.

THEORY AND HYPOTHESES

Theoretical Background and Model Overview

Our research emerged from the understanding that rival firms have developed an equilibrium by coordinating their level of overlapping products and by choosing to colocate or locate at a distance from each other (Ren *et al*., 2011; Seamans and Zhu, 2013), and that this equilibrium helps preserve the status quo of the rivals and fend off new entrants (Clarkson and Toh, 2010; Lieberman and Asaba, 2006). We argue that the exit of a main rival disrupts the earlier equilibrium achieved by rival firms. Without the rival, a surviving firm seems to enjoy a temporary monopoly. However, this temporary monopoly is fraught with uncertainty and threat, as it attracts potential new entrants with whom the surviving incumbent has not yet interacted, thereby putting the incumbent at an informational disadvantage (Barnett, 2006; Seamans, 2013). Against this background, we focus on a set of duopoly retailers and develop a simple analytical model to examine how a surviving firm repositions itself in both product and geographic spaces to respond to the departure of its rival. Because they differ in their level of commitment, these two responses—those made in product and in geographical space—may not follow a simple sequential order. We argue that prior to engaging in new store openings, a surviving retailer would consider adjusting its product variety, as this alternative entails significantly lower costs than opening a new store, can be implemented more quickly, and is more reversible. After opening a new sister store, the retailer would *re-optimize* the existing store's product variety.

We provide an overview of our formal model by highlighting the key assumptions and insights derived from it. We built our model by letting the surviving store choose its optimal level of product variety to maximize its store profit. Relatedly, our model is based on a consumer demand function in which a representative consumer derives her utility from product variety. We note two assumptions in regard to our demand function. One assumption is that prices are the same across rivals.[3] In light of the prevalence of price-match guarantees in the retail industry, we restricted stores from using price differences to attract customers. In the second assumption, we decomposed a store's product variety into overlapping and unique products. Overlapping products demonstrate a certain level of similarity between rival firms, which sends signals to stakeholders that these firms conform to industry norms and are legitimate players in a market, while unique products

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[3] To validate the claim, we collected price data on digital cameras available in March 2006 for all Best Buy and Circuit City stores. A paired t-test on the prices of digital cameras showed no significant difference in prices ($p = 0.53$). The average paired price difference between the two chains is .23% of the price, and 47% of the matched products have the same prices at both chains.

differentiate a firm from its rival and thereby serve to reduce competition (Deephouse, 1999). Consistent with existing studies (Dobrev, 2007; Lynch and Ariely, 2000), we assume unique products contribute more to store profits than do overlapping products.

In our model, we considered the benefits and costs of adding product variety following a rival's exit. Adding retail variety incurs costs such as inventory, transportation, set-ups, change-overs, and opportunity costs of shelf space (Ryzin and Mahajan, 1999). Compared to the cost side, the benefits of postexit product variety expansion are more nuanced and have strategic implications. First, in the case of a duopoly, any additional products a store considers carrying are likely to be overlapping products. After the exit of the rival, however, any additional products the store carries become unique ones. No longer facing the discounting constraint of product overlap, the store has incentives to increase products, as it now can enjoy a higher level of marginal profit for carrying additional products. Second, when a firm lacks knowledge about the entry plans of potential rivals, having a broader product variety can establish barriers to entry, in that the incumbent firm has preemptively filled all potential market gaps in which a new firm could have entered (Lancaster, 1998). If a new firm decides to enter the market, the products it offers are more likely to be overlapping ones when the surviving store has already expanded its variety, which reduces the entrant's post-entry profit.

While the costs of postexit product variety expansion do not vary much between non-colocated and colocated markets, the benefits are greater for stores in colocated markets. First, the inferiority of overlapping products in terms of contribution to store profit is more severe in colocated markets. As a result, the profit enhancement gained by switching from overlapping to unique products is greater for stores in colocated markets. Second, because colocation results in fiercer competition, colocated rivals are more likely than distant rivals to differentiate themselves by carrying fewer overlapping products, yet each carries a smaller product variety to save on stocking costs (Ren *et al*., 2011). As such, a colocated market provides more room to offer unique products and appears more attractive to potential rivals, thereby posing a more serious threat to the surviving store. Together all these arguments suggest that a surviving store in a colocated market has more incentive to increase its product variety than a surviving store in a non-colocated market. To share a better understanding of the nuances of the benefits, Appendix 1 illustrates different patterns of preexisting product variety and postexit expansion in non-colocated and colocated markets.

We also model the cost-benefit tradeoffs in store opening to illuminate the circumstances under which the surviving retailer opens a new store. Although opening a new store is rarely financially trivial (Zhu, Singh, and Manuszak, 2009) and can cannibalize sales of existing stores (Kalnins, 2004), it allows the surviving retailer to occupy the vacant side of the market and deter potential competitors from entry (Liu, Gupta, and Zhang, 2006). Moreover, opening new stores enables the retailer to redeploy its resources and capabilities, including by replicating operating procedures or store configurations, sharing supply channels, distribution and advertising, and applying market-specific knowledge (Helfat and Lieberman, 2002). We take these benefits and costs into account in our model and make a convenient and plausible assumption that the new store will be located at the same site as the exiting store.[4] Our model suggests that the net gain of a new store opening is greater in non-colocated markets. Why? When preexisting rival stores were located

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[4] This assumption is consistent with the pattern found in our empirical setting. Best Buy was reported to have leased a number of former Circuit City stores (Pardy, 2009). Many new Best Buy stores were geographically proximate to the former locations of Circuit City: 12% were located within half a mile of an old Circuit City store, 20% within one mile, and 58% within five miles. The average distance was 4.31 miles. This assumption also provides us the additional advantage of making the model mathematically more tractable without losing generality. We acknowledge that in a colocated market, a surviving retailer is less likely to open a new store colocated with the exiting store. This, however, does not change our conclusion that the net gain of opening a new store is smaller in colocated markets. The reason is as follows: The colocated region might be the prime central location in a colocated market in terms of market coverage. A new store opened somewhere else alleviates the cannibalization concern but suffers reduced market coverage.

farther from each other, each store held a geographical advantage for consumers in the proximate part of the market. A new store opened in such a market is thus more likely to generate incremental sales by covering that side of the market without incurring high cannibalization costs. As cannibalization risk significantly escalates with geographic proximity (Pancras, Sriram, and Kumar, 2012), the negative impacts of cannibalization surpass all possible benefits in colocated markets.

Our model further shows how the surviving retailer re-optimizes its product variety when a new sister store opens in the market. The objective now becomes maximizing the joint profits of the surviving store and the new sister store by determining both stores' optimal levels of product variety and level of product overlap. Both decisions involve high coordination costs. Offering more product variants alone increases the difficulty of coordinating inventory management and increases the odds of stock-outs and overstocking (Ryzin and Mahajan, 1999), which reduces customer satisfaction and hurts store sales and future demand (Zhou and Wan, 2017a). To find the optimal level of overlap, the surviving firm needs to balance a number of factors including the joint revenues of both sister stores, the fixed cost of opening a sister store, the economy of scale benefit enjoyed by sister stores, and the cannibalization risk associated with overlapping products. The complexity of coordination might make exercising both strategies concurrently too costly for the firm (Zhou and Wan, 2017a; 2017b), which may lead the retailer to use them as substitutes.

Baseline Model: Product Variety in a Preexisting Duopoly Market

We first use the classic differentiated duopoly model of Singh and Vives (1984) to model consumers' purchasing decisions across two stores: Store 1 of the surviving firm and Store 2 of the rival.[5] Store i's (i = 1, 2) product variety, t_i, is presented as $t_i = v_i + v_o$, where v_i denotes the

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[5] Note that there are two major differences between our model and the model of Singh and Vives (1984). First, their model considers price a decision variable that is simultaneously determined by competing firms, while in our model product varieties are firms' decision variables in a sequential game, as will be discussed later. Second, their model

number of unique products carried by Store i and v_o denotes the number of overlapping products carried by both stores. Parameter $\bar{V}$ denotes the product variety universe comprised of the total available products offered by the manufacturers from which the stores choose. The value that Store i's product variety provides for a consumer is modeled as $\Phi_i = \phi(v_i + mv_o)$, with $\phi > 0$ reflecting the fact that more product variety brings higher value to consumers (Lancaster, 1990), and m captures a utility discount ($½ < m < 1$) because consumers can derive only a fraction of the value from overlapping products that they can gain from unique products.[6] The utility discount of overlapping products is more severe for colocated stores (m_c) than for non-colocated stores (m_n). In other words, $m_c < m_n$. As consumers can visit both stores without incurring transport costs and may purchase from either, the two stores are akin to one big store to consumers. The joint value of overlapping products at *both* stores is almost the same as the value when these products are available at *only* one store (i.e., m → ½).

In a duopoly market with two stores, a representative consumer's utility function is given by

$$u = \alpha_1 q_1(\Phi_1 + 1) + \alpha_2 q_2(\Phi_2 + 1) - \frac{1}{2}(\beta_1 q_1^2 - 2\gamma q_1 q_2 + \beta_2 q_2^2) - pq_1 - pq_2 \quad \textbf{(1)}$$

where p is price, q_i is demand of store i, $\alpha_i > 0$, $\beta_i > 0$, $\gamma \geq 0$, $\beta_1\beta_2 - \gamma^2 > 0$, and $\alpha_i\beta_j - \alpha_j\gamma > 0$ for $i = 1, 2$ and $j = 3 - i$. Parameter γ measures the competition effect between stores. $\alpha_i q_i(\Phi_i + 1)$ captures two aspects of a consumer's utility from purchasing q_i units of products from store i.

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considers only one product while our model considers multiple products because we focus on product variety. Accordingly, in their model, demand refers to the demand for a single product, while in our model demand refers to the total amount of purchase from the available product variety in a store. Using Singh and Vives' model to study our research question provides at least two benefits. First, the linear demand function derived in principle from the quadratic utility function presented by Singh and Vives (1984) offers a simple yet powerful framework for our research. Second, the quadratic utility function nicely captures the effects of decreasing marginal return, competition, and discounted value increase from product variety increase. We thank an anonymous reviewer for suggesting that we elaborate on the differences between our model and Singh and Vives' model.

[6] When a product is uniquely available at one store, a consumer can visit only that store to purchase the product. In contrast, when a product is available at both stores, the consumer can visit either store. Therefore, a unique product at store i increases that store's attractiveness to a consumer to a greater extent than does an overlapping product.

First, regarding the quantity of purchased products $\alpha_i q_i$, a consumer's utility increases as she obtains more units of products from the store, given the store's fixed product variety. Second, regarding the quality of selected products $\alpha_i q_i \Phi_i$, a consumer's utility increases with the store's product variety because higher product variety makes it more possible for the consumer to find suitable products to satisfy her needs.[7] The consumer's decreasing marginal utility from purchasing quantity q_i is reflected by the quadratic term $\frac{1}{2}(\beta_i q_i^2)$, wherein the coefficient ½ is added for mathematical convenience. The consumer chooses quantities (q_1 and q_2) to purchase from Stores 1 and 2 to maximize her utility, u. Following the way of rewriting by Singh and Vives (1984), we simplify the demand functions as follows:[8]

$$
\begin{aligned}
q_1 &= a_o + a(v_1 + mv_o) - e(v_2 + mv_o) - (b - d)p \\
q_2 &= a_o + a(v_2 + mv_o) - e(v_1 + mv_o) - (b - d)p
\end{aligned}
\tag{2}
$$

where $a > e$ because it is reasonable to assume that a store's product variety has a higher impact on its own demand than on the other store's demand.

We solve for the optimal levels of product variety in a duopoly market. The cost for Store i to carry a product variety of $t_i = v_i + v_o$ is given by $ct_i^2 = c(v_i + v_o)^2$, which suggests that Store i's cost of carrying products increases with product variety and becomes 0 if product variety is given by 0. We use a quadratic cost function to reflect the increasing marginal cost of carrying more product variety (Mas-Colell, Whinston, and Green, 1995). We assume that the cost of carrying

[7] For $\Phi_i = 0$, our model will revert back to the pricing model of Singh and Vives (1984) because it does not capture the effect of a consumer's utility increase from higher product variety.

[8] Like Singh and Vives (1984), we assume $a_{oi} = 1$, $a_i = a$, $b_i = b$, and $e_i = e$. They assume that consumers have the same elasticity to price across firms. Since firms' decision variable in our model is product variety, our assumption implies that consumers have the same elasticity to product variety. See Appendix 2 for the details of the rewriting and simplification.

products is independent of the composition of the variety.[9] Because the setting we are examining is retail, we assume zero marginal production cost for stores. Store i's profit is thus given by

$$\begin{aligned}\Pi_i &= pq_i - c(v_i + v_o)^2 \\ &= p\left[a_o + a(v_i + mv_o) - e\left(v_j + mv_o\right) - (b-d)p\right] - c(v_i + v_o)^2.\end{aligned} \quad \textbf{(3)}$$

Consistent with Moorthy (1988), we assume Store 1, the surviving store, to be the market leader and move first in deciding on its product variety t_1 before Store 2 decides on t_2. Lemma 1 below summarizes the results in which the conditions for $c\bar{V}$ ensure the existence of preexisting product overlap.[10] Appendix 2 provides proof of all lemmas and propositions.

LEMMA 1. *In a duopoly market wherein the product variety universe is fully covered by both stores, for* $\max\{\bar{c}, \frac{pam+pe(1-m)}{2}\} \leq c\bar{V} \leq pam + pe(1-m)$, *the optimal levels of product variety are given by:*[11]

$$t_1^D = t_2^D = \frac{p}{2c}[am + e(1-m)]. \quad \textbf{(4)}$$

Product Variety Change in the Postexit Market

We now solve for the optimal level of product variety of the surviving store after the rival exits the market, assuming the surviving firm does not open any new stores in the market. If the surviving firm does not open a new store in the postexit market, only Store 1's products will be available for the consumer to purchase. The consumer's utility function in Equation 1 consists of q_1 only. Accordingly, the demand function for the surviving store is given by:

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[9] This assumption fits settings such as consumer electronics retail stores wherein the sizes of products do not significantly differ from each other (Ryzin and Mahajan, 1999). We thank an anonymous reviewer for suggesting the addition of this assumption.

[10] Two points are noteworthy regarding our theoretical model. First, we focus on unique pure strategy equilibrium in this study. Second, in a duopoly market, there are two possible scenarios: some level of product variety overlap exists between the two stores (Scenario 1), and *no* overlap exists in product variety (Scenario 2). Since it is common in many industries for rival stores to hold at least some overlapping products, our model and empirical analysis focus on Scenario 1, in which there exists some level of overlapping product variety (i.e., the product variety universe is fully covered by both stores). The analysis of the zero-overlap scenario is also provided in Appendix 2.

[11] $\bar{c} = \frac{2m(a-e)^2 - 3m^2(a-e)^2 - 2em(a-e) + 2ae - e^2}{4[a_0 + (1-m)(a-e)\bar{V} - (b-d)p]} p\bar{V}$.

$$q_1 = a_o + at_1 - bp. \tag{5}$$

Note that when there is only one store in the market, $m = 1$ since all of the products carried by Store 1 are unique in the market. Solving Store 1's profit maximization problem leads to the optimal level of product variety for Store 1, as follows:

$$t_1^S = v_1^S = \frac{pa}{2c} \tag{6}$$

To investigate how Store 1 adjusts its product variety after the rival's exit, we compared the optimal product variety of the postexit single-store case (t_1^S) with that of the preexisting duopoly case (t_1^D). As shown in Proposition A1 in Appendix 2, $t_1^S > t_1^D$, as long as product overlap existed prior to rival exit. Whereas a surviving store tends to increase its product variety following the exit of its rival, the extent of product variety expansion differs by market structure. The difference in product variety increase between a colocated market and a non-colocated one is given by $(t_{1c}^S - t_{1c}^D) - (t_{1n}^S - t_{1n}^D) = \frac{p}{2c}(a - e)(m_n - m_c)$, which is positive because $a > e$ and $m_n > m_c$. We therefore submit the following hypotheses:

H1A. *After the exit of the rival store, a surviving store increases its product variety.*

H1B. *After the exit of the rival store, a surviving store in a colocated market increases its product variety to a greater extent than it would in a non-colocated market.*

New Store Opening in the Postexit Market

We have modeled the benefits and costs associated with a new store opening in the postexit market. First, the new store generates incremental sales for the retailer. Second, the surviving retailer pays a fixed cost of *F* for opening a new store. Third, we account for both the cannibalization risk, *m*, between overlapping products across both stores (Kalnins, 2004) and the economy of scale benefit, *w*, of carrying products that overlap with those of sister stores (Helfat and Lieberman, 2002). Fourth, we consider the competition effect, *e*, between sister stores.

Suppose a store incurs a cost of $c(v_i + wv_o)^2$ for carrying a product variety of $t_i = v_i + v_o$. The parameter *w* ($\frac{1}{2} < w \leq 1$) captures the benefits of economy of scale when a firm's sister store sells overlapping products. $w > \frac{1}{2}$ suggests that the marginal cost of carrying an overlapping product is higher than half of the marginal cost of carrying a unique product, and $w = 1$ refers to the duopoly case of rival stores. Since two geographically proximate sister stores are more likely to both benefit from economy of scale and suffer cannibalization risks than two distant sister stores, both *w* and *m* are smaller for closer stores.

In contrast to two rival stores, two sister stores can fully coordinate with each other to maximize their total profit in the market. In the analysis of sister stores, we assume that the new store will stock unique products before carrying any overlapping ones.[12] Lemma A1 in Appendix 2 shows the conditions under which the surviving firm would choose to open a new store. It suggests that the firm may not always want to open a new store, even when the fixed cost of opening a new store, *F*, is minimal. Proposition A2 summarizes the results of Lemma A1 and concludes that the surviving firm is less likely to open new stores when the cannibalization effect between overlapping products is stronger. Since the cannibalization effect is stronger for colocated sister stores than for non-colocated sister stores ($m_c < m_n$), we submit the following hypothesis:

H2. *Following the exit of the rival store, the surviving firm is less likely to open new stores in a colocated market than in a non-colocated market.*

Product Variety Change Moderated by a New Store Opening in the Postexit Market

To study how the surviving store's product variety increase is affected by opening a new store, we compared the store's product variety increase in the case wherein it opens a new store ($t_1^T - t_1^D$) to

[12] This is true as long as the cost parameter, *w*, is no smaller than the parameter, *m*, that denotes the utility discount from product overlap and measures cannibalization in the case of sister stores.

the case wherein it does not open a new store $(t_1^S - t_1^D)$. Lemma A2 summarizes the optimal levels of product variety when the surviving firm operates sister stores (t_i^T).

The detailed analysis of Lemma A2 and Proposition A3 shows that $(t_1^T - t_1^D) - (t_1^S - t_1^D) < 0$, suggesting that product variety increase at a surviving store accompanied by a sister store is smaller than that of a standalone surviving store. The rationale is as follows. After the rival's exit, if a sister store opens in the market, the surviving retailer needs to decide on both stores' product varieties, as well as the level of overlapping products, to maximize the joint profits of both stores. Coordinating the optimal level of overlap between sister stores is not easy: The firm needs to balance its resources (product variety universe) and constraints (carrying cost of product variety) while taking into account the complex benefit-cost tradeoffs including additional revenues from more product offerings, economy of scale benefits, and cannibalization costs associated with overlapping products. The coordination difficulty increases even more when more product variants are offered at each store. Although both product variety and convenient new store locations are effective means of attracting consumers, such coordination challenges might make it too costly for the firm to adopt both strategies simultaneously. The results lead to our third hypothesis:

H3. *When the surviving firm opens a new store after the rival's exit, its existing store increases product variety to a lesser extent than when the firm does not open a new store.*

EMPIRICAL ANALYSIS

Data

We assembled our data set from four major sources. First, we obtained the store locations of every Best Buy and Circuit City retail store in the United States from their websites, www.bestbuy.com and www.circuitcity.com. Additionally, we used Python to write web crawlers to acquire product variety data from the Best Buy website on the digital cameras available at each store. We chose digital cameras as the focal product category for several reasons. The first is the importance of digital cameras to the consumer electronics retail industry as well as to Best Buy. Digital cameras were one of the hottest markets for consumer electronics products in 2006 (Chen and Xie, 2008) and continued to grow until 2010, according to the digital cameras shipment history from the Camera and Imaging Products Association. Best Buy has consistently highlighted digital cameras as a major product category in its annual reports. Furthermore, product variety is highly valued in this category because consumers choose digital cameras based on a list of key product attributes (such as brand, optical versus digital zoom, camera type, and megapixels), with respect to which their tastes and preferences vary substantially. Moreover, digital cameras require a reasonably high inventory cost (e.g., shelf space, warehouse cost, inventory turnover speed) that prevents stores from expanding product variety without limits. In addition, we were able to acquire product variety data for digital cameras with a high level of precision and accuracy. In some consumer electronics categories, manufacturers routinely provide slight attribute differences and different model numbers across retailers in an attempt to thwart price-match guarantees. In extreme cases, they even put different model numbers on identical products. We did not observe such a practice in the digital camera category within the U.S. market, however.

We monitored our web crawlers closely in case changes occurred to the website. For example, we used 20–30 computers to extract web pages simultaneously so that the data crawling processes finished on the same day to minimize any possible changes in the product information. Each round of data collection took roughly eight hours. Before formally launching the crawling processes, we interviewed several store managers, who confirmed the consistency between their actual in-store product variety and the information listed online. After the data was crawled, we checked the accuracy of the data crawl by visiting several local stores and manually collecting product variety information for digital cameras. We found no difference between the hand-collected information and the data collected with the crawling program. We collected the product variety and store location data in March 2006, when Circuit City was still profitable,[13] and again in July 2010, when Best Buy had fully responded to the complete exit of Circuit City. Of the 710 Best Buy retail stores that existed in 2006, 709 remained open in 2010 (i.e., the surviving stores). In addition, Best Buy opened 370 new stores between March 2006 and July 2010.

Second, we collected long-term market-level demographics data (i.e., that which had been stable for ten years) from the Missouri Census Data Center (MCDC). Following the concentric method used by Ren *et al.* (2011), we delineated a local market by drawing a circle with a 10-mile radius around each store's location, with the presumption that this distance represents a relevant competitive area. With the raw demographic information at the tract level provided by Census 2000, MCDC aggregates the tract-level data to the market level by taking weighted averages, using the tract-level population as the weight. The MCDC website also provides an interface from which we used Python to extract the relevant demographic information of the 10-mile circle surrounding each specified store location.

Third, because local market conditions may have changed rapidly during the 2006–2010 period, we acquired annual demographic information from the American Community Survey (ACS) of the Census. The annual demographic data of the ACS is collected at the county level, and we matched this data with each surviving store's location.

Fourth, to reflect the absolute level of and changes in online retailing prevalence in each market, we collected search data for Amazon.com through Google Trends, which provides data on

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[13] When we first collected the data in March 2006, Circuit City showed no sign of trouble. During the first fiscal quarter that ended on May 31, 2006, Circuit City reported a $6.4 million profit and earned 4 cents per share, exceeding analysts' expectations for four consecutive quarters. Moreover, it expected growth in domestic same-store sales to average between 5 and 7 percent (Associated Press, 2006).

the relative frequency of search terms entered by Google users across time and geographic units (for applications of Google Trends, see Ginsberg *et al*., 2009; Hu, Du, and Damangir, 2014). Google Trends provides volume indexes for queries consumers have entered into the Google search engine, free of charge and going as far back as January 2004. Given the ubiquity of consumer online searches and Google's dominance, the volume of Google searches can plausibly be viewed as a reflection of the collective interests of Internet users.[14] We conducted a Google search for Amazon.com at the county level for both 2006 and 2010. As the rate of Internet penetration in a geographic region may influence consumers' adoption of online retailing, we also collected state-level Internet penetration rates for the years of 2006 and 2010 from the Federal Communications Commission and matched the data with each surviving Best Buy store's location.

Measures

Before describing our variable measures, we will explain how we define a pair of rivals. Using the latitude and longitude of each store, we calculated the spherical distance between a surviving store and all rival stores. We then selected the rival store closest to the surviving store in distance and defined these two stores as a pair of preexisting rivals.

Our dependent variable is based on the product variety at each surviving store. Following Zhou and Wan (2017a; 2017b), we measured total product variety in each store as the number of stock-keeping units (SKUs) in the digital camera product category. SKU has several advantages as a measure of product variety. First, it serves as the unit for measuring inventory from the retailer's perspective. Second, compared to other measures such as product attributes, SKU is more objective

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[14] We customized Google Trends to extract queries filtered by geographic areas (e.g., metropolitan areas), time ranges (e.g., 2006 and 2010), and categories (e.g., shopping). As an indicator of Google's standing as the dominant search engine in the U.S., according to www.Compete.com, Google accounted for 63.8 percent of online searches in May 2011, handling more than 9.5 billion queries from over 138 million unique users during that month. The reliability of Google search-term data as proxies for underlying economic and social data has been established in a variety of contexts, such as predicting car sales, home purchases, international travel, and religious affiliation (Ginsberg *et al*., 2009; Hu *et al*., 2014).

(Fader and Hardie, 1996). When using this measure, researchers are not engaging in a subjective attribute selection process. Moreover, unlike with conjoint analysis or panel data, we cannot directly observe or interpret how much weight consumers place on each researcher-defined attribute. An attribute-based variety measure would have been even less desirable.

Two independent variables measure preexisting market structures. Following Rosenthal and Strange (2003) and Ren *et al*. (2011), we coded $\mathrm{COLOCATE}$ as equal to 1 if the preexisting nearest rival store is within a half-mile radius of the surviving store, and 0 otherwise. We defined NONCOL as equal to 1 if the distance between a surviving store and its nearest former rival store was greater than half a mile but no greater than 10 miles, and 0 otherwise. These two variables describe the two mutually exclusive competitive market structures prior to the exit of Circuit City. Of the 709 Best Buy surviving stores, 397 previously were in non-colocated competitive markets ($\mathrm{NONCOL} = 1$), 186 had colocated rivals ($\mathrm{COLOCATE} = 1$), and the remaining 126 stores used to be in monopoly markets ($\mathrm{NONCOL} = 0$ and $\mathrm{COLOCATE} = 0$). Our third independent variable, ENTRY, specifies whether Best Buy made new entries into a given market after Circuit City exited. We coded ENTRY as equal to 1 if at least one new Best Buy store opened within the 10-mile radius of a surviving Best Buy store, and 0 otherwise.

Further, we controlled for a number of variables that affect long-term market-level demand and consumer taste heterogeneity. Specifically, INCOME (log of median household income in a market) and POPDEN (population density in a market) relate to a market's product variety; the former indicates potential income constraints on purchasing behavior (Hoch, Kim, Montgomery, and Rossi, 1995), and the latter affects the market's demand level and relative profitability (Watson, 2009). Other demographic variables include the fraction of the population with a college-level or higher education ($\mathrm{EDUCATION}$), the fraction of the population over 18 years of age (ADULT), the fraction of the population older than 65 years (SENIOR), the fraction of male residents (MALE), the fraction of married population (MARRIED), and the fraction of consumers who are non-white (NONWHITE). All of these demographic variables are based on Census 2000 data computed by MCDC. Some strongly urban areas, such as New York City, Chicago, and Boston, may reflect a different market structure than the rest of the United States. On the one hand, these areas are extremely populated, so rival stores may be more likely to colocate within one mile. On the other hand, because the expensive real estate in these areas causes inventory costs to rise quickly, new store openings and product variety levels might be limited in super-urban areas. To control for the effects of these super-urban regions, we followed Chung and Kalnins (2001) by generating an indicator variable, SUPERURBAN, that equals 1 if the tract-level population density of the focal store (also from Census 2000) is greater than 4,400 people per square mile. We also accounted for each market's outside competition from brick-and-mortar stores by including the logged number of Walmart stores in 2010 (WM) based on the Walmart store location data we retrieved from Walmart's website. Finally, we controlled for the prevalence of online retailing by adding the 2010 Google search index for Amazon (AMAZON) and the 2010 Internet penetration rate of each market (INTERNET).

Additionally, we included a set of controls that reflect the changes in local market conditions from 2006 to 2010. These change variables are consistent with the static demographic variables that we included. For example, local demographics might change, and Internet retailing may become more common. Using the annual demographic data collected from ACS, we calculated the percentage growth from 2006 to 2010 of population (ΔPOPULATION), income (ΔINCOME), and fraction of adult, senior, male, and nonwhite population (ΔADULT, ΔSENIOR, ΔMALE, and ΔNONWHITE). To control for the changes in both offline and online competition, we also calculated the percentage growth from 2006 to 2010 of the logged number of Walmart stores ($\Delta \mathrm{WM}$), search intensity for Amazon ($\Delta \mathrm{AMAZON}$), and Internet penetration rate ($\Delta \mathrm{INTERNET}$). We calculated $\Delta \mathrm{EDUCATION}$ as the percentage growth from 2006 to 2011 because the 2010 data on the fraction of the population with a college-level or higher education was not available. We did not include $\Delta \mathrm{MARRIED}$ because annual data for this variable is not available in ACS, nor did we include $\Delta \mathrm{SUPERURBAN}$ because no change occurred for this variable from 2006 to 2010. We provide detailed definitions and descriptive statistics for all of these variables in Table 1.

[Insert Table 1 about here.]

Statistical Model and Analysis

Normally it is difficult to measure change in market structure because it represents the endogenous outcome of a competitive process (Berry and Waldfogel, 2001). However, Circuit City's complete and quick market exit represented an exogenous change to the market structures of all of Best Buy's geographic markets. To compare the product variety at each Best Buy store before and after Circuit City's exit, we included in our analysis a number of demographic changes that occurred during this period of time. However, to ensure stricter control of other possible changes in local market conditions and trends (for example, which products are popular may change from 2006 to 2010), we used the product variety change of Best Buy stores in monopoly markets as a baseline for our empirical analysis. The external changes that influence product variety, other than Circuit City's exit, apply to Best Buy stores in both monopoly and competitive markets. Appendix 3 provides a comparison of market-level characteristics between monopoly and competitive markets to better illustrate the basic conditions of the two types of markets.

We constructed an empirical analysis that in spirit is a difference-in-difference comparison. For each store, i, that existed in both 2006 and 2010, we know its product variety both before and after Circuit City's exit ($\mathrm{PV}_{\mathrm{i}2006}$ and $\mathrm{PV}_{\mathrm{i}2010}$). We log-transformed the product variety counts and defined the dependent variable as

$$\Delta\mathrm{PV}_{\mathrm{i}} = \log(\mathrm{PV}_{\mathrm{i}2010}) - \log(\mathrm{PV}_{\mathrm{i}2006}) \tag{7}$$

Equation 7 produces a logged ratio directly, which removes any variety change related to magnitude. Regardless of how large or small a given store's product variety is, we are more interested in the relative than the absolute change.[15] This definition captures the variety change that occurred after the exit event and accounts for the temporal difference in a difference-in-difference analysis. The second "difference" here refers to product variety variations across geographic regions—namely, the difference between competitive markets and the baseline monopoly markets.

We modeled product variety change as a function of dummy independent variables and a set of market-level controls. Specifically, the functional form is as follows:

$$\Delta\mathrm{PV}_{\mathrm{i}} = \beta_0 + \beta_1\mathrm{NONCOL}_{\mathrm{i}} + \beta_2\mathrm{COLOCATE}_{\mathrm{i}} + \beta_3\mathrm{ENTRY}_{\mathrm{i}} + W_i\delta + \varepsilon_i \tag{8}$$

where W_i is a vector of control variables reflecting the long-term, stable market conditions as well as changes in market conditions from 2006 to 2010 (as specified in Table 1) that might influence product variety change, δ is a coefficient vector, and ε_i is the error term following an i.i.d. normal distribution with a mean of 0.

Store entry decisions (ENTRY) are typically long-term-oriented, difficult to reverse, and very costly; in most cases, they are not made simultaneously with short-term decisions on product variety (ΔPV). There is a *slight* possibility that the ENTRY variable may still be endogenous in that both product variety and entry decisions may be determined by some unobservable market-level characteristics, leaving the variable ENTRY possibly correlated with the error term ε_i. We adopted the Instrumental Variable (IV) approach to address such potential endogeneity. Specifically, we

[15] We also checked the result without the log transformation; our results did not change substantively.

adopted a two-step procedure as suggested by Angrist and Pischke (2009). In the first step, we applied a probit model to analyze Best Buy's new store opening. The probability that Best Buy would open a new store in market i (where surviving store i exists) is a function of market structures and a set of exogenous market-level demographic variables:

$$\Pr\ (\mathrm{ENTRY_i} = 1|X_i) = \Phi\ (X_i\alpha) \tag{9}$$

where $\Phi(\cdot)$ is the cumulative distribution function of the standard normal distribution and X_i includes market structure variables (NONCOL and COLOCATE) as well as demographic variables that may affect market demand and thus are related to the store-opening decision in a given market. In the second step, we then used the predicted value of the non-linear regression (Equation 9) as an *instrument* for ENTRY and applied the conventional 2SLS procedure to estimate the model of product variety change (Equation 8).

Such estimation requires at least one "extra" explanatory variable that drives entry decisions but does not affect product variety change directly (Angrist and Pischke, 2009). Following Olivares and Cachon (2009), we used the market-level population size as our "extra" variable. Population is correlated with market entry since more firms would enter as a market's population increases, which suggested that we should include population in the probit model. Nevertheless, population may not be correlated with unobserved consumer characteristics that influence product variety following our use of a set of controls (W_i) to capture observed consumer characteristics. This variable not only makes intuitive sense but also satisfies two statistical conditions, making it a reasonable "extra" variable. First, it has a positive and significant impact (coefficient = 0.445, p = 0.000) on the first-step dependent variable ENTRY. Second, we regressed ΔPV on POPULATION, two market structure dummies, and the set of exogenous market-level controls (W_i) and found the coefficient of POPULATION to be insignificant (coefficient = –0.004, p = 0.757), suggesting that this variable does not *directly* affect the change in product variety.

RESULTS

Main Results

Table 2 presents the general pattern of product variety change in the three preexisting market structures. Overall, the average store-level product variety for surviving Best Buy stores increased from 33.25 in 2006 to 44.93 in 2010. Consistent with our theory, following the exit of Circuit City, Best Buy's store-level product variety increased in both non-colocated and colocated markets (from 33.43 to 46.01 and from 33.57 to 47.41, respectively), as compared to the baseline monopoly markets (from 32.22 to 37.81). The magnitude of increase was larger in colocated markets ($\Delta\text{PV} = 13.84$) than in non-colocated markets ($\Delta\text{PV} = 12.60$). We also considered where Best Buy opened its new stores. As shown in Table 3, with only ten exceptions in monopoly markets, all store openings occurred in competitive markets. The number of new stores opened in non-colocated markets (202) was greater than that in colocated markets (67).

[Insert Table 2 and Table 3 about here]

We present the main estimation results in Table 4. Model 1 represents the probit analysis of Best Buy's new store opening, which is also used to generate the instrument for the potentially endogenous variable ENTRY. Model 2 and Model 3 contain the ordinary least squares (OLS) and IV results of our analysis of product variety change from before to after Circuit City's market exit. We focus on the IV analysis results (Model 3); the OLS estimation results (Model 2) are presented only for comparison, because we found that ENTRY is empirically endogenous (endogeneity test χ^2 = 4.977, $p = 0.026$). Throughout all the specifications, we calculated robust standard errors to deal with issues of heteroscedasticity.

H1 investigates how the surviving stores' postexit product variety change varies with preexisting market structures. In Model 3, both NONCOL and COLOCATE have positive and significant coefficients ($\beta_1 = 0.122, p = 0.000$; $\beta_2 = 0.158, p = 0.000$), suggesting that the surviving stores in both non-colocated and colocated markets tend to increase their product variety, which supports H1A. Moreover, the coefficient of COLOCATE is significantly greater than that of NONCOL ($\chi^2 = 3.72$, p = 0.027 for a one-tailed test of $\beta_2 > \beta_1$)[16], suggesting that the surviving stores in colocated markets increase their variety to a greater extent than those in non-colocated markets. H1B thus is supported.

We now turn to the probit analysis of ENTRY (Model 1) to further explore a firm's store-opening decisions (H2). A number of control variables have significant coefficients. For example, Best Buy is more likely to open new stores in markets characterized by larger population size (POPULATION), higher median household income (INCOME), more Walmart stores (WM), and a higher level of urbanization (SUPERURBAN), as these variables may signal a higher demand level. Store opening is also more likely in markets with a more educated, adult, senior, male, non-married, and non-white population. Among the change variables from 2006 to 2010, if a market has a higher growth rate in income and adult population and if Amazon became a stronger competitor in 2010 in the market, we would observe a higher likelihood for Best Buy to open new stores. Regarding how Best Buy's entry pattern is affected by preexisting market structures, we find that compared to the baseline monopoly markets, the tendency for Best Buy to open new stores is not significantly higher in colocated markets ($\alpha_{\mathrm{COLOCATE}} = 0.189, p = 0.434$), but Best Buy is more likely to do so in non-

[16] Our results also held when we conducted a two-tailed test to compare the coefficients of NONCOL and COLOCATE. Specifically, when we defined COLOCATE as a radius of 0.5 mile and NONCOL as a radius of 0.5–10 mile, p = 0.054 for a two-tailed test of $\beta_2 > \beta_1$. In another two-tailed test, p = 0.002 when COLOCATE was defined as a radius of 0.5 mile and NONCOL as a radius of 0.5–12 miles. Finally, in a third two-tailed test, p = 0.020 when we defined COLOCATE as a radius of 1 mile and NONCOL as a radius of 1–12 miles. We thank an anonymous reviewer for this valuable suggestion.

colocated markets ($\alpha_{\text{NONCOL}} = 0.478, p = 0.036$). Among the two types of competitive markets, Best Buy is more likely to open new stores in non-colocated than in colocated markets ($\chi^2 = 4.55$, p = 0.016 for a one-tailed test of $\alpha_{\text{NONCOL}} > \alpha_{\text{COLOCATE}}$). H2 thus is supported.

H3 examines how new store opening affects the firm's product variety adjustment. In Model 3, the coefficient of ENTRY is negative and significant ($\beta_3 = -0.145, p = 0.044$), suggesting that Best Buy's postexit product variety increase was negatively affected by new store entry, in support of H3. When Best Buy enters its own store's market by opening at least one new store, the surviving store does not increase product variety as much as it would in the absence of a new Best Buy store. This outcome implies that a market expansion strategy (i.e., opening new stores to attract consumers) and a product variety strategy (i.e., stocking more product variety to make the store more attractive to consumers) act as substitute strategies for a single firm. Among the control variables, we found that markets that have a higher median household income, are located in super-urban areas, have more Walmart stores, and have experienced a greater population rise from 2006 to 2010 tend to display greater increase in product variety. We also found that Best Buy's product variety change is affected by market-level consumer heterogeneity: Greater variety increase is found in markets with a higher fraction of adult, senior, male, unmarried, and nonwhite population.

[Insert Table 4 about here]

Robustness Tests

We conducted several robustness checks and reported the results in Appendix 4. First, we varied the market definition by changing it to span a 12-mile radius. Correspondingly, we defined NONCOL as a dummy variable indicating the presence of the nearest rival in a 0.5–12-mile radius, while defining ENTRY as signifying whether or not a new store opened in a 12-mile radius (Model 4). Second, we kept the 10-mile market definition but expanded the radius of COLOCATE to 1 mile.

Accordingly, we defined NONCOL as a 1–10-mile radius (Model 5). Third, we used the 1-mile cutoff point for COLOCATE and defined NONCOL as constituting a 1–12-mile radius. The entry cutoff point (ENTRY) was changed to 12 miles as well (Model 6). None of these alternative specifications substantively altered our findings. In Model 5, the magnitude of product variety increase is not significantly higher in colocated markets than in non-colocated markets ($\chi^2 = 1.39$, p = 0.119 for a one-tailed test of $\beta_2 > \beta_1$), yet we found strong support for H1B in all other specifications (0.5 mile versus 10 miles, 1 mile versus 12 miles, 0.5 versus 12 miles). This finding suggests that H1B is supported in a slightly more polarized market definition. Fourth, our results remained robust when ENTRY was dropped from the regression (Model 7) and in the subsample wherein no store opening occurred (ENTRY = 0) (Model 8).

Fifth, we replaced the two dummy variables reflecting market structures (COLOCATE and NONCOL) with a continuous variable measuring a surviving store's distance (logged) from its nearest rival store (Model 9). The DISTANCE variable is negative and significant, suggesting the surviving store increases its product variety to a greater extent when the nearest rival store is geographically closer, in support of both H1A and H1B. Our results remained supported with two alternative measures of DISTANCE: (1) DISTANCE was defined as the logged distance from the nearest Circuit City store for competitive markets and 0 for monopoly markets (Model 10), and (2) DISTANCE was defined as the exponential of negative distance from the former nearest Circuit City store for competitive markets and as 0 for monopoly markets (Model 11). In both Model 10 and Model 11, a dummy variable COMPETITIVE (= 1 for competitive markets, = 0 for monopoly markets) was included to test H1A.

Sixth and finally, to distinguish Best Buy's expansion that occurred before versus after Circuit City's exit, we sorted all the new stores that opened after 2006 by their store IDs, split them in half, coded the first half as early entries (i.e., before Circuit City's exit in late 2008), and coded the second half as late entries.[17] The dummy variable LATE ENTRY (= 1 for late entries, and 0 otherwise) in Model 12 is insignificant, suggesting that there were no systematic differences between pre-2008 and post-2008 entries. Our results still held in the subsample of only post-2008 entries (i.e., the subsample of LATE ENTRY = 1), as presented in Model 13.

DISCUSSION AND CONCLUSIONS

Contributions

Our paper provides several important contributions to the literature. First and foremost, our study is the first to examine how incumbents respond to a main rival's exit. Our formal model and empirical study show that following the rival's exit, the survivor is motivated to expand in both product and geographic spaces by increasing its store-level product variety and opening new stores. Such expansions involve a joint consideration of filling in the "holes" in the market and preempting attractive locations to deter potential and unknown entrants. At a broad level, our findings contribute to the literature on incumbent responses to entry (Geroski, 1995; Seamans, 2013; Seamans and Zhu, 2013) by highlighting the difference between entry and exit. Incumbents play the role of defenders when responding to entry. In comparison, surviving incumbents following a rival's exit act more like aggressors due to their limited information and engage in preemption without specific potential rivals in mind. Our findings of postexit expansion thus add to the literature on *ex ante* entry deterrence (Goolsbee and Syverson, 2008; Seamans, 2013). Moreover, this study contributes to a nascent body of research on incumbent repositioning (Du, Li, and Wu,

[17] The rationale behind Best Buy's store openings before versus after Circuit City's exit might be different. Unfortunately, data on the opening dates of Best Buy stores is not available. After an extensive study of Best Buy store IDs and store-opening sequences, we found that Best Buy has been using monotonically increasing integers as store IDs, which suggests that stores with smaller IDs were opened earlier and stores with larger IDs opened later. We thus used store IDs as a proxy for store-opening sequence. Knowing that Best Buy opened 80 stores in 2007, 101 in 2008, 100 in 2009, 46 in 2010, and 30 in 2011, we split the new stores in half to identify early and late entries.

2018; Seamans and Zhu, 2017; Wang and Shaver, 2014). Repositioning, or response in general, can be opportunity-driven (de Figueiredo and Silverman, 2007; Greve, 1995) as well as competition-driven (Wang and Shaver, 2014). The former is argued to enhance future payoffs, as the new position is more attractive than the current one, and the latter is argued to mitigate immediate losses by making the current position less attractive (Wang and Shaver, 2014). We add uncertainty resulting from the rival's exit as the third motive to the repositioning literature. Because information about the postexit world is at best incomplete, it is problematic to categorize uncertainty-driven repositioning as either pursuit of gains or avoidance of losses. For the same reason, we speculate that surviving firms may over-expand shortly after the exit and then contract after new firms enter and more information about the new entrants becomes available.

Second, our study considers multiple non-pricing responses and the relationship between them. Whereas the traditional focus has been on pricing responses (Geroski, 1995; Goolsbee and Syverson, 2008; McCann and Vroom, 2010; Simon, 2005), a growing stream of research has recently turned to non-pricing responses, such as store location (Thomadsen, 2007), product overlap (Hwang *et al*., 2010), the decision to go online or stay offline (Seamans and Zhu, 2013), service quality (Bennett *et al*., 2013), and product variety (Casadesus-Masanell and Hałaburda, 2014). Notably, Casadesus-Masanell and Zhu (2010) have examined how an incumbent chooses between multiple responses, including changing its business model and two tactical measures (pricing and advertising intensity), to cope with competition from new entrants. Similar to their study, we also focus on multiple responses that differ in terms of cost, reversibility, time consumption, and long-term orientation. We show that with the opening of a new sister store, the surviving store increases its product variety to a lesser extent. Such a substitutive relationship is consistent with the tradeoffs between product variety (horizontal scope) and vertical integration (vertical scope) found in the soft-drink industry (Zhou and Wan, 2017b). Our study thus provides additional evidence on the constraint of firms' coordination capacity (Zhou, 2011; Zhou and Wan, 2017a).

Third, we explore how firm responses vary across different market structures. We focus on the distinction between colocated and non-colocated markets, partly because colocation has been particularly prevalent and important in retail yet has received little study in this context (Chung and Kalnins, 2001). Preexisting market structures reflect the distribution of customer preferences in the market and affect the equilibrium that rival firms are able to achieve, both of which influence the surviving firm's postexit responses. We find the pattern of new store openings varies across market types in that the surviving firm is less willing to open new stores in colocated markets. This likely occurs because customers are more concentrated in colocated markets, resulting in fewer attractive locations for the surviving firm to choose from (Greve, 1995). In contrast, in non-colocated markets wherein customers are more evenly distributed, the surviving firm has more latitude to choose locations to balance the benefits of market coverage and risks of cannibalization (Anderson, Goeree, and Ramer, 1997). Moreover, the different patterns we find for postexit product-variety expansion are consistent with the preexisting equilibrium identified by Ren *et al.* (2011). They find that colocated rivals carry a lower level of product variety than non-colocated ones, but they differentiate themselves more from each other by carrying fewer overlapping products. Our analytical model (represented in Lemma 1, as shown in Appendix 2) corroborates their empirical finding. We further show that because of this preexisting equilibrium on product variety, the surviving store in a colocated market tends to increase product variety to a greater extent than occurs in a non-colocated market. By adding temporal elements and studying the linkages between preexisting and postexit competitive dynamics, our finding thus extends Ren *et al.*'s (2011) work that emphasizes only cross-market-type variations.

Fourth, our study contributes to the literature on the relationship between product variety and market structure by focusing on radical changes in market structure. Most extant studies either focus on cross-sectional data (Olivares and Cachon, 2009; Watson, 2009) or treat market structure as a relatively stable element in panel data and do not explore the dynamic nature of the industries (Bayus and Putsis, 1999). We note, however, that market structure may experience abrupt or drastic changes. The changes can be driven by a new business model (Seamans and Zhu, 2013), consumer demand shifts (de Figueiredo and Silverman, 2007), competitive entry (Zhu et al., 2009), or policy change (Berry and Waldfogel, 2001). Berry and Waldfogel's (2001) seminal study of radio broadcasting stations after the Telecommunications Act of 1996 is the only extant research on how a drastic change in market structure affects product variety. Likewise, we also find that greater concentration in a geographic market results in more product variety. In the setting explored by Berry and Waldfogel (2001), market structure becomes consolidated when an exogenous policy change triggers a major wave of mergers. We complement their work by exploring increased market concentration triggered by the exit of a major rival. Moreover, with their focus on the total product variety available to consumers at the market level, their findings have implications for consumer welfare and public policies. With a firm-level analysis, our study extends their findings and sheds light on firms' strategies in response to market structure changes.

Limitations and Future Research Directions

We note several caveats to our analysis and thus directions for future research. First, the findings of our study are based on firms in a consolidated industry over two periods of time; the results thus might reflect some factors specific to this industry or the study periods. Replications in other settings, such as booksellers (Barnes & Noble and Borders) could help ensure the generalizability of our findings. Second, we restricted our analysis to duopoly cases. Although the duopoly setting is common to many retail markets, allowing for multiple competitors and incorporating the effect of firm characteristics (e.g., size, age, and organizational structure) would extend our research. Consider, for example, the competitive dynamics of Netflix, Redbox, and Blockbuster. Do multiple surviving firms compete more aggressively and expand product variety more than if there were only one major surviving firm? How does the inclusion of additional players alter the interaction of product variety with market entry? If surviving firms are heterogeneous in characteristics and strategies, which kinds of firms are more likely to benefit from rivals' exit?

Third, as the first study to examine how surviving firms respond to rival exit, we define exit in a general way and our findings are generalizable to all markets undergoing drastic changes in market structure due to rival exit. We do not equate exit with failure, nor do we imply the industry is declining. We note that exit is a complex phenomenon that can be triggered by many factors such as high competitive intensity in the market (Baum and Korn, 1996), instability of overall market demand (Harrigan, 1980), and the viability of the exiting rival's business model (Chuang and Baum, 2003). Exploring the fundamental reasons behind exit and distinguishing different types of exits will advance our understanding of the motives and patterns of incumbent responses to rival exit. Fourth and finally, we suggest that surviving firms expand out of the motives of meeting demand and preempting entry from unfamiliar entrants. Future research can further investigate how these mechanisms play out. We also suggest that surviving firms might *overly* expand out of uncertainty. Future research can examine the performance implications of incumbent responses to exit and use empirical evidence to validate this speculation. In summary, we hope our study ignites more scholarly interest in questions related to how surviving firms are affected by and act on the exit of rivals, regardless of whether they operate within thriving or declining industries.

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Table 1: Summary and descriptive statistics of the market level variables (N = 709)

Variable	Description	Mean	Std. Dev.	Min	Max
ΔPV	Change in the logged number of a surviving store's total product variety (SKUs) after the rival chain exits	0.282	0.215	-0.633	0.842
NONCOL	Indicator = 1 if a surviving store's distance from its preexisting nearest rival store > 0.5 mile and ≤ 10 miles	0.560	0.497	0.000	1.000
COLOCATE	Indicator = 1 if a surviving store's distance from its preexisting nearest rival store ≤ 0.5 mile	0.262	0.440	0.000	1.000
ENTRY	Indicator = 1 if the surviving chain opens at least one new store in the market of a surviving store	0.394	0.489	0.000	1.000
POPULATION	Population size in a market (logged), Census 2000	13.670	1.161	10.691	16.316
INCOME	Median household income (US$, logged units), Census 2000	10.788	0.223	10.194	11.445
EDUCATION	Decimal fraction of the population with a college school or higher education, Census 2000	0.112	0.030	0.043	0.200
ADULT	Decimal fraction of the population older than 18 years, Census 2000	0.257	0.025	0.181	0.362
SENIOR	Decimal fraction of the population older than 65 years, Census 2000	0.117	0.031	0.046	0.280
MALE	Decimal fraction of male population, Census 2000	0.489	0.009	0.468	0.549
MARRIED	Decimal fraction of married population, Census 2000	0.514	0.074	0.318	0.708
NONWHITE	Decimal fraction of consumers who are non-white, Census 2000	0.272	0.156	0.024	0.741
SUPERURBAN	Indicator variable for super-urban market. Census 2000	0.226	0.418	0.000	1.000
WM	Number of Walmart stores in 2010 (logged units)	1.430	0.508	0.000	2.708
AMAZON	Google search index for Amazon in 2010	38.563	8.244	12.962	51.923
INTERNET	Internet penetration in 2010	80.550	3.537	70.870	90.100
ΔPOPULATION	Percentage change of population between 2006 and 2010	0.039	0.047	-0.079	0.231
ΔINCOME	Percentage change of median household income between 2006 and 2010	0.026	0.057	-0.150	0.242
ΔEDUCATION	Percentage change of population with a college or higher education between 2006 and 2010	-0.052	0.076	-0.278	0.338
ΔADULT	Percentage change of population for those 18 and older between 2006 and 2010	0.009	0.014	-0.050	0.062
ΔSENIOR	Percentage change of population change for those 65 and older between 2006 and 2010	0.060	0.062	-0.324	0.438
ΔMALE	Percentage change of male population between 2006 and 2010	-0.004	0.010	-0.051	0.055
ΔNONWHITE	Percentage change of non-white population between 2006 and 2010	0.005	0.154	-0.719	0.978
ΔWM	Percentage of the number of Walmart stores between 2006 and 2010	0.131	0.321	0.000	4.000
ΔAMAZON	Percentage change of Google search index for Amazon between 2006 and 2010	0.679	0.285	-0.329	1.353
ΔINTERNET	Percentage change of Internet penetration between 2006 and 2010	0.129	0.038	0.048	0.252

Table 2: Product variety levels at surviving Best Buy stores in 2006 and 2010

	N	Average SKU Count 2006	Average SKU Count 2010	Change from 2006 to 2010
Monopoly market (baseline)	126	32.22	37.81	5.59
$(NONCOL = 0;\ COLOCATE = 0)$		(2.97)	(8.75)	(8.17)
Non-colocated competitive market	397	33.43	46.03	12.60
$(NONCOL = 1;\ COLOCATE = 0)$		(2.65)	(8.55)	(8.64)
Colocated competitive market	186	33.57	47.41	13.84
$(NONCOL = 0;\ COLOCATE = 1)$		(2.55)	(7.44)	(7.05)

Notes: Standard deviations appear in parentheses.

Table 3: Where did Best Buy open new stores after Circuit City exited?

A: Across all markets (N = 709)

		AFTER: Did Best Buy open a new store in the market?	
		No	Yes
BEFORE	Monopoly market	116	10
	Competitive market	314	269

B: Competitive markets (N = 583)

		AFTER: Did Best Buy open a new store in the market?	
		No	Yes
BEFORE	Non-colocated market	195	202
	Colocated market	119	67

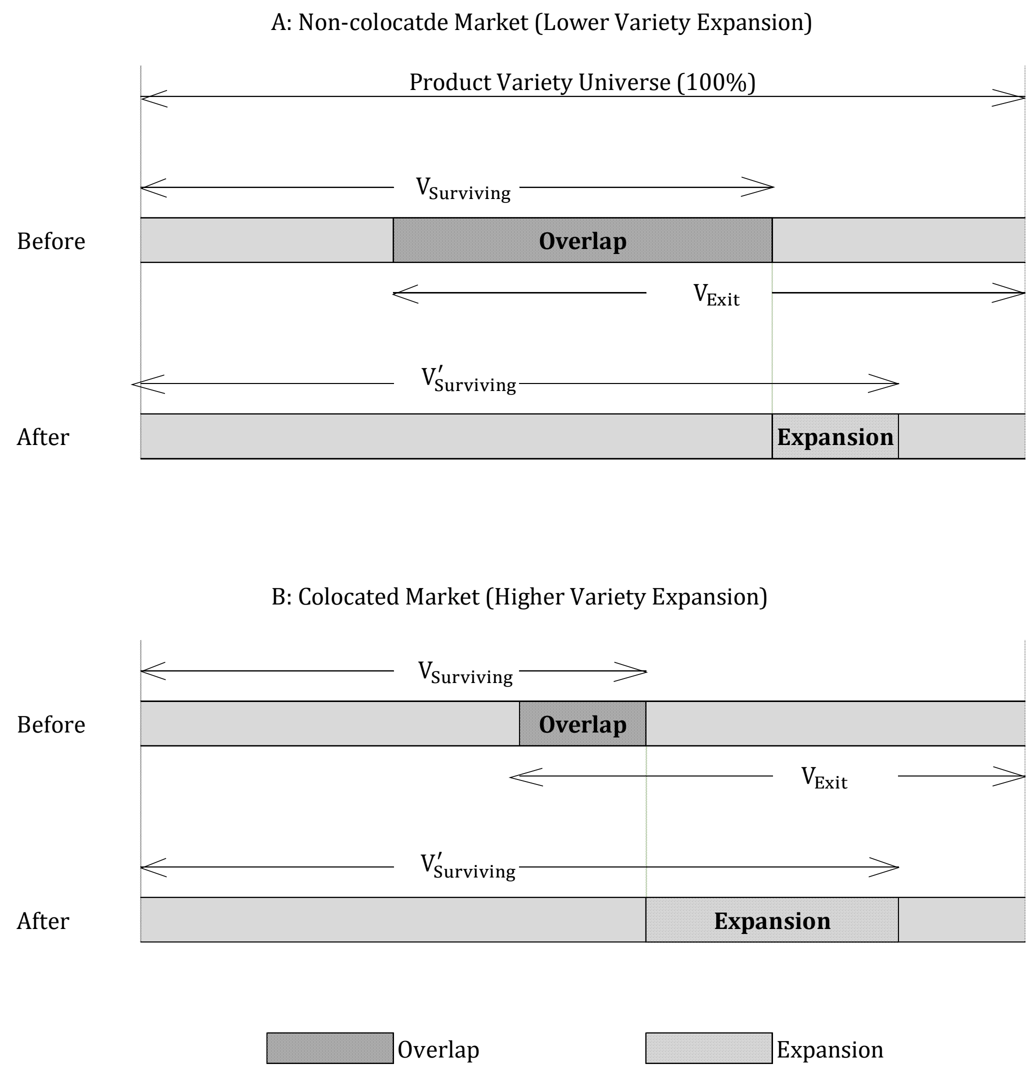
Table 4: Results of Best Buy's postexit new store opening and product variety change (N=709)

	Model 1			Model 2			Model 3		
Dependent Variable	ENTRY			ΔPV			ΔPV		
Estimation Method	Probit			OLS			IV [a]		
Intercept	-33.234	(8.137)	*0.000*	-3.604	(1.094)	*0.001*	-4.850	(1.245)	*0.000*
NONCOL	0.478	(0.228)	*0.036*	0.110	(0.026)	*0.000*	0.122	(0.026)	*0.000*
COLOCATE	0.189	(0.242)	*0.434*	0.159	(0.025)	*0.000*	0.158	(0.025)	*0.000*
ENTRY				0.002	(0.018)	*0.928*	-0.145	(0.072)	*0.044*
POPULATION	0.445	(0.115)	*0.000*						
INCOME	1.033	(0.591)	*0.081*	0.169	(0.075)	*0.025*	0.250	(0.086)	*0.004*
EDUCATION	10.275	(3.684)	*0.005*	-0.264	(0.491)	*0.592*	0.068	(0.524)	*0.897*
ADULT	16.067	(4.718)	*0.001*	0.828	(0.638)	*0.195*	1.276	(0.683)	*0.062*
SENIOR	15.452	(3.632)	*0.000*	0.787	(0.484)	*0.104*	1.291	(0.526)	*0.014*
MALE	21.478	(9.859)	*0.029*	2.961	(1.312)	*0.024*	3.425	(1.343)	*0.011*
MARRIED	-4.221	(1.443)	*0.003*	-0.485	(0.206)	*0.019*	-0.693	(0.233)	*0.003*
NONWHITE	1.612	(0.584)	*0.006*	0.113	(0.082)	*0.171*	0.212	(0.099)	*0.032*
SUPERURBAN	0.276	(0.156)	*0.076*	0.041	(0.020)	*0.039*	0.057	(0.023)	*0.013*
WM	0.457	(0.143)	*0.001*	0.027	(0.018)	*0.137*	0.057	(0.024)	*0.019*
AMAZON	-0.004	(0.009)	*0.700*	0.001	(0.001)	*0.371*	0.001	(0.001)	*0.659*
INTERNET	-0.022	(0.021)	*0.289*	0.004	(0.003)	*0.136*	0.004	(0.003)	*0.123*
ΔPOPULATION	2.337	(1.727)	*0.176*	0.438	(0.223)	*0.050*	0.481	(0.232)	*0.038*
ΔINCOME	2.849	(1.226)	*0.020*	-0.205	(0.160)	*0.070*	-0.119	(0.169)	*0.482*
ΔEDUCATION	0.473	(0.844)	*0.575*	0.044	(0.105)	*0.674*	0.078	(0.107)	*0.465*
ΔADULT	12.280	(5.776)	*0.034*	0.640	(0.729)	*0.380*	1.181	(0.800)	*0.140*
ΔSENIOR	0.941	(1.177)	*0.424*	0.009	(0.157)	*0.954*	0.036	(0.163)	*0.826*
ΔMALE	-8.921	(7.447)	*0.231*	0.960	(0.970)	*0.323*	0.658	(0.988)	*0.505*
ΔNONWHITE	-0.764	(0.460)	*0.097*	-0.052	(0.049)	*0.289*	-0.068	(0.052)	*0.194*
ΔWM	-0.182	(0.217)	*0.399*	-0.016	(0.026)	*0.537*	-0.026	(0.022)	*0.242*
ΔAMAZON	0.524	(0.283)	*0.064*	-0.003	(0.035)	*0.933*	0.017	(0.038)	*0.649*
ΔINTERNET	-0.948	(1.740)	*0.586*	0.223	(0.220)	*0.312*	0.235	(0.224)	*0.295*
Log pseudo-likelihood	-314.061								
Wald chi2(24)	226.25		*0.000*						
F Statistics				F(24, 684) = 7.24		*0.000*	F(24, 684) = 7.34		*0.000*
R^2 [b]				0.176			N/A		
Endogeneity Test				N/A			χ^2 (1)=4.977		*0.026*

Notes: Robust standard errors appear in parentheses; p-values in italics. All tests are two tailed.

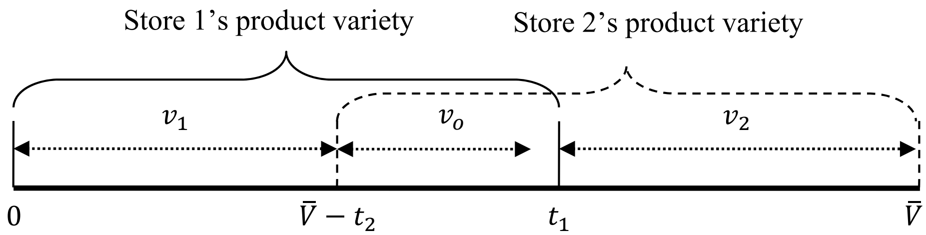
[a] In the IV estimation of Model 3, we use the predicted value of ENTRY from the probit analysis in Model 1 as the instrument for ENTRY. [b] We report R^2 for the OLS estimation. We do not report R^2 for the IV estimation since R^2 is not an appropriate measure of goodness of fit for IV regressions.

APPENDIX 1. Patterns of preexisting product variety and postexit expansion: Non-colocated vs. colocated markets

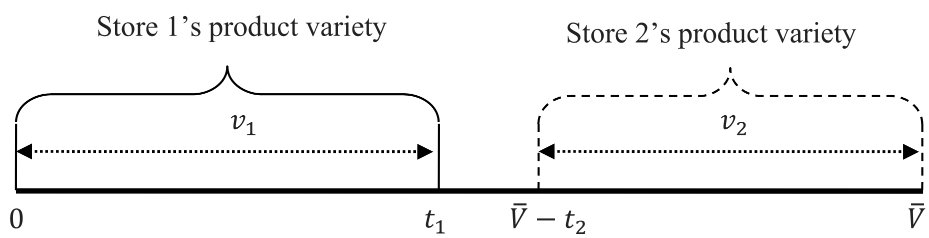


APPENDIX 2. Proof of lemmas and propositions

Figure A1: Product variety in a duopoly market



A. Scenario 1 (existence of product variety overlap):
$v_o > 0, t_1 + t_2 > \bar{V}$



B. Scenario 2 (no product variety overlap):
$v_o = 0, t_1 + t_2 \leq \bar{V}$

Derivation of demand functions. Based on the consumer utility function in Euqation (1), consumer demand functions are given as follows,

$$\begin{aligned} \boldsymbol{q_1} &= \frac{\mathbf{1}}{\boldsymbol{\beta_1\beta_2} - \gamma^2}\left[\boldsymbol{\alpha_1\beta_2}\phi(\mathbf{1} + \boldsymbol{v_1} + \boldsymbol{mv_o}) - \boldsymbol{\alpha_2}\gamma\,\phi(\mathbf{1} + \boldsymbol{v_2} + \boldsymbol{mv_o}) - \beta_2\boldsymbol{p_1} + \gamma\,\boldsymbol{p_2}\right] \\ \boldsymbol{q_2} &= \frac{\mathbf{1}}{\boldsymbol{\beta_1\beta_2} - \gamma^2}\left[\boldsymbol{\alpha_2\beta_1}\phi(\mathbf{1} + \boldsymbol{v_2} + \boldsymbol{mv_o}) - \boldsymbol{\alpha_1}\gamma\,\phi(\mathbf{1} + \boldsymbol{v_1} + \boldsymbol{mv_o}) - \beta_1\boldsymbol{p_2} + \gamma\,\boldsymbol{p_1}\right]. \end{aligned} \quad \textbf{(A1)}$$

Letting $\delta = \beta_1\beta_2 - \gamma^2$, $a_{oi} = \frac{(\alpha_i\beta_j - \gamma\alpha_j)\phi}{\delta}$, $a_i = \frac{\alpha_i\beta_j\phi}{\delta}$, $b_i = \frac{\beta_j}{\delta}$, $d = \frac{\gamma}{\delta}$, and $e_i = \frac{\alpha_j\gamma\phi}{\delta}$ for $i \neq j$, $i = 1,2$, we can write demands of both stores as

$$\begin{aligned} \boldsymbol{q_1} &= \boldsymbol{a_{o1}} + \boldsymbol{a_1}(\boldsymbol{v_1} + \boldsymbol{mv_o}) - \boldsymbol{e_1}(\boldsymbol{v_2} + \boldsymbol{mv_o}) - \boldsymbol{b_1p_1} + \boldsymbol{dp_2} \\ \boldsymbol{q_2} &= \boldsymbol{a_{o2}} + \boldsymbol{a_2}(\boldsymbol{v_2} + \boldsymbol{mv_o}) - \boldsymbol{e_2}(\boldsymbol{v_1} + \boldsymbol{mv_o}) - \boldsymbol{b_2p_2} + \boldsymbol{dp_1}. \end{aligned} \quad \textbf{(A2)}$$

From Equation (A2), we have $\frac{\partial q_i}{\partial v_i} = a_i > 0$ and $\frac{\partial q_i}{\partial v_j} = -e_i < 0$, which suggests that a store's demand increases with its unique product variety and decreases with its rival's unique product variety.

We assume $p_i = p$ in light of the popularity of price match guarantees in the retail industry. Same as in Singh and Vives (1984), we assume $a_{oi} = 1$, $a_i = a$, $b_i = b$, and $e_i = e$, which imply that consumers have same elasticity to product variety. For simplicity, we assume that $1-(b-d)p \geq 0$, that is, demand is non-negative when product variety is zero. Therefore, the demand functions in (A2) become

$$\begin{aligned} \boldsymbol{q_1} &= \mathbf{1} + \boldsymbol{a}(\boldsymbol{v_1} + \boldsymbol{m}\boldsymbol{v_o}) - \boldsymbol{e}(\boldsymbol{v_2} + \boldsymbol{m}\boldsymbol{v_o}) - (\boldsymbol{b}-\boldsymbol{d})\,\boldsymbol{p} \\ \boldsymbol{q_2} &= \mathbf{1} + \boldsymbol{a}(\boldsymbol{v_2} + \boldsymbol{m}\boldsymbol{v_o}) - \boldsymbol{e}(\boldsymbol{v_1} + \boldsymbol{m}\boldsymbol{v_o}) - (\boldsymbol{b}-\boldsymbol{d})\,\boldsymbol{p}. \end{aligned} \tag{A3}$$

Q.E.D.

LEMMA 1. *In a duopoly market where the product variety universe $\bar{V}$ is fully covered by both stores, for* $\frac{pam+pe(1-m)}{2} \leq c\bar{V} \leq pam+pe(1-m)$, *the optimal levels of product variety are given by:*

$$\begin{aligned} v_1^D &= v_2^D = \frac{1}{2c}[2c\bar{V} - pam - pe(1-m)] \\ v_o^D &= \frac{1}{c}[pam + pe(1-m) - c\bar{V}] \\ t_1^D &= t_2^D = \frac{p}{2c}[am + e(1-m)]. \end{aligned}$$

Proof of Lemma 1. As Store 1 moves first in deciding on its product variety t_1 before Store 2 decides on t_2, given Store 1's product variety t_1 Store 2 sets its product variety $t_2 = v_2 + v_o$ to maximize its profit Π_2. Store *i*'s profit is given in Equation (3) and listed below,

$$\begin{aligned} \boldsymbol{\Pi_i} &= \boldsymbol{p}\boldsymbol{q_i} - \boldsymbol{c}(\boldsymbol{v_i} + \boldsymbol{v_o})^2 \\ &= \boldsymbol{p}\left[\boldsymbol{a_o} + \boldsymbol{a}(\boldsymbol{v_i} + \boldsymbol{m}\boldsymbol{v_o}) - \boldsymbol{e}(\boldsymbol{v_j} + \boldsymbol{m}\boldsymbol{v_o}) - (\boldsymbol{b}-\boldsymbol{d})\,\boldsymbol{p}\right] - \boldsymbol{c}(\boldsymbol{v_i} + \boldsymbol{v_o})^2. \end{aligned} \tag{A4}$$

The first derivatives of Π_2 with respect to v_2 and v_o are given by $\frac{\partial \Pi_2}{\partial v_2} = pam + pe(1-m) - 2c(v_2+v_o)$ and $\frac{\partial \Pi_2}{\partial v_o} = pa - 2c(v_2+v_o)$. It is easy to show that for any $a > e$ and $\frac{1}{2} < m < 1$, we have

$$\frac{\partial \boldsymbol{\Pi_2}}{\partial \boldsymbol{v_2}} - \frac{\partial \boldsymbol{\Pi_2}}{\partial \boldsymbol{v_o}} = \boldsymbol{p}(\boldsymbol{a}-\boldsymbol{e})(\mathbf{1}-\boldsymbol{m}) > \mathbf{0}. \tag{A5}$$

Equation (A5) implies that Store 2 will carry unique products before carrying any overlapping products given Store 1's product variety t_1. Solving both stores' profit maximization problems leads to the optimal levels of product variety.

We first analyze Scenario 1 in Figure A1 in which the level of overlapping product variety is greater than zero ($v_o > 0$). We solve Store 2's level of product variety first, given Store 1's product variety of t_1. Given $v_1 = t_1 - v_o$, we have $\frac{\partial \Pi_2}{\partial v_2} - \frac{\partial \Pi_2}{\partial v_o} = p(a-e)(1-m) > 0$. Thus Store 2 will increase the level of unique product variety before adopting any overlapping product variety, i.e., $v_2 = \bar{V} - t_1$. Solving Store 2's profit maximization problem leads to:

$$\begin{aligned} \boldsymbol{v_2^D} &= \bar{\boldsymbol{V}} - \boldsymbol{t_1} \\ \boldsymbol{v_o^D} &= \frac{\mathbf{1}}{\mathbf{2}\boldsymbol{c}}[\boldsymbol{pam} + \boldsymbol{pe}(\mathbf{1}-\boldsymbol{m}) - \mathbf{2}\boldsymbol{c}\bar{\boldsymbol{V}} + \mathbf{2}\boldsymbol{c}\boldsymbol{t_1}]. \end{aligned} \tag{A6}$$

Store 2's profit function is thus given by

$$\begin{aligned} \boldsymbol{\Pi_2^D} &= \boldsymbol{p}\boldsymbol{q_2} - \boldsymbol{c}(\boldsymbol{v_2} + \boldsymbol{v_o})^2 \\ &= \frac{\mathbf{1}}{\mathbf{2c}}(-\mathbf{2}\boldsymbol{c}^2\boldsymbol{t_1^2} + \mathbf{2}\boldsymbol{pct_1}[\boldsymbol{am} + \boldsymbol{e}(\mathbf{1}-\boldsymbol{m})] + \mathbf{2}\boldsymbol{pc}\bar{\boldsymbol{V}}(\boldsymbol{a}-\boldsymbol{e})(\mathbf{1}-\boldsymbol{m}) + \mathbf{2}\boldsymbol{pa_o c} - \\ &\qquad \mathbf{2}\boldsymbol{p}^2\boldsymbol{c}(\boldsymbol{b}-\boldsymbol{d}) - \boldsymbol{p}^2[\boldsymbol{ae} + \boldsymbol{m}(\mathbf{1}-\boldsymbol{m})(\boldsymbol{a}-\boldsymbol{e})^2]). \end{aligned} \tag{A7}$$

Store 2 maximizes its profit by choosing t_2. The optimal levels of product variety are as shown in Equation (4). Constraints of $t_1 \geq v_o$ and $v_o \geq 0$ lead to $\frac{pam+pe(1-m)}{2} \leq c\bar{V} \leq pam + pe(1-m)$.

In Scenario 2, each store operates as a monopoly, given the demand function in Equation (2). Solving the first-order conditions gives us the optimal levels of product variety $t_1^D = t_2^D = v_1^D = v_2^D = \frac{pa}{2c}$. The constraint of $v_1^D + v_2^D \leq \bar{V}$ leads to $c\bar{V} \geq pa$. Q.E.D.

PROPOSITION A1. *When the surviving firm operates a single store in the market after the rival's exit, the product variety of the surviving store increases for* $\frac{pa}{2} \leq c\bar{V} \leq pam + pe(1-m)$.

Proof of Proposition A1. Comparing the optimal product variety of the single-store case (t_1^S) with that of the duopoly case (t_1^D) leads to $t_1^S - t_1^D = \frac{p}{2c}(a-e)(1-m)$, which is always positive for $a > e$ and $m < 1$. Proposition A1 is thus easy to derive together with Lemma 1.

Q.E.D.

PROPOSITION A2. *The surviving firm is less likely to open new stores when the cannibalization effect between overlapping products is stronger.*

PROPOSITION A3. *The product variety increase at the surviving store is larger if the surviving firm does not open a new store than if the surviving firm opens a new store when* $\max\left\{\frac{p(a-e)(2m-1)}{2w(2w-1)}, \frac{pa}{2}\right\} \leq c\bar{V} \leq \frac{p(a-e)(2m-1)}{2w-1}$ *and* $c\bar{V} > \frac{p(a-e)(2m-1)-pa(2w-1)^2}{2(1-w)(2w-1)}$.

In order to prove Propositions A2 and A3, we first prove the following two lemmas, Lemma A1 and Lemma A2.

LEMMA A1. *The surviving firm would open a new store in the market when the following condition is satisfied:*

for $\max\left[\frac{pa}{2}, \frac{p(a-e)(2m-1)}{2w(2w-1)}\right] \leq c\bar{V} \leq \frac{p(a-e)(2m-1)}{2w-1}$,

$$F \leq \bar{F}_1 = \frac{p}{4c(2w-1)^2}[8c\bar{V}(a-e)(2w-1)(w-m) + 2p(a-e)^2(1-4m+4wm) + (2w-1)^2(4a_oc - pa^2 + 8pcd - 4pbc)]; \tag{A8}$$

for $c\bar{V} \geq \max\left[\frac{pa}{2}, p(a-e)\right]$,

$$F \leq \bar{F}_2 = \frac{p}{4c}[p(a-2e)^2 - 2pe^2 - 4pbc + 8pdc + 4a_oc]. \tag{A9}$$

Proof of Lemma A1. Equation (6) shows that the optimal level of product variety for the surviving firm is given by $t_1^S = v_1^S = \frac{pa}{2c}$ for $c\bar{V} \geq \frac{pa}{2}$ when the surviving firm does not open any new store. The firm's profit is given by $\Pi_1^S = \frac{p(pa^2+4a_oc-4pbc)}{4c}$. If the surviving firm decides to open a new store, the optimal levels of product variety are as shown in Lemma A1 and the optimal profits are calculated as below.

For $\frac{p(a-e)(2m-1)}{2w(2w-1)} \leq c\bar{V} \leq \frac{p(a-e)(2m-1)}{2w-1}$,

$$\boldsymbol{\Pi_1^T = \frac{p}{2c(2w-1)^2}\left[p(a-e)^2(2m-1)^2 + 4c(2w-1)^2(a_o - pb + pd) + 4c\bar{V}(a-e)(w-m)(2w-1)\right] - F.} \quad \textbf{(A10)}$$

For $c\bar{V} \geq p(a-e)$,

$$\boldsymbol{\Pi_1^T = \frac{p}{2c}\left[p(a-e)^2 + 4a_o c - 4pc(b-d)\right] - F.} \quad \textbf{(A11)}$$

Comparing the firm's profit when the firm opens a new store with its profit when the firm does not open a new store gives us the results as shown in Lemma A1. Q.E.D.

LEMMA A2. *When the surviving firm opens a new store in the market, if the product variety universe $\bar{V}$ is fully covered by both stores for $\frac{p(a-e)(2m-1)}{2w(2w-1)} \leq c\bar{V} \leq \frac{p(a-e)(2m-1)}{2w-1}$, the optimal levels of product variety are given by:*

$$\begin{aligned} \boldsymbol{v_1^T = v_2^T} &= \boldsymbol{\frac{1}{2c(2w-1)^2}\left[2w(2w-1)c\bar{V} - p(a-e)(2m-1)\right]} \\ \boldsymbol{v_o^T} &= \boldsymbol{\frac{1}{c(2w-1)^2}\left[p(a-e)(2m-1) - c\bar{V}(2w-1)\right]} \\ \boldsymbol{t_1^T = t_2^T} &= \boldsymbol{\frac{1}{2c(2w-1)^2}\left[p(a-e)(2m-1) - 2(1-w)(2w-1)c\bar{V}\right].} \end{aligned} \quad \textbf{(A12)}$$

Proof of Lemma A2. Similar to the duopoly market, there are two scenarios when the surviving firm opens a new store after the rival exits the market. In the first scenario, similar as Scenario 1 in Figure A1, two sister stores of the surviving firm cover the entire product variety universe and thus $v_o^T > 0$. We solve the new store's optimal levels of product variety first, given the original store's total product variety is given by t_1^T. We use Π_1^T to denote the total profit for the surviving firm after the firm opens a new store. We assume the firm would like to increase the level of unique product variety before adopting any overlapping product variety, which will be validated at equilibrium later. Thus we have i.e., $v_2^T = \bar{V} - t_1^T$. Solving the surviving firm's profit maximization leads to:

$$\begin{aligned} \boldsymbol{v_2^T} &= \boldsymbol{\bar{V} - t_1^T} \\ \boldsymbol{v_o^T} &= \boldsymbol{\frac{1}{2c(2w^2-2w+1)}\left[p(a-e)(2m-1) - 2wc\bar{V} + 2ct_1^T\right].} \end{aligned} \quad \textbf{(A13)}$$

The firm's profit function is thus given by

$$\boldsymbol{\Pi_1^T = p(q_1 + q_2) - c(v_1^T + wv_o^T)^2 - c(v_2^T + wv_o^T)^2} \quad \textbf{(A14)}$$

where q_i is as given in Equation (2) and v_2^T and v_o^T are as given in Equation (A13). Solving the firm's profit maximization problem leads to the optimal levels of product variety as given in Equation (A12). At the optimal levels of product variety, we have $\frac{\partial \Pi_1^T}{\partial v_2^T} - \frac{\partial \Pi_1^T}{\partial v_o^T} = \frac{2p(a-e)(w-m)}{2w-1} > 0$. The surviving firm increases the level of unique product variety before adopting any overlapping product variety. Constraints of $t_1^T \geq v_o^T$ and $v_o^T \geq 0$ lead to $\frac{p(a-e)(2m-1)}{2w(2w-1)} \leq c\bar{V} \leq \frac{p(a-e)(2m-1)}{2w-1}$.

In the other scenario where the entire product variety is not fully covered by the surviving firm's sister stores, each store operates as a monopoly, given the demand function in Equation (2). Solving the first-order conditions gives us the optimal levels of product variety $t_1^T = t_2^T = v_1^T = v_2^T = \frac{p(a-e)}{2c}$. The constraint of $v_1^T + v_2^T \leq \bar{V}$ leads to $c\bar{V} \geq p(a-e)$. This completes the proof of Lemma A2. Q.E.D.

Proof of Proposition A2. The conditions under which the firm would choose to open a new store are summarized in Lemma A1. The proof of Proposition A2 is then easy to derive from Lemma A1. Q.E.D.

Proof of Proposition A3. Given a consumer's utility as shown in Equation (1), the costs of carrying product variety $c(v_i + wv_o)^2$, and the cost of opening a new store *F*, the surviving firm's profit with opening a new store is given by

$$\begin{aligned} \boldsymbol{\Pi_T} &= \boldsymbol{pq_1 + pq_2 - c(v_1 + wv_o)^2 - c(v_2 + wv_o)^2 - F} \\ &= \boldsymbol{\sum_{i=1}^{2}\{p[a_o + a(v_i + mv_o) - e(v_{3-i} + mv_o) - (b-d)p] - c\left(v_i + wv_o\right)^2\} - F.} \end{aligned} \tag{A15}$$

The firm maximizes its profit by choosing v_i and v_o. Lemma A2 summarizes the optimal levels of product variety when the surviving firm operates sister stores. The proof of Proposition A3 is then easy to derive from $t_1^S = v_1^S = \frac{pa}{2c}$ and Lemma A2. Q.E.D.

APPENDIX 3. Monopoly markets vs. competitive markets: Comparison of market-level characteristics

Variable	Monopoly Markets	Competitive Markets	Difference	|t|
POPULATION	11.71 (0.70)	13.07 (0.85)	-1.35***	-18.61
INCOME	10.68 (0.18)	10.81 (0.23)	-0.14***	7.24
EDUCATION	0.10 (0.03)	0.12 (0.04)	0.02***	5.31
ADULT	0.25 (0.03)	0.26 (0.03)	-0.00	1.10
SENIOR	0.12 (0.03)	0.12 (0.03)	0.00*	1.86
MALE	0.49 (0.01)	0.49 (0.01)	0.00	1.20
MARRIED	0.53 (0.07)	0.51 (0.07)	0.02**	2.23
NONWHITE	0.17 (0.12)	0.30 (0.14)	-0.12***	9.40
SUPERURBAN	0.08 (0.28)	0.27 (0.47)	-0.18***	5.88
WM	1.07 (0.41)	1.51 (0.49)	-0.44***	10.40
AMAZON	40.64 (6.75)	38.06 (8.43)	2.58***	3.66
INTERNET	80.16 (3.81)	80.72 (3.48)	-0.56	1.49
ΔPOPULATION	0.05 (0.05)	0.04 (0.05)	0.01**	2.14
ΔINCOME	0.03 (0.07)	0.02 (0.05)	0.01	1.28
ΔEDUCATION	-0.05 (0.11)	-0.05 (0.07)	0.01	0.81
ΔADULT	0.00 (0.01)	0.01 (0.01)	-0.01***	5.29
ΔSENIOR	0.05 (0.07)	0.06 (0.06)	-0.01	1.37
ΔMALE	0.00 (0.01)	-0.00 (0.01)	0.01***	4.24
ΔNONWHITE	0.04 (0.24)	-0.00 (0.14)	0.04*	1.77
ΔWM	0.16 (0.48)	0.13 (0.28)	0.04	0.81
ΔAMAZON	0.76 (0.26)	0.66 (0.29)	0.10***	3.76
ΔINTERNET	0.13 (0.04)	0.13 (0.04)	-0.00	0.62

Notes: N=709. Standard errors appear in parentheses. * $0.05 < p \leq 0.1$; ** $0.01 < p \leq 0.05$; *** $p \leq 0.01$

APPENDIX 4: Robustness checks of Best Buy's postexit PV change

Variable	Model 4		Model 5		Model 6		Model 7		Model 8	
Estimation Method	IV		IV		IV		OLS		OLS	
INTERCEPT	-4.829	(1.215)***	-4.700	(1.235)***	-4.677	(1.207)***	-3.618	(1.076)***	-4.172	(1.480)**
NONCOL	0.096	(0.028)***	0.121	(0.028)***	0.090	(0.029)***	0.110	(0.025)***	0.098	(0.028)***
COLOCATE	0.148	(0.027)***	0.143	(0.025)***	0.129	(0.027)***	0.159	(0.025)***	0.147	(0.028)***
ENTRY	-0.098	(0.054)*	-0.140	(0.071)**	-0.096	(0.054)*				
INCOME	0.221	(0.085)***	0.245	(0.085)***	0.220	(0.085)***	0.170	(0.074)**	0.235	(0.108)**
EDUCATION	0.028	(0.505)	0.036	(0.524)	-0.004	(0.506)	-0.260	(0.493)	0.260	(0.610)
ADULT	1.328	(0.668)**	1.232	(0.686)*	1.284	(0.675)*	0.833	(0.638)	.272	(0.761)***
SENIOR	1.207	(0.495)**	1.219	(0.525)**	1.122	(0.493)**	0.792	(0.483)	1.154	(0.580)**
MALE	3.945	(1.338)***	3.305	(1.340)**	3.758	(1.338)***	2.966	(1.307)**	2.677	(1.615)*
MARRIED	-0.735	(0.235)***	-0.672	(0.232)***	-0.716	(0.235)***	-0.488	(0.208)**	-1.177	(0.293)***
NONWHITE	0.183	(0.094)*	0.208	(0.100)**	0.181	(0.095)*	0.114	(0.080)	-0.083	(0.094)
SUPERURBAN	0.057	(0.022)***	0.057	(0.023)**	0.056	(0.022)***	0.041	(0.020)**	0.041	(0.028)
WM	0.054	(0.022)**	0.058	(0.024)**	0.056	(0.022)**	0.027	(0.018)	0.053	(0.027)*
AMAZON	0.001	(0.001)	0.001	(0.001)	0.001	(0.001)	0.001	(0.001)	0.001	(0.002)
INTERNET	0.005	(0.003)*	0.004	(0.003)	0.005	(0.003)*	0.004	(0.003)	0.004	(0.003)
ΔPOPULATION	0.494	(0.232)**	0.479	(0.233)**	0.495	(0.223)**	0.438	(0.223)**	0.482	(0.296)
ΔINCOME	-0.189	(0.163)	-0.117	(0.170)	-0.184	(0.164)	-0.204	(0.160)	-0.112	(0.195)
ΔEDUCATION	0.051	(0106)	0.069	(0.107)	0.040	(0.105)	0.045	(0.105)	0.084	(0.117)
ΔADULT	0.890	(0.751)	1.173	(0.800)	0.898	(0.753)	0.646	(0.728)	0.862	(0.937)
ΔSENIOR	-0.039	(0.159)	0.011	(0.161)	-0.073	(0.157)	0.009	(0.157)	-0.145	(0.208)
ΔMALE	0.693	(0.997)	0.553	(0.988)	0.513	(1.002)	0.956	(0.969)	-0.024	(1.075)
ΔNONWHITE	-0.028	(0.052)	-0.063	(0.052)	-0.064	(0.051)	-0.052	(0.049)	-0.084	(0.058)
ΔWM	-0.069	(0.051)	-0.027	(0.021)	-0.030	(0.023)	-0.016	(0.026)	0.017	(0.025)
ΔAMAZON	0.009	(0.036)	0.016	(0.038)	0.008	(0.037)	-0.003	(0.035)	-0.045	(0.042)
ΔINTERNET	0.315	(0.225)	0.205	(0.223)	0.276	(0.224)	0.223	(0.220)	0.121	(0.276)
F Statistics	$F(24, 684) = 6.44$***		$F(24, 684) = 6.96$***		$F(24, 684) = 6.17$***		$F(23, 685)=7.56$***		$F(23, 406)=5.69$***	
Endogeneity Test	$\chi^2(1)=4.943$** (p=0.026)		$\chi^2(1)=4.697$** (p=0.030)		$\chi^2(1)=4.748$** (p=0.029)		N/A		N/A	

Notes: Robust standard errors appear in parentheses. * $0.05 < p \leq 0.1$; ** $0.01 < p \leq 0.05$; *** $p \leq 0.01$

Model 4: COLOCATE is defined the same as in Models 2-3 (radius of 0.5 mile). NONCOL is defined as the radius of 0.5-12 miles. ENTRY is defined as equal to 1 (0 otherwise) if at least one new sister store opens in the 12-mile radius circle of the focal store. One-sided test of COLOCATE>NONCOL: $\chi^2(1)=9.14$, p-value= 0.001.

Model 5: COLOCATE is defined as the radius of 1 mile. Accordingly, NONCOL is defined as the radius of 1-10 miles. ENTRY is defined the same as in Models 2-3 (i.e., =1 if at least one new sister store opens in the 10-mile radius circle of the focal store, =0 otherwise). One-sided test of COLOCATE>NONCOL: $\chi^2(1)=1.39$, p-value= 0.119.

Model 6: COLOCATE is defined as the radius of 1 mile. NONCOL is defined as the radius of 1-12 miles. ENTRY is equal to 1 if at least one new sister store opens in the 12-mile radius circle of the focal store, =0 otherwise. One-sided test of COLOCATE>NONCOL: $\chi^2(1)=5.47$, p-value= 0.010.

Model 7: OLS regression after dropping ENTRY from the model. One-sided test of COLOCATE>NONCOL: F(1, 685)=8.37, p-value=0.002.

Model 8: OLS regression in the ENTRY=0 subsample. N=430. One-sided test of COLOCATE>NONCOL: F(1, 406)=4.67, p-value=0.016.

APPENDIX 4 (continued): Robustness checks of Best Buy's postexit PV change

Variable	Model 9		Model 10		Model 11		Model 12		Model 13	
Estimation Method	IV		IV		IV		IV		IV	
INTERCEPT	-4.600	(1.264)***	-4.734	(1.247)***	-4.767	(1.240)***	-5.281	(1.263)***	-4.329	(1.673)***
NONCOL							0.128	(0.027)***	0.068	(0.034)**
COLOCATE							0.159	(0.025)***	0.126	(0.038)***
DISTANCE	-0.034	(0.007)***	-0.043	(0.015)***	0.053	(0.029)*				
COMPETITIVE			0.167	(0.026)***	0.110	(0.029)***				
ENTRY	-0.133	(0.070)*	-0.133	(0.072)*	-0.140	(0.071)**	-0.160	(0.069)**	-0.204	(0.109)*
LATE ENTRY							0.015	(0.016)		
INCOME	0.250	(0.086)***	0.252	(0.085)***	0.250	(0.085)***	0.240	(0.086)***	0.271	(0.128)**
EDUCATION	0.077	(0.525)	0.054	(0.517)	0.050	(0.522)	0.140	(0.511)	-0.293	(0.732)
ADULT	1.235	(0.687)*	1.206	(0.681)*	1.236	(0.684)*	1.528	(0.678)**	0.542	(0.938)
SENIOR	1.210	(0.530)**	1.166	(0.528)**	1.225	(0.527)**	1.408	(0.518)***	0.894	(0.762)
MALE	3.178	(1.341)**	3.170	(1.346)**	3.307	(1.345)**	4.392	(1.382)***	2.671	(1.676)
MARRIED	-0.669	(0.231)***	-0.660	(0.228)***	-0.678	(0.232)***	-0.807	(0.241)***	-0.656	(0.318)**
NONWHITE	0.212	(0.102)**	0.203	(0.100)**	0.208	(0.100)**	0.208	(0.099)**	0.341	(0.154)**
SUPERURBAN	-0.669	(0.231)***	0.057	(0.023)**	0.058	(0.023)**	0.058	(0.022)***	0.063	(0.033)*
WM	0.064	(0.025)***	0.056	(0.024)**	0.058	(0.024)**	0.061	(0.024)**	0.084	(0.036)**
AMAZON	0.001	(0.001)	0.000	(0.001)	0.000	(0.001)	0.001	(0.001)	0.001	(0.002)
INTERNET	0.005	(0.003)*	0.004	(0.003)	0.004	(0.003)	0.004	(0.003)	0.003	(0.004)
ΔPOPULATION	0.478	(0.230)**	0.484	(0.227)**	0.478	(0.231)**	0.509	(0.240)**	0.343	(0.324)
ΔINCOME	-0.119	(0.169)	-0.146	(0.169)	-0.126	(0.170)	-0.159	(0.171)	-0.231	(0.221)
ΔEDUCATION	0.080	(0.108)	0.082	(0.105)	0.075	(0.106)	0.071	(0.108)	0.204	(0.170)
ΔADULT	1.288	(0.799)	1.126	(0.781)	1.166	(0.795)	1.097	(0.809)	1.221	(1.200)
ΔSENIOR	0.002	(0.163)	0.009	(0.159)	0.017	(0.161)	-0.036	(0.164)	-0.017	(0.235)
ΔMALE	0.489	(0.981)	0.581	(0.982)	0.585	(0.986)	0.661	(1.015))	-0.049	(1.764)
ΔNONWHITE	-0.063	(0.052)	-0.070	(0.052)	-0.067	(0.052)	-0.081	(0.053)	-0.146	(0.070)**
ΔWM	-0.032	(0.023)	-0.027	(0.022)	-0.027	(0.021)	-0.033	(0.022)	-0.061	(0.026)**
ΔAMAZON	0.010	(0.038)	0.016	(0.037)	0.017	(0.038)	0.013	(0.038)	0.011	(0.055)
ΔINTERNET	0.172	(0.222)	0.236	(0.221)	0.222	(0.223)	0.249	(0.231)	-0.025	(0.317)
F Statistics	F(23, 685) = 6.55***		F(24, 684) = 7.41***		F(24, 684) = 7.13***		F(25, 683) = 6.81***		F(24, 330) = 4.13***	
Endogeneity Test	χ^2 (1)=4.637** (p=0.031)		χ^2 (1)=4.382** (p=0.036)		χ^2 (1)=4.779** (p=0.029)		χ^2 (1)=6.592*** (p=0.008)		χ^2 (1)=3.825** (p=0.050)	

Notes: Robust standard errors appear in parentheses. * $0.05 < p \le 0.1$; ** $0.01 < p \le 0.05$; *** $p \le 0.01$
Model 9: In the same setting as Models 2-3, substitute NONCOL and COLOCATE with DISTANCE, which is the logged distance from the preexisting nearest Circuit City store.
Model 10: DISTANCE is the logged distance from the preexisting nearest Circuit City store for competitive markets, and zero for monopoly markets. Its significantly negative coefficient supports H1B. COMPETITIVE (=1 for competitive markets, =0 for monopoly markets) has a significantly positive coefficient, in support of H1A.
Model 11: DISTANCE=EXP (- (distance from the preexisting nearest Circuit City store)) for competitive markets, and zero for monopoly markets. As a result of such transformation (i.e., f(x)=exp(-x)), this DISTANCE variable ranges constitutes a nice measure of distance-based competitive intensity between 0 and 1 (i.e., f(x)=1 when distance is zero and f(x) →0 when distance is very large). For this definition, colocated markets have greater values of DISTANCE than non-colocated markets.
Model 12: LATE ENTRY is a dummy variable denoting post-2008 new store openings. One-sided test of COLOCATE>NONCOL: χ^2 (1) =2.62, p-value=0.050.
Model 13: The analysis was conducted in the LATE ENTRY=1 subsample (N=355). One-sided test of COLOCATE>NONCOL: χ^2 (1) =4.86, p-value=0.014.