Amazon and the Evolution of Retail

Abstract. The growth of Amazon and other online retailers questions the survival of bricks-and-mortar retail. We show that, in response to the online trend, offline retailers — especially smaller ones — optimally follow a specialization strategy, in particular specialization in narrow niches. The intuition for this result is that the growth of online platforms like Amazon hurts all bricks-and-mortar stores, but it especially hurts large stores selling popular-appeal items. Specialization may lead to offline markets being more niche-concentrated than online ones, contrary to the conventional wisdom of the "embarrassment of niches" induced by online sales. We discuss this and other relevant comparative statics based on a simple model of consumer demand and retail design. We develop various extensions, including pricing, consumer eclecticism, offline amenities, and the role of offline-to-offline competition. We also show theoretically that offline-store specialization benefits consumers, and that in equilibrium bricks-and-mortar stores fall short of what consumers would prefer in terms of specialization.

Keywords: retail, Amazon, bookstores, niche consumption

1. Introduction

Over the last two and a half decades, Amazon has entered an increasing number of markets with its combination of product variety, low prices, and overall shopping convenience. Unlike Amazon, bricks-and-mortar stores — especially smaller ones — have limited capacity, are mostly limited to selling locally, and lack both data and data analytics. In this dire context, it is natural to ask whether there is any hope for the survival of traditional retail.

The purpose of our paper is to analyze the implications of Amazon's growth for the future of retail: Are brick and mortar stores doomed? If not, which ones are more likely to survive? And what strategic decisions can help them facing such a tough competitor? For instance, what type of products should they stock? These are some of the questions we address.

While these concerns — as well as our model — apply to virtually all retail industries, nowhere have they been more apparent than in the book retail market, Amazon's initial segment of choice. Accordingly, our analysis is motivated by and focused on the book-selling industry. That said, we believe our results have broader interest and applicability.

We consider a demand system with elements of horizontal differentiation (different book genres and different genre preferences) and vertical differentiation (different levels of book quality). Moreover, we assume that, all else equal, buyers have a preference for a specific channel (offline as opposed to online).

Our model describes a bricks-and-mortar store's decision of whether to remain active and, if so, how to stock its shelves. We consider the trade-offs between a generalist bookstore and a specialist bookstore, i.e., one that is focused on a particular genre. Within the latter, we also distinguish between popular genres and niche genres. In various extensions of our baseline model, we consider the impact of pricing and exit decisions, competition between bricks-and-mortar stores, and consumer eclecticism.

Our central result is that, as Amazon becomes bigger (more available titles), a bookstore's optimal strategy is likely to shift from generalist to specialist. Intuitively, the store's choice trades off extensive margin, which favors a generalist approach, and intensive margin, which favors a specialist store. In other words, a generalist store attracts more potential customers, but a specialist store elicits greater willingness to pay from its patrons. As Amazon grows, the intensive margins of both generalist and specialist stores decrease equally. The generalist bookstore's extensive margin, by contrast, decreases at a faster pace than the specialist bookstore's extensive margin. In other words, while Amazon's growth is bad news for all bricks-and-mortar stores, it is particularly bad news for larger stores and stores carrying popular titles.

Our results speak to some conventional wisdom regarding the rise of online sales. Anderson (2004) famously referred to the "embarrassment of niches" provided by online giants like Amazon:

> The theory of the Long Tail can be boiled down to this: Our culture and economy are increasingly shifting away from a focus on a relatively small number of hits (mainstream products and markets) at the head of the demand curve, and moving toward a huge number of niches in the tail. In an era *without the constraints of physical shelf space* and other bottlenecks of distribution, *narrowly targeted goods and services* can be as economically attractive as mainstream fare (our emphasis).[1]

In other words, it is the absence of capacity constraints allows online sellers like Amazon to narrowly target their offerings. By contrast, traditional channels are forced to go with the mainstream fare.

Interestingly, the drivers behind our results are opposite to those in Anderson (2004): it is precisely the presence of strict capacity constraints that push independent bookstores – especially the smallest ones – in our model to specialize in narrow niches. The intuition is that, facing an increasingly formidable competitor, these stores find it optimal to excel at a niche, rather than being mediocre at everything. In doing so, they give up on mainstream genres, whose large number of titles makes it impossible for them to replicate Amazon's assortment.

Our results are also related to Waldfogel's (2007) "tyranny of the majority." As he put it, in the bricks-and-mortar world, "when fixed costs are substantial, markets provide only products desired by large concentrations of people." While we agree with Waldfogel's (2007) assessment, we add that Amazon's growth has brought some good news to the taste minorities that have fallen victim to Waldfogel's (2007) "tyranny of the majority." Examples include the emergence of highly specialized bricks-and-mortar stores such as Arkipelago Books: the Filipino Bookstore (which caters to the San Francisco Filipino community), Sweet Pickle Books (which sells its own line of craft pickles as well as books, as a tribute to its neighborhood's history) and Dashwood Books (which specializes in art photography books).

1. See also Brynjolfsson, Hu, and Simester (2011).

We offer a number of extensions of our basic theoretical framework. We show that, as Amazon grows, smaller stores are more likely to survive. This is consistent with the prediction a "polarization" of the firm-size distribution, with a large (online) player co-existing with multiple niche players and a declining number of mid-size and large bricks-and-mortar stores such as Barnes & Noble (Kahn and Wimer, 2019).[2]

Next we show that our basic result (small stores focus on nich-genre titles as a response to Amazon's growth) is robust to the introduction of pricing. Moreover, we identify a "boutique effect", whereby independent bookstores increase their prices as they focus on niche-genre titles, optimally sacrificing some market shares.

We consider the possibility of investments by bookstores that increase their patrons' willingness to shop, and show that the marginal return of such investments increases as Amazon grows larger. Moreover, these investments are stronger for generalists bookstores. This is consistent with the emergence of new business models such as Washington, D.C.'s Kramers, an independent bookstore that boasts an all-day restaurant and live jazz music (for more examples, see Saxena (2022)).

Most of our paper focuses on the competition between Amazon and a generic independent bookstore. We also consider the possibility of independent bookstores competing with each other. We uncover a pattern of strategic complementarity: if a competing bookstore specializes on a book genre, then I'm more likely to also become a specialist (though one a different genre). So, competition between bookstores magnifies the effect of Amazon on independent bookstores' choices. Moreover, Amazon is strictly worse off competing against two specialists than doing so against two generalists, as the latter are far more redundant.

Finally, we show that, from a consumer's point of view, the market equilibrium provides too little specialization: when a store is indifferent between specializing or not, consumers would strictly prefer the former. This is similar too, but different from, the result found in Waldfogel (2007) and the literature that he cites. So, while Amazon's growth is good news for taste minorities (considering the endogenous increase in niche-genre stores), the rate at which such stores increase is too slow compared to what consumers would prefer.

Before moving on, we remark that the scope of our theoretical analysis can be extended well beyond competition between Amazon and bricks-and-mortar bookstores. In fact, as will become clear, our analysis applies to any situation when one seller has a size (or catalog) advantage, and consumers have heterogeneous preferences for

2. See also Igami (2011).

sellers.

■ **Road map.** The rest of the paper is structured as follows: we start by reviewing the existing literature. Then, we present the model and its main implications in Section 2, and a variety of extensions in Section 3, including endogenous prices, eclectic consumers, the role of offline amenities, offline-to-offline competition, and consumer welfare. Section 4 offers a discussion of the results. Section 5 concludes the paper.

■ **Related literature.** Conceptually, the paper that is closest to ours is probably Bar-Isaac, Caruana, and Cuñat (2012), who in turn build on Johnson and Myatt (2006). Bar-Isaac, Caruana, and Cuñat (2012) develop a search model with a continuum of firms who set prices and choose their product design as general or specialized. Consumers, in turn, search for prices and product fit. Their main results pertain to the comparative statics of lower search costs, specifically how these lower search costs can lead both to superstar effects and long-tail effects. By contrast, our main focus is on the effect of an increase in a dominant firm's size (and quality, through better selection). Despite these differences, we share with Bar-Isaac, Caruana, and Cuñat (2012) the prediction that some firms "switch to niche designs with lower sales and higher markups" (p. 1142).[3] An additional contribution with respect to Bar-Isaac, Caruana, and Cuñat (2012) is that, by considering the contrast between online and bricks-and-mortar stores, we suggest, theoretically and empirically, that offline markets might be becoming more niche concentrated than online ones.

Rhodes and Zhou (2019) observe that, in many retail industries, large sellers co-exist with small, specialized ones. They provide an explanation based on a model of consumer search frictions, showing that there exist equilibria where large, one-stop-shopping sellers co-exist with small, specialized sellers. We too provide an equilibrium explanation for the seller size distribution, albeit in a very different context (namely competition against a large online seller).

A number of authors have documented some of the patterns that motivate our analysis. Brynjolfsson, Hu, and Simester (2011) show that "the Internet channel exhibits a significantly less concentrated sales distribution when compared with the catalog channel." This corresponds to the long-tail conventional wisdom as in An-

3. See also Kuksov (2004) and Cachon, Terwiesch, and Xu (2008) on the effects of lower search costs on firm's optimal assortments and profits.

derson (2004). Using the closure of a national video rental chain as an instrument, Zentner, Smith, and Kaya (2013) show that the same consumers are more likely to rent niche products when buying online, thus ruling out that the phenomenon is simply driven by selection effects from the types of consumers who decide to use the Internet channel.[4] In contrast, we argue that as a consequence of brick-and-mortar bookstores' survival strategies, the bricks-and-mortar channel might have become more niche-concentrated than the online one, leading to a thicker long tail offline than online.

The strategies we highlight are at odds with some classic research on both optimal retail stocking policy and, relatedly, the nature of offline-online competition. For instance, Chen et al. (1999) claim that *"Profit-maximizing offline retailers allocate shelf space according to the Pareto, or "80-20", rule"*, while Brynjolfsson, Hu, and Rahman (2009) argue that *"Internet retailers face significant competition from brick and mortar retailers when selling mainstream products, but are virtually immune from competition when selling niche products."* Once again, we argue that the increasing dominance of Amazon and other online retailers might have changed this picture to the point of flipping it: to survive against the online giants, stores might find it optimal to specialize in one small niche and excel at it.

Goldmanis et al. (2010) interpret the expansion of online commerce as a reduction in search costs and examine the impact this has on the structure of bricks-and-mortar retail. They examine data from travel agencies, bookstores and new car dealers and show that market shares are shifted from high-cost to low cost sellers. This is consistent with our theoretical predictions, though the mechanism is different.

Choi and Bell (2011) establish a link between the prevalence of preference minorities (consumers with unusual tastes) and the share of online sales. Using data from the LA metropolitan area, they find a strong link, and conclude that *"[...] Offline retailers pay less attention to categories favored by preference minorities."*

In similar vein, Forman, Ghose, and Goldfarb (2009) "examine the trade-off between the benefits of buying online and the benefits of buying in a local retail store," and show that "when a store opens locally, people substitute away from online purchasing." However, they "find no consistent evidence that the breadth of the product line at a local retail store affects purchases."

Consistent with both our theory and recent anecdotes from the US book market, Igami (2011) conducts an empirical analysis of Tokyo's grocery market and finds that

4. See also Ratchford, Soysal, and Zentner (2022).

the rise of large supermarkets does not crowd out small, independent stores, but rather mid-size ones. Furthermore, we suggest that niche specialization — a strategy not available to (or at least not optimal for) mid-size retailers — is an important driver of small stores survival, suggesting that these results might fail to hold in markets in which specialization is not a possibility in the first place.

Neiman and Vavra (2019) observe that "the typical household has increasingly concentrated its spending on a few preferred products." They argue that this is not driven by "superstar" products, rather by increasing product variety. "When more products are available, households select products better matched to their tastes." They also argue that the distinction between online and offline sales does not play an important role in explaining this trend.

Focusing on the US book market, Raffaelli (2020) summarizes the drivers of independent bookstores' recent success in three Cs: curation ("Independent booksellers began to focus on curating inventory that allowed them to provide a more personal and specialized customer experience"), convening ("Intellectual centers for convening customers with likeminded interests") and community. All of these strongly resonate with our theoretical findings.

2. Model and Main Results

Consider an economy with two book sellers, a (Amazon) and b (bricks-and-mortar); and two different book genres, x and y. (Considering the large number of different variables used in the paper, Table 1 lists the main notation used in the paper.) While we assume there exists only one bricks-and-mortar store, our intent is to model this as a generic bricks-and-mortar store, assuming that its effective competitor is the online store. Later we also consider the possibility of competition between bricks-and-mortar stores.

We assume that there is a measure one of book buyers, equally split into two types, x lovers and y lovers.[5] Buyers of type x (resp. y) have a value $\tilde{v}$ for one book of genre x (resp. y) and zero for any book of genre y (resp. x), where the value of $\tilde{v}$ is generated from a cdf $F(\tilde{v})$, where $f(\tilde{v}) > 0$ if and only if $\tilde{v} \in [0, v]$, where v is possibly infinite.[6]

5. Later in the paper, we consider the asymmetric case, that is, the case of a popular genre and a niche genre.
6. Later in the paper, we extend this to the case of eclectic consumers, who have positive valuations for both genres.

Table 1
Main notation used in the paper

Variable	Description
a, b	online store (Amazon) and offline (bricks-and-mortar) stores
k, c	store b's capacity and cost per unit of capacity
$\tilde{d}, d$	horizontal distance from bricks-and-mortar store b_0; $d = \max \tilde{d}$
f, F	pdf and cdf of $\tilde{v}$
g, s	general and specialty store
$m(t)$	maximum $\tilde{v}$ from t draws out of $F(\tilde{v})$
p	book price
q	bricks-and-mortar's store market share
t	number of titles
$\tilde{v}, \tilde{w}$	vertical and horizontal preferences (maximum values: v and w)
x, y	popular and niche genre
z	total number of titles (carried by store a)
α, β	popularity of x, fraction of b's capacity devoted to x
π	store b's profit
τ	transportation cost (when b_0 and b_1 compete)

We assume that, independently of preferences for x and y, book buyers have a preference for firm b (with respect to firm a). This may reflect an intrinsic taste for in-person shopping, the presence of additional amenities (which we endogenize in one of our extensions), a desire to support small and local businesses, or an ideological aversion to (or taste for) Amazon.[7] We assume that this preference (extra welfare from buying at a local store), denoted by $\tilde{w}$, is uniformly distributed in $[0, w]$.[8]

Seller a carries all titles in the economy, a total of z titles, $z/2$ of each genre. By contrast, seller b can only carry k titles, that is, k measures the bookstore's capacity.

Book prices are constant and exogenously given (until later in this section), and with no further loss of generality we assume prices are equal to \$1.

At a given seller, buyers can learn both the genre and the value $\tilde{v}$ of a title at no cost. By contrast, when b chooses what books to carry, it can observe genre but not $\tilde{v}$. Therefore, the bookstore determines which type of books to sell but otherwise selects a random sample of values distributed according to $F(\tilde{v})$.

Each buyer selects the bookseller providing the highest expected value and, within a given bookstore, buys the one book that yields the highest value $\tilde{v}$. If the store carries t titles of the buyer's preferred genre, then the buyer receives an expected value $m(t)$, where $m(t)$ is the expected value of the highest element of a sample of size t drawn from $F(\tilde{v})$.

■ **General or specialty store?** The focus of our analysis is on bookstore b's strategy as the value of z increases. Specifically, firm b (the bricks-and-mortar store) has three options: to exit, to remain active as a general store, and to remain active as a specialty store. A general store carries $k/2$ titles of each genre, whereas a specialty store carries k titles of a given genre.

Thus, profits for generalist and specialized bookstores are given by

$$\begin{aligned} \pi_g(z,k) &= \left(1 - \left(\frac{m(z/2) - m(k/2)}{w}\right)\right), \\ \pi_s(z,k) &= \tfrac{1}{2}\left(1 - \left(\frac{m(z/2) - m(k)}{w}\right)\right). \end{aligned} \tag{1}$$

7. Saxena (2022) describes recent examples of independent bookstores providing offline perks such as bars and cafes.

8. The assumption that the lower bound of $\tilde{w}$ is zero is without loss of generality. That is, all of our results would be unaffected if we assumed a negative lower bound for $\tilde{w}$, corresponding to a relative preference for seller a. The reason for this is that, because seller a has a size advantage ($z > k$), a positive $\tilde{w}$ is required to buy offline. Put differently, all consumers with $\tilde{w} < 0$ or $\tilde{w} = 0$ purchase from Amazon, so that we can simply assume $\tilde{w} \geq 0$.

We first consider the case when b pays no fixed cost to remain active, so that it's a dominant strategy to do so. The only question is then how to design the store, namely whether to be a general or a specialty store. We present our results both as comparative statics with respect to the value of z (a measure of the online store's growth), and k (the bricks-and-mortar store's capacity).

Proposition 1. *Suppose that*

$$w < \min\{m(z/2), v - m(k/2)\}$$

(a) There exists a threshold $z_{gs} = z_{gs}(k, w)$ such that an active firm b optimally chooses to be a specialty store if and only if $z > z_{gs}$. Moreover, $z_{gs}(k, w)$ is increasing in both k and w.
(b) There exists a threshold $k_{gs} = k_{gs}(z, w)$ such that an active firm b optimally chooses to be a specialty store if and only if $k < k_{gs}$. Moreover, $k_{gs}(z, w)$ is increasing in z and decreasing in w.

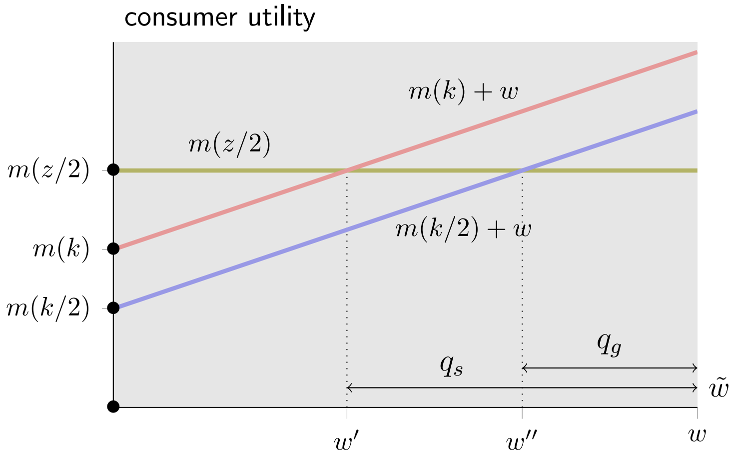
The proof for this and all other results can be found in the Appendix.

In order to understand the intuition for Proposition 1, note that the choice between a general and a specialty store trades off an "extensive margin" and an "intensive margin" effect. By switching to a specialty strategy, a store forgoes half of its potential customers, those interested in the genre that is no longer stocked (extensive margin). On the other hand, by stocking twice as many titles of a given genre, the store increases the expected quality that a patron expects from visiting the store (intensive margin). As total supply z increases, the expected payoff from visiting store a, $m(z)$, increases.

As z increases, store a becomes relatively more attractive, which in turn lowers the demand for store b. This increase in valuation for store a hurts the general store b more than the specialty store b. Basically, the general store loses readers from both genres, whereas the specialty store only looses readers from a smaller set. It follows that, starting from a point where a general store strategy is better, there exists a threshold value of z past which a specialty store strategy yields higher profit.

Another way of understanding Proposition 1 is that, as z increases, the profit of both a general and a specialty store decrease. However, the profit of a general store decreases at a faster rate. In other words, specialty stores are better "insured" against Amazon's growth, whereas general stores — such as Barnes & Noble or the now defunct Borders — are likely to suffer bigger profit losses.

Figure 1
Choice of general vs specialty store



This idea is illustrated by Figure 1. The horizontal axis measures the value of $\tilde{w}$: the further to the right, the more reluctant a consumer is to purchase from a. The vertical axis measures the value offered by each store (aside from the preference against a). Consider specifically the case when $\tilde{w} = 0$, so that the consumer has no aversion to buying from a. The four bullet points along the vertical axis indicate the utility of buying from four different types of stores:

- A specialty store b offering k titles of the genre the consumer is not interested in: utility zero.
- A general store b offering $k/2$ titles of the genre the consumer is interested in (as well as $k/2$ titles of the genre the consumer is not interested in): utility $m(k/2)$.
- A specialty store b offering k titles of the genre the consumer is interested in: utility $m(k)$.
- Store a, offering $z/2$ tiles of the genre the consumer interested in (as well as $z/2$ titles of the genre the consumer is not interested in): utility $m(z/2)$.

As the value of $\tilde{w}$ increases, the utility from buying in bricks-and-mortar store increases, whereas the utility form buying from store a remains constant. Thus w' is the threshold value of $\tilde{w}$ such that a consumer with $\tilde{w} > w'$ prefers a specialty store (of her preferred genre) with respect to store a, whereas w'' is the threshold value of $\tilde{w}$ such that a consumer with $\tilde{w} > w''$ prefers a general store with respect to store a.

The values of k and z in Figure 1 were chosen so that store b is indifferent between general and specialty strategy. To see this, notice that the share of patrons buying at a specialty store, q_s, is twice as large as the share of patrons buying at a general store, q_g. Since a general store attracts twice as many patrons as a specialty store, the two differences exactly balance out.

The point of Proposition 1 is that, as we increase z beyond the value in Figure 1, both q_s and q_g decline at the same rate. However, *proportionately* speaking, q_g drops at a higher rate than q_s. Since the ratio of patrons remains fixed at 1:2, it follows that, starting from the indifference point illustrated in Figure 1, becoming a specialty store becomes a dominant strategy for store b.

The condition in Proposition 1 ensures that the solution is interior. If the condition does not hold, then we are in a corner solution whereby it is a dominant strategy for b to be a general store.

We consider comparative statics in both k and w. First, for a given value of z, a store with larger capacity k is less likely to specialize, that is, it requires a larger Amazon for such a store to abandon a generalist strategy.

Or, to put it differently, store b's decision to specialize is based on its *relative* size with respect to Amazon.[9] Similarly, the threat posed by Amazon is lower the greater w, that is, the greater the buyers' aversion to purchasing from Amazon. Accordingly, given z and k, store b is less likely to become a specialty store as a strategy to cope with online competition the higher w is.

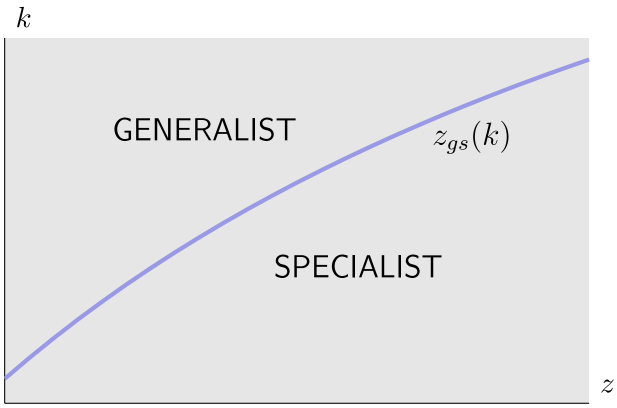
These findings reverse the intuition found in classic research on this topic from the last two decades, such as Chen et al. (1999), Choi and Bell (2011) and Brynjolfsson, Hu, and Rahman (2009), which argue that it is optimal for brick-and-mortar retailers to focus on mainstream products and that, therefore, the internet is especially beneficial to consumers belonging to preference minorities.

At the same time, industry players understand these dynamics. James Daunt, the long-time managing director of UK bookstore chain Waterstones, and the CEO of Barnes & Noble since 2019, argues that

> [Amazon's] unmatchable scale is liberating for booksellers; it means stores can focus on curating books that communicate a particular aesthetic, rather than stocking up on things people need but don't get excited about

9. Non-linearities in $m(\cdot)$ imply that the ratio k/s is not a sufficient statistic for the specialization decision. Nevertheless, the specialist strategy is more likely when either k is small or z is large.

Figure 2
Comparative statics with respect to z and k.



(Todd, 2019).

In private communication, Mark Cohen, Director of Retail Studies at Columbia GSB, echoes this view:

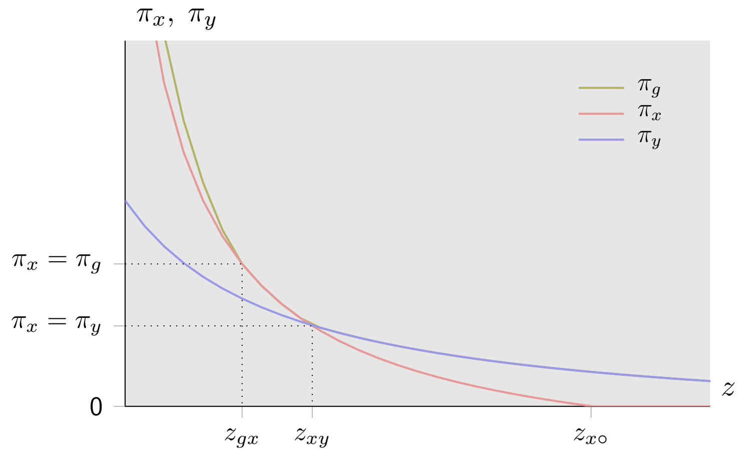
> There is a tremendous resurgence of local bookstores, but these have relevance because (...) they're not trying to be all things to all people as Barnes & Noble has always tried to be. They're either picking on a genre or curating an assortment that appeals to a local customer.

Part (a) of Proposition 1 highlights the dynamic interpretation of online-offline competition, namely what happens as Amazon increases in size; conversely, part (b) highlights the cross-sectional interpretation, namely what happens to large and to small bricks-and-mortar stores.

This idea is illustrated by Figure 2, which plots the critical value $z_{gs}(k)$ derived in Proposition 1 (the plot assumes $\tilde{v} \sim U[0,1]$). The figure may be read in two ways. One is to consider variations in z, which we think of as essentially time-series variation—the growth of Amazon. Alternatively, we can consider variations in k, which we think of as essentially cross-section variation: at a given moment, there are different stores with different sizes. Proposition 1 may be stated either as specialization for large enough z or specialization for small enough k.

■ **Niche genres.** So far we have assumed that both genre x and genre y have the same popular appeal. A more realistic case has one of the genres — say, genre x —

Figure 3
Bookstore profits from specializing in popular genre (π_x) or niche genre (π_y) as a function of z when $F(\tilde{v}) = \tilde{v}/v$.



be a popular genre, whereas y is a less popular one — a niche genre. Suppose that there is a measure 1 of potential book buyers, α of which are only interested in genre x books; and suppose that $\alpha > \frac{1}{2}$. (So far, we have implicitly assumed that $\alpha = \frac{1}{2}$.) Consistent with the assumption that genres x and y have different popular appeal, we assume that a fraction $\alpha\, z$ of the total titles are of genre x, and a fraction $(1-\alpha)\, z$ are of genre y.

Proposition 1 states that, as z increases, store b optimally switches from general to specialty store. The next proposition complements that result by stating that, within the specialty strategy, store b optimally chooses the niche strategy if z is high enough.

Proposition 2. *Suppose that*

$$w < \min\{m(z/2), v - m(k/2)\}$$

(a) There exists an z_{xy} such that an active store b specializes in a niche genre (rather than a popular genre) if $z > z_{xy}$.
(b) There exists a k_{xy} such that an active store b specializes in a popular genre if $k > k_{xy}$.

Figure 3 illustrates Proposition 2. The key insight is that, *relatively* speaking, a niche-genre store suffers less from an increase in z than a popular-genre store, in a way that is similar to, but different from, the general-specialist trade-off considered in Proposition 1. For low values of z, the advantage of a niche-genre store, in terms of higher intensive margin, is outweighed by the simple fact that a popular genre is more popular, that is, attracts a greater number of potential customers. For high values of z, however, the niche strategy becomes increasingly attractive, as illustrated by Figure 3. Specifically, for $z > z_{xy}$, π_y, the profit from a niche-genre strategy, is greater than π_x, the profit from a popular-genre strategy. In this way, Figure 3 illustrates both Proposition 1 and Proposition 2.

Formally, the proof of Proposition 2 proceeds by deriving the value z_x when $\pi_x = 0$ and establishing that, at that value, $\pi_y > 0$. This proof strategy is similar to that of Proposition 1. There is one difference, however. In Proposition 1, we show that $z > z_{gs}$ is a necessary and sufficient condition for specialization. By contrast, in Proposition 2 $z > z_{xy}$ is only a sufficient condition. The difference stems from the fact that we can prove the monotonicity of $\pi_s - \pi_g$ in general terms but not the monotonicity of $\pi_y - \pi_x$. If we further assume that v is uniformly distributed, then the condition $z > z_{xy}$ becomes a necessary and sufficient condition.[10]

An implication of this result is that, as Amazon grows large, bricks-and-mortar sales are more niche-concentrated than online sales (or total sales), contrary to conventional wisdom. We return to this in the next section.

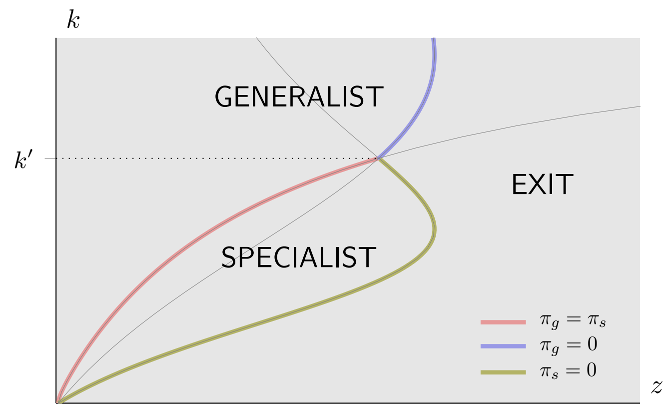
3. Extensions

The base model developed in Section 2 helped us make the point that, as Amazon increases in size, bricks-and-mortar stores have a tendency to specialize in a limited number of genres and, within this specialization strategy, have a tendency to select niche genres. In the previous section we provided some supporting empirical evidence from bricks-and-mortar bookstores, in particular independent bookstores. In this section, we present a number of extensions of the basic framework introduced in Section 2.

■ **Exit.** Suppose that the bricks-and-mortar store must pay a fixed cost $c\,k$ in order to operate, where c is cost per unit of capacity. For simplicity, we return to the

10. The proof can be obtained from the authors upon request.

Figure 4
Comparative statics with respect to z and k when exit is a possibility



assumption that both genres are equally popular. Store profit is then given by

$$\begin{aligned}\pi_g(z,k) &= \left(1 - \left(\frac{m(z/2) - m(k/2)}{w}\right)\right) - c\,k \\ \pi_s(z,k) &= \tfrac{1}{2}\left(1 - \left(\frac{m(z/2) - m(k)}{w}\right)\right) - c\,k\end{aligned} \tag{2}$$

depending on whether the store follow a general or a specialist strategy. Now that we assume $c > 0$, a third option — exit — becomes non-trivial. We consider the bookstore's optimal choice in the (z, k) space, now a choice between being a general store, a specialty store, or simply exiting.

Figure 4 illustrates the new equilibrium, where we assume that $\tilde{v}$ is uniformly distributed. The red line corresponds to the indifference condition $\pi_g(z,k) = \pi_s(z,k)$. It's the same line as $z_{gs}(k)$ in Figure 2. As per Proposition 1, for points to the NW (higher k or lower z), firm b prefers to be a general store, whereas for points to the SE of the red line firm b prefers to be a specialty store. What Figure 4 adds with respect to Figure 2 is the possibility of exit. Specifically, two additional lines are plotted in Figure 4: the blue line corresponds to the zero profit condition for a general store, whereas the green line corresponds to the zero profit condition for a specialty store.

Note that the three lines must cross at the same point. If fact, when the blue line and green line cross, both $\pi_g = 0$ and $\pi_s = 0$. Since both stores have the same profit level, firm b is indifferent between being a general store and a specialty store, which in turn implies that the red line must cross at the point.

We thus have three well-defined regions. The GENERALIST area is located above the red line (g is better than s) and to the left of the blue line (g is better than nothing). The SPECIALIST area is located below the red line (s is better than g) and to the left of the green line (s is better than nothing). Finally, the EXIT area is located to the right of the blue and green lines (exit is better than g and s).

Figure 4 suggests a series of qualifications with respect to Proposition 1. First, once we consider the possibility of exit, it is not enough to state that, as z increases, eventually firm b will switch from being general to being a specialist store. If fact, if $k > k'$, firm b will exit before it changes its strategy.

For lower values of k, specifically for $k < k'$, the intuition underlying Proposition 1 still applies: as firm a increases in size, firm b optimally switches its strategy from general to specialist store. However, such strategy can only help to some extent: as firm a continues to increase, eventually firm b optimally exits.

The green and blue lines in Figure 4 also suggest that there is an "optimal" size k for a given store strategy. Not surprisingly, the "optimal" k is higher for a general store than for a specialty store. Related to that, the figure also suggests that the comparative statics with respect to k are far from trivial. This is particularly the case as we consider variation in the value of k for z slightly higher the point at which the three lines cross: as we increase k from zero, firm b's optimal strategy changes from exit to being a specialty store to exit to being a general store.

■ **Endogenous prices.** So far, we have assumed that all books are priced \$1. This has allowed us to focus on the main issues regarding specialization while keeping the analysis tractable. We now explicitly consider pricing choices. Our goal is to verify the robustness of our previous findings as well as to develop additional intuition regarding the comparative statics of Amazon's expansion.

Recall that the actual market structure we have in mind includes one dominant firm and a large number of fringe firms. Although for simplicity we focus on the decisions of one representative fringe firm, it makes sense to treat firms a and b as different types of strategic players. Consistent with this interpretation, we assume that firm a acts a price leader by setting p_a first.

Given p_a, the bricks-and-mortar store b responds by setting its price, which we denote by p_g if the store is a general store and p_s if the store is a specialty store. Our focus is on firm b's decisions. Accordingly, we take p_a as an exogenous variable (and later consider comparative statics with respect to it).[11] Similar to Propositions 1 and

11. Endogeneizing Amazon's decisions when competing against different types of brick-and-mortar stores would be a promising direction for future research.

2, we make a parameter assumption so as to eliminate trivial corner solutions (if the following assumption fails to hold, then we may be in the case in which a specialty store is always optimal).

In what follows, we first solve for store b's optimal price and then reconsider the store's optimal positioning (general or specialty). Our next result extends the main intuition of Proposition 1, adding one new dimension of comparative statics.

Proposition 3. *Suppose that*

$$p_a > \frac{m(k) - \sqrt{2}\, m(k/2)}{\sqrt{2} - 1} - w. \tag{3}$$

Then, there exists a threshold z_{gs} such that store b optimally chooses to be a specialty store if $z > z_{gs}$. In the right neighborhood of z_{gs}, the specialty store sets a higher price, captures a lower market share and earns a higher profit than a general store.

When discussing Proposition 1, we argued that the trade-off between a general and a specialty store is a trade-off between the extensive margin (which favors a general store) and the intensive margin (which favors a specialty store). The proof of Proposition 3 establishes that, when it comes to price setting, only the intensive margin matters. This explains why a specialty store sets a higher price than a general store. By devoting its space to one book genre only, a specialty store elicits a higher willingness to pay from buyers interested in that genre, which in turn allows the store to set higher prices. This in turn increases the store's incentives to specialize.

Similar to Proposition 1, Proposition 3 establishes that, if firm a is big enough (high z), then firm b is better off by becoming a specialty store. The main intuition for the z-threshold part of Proposition 3 is similar to Proposition 1: As total supply z increases, the specialty store option becomes *relatively* more attractive. In sum, the first part of Proposition 3 shows that the intuition from Proposition 1 is robust to the introduction of pricing.

The novel aspect of Proposition 3 is its second part, the statement that, past the disruption level z_{gs}, a specialty store sets a higher price, captures a *lower* market share and earns a higher profit than a general store. We call this the *boutique effect*. The specialty store in the model with fixed prices trades-off extensive margin and intensive margin so as to maximize the number of customers. By switching from general to specialty store, firm b loses potential customers, but its offering becomes so much more attractive to its reduced set of customers that it ends up attracting more customers. By contrast, once we introduce prices we observe that the switch to a specialty-store strategy not only sacrifices *potential* demand but also sacrifices *actual* demand. Such drop in actual demand is more than compensated by an increase in the intensive margin via higher sale prices.

■ **Eclectic consumers.** So far we have assumed that consumers are divided into x fans and y fans. Specifically, the value v of a book outside of a consumer's preferred genre is zero. At the opposite extreme, consider the case when consumers are totally eclectic, that is, they value both genres equally.

Clearly, eclectic consumers are bad news for specialty stores. Before, an x fan valued a specialty store at $m(k)$ and the online store at $m(z/2)$. By contrast, an eclectic consumer values the online store at $m(z)$ whereas the specialty store is still valued at $m(k)$ (here we are excluding the preference parameter z).

Regarding a general store, the analysis is not as obvious. Before, the value of a general store was $m(k/2)$ for an x fan or a y fan, whereas the value of the online store was $m(z/2)$. By contrast, an eclectic consumer values the online store at $m(z)$ whereas the general store is valued at $m(k)$ (again, we are excluding the preference parameter z). In which case is the general store better off? The answer depends on which difference is greater, $m(z/2) - m(k/2)$ or $m(z) - m(k)$. Notice that $m(z) - m(k) > m(z/2) - m(k/2)$ if and only if $m(z) - m(z/2) > m(k) - m(k/2)$. Since $z > k$, $z - z/2 > k - k/2$, which would suggest the inequality holds. However, concavity of $m(t)$ would work against the inequality. Suppose that $F = v$ is linear, so that $m(t) = t/(1+t)$. Then the function $m(t) - m(t/2)$ is non-monotonic, first increasing for $t \in [0, \sqrt{2}]$ and then decreasing. This implies that we can find values of z and k such that the inequality is in turn true or false. So, even assuming a specific distribution of v, we cannot guarantee that a general store is better off or worse off when serving eclectic consumers rather than polarized consumers.

It has long been argued that Amazon benefits from increased consumer specialization, and that this is largely the purpose of its recommendation system: by presenting each consumer with increasingly personalized offerings, it makes bookstores obsolete, since bookstores cannot, due their limited size, cater to each consumer's idiosyncrasies. However, as the above analysis shows, this is not necessarily true when we endogenize bricks-and-mortar stores' strategies: more specialized consumers allow specialty stores to emerge, which can be detrimental to Amazon's profits.

■ **Offline Amenities.** What can bookstores do when consumers are eclectic? We know that, *ceteris paribus*, bookstores' survival is crucially dependent on the relative consumer preferences for offline shopping.

While so far we have treated this distribution as exogenous, it is interesting to consider the case in which bookstores explicitly invest in it, for instance by boosting their distinctly offline, or "social", features: readings, cafes, bars, but also personalized staff recommendations, for instance. These features are appealing in that they can not be directly replicated by Amazon.[12] They are also increasingly widespread: see Raffaelli (2020) for a discussion of "community" as one of the pillars of brick-and-mortar bookstores survival, and Saxena (2022) for some recent examples.

We model stores' investment in offline amenities as an increase in ω, that is, by assuming that $\tilde{\omega} \sim U(0, \omega')$, for some $\omega' > \omega$. That is, after the store invests in offline amenities, each consumer values the offline shopping experience more by a factor ω'/ω.[13]

Are offline amenities a complement or a substitute of specialization? And which stores benefit the most from them? We have the following:

Proposition 4. *Investing in online amenities is more profitable when the size disadvantage is larger:* $\partial^2\pi/\partial w\ \partial z > 0$ *and* $\partial^2\pi/\partial w\ \partial k < 0$*, where* π *stands for either* π_g *or* π_s*. Moreover, it is more profitable for generalist stores, and its benefits exhibit decreasing returns:* $\partial\pi_g/\partial w > \partial\pi_s/\partial w > 0$ *and* $d^2\pi_g/dw^2 < d^2\pi_s/dw^2 < 0$*.*

In words, $\partial^2\pi/\partial w\ \partial z > 0$ states that the benefits from improved amenities is increasing in the value of z. So, the greater the size of the online store, the greater the incentive for bricks-and-mortar stores to invest in amenities that shift consumer preference in favor of bricks-and-mortar stores.

The "time series" comparative static (increase in z) is complemented by a "cross section" comparative static (variation in k). In this case, Proposition 4 states that smaller stores have a greater incentive in investing in amenities than larger stores.

The second part of Proposition 4 compares incentives in terms of store type rather than store size. It states that a generalist store has a greater incentive to invest in increasing w, but the returns from such an investment are themselves decreasing.

12. For a more general analysis of the advantages associated to a better shopping experience, see Iyer and Kuksov (2012).

13. An alternative approach would have been to instead use an additive form, that is, to assume that an investment $i > 0$ in offline amenities shifts the distribution $U(0,\ \omega)$ to $U(i,\ \omega + i)$. The two approaches yield qualitatively similar predictions.

The idea is that investments in w appeal to all consumers. Therefore, they are more valuable to those stores (generalist stores) which did not give up on half of the consumers to begin with. Moreover, amenities compensate for a "quality gap" in catalogue terms, and this gap is larger for generalist stores than for specialty stores, that is, $m(z/2) - m(k/2) > m(z/2) - m(k)$. The fact that amenities offer decreasing returns follows straightforwardly from the concavity of the demand function with respect to w.

Proposition 4 suggests that, for a small store (low k), investing in amenities (i.e., increasing the value of w) may provide an alternative strategy to specialization. This is particularly the case when a significant fraction of consumers are eclectic (so that becoming a specialist is not a profitable strategy).

Finally, we note that, by Proposition 3, higher prices correspond to a higher w. Thus, similar to specialization, improving offline amenities allows bricks-and-mortar stores to charge higher markups. Unlike specialization, however, this conclusion is robust to different preference specifications for consumers.

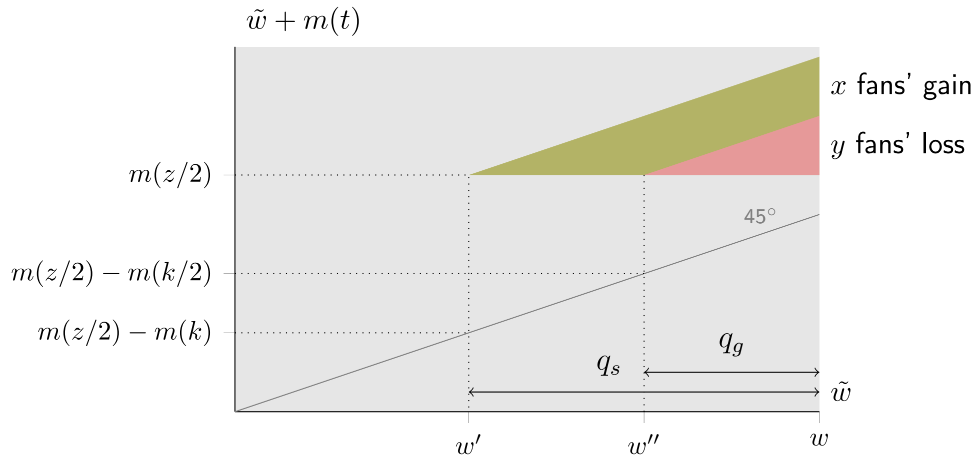
■ **Bricks-and-mortar store competition.** Up to now, we considered competition between one online store and one bricks-and-mortar store. Implicitly, the idea is that there are a plethora of small (possibly independent) bricks-and-mortar stores with a catchment area that does not overlap with any other bricks-and-mortar store.

Consider now the case when two bricks-and-mortar stores, say b_0 and b_1, do compete for the same potential demand. Specifically, we assume a consumer is characterized by a bricks-and-mortar-store preference $\tilde{w}$ and a relative preference between stores b_0 and b_1 in the form of a location $\tilde{d} \in [0, 1]$ and transportation cost τ per unit of distance to store b_0 (located at 0) and to store b_1 (located at 1). Moreover, we assume that $\tilde{d}$ and $\tilde{w}$ are independently and uniformly distributed: $\tilde{d} \sim U[0, 1]$ and $\tilde{w} \sim U[0, w]$. Our main result is that, under competition, the choices of genre by stores b_0 and b_1 exhibit strategic complementarities.

Proposition 5. *Let z be such that store b_0 and b_1 are indifferent between a general- and a specialty-store strategy absent offline competition. In the neighborhood of z, being a specialty store is a strict best response to the rival choosing to be a specialty store.*

Proposition 5 suggests that competition provides an additional force pushing in the direction of specialization. Suppose that we fix firm b_1's strategy at being a general

Figure 5
Firm profit and consumer welfare. Effects of switching from general to specialty x store.



store. As z crosses a certain threshold, say $z_\circ$, then firm b_0's optimal strategy switches to becoming a specialty firm (of either x or y). However, if firm b_1 has become a specialty firm (choosing, say, genre y), then, *even if z is lower than $z_\circ$* (by a little), firm b_1 also optimally switches to being a specialist (specializing in the niche that firm b_1 did not).

To conclude this section, we note how Amazon is strictly worse off when competing with two specialty stores compared to two generalist stores, as the overlap between the latter is far greater than between the former. Again, this suggests caution when interpreting a higher degree of consumer specialization as a desirable outcome for larger, online retailers.

■ **Welfare analysis.** All of our analysis so far has focused on firm b's profits and optimal choices. A natural follow-up question is the relation between firm b's decisions and consumer welfare. Let us go back to the model with fixed prices and one bricks-and-mortar store, firm b. Let us consider, as in the initial model, the choice between being a general and being a specialty store. Suppose social welfare is given by consumer surplus plus firm profits. Since all sellers set $p = 1$ and the market is covered (all consumers make a purchase), consumer surplus is a sufficient statistic of social welfare.

Figure 5 illustrates the contrast between a general and a specialty store when competing against firm a. On the horizontal axis we measure each consumer's value of z, that is, their disutility from buying from firm a. On the vertical axis we measure the advantage, in terms of vertical quality, of the online store with respect to the bricks-and-mortar store. The 45° line measures the points at which the "horizontal" differentiation advantage of firm b exactly compensates the "vertical" differentiation advantage of firm a.

Consider first the case of a general store b. Its disadvantage with respect to store a is given by $m(z/2) - m(k/2)$. It follows that only consumers with a value of $\tilde{w}$ greater than w'' purchase at the bricks-and-mortar store. Since $\tilde{w}$ is uniformly distributed, we conclude that firm b's market share is given by $q_g = w - w''$.

Consider now the case of a specialty store b. Its disadvantage with respect to store a is given by $m(z/2) - m(k)$. It follows that only consumers with a value of $\tilde{w}$ greater than w' purchase at the bricks-and-mortar store. Since $\tilde{w}$ is uniformly distributed, we conclude that firm b's market share (among its genre followers) is given by $q_s = w - w'$. However, we must keep in mind that if firm b focuses on genre x, for example, then it loses potential buyers who are only interested in y. In other words, by becoming a specialty store firm b halves its potential demand. Therefore, its market share is $(w - w')/2$.

The values of z and k were selected so that $\pi_g = w - w'' = (w - w')/2 = \pi_s$. In other words, for the particular values of z and k underlying Figure 5, firm b is indifferent between being a general store or being a specialty store. Consumers, however, are not indifferent between the two types of store. Consumer surplus is given by the area below

$$\max\{m(z/2), \tilde{w} + m(\widetilde{k})\}$$

where $\widetilde{k} = k/2$ or $\widetilde{k} = k$ for a general and a specialty store, respectively. It follows that, for genre x consumers, the switch from a general to a genre x specialty store implies an increase in consumer surplus given by the green trapezoid in Figure 5. By contrast, for genre y consumers the switch implies a decrease in consumer surplus given by the red area in Figure 5. By construction, the green area is greater than the red area. More generally, we have just established the following result:

Proposition 6. *When store b is indifferent between being a general or a specialty store, the average consumer strictly prefers the latter.*

Intuitively, consumer surplus is "convex" in the vertical utility provided by the bricks-and-mortar store. This implies that consumers prefer the "bet" of having a specialty store of their preferred genre with probability 50% than a general store with probability 100%.

This intuition is related to a number of results in the IO literature. Mankiw and Whinston (1986) provide conditions such that, in equilibrium, there is excess entry into a market. Intuitively, the entrant does not correctly take into account the positive externality it creates for consumers nor the negative externality it creates for its competitors. Similarly, our firm b does not take into account the positive surplus effect it has on the consumers who like the genre in which they specialize.

4. Discussion

We believe that our theoretical findings have important practical implications for marketing and strategy, namely in the context of bookstores and other retail markets. In this section, we discuss some of these implications.

■ **Barnes & Noble.** In 2019, Barnes & Noble appointed James Daunt as its new CEO. Daunt was previously the founder of Daunt Books and managing director of UK's large bookshop chain Waterstones (Chaudhuri, 2019). Daunt's philosophy, as he puts it, is centered around some core tenets (Segal, 2019):

- Escape broad genres, such as "self-help" or "history", organizing bookstores around some specific, and often niche, themes;
- Curate selections locally, allowing the local staff to pick books, and avoiding general, UK-wide catalogs;
- Avoid the convenience trap, focusing on the many perks of the offline experience instead.

This business strategy resonates with our theoretical findings. First, and most obvious, Daunt clearly emphasizes the importance of specialization (Proposition 1 and 2), thus avoiding broad genres on which Amazon's size advantage is hard to counteract. Moreover, Daunt stresses the importance of offering offline amenities such as readings, cafes and curated staff recommendations (Proposition 4).

■ **The tyranny of the majority.** In his influential book, Waldfogel (2007) states that

> When fixed costs are substantial, markets provide only products desired by large concentrations of people.

Our analysis suggests that the competition between an ever-larger online platform and bricks-and-mortar stores may actually counter Waldfogel's "tyranny of the majority." In other words, while we acknowledge that there is empirical evidence for Waldfogel's prediction, we argue that Amazon's increased dominance might have at least partly reversed this picture in a variety of retail markets. Chief among them is arguably the book market, which combines early Amazon penetration with enormous product variety. So we now find bookstores such as Arkipelago Books (the Filipino Bookstore), which caters to the Bay Area Filipino community, and Sweet Pickle Books (which, in addition to books, also sells its own line of craft pickles), among many others.

That said, some of our results parallel Waldfogel's main thesis. Proposition 6, in particular, shows that the extent of specialization is insufficient: consumer welfare would increase with more specialization than it results in equilibrium.

■ **Amazon's embarrassment of niches.** According to Anderson (2004),

> The theory of the Long Tail can be boiled down to this: Our culture and economy are increasingly shifting away from a focus on a relatively small number of hits (mainstream products and markets) at the head of the demand curve, and moving toward a huge number of niches in the tail. In an era *without the constraints of physical shelf space* and other bottlenecks of distribution, *narrowly targeted goods and services* can be as economically attractive as mainstream fare. (our emphasis)

Our point is that, *precisely* because shelf space is limited, the physical retail world is turning into "narrowly targeted goods." That is, the drivers for the economic appeal of niche titles in our model are the exact opposite to those in Anderson (2004). In Anderson (2004), it is the lack of capacity constraints that makes it economically viable for large retailers to stock increasingly obscure titles. Conversely, we argue that, given small stocking capacity, it can be optimal to excel at one niche and neglect all others, rather than to be passable at everything.

A related "conventional wisdom" is that Amazon's highly personalized algorithms have fractured consumers into taste niches, lengthening the tail in sales and thus the value of Amazon's virtually infinite inventory. Our analysis highlights a potential drawback to Amazon's strategy: as more consumers acquire (or discover) a specific taste, more specialized bricks-and-mortar retailers can enter (or survive in) the market. In other words, taking into account bricks-and-mortar specialization decisions, it is unclear whether consumer specialization is good news for Amazon after all.

■ **A contrast of strategies and mechanisms.** Anderson (2004) describes Amazon's strategy as follows:

> This is the power of the Long Tail. The companies at the vanguard of it are showing the way with three big lessons:
> Rule 1: Make everything available
> Rule 2: Cut the price in half. Now lower it.
> Rule 3: Help me find it

There is an interesting contrast with respect to the niche specialty bricks-and-mortar stores we increasingly find in the US market. First, contrary to Amazon, they do not make everything available; in fact, they restrict to a very narrow section of the spectrum. Second, as Proposition 3 suggests, they set higher prices, rather than lower prices.

■ **Bookshop.** Anderson (2004) goes on to argue that

> Most successful businesses on the Internet are about aggregating the Long Tail in one way or another. ... By overcoming the limitations of geography and scale, ... [they] have discovered new markets and expanded existing ones.

One interesting instance of this is given by Bookshop, a relatively recent newcomer in the US book market (Alter, 2020). In essence, Bookshop aggregates local bookstores' catalogues and offers quick, efficient shipping to try and replicate Amazon's business model while supporting small businesses. Andy Hunter, Bookshop's founder, pitched the e-commerce platform as "the indie alternative to Amazon", and claimed it could represent a "boon for independent stores".

It stands to reason that this type of aggregation is all the more powerful the more specialization (and, thus, heterogeneity) there is among bookstores: if all bookstores were stocking the same bestsellers, Bookshop's business model would fail to replicate even a small fraction of Amazon's variety. Thus, indirectly, our analysis also provides support for Bookshop's strategy.

■ **Beyond books.** While our primary focus has been on the book retail market, our analysis, as mentioned in the Introduction, extends to other industries as well.

Consider the case of Heatonist, a hot sauce specialist with locations in Manhattan and Brooklyn, New York. Heatonist stocks a wide variety hot sauces, almost always by independent, obscure producers. Popular sauces like Sriracha, which can be found at most US supermarkets, are not offered.

A quick search reveals the extreme extent of Heatonist's specialization: among Heatonist's staff picks, some are entirely absent on Amazon, while less than half have amassed more than 50 Amazon reviews. This is an ever greater degree of specialization than that we model in our paper — in which, for simplicity, we posit that Amazon stocks the whole product space, while brick and mortar stores optimize given capacity.

In the limit, the selection of hot sauces purchased on Amazon can become less niche than that of sauces sold offline. In line with our theory, this is likely particularly true for smaller, boutique retailers: large supermarkets' sales are much more likely to be more top heavy than Amazon's.

5. Conclusion

How can bricks-and-mortar stores survive in an increasingly Amazon-dominated world? In this paper, we suggest that specialization on increasingly narrow niches represents a fundamental strategy to do so. Examples of highly specialized offline retailers abound, and bookstores are becoming more diverse (Alter and Harris, 2022).[14] By specializing, these bookstores choose to excel at one (often admittedly niche) genre, and to neglect all others. In doing so, they attract a small but loyal consumer base and, we show, generate a lot of consumer surplus.

While we chose the book industry as the leading example of our analysis, we believe that the dynamics we identify apply much more broadly. Outside of the book industry, we have discussed Heatonist's example – only one of many success stories in boutique food retailing. Similar example can be found in the apparel and home decor industries, among many others.

Specialization, of course, comes at a steep cost: by specializing in a niche genre that only appeals to a few consumers, bricks-and-mortar stores automatically lose a majority of their potential buyers. However, we show that, as Amazon grows, and particularly for smaller stores, this is a price worth paying: it is better to strongly appeal to some consumers and be ignored by others than to leave all consumers

14. See also `https://www.news4jax.com/news/local/2022/07/14/new-female-owned-bookstore-in-riverside-focuses-on-sharing-diverse-stories/`

lukewarm.

This conclusion is robust to (and, in fact, strengthened by) a variety of extensions, including endogenous prices and offline competition. We identify a "boutique effect", whereby specialized stores give up market shares but price high enough to more than compensate for their reduced sales. Furthermore, the choice to specialize exhibits strategic complementarity. This is bad news to Amazon, since Amazon is strictly worse off competing against two specialized stores than it would be if the stores were generalists. This is because in equilibrium, two competing specialized stores choose opposite niches, and thus exhibits no overlap, better covering the market and persuading more consumers to buy offline. We believe this heterogeneity could be an important force behind the success of Bookshop, an offline bookstore aggregator that pitched itself as the indie alternative to Amazon.

Our theory allows us to revisit some important ideas on the impact of e-commerce on bricks-and-mortar stores and consumers alike. Waldfogel's (2007) "tyranny of the majority" central claim is that, in the presence of substantial fixed costs, offline businesses will disproportionately serve the majority of consumers. Taste minorities, in other words, are the main benefactors of e-commerce. Along these lines, Choi and Bell (2011) show that geographic variation in preference minority status of target customers explains geographic variation in online sales. On the other hand, we argue that, in a world in which Amazon is dominant, more bricks-and-mortar stores will find it optimal to specialize in narrow niches, forgoing a majority of potential consumers but capturing higher market shares in their domain of specialization. Thus, in equilibrium, at least some taste minorities will be well served offline. Nevertheless, we share Waldfogel (2007)'s intuition that specialization is insufficient: consumer surplus would increase if more bricks-and-mortar stores specialized.

Our model also allows us to rethink, and qualify, the celebrated long tail theory of Anderson (2004), and to add two novel elements to it: first, while the online long tail has been shown to grow longer over time (Anderson (2006), Brynjolfsson, Hu, and Smith (2010)), we argue that it is unclear whether it is growing *relatively* longer than its offline equivalent, contrary to Anderson's central claim. That is, unlike Anderson, we do not believe simply stocking bestselling items is a viable strategy for bricks-and-mortar retailers, differently from twenty years ago. In this sense, while Anderson's long tail is predicated on the lack of capacity constraints, ours builds exactly on their presence.

Interestingly, this implies that, if anything, Amazon's impact on the rise of niche consumption has been understated, as it has neglected the central role of Amazon's ever increasing dominance in giving rise to an offline long tail.

We conclude by noting that our paper is about how brick-and-mortar stores "limit the damage", not about how they thrive. Specialization allows stores to partly insulate themselves from Amazon's growth, but it need not be the case that it will prove a viable long-term strategy, especially as the optimal niches will become narrower and narrower. While independent bookstores have rebounded nicely over the last few years after almost a decade of steady decline, it is hard to predict whether this trend can be sustained in the long term.

Appendix

Proof of Proposition 1: Part (a): Consider the case of a general bookstore. For a x (or y) reader, visiting b yields expected value

$$\tilde{w} + m(k/2)$$

By contrast, buying at a yields expected value

$$m(z/2)$$

given that half of the total titles correspond to genre x (or y). The indifferent buyer is characterized by

$$\tilde{w} = m(z/2) - m(k/2)$$

whenever $m(z/2) - m(k/2) < w$. (Otherwise, every consumer strictly prefers seller a and b makes zero profits.) Finally, b's expected profit (when strictly positive) is given by

$$\pi_g = 1 - \big(m(z/2) - m(k/2)\big)\,/w \tag{4}$$

Consider now the case of a bookstore specializing in genre x. For an x reader, visiting b yields expected value

$$\tilde{w} + m(k)$$

For a y reader, the value of the x specialty store is zero. As before, buying at a yields expected value

$$m(z/2)$$

both for x and for y readers. The indifferent x buyer is now characterized by

$$\tilde{w} = m(z/2) - m(k)$$

whenever $m(z/2) - m(k) < w$. (Otherwise, every consumer strictly prefers seller a and b makes zero profits.) Finally, b's expected profit (when strictly positive) is given by

$$\pi_s = \tfrac{1}{2}\left(1 - \big(m(z/2) - m(k)\big)\,/w\right) \tag{5}$$

(Note that, by specializing, b expects to make, at most, $\frac{1}{2}$ in sales. This is because it will have lost all potential readers from the genre it did not specialize in.)

If $z = 0$, that is, if Amazon is out of the picture, then being a general store is trivially a dominant strategy: the store sells to a measure 1 of consumers, whereas the specialty store sells to a measure $\frac{1}{2}$ only (at the same price). Specifically, a general store's profits are equal to 1, the highest value possible, while a specialty store would only achieve its upper bound, $\frac{1}{2}$.

At the opposite end, let z_g is such that $\left(m(z_g/2) - m(k/2)\right)/w = 1$. For $z = z_g$, we have $\pi_g = 0$, whereas

$$\pi_s = \tfrac{1}{2}\,\left(1 - \big(m(z_g/2) - m(k)\big)\,/w\right) > \tfrac{1}{2}\,\left(1 - \big(m(z_g/2) - m(k/2)\big)\,/w\right) = 0$$

Such an z will exist whenever $\lim_{z\to\infty}\big(m(z/2) - m(k/2)\big)\,/w > 1$, which is implied by the condition in the Proposition. (As mentioned in the text, if this condition does not hold — for instance because w or k are very large, or $m(n)$ is very flat —, then it may always be optimal for the store to be generalist.)

Given continuity of π_g and π_s, it follows from the intermediate value theorem that there exists an $z_{gs} \in (0, z_g)$ such that $\pi_g(z_{gs}) = \pi_s(z_{gs})$, where for notational simplicity we have suppressed the store profit's dependence on k and w. To show that z_{gs} is unique we note that

$$\frac{d(\pi_s - \pi_g)}{dz} = \big(-m'(z/2) + 2\,m'(z/2)\big)\,/(4\,w) = m'(z/2)/(4\,w) > 0 \tag{6}$$

where the inequality follows from the fact that $m(z)$ is strictly increasing for every z. This concludes the first part of the proof.

To show that $z_{gs}(k, w)$ increases in k and w, we compute the derivative of the profit difference $(\pi_s - \pi_g)$ with respect to k and w:

$$\frac{\partial(\pi_s - \pi_g)}{\partial k} = \frac{m'(k)}{2\,w} - \frac{m'(k/2)}{2\,w} = \frac{1}{2\,w}\,\big(m'(k) - m'(k/2)\big) < 0 \tag{7}$$

where the inequality follows from concavity of m (David, 1997). Similarly,

$$\frac{\partial(\pi_s - \pi_g)}{\partial w} = \frac{m(z/2) - m(k)}{2\,w^2} - \frac{m(z/2) - m(k/2)}{w^2} = (\tfrac{1}{2} - \pi_s)/w - (1 - \pi_g)/w$$

where the second equality follows from (4) and (5). By definition, $\pi_s = \pi_g = \overline{\pi}$ at $z = z_{gs}$. It follows that

$$\left.\frac{\partial(\pi_s - \pi_g)}{\partial w}\right|_{z\,=\,z_{gs}} = (\tfrac{1}{2} - \overline{\pi})/w - (1 - \overline{\pi})/w = -1/(2\,w) < 0 \tag{8}$$

By the implicit function theorem,

$$\frac{\partial z_{gs}(k, w)}{\partial k} = -\frac{\partial(\pi_s - \pi_g)/\partial k}{\partial(\pi_s - \pi_g)/\partial z} > 0$$

where the inequality follows from (6) and (7). Also by the implicit function theorem,

$$\frac{\partial z_{gs}(k,w)}{\partial w}\bigg|_{z\,=\,z_{gs}} = -\frac{\partial(\pi_s - \pi_g)/\partial w\,|_{s\,=\,z_{gs}}}{\partial(\pi_s - \pi_g)/\partial z} > 0$$

where the inequality follows from (6) and (8).

Part (b): We have that

$$\frac{\partial(\pi_g - \pi_s)}{\partial k} = \frac{1}{2}m'(k/2) - \frac{1}{2}m'(k) > 0$$

by concavity of k. Moreover, we know that, as $k \to z$, $\pi_g \to 1$, $\pi_s \to 1/2$, and thus $k_g > k_s$ whenever k is large enough.

Conversely, we know that $\pi_g = 0$ whenever $m(z/2) - m(k/2) \geq w$, while $\pi_s = 0$ whenever $m(z/2) - m(k) \geq w$. Denote by k_g^* and k_s^* the two values of k that satisfy these two with equality. Because both expressions are decreasing in k, these exist and are non-negative if and only if $m(z/2) \geq w$, which is implied by the condition in the proposition.

Now, notice that $k_g^* = 2k_s^*$. Thus, whenever k_g^* and k_s^* are positive, we have that $k_g^* > k_s^*$ or, in other words,

$$\pi_s > \pi_g = 0, \quad \forall k \in [k_s^*,\ k_g^*].$$

Combining our observations, we have that the difference $\pi_g - \pi_s$ is negative for $k \in [k_s^*,\ k_s^*]$ and monotonically increases, becoming strictly positive for $k \to s$. Thus, there exists a unique k_{gs} such that $\pi_s(k_{gs}, s) = \pi_g(k_{gs}, s)$.

Now, we want to show that $k_g s(z,w)$ is decreasing in z and increasing in w. To do so, we appeal to the Implicit Function Theorem again, in a similar fashion as in part (a).

We have that

$$\frac{\partial k_{gs}(z,w)}{\partial s} = -\frac{\partial(\pi_g - \pi_s)/\partial s}{\partial(\pi_g - \pi_s)/\partial k} > 0$$

and

$$\frac{\partial k_{gs}(z,w)}{\partial w} = -\frac{\partial(\pi_g - \pi_s)/\partial s}{\partial(\pi_g - \pi_s)/\partial w} < 0,$$

which concludes part (b) of the proof. ■

Proof of Proposition 2: Suppose store b specializes in genre x, the popular genre ($\alpha > \frac{1}{2}$). Then store b reaches at most α of its potential customers. The indifferent customer (indifferent between store a and store b) has z such that

$$m(\alpha\, z) = m(k) + \tilde{w}$$

where $\alpha\, z$ is total supply of titles of genre x, all of which are available at store a; and k is the supply of titles of genre x at store b (in other words, all of store b's capacity, k, is devoted to carrying genre x titles). It follows that, of the k store-b potential customers, a fraction $\alpha\, k$ is interested in the genre offered by store b, and a fraction $\big(m(\alpha\, z) - m(k)\big)\,/\tilde{w}$ of this fraction prefers store b to store a. This implies that store b's profit from specializing in genre x is given by

$$\pi_x = \alpha\Big(1 - \big(m(\alpha\, z) - m(k)\big)\,/\tilde{w}\Big)$$

Similarly, the profit from specializing in genre y is given by

$$\pi_y = (1-\alpha)\bigg(1 - \Big(m\big((1-\alpha)\, z\big) - m(k)\Big)\,/\tilde{w}\bigg)$$

If $z = 0$, that is, if Amazon is out of the picture, then the popular genre x is trivially a dominant strategy: the store sells to a measure α of consumers, whereas the niche-genre store sells to a measure $1 - \alpha < \alpha$ only (and at the same price). At the opposite end, let z_x be the value of z such that $\pi_x = 0$. Such an z will exist whenever $\lim_{z\to\infty}\big(m(\alpha\, z) - m(k)\big)\,/w > 1$, which is equivalent to the condition in the Proposition. We then have

$$\pi_y = (1-\alpha)\bigg(1 - \Big(m\big((1-\alpha)\, z_x\big) - m(k)\Big)\,/\tilde{w}\bigg) > \alpha\Big(1 - \big(m(\alpha\, z_x) - m(k)\big)\,/\tilde{w}\Big) = 0$$

(If this condition does not hold — for instance because w or k are very large, or $m(n)$ is very flat —, then it may always be optimal for the store to choose the popular genre.)

Given continuity of π_x and π_y, the intermediate value theorem implies that there exists at least one value $\widehat{z}_{xy} \in (0, z_x)$ such that $\pi_g(\widehat{z}_{xy}) = \pi_s(\widehat{z}_{xy})$, where for notational simplicity we have suppressed the store profit's dependence on k and $\tilde{w}$. Let z_{xy} be the highest of these values. Then $\pi_y \geq \pi_x$ for $z > z_{xy}$.

Consider now the comparative statics with respect to k. First notice that there are only $(1-\alpha)\, z$ titles of genre y. Therefore, $m\big((1-\alpha)\, z_x\big)$ is an upper bound of the benefit from stocking only y genre titles. Therefore, for $k > (1-\alpha)\, z_x$, $\pi_y = (1-\alpha)\, k$. As to π_x, we can see that it is increasing in k and, as k reaches $k = m(\alpha\, z)$, $\pi_x = \alpha\, k > \pi_y$. It follows that there exist a k_{xy} such that $\pi_x > \pi_y$ if $k > k_{xy}$. ■

Proof of Proposition 3: We first solve for the optimal prices of a general store given that store a sets p_a. Store g's profit is given by $\pi_g = p_g\, q_g$, where q_g, the store's sales, are given by

$$q_g = 1 - \big(m(z/2) - m(k/2) - p_a + p_g\big)\,/w$$

The profit-maximizing price, quantity and profit levels are given by

$$\widehat{p}_g = \tfrac{1}{2}\big(w - m(z/2) + m(k/2) + p_a\big) \tag{9}$$

$$\widehat{q}_g = \tfrac{1}{2}\big(w - m(z/2) + m(k/2) + p_a\big)\,/w = \widehat{p}_g/w \tag{10}$$

$$\widehat{\pi}_g = \widehat{p}_g\,\widehat{q}_g = (\widehat{p}_g)^2/w \tag{11}$$

In the case of a specialty store, profit is given by $\pi_s = p_s\, q_s$, where q_s, the store's sales, are given by

$$q_s = \tfrac{1}{2}\Big(1 - \big(m(z/2) - m(k) - p_a + p_s\big)\,/w\Big)$$

The profit-maximizing price, quantity and profit levels are given by

$$\widehat{p}_s = \tfrac{1}{2}\big(w - m(z/2) + m(k) + p_a\big) \tag{12}$$

$$\widehat{q}_s = \tfrac{1}{4}\big(w - m(z/2) + m(k) + p_a\big)\,/w = \widehat{p}_s/(2\,w) \tag{13}$$

$$\widehat{\pi}_s = \widehat{p}_s\,\widehat{q}_s = (\widehat{p}_s)^2/(2\,w) \tag{14}$$

Direct inspection of (9) and (12) reveals that

$$\widehat{p}_s > \widehat{p}_g$$

that is, in equilibrium specialty bookstores set a higher price. Moreover, from (9)–(10) and (12)–(13) we conclude that

$$\widehat{p}_s/\widehat{q}_s = 2\,w > \widehat{p}_g/\widehat{q}_g = w \tag{15}$$

Consider the extreme case when $z = 0$. Straightforward computation shows that $\widehat{\pi}_g > \widehat{\pi}_s$ if and only if condition (3) in the Proposition holds. At the opposite end, let z_g be such that $\widehat{p}_g = 0$. Comparing (9) and (12), we see that, at $z = z_g$, $\widehat{p}_s > \widehat{p}_g = 0$. From (11) and (14) we conclude that, at $z = z_g$, $\widehat{\pi}_s > \widehat{\pi}_g = 0$. Since both $\widehat{\pi}_s$ and

$\widehat{\pi}_g$ are continuous we conclude by the intermediate-value theorem that there exists at least one $\widetilde{z}_{gs}$ such that $\widehat{\pi}_s = \widehat{\pi}_g$. Let z_{gs} be the highest of these values. Then $\widehat{\pi}_s > \widehat{\pi}_g$ when $z_{gs} < s < z_g$.

Finally, notice that, at $z = z_{gs}$, $\widehat{\pi}_g = \widehat{\pi}_s$, that is, $\widehat{p}_g\,\widehat{q}_g = \widehat{p}_s\,\widehat{q}_s$. Since, from (15), $\widehat{p}_s/\widehat{q}_s > \widehat{p}_g/\widehat{q}_g$, it must be that, at $z = z_{gs}$, $\widehat{p}_s > \widehat{p}_g$ and $\widehat{q}_s < \widehat{q}_g$. Since these are strict inequalities, they also hold in the neighborhood of $z = z_{gs}$. It follows that, in the right neighborhood of $z = z_{gs}$, a specialty store earns a higher profit, sets a higher price, and captures a lower market share. ■

Proof of Proposition 4: The proof follows straightforwardly from the definitions of π_g and π_s. Specifically, from (4) and (5) we derive

$$\begin{aligned} \frac{\partial \pi_g}{\partial w} &= \frac{m(z/2) - m(k/2)}{w^2}, \\ \frac{\partial \pi_s}{\partial w} &= \frac{m(z/2) - m(k)}{2\,w^2}. \end{aligned} \tag{16}$$

Taking derivatives of (16) with respect to z, we get

$$\begin{aligned} \frac{\partial^2 \pi_g}{\partial w\;\partial z} &= \frac{m'(z/2)}{2w^2} > 0, \\ \frac{\partial^2 \pi_s}{\partial w\;\partial z} &= \frac{m'(z/2)}{4w^2} > 0, \end{aligned} \tag{17}$$

while derivatives of (16) with respect to k are

$$\begin{aligned} \frac{\partial^2 \pi_g}{\partial w\;\partial k} &= -\frac{m'(k/2)}{2w^2} < 0, \\ \frac{\partial^2 \pi_s}{\partial w\;\partial k} &= -\frac{m'(k)}{2w^2} < 0, \end{aligned} \tag{18}$$

which proves the first half of the proposition.

To prove the second part, notice that (16) implies

$$\frac{\partial \pi_g}{\partial w} = \frac{m(z/2) - m(k/2)}{w^2} > \frac{m(z/2) - m(k)}{w^2} > \frac{m(z/2) - m(k)}{2\,w^2} = \frac{\partial \pi_s}{\partial w} > 0. \tag{19}$$

Similarly, given (16) we have

$$d^2\pi_g/dw^2 = \frac{-m(z/2) + m(k/2)}{2\omega^3} < \frac{-m(z/2) + m(k)}{2\omega^3} < \frac{-m(z/2) + m(k)}{4\omega^3} = d^2\pi_s/dw^2 < 0. \tag{20}$$

■

Proof of Proposition 5: Figure 6 illustrates the competition case. On the horizontal axis we measure the consumer location d, where $d = 0$ corresponds to bricks-and-mortar store b_0 and $d = 1$ corresponds to bricks-and-mortar store b_1. On the vertical axis we measure z, the relative preference for a bricks-and-mortar store. We assume that d and z are independently and uniformly distributed: $\tilde{d} \sim U[0, 1]$ and $\tilde{w} \sim U[0, w]$. Since there are two different genres, we need to plot one graph per genre, genre x on the top panel and genre y on the bottom panel.

Figure 6
Store strategy under bricks-and-mortar competition

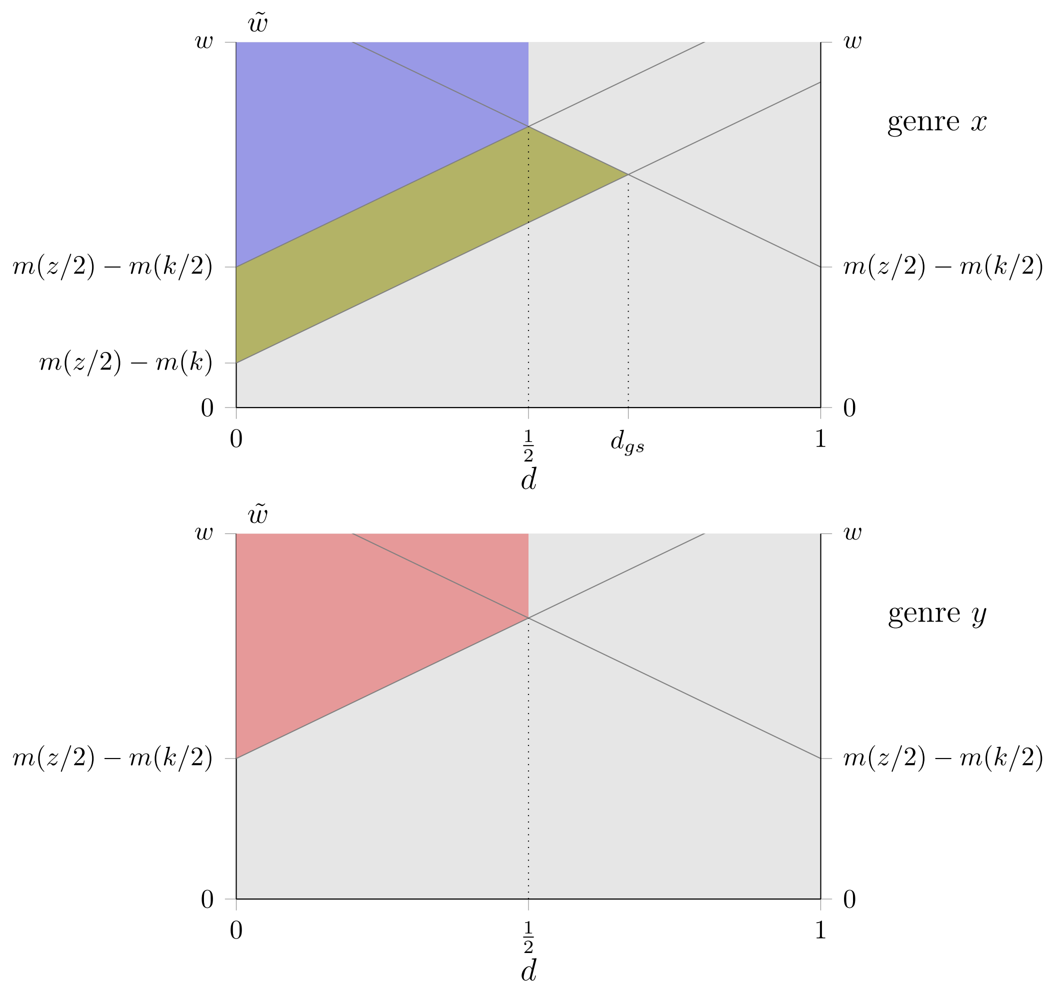


Figure 6 illustrates the case when both b_0 and b_1 are general stores. Store b_0's demand of genre x is given by the area in blue in the top panel, whereas store b_0's demand of genre y is given by the area in red in the top panel. To understand that, notice that store b_0 must beat both store a and store b_1. Beating store a requires

$$m(k/2) + z - \tau\,\tilde{d} > m(z/2)$$

whereas beating store b_1 requires

$$m(k/2) + z - \tau\,\tilde{d} > m(k/2) + z - \tau\,(1 - \tilde{d})$$

This results in the following set of inequalities

$$\begin{aligned} \tilde{w} &> m(z/2) - m(k/2) + \tau\,\tilde{d} \\ \tilde{d} &< \tfrac{1}{2} \end{aligned}$$

which in turn correspond to the areas in blue (top panel) and red (bottom panel).

Given that b_1 chooses to be a general store, how does b_0 change its profits by specializing in genre x? Store b_1's demand from x consumers is now determined by

$$m(k) + \tilde{w} - \tau\,\tilde{d} > m(z/2)$$

(beat firm a) and

$$m(k) + \tilde{w} - \tau\,\tilde{d} > m(k/2) + \tilde{w} - \tau\,(1 - \tilde{d})$$

(beat firm b_1). This simplifies to

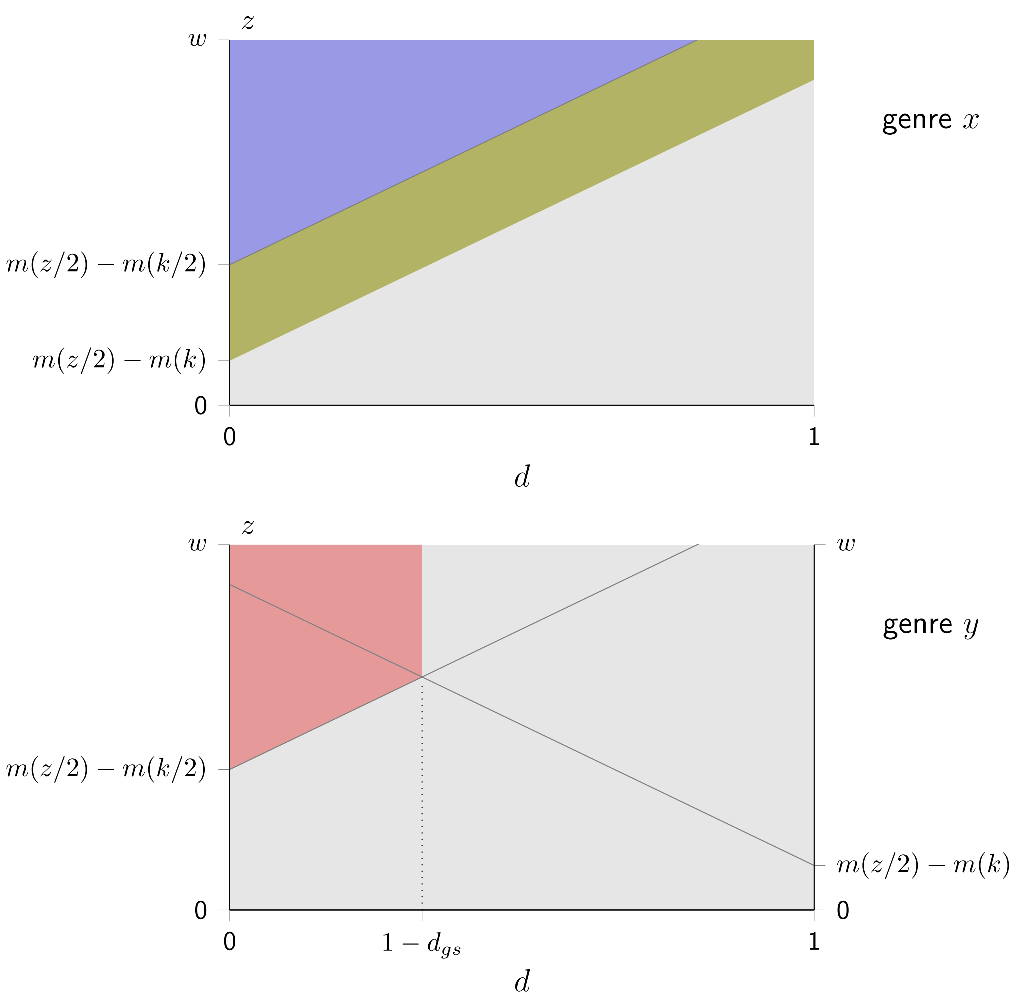
$$\begin{aligned} \tilde{w} &> m(z/2) - m(k) + \tau\,\tilde{d} \\ \tilde{d} &< d_{gs} \equiv \tfrac{1}{2} + \big(m(k) - m(k/2)\big)\,/\tau \end{aligned}$$

This corresponds to an increase in demand for genre x given by the area in green on the top panel and a loss in demand for genre y given by the area in red on the bottom panel. The green area on the top panel corresponds entirely to consumers who purchased from a when both b_0 and b_1 were general stores and now prefer to buy from b_0, the genre x specialty store. The red area on the bottom panel corresponds to consumers who were interested in store b_0 when it was a general store but are now not interested since it no longer carries any genre y titles.

The values of z and k in Figure 6 were chosen so that the areas in green and red are equal. This implies that, given that store b_1 follows a general-store strategy, store

Figure 7

Store strategy under bricks-and-mortar competition



b_0 is indifferent between being a general store and being a specialty store. Suppose now that b_1 chooses to be a y-specialty store. What is the gain for store b_0 from specializing in x? This alternative scenario is described in Figure 7. In terms of x consumers, the battle is now limited to firms b_0 and a, since firm b_1 is absent from this genre. Demand for firm b_0 is determined by

$$m(k/2) + \tilde{w} - \tau\,\tilde{d} > m(z/2)$$

which corresponds to the area in blue. Regarding genre y (bottom panel), we still need to consider both competition by a and competition by b_1. Since b_1 is a genre y specialty store, we now have

$$\begin{aligned} \tilde{w} &> m(z/2) - m(k) + \tau\,\tilde{d} \\ \tilde{d} &< 1 - d_{gs} \equiv \tfrac{1}{2} + \big(m(k/2) - m(k)\big)/\tau \end{aligned}$$

which corresponds to the area in red. What happens to firm b_0's profit as it switches from a general store to a genre x specialty store? On the top panel (that is, in terms of x sales), it experiences a profit increase given by the green area. On the top panel (that is, in terms of y sales), it experiences a profit loss given by the red area.

Immediate inspection reveals that the green area in the top panel of Figure 7 is greater than the green area in the top panel of Figure 6, whereas the red area in the bottom panel of Figure 7 is lower than the red area in the bottom panel of Figure 6. This implies that, if firm b_0 is indifferent between being a general store and being a specialty store when its rival is a general store, then it strictly prefers to be a specialized store when its rival is a specialty store. ■

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