Competing Multiproduct Intermediaries*

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Abstract

This paper develops a new framework to analyze asymmetric competition between multiproduct intermediaries that offer a range of product categories. It highlights a novel interplay between vertical and horizontal marginalization. Vertical marginalization arises from within- and cross-channel interactions between intermediaries and producers, and is further amplified by horizontal marginalization, driven by Cournot miscoordination among producers selling through a common intermediary. We analyze the distinct mechanisms underlying this interplay across different business models and examine how heterogeneous intermediary buyer power shapes retail competition and consumer welfare.

Key words: Multiproduct intermediary, buyer power, vertical marginalization, horizontal marginalization.

JEL classification: D43, L13, L43

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1 Introduction

Multiproduct intermediaries, such as supermarkets and online retailers, coordinate the access and distribution of a broad range of products from producers to consumers, enabling one-stop shopping across diverse needs. They engage with a diverse array of producers (suppliers), with trading terms and pricing mechanisms that vary substantially across product categories.[1]

Competition between multiproduct intermediaries differs fundamentally from standard single-product oligopoly models. First, intermediaries vary in their ability to influence producers' pricing and extract their margins, leading to differing degrees of vertical marginalization across retail channels. Second, one-stop shopping behavior turns otherwise independent products into effective complements, creating a Cournot miscoordination problem when independent producers set prices—resulting in horizontal marginalization. The interplay between vertical and horizontal marginalization critically shapes the outcomes of retail competition. Yet, surprisingly little research has examined the mechanisms underlying this interaction.

This paper develops a new framework for analyzing competition between two asymmetric multiproduct intermediaries, capturing the interaction between vertical and horizontal marginalization. The intermediaries offer a range of product categories and provide one-stop shopping convenience for consumers with multiproduct demand. We study a two-stage linear pricing game under two distinct business models. In the *reseller model*, producers set wholesale prices, followed by intermediaries setting retail prices. In the *marketplace model*, intermediaries first set per-unit fees, after which producers determine retail prices.[2] Intermediaries differ in their buyer power, defined as their ability to extract supplier margins through competitive sourcing.[3] We model buyer power in reduced form by assuming two types of product categories: competitive categories, supplied by fringe producers earning zero margins, and monopolized categories, supplied by monopoly producers retaining a positive margin. The number of competitive categories serves as a measure of an intermediary's buyer power.

We characterize the pricing equilibrium and address several central research questions: What are the effects of shifts in retail business models? How does variation in intermediary buyer power shape retail competition and consumer welfare? What are the implications of the growing trends toward hybridization and vertical integration in the retail sector? For each of these questions, our analysis yields novel insights that emerge uniquely from our framework of competing mul-

[1] For example, the Australian Competition and Consumer Commission's Supermarket Inquiry (ACCC, 2025) highlights substantial variation in trading terms across grocery categories, reflecting differences in supply chain structures. Supermarket buyer power is strongest in fresh produce—where supply is fragmented and products are perishable and homogeneous—and weakest in categories dominated by branded suppliers with strong consumer loyalty or alternative sales channels.

[2] All choices of business models and prices are made under complete information.

[3] According to the definition provided in *Buyer Power of Large Scale Multiproduct Retailers* (OECD, 1998), "A retailer is defined to have buyer power if, in relation to at least one supplier, it can credibly threaten to impose a long-term opportunity cost (i.e., harm or withheld benefit) which, were the threat carried out, would be significantly disproportionate to any resulting long-term opportunity cost to itself."

tiproduct intermediaries.

As a first result, we show that the equilibrium characterization features a novel interplay between vertical and horizontal marginalization in multiproduct intermediary competition. Vertical marginalization arises from strategic pricing between intermediaries and monopoly producers and manifests in two key forms. First, *within-channel interaction* stems from the strategic substitutability of pricing across stages in own channel: a higher Stage-1 price leads to a lower Stage-2 price, allowing Stage-1 players to capture more surplus—an instance of first-mover advantage. Second, *cross-channel interaction* reflects strategic complementarity across retail channels: a higher Stage-1 price in one channel induces a higher Stage-2 price in the rival channel. These vertical effects are further amplified by horizontal marginalization, driven by Cournot miscoordination among monopolized categories selling through a common intermediary: each producer fails to internalize the negative externality of its pricing on total channel demand. The degree of amplification depends critically on the intermediary's business model.

When both intermediaries adopt the reseller model (i.e., the reseller configuration), Cournot miscoordination arises in Stage 1, where each monopoly producer responds to the intermediary's Stage-2 pricing—within its own channel and in the rival channel. As a result, vertical marginalization from both within- and cross-channel interactions is amplified by the number of monopolized categories in the intermediary's own channel. All else equal, a channel with stronger buyer power (i.e., fewer monopolized categories) sets lower retail prices and captures a larger market share. Moreover, increasing buyer power in one channel raises profits for both the intermediary and its producers, reduces profits in the rival channel, and lowers retail prices in both.

In contrast, when both intermediaries adopt the marketplace model (i.e., the marketplace configuration), Cournot miscoordination arises in Stage 2. Vertical marginalization now stems from the intermediary's Stage-1 best response to each monopoly producer's Stage-2 pricing—within its own channel and in the rival channel. Consequently, cross-channel interaction is amplified by the number of monopolized categories in the rival channel, while within-channel interaction remains amplified by the number of monopoly producers in the own channel. As a result, an increase in buyer power in one channel has two opposing effects: it reduces the own-channel aggregate markup—benefiting strategic parties within that channel—but also decreases the rival channel's markup through cross-channel interaction, thereby harming the intermediary and producers in the original channel.

Cross-channel interactions diverge when competing channels adopt asymmetric business models. In the channel operating under the marketplace model, the cross-channel interaction is unaffected by Cournot miscoordination from either channel, as the Stage-1 intermediary optimally responds to the Stage-2 pricing set by the rival intermediary under the reseller model. In contrast, in the channel operating under the reseller model, each Stage-1 monopoly producer responds to each Stage-2 monopoly producer in the rival marketplace channel. As a result, the cross-channel interaction is amplified twice by the Cournot effect. This *double amplification* of marginalization disadvantages the reseller model and may lead intermediaries to choose business models strategically to strengthen their competitive position. Indeed, when intermediaries can freely choose their models, a symmetric marketplace configuration can emerge in equilibrium.

Notably, differences in cross-channel interactions drive divergence in competition outcomes across business model configurations, offering new insights and policy implications.

While traditional big-box intermediaries have mainly operated under the reseller model, there has been a marked shift toward the marketplace model. We find that intermediaries earn higher profits under the marketplace model due to weaker cross-channel competition. Interestingly, the shift disproportionately benefits the intermediary with weaker buyer power by expanding its market share—potentially explaining the rise of new online retail platforms adopting the marketplace model. However, this shift can weaken retail competition, resulting in higher prices and lower consumer surplus.

Recently, the retail sector has witnessed a shift in bargaining power from producers to large retailers, raising antitrust concerns over increasing buyer power.[4] We show that, across two business model configurations, stronger buyer power in a retail channel consistently leads to lower equilibrium retail prices by mitigating marginalization within that channel. This intensifies cross-channel competition and increases consumer surplus. However, the effects on market shares and profits vary by configuration.

In the reseller configuration, the results align with conventional wisdom: greater buyer power enhances an intermediary's competitiveness, boosting its market share and profit while harming its rival. In contrast, these outcomes may not hold under the marketplace configuration. Although increased buyer power lowers own-channel markups, it also reduces the rival channel's markup through cross-channel interaction—potentially harming the intermediary itself. This adverse effect dominates when the intermediary faces a significant efficiency disadvantage, in which case greater buyer power may reduce both its market share and profit. Thus, a marketplace intermediary—such as an e-commerce platform—may have a strategic incentive to limit its own buyer power,[5] especially when at an efficiency disadvantage. Such a limitation not only raises markups within the intermediary's own channel but also softens competitive pressure from the rival, resulting in higher equilibrium retail prices and lower consumer welfare.

An increasing number of e-commerce intermediaries are adopting the hybrid business model, in which the intermediary operates as a marketplace for some product categories and as a reseller for others. Under this configuration, the intermediary can coordinate pricing across the two stages, eliminating vertical marginalization in certain categories. However, in the remaining

[4] See Inderst and Mazzarotto (2008) for evidence on rising buyer power in retail and a comprehensive survey of the literature.

[5] This can be achieved, for example, by stocking more big-brand products or manipulating aspects of platform recommendations and governance design.

categories, the interaction between vertical and horizontal marginalization leads to a double amplification of both within-channel and cross-channel effects—a mechanism similar to that in asymmetric business models. We show that this double amplification can dominate, resulting in higher retail prices and lower consumer surplus compared to a pure marketplace configuration.

Related literature

☐ **Multiproduct intermediaries and vertical relations.** Our paper contributes to the growing literature on multiproduct intermediaries that use models of multiproduct retailing—that is, firms carrying a range of potentially unrelated products and serving consumers with multiproduct demand—to explore new questions in vertical relations. A key feature in this literature is that such intermediaries turn otherwise unrelated products into effective complements in one-stop shopping or search environments.[6] Rhodes et al. (2021) develop a search model to study a monopolistic intermediary's assortment decision—that is, the range of manufacturers' product categories to stock. Their focus is on how the search environment shapes the intermediary's trade-off between attracting consumers and extracting surplus from manufacturers. Other key issues addressed in this literature include how one-stop shopping alters the effects of mergers between producers (Ide, forthcoming), and the intermediary's incentive to charge consumers an access fee (Gao, 2025).[7] However, these studies do not examine the role of competition between intermediaries or the implications of their business models.[8]

In a related but distinct line, the vertical relations literature (Rey and Tirole, 2007) has examined competition among multiproduct firms, though typically without incorporating shopping or search frictions. The most relevant contribution is Rey and Vergé (2022), who study a sophisticated multilateral vertical contracting problem and provide microfoundations for bargaining equilibria. Their framework differs from ours in two key respects. First, they consider differentiated multiproduct environments and represent consumer multiproduct needs through a reduced-form demand function, without addressing Cournot miscoordination among producers. In contrast, we model consumers as demanding multiple independent products and use a multiproduct discrete-choice framework to characterize demand, allowing us to explicitly capture horizontal marginalization arising from Cournot effects. Second, their model assumes that intermediaries and producers contract via two-part tariffs or through efficient bilateral bargaining,

[6] Models on multiproduct intermediaries are distinct from those analyzing multiproduct firms (or producers in our terminologies) selling substitutable products (e.g., Anderson and De Palma, 2006; Nocke and Schutz, 2018, 2019), where: (i) one-stop shopping or search facilitation is not relevant; and (ii) vertical contracting is absent.

[7] Related contributions on multiproduct retailing that incorporate one-stop shopping but abstract from vertical relations include, among others, Lal and Matutes (1994), Chen and Rey (2012), and Rhodes (2015).

[8] More broadly, multiproduct intermediaries can be viewed as two-sided platforms connecting buyers and producers (or sellers). Some existing works on competing two-sided platforms also model buyers with multiproduct demand and sellers with pricing power, but focus primarily on cross-group network externalities (e.g., Hagiu, 2009; Belleflamme and Peitz, 2010, 2019; Jeon and Rey, 2024). Jullien et al. (2021) provides a comprehensive survey of this literature. Our setting, which combines reseller and marketplace models, also relates to the emerging literature on hybrid platforms (e.g., Etro, 2021; Hagiu et al., 2022; Zennyo, 2022; Anderson and Bedre-Defolie, 2024; Hervas-Drane and Shelegia, forthcoming), discussed in detail in Section 6.1.

thereby eliminating standard double marginalization through efficient transfers. While their framework suits well for analyzing rent allocation and exclusion, it obscures the pricing distortions that arise in practice where multiproduct intermediaries cannot perfectly coordinate prices. Our model makes these distortions explicit and shows that the interaction between vertical marginalization and horizontal marginalization yields new insights into intermediaries' business models and their buyer power.

□ **Models of intermediation.** In our paper, the reseller and marketplace models differ in who sets the final retail prices—intermediaries or producers—reflecting a shift in control over retail pricing (Hagiu and Wright, 2015). The literature on retail business models has similarly examined the trade-offs associated with shifts in retail pricing control—or more broadly, the relative order of moves between intermediaries and producers—by comparing the so-called "wholesale" and "agency" models (e.g, Johnson, 2017; Foros et al., 2017). Key considerations in this literature include vertical double marginalization (e.g, Johnson, 2017; Foros et al., 2017), the role of access fees charged to consumers (Gaudin and White, 2021) and to sellers (Allain et al., 2024), the effect of negative cross-brand pass-through (Hu et al., 2022), the distribution of bargaining power among channel members (De los Santos et al., 2024), dynamic pricing and consumer lock-in effects (Johnson, 2020), and spillovers between online to offline sales channels (Abhishek et al., 2016). Most of this literature, however, focuses on either a monopoly intermediary or symmetric competition between intermediaries. We develop a tractable model of competition between asymmetric multiproduct intermediaries under each intermediation model, where one intermediary holds greater buyer power and value efficiency than its rival.

□ **Buyer power in reseller and marketplace settings**. We model buyer power as the reduced-form ability of an intermediary to influence producers' pricing—wholesale prices in the reseller model and retail prices in the marketplace model—and to eliminate their profit margins. In reseller settings involving retailers and manufacturers, such capabilities have been studied through the lens of countervailing power (e.g., Galbraith, 1954; Inderst and Shaffer, 2007; Inderst and Valletti, 2011; Gaudin, 2018), which captures the idea that large downstream buyers can bargain for lower input prices, potentially benefiting consumers. In marketplace settings involving platforms and third-party sellers, the analogous concept is the platform's ability to govern retail pricing indirectly through design choices—such as highlighting certain sellers in recommendation systems or structuring search interfaces to favor lower-priced offerings (e.g., Dinerstein et al., 2018; Casner, 2020; Teh, 2022; Johnson et al., 2023). We synthesize these two strands of literature by analyzing intermediary buyer power within a unified model that accommodates both reseller and marketplace settings. Our approach yields results that are distinct from prior work, as we discuss in detail later.

The remainder of the paper is organized as follows. Section 2 presents the baseline model. Section 3 characterizes the equilibrium outcomes under symmetric business model configurations, with policy implications discussed in Section 4. Section 5 analyzes asymmetric configurations and explores the endogenous choice of business models. Section 6 offers extensions and applications of the baseline analysis. Section 7 concludes.

2 The baseline model

We consider a market with two competing channels $k \in \{A, B\}$, each consisting of an intermediary denoted as k and a finite set $\mathcal{N}$ of distinct independent product categories (where $|\mathcal{N}| = N \geq 1$). To simplify notations, we normalize the production costs for all products and the retailing costs to zero. There is also a unit mass of heterogeneous consumers who are interested in buying from every product category.

□ **Shopping within each channel**. Each consumer chooses a single retail channel for all purchases, engaging in one-stop shopping.[9] If a consumer purchases a product from category i at retail price p_i^k, she derives value $u_i^k - p_i^k$, where u_i^k is the gross utility derived from consuming product i at channel k. Assuming $u_i^k - p_i^k \geq 0$, which indeed holds in the equilibrium, a consumer choosing channel k receives total consumer value

$$V^k \equiv \sum\nolimits_{i \in \mathcal{N}} u_i^k - \sum\nolimits_{i \in \mathcal{N}} p_i^k.$$

We define $z \equiv \sum_{i \in \mathcal{N}} (u_i^A - u_i^B)$ as the efficiency difference (in terms of gross product utility) between the two channels. This setup allows for $u_i^A \neq u_i^B$, reflecting potential quality difference between channels. Here, $z > (<) 0$ indicates that intermediary A enjoys an advantage (disadvantage) over B.

□ **Producers within each channel**. We aim to capture the idea that intermediaries vary in their capability to influence producers' pricing and extract producers' profit margins.[10] We model this in a reduced-form way: within each channel k, a finite subset $\mathcal{F}^k$ of product categories is supplied by competitive fringe producers that price at effective marginal cost, while the remaining set $\mathcal{N} \backslash \mathcal{F}^k$ of product categories are each supplied by a *monopoly* producer that makes strategic pricing decisions. Let $m_k = |\mathcal{F}^k|$, which we interpret as intermediary k's *buyer power*—the ability to source from multiple potential producers in each category (so a higher m_k implies stronger buyer power). For now, we assume that each producer supplies exclusively to one retail channel, that is, there is no cross-channel listing. We discuss these assumptions in details in Section 2.1.

□ **Competition between retail channels.** Retail channels are horizontally differentiated,

[9] One-stop shopping is a common retail phenomenon. For example, large retailers offer a wide range of product categories and varieties, enabling consumers to fill their shopping baskets through one-stop shopping. Additionally, retailers develop loyalty programs (such as Amazon's Prime Membership) to reward returning customers.

[10] In markets with many competing brands (i.e., fringe producers), a powerful intermediary can often use bidding mechanisms for limited shelf or display space to fully appropriate producers' margins (Inderst and Shaffer, 2007; Marx and Shaffer, 2010). In contrast, when dealing with essential, must-stock brands, bargaining power may shift toward the established brand producers.

and the market is fully covered. We formulate horizontal differentiation following the random-utility discrete choice specification. Consumers have channel-specific idiosyncratic preferences described by a random draw θ such that a consumer prefers to shop at channel A if and only if $\theta \leq V^A - V^B$; otherwise, the consumer shops at channel B. Here, θ is distributed according to cumulative distribution function (CDF) $G(\cdot)$, which is twice continuously differentiable and has a strictly positive density function $g(\cdot)$. This demand system nests standard Hotelling and Perloff-Salop duopoly models as special cases.

Let $\Delta \equiv V^A - V^B$ denote the consumer value difference between channels. Then, the mass of consumers who choose channels A and B are given by $G(\Delta)$ and $1 - G(\Delta)$, respectively. Define the standard markup terms at channels A and B as:

$$\lambda(\Delta) \equiv \frac{G(\Delta)}{g(\Delta)}, \ \mu(\Delta) \equiv \frac{1 - G(\Delta)}{g(\Delta)}.$$

We assume that the corresponding derivatives satisfy $\lambda'(\Delta) > 0$ and $\mu'(\Delta) < 0$, which are equivalent to strict log-concavity of $G(\Delta)$ and $1 - G(\Delta)$ (Bagnoli and Bergstrom, 2005). For simplicity, we focus on distributions that are symmetric around $\Delta = 0$, while allowing asymmetry across channels through the efficiency term z.

☐ **Timing and business models.** Following the literature on intermediation models (e.g, Johnson, 2017; Foros et al., 2017), we focus on simple vertical contracts with uniform pricing only, without involving lump-sum transfers. Specifically, we consider two possible move orders, corresponding to the following business models:

- **Reseller model:** In Stage 1, producers in each channel simultaneously set wholesale prices $\{w_i^A\}_{i \in \mathcal{N}}$ and $\{w_i^B\}_{i \in \mathcal{N}}$; in Stage 2, intermediaries set retail prices $\{p_i^A\}_{i \in \mathcal{N}}$ and $\{p_i^B\}_{i \in \mathcal{N}}$.
- **Marketplace model:** In Stage 1, intermediaries in each channel set per-unit fees f^A and f^B simultaneously; in Stage 2, producers set retail prices $\{p_i^A\}_{i \in \mathcal{N}}$ and $\{p_i^B\}_{i \in \mathcal{N}}$.

The terms *reseller* and *marketplace* capture the differences in the move orders across the two business models–specifically, the stage at which the intermediary makes its pricing decisions relative to its producers. This distinction reflects a shift in control right (Hagiu and Wright, 2015): in the reseller model, the intermediary sets retail prices for all products; in the marketplace model, producers set retail prices. To ensure a consistent comparison between these two timing structures, we assume a common tariff structure of per-unit pricing across both models.[11] We

[11] As noted in Section 1, these two business models have been alternatively labeled in the literature as the "wholesale model" and "agency model" respectively. However, in the agency model, the intermediaries and producers often adopt a revenue-sharing rule in pricing, indicating a different pricing mechanism from that used in our setup of the marketplace model.

initially treat the business models as exogenously imposed in our baseline, before endogenizing them in Section 5.

We assume that all prices and fees are public information. Our solution concept is Subgame Perfect Nash Equilibrium (SPNE). To ensure that the first-stage pricing problems in each model are quasiconcave, we impose the following regularity assumption throughout the paper:

Assumption 1. *For all Δ in the support of CDF $G(\cdot)$, the markup terms $\lambda(\Delta)$ and $\mu(\Delta)$ and their first and second derivatives satisfy*

$$\frac{\lambda'(\Delta)}{\lambda(\Delta)} \geq -\frac{\lambda''(\Delta)}{\lambda'(\Delta)} \geq \frac{\mu'(\Delta)}{\mu(\Delta)} \quad \text{and} \quad \frac{\lambda'(\Delta)}{\lambda(\Delta)} \geq -\frac{\mu''(\Delta)}{\mu'(\Delta)} \geq \frac{\mu'(\Delta)}{\mu(\Delta)}.$$

Intuitively, Assumption 1 requires that the markup terms λ and μ exhibit bounded curvature, ensuring that Stage-2 pricing responses remain sufficiently "well-behaved" in response to changes in Stage-1 prices. A clear example satisfying Assumption 1 is when G corresponds to a uniform distribution over a bounded interval $[-\bar{\theta}/2, \bar{\theta}/2]$ (e.g., Hotelling model), where

$$G(\Delta) = \frac{1}{2} + \frac{\Delta}{\bar{\theta}},\ \lambda(\Delta) = \frac{\bar{\theta}}{2} + \Delta,\ \mu(\Delta) = \frac{\bar{\theta}}{2} - \Delta, \tag{1}$$

and so $\lambda''(\Delta) = \mu''(\Delta) = 0$. We will occasionally refer to this uniform distribution specification (1) to sharpen certain results. When doing so, we assume

$$\frac{z}{\bar{\theta}} \in \left[-3\left(\frac{1}{2} + N - \min\{m_A, m_B\}\right), 3\left(\frac{1}{2} + N - \max\{m_A, m_B\}\right)\right]$$

to ensure that both channels maintain strictly positive market shares in equilibrium.

2.1 Discussion of modelling choices

□ **Linear vertical contracts.** Our goal is to examine price competition between retail channels under linear pricing contracts, which are prevalent in many real-world settings. For example, between TV networks and cable distributors (Crawford and Yurukoglu, 2012), between insurers and hospitals (Ho and Lee, 2019), and between book publishers and resellers (Gilbert, 2015). The absence of lump-sum transfers in our model also distinguishes our result from the standard approach in the vertical relations literature, which often relies on joint-profit maximization logic (Rey and Tirole, 2007), thus allowing us to highlight interactions among vertical and horizontal marginalization in the retail competition.[12]

[12] Dobson and Waterson (1997, 2007) pointed out that simple linear tariffs are preferable when there are disparities between the frequency at which supermarket retailers order inputs (e.g., weekly, in order to adjust to demand) and that at which they meet with the suppliers (e.g., monthly or annually). Linear contracts are also widely used in the theoretical literature on input price discrimination (e.g, Inderst and Shaffer, 2007; O'Brien, 2014).

☐ **Intermediary's buyer power.** Our model is designed to capture the variation in buyer power that an intermediary may hold across different product categories. For example, in its Supermarkets Inquiry Report, the Australian Competition and Consumer Commission (ACCC, 2025) finds that intermediaries such as large supermarkets typically have strong bargaining positions in categories like fresh produce and perishables, where producers are relatively homogeneous and easily substitutable. In contrast, in categories dominated by a few strong-brand producers, bargaining power shifts toward the producers, as intermediaries rely on these must-stock, non-substitutable products to attract and retain consumers. The parameter m_k provides a stylized measure of each intermediary k's overall buyer power, defined as the number of categories in which it possesses full bargaining power to extract producer margins.[13]

☐ **Cross-channel listing and multihoming.** We assume that each producer supplies exclusively to a single retail channel. This assumption reflects the common practice among intermediaries of differentiating their supply chains to avoid intra-brand competition across channels—achieved either by sourcing from distinct producers or by developing their own brands (e.g., private labels). This simplification allows us to abstract away from multi-channel price coordination problems faced by producers and to focus solely on the effects of inter-channel competition. See, for example, Wang and Wright (2025) for a related analysis. In Section 6.3, we show that if a monopoly producer i can supply the same product to both channels, then under the reseller model it charges a monopoly price $p_i^k = u_i^k$ in each channel $k \in \{A, B\}$, given that consumers are one-stop shoppers and the market is fully covered. A similar result holds under the marketplace model when N, the total number of product categories, is sufficiently large. Therefore, in our model multihoming producers do not contribute to the net value difference across retail channels and, as such, do not affect the equilibrium outcomes.

☐ **Channel asymmetry**. In our baseline model, the two channels differ only in terms of $z = \sum_{i\in\mathcal{N}}(u_i^A - u_i^B)$ (the efficiency difference) and the intermediaries' buyer power, m_A and m_B. If $z = 0$ and $m_A = m_B$, then the two channels are perfectly symmetric. Our framework can be easily extended to incorporate cost asymmetries between channels. For instance, suppose the retailing and production costs in each channel k are $\sum_{i\in\mathcal{N}} \gamma_i^k$ and $\sum_{i\in\mathcal{N}} c_i^k$, respectively. Then, our analysis remains applicable after redefining $z = \sum_{i\in\mathcal{N}}(u_i^A - u_i^B) - \sum_{i\in\mathcal{N}}(c_i^A - c_i^B) - \sum_{i\in\mathcal{N}}(\gamma_i^A - \gamma_i^B)$. Accordingly, the parameter z can be interpreted more broadly as the value-cost efficiency difference between channels A and B.

[13] We also formalize the bargaining process in Online Appendix A, where we relate buyer power to both the ease of replacing individual producers and the intensity of competition among producers within each category. In Section 6.2, we further extend the model to incorporate vertical integration (assuming all categories all occupied by a monopoly producer), and we show that m_k is equivalent to the number of categories controlled by intermediary k's integrated producers.

3 Equilibrium analysis

We analyze the equilibrium of retail competition, assuming intermediaries' business models are exogenously given. We begin by building initial intuitions through an analysis of the equilibrium in the more "conventional" reseller model in Section 3.1. We then employ similar techniques to analyze the equilibrium of the marketplace model in Section 3.2, and then discuss the qualitative differences across the two equilibria.

3.1 Reseller configuration

We consider the configuration in which both intermediaries adopt the reseller model, hereafter referred to as rr when applicable.

□ **Stage-2 pricing**. By backward induction, we consider the retail pricing decisions of intermediaries in the Stage-2 subgame, given the Stage-1 prices at both channels $\{w_i^A\}_{i\in\mathcal{N}}$ and $\{w_i^B\}_{i\in\mathcal{N}}$. Intermediary A chooses $\{p_i^A\}_{i\in\mathcal{N}}$ to maximize its profit

$$\Pi^A = \left(\sum\nolimits_{i\in\mathcal{N}} p_i^A - \sum\nolimits_{i\in\mathcal{N}} w_i^A\right) G(\Delta),$$

whereas intermediary B chooses $\{p_i^B\}_{i\in\mathcal{N}_B}$ to maximize the profit

$$\Pi^B = \left(\sum\nolimits_{i\in\mathcal{N}} p_i^B - \sum\nolimits_{i\in\mathcal{N}} w_i^B\right) (1 - G(\Delta)).$$

Here, the consumer value difference between channels is given by

$$\Delta = V^A - V^B = z + \sum\nolimits_{i\in\mathcal{N}} p_i^B - \sum\nolimits_{i\in\mathcal{N}} p_i^A.$$

In what follows, we will use the value difference Δ as the key variable and express the equilibrium markups and profits as functions of Δ. Then, the equilibrium outcomes are determined after we solve for the equilibrium value difference, denoted as Δ^*.

The pricing problem for each intermediary $k \in \{A, B\}$ is equivalent to choosing the aggregate channel-k retail price $P^k \equiv \sum_{i\in\mathcal{N}} p_i^k$. The first-order conditions yield

$$P^A = \sum\nolimits_{i\in\mathcal{N}} w_i^A + \lambda(\Delta) \qquad \text{and} \qquad P^B = \sum\nolimits_{i\in\mathcal{N}} w_i^B + \mu(\Delta)\ . \tag{2}$$

Here, $\lambda(\Delta)$ and $\mu(\Delta)$ represent the markups for intermediaries A and B, respectively. The value difference Δ^* in the equilibrium of the subgame is implicitly determined by

$$\Delta^* = z + \sum\nolimits_{i\in\mathcal{N}} w_i^B + \mu(\Delta^*) - \sum\nolimits_{i\in\mathcal{N}} w_i^A - \lambda(\Delta^*), \tag{3}$$

which is a function of Stage-1 prices $\{w_i^A\}_{i\in\mathcal{N}}$ and $\{w_i^B\}_{i\in\mathcal{N}}$.

□ **Stage-1 pricing**. Turning to Stage 1, in each channel $k \in \{A, B\}$, the fringe producers in categories $i \in \mathcal{F}^k$ set their wholesale prices equal to their marginal cost, $w_i^k = 0$.

Meanwhile, in channel A, each monopoly producer $i \in \mathcal{N} \backslash \mathcal{F}^A$ sets the wholesale price w_i^A to maximize its profit $\pi_i^A = w_i^A G(\Delta^*)$, where Δ^* is determined by (3). Then, the first-order condition for the symmetric equilibrium wholesale price in channel A is:[14]

$$w^A = \frac{-\lambda(\Delta^*)}{d\Delta^*/dw_i^A} = \lambda(\Delta^*)(1 + \lambda'(\Delta^*) - \mu'(\Delta^*)), \tag{4}$$

where the derivative of Δ^* comes from totally differentiating its definition (3). Similarly, in channel B, each monopoly producer $i \in \mathcal{N} \backslash \mathcal{F}^B$ maximizes its profit $\pi_i^B = w_i^B (1 - G(\Delta^*))$, and the associated first-order condition is

$$w^B = \frac{\mu(\Delta^*)}{d\Delta^*/dw_i^B} = \mu(\Delta^*)(1 + \lambda'(\Delta^*) - \mu'(\Delta^*)). \tag{5}$$

Observe that Assumption 1 implies that the right hand sides of (4) and (5) are respectively increasing and decreasing in Δ^*, which verifies the quasiconcavity of the pricing problems. Substituting the resulting wholesale prices into (3) determines the overall equilibrium, which is summarized in the proposition below.

Proposition 1 *(reseller configuration equilibrium rr). Denote channel-A and channel-B equilibrium markup functions as*

$$\begin{aligned} P_{rr}^A(\Delta) &\equiv \lambda(\Delta) + (N - m_A)\lambda(\Delta)\left(1 + \lambda'(\Delta) - \mu'(\Delta)\right), & (6) \\ P_{rr}^B(\Delta) &\equiv \mu(\Delta) + (N - m_B)\mu(\Delta)(1 + \lambda'(\Delta) - \mu'(\Delta)). & (7) \end{aligned}$$

The equilibrium value difference Δ_{rr}^* is uniquely pinned down by

$$\Delta_{rr}^* = z + P_{rr}^B(\Delta_{rr}^*) - P_{rr}^A(\Delta_{rr}^*), \tag{8}$$

and the aggregate retail prices are $P_{rr}^{A*} = P_{rr}^A(\Delta_{rr}^*)$ and $P_{rr}^{B*} = P_{rr}^B(\Delta_{rr}^*)$.

The equilibrium markups can be expressed as functions of the equilibrium value difference Δ_{rr}^*, which is uniquely determined by (8). This formulation makes the equilibrium analysis tractable, allowing us to focus on Δ_{rr}^* as the key object. To interpret the equilibrium in the reseller configuration, as outlined in Proposition 1, we begin by examining the total markup in

[14] Note that if $w_i^k > u_i^k$, then producer i would reduce the total value offered at channel k, so that the intermediary would prefer not dealing with producer i. Therefore, implicit in our analysis is that the product gross utility u_i^k is sufficiently large such that the interior solutions (3) and (5) do not violate boundary constraints $w_i^k \leq u_i^k$. This is without loss of generality because otherwise producer i would just optimally set $w_i^k = u_i^k$, as if category i is absent in channel k. The same implicit interiority assumption applies to the analysis of other configurations.

channel A (the same reasoning applies symmetrically to channel B). Figure 1 summarizes the markup structure under the reseller equilibrium.

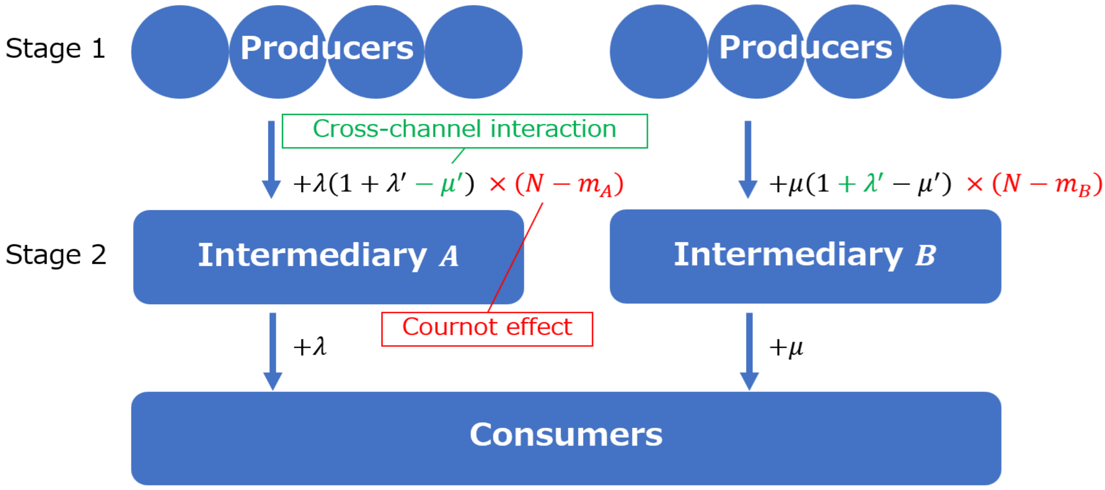

Figure 1: Equilibrium markups in the reseller configuration.

Channel pricing exhibits a novel combination of *vertical marginalization* (between the intermediary and each monopoly producer) and *horizontal marginalization* (among the $N - m_A$ monopoly producers). The interaction mechanism can be understood as follows.

The total markup in channel A, as given by (6), consists of: (i) the intermediary's Stage-2 markup λ, and (ii) each of the $N - m_A$ monopoly producers' Stage-1 markup $\lambda(1 + \lambda' - \mu')$. Each producer's markup in Stage 1 includes an amplification factor $1 + \lambda' - \mu'$ from vertical marginalization. The term $\lambda' \geq 0$ captures *within-channel strategic interaction*, arising from the fact that prices in the two stages are strategic substitutes when demand is log-concave. Specifically, a higher Stage-1 price leads the intermediary to lower the Stage-2 price, enabling Stage-1 producers to extract more surplus—an instance of the "first-mover advantage." In contrast, the term $-\mu' \geq 0$ reflects *cross-channel strategic interaction*. Here, prices are strategic complements across retail channels: when the Stage-1 price rises in channel A, the rival intermediary in channel B has an incentive to raise its Stage-2 price. Anticipating this, the Stage-1 producers in channel A are incentivized to raise their prices, softening downstream competition. Both types of strategic interaction distort Stage-1 pricing upward.

The interaction among the $N - m_A$ monopoly producers is analogous to the classic Cournot miscoordination in the pricing of complementary goods, leading to horizontal marginalization. Selling through a common intermediary effectively transforms independent products into complements, causing each producer to ignore the negative externality that its own price increase imposes on the profits of others by reducing total channel demand.[15] In the reseller model, this Cournot miscoordination arises at the Stage-1 level. As a result, horizontal marginalization exacerbates the distortion already introduced by vertical marginalization, driven by both within-channel and cross-channel strategic interactions. This results in a total Stage-1 markup of $(N - m_A)\,\lambda(1 + \lambda' - \mu')$ in channel A.

3.2 Marketplace configuration

We consider the configuration in which both intermediaries adopt the marketplace model, which is denoted as mm.

□ **Stage-2 pricing**. By backward induction, we analyze the retail pricing decisions of producers in the Stage 2 subgame, given the per-unit fees f^A and f^B for channels A and B respectively. Fringe producers in category $i \in \mathcal{F}^k$ for each channel $k \in \{A, B\}$ set their retail prices equal to their effective marginal cost, $p_i^k = f^k$. Each monopoly producer in category $i \in \mathcal{N} \backslash \mathcal{F}^A$ in channel A sets its retail price to maximize its profit, $\pi_i^A = (p_i^A - f^A)G(\Delta)$, whereas those in channel B set their retail price to maximize $\pi_i^B = (p_i^B - f^B)(1 - G(\Delta))$. The first-order conditions yield

$$p_i^A = f^A + \lambda(\Delta) \qquad \text{and} \qquad p_i^B = f^B + \mu(\Delta).$$

The equilibrium value difference of the subgame Δ^* is obtained by aggregating the prices of all producers in both channels:

$$\Delta^* = z + Nf^B + (N - m_B)\mu\left(\Delta^*\right) - Nf^A - (N - m_A)\lambda\left(\Delta^*\right). \tag{9}$$

□ **Stage-1 pricing**. Turning to Stage 1, each intermediary sets its per-unit fee to maximize its profit: $\Pi^A = Nf^A G\left(\Delta^*\right)$ and $\Pi^B = Nf^B\left(1 - G\left(\Delta^*\right)\right)$ where Δ^* is given by (9). Assumption 1 ensures the quasiconcavity of these profit functions. The first-order conditions yield

$$\begin{aligned} f^A &= \frac{-\lambda(\Delta^*)}{d\Delta^*/df^A} = \frac{\lambda(\Delta^*)}{N}(1 + (N - m_A)\lambda'(\Delta^*) - (N - m_B)\mu'(\Delta^*)), \\ f^B &= \frac{\mu(\Delta^*)}{d\Delta^*/df^B} = \frac{\mu\left(\Delta^*\right)}{N}(1 + (N - m_A)\lambda'(\Delta^*) - (N - m_B)\mu'(\Delta^*)). \end{aligned}$$

Substituting these back to (9), we establish the overall equilibrium as follows:

Proposition 2 *(marketplace configuration equilibrium mm). Denote channel-A and channel-B*

[15] Formally, the wholesale price (4) is higher than what would maximize joint-producer profits the maximizer of $\sum_{i \in N} \pi_i^A$, with the first-order condition being $w_i^A = \frac{1}{(N - m_A)}\lambda(\Delta)(1 + \lambda'(\Delta) - \mu'(\Delta))$.

equilibrium markup functions as

$$P^A_{mm}(\Delta) \equiv (N-m_A)\lambda(\Delta) + \lambda(\Delta)\left(1 + (N-m_A)\lambda'(\Delta) - (N-m_B)\mu'(\Delta)\right) \quad (10)$$
$$P^B_{mm}(\Delta) \equiv (N-m_B)\mu(\Delta) + \mu(\Delta)\left(1 + (N-m_A)\lambda'(\Delta) - (N-m_B)\mu'(\Delta)\right). \quad (11)$$

The equilibrium value difference Δ^*_{mm} is uniquely pinned down by

$$\Delta^*_{mm} = z + P^B_{mm}(\Delta^*_{mm}) - P^A_{mm}(\Delta^*_{mm}), \quad (12)$$

and the aggregate retail prices are $P^{A*}_{mm} = P^A_{mm}(\Delta^*_{mm})$ and $P^{B*}_{mm} = P^B_{mm}(\Delta^*_{mm})$.

Similarly, the equilibrium markups can be expressed as functions of the equilibrium value difference Δ^*_{mm}, which is uniquely determined by (12). In the marketplace configuration, the equilibrium total markup in channel A, as given by (10), consists of: (i) the Stage-2 markup $(N-m_A)\,\lambda$ imposed by $N-m_A$ monopoly producers, and (ii) the intermediary's Stage-1 markup $\lambda(1+(N-m_A)\lambda' - (N-m_B)\mu')$. As in Proposition 1, we observe a combination of vertical and horizontal marginalization. The Stage-1 markup reflects both the *within-channel strategic interaction* between the intermediary and each of the $N-m_A$ producers in channel A—captured by the term $(N-m_A)\lambda\lambda'$ —and the *cross-channel strategic interaction* between the intermediary and each of the $N-m_B$ monopoly producers in the rival channel B—captured by the term $(N-m_B)\lambda\,(-\mu')$. Figure 2 below summarizes the markup structure in the equilibrium of the marketplace configuration.

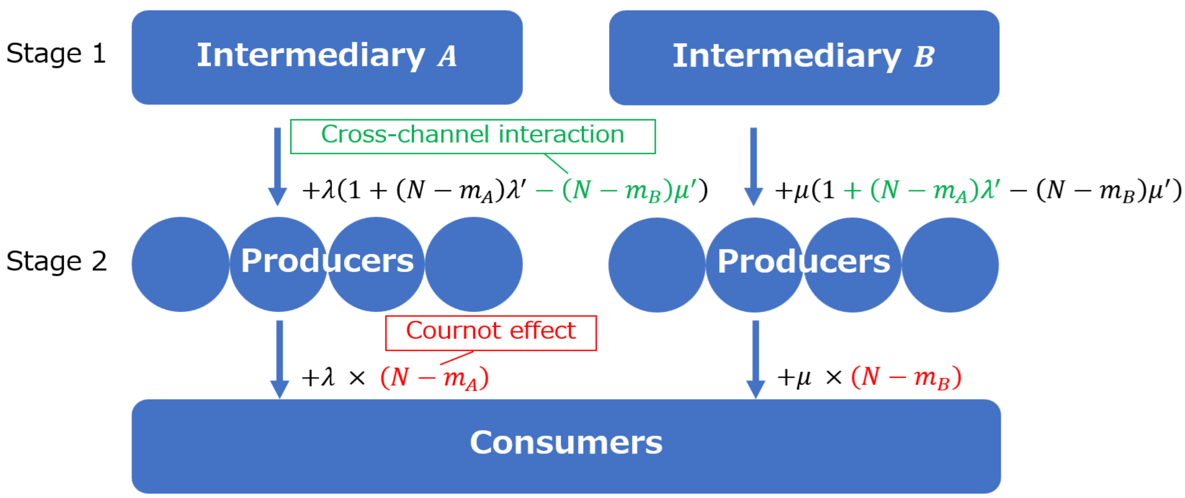

Figure 2: Equilibrium markups in the marketplace configuration.

3.3 Comparison

To further compare the equilibria under the two configurations, we decompose the aggregate markup in channel A into two components: the markup arising from the *within-channel interaction* and that from the *cross-channel interaction*, as follows:

$$\begin{array}{rl} P^A_{mm}(\Delta) \equiv & (N-m_A+1)\,\lambda(\Delta) + (N-m_A)\lambda(\Delta)\lambda'(\Delta) \quad + \quad (N-m_B)\lambda(\Delta)(-\mu'(\Delta)) \\ P^A_{rr}(\Delta) \equiv & \underbrace{(N-m_A+1)\,\lambda(\Delta) + (N-m_A)\lambda(\Delta)\lambda'(\Delta)}_{\text{aggregate within-channel markup}} \quad + \quad \underbrace{(N-m_A)\lambda(\Delta)(-\mu'(\Delta))}_{\text{aggregate cross-channel markup}} \end{array}. \tag{13}$$

Suppose, for the moment, that we ignore the cross-channel interaction ($\mu' = 0$). In the marketplace configuration, the interplay of vertical and horizontal marginalization in channel A results in an aggregate within-channel markup that consists of the Stage-2 markup $(N-m_A)\lambda$ and the Stage-1 markup $\lambda\left(1+(N-m_A)\lambda'\right)$. Meanwhile, in the reseller configuration, the aggregate within-channel markup consists of the Stage-2 markup of λ and the Stage-1 markup of $(N-m_A)\lambda\left(1+\lambda'\right)$. Summing these components, both configurations yield the same aggregate within-channel markup $(N-m_A+1)\,\lambda+$ $(N-m_A)\lambda\lambda'$ shown in (13). Here, $(N-m_A+1)\,\lambda$ represents the total markup imposed by the $N-m_A+1$ strategic players in channel A, while $(N-m_A)\lambda\lambda'$ captures the additional markup arising from the interplay of horizontal and vertical marginalization in the two-stage pricing game.

This observation implies a retail-price neutrality result in the absence of retail competition: the final retail price remains unchanged regardless of whether the Cournot miscoordination effect appears at Stage 1 or Stage 2. Johnson (2017) finds a similar neutrality result in a monopoly single-product channel, showing that the equilibrium retail price is invariant to the timing of moves between the producer and retailer. Our result extends this insight to a monopoly multi-product channel with independent producers.

However, this neutrality result does not hold in scenarios involving retail competition ($-\mu' > 0$). A key distinction between Propositions 1 and 2 lies in the differing amplification of the cross-channel strategic interaction. In the marketplace configuration (Proposition 2) where the Cournot effect emerges in Stage 2, channel A's cross-channel interaction $-\mu'$ is amplified by the number of monopoly producers $N-m_B$ in the *rival channel*, leading to an aggregate cross-channel markup of $(N-m_B)\lambda(-\mu')$. This amplification reflects intermediary A's anticipation of the best responses from the $N-m_B$ rival-channel monopoly producers in Stage 2. In contrast, in the reseller configuration (Proposition 1), where the Cournot effect emerges in Stage 1, the cross-channel interaction is amplified by the number of Stage-1 monopoly producers $N-m_A$ in the *own channel*, resulting in an aggregate cross-channel markup of $(N-m_A)\lambda(-\mu')$. The amplification reflects how each of the $N-m_A$ monopoly producers in channel A anticipates the best response of the sole rival-channel intermediary B.

The discussion above, based on (13), leads to the following corollary:

Corollary 1 *The interplay of vertical and horizontal marginalization yields the same aggregate within-channel markup under both rr and mm configurations, but results in different aggregate cross-channel markups.*

Notably, the difference in cross-channel interactions drives the divergence in price competition outcomes across the two configurations. These strategic cross-channel effects remain underexplored in the existing literature. In what follows, we show that such interactions yield novel insights when comparing alternative business model configurations.

4 Policy Implications

4.1 An industry-wide shift in business model

While traditional big-box intermediaries have predominantly operated under the reseller model, there has been a significant shift toward the marketplace model, particularly among emerging online retail platforms. To assess the impact of this industry-wide shift on competition and consumer welfare, we compare the equilibrium outcomes under the two configurations. In Section 5, we further demonstrate that the marketplace model emerges endogenously when intermediaries choose their business models prior to engaging in price competition.

We begin by identifying the differing impact on the market shares and profits for asymmetric intermediaries, as summarized below:

Proposition 3 *Suppose intermediary A has a stronger buyer power ($m_A > m_B$) and efficiency advantage $z \geq 0$. Then, the industry-wide shift from the reseller model to the marketplace model reduces intermediary A's market share and profit advantages relative to those of intermediary B, i.e.,*

$$0 \leq \Delta^*_{mm} < \Delta^*_{rr} \quad \textit{and} \quad 1 \leq \frac{\Pi^{A*}_{mm}}{\Pi^{B*}_{mm}} < \frac{\Pi^{A*}_{rr}}{\Pi^{B*}_{rr}}.$$

Suppose intermediary A has a clear advantage in terms of buyer power and efficiency. Naturally, this advantage translates into superior market share and profit relative to intermediary B, i.e., $\Delta^* > 0$ and $\Pi^{A*} > \Pi^{B*}$ under both configurations. However, Proposition 3 says that an industry-wide shift to the marketplace model diminishes intermediary A's dominance in both market share and profit advantages. To see this, note that in both configurations, Δ is pinned down by $\Delta + P^A_\omega(\Delta) - P^B_\omega(\Delta) = z$ for $\omega \in \{rr, mm\}$. From our earlier discussion in (13), we also know that $m_A > m_B$ implies $P^A_{mm}(\Delta) > P^A_{rr}(\Delta)$ (an analogous argument shows $P^B_{mm}(\Delta) < P^B_{rr}(\Delta)$). It follows that $P^A_{mm}(\Delta) - P^B_{mm}(\Delta) > P^A_{rr}(\Delta) - P^B_{rr}(\Delta)$, which implies $\Delta^*_{mm} < \Delta^*_{rr}$.

This result is driven by the differing cross-channel interactions in the two configurations. Intuitively, under the reseller model, intermediary A's buyer power directly amplifies its pricing advantage via the cross-channel interaction. In contrast, under the marketplace model, the cross-channel markup in channel A is no longer directly affected by its own buyer power m_A, but rather by that of the rival channel, m_B. As a result, intermediary A's buyer power advantage becomes less effective in shaping competitive outcomes, leading to a reduction in its relative market share and profit.

Building on Proposition 3, we now examine the implications for retail prices and profits. To gain tractability, we adopt the uniform distribution specification (1).

Proposition 4 *Continuing from Proposition 3 and assuming the uniform distribution specification (1), the industry-wide shift to the marketplace model yields the following effects:*

- *Higher equilibrium retail prices and intermediary profits in both channels, i.e., $P^{k*}_{mm} \geq P^{k*}_{rr}$ and $\Pi^{k*}_{mm} > \Pi^{k*}_{rr}$ for $k \in \{A, B\}$;*
- *Lower producer profit in channel A, i.e., $\pi^{A*}_{mm} < \pi^{A*}_{rr}$;*
- *Higher producer profit in channel B, i.e., $\pi^{B*}_{mm} < \pi^{B*}_{rr}$, if and only if $z < \bar{z}_0 \approx [1.5 + 3(N - m_A) - 1.37(m_A - m_B)]\bar{\theta}$.*

Proposition 4 highlights three important implications of an industry-wide shift to the marketplace model.

First, both intermediaries earn higher profits under the marketplace model. This occurs for two main reasons: (i) the marketplace model induces less intense cross-channel competition, leading to higher equilibrium prices, and (ii) as first-movers in pricing, intermediaries can extract greater surplus from monopoly producers. While the first-mover advantage has been previously analyzed in the literature (e.g., Johnson, 2017), the additional effect stemming from the relaxation of cross-channel competition under the marketplace model has not been identified.

The reasoning for the weakened price competition is the following. Continuing from (13) and fixing Δ, we observe that the shift to the marketplace model increases channel A's cross-channel markup from $(N - m_A)\lambda(-\mu')$ to $(N - m_B)\,\lambda(-\mu')$. This imposes upward pricing pressure on channel A's retail price, which—through strategic complementarities—translates into an upward pressure on channel B's retail price as well. Conversely, the cross-channel markup in channel B decreases from $(N - m_B)\,\mu\lambda'$ to $(N - m_A)\,\mu\lambda'$, generating downward pricing pressure on both channels. However, in equilibrium, the larger market share of channel A means that the upward pressure originating from channel A dominates, resulting in higher equilibrium retail prices in both channels.

Second, the shift to the marketplace model harms the (monopoly) producers in the leading channel A, as the intermediary gains a first-mover advantage in pricing, enabling it to extract greater surplus from upstream producers. In contrast, the impact on producers in the rival channel B is ambiguous. On one hand, channel-B producers are harmed by intermediary B's increased ability to extract rents due to its first-mover position. On the other hand, they benefit from an expanded market share under the marketplace model. When channel B's competitive disadvantage is relatively small—i.e., when $z < \bar{z}_0$ —the positive market share effect dominates, leading to higher producer profits in channel B.

Third, the shift to the marketplace model weakens retail competition, leading to higher retail prices and, consequently, lower consumer surplus. Notably, this competition-dampening effect is absent in the existing literature (e.g, Johnson, 2017), which focuses on monopoly or symmetric duopoly intermediaries. To see this, observe that if intermediaries have equal buyer power, i.e., $m_A = m_B$ (while allowing for any efficiency difference z), then differences in cross-channel markups across the two configurations become irrelevant. In this case, the equilibrium outcomes are identical: $\Delta^*_{mm} = \Delta^*_{rr}$ so that $P^{k*}_{rr} = P^{k*}_{mm}$ for $k \in \{A, B\}$. Regardless of the value of z, the only effect of the shift from the reseller to the marketplace configuration is a redistribution of profits—away from producers and toward intermediaries within each channel: $\pi^{k*}_{mm} < \pi^{k*}_{rr}$ and $\Pi^{k*}_{mm} > \Pi^{k*}_{rr}$ for $k \in \{A, B\}$.

In sum, by allowing for asymmetric buyer power, our model shows that changes in intermediation models affect not only profit distribution but also prices, competition intensity, and consumer surplus. This perspective complements existing analyses—which primarily highlight producer harm under marketplace models—by uncovering novel consumer harms that emerge in the presence of asymmetric competing intermediaries.

4.2 Implications of buyer power

We now examine the price and profit implications of stronger buyer power for each intermediary $k \in \{A, B\}$, represented by an increase in the number m_k of fringe producers supplying that intermediary (holding N fixed). Specifically, consider a category $i \in N \backslash F^k$ that is initially supplied by a monopoly producer. Suppose intermediary k acquires homogeneous alternative sources for category i, so that it is now supplied by fringe producers. This amounts to moving category i from set $\mathcal{N} \backslash \mathcal{F}^k$ to set F^k, thereby increasing m_k by one.

☐ **Price and intermediary profits.** In what follows, we focus on the comparative statics with respect to intermediary A's buyer power m_A, noting that results for m_B follow symmetrically by appropriately adjusting the value of z. To facilitate the analysis, we treat m_A as a continuous variable and derive the comparative statics using calculus. As shown below, this approach entails no loss of generality, since the sign of the comparative statics remains unchanged for all $m_A \in [0, N]$.[16]

Proposition 5 *An increase in intermediary A's buyer power m_A has the following effects (where*

[16] The only exception is $d\Pi^{A*}/dm_A$, which can change its sign from negative to positive when m_A increases from 0 to N.

$\bar{z} < 0$ *is a threshold independent of* m_A*):*

Configuration	P^{A*} *and* P^{B*}	Δ^*	Π^{A*}	Π^{B*}
Reseller (rr)	$\downarrow$	$\uparrow$	$\uparrow$	$\downarrow$
Marketplace (mm)	$\downarrow$	$\downarrow$ *if* $z < \bar{z}$ $\uparrow$ *otherwise*	$\downarrow$ *if* $z < \bar{z}$ $\sim$ *otherwise*	$\downarrow$

" $\uparrow$ *" = increases; "* $\downarrow$ *" = decreases; "* $\sim$ *" = generally non-monotone.*

In both configurations, stronger buyer power in channel A (i.e., a higher m_A) consistently leads to lower equilibrium retail prices by mitigating the marginalization problem within that channel. This, in turn, induces more competitive pricing and intensifies cross-channel competition, thus increasing consumer surplus.[17] However, the implications for market shares and profits differ across the two configurations.

In the reseller configuration, the results align with conventional wisdom: greater buyer power enhances the competitiveness of intermediary A, leading to an increase in its market share Δ^*_{rr} and profit Π^{A*}_{rr}, while reducing those of intermediary B. In contrast, these effects may not hold in the marketplace configuration. Specifically, when channel A has a large disadvantage in efficiency (i.e., $z < \bar{z} < 0$), an increase in m_A may reduce both Δ^*_{mm} and Π^{A*}_{mm}.

To understand this disparity across configurations, we totally differentiate the expressions for Δ^*_{rr} and Δ^*_{mm} given in Propositions 1 and 2. This yields the following comparative statics conditions. In the reseller model, we have:

$$\frac{d\Delta^*_{rr}}{dm_A} > 0 \Leftrightarrow \frac{\partial P^A_{rr}}{\partial m_A} = \left[-\lambda\left(1 + \lambda' - \mu'\right)\right]_{\Delta=\Delta^*_{rr}} < 0.$$

This inequality always holds, since increasing m_A reduces the own-channel markup (i.e., $\partial P^A_{rr}/\partial m_A < 0$) without affecting the rival-channel markup (i.e., $\partial P^B_{rr}/\partial m_A = 0$). In contrast, in the marketplace model, we obtain:

$$\frac{d\Delta^*_{mm}}{dm_A} > 0 \Leftrightarrow \frac{\partial P^A_{mm}}{\partial m_A} - \frac{\partial P^B_{mm}}{\partial m_A} = \left[-\lambda\left(1 + \lambda'\right) + \mu\lambda'\right]_{\Delta=\Delta^*_{mm}} < 0.$$

Here, the last inequality does not always hold. An increase in m_A reduces the own-channel markup (i.e., $\partial P^A_{mm}/\partial m_A < 0$), but also reduces the rival-channel markup through cross-channel

[17] Our results for the reseller configuration parallel those of Gaudin (2018), who analyzes a model in which a monopoly producer engages in bilateral Nash bargaining with several competing intermediaries. He shows that a merger between intermediaries—interpreted as an increase in buyer power—can lower input and retail prices. However, the pro-consumer effect of lower prices is partially offset by weakened downstream competition. In contrast, our model captures buyer power as the elimination of producer margins due to shifts in bargaining positions that do not stem from mergers. As a result, an increase in buyer power in our setting lowers retail prices in both the intermediary's own channel and its rival's, thereby amplifying the pro-consumer effect and improving consumer surplus.

interactions (i.e., $\partial P^B_{mm}/\partial m_A < 0$). As a result, $d\Delta^*_{mm}/dm_A > 0$ holds only if the effect on the own channel outweighs the effect on the rival channel.

Proposition 5 further shows that when $z < \bar{z} < 0$ —so that intermediary A is an underdog with a large efficiency disadvantage —the impact of increased buyer power m_A on the rival channel B dominates that on the own channel. Consequently, an increase in m_A reduces intermediary A's market share and profit ($d\Delta^*_{mm}/dm_A < 0$ and $d\Pi^{A*}_{mm}/dm_A < 0$).

A novel implication of Proposition 5 is that an intermediary operating under the marketplace model—such as an e-commerce platform—may have a strategic incentive to deliberately weaken its buyer power, particularly when it faces a significant efficiency disadvantage. In such cases, the intermediary may benefit from limiting competition among producers in certain product categories. This can be achieved, for example, by stocking more big-brand products or manipulating aspects of platform recommendations and governance design (e.g., Dinerstein et al., 2018; Casner, 2020; Teh, 2022; Choi and Jeon, 2023; Johnson et al., 2023). Intuitively, although reducing competition among producers increases their markups within the intermediary's own channel, it also softens the competitive pressure from the rival intermediary. This mechanism highlights a potential avenue for anti-competitive conduct that benefits intermediaries but ultimately leads to higher equilibrium retail prices and reduced consumer welfare.[18]

For completeness, let us now consider the case where $z > \bar{z}$. In this setting, Proposition 5 shows that an increase in m_A leads to an expansion of channel A's market share (i.e., Δ^*_{mm} increases), while the effect on intermediary A's profit is ambiguous. To obtain sharper results, we impose the uniform distribution specification introduced in (1). Under this assumption, the critical threshold becomes:[19]

$$\bar{z} = -\bar{\theta}\left(\frac{1}{2} + N - m_B\right).$$

When $z \geq \bar{z}$, we can show that $d\Pi^{A*}_{mm}/dm_A < 0$ holds if and only if $m_A < \frac{1}{2} + N - z/\bar{\theta}$, which corresponds to cases where Δ^*_{mm} is sufficiently small. Figure 3 below illustrates Proposition 5. We assume linear demand with parameters $\bar{\theta} = 2$, $N = 10$, $m_B = 7$. We consider varying levels of value difference $z \in \{-10, -7, 10\}$. The parameters imply $\bar{z} = -7$.

[18] Notably, our reasoning here differs from those in the literature, whereby a platform's incentive to limit seller competition typically stem from tariff structures that internalize seller profits, such as proportional fees or seller-side participation fees (e.g., Casner, 2020; Teh, 2022; Choi and Jeon, 2023).

[19] In the proof of Proposition 5, we further show that $z \geq \bar{z}$ implies that $\Delta^*_{mm} > 0$ for any m_A and m_B. Therefore, $z < \bar{z}$ does not necessarily violate the interiority of the equilibrium.

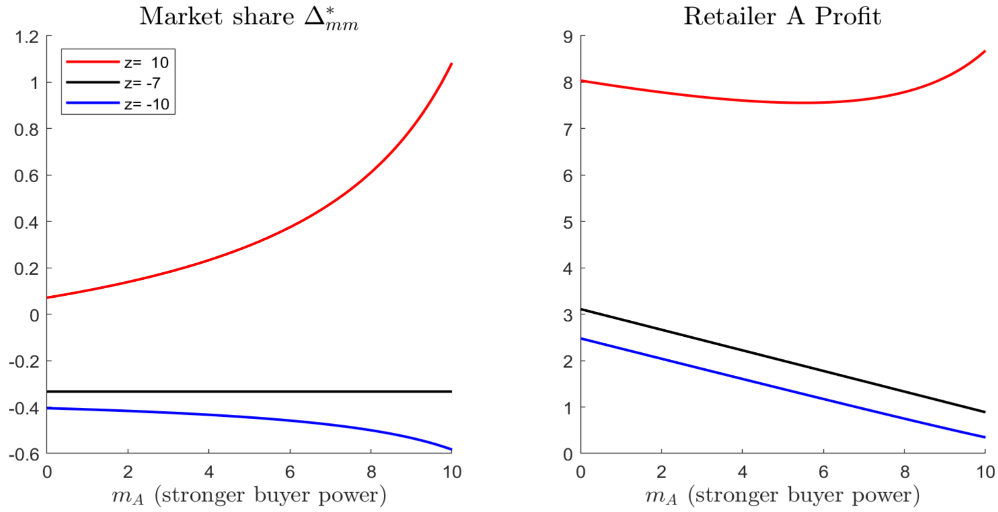

Figure 3. Effects of buyer power in the marketplace mode depends on z.

□ **Producer profits.** Recall that our comparative statics analysis is framed as intermediary A gaining buyer power with respect to a specific category $i \in \mathcal{N} \backslash \mathcal{F}^A$ —that is, moving category i from set $\mathcal{N} \backslash \mathcal{F}^A$ into the set $\mathcal{F}^A$ of categories supplied by fringe producers. As a result, the profit of the producer previously supplying category i, denoted as π_i^{*A}, must decline under both configurations. It remains to examine the impact on producer profits in other categories $j \neq i$ in channel A and arbitrary categories j in channel B, denoted respectively as $\{\pi_j^{*A}\}_{j \neq i}$ and $\{\pi_j^{*B}\}_{j \notin \mathcal{F}^B}$.

Corollary 2 *When intermediary A gains buyer power with respect to some category i, thereby increasing m_A, it has the following effects (where $\bar{z}$ is defined as in Proposition 5):*

Configuration	π_j^{*A}, $j \neq i$	π_j^{*B}, $j \notin \mathcal{F}^B$
Reseller (rr)	$\uparrow$	$\downarrow$
Marketplace (mm)	$\downarrow$ *if* $z < \bar{z}$	$\uparrow$ *if* $z < \bar{z}$
	$\uparrow$ *otherwise*	$\downarrow$ *otherwise*

"$\uparrow$" = increases; "$\downarrow$" = decreases.

Corollary 2 shows that stronger buyer power for intermediary A is not always harmful to producers in channel A. Intuitively, when intermediary A gains buyer power over a specific category i, monopoly producers in other categories $j \neq i$ within the same channel may benefit, provided that the equilibrium market share of channel A, Δ^*, increases. According to Proposition 5, under the reseller model, an increase in m_A consistently leads to a higher Δ^*_{rr}, thereby raising π_j^{*A} for all $j \neq i$. In contrast, under the marketplace model, increasing m_A can lead to a decline in both Δ^*_{mm} and π_j^{*A} when channel A's faces a large efficiency disadvantage (i.e., $z < \bar{z} < 0$). In this case, the gain in buyer power harms producers in other categories within the same channel. The opposite implications apply symmetrically to channel-B producers.

5 Business model as a competitive advantage

Our baseline model analyzes the dynamics of price competition in multiproduct retail channels with symmetric configurations of business models. In this section, we endogenize the choice of business models. To this end, we first describe the pricing equilibrium under asymmetric business models in Section 5.1. We then present the optimal response in business model choices for an individual intermediary perspective in Section 5.2. Finally, we identify the equilibrium business model configurations in Section 5.3. All proofs are relegated to Online Appendix B.

5.1 Mixed configuration

As a preliminary step, let us briefly consider the case of a mixed configuration, in which intermediary A adopts the marketplace model and intermediary B adopts the reseller model. We refer to this configuration as mr, with rm denoting its mirror case. The timing of pricing decisions in this configuration proceeds as follows. In Stage 1, intermediary A sets per-unit fees f^A, while producers in channel B set wholesale prices $\{w_i^B\}_{i\in\mathcal{N}}$; In Stage 2, producers in channel A and intermediary B set retail prices $\{p_i^A\}_{i\in\mathcal{N}}$ and $\{p_i^B\}_{i\in\mathcal{N}}$, respectively.

The analysis of this configuration is straightforward as it essentially combines the reseller and marketplace configurations considered in the baseline model. The equilibrium is summarized below:

Lemma 1 *(mixed configuration equilibrium mr). Denote channel-A and channel-B equilibrium markup functions as*

$$\begin{array}{ll} P^A_{mr}(\Delta) \equiv & \underbrace{\begin{array}{c}\lambda(\Delta) + (N - m_A)\lambda(\Delta)(1 + \lambda'(\Delta)) \\ \mu(\Delta) + (N - m_B)\mu(\Delta)(1 - \mu'(\Delta))\end{array}}_{\text{aggregate within-channel markup}} + \underbrace{\begin{array}{c}\lambda(\Delta)(-\mu'(\Delta)) \\ (N - m_B)(N - m_A)\mu(\Delta)\lambda'(\Delta)\end{array}}_{\text{aggregate cross-channel markup}} . \\ P^B_{mr}(\Delta) \equiv & \end{array} \tag{14}$$

The equilibrium value difference Δ^*_{mr} is uniquely pinned down by

$$\Delta^*_{mr} = z + P^B_{mr}(\Delta^*_{mr}) - P^A_{mr}(\Delta^*_{mr}),$$

and the aggregate retail prices are $P^A_{mr}(\Delta^*_{mr})$ and $P^B_{mr}(\Delta^*_{mr})$.

Lemma 1 suggests a disadvantage of the reseller model (relative to the marketplace model) that arises due to strategic interaction across channels. As shown in (14), the aggregate cross-channel markup differs across the two channels due to their asymmetric business models. In channel A, which adopts the marketplace model, the cross-channel interaction term $(-\mu')$ is not influenced by the Cournot miscoordination effect from either channel, because the Stage-1 intermediary in channel A optimally responds to the Stage-2 pricing set by intermediary B. As a result, the pricing distortion from the cross-channel interaction is independent of m_A and m_B. In contrast, in channel B, which operates under the reseller model, each Stage-1 monopoly producer anticipates the best response from each Stage-2 monopoly producer in the rival channel A that adopts the marketplace model. Consequently, the cross-channel interaction (λ') is amplified twice by the Cournot effect, resulting in the aggregate cross-channel markup $(N - m_B)(N - m_A)\mu\lambda'$.

Due to this double amplification, channel B is placed at a competitive disadvantage whenever $m_B < N$ and $m_A < N$. Indeed, it can be shown that if the two intermediaries are otherwise equivalent ($z = 0$ and $m_B = m_A < N$), then the equilibrium satisfies $\Delta^*_{mr} > 0$, meaning that channel B captures less than half of the market in equilibrium. Hence, an interesting implication of Lemma 1 is that, in head-to-head retail competition, a channel operating under the reseller model (e.g., traditional retailers) may be disadvantaged relative to a rival channel adopting the marketplace model (e.g., online retail platforms), purely due to differences in how the business models shape strategic interactions across channels. This highlights the possibility that intermediaries may have incentives to strategically choose their business models to strengthen their competitive positions, which we analyze next.

5.2 Best-responding business models

Suppose intermediaries simultaneously choose their business models prior to the pricing game. Our first question is: what is intermediary k's best-response business model, given the business model choice of its rival, denoted $-k$? This analysis is also relevant in settings where one intermediary is an incumbent with a fixed business model, and the other is an entrant that can choose between the reseller and marketplace models before entering the market.

Without loss of generality, we focus on deriving intermediary A's best-responding choice of business model. For clarity, we denote the business model choices as $\omega_A, \omega_B \in \{rs, mk\}$, with rs representing the reseller model and mk the marketplace model. We begin by examining how intermediary A's choice affects its equilibrium market share:

Lemma 2 *If intermediary A's buyer power satisfies $m_A < N$, then its market share always increases when it switches from the reseller to the marketplace model, regardless of B's business model, i.e.,*

$$\Delta^*_{mr} \geq \Delta^*_{rr} \quad \textit{and} \quad \Delta^*_{mm} \geq \Delta^*_{rm}. \tag{15}$$

If intermediary A's buyer power is maximal at $m_A = N$, then the opposite inequalities hold in (15).

Lemma 2 is driven by the way business models shape the aggregate markup arising from cross-channel interactions, as discussed in Section 3. The key idea is that channel A becomes relatively more competitive when its Stage-2 prices are set by the party that is more responsive to Stage-1 prices in the rival channel—namely, monopoly producers when $m_A < N$ (i.e., intermediary A sources from at least one monopoly producer), and the intermediary itself when $m_A = N$ (i.e., all categories are supplied by fringe producers).[20] Adopting the marketplace model enables channel A to mitigate its aggregate markup from the cross-channel interaction, while amplifying the corresponding markup in channel B.

Building on Lemma 2, we obtain the best-response function $BR_A(\omega_B)$ as follows:

Proposition 6 *Let $BR_A(\omega_B) \in \{rs, mk\}$ denote intermediary A's optimal business model choice when intermediary B adopts $\omega_B \in \{rs, mk\}$.*

- *If $m_A < N$, then $BR_A(\omega_B) = mk$ for all ω_B.*
- *If $m_A = N$ and $m_B = N$, then $BR_A(rs) = mk$ and $BR_A(mk) = rs$.*
- *If $m_A = N$ and the uniform distribution specification (1) holds, then there exists a cutoff threshold $\bar{m}_B \leq N - 1$ such that $BR_A(\omega_B) = mk$ if $m_B < \bar{m}_B$.*

As long as intermediary A's buyer power is less than maximal (i.e., $m_A < N$), Proposition 6 shows that choosing the marketplace model is a dominant strategy. However, when $m_A = N$, the reseller model may become optimal. This result reflects the interaction of two main economic forces that shape intermediary A's business model choice:

- *Cross-channel competitive advantage*: As discussed in Lemma 2, intermediary A can enhance the competitiveness of channel A by allowing the party that is more strategically responsive to set Stage-2 prices. This effect favors the marketplace model when $m_A < N$, but favors the reseller model when $m_A = N$.
- *Within-channel first-mover advantage*: In vertically related monopoly channels, it is well established that the Stage-1 player earns higher profits when prices are strategic substitutes. This effect applies in our competitive setting as well and consistently favors the marketplace model. However, it becomes irrelevant when intermediary A has maximal buyer power (i.e., $m_A = N$) and thus faces only fringe producers in its channel.

[20] Remarkably, this result does not depend on m_B or other characteristics of channel B.

The results in Proposition 6 can be understood by considering the combined effects of both forces. When $m_A < N$, both forces align in favor of the marketplace model, making it the dominant strategy for intermediary A. When $m_A = N$, the first force (cross-channel competitive advantage) now favors the reseller model, while the second force (within-channel first-mover advantage) becomes irrelevant. Nevertheless, the marketplace model may still be superior because it has an additional advantage that arises only when $m_A = N$: the ability of intermediary A to commit to its final price through its Stage-1 fee. In this case, since all producers price at marginal cost, the Stage-1 fee directly determines the final retail price in channel A. By committing to a high final price (via a higher fee), intermediary A can induce the strategically responsive second movers in channel B to also raise their prices, thus avoiding aggressive undercutting.[21] Thus, Proposition 6 shows that as long as the rival's buyer power m_B is not too strong, the marketplace model remains the dominant choice for intermediary A.

5.3 Equilibrium configuration

We are now ready to analyze the equilibrium business model configurations, where both intermediaries simultaneously choose their business models prior to the pricing game. The equilibrium outcomes follow directly from the best responses characterized in Proposition 6, with analogous reasoning applied to intermediary B.

Corollary 3 *(Equilibrium business model).*

- *If $m_A < N$ and $m_B < N$, then both intermediaries adopt the marketplace model in the equilibrium.*
- *If $m_A = m_B = N$, then intermediaries adopt distinct business models in the equilibrium.*

Corollary 3 shows that symmetric marketplace configurations arise in equilibrium as long as both intermediaries lack maximal buyer power (i.e., $m_A < N$ and $m_B < N$). This finding supports our focus on the industry-wide shift to the marketplace model, as discussed in Section 4.1. In contrast, when both channels possess strongest buyer power (i.e., $m_A = m_B = N$), the equilibrium features asymmetric business model choices, as intermediaries strategically differentiate to soften competition.

We acknowledge that an intermediary's choice of business model is shaped by a range of factors, including logistics, category management, marketing activities, and differences in operational costs across models. For example, Hagiu and Wright (2015) frame the choice as an allocation of control rights over non-contractible variables such as marketing, showing that the preferred model—reseller or marketplace—depends on whether the intermediary or independent

[21] This is reminiscent to the reasoning in the classic literature on sequential price competition (Gal-Or, 1985; Bonanno and Vickers, 1988).

suppliers possess more relevant information for tailoring product-specific marketing strategies. Tian et al. (2018) highlight that the interplay between order-fulfillment costs and the intensity of upstream competition also influences the optimal business model. In this paper, we abstract from these considerations and focus solely on the strategic advantages and disadvantages of each model, taking other factors as exogenous.

6 Extensions and applications

In this section, we extend and apply our framework to several additional settings: hybrid platform models (Section 6.1), vertical integration within each channel (Section 6.2), and multihoming producers that supply and sell across both channels (Section 6.3). All proofs and omitted technical details are provided in the Online Appendices C-E.

6.1 Hybrid models

An increasing number of e-commerce intermediaries—such as Amazon, JD.com, Target, and Walmart—are adopting the so-called hybrid platform model (e.g., Etro, 2021; Hagiu et al., 2022; Zennyo, 2022; Anderson and Bedre-Defolie, 2024; Hervas-Drane and Shelegia, forthcoming). That is, the intermediary functions both as a marketplace (allowing third-party producers to sell directly to consumers) and as a reseller (selling directly to consumers itself). Existing theoretical work on hybrid models has primarily focused on cases where the intermediary competes with third-party sellers within the same product categories—i.e., it is a hybrid within each category. In this section, we offer a new perspective by analyzing intermediaries that are hybrids across categories—operating as a marketplace in some categories and as a reseller in others.

We now extend our baseline model setup to analyze intermediary competition under the hybrid configuration. For simplicity, we assume that each category i is supplied by a monopoly producer, i.e., $m_A = m_B = 0$, and that both intermediaries adopt the hybrid model. In each channel $k \in \{A, B\}$, a subset S_r^k of categories operate under the reseller mode, with cardinality $|S_r^k| = n_k$. The remaining categories, denoted by S_m^k, operate under the marketplace model, with $|S_m^k| = N - n_k$. To rule out the trivial case of a pure marketplace configuration, we restrict attention to $1 \leq n_k \leq N$ for each channel $k \in \{A, B\}$.

The timing of the game is as follows: in Stage 1, each producer in the "reseller categories" $i \in S_r^k$ sets a wholesale price w_i and, simultaneously, intermediary k sets a per-unit fee f^k. In Stage 2, each intermediary k sets the retail price p_i^k for its "reseller categories" $i \in S_r^k$ and, simultaneously, each producer in the "marketplace categories" $j \in S_m^k$ sets a retail price p_j^k.

Consider the Stage-2 pricing subgame given the Stage-1 wholesale prices $\{w_i^k\}_{i \in S_r^k}$ and per-unit fees f^k at both channels. Focusing on retail pricing in channel A, each producer in a marketplace category $j \in S_m^A$ faces the same optimization problem as in the baseline model and thus sets the retail price $p_j^A = f^A + \lambda(\Delta)$. For each reseller category $i \in S_r^A$, intermediary A chooses $\{p_i^A\}_{i\in S_r^A}$ to maximize its profit

$$\Pi^A = \left(\sum\nolimits_{i\in S_r^A} p_i^A - \sum\nolimits_{i\in S_r^A} w_i^A + (N-n_A)f^A\right) G(\Delta),$$

where $(N-n_A)f^A$ is the sum of fees collected from the marketplace categories. The first-order condition yields

$$\sum\nolimits_{i\in S_r^A} p_i^A + (N-n_A)f^A = \sum\nolimits_{i\in S_r^A} w_i^A + \lambda(\Delta).$$

Therefore, the total retail price in channel A is

$$\sum\nolimits_{i\in S_r^A} p_i^A + \sum\nolimits_{i\in S_m^A} p_j^A = \sum\nolimits_{i\in S_r^A} w_i^A + (N-n_A+1)\,\lambda(\Delta),$$

which is independent of f^A.

A similar analysis for channel B shows

$$\sum\nolimits_{i\in S_r^B} p_i^B + \sum\nolimits_{i\in S_m^B} p_j^B = \sum\nolimits_{i\in S_r^B} w_i^B + (N-n_B+1)\mu(\Delta).$$

The equilibrium value difference Δ^* is determined by

$$\Delta = z + \sum\nolimits_{i\in S_r^B} w_i^B - \sum\nolimits_{i\in S_r^A} w_i^A + (N-n_B+1)\mu(\Delta) - (N-n_A+1)\lambda(\Delta), \qquad (16)$$

which is independent of Stage-1 fees due to the aforementioned internalization mechanism. Therefore, in the Stage-1 pricing problem, without loss of generality we assume the intermediaries set $f^A = f^B = 0$. Meanwhile, for each reseller category $i \in S_r^k$, the producer's Stage-1 wholesale pricing problem is the same as the baseline reseller configuration. Substituting the resulting wholesale prices into (16) determines the overall equilibrium.

Proposition 7 *In the hybrid configuration with $n_k \geq 1$, the channel-A and channel-B equilibrium markup functions are given by*

$$P_{hh}^A(\Delta) = (N+1)\lambda(\Delta) + n_A\lambda(\Delta)\left[(N-n_A+1)\lambda'(\Delta) - (N-n_B+1)\mu'(\Delta)\right], \qquad (17)$$

$$P_{hh}^B(\Delta) = (N+1)\mu(\Delta) + n_B\mu(\Delta)\left[(N-n_A+1)\lambda'(\Delta) - (N-n_B+1)\mu'(\Delta)\right]. \qquad (18)$$

The equilibrium value difference Δ_{hh}^* is uniquely pinned down by

$$\Delta_{hh}^* = z + P_{hh}^B(\Delta_{hh}^*) - P_{hh}^A(\Delta_{hh}^*), \qquad (19)$$

and the aggregate retail prices are $P_{hh}^A(\Delta_{hh}^*)$ and $P_{hh}^B(\Delta_{hh}^*)$.

Under the hybrid configuration, the intermediary can coordinate pricing across the two stages, eliminating vertical marginalization in categories $j \in S_m^k$. However, in the remaining categories $i \in S_r^k$, the interaction between vertical and horizontal marginalization leads to a double amplification of both within-channel and cross-channel interactions.[22] In channel A, the markup arising from within-channel interaction is amplified by a factor of $n_A \times (N - n_A + 1)$, as each of the n_A producers involved in Stage-1 pricing anticipates the strategic responses of the $N - n_A + 1$ players engaged in Stage-2 pricing. Similarly, the markup due to cross-channel interaction is amplified by $n_A \times (N - n_B + 1)$, since each of the n_A producers in Stage-1 pricing anticipates the strategic response of each of the $(N - n_B + 1)$ players in the rival channel's Stage-2 pricing. This double amplification can dominate, resulting in higher retail prices and lower consumer surplus compared to a pure marketplace configuration.

We now compare Proposition 7 with the pure marketplace configuration in Proposition 2 to examine the implications of a shift toward the hybrid configuration. In the hybrid configuration, the double amplification of marginalization effects can result in higher aggregate markups relative to the marketplace configuration. Specifically, under the marketplace configuration with $m_k = 0$, the aggregate markup in channel A is:

$$P_{mm}^A(\Delta) = (N+1)\,\lambda(\Delta) + N\lambda(\Delta)\left[\lambda'(\Delta) - \mu'(\Delta)\right],$$

where both the within-channel and cross-channel interactions are amplified by N only. Assuming symmetry with $n_A = n_B = n$, the condition $N \leq n(N - n + 1)$ implies that markups are higher under the hybrid model, leading to higher prices in both channels. This industry-wide shift softens competition and reduces consumer surplus. The resulting welfare implications are as follows:[23]

Corollary 4 *Suppose the intermediaries are symmetric (i.e., $z = 0$ and $n_A = n_B = n$). Then, a shift from the marketplace configuration ($n = 0$) to the hybrid configuration ($n > 0$) leads to higher equilibrium prices ($P_{hh}^{k*} \geq P_{mm}^{k*}$), higher producer profits ($\pi_{hh}^{k*} \geq \pi_{mm}^{k*}$), and lower intermediary profits ($\Pi_{hh}^{k*} \leq \Pi_{mm}^{k*}$) in both channels.*

6.2 Vertical integration

In the grocery retail sector, there is a growing trend of supermarkets vertically integrating by acquiring suppliers and taking ownership of parts of their supply chains (ACCC, 2025). Our framework can be directly applied to study the implications of such within-channel vertical integration in a multiproduct setting. In this section, we show that, under the reseller configuration,

[22] A similar form of double amplification appears in the cross-channel interaction under the asymmetric configuration mr.

[23] Note that the result below is not a violation of Proposition 4 (which assumes asymmetric intermediaries). If we impose symmetry in Proposition 4, then we yield $P_{mm}^{k*} = P_{rr}^{k*}$, consistent with the case of $n = N$ of Corollary 4 where $P_{mm}^{k*} = P_{hh}^{k*}$ holds.

vertical integration between an intermediary k and one of its producers is formally equivalent to an increase in the intermediary's buyer power m_k. We then demonstrate that the same logic extends to the marketplace configuration when a non-negative pricing constraint (NPC) is imposed on retail prices.

Suppose intermediary k initially transacts with a single monopoly producer in each category $i \in \mathcal{N}$. Through the development of private-label products or strategic acquisition, intermediary k becomes vertically integrated with a subset F^k of producers. We define $m_k = |\mathcal{F}^k|$ as the number of product categories in which intermediary k has an integrated presence. Within each integrated category $l \in \mathcal{F}^k$, the retail prices p_l^k are set to maximize the joint profit of the vertically integrated entity, taking the wholesale price or the per-unit fee as internal transfers. In contrast, the remaining (independent) producers $i \in \mathcal{N} \backslash \mathcal{F}^k$ continue to set prices independently, creating double marginalization. The timing of the game remains the same as in the baseline setting.

☐ **Reseller configuration.** Under the reseller configuration, the remaining $N - m_k$ independent producers set their wholesale prices w_i. Consider the stage-2 pricing decision of intermediary A, who now internalizes the profit of each vertically integrated producer $l \in \mathcal{F}^A$. As the wholesale prices w_l^A by the intergrated producers $l \in \mathcal{F}^A$ are treated as internal transfers, the first-order condition for the optimal prices $\{p_i^A\}_{i \in \mathcal{N}}$ yields

$$\sum\nolimits_{i \in \mathcal{N}} p_i^A = \sum\nolimits_{i \in \mathcal{N} \backslash \mathcal{F}^A} w_i^A + \lambda(\Delta^*).$$

Hence, it is without loss of generality to set $w_l^A = 0$, as if producer l behaves like a competitive fringe. Meanwhile, each independent monopoly producer $i \in \mathcal{N} \backslash \mathcal{F}^k$ behaves the same as in the baseline model. Applying the same argument to channel B shows $w_l^B = 0$. Therefore, the resulting equilibrium is exactly the same as Proposition 1, with $N - m_k$ independent monopoly producers in each channel k.

☐ **Marketplace configuration**. Suppose that we restrict retail prices to be non-negative. Given the Stage-1 per-unit fees f^A and f^B, in Stage 2, all non-integrated producers $i \in \mathcal{N} \backslash \mathcal{F}^A$ set $p_i^A = f^A + \lambda(\Delta^*)$, as in the baseline model. Meanwhile, the integrated entity (of intermediary A and producers $l \in \mathcal{F}^A$) chooses prices $\{p_l^A\}_{l \in \mathcal{F}^A}$ to maximize

$$\left(\sum\nolimits_{l \in \mathcal{F}^A} p_l^A + (N - m_A) f^A\right) G(\Delta),$$

where $(N - m_A) f^A$ is the sum of per-unit fees collected from non-integrated producers. Taking into account the non-negative pricing constraint, the first-order conditions yield:

$$\sum\nolimits_{l \in \mathcal{F}^A} p_l^A = \max\{0, -(N - m_A) f^A + \lambda(\Delta^*)\}. \tag{20}$$

A similar analysis for channel B shows $\sum_{l \in \mathcal{F}^B} p_l^B = \max\{0, -(N - m_B) f^B + \mu(\Delta^*)\}$.

Suppose the non-negative pricing constraints (NPC) bind in both channels in the equilibrium, implying

$$\sum_{l\in\mathcal{F}^A} p_l^A = \sum_{l\in\mathcal{F}^B} p_l^B = 0.$$

This requires $f^A > \frac{\lambda(\Delta^*)}{N-m_A}$ and $f^B > \frac{\mu(\Delta^*)}{N-m_B}$, which we verify ex-post to be true. Given the binding non-negative pricing constraint, in the equilibrium of the subgame,

$$\Delta^* = z + \sum_{i\in\mathcal{N}\backslash\mathcal{F}^B} p_i^B - \sum_{i\in\mathcal{N}\backslash\mathcal{F}^A} p_i^A = z + (N-m_B)(f^B + \mu(\Delta^*)) - (N-m_A)(f^A + \lambda(\Delta^*)). \tag{21}$$

Then, Stage-1 pricing decisions yield

$$f^A = \frac{-\lambda(\Delta^*)}{d\Delta^*/df^A} = \frac{\lambda(\Delta^*)}{N-m_A}(1 + (N-m_A)\lambda'(\Delta^*) - (N-m_B)\mu'(\Delta^*)), \tag{22}$$

$$f^B = \frac{\mu(\Delta^*)}{d\Delta^*/df^B} = \frac{\mu(\Delta^*)}{N-m_B}(1 + (N-m_A)\lambda'(\Delta^*) - (N-m_B)\mu'(\Delta^*)). \tag{23}$$

Substituting these expressions back into (21) yields the same equilibrium as in Proposition 2. Moreover, conditions (22) and (23) imply that $f^A > \frac{\lambda(\Delta^*)}{N-m_A}$ and $f^B > \frac{\mu(\Delta^*)}{N-m_B}$ indeed hold in equilibrium, given that $\lambda' > 0$ and $-\mu' > 0$. Thus, the non-negative pricing constraints are binding.[24] As shown in Online Appendix D, it is never optimal for any intermediary to unilaterally set a sufficiently low fee—such as $f^k = 0$—to render the NPC constraint non-binding, regardless of the rival's fee. Therefore, (22) and (23) uniquely characterize the equilibrium fees.

To intuitively understand why the NPC must bind in the equilibrium, consider the case without the NPC. From (20), we obtain $\sum_{l\in\mathcal{F}^A} p_l^A = -(N-m_A)f^A + \lambda(\Delta^*)$, so the total retail price in channel A becomes

$$\sum_{l\in\mathcal{F}^A} p_l^A + \sum_{i\in\mathcal{N}\backslash\mathcal{F}^A} p_i^A = (N-m_A+1)\lambda(\Delta^*),$$

which is independent of channel-A fee f^A. Applying the same reasoning to channel B yields a total retail price of $(N-m_B+1)\mu(\Delta^*)$, also independent of f^B. Given the irrelevance of Stage-1 fees, the model reduces to a one-stage model with $N-m_k+1$ independent price-setting players in each channel k. The marketplace configuration equilibrium is then characterized by $\Delta^*_{mm} = z + P^B_{mm}(\Delta^*_{mm}) - P^A_{mm}(\Delta^*_{mm})$, with markup functions $P^A_{mm}(\Delta) \equiv (N-m_A+1)\lambda(\Delta)$ and $P^B_{mm}(\Delta) \equiv (N-m_B+1)\mu(\Delta)$, whereby both within-channel and cross-channel interactions (manifested as derivatives λ' and μ') vanish. Intuitively, without the NPC, an integrated intermediary has no commitment power: its Stage-1 fee f^k can be entirely offset in Stage 2 by lowering retail prices $\sum_{l\in\mathcal{F}^k} p_l^k$. In contrast, a binding NPC restores commitment power—by setting a sufficiently high f^k, the intermediary ensures it cannot later nullify it

[24] The presence of retail marginal cost (say, $c > 0$) does not affect our conclusion here. In that case, the condition for the binding constraint in channel A simply becomes $f^A > \frac{\lambda(\Delta^*)}{N-m_A} + c$, which is implied by a modified version of (22) that similarly adds the cost term c to its right hand side.

through price cuts constrained by $p_l^k \geq 0$.

The following corollary summarizes the main result of this section.

Corollary 5 *Each vertically integrated producer's pricing behavior corresponds to that of a fringe producer in our baseline model under the reseller configuration, and also under the marketplace configuration if the retail prices are restricted to be non-negative.*

Corollary 5 yields two important implications. First, it offers a microfoundation for the buyer-power parameter m_k in the baseline model by interpreting it as the number of product categories in which intermediary k has integrated presence. Second, the effects of increasing vertical integration mirror those of increasing buyer power m_k, as analyzed in Section 4.2. In particular, vertical integration in channel k (i.e., an increase in m_k) does not necessarily lead to higher market share or profits for that channel, due to its impact on cross-channel strategic interactions.

6.3 Cross-channel listings and multihoming

In this section, we show that the assumption of exclusive channel supply—where each producer sells through a single intermediary—can be relaxed, given that all consumers are one-stop shoppers and the market is fully covered. To illustrate this, consider the introduction of a strategic multihoming producer l, who can potentially sell through both retail channels. For clarity of exposition, assume symmetric utility: $u_l^A = u_l^B = u_l$.

☐ **Reseller model.** Producer l's wholesale prices are constrained by $w_l^A \leq u_l$ and $w_l^B \leq u_l$; otherwise, the intermediaries would reject the product, as it would not generate surplus. Given this constraint, the equilibrium value difference Δ^* in the subgame is implicitly determined by:

$$\Delta^* = z + \sum\nolimits_{i \in \mathcal{N}} w_i^B + \mu(\Delta^*) - \sum\nolimits_{i \in \mathcal{N}} w_i^A - \lambda(\Delta^*) + w_l^B - w_l^A.$$

It is a function of Stage-1 prices $\{w_i^A\}_{i \in \mathcal{N}}$ and $\{w_i^B\}_{i \in \mathcal{N}}$, as well as a new component $w_l^A - w_l^B$, introduced by the presence of the multihoming producer l. Producer l's profit is given by

$$\pi_l = w_l^A G(\Delta^*) + w_l^B (1 - G(\Delta^*)).$$

Note that producer l can always raise both w_l^A and w_l^B simultaneously to increase its margin without affecting Δ^*, as long as the resulting retail prices do not exceed u_l^k. Hence, in equilibrium, producer l will offer the same net value $u_l^k - p_l^k$ across both channels $k \in \{A, B\}$, by charging the monopoly price $p_l^k = u_l$ in each channel. As a result, the equilibrium value difference satisfies:

$$\Delta^* = z + \sum\nolimits_{i \in \mathcal{N}} w_i^B + \mu(\Delta^*) - \sum\nolimits_{i \in \mathcal{N}} w_i^A - \lambda(\Delta^*)$$

which is identical to the expression in the baseline model.

□ **Marketplace model.** Under the marketplace model, however, the reasoning above does not always apply. This is because a multihoming producer l will generally prefer to set a lower price in the channel with a lower fee—whenever the fee differential is sufficiently large—akin to the logic of "platform leakage" (Hagiu and Wright, 2024). This pricing behavior introduces potential non-quasiconcavity in an intermediary's objective function when it deviates by setting an unusually low fee. Nevertheless, as shown in Online Appendix E, such large fee differentials are infeasible in equilibrium if N is sufficiently large (while holding constant the number of single-homing monopoly producers $N - m_k$ in each channel). As a result, multihoming producers again end up offering the same value $u_l^k - p_l^k$ across both channels $k \in \{A, B\}$.

In summary, multihoming producers do not contribute to the relative value difference between channels A and B, and thus their presence does not affect the equilibrium outcomes in our model.

7 Conclusion

Multiproduct intermediaries serve as gatekeepers between consumers and producers. This paper develops a new framework to analyze competition between asymmetric multiproduct intermediaries that serve consumers with multiproduct demand. We show that the pricing equilibrium features novel interactions between vertical and horizontal marginalization, and that the nature of these interactions depends critically on the retail business models in place.

Several high-level insights emerge from our analysis. First, an industry-wide shift from the reseller model to the marketplace model can soften price competition across channels by changing the cross-channel interactions in pricing. Second, a rise in an intermediary's buyer power can reduce its market share and profit, as rival channels respond with more aggressive pricing. Third, by adopting the marketplace model, an intermediary can strategically influence cross-channel pricing dynamics to gain a competitive advantage over its rival. These insights are consequences of the pricing equilibrium shaped by the interplay between vertical and horizontal marginalization.

Our framework can usefully be extended in several major directions. First, for analytical tractability, we model an intermediary's buyer power in reduced form by distinguishing between two types of product categories: monopolized and competitive. While we discuss microfoundations for this modeling choice, we acknowledge its limitations. Extending the analysis to a more general vertical contracting framework while maintaining tractability presents a significant challenge.

Second, our model assumes that consumers are one-stop shoppers to simplify the demand specification. While one-stop shopping captures a substantial share of real-life consumer behaviours, some consumers do engage in multi-stop shopping.[25] Incorporating a generalized

[25] For example, Thomassen et al. (2017) find that 36% of grocery shoppers in the UK consistently use a single

multiproduct demand system—such as the aggregative game approach by Nocke and Schutz (2018)—into our vertical relation framework could be a promising direction for further research.

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8 Appendix: proofs

8.1 Proof of Propositions 1 and 2

In the reseller configuration, it remains to verify that $P^A_{rr}(\Delta)$ and $P^B_{rr}(\Delta)$ are, respectively, increasing and decreasing functions of Δ. This follows from the log-concavity of G, which implies $\lambda'(\Delta) > 0$ and $\mu'(\Delta) < 0$. Assumption 1 further implies that $\lambda(\Delta)\lambda'(\Delta) > 0$ and $-\lambda(\Delta)\mu'(\Delta) > 0$ are increasing functions, while $\mu(\Delta)\lambda'(\Delta) > 0$ and $-\mu(\Delta)\mu'(\Delta) > 0$ are decreasing functions. The same reasoning applies in the marketplace configuration, where $P^A_{mm}(\Delta)$ and $P^B_{mm}(\Delta)$ are likewise increasing and decreasing in Δ.

8.2 Proof of Proposition 3

Let $\Gamma_{rr}(\Delta) \equiv \Delta + P^A_{rr}(\Delta) - P^B_{rr}(\Delta)$ and $\Gamma_{mm}(\Delta) \equiv \Delta + P^A_{mm}(\Delta) - P^B_{mm}(\Delta)$; both are increasing functions. We have

$$\Gamma_{rr}(\Delta) - \Gamma_{mm}(\Delta) = \left[\lambda(-\mu') + \mu\lambda'\right](m_B - m_A) \leq 0 \quad \text{iff} \quad m_A \geq m_B,$$

which implies that $\Delta^*_{mm} < \Delta^*_{rr}$, with strict inequality holding if $m_A > m_B$.

The equilibrium profits of intermediaries under configurations rr and mm are given respectively by

$$\begin{aligned} \Pi^{A*}_{rr} &= \lambda(\Delta^*_{rr})G(\Delta^*_{rr}), \\ \Pi^{B*}_{rr} &= \mu\left(\Delta^*_{rr}\right)\left(1 - G(\Delta^*_{rr})\right), \end{aligned}$$

and

$$\begin{aligned} \Pi^{A*}_{mm} &= \left[1 + (N - m_A)\lambda'(\Delta^*_{mm}) - (N - m_B)\mu'(\Delta^*_{mm})\right]\lambda(\Delta^*_{mm})G(\Delta^*_{mm}), \\ \Pi^{B*}_{mm} &= \left[1 + (N - m_A)\lambda'(\Delta^*_{mm}) - (N - m_B)\mu'\left(\Delta^*_{mm}\right)\right]\mu\left(\Delta^*_{mm}\right)\left(1 - G(\Delta^*_{mm})\right). \end{aligned}$$

Then, $\Delta^*_{rr} \geq \Delta^*_{mm}$ implies

$$\frac{\Pi^{A*}_{mm}}{\Pi^{B*}_{mm}} = \frac{\lambda(\Delta^*_{mm})G(\Delta^*_{mm})}{\mu\left(\Delta^*_{mm}\right)\left(1 - G(\Delta^*_{mm})\right)} < \frac{\lambda(\Delta^*_{rr})G(\Delta^*_{rr})}{\mu\left(\Delta^*_{rr}\right)\left(1 - G(\Delta^*_{rr})\right)} = \frac{\Pi^{A*}_{rr}}{\Pi^{B*}_{rr}}.$$

8.3 Proof of Proposition 4

Given the uniform distribution specification, we can utilize the closed-form solutions in Online Appendix F.

Prices.

$$
\begin{aligned}
P_{rr}^{A*} - P_{mm}^{A*} &= \frac{(1+3N-3m_A)(2z+(3+6N-6m_B)\overline{\theta})}{6(2N-m_A-m_B+1)} \\
&\quad - \frac{(1+3N-2m_A-m_B)(2z+(3+6N-2m_A-4m_B)\overline{\theta})}{6(2N-m_A-m_B+1)}, \\
P_{rr}^{B*} - P_{mm}^{B*} &= \frac{(1+3N-3m_B)(-2z+(3+6N-6m_A)\overline{\theta})}{6(2N-m_A-m_B+1)} \\
&\quad - \frac{(1+3N-2m_B-m_A)(-2z+(3+6N-2m_B-4m_A)\overline{\theta})}{6(2N-m_A-m_B+1)}.
\end{aligned}
$$

Using $m_A - m_B > 0$, we have

$$
P_{rr}^{A*} < P_{mm}^{A*} \ \text{ iff } \ m_A - m_B > -\frac{1}{4} - \frac{z}{2\overline{\theta}} \tag{24}
$$

$$
P_{rr}^{B*} < P_{mm}^{B*} \ \text{ iff } \ m_A - m_B > \frac{1}{4} - \frac{z}{2\overline{\theta}}. \tag{25}
$$

Recall m_A and m_B are integers, so $m_A - m_B > 0$ implies $m_A - m_B \geq 1$. Hence, (24) and (25) are both satisfied given $z \geq 0$.

Intermediary profits. For intermediary A,

$$
\Pi_{rr}^{A*} - \Pi_{mm}^{A*} = \frac{(2z+(3+6N-6m_B)\overline{\theta})^2}{36(2N-m_A-m_B+1)^2\overline{\theta}} - \frac{(2z+(3+6N-2m_A-4m_B)\overline{\theta})^2}{36(2N-m_A-m_B+1)\overline{\theta}}.
$$

A sufficient condition for

$$
\left[\Pi_{rr}^{A*} - \Pi_{mm}^{A*}\right]_{z=0} = \frac{(3+6N-6m_B)^2\overline{\theta}}{36(2N-m_A-m_B+1)^2} - \frac{(3+6N-2m_A-4m_B)^2\overline{\theta}}{36(2N-m_A-m_B+1)} < 0
$$

is $N \geq m_A \geq m_B+1$, which holds given m_A and m_B are integers. Moreover, the sign of $\frac{d}{dz}\left[\Pi_{rr}^{A*} - \Pi_{mm}^{A*}\right]$ coincides with

$$
\begin{aligned}
&\underbrace{-\left(4N-2m_A-2m_B\right)z-\left(6N-5m_A-m_B\right)}_{\leq 0 \text{ given } m_k \leq N} + \underbrace{10Nm_A - 12N^2 + 14Nm_B - 6N - 2m_A^2 - 6m_Am_B + 5m_A - 4m_B^2 + m_B}_{\text{increasing in } m_A \text{ and } m_B} \\
\leq\ & 10N^2 - 12N^2 + 14N^2 - 6N - 2N^2 - 6N^2 + 5N - 4N^2 + N = 0,
\end{aligned}
$$

thus, $\Pi_{rr}^{A*} - \Pi_{mm}^{A*} < 0$ holds for all $z \geq 0$.

For intermediary B,

$$
\begin{aligned}
\Pi_{rr}^{B*} - \Pi_{mm}^{B*} &= \frac{1}{4\overline{\theta}}\left(\overline{\theta} - 2\Delta_{rr}^*\right)^2 - \frac{1+2N-m_A-m_B}{4\overline{\theta}}\left(\overline{\theta} - 2\Delta_{mm}^*\right)^2 \\
&< \frac{1}{4\overline{\theta}}\left(\overline{\theta} - 2\Delta_{rr}^*\right)^2 - \frac{1}{4\overline{\theta}}\left(\overline{\theta} - 2\Delta_{mm}^*\right)^2 < 0,
\end{aligned}
$$

given $\Delta_{mm}^* < \Delta_{rr}^* < \bar{\theta}/2$.

Producer profits. For producers in channel A,

$$\begin{aligned}\pi_{rr}^{A*} - \pi_{mm}^{A*} &= \frac{3}{4\bar{\theta}}\left(\bar{\theta} + 2\Delta_{rr}^*\right)^2 - \frac{1}{4\bar{\theta}}\left(\bar{\theta} + 2\Delta_{mm}^*\right)^2 \\ &> \frac{1}{4\bar{\theta}}\left(\bar{\theta} + 2\Delta_{rr}^*\right)^2 - \frac{1}{4\bar{\theta}}\left(\bar{\theta} + 2\Delta_{mm}^*\right)^2 > 0,\end{aligned}$$

given $\Delta_{mm}^* < \Delta_{rr}^* < \bar{\theta}/2$.

For producers in channel B,

$$\pi_{rr}^{B*} - \pi_{mm}^{B*} = \frac{(-2z + (3 + 6N - 6m_A)\bar{\theta})^2}{12(2N - m_A - m_B + 1)^2\bar{\theta}} - \frac{(-2z + (3 + 6N - 2m_A - 4m_B)\bar{\theta})^2}{36(2N - m_A - m_B + 1)^2\bar{\theta}} > 0$$

if and only if

$$\frac{z}{\bar{\theta}} < \frac{3}{2} + 3N - \frac{(3\sqrt{3} - 2)(N - m_A) + m_B}{\sqrt{3} - 1} \equiv \bar{z}_0.$$

8.4 Proof of Proposition 5

Step 1: reseller configuration.

By the implicit function theorem, we have

$$\frac{d\Delta_{rr}^*}{dm_A} = \frac{-\partial P_{rr}^A/\partial m_A}{1 - \partial P_{rr}^B/\partial\Delta + \partial P_{rr}^A/\partial\Delta} > 0.$$

Profits in channel A are given by

$$\begin{aligned}\Pi_{rr}^{A*} &= \lambda(\Delta_{rr}^*)G(\Delta_{rr}^*) \\ \pi_{rr}^{A*} &= \lambda(\Delta_{rr}^*)(1 + \lambda'(\Delta_{rr}^*) - \mu'(\Delta_{rr}^*))G\left(\Delta_{rr}^*\right),\end{aligned}$$

which are increasing in Δ_{rr}^* by the log-concavity of G and Assumption 1.

Profits in channel B are

$$\begin{aligned}\Pi_{rr}^{B*} &= \mu(\Delta_{rr}^*)\left(1 - G(\Delta_{rr}^*)\right) \\ \pi_{rr}^{B*} &= \mu\left(\Delta_{rr}^*\right)\left(1 + \lambda'(\Delta_{rr}^*) - \mu'(\Delta_{rr}^*)\right)\left(1 - G\left(\Delta_{rr}^*\right)\right),\end{aligned}$$

which are decreasing in Δ_{rr}^* by the log-concavity of $1 - G$ and Assumption 1.

Finally, recall $\partial P_{rr}^B/\partial\Delta < 0$ and $\partial P_{rr}^A/\partial\Delta > 0$, then

$$\begin{aligned}\frac{dP_{rr}^{B*}}{dm_A} &= \frac{\partial P_{rr}^B}{\partial\Delta}\frac{d\Delta_{rr}^*}{dm_A} < 0, \\ \frac{dP_{rr}^{A*}}{dm_A} &= \frac{\partial P_{rr}^A}{\partial m_A} + \frac{\partial P_{rr}^A}{\partial\Delta}\frac{d\Delta_{rr}^*}{dm_A} = \frac{\partial P_{rr}^A}{\partial m_A}\left(1 - \frac{\partial P_{rr}^A/\partial\Delta}{1 - \partial P_{rr}^B/\partial\Delta + \partial P_{rr}^A/\partial\Delta}\right) < 0.\end{aligned}$$

Step 2: marketplace configuration.

For the purpose of this proof, it is occasionally useful to make explicit the dependence of the equilibrium $\Delta_{mm}^*(m_A, z)$ on the parameters m_A and z. In what follows, we will suppress the arguments of $\lambda(\Delta)$ and $\mu(\Delta)$ when doing so does not cause confusion.

□ **Equilibrium Δ^*_{mm} and threshold $\bar{z}$.** We first note the following total derivative from (12):

$$\left(1 - \frac{\partial P^B_{mm}}{\partial \Delta} + \frac{\partial P^A_{mm}}{\partial \Delta}\right) \frac{d\Delta^*_{mm}}{dm_A} = -\left[\mu\lambda' - \lambda\left(1+\lambda'\right)\right]_{\Delta=\Delta^*_{mm}}. \tag{26}$$

Define a critical threshold value $\bar{\Delta}$ implicitly by $\left[\mu\lambda' - \lambda\left(1+\lambda'\right)\right]_{\Delta=\bar{\Delta}} = 0$, such that

$$\left[\mu\lambda' - \lambda\left(1+\lambda'\right)\right]_{\Delta} > (<)0 \text{ whenever } \Delta < (>)\bar{\Delta},$$

which is valid given $\mu\lambda' - \lambda\left(1+\lambda'\right)$ is decreasing in Δ by Assumption 1. Then, define threshold $\bar{z}$ as

$$\begin{aligned} \bar{z} &= \bar{\Delta} - P^B_{mm}(\bar{\Delta}; m_A) + P^A_{mm}(\bar{\Delta}; m_A) \\ &= \bar{\Delta} + \lambda(\bar{\Delta}) - \mu(\bar{\Delta}) - (N - m_B)\left[\mu(\bar{\Delta}) - \mu(\bar{\Delta})\mu'(\bar{\Delta}) + \lambda(\bar{\Delta})\mu'(\bar{\Delta})\right], \end{aligned} \tag{27}$$

where we used $\mu(\bar{\Delta})\lambda'(\bar{\Delta}) = \lambda(\bar{\Delta})\left(1 + \lambda'(\bar{\Delta})\right)$ to derive the last line.

Observe that $\frac{d\bar{z}}{dm_A} = 0$. We claim that $\bar{z}$ is the required threshold. To see this, note that $\Delta^*_{mm}(m_A; \bar{z}) = \bar{\Delta}$ for any m_A by plugging the definition of $\bar{z}$ (27). Note that Δ^*_{mm} is the unique solution to

$$\Gamma_{mm}(\Delta) \equiv \Delta + P^A_{mm}(\Delta) - P^B_{mm}(\Delta) = z.$$

Since $\Gamma_{mm}(\Delta)$ is an increasing function, then

$$\frac{d}{dz}\Delta^*_{mm}(m_A; z) = \frac{-1}{\Gamma'_{mm}(\Delta)} < 0.$$

It follows that $z > (<)\bar{z}$ implies $\Delta^*_{mm}(m_A; z) > (<)\bar{\Delta}$, which then implies $\frac{d\Delta^*_{mm}}{dm_A} < (>)0$ by the definition of $\bar{\Delta}$.

To show $\bar{z} < 0$, we first observe that $\bar{\Delta} < 0$ because $\left[\mu\lambda' - \lambda\left(1+\lambda'\right)\right]_{\Delta=0} = -\lambda < 0$ by the symmetry of the distribution function. Then, $\bar{\Delta} < 0$ implies $\bar{\Delta} + \lambda(\bar{\Delta}) - \mu(\bar{\Delta}) < 0$ by distribution symmetry, while

$$\left[\mu - \mu\mu' + \lambda\mu'\right]_{\Delta=\bar{\Delta}} > \left[\mu - \mu\mu' + \lambda\mu'\right]_{\Delta=0} = \mu > 0$$

from the definition of $\bar{z}$ (27).

□ **Retail prices.** If $z < \bar{z}$ such that $\frac{d\Delta^*_{mm}}{dm_A} < 0$, then we can express the overall price impacts $\frac{d}{dm_A}P^A_{mm}(\Delta^*_{mm}(m_A); m_A)$ and $\frac{d}{dm_A}P^B_{mm}(\Delta^*_{mm}(m_A); m_A)$ as

$$\frac{dP^{A*}_{mm}}{dm_A} = \underbrace{-\lambda\left(1+\lambda'\right)}_{<0} + \underbrace{\frac{\partial P^A_{mm}}{\partial \Delta}}_{>0} \times \frac{\partial \Delta^*_{mm}}{\partial m_A} < 0, \tag{28}$$

$$\frac{dP^{B*}_{mm}}{dm_A} = \underbrace{-\mu\lambda'}_{<0} + \underbrace{\frac{\partial P^B_{mm}}{\partial \Delta}}_{<0} \times \frac{\partial \Delta^*_{mm}}{\partial m_A} < 0. \tag{29}$$

If $z > \bar{z}$ so that $\frac{d\Delta^*_{mm}}{dm_A} > 0$, then we can use (26) to rewrite (28) and (29) as

$$\begin{aligned}
\frac{dP^{A*}_{mm}}{dm_A} &= \underbrace{-\mu\lambda'}_{<0} - \underbrace{\left(1 - \frac{\partial P^B_{mm}}{\partial \Delta}\right)}_{>0} \times \frac{\partial \Delta^*_{mm}}{\partial m_A} < 0, \\
\frac{dP^{B*}_{mm}}{dm_A} &= \underbrace{-\lambda\left(1+\lambda'\right)}_{<0} + \underbrace{\left(1 + \frac{\partial P^A_{mm}}{\partial \Delta}\right)}_{>0} \times \frac{\partial \Delta^*_{mm}}{\partial m_A} < 0.
\end{aligned}$$

☐ **Intermediary A's profit.** We write the profit as $\Pi^{A*}_{mm} = \Pi^A_{mm}(\Delta^*_{mm}; m_A)$, where

$$\Pi^A_{mm}(\Delta; m_A) = \left[1 + (N - m_A)\lambda'(\Delta) - (N - m_B)\mu'(\Delta)\right]\lambda(\Delta)G(\Delta) = \left(P^A_{mm}(\Delta; m_A) - (N - m_A)\lambda\right)G(\Delta). \tag{30}$$

Differentiating with respect to m_A yields

$$\frac{d\Pi^A_{mm}}{dm_A} = \underbrace{-\lambda\lambda' G(\Delta^*_{mm})}_{=\frac{\partial \Pi^A_{mm}}{\partial m_A}<0} + \underbrace{\frac{\partial \Pi^A_{mm}}{\partial \Delta}}_{>0} \times \frac{\partial \Delta^*_{mm}}{\partial m_A}. \tag{31}$$

If $z < \bar{z}$ so that $\frac{d\Delta^*_{mm}}{dm_A} < 0$, then (31) implies $\frac{d\Pi^A_{mm}}{dm_A} < 0$.
If $z > \bar{z}$ so that $\frac{d\Delta^*_{mm}}{dm_A} > 0$, then we use the uniform distribution specification in (1) to obtain

$$\Delta^*_{mm} = \frac{2z - \bar{\theta}\,(m_B - m_A)}{6\,(2N - m_A - m_B + 1)} \quad \text{and} \quad \Pi^{A*}_{mm} = \frac{(2z + (3 + 6N - 2m_A - 4m_B)\bar{\theta})^2}{36(2N - m_A - m_B + 1)\bar{\theta}}.$$

Then, the definitions of critical value and thresholds give $\bar{\Delta} = -\bar{\theta}/6$ and

$$\bar{z} = -\frac{\bar{\theta}}{2}\left(1 + 2N - 2m_B\right),$$

which are indeed independent of m_A. Moreover,

$$\frac{d\Pi^{A*}_{mm}}{dm_A} = \frac{2\bar{\theta}}{36\left(m_A - 2N + m_B - 1\right)^2}\left(\frac{2z}{\bar{\theta}} + 3 + 6N - 2m_A - 4m_B\right)\left(m_A - \frac{1}{2} + \frac{z}{\bar{\theta}} - N\right) > 0$$

if and only if $m_A > N + 1/2 - z/\bar{\theta}$, as stated in the text. Finally, we note that interiority of the equilibrium requires $\Delta^*_{mm} > 0$, or equivalently,

$$z > -3\bar{\theta}\left(\frac{1}{2} + \frac{3N - 2m_B - m_A}{3}\right),$$

which does not contradict with $z < \bar{z}$ as long as $m_A + m_B < 2N + 1$.

☐ **Intermediary B's profit.** We write the profit as $\Pi^{B*}_{mm} = \Pi^B_{mm}(\Delta^*_{mm}; m_A)$, where

$$\begin{aligned}
\Pi^B_{mm}(\Delta; m_A) &= \left[1 + (N - m_A)\lambda'(\Delta) - (N - m_B)\mu'(\Delta)\right]\mu(\Delta)\left(1 - G(\Delta)\right) \\
&= \left(P^B_{mm}(\Delta; m_A) - (N - m_A)\mu\right)\left(1 - G(\Delta)\right).
\end{aligned}$$

Differentiating with respect to m_A, we obtain

$$\frac{d\Pi_{mm}^{B*}}{dm_A} = \underbrace{-\mu\lambda'\left(1 - G(\Delta_{mm}^*)\right)}_{=\frac{\partial \Pi_{mm}^B}{\partial m_A}<0} + \underbrace{\frac{\partial \Pi_{mm}^B}{\partial \Delta}}_{<0} \times \frac{\partial \Delta_{mm}^*}{\partial m_A}. \tag{32}$$

If $z > \bar{z}$ so that $\frac{d\Delta_{mm}^*}{dm_A} > 0$, then then (32) implies $\frac{d\Pi_{mm}^B}{dm_A} < 0$.
If $z < \bar{z}$ so that $\frac{d\Delta_{mm}^*}{dm_A} < 0$, we expand the partial derivative of $\Pi_{mm}^B(\Delta; m_A)$ as

$$\frac{\partial \Pi_{mm}^B}{\partial \Delta} = (1 - G(\Delta))\left(\frac{\partial P_{mm}^B(\Delta)}{\partial \Delta} - 1 - (N - m_A)\lambda'\right).$$

Evaluating at $\Delta = \Delta_{mm}^*$ and using (26), we obtain

$$\left(\frac{\partial \Pi_{mm}^B}{\partial \Delta} \times \frac{\partial \Delta_{mm}^*}{\partial m_A}\right)_{\Delta=\Delta_{mm}^*} = (1 - G(\Delta_{mm}^*))\left(\frac{\partial P_{mm}^A}{\partial \Delta}\frac{\partial \Delta_{mm}^*}{\partial m_A} + \mu\lambda' - \lambda\left(1 + \lambda'\right) - (N - m_A)\lambda'\frac{\partial \Delta_{mm}^*}{\partial m_A}\right).$$

Substituting into (32), we get

$$\frac{1}{1 - G(\Delta_{mm}^*)}\frac{d\Pi_{mm}^{B*}}{dm_A} = -\lambda\left(1 + \lambda'\right) + \underbrace{\left(\frac{\partial P_{mm}^A}{\partial \Delta} - (N - m_A)\lambda'\right)\frac{\partial \Delta_{mm}^*}{\partial m_A}}_{<0 \text{ given } z<\bar{z}},$$

where $\frac{\partial P_{mm}^A}{\partial \Delta} - (N - m_A)\lambda' = \lambda' + (N - m_A)(\lambda\lambda'' + \lambda'\lambda') - (N - m_B)(\lambda\mu'' + \lambda'\mu') > 0$ by Assumption 1.

8.5 Proof of Corollary 2

In channel A, each monopoly producer's profit in category $j \notin \mathcal{F}^A$ in reseller and marketplace configurations are respectively given by

$$\pi_j^{*A} = \lambda(\Delta_{rr}^*)(1 + \lambda'(\Delta_{rr}^*) - \mu'(\Delta_{rr}^*))G\left(\Delta_{rr}^*\right) \text{ and } \pi_j^{*A} = \lambda(\Delta_{mm}^*)G\left(\Delta_{mm}^*\right),$$

which are respectively increasing in Δ_{rr}^* and Δ_{mm}^* by Assumption 1.

Similarly, in channel B, each producer's profit in category $j \notin \mathcal{F}^B$ in reseller and marketplace configurations are respectively given by

$$\pi_j^{*B} = \mu(\Delta_{rr}^*)(1 + \lambda'(\Delta_{rr}^*) - \mu'(\Delta_{rr}^*))(1 - G\left(\Delta_{rr}^*\right)) \text{ and } \pi_j^{*B} = \mu(\Delta_{mm}^*)(1 - G\left(\Delta_{mm}^*\right)),$$

which are respectively decreasing in Δ_{rr}^* and Δ_{mm}^* by Assumption 1.

Therefore, in each configuration $\omega \in \{rr, mm\}$, $d\pi_j^{*A}/dm_A$ has the same sign as $d\Delta_\omega^*/dm_A$, whereas $d\pi_j^{*B}/dm_A$ has the opposite sign as $d\Delta_\omega^*/dm_A$. The corollary statement then follows from Proposition 5 that signs $d\Delta_\omega^*/dm_A$.

Online Appendix

A Bargaining interpretations of buyer power

In this section, we offer a bargaining power interpretation to our definition of the intermediary-specific buyer power m_k (recall Section 6.2 has provided a vertical-integration interpretation of m_k). To formalize the idea, each category $i \in \mathcal{N}$ initially consists of a single monopoly producer, denoted as i. Following Rey and Vergé (2022), we assume that intermediaries $k \in \{A, B\}$ differ in their exogenous bargaining powers $\beta_i^k \in \{0, 1\}$ when dealing with producer i.[26] Then, we revise the model timing as follows.

- In the reseller configuration, each intermediary-producer pair $ki \in \{A, B\} \times \mathcal{N}$ meets separately and simultaneously in Stage 1 to bargain and determine the wholesale price w_i^k; then, the intermediaries set retail prices in Stage 2. Here, $\beta_i^k = 0$ $(= 1)$ means the producer (intermediary) makes a take-it-or-leave-it (TIOLI) wholesale price offer of w_i^k to the counter-party, subject to the constraint that the counter-party does not suffer a loss from accepting the offer.
- In the marketplace configuration, intermediaries set fees in Stage 1; then, each intermediary-producer pair $ki \in \{A, B\} \times \mathcal{N}$ meets separately and simultaneously in Stage 2 to bargain and determine the retail price p_i^k. Similarly, $\beta_i^k = 0$ $(= 1)$ means the producer (intermediary) makes a TIOLI offer on the retail price p_i^k to be set in Stage 2, and then the counter-party decides whether to comply with the offer. An alternative interpretation is that $\beta_i^k = 0$ means the producer has full control over the retail price it can set on the marketplace, whereas $\beta_i^k = 1$ means the intermediary has full control over the retail price set by the producer on its marketplace. The latter control could arise from governance design decisions, including strategies to highlight certain producers in recommendation systems that favor those with the lower retail price.

To proceed, let us denote

$$\mathcal{F}^k = \{i \in \mathcal{N} : \beta_i^k = 1\} \quad \text{and} \quad m^k = |\mathcal{F}^k|. \tag{33}$$

We now describe how the formulation in (33) leads to the same equilibrium as Propositions 1 and 2. Without loss of generality, let us focus on channel $k = A$ in the description below.

□ **Reseller model.** For each $i \in \mathcal{N} \backslash \mathcal{F}^A$, the producer's wholesale price offer w_i^A to intermediary A in Stage 1 is equivalent to that in Section 3.1. That is, w_i^A maximizes producer i's profit, holding fixed the wholesale prices in other intermediary-producer pairs (recall that bargaining are simultaneous and separate, and that each producer only makes one offer). For all other categories $i \in \mathcal{F}^A$, intermediary A's choice of offer $\{w_i^A\}_{i \in \mathcal{F}^A}$ maximizes

$$\left(\sum\nolimits_{i\in\mathcal{N}} p_i^k - \sum\nolimits_{i\in\mathcal{F}^A} w_i^A - \sum\nolimits_{j\in\mathcal{N}\backslash\mathcal{F}^A} w_j^A\right) G(\Delta^*),$$

[26] This formulation is a special case of the Nash-in-Nash bargaining protocol with exogenous bargaining power parameters, which have been used by Crawford and Yurukoglu (2012), Ho and Lee (2019), and Gaudin (2018) in both theoretical and empirical settings.

where Δ^* is given by (3), holding $\{w_j^A\}_{j\in\mathcal{N}\backslash\mathcal{F}^A}$ constant (as these wholesale prices are decided by the corresponding producer j). Clearly, the intermediary's optimal offers are $w_i^A = 0$ for $i \in \mathcal{F}^A$.[27]

□ **Marketplace model.** Given fee f^A, each producer $i \in \mathcal{N}\backslash\mathcal{F}^A$ chooses retail price p_i^A in Stage 2, which is equivalent to that in Section 3.2. For all other categories $i \in \mathcal{F}^A$, intermediary A's choice of retail prices $\{p_i^A\}_{i\in\mathcal{F}^A}$ maximizes

$$f^A G(z + \sum\nolimits_{i\in\mathcal{N}} p_i^B - \sum\nolimits_{i\in\mathcal{F}^A} p_i^A - \sum\nolimits_{j\in\mathcal{N}\backslash\mathcal{F}^A} p_j^A),$$

holding $\{p_j^A\}_{j\in\mathcal{N}\backslash\mathcal{F}^A}$ constant (as these retail prices are set by the corresponding producer j). Clearly, the intermediary's optimal offers are based on marginal cost $p_i^A = f^A$ for $i \in \mathcal{F}^A$ due to the constraint of a non-negative producer profit constraint.

In sum, we interpret each category $i \in \mathcal{F}^k$ as one in which the intermediary holds full bargaining power in negotiations with the producer. That is, the intermediary makes a take-it-or-leave-it (TIOLI) offer on: (i) the wholesale price w_i^k it pays in the reseller model; or (ii) the retail price p_i^k that the producer sets in the marketplace model. For each such category, the outcome is equivalent to having a competitive fringe that prices at effective marginal cost. Thus, an increase in m^k reflects an exogenous shift in the market environment that expands the set of categories in which the intermediary has full bargaining power (i.e., $\beta_i^k = 1$), or more broadly, improves its bargaining position.

□ **Bargaining position as representing the replacement threat.** One microfoundation for the intermediary's gain in bargaining power is the threat of replacement (Ho and Lee, 2019). To illustrate this concisely, consider the reseller model (the same logic applies to the marketplace model). Suppose there is a category $i \in \mathcal{N}\backslash\mathcal{F}^A$, initially occupied by a monopoly producer who makes a take-it-or-leave-it (TIOLI) offer to intermediary k. However, upon observing the offer, intermediary k can incur an investment cost C_k^i to replace producer i with a homogeneous alternative willing to supply at the minimum acceptable wholesale price. If $C_k^i \to \infty$ (i.e., replacement is infeasible), then producer i optimally sets w_i^k to maximize its profit. If $C_k^i = 0$ (i.e., replacement is readily available), then the producer anticipates being replaced unless it sets $w_i^k = 0$, effectively behaving like a competitive fringe, as in Ho and Lee (2019). Thus, the availability of viable alternative producers transforms category i into one in which the intermediary holds full bargaining power.

□ **Bargaining position as representing of competition intensity.** At a higher level, the intermediary's gain in bargaining power in category i may reflect an increase in the intensity of competition among multiple symmetric producers within that category. This idea can be formalized using the conduct parameter approach (see, e.g., Johnson, 2017). In this framework, intra-category competition among producers supplying to intermediary k is captured by an exogenously imposed conduct parameter θ_i^k, which summarizes the competitiveness of the supply side. The conduct parameter serves as a reduced-form representation of the intermediary's ability to leverage multiple producers in each category to induce competitive pricing behavior, as discussed above. Under this approach, all producers in category i set symmetric equilibrium prices (either wholesale or retail) that satisfy the Lerner formula, indexed by θ_i^k.

[27] Observe that $w_i^A = 0$ is optimal regardless of whether the intermediary's offers $\{w_i^A\}_{i\in\mathcal{F}^A}$ to producers are public or private. In particular, this conclusion holds even if the intermediary makes market-by-market offers. The simplicity is due to the absence of lump-sum transfers in the contracting.

A higher value of θ_i^k corresponds to less competitive conduct and hence higher producer markups. The next subsection details this derivation and shows that

$$m_k = N - \sum_{i\in\mathcal{N}} \theta_i^k.$$

A.1 Conduct parameter interpretation

For the sake of exposition, we focus on channel $k = A$. Suppose that each category $i \in \mathcal{N}$ of channel A consists of multiple symmetric producers, each indexed by l. Within category i, the intra-category competition between the producers is described by an exogenously imposed conduct parameter θ_i^A (Johnson, 2017). In equilibrium, all producers in the category set the same prices (wholesale or retail), and the symmetric equilibrium price is assumed to follow the Lerner formula indexed by θ_i^A. The exact formula depends on the business model considered.

☐ **Marketplace configuration.** In Stage-2 pricing, the effective marginal cost of each producer is f^A. In category i, the elasticity adjusted Lerner formula for the symmetric equilibrium retail price is given by

$$\frac{p_i^A - f^A}{p_i^A} = \frac{\theta_i^A}{\epsilon_{DA}}, \tag{34}$$

where ϵ_{DA} is the Stage-2 (or "downstream") *effective elasticity* of channel-A demand $G(\Delta)$ with respect to p_i^A, as given by

$$\epsilon_{DA} = \frac{p_i^A g(\Delta)}{G(\Delta)} = \frac{p_i^A}{\lambda(\Delta)}.$$

Then,

$$p_i^A - f^A = \theta_i^A \lambda(\Delta). \tag{35}$$

Note that $\theta_i^A = 1$ leads to the monopoly pricing (e.g., there is a monopoly producer in this category or that producers are colluding), and that $\theta_i = 0$ corresponds to perfect competition with marginal-cost pricing. Thus, $\theta_i^A \in (0, 1)$ represents any situation with imperfect competition between the two extreme cases.

Summing up 35 across all categories i, the channel-A aggregate price in Stage 2 is

$$Nf^A + \sum_{i\in\mathcal{N}} \theta_i^A \lambda(\Delta).$$

Denoting by $\sum_{i\in\mathcal{N}} \theta_i^A = N - m_A$, then this expression becomes the same as the corresponding equation (9) in our baseline model.

Likewise, the channel-B aggregate price in Stage 2 is given by

$$Nf^B + \sum_{i\in\mathcal{N}} \theta_i^B \mu(\Delta),$$

where we will denote $\sum_{i\in\mathcal{N}} \theta_i^B = N - m_B$. Therefore, the equilibrium value difference is given by exactly the same expression as in the baseline model:

$$\Delta^* = z + Nf^B + (N - m_B)\mu(\Delta^*) - Nf^A - (N - m_A)\lambda(\Delta^*).$$

It follows that the overall equilibrium is the same as Proposition 2. A minor difference is that each category-i producer's profit is instead expressed as

$$\pi_{i,mm}^{A*} = \theta_i^A \lambda(\Delta_{mm}^*) G(\Delta_{mm}^*) \quad \text{and} \quad \pi_{i,mm}^{B*} = \theta_i^B \mu(\Delta_{mm}^*)(1 - G(\Delta_{mm}^*))$$

respectively.

□ **Reseller configuration**. In the Stage-2 pricing, given the Stage-1 prices at both channels $\{w_i^A\}_{i\in\mathcal{N}}$ and $\{w_i^B\}_{i\in\mathcal{N}}$, each intermediary chooses the aggregate retail price to maximize its profit. The first-order conditions are exactly the same as in the baseline setting, and the value difference Δ^* in the equilibrium of the subgame is implicitly determined by

$$\Delta^* = z + \sum\nolimits_{i\in\mathcal{N}} w_i^B + \mu(\Delta^*) - \sum\nolimits_{i\in\mathcal{N}} w_i^A - \lambda(\Delta^*).$$

In Stage-1 pricing, the effective marginal cost of each producer is 0. In category i, the elasticity adjusted Lerner formula for the symmetric equilibrium wholesale price is

$$1 = \frac{\theta_i^A}{\epsilon_{UA}},$$

where the Stage-1 (or "upstream") *effective elasticity* ϵ_{UA} takes into account potential Stage-2 responses. Specifically,

$$\epsilon_{UA} = -\frac{w_i^A g(\Delta^*)}{G(\Delta^*)}\frac{\partial\Delta^*}{\partial w_i^A} = -\frac{w_i^A}{\lambda(\Delta^*)}\frac{\partial\Delta^*}{\partial w_i^A}.$$

This leads to

$$w_i^A = -\frac{\theta_i^A \lambda(\Delta^*)}{\partial\Delta^*/\partial w_i^A}\ .$$

Denoting by $\sum_{i\in\mathcal{N}} \theta_i^A = N - m_A$, the total markup by producers in channel A is given as

$$\sum\nolimits_{i\in\mathcal{N}} w_i^A = -\frac{(N-m_A)\lambda(\Delta^*)}{\partial\Delta^*/\partial w_i^A} = (N-m_A)\lambda(\Delta^*)(1+\lambda'(\Delta^*)-\mu'(\Delta^*)),$$

which is the same as the corresponding equation in the main model. Likewise, the total markup by producers in channel B is

$$\sum\nolimits_{i\in\mathcal{N}} w_i^B = \frac{(N-m_B)\mu(\Delta^*)}{\partial\Delta^*/\partial w_i^B} = (N-m_B)\mu(\Delta^*)(1+\lambda'(\Delta^*)-\mu'(\Delta^*)).$$

Therefore, the overall equilibrium is the same as Proposition 1. A minor difference is that each category-i producer's profit is now expressed as

$$\begin{aligned}
\pi_{i,rr}^{A*} &= \theta_i^A \lambda(\Delta_{rr}^*)(1+\lambda'(\Delta_{rr}^*)-\mu'(\Delta_{rr}^*))G(\Delta_{rr}^*)\,, \\
\pi_{i,rr}^{B*} &= \theta_i^B \mu(\Delta_{rr}^*)(1+\lambda'(\Delta_{rr}^*)-\mu'(\Delta_{rr}^*))(1-G(\Delta_{rr}^*))\,.
\end{aligned}$$

B Details of Section 5

B.1 Proof of Lemma 1

Following the same analysis as configurations rr and mm, the first-order conditions for the Stage-2 pricing (by channel-A strategic producers and channel-B intermediary) are given by

$$p_i^A = f^A + \lambda(\Delta^*) \qquad \text{and} \qquad \sum\nolimits_{i\in\mathcal{N}} p_i^B = \sum\nolimits_{i\in\mathcal{N}} w_i^B + \mu(\Delta^*),$$

where the value difference Δ^* in the equilibrium of the subgame is given by

$$\Delta^* = z + \sum\nolimits_{i\in\mathcal{N}} w_i^B + \mu(\Delta^*) - Nf^A - (N - m_A)\lambda(\Delta^*). \tag{36}$$

Turning to Stage 1 pricing (by channel-A intermediary and channel-B strategic producers), Assumption 1 guarantees the quasiconcavity of profit functions, and first-order conditions yield

$$\begin{aligned} f^A &= \frac{-\lambda(\Delta^*)}{d\Delta^*/df^A} = \frac{\lambda(\Delta^*)}{N}(1 + (N - m_A)\lambda'(\Delta^*) - \mu'(\Delta^*)) \\ w^B &= \frac{\mu(\Delta^*)}{d\Delta^*/dw_i^B} = \mu(\Delta^*)(1 + (N - m_A)\lambda'(\Delta^*) - \mu'(\Delta^*)). \end{aligned}$$

Substituting these back to (36) yields the overall equilibrium, and the uniqueness follows from Assumption 1.

B.2 Proof of Lemma 2

As a preliminary step, we summarize the key equilibrium objects in the text as follow, where the case of $\omega = rm$ is obtained by reversing the roles of channels A and B configuration mr. In what follows, we suppress the arguments of $\lambda(\Delta)$ and $\mu(\Delta)$ whenever doing so does not cause confusions.

For each configuration $\omega \in \{rr, mm, mr, rm\}$, the equilibrium difference is given by

$$\Delta_\omega^* = z + P_\omega^B(\Delta_\omega^*) - P_\omega^A(\Delta_\omega^*),$$

where

$$\begin{aligned} P_{rr}^B(\Delta) - P_{rr}^A(\Delta) &= \mu\left[(N - m_B) + 1 + (N - m_B)(\lambda' - \mu')\right] - \lambda\left[(N - m_A) + 1 + (N - m_A)(\lambda' - \mu')\right] \\ P_{mr}^B(\Delta) - P_{mr}^A(\Delta) &= \mu\left[(N - m_B) + 1 + (N - m_B)\left((N - m_A)\lambda' - \mu'\right)\right] - \lambda\left[(N - m_A) + 1 + (N - m_A)\lambda'(\Delta) - \mu'(\Delta)\right] \\ P_{mm}^B(\Delta) - P_{mm}^A(\Delta) &= \mu\left[(N - m_B) + 1 + (N - m_A)\lambda' - (N - m_B)\mu'\right] - \lambda\left[(N - m_A) + 1 + (N - m_A)\lambda' - (N - m_B)\mu'\right] \\ P_{rm}^B(\Delta) - P_{rm}^A(\Delta) &= \mu\left[(N - m_B) + 1 + \lambda' - (N - m_B)\mu'\right] - \lambda\left[(N - m_A) + 1 + (N - m_A)\left(\lambda' - (N - m_B)\mu'\right)\right]. \end{aligned}$$

Assumption 1 implies $P_\omega^B(\Delta) - P_\omega^A(\Delta)$ is decreasing in Δ for every configuration ω. Then, we have

$$\begin{aligned} \Delta_{rr}^* \le \Delta_{mr}^* \quad &\Leftrightarrow \quad P_{rr}^B(\Delta) - P_{rr}^A(\Delta) \le P_{mr}^B(\Delta) - P_{mr}^A(\Delta) \text{ for all } \Delta \\ &\Leftrightarrow \quad (N - m_A - 1)\left((N - m_B)\mu\lambda' - \lambda\mu'\right) \ge 0 \\ &\Leftrightarrow \quad m_A \le N - 1, \end{aligned}$$

and

$$\begin{aligned}\Delta^*_{mm} \geq \Delta^*_{rm} &\Leftrightarrow P^B_{mm}(\Delta) - P^A_{mm}(\Delta) \geq P^B_{rm}(\Delta) - P^A_{rm}(\Delta) \text{ for all } \Delta \\ &\Leftrightarrow (N - m_A - 1)\left[\mu(\Delta)\lambda'(\Delta) - (N - m_B)\mu'(\Delta)\lambda(\Delta)\right] \geq 0 \\ &\Leftrightarrow m_A \leq N - 1.\end{aligned}$$

B.3 Proof of Proposition 6

Case 1: Suppose $m_A \leq N - 1$. To show $BR_A(rs) = mk$, we know that $\Delta^*_{mr} \geq \Delta^*_{rr}$, which implies

$$\begin{aligned}\Pi^{A*}_{mr} &= \lambda(\Delta^*_{mr})\left(1 + (N - m_A)\lambda'(\Delta^*_{mr}) - \mu'(\Delta^*_{mr})\right)G(\Delta^*_{mr}) \\ &> \lambda(\Delta^*_{mr})G(\Delta^*_{mr}) \\ &\geq \lambda(\Delta^*_{rr})G(\Delta^*_{rr}) = \Pi^{A*}_{rr}.\end{aligned}$$

To show $BR_A(mk) = mk$, we know that $\Delta^*_{mm} \geq \Delta^*_{rm}$, which implies

$$\begin{aligned}\Pi^{A*}_{mm} &= \lambda(\Delta^*_{mm})\left(1 + (N - m_A)\lambda'(\Delta^*_{mm}) - (N - m_B)\mu'(\Delta^*_{mm})\right)G(\Delta^*_{mm}) \\ &> \lambda(\Delta^*_{mm})G(\Delta^*_{mm}) \\ &\geq \lambda(\Delta^*_{rm})G(\Delta^*_{rm}) = \Pi^{A*}_{rm}.\end{aligned}$$

Case 2: Suppose $m_A = m_B = N$. To show $BR_A(rs) = mk$, we know $\Delta^*_{rr} > \Delta^*_{mr}$ in this case. When $m_A = m_B = N$, each channel's price consists only of the intermediary's markup. Then, we can use the definitions of Δ^*_{mr} and Δ^*_{rr} to express the profits as

$$\begin{aligned}\Pi^{A*}_{mr} &= P^A_{mr}(\Delta^*_{mr})G(\Delta^*_{mr}) = (z + \mu(\Delta^*_{mr}) - \Delta^*_{mr})\,G(\Delta^*_{mr}) \\ \Pi^{A*}_{rr} &= P^A_{rr}(\Delta^*_{rr})G(\Delta^*_{rr}) = (z + \mu(\Delta^*_{rr}) - \Delta^*_{rr})\,G(\Delta^*_{rr}).\end{aligned}$$

Given $\Delta^*_{rr} > \Delta^*_{mr}$, we can conclude $\Pi^{A*}_{mr} > \Pi^{A*}_{rr}$ if $\psi(\Delta) \equiv (z + \mu(\Delta) - \Delta)G(\Delta)$ is decreasing for all $\Delta \geq \Delta^*_{mr}$. The latter is true because

$$\frac{d\psi(\Delta)}{d\Delta} = [z + \mu(\Delta) - \Delta + (\mu' - 1)\lambda(\Delta)]\,G'(\Delta) = \left[z + P^B_{mr}(\Delta) - P^A_{mr}(\Delta) - \Delta\right]G'(\Delta),$$

where $z + P^B_{mr}(\Delta) - P^A_{mr}(\Delta) - \Delta$ is zero when $\Delta = \Delta^*_{mr}$ and is negative for all $\Delta \geq \Delta^*_{mr}$. To show $BR_A(mk) = rs$, we know $\Delta^*_{rm} > \Delta^*_{mm}$ in this case, which implies

$$\Pi^{A*}_{rm} = \lambda(\Delta^*_{rm})G(\Delta^*_{rm}) > \lambda(\Delta^*_{mm})G(\Delta^*_{mm}) = \Pi^{A*}_{mm}.$$

Case 3: With uniform distribution specification,

$$\begin{aligned}
\Delta_{rr} &= \frac{2z-3\bar{\theta}\,(m_B-m_A)}{6\,(2N-m_A-m_B+1)} \\
\Delta_{mm} &= \frac{2z-\bar{\theta}\,(m_B-m_A)}{6\,(2N-m_A-m_B+1)} \\
\Delta_{rm} &= \frac{2z-\theta\left(N^2-1-(N+2-m_B)m_A-(N-2)m_B\right)}{4(2N-m_A-m_B)+2(N-m_A)(N-m_B)} \\
\Delta_{mr} &= \frac{2z-\theta\left(N^2+1-(N+2+m_B)m_A-(N-2)m_B\right)}{4(2N-m_A-m_B)+2(N-m_A)(N-m_B)}.
\end{aligned}$$

Suppose $m_A = N$. To identify a sufficient condition for $\Pi_{mr}^{A*} > \Pi_{rr}^{A*}$, we apply a revealed preference argument. Consider configuration mr, and suppose intermediary A deviates by choosing Stage-1 price $Nf^A = \lambda(\Delta_{rr}^*)$ while the channel-B Stage-1 price remains at $(N-m_B)\mu\,(\Delta_{mr}^*)\,(1-\mu'(\Delta_{mr}^*))$. From (36), the resulting value difference in the Stage-2 subgame is the solution $\hat{\Delta}$ to

$$\hat{\Delta} = z + (N-m_B)\mu\,(\Delta_{mr}^*)\,(1-\mu'(\Delta_{mr}^*)) + \mu(\hat{\Delta}) - \lambda(\Delta_{rr}^*), \tag{37}$$

and the resulting profit from the deviation is $\hat{\Pi}_{mr}^{A} = \lambda(\Delta_{rr}^*)G(\hat{\Delta}) \le \Pi_{mr}^{A*}$ by the definition of equilibrium profit. Therefore, a sufficient condition for $\Pi_{mr}^{A*} > \Pi_{rr}^{A*} = \lambda(\Delta_{rr}^*)G\,(\Delta_{rr}^*)$ is $\hat{\Delta} > \Delta_{rr}^*$, where Δ_{rr}^* is pinned down by

$$\Delta_{rr}^* = z + (N-m_B)\mu\left[1+\lambda'(\Delta_{rr}^*)-\mu'(\Delta_{rr}^*)\right] + \mu(\Delta_{rr}^*) - \lambda(\Delta_{rr}^*).$$

Given Assumption 1, it remains to show $\mu(1-\mu')|_{\Delta_{mr}^*} > \mu\left(1+\lambda'-\mu'\right)|_{\Delta_{rr}^*}$, which simplifies to the following due to the uniform distribution and $m_A = N$:

$$\begin{aligned}
& 2(\frac{\bar{\theta}}{2}-\Delta_{mr}^*) > 3\left(\frac{\bar{\theta}}{2}-\Delta_{rr}^*\right) \\
\Leftrightarrow\quad & 1-\frac{2\frac{z}{\bar{\theta}}+2(N-m_B)-1}{2(N-m_B)+4} > \frac{3}{2}-\frac{2\frac{z}{\bar{\theta}}+3(N-m_B)}{2(N-m_B)+2} \\
\Leftrightarrow\quad & m_B < N-\frac{1}{2}+\frac{z}{\bar{\theta}}.
\end{aligned}$$

Likewise, to identify a sufficient condition for $\Pi_{mm}^{A*} > \Pi_{rm}^{A*}$, we apply a revealed preference argument to configuration mm. Suppose intermediary A deviates and chooses Stage-1 price $Nf^A = \lambda(\Delta_{rm}^*)$ while the channel-B Stage-1 price remains at $\mu(\Delta_{mm}^*)\,[1-(N-m_B)\mu'(\Delta_{mm}^*)]$. The resulting value difference in the Stage-2 subgame is the solution $\hat{\Delta}$ to

$$\hat{\Delta} = z + \mu(\Delta_{mm}^*)\,[1-(N-m_B)\mu'(\Delta_{mm}^*)] + (N-m_B)\mu(\hat{\Delta}) - \lambda(\Delta_{rm}^*),$$

and the resulting profit from the deviation is $\hat{\Pi}_{mm}^{A} = \lambda(\Delta_{rm}^*)G(\hat{\Delta})$. Hence, a sufficient condition for $\Pi_{mm}^{A*} > \Pi_{rm}^{A*}$ is $\hat{\Delta} > \Delta_{rm}^*$, where Δ_{rm}^* is pinned down by

$$\Delta_{rm}^* = z + \mu\left[1+\lambda'(\Delta_{rm}^*)-(N-m_B)\mu'(\Delta_{rm}^*)\right] + (N-m_B)\mu(\Delta_{rm}^*) - \lambda(\Delta_{rm}^*).$$

Given Assumption 1, it remains to show $\mu(1-(N-m_B)\mu')|_{\Delta^*_{mm}} > \mu\left(1+\lambda'-(N-m_B)\mu'\right)|_{\Delta^*_{rm}}$, which simplifies to the following due to uniform distribution and $m_A = N$:

$$\begin{aligned} & (1+N-m_B)(\frac{\bar{\theta}}{2}-\Delta^*_{mm}) > (2+N-m_B)\left(\frac{\bar{\theta}}{2}-\Delta^*_{rm}\right) \\ \Leftrightarrow\quad & (1+(N-m_B))\left(\frac{1}{2}-\frac{2\frac{z}{\bar{\theta}}+(N-m_B)}{6(N-m_B)+6}\right) > (2+N-m_B)\left(\frac{1}{2}-\frac{2\frac{z}{\bar{\theta}}+2(N-m_B)+1}{4(N-m_B)+8}\right) \\ \Leftrightarrow\quad & m_B < N-\frac{3}{4}+\frac{z}{2\bar{\theta}} \end{aligned}$$

Let $\bar{m}_B \equiv \min\{N-\frac{1}{2}+\frac{z}{\bar{\theta}}, N-\frac{3}{4}+\frac{z}{2\bar{\theta}}\} = N-\frac{3}{4}+\frac{z}{2\bar{\theta}}$, then $\Pi^{A*}_{mr} > \Pi^{A*}_{rr}$ and $\Pi^{A*}_{mm} > \Pi^{A*}_{rm}$ for $m_B < \bar{m}_B$, implying $BR_A(\omega_B) = mk$.

C Details of Section 6.1

C.1 Proof of Proposition 7

Suppose $1 \le n_k \le N$ for each channel $k \in \{A, B\}$. The Stage-2 pricing best responses are derived in the main text. The consumer value difference Δ^* is given by

$$\Delta = z + \sum\nolimits_{i\in S^B_r} w^B_i - \sum\nolimits_{i\in S^A_r} w^A_i + (N-n_B+1)\mu(\Delta) - (N-n_A+1)\lambda(\Delta).$$

Now consider Stage-1 pricing. In channel A, each monopoly producer $i \in S^A_r$ chooses the wholesale price w^A_i to maximize its profit $\pi^A_i = w^A_i G(\Delta^*_{hh})$. The first-order condition for the symmetric equilibrium wholesale price is given by

$$w^A = \frac{-\lambda(\Delta^*_{hh})}{d\Delta^*/dw^A_i} = \lambda(\Delta^*_{hh})\left[1+(N-n_A+1)\lambda'(\Delta^*_{hh})-(N-n_B+1)\mu'(\Delta^*_{hh})\right], \tag{38}$$

where the derivative of Δ^*_{hh} comes from totally differentiating its definition Δ^*_{hh}. Similarly, in channel B, each monopoly producer $i \in S^B_r$ maximizes its profit $\pi^B_i = w^B_i(1-G(\Delta^*_{hh}))$, and the associated first-order condition is

$$w^B = \frac{\mu(\Delta^*_{hh})}{d\Delta^*/dw^B_i} = \mu(\Delta^*_{hh})\left[1+(N-n_A+1)\lambda'(\Delta^*_{hh})-(N-n_B+1)\mu'(\Delta^*_{hh})\right].$$

Substituting the resulting wholesale prices into the definition of Δ determines the overall equilibrium, as shown in Proposition 7.

C.2 Proof of Corollary 4

By symmetry, $\Delta^*_{hh} = \Delta^*_{mm} = 0$, so that $P^{A*}_{hh} = P^{B*}_{hh} = P^A_{hh}(0)$ and $P^{A*}_{mm} = P^{B*}_{mm} = P^A_{mm}(0)$, where

$$\begin{aligned} P^A_{hh}(\Delta) &= (N+1)\lambda(\Delta) + n(N-n_A+1)\lambda(\Delta)\left[\lambda'(\Delta)-\mu'(\Delta)\right] \\ &> (N+1)\lambda(\Delta) + N\lambda(\Delta)\left[\lambda'(\Delta)-\mu'(\Delta)\right] \\ &= P^A_{mm}(\Delta). \end{aligned}$$

Therefore, $P^{k*}_{hh} > P^{k*}_{mm}$ for both channels.

Then, intermediary k's profit is lower under the hybrid configuration:

$$\Pi^{A*}_{mm} = (1 + N\left(\lambda'(0) - \mu'(0)\right))\lambda(0)G(0) > \lambda(0)G(0) = \Pi^{A*}_{hh},$$

and

$$\Pi^{B*}_{mm} = (1 + N\left(\lambda'(0) - \mu'(0)\right))\mu(0)\left(1 - G(0)\right) > \mu(0)\left(1 - G(0)\right) = \Pi^{B*}_{hh}.$$

Consider producer profits in each channel $k \in \{A, B\}$. For each category j that remains as a marketplace category (i.e., $j \in S^k_m$), it is clear that each individual producer's profit does not change given $\Delta^*_{hh} = \Delta^*_{mm} = 0$:

$$\pi^{k*}_{hh} = \pi^{k*}_{mm} = \lambda(0)G(0) = \mu(0)G(0).$$

For each category i that becomes a reseller category after the shift to hybrid model (i.e., $i \in S^k_r$), individual producer's profit increases because

$$\pi^{k*}_{hh} = \lambda(0)(1 + (N - n_A + 1)\lambda'(0) + (N - n_B + 1)\mu'(0))G(0) > \pi^{k*}_{rr}.$$

D Details of Section 6.2

It remains to check that in the marketplace configuration with vertical integration, each individual intermediary k always finds it suboptimal to set a fee f^k where NPC does not bind. Recall that in this configuration, the Stage-2 pricing subgame has equilibrium value difference Δ^* that solves the fixed-point equation:

$$\Delta^* = \begin{array}{l} z - (N - m_A)(f^A + \lambda(\Delta^*)) + \ (N - m_B)(f^B + \mu(\Delta^*)) \\ - \max\{\lambda(\Delta^*) - (N - m_A)f^A, 0\} + \max\{\mu(\Delta^*) - (N - m_B)f^B, 0\} \end{array}, \tag{39}$$

where m_k is the number of vertically integrated categories.

Without loss of generality, we consider intermediary A Stage-2 fee-setting decision. To proceed, we first define Δ^*_{bind} and Δ^*_{nobind} respectively as the solutions to (39) when NPC binds and does not bind for intermediary A:

$$\begin{aligned} \Delta^*_{nobind} &= z - (N - m_A + 1)\lambda(\Delta^*_{nobind}) + \ (N - m_B)(f^B + \mu(\Delta^*_{nobind})) + \max\{\mu(\Delta^*_{nobind}) - (N - m_B)f^B, 0\}, \\ \Delta^*_{bind} &= z - (N - m_A)(f^A + \lambda(\Delta^*_{bind})) + \ (N - m_B)(f^B + \mu(\Delta^*_{bind})) + \max\{\mu(\Delta^*_{bind}) - (N - m_B)f^B, 0\}. \end{aligned}$$

Observe that Δ^*_{nobind} is independent of f^A, whereas Δ^*_{bind} is continuous and strictly decreasing in f^A because it is generally piece-wise differentiable:

$$\frac{d\Delta^*_{bind}}{df^A} = \begin{array}{ll} \frac{-(N-m_A)}{1+(N-m_A)\lambda'(\Delta^*_{bind}) - \ (N-m_B)\mu'(\Delta^*_{bind})} & \text{if } \mu(\Delta^*_{bind}) < (N - m_B)f^B \\ \frac{-(N-m_A)}{1+(N-m_A)\lambda'(\Delta^*_{bind}) - \ (N-m_B+1)\mu'(\Delta^*_{bind})} & \text{if } \mu(\Delta^*_{bind}) > (N - m_B)f^B \end{array}$$

so that

$$-\,(N - m_A) < \frac{d\Delta^*_{bind}}{df^A} < 0, \tag{40}$$

and we note that there is a kink point when f_A is such that $\mu(\Delta^*_{bind}) = (N - m_B)f^B$.

Next, we define $\bar{f}^A$ as the critical threshold fee above which the NPC binds

$$\bar{f}^A = \frac{\lambda(\Delta^*_{nobind})}{N - m_A} > 0.$$

Observe that $\Delta^*_{nobind} = \Delta^*_{bind}$ when $f^A = \bar{f}^A$. Given these definitions, the equilibrium value difference can be piece-wise defined as:

$$\Delta^* = \begin{cases} \Delta^*_{nobind} & \text{if } f^A < \bar{f}^A \\ \Delta^*_{bind} & \text{if } f^A \geq \bar{f}^A \end{cases}.$$

Observe that Δ^* is continuous at $f^A = \bar{f}^A$ but not differentiable at $f^A = \bar{f}^A$.

Intermediary A's Stage-1 integrated profit is

$$\Pi^A(f^A) = \left\{ \begin{array}{ll} \lambda(\Delta^*_{nobind})G(\Delta^*_{nobind}) & \text{if } f^A < \bar{f}^A \\ (N - m_A)f^A G(\Delta^*_{bind}) & \text{if } f^A \geq \bar{f}^A \end{array} \right\}, \tag{41}$$

which is constant in f^A for $f^A < \bar{f}^A$, and the right-hand limit of the profit derivative near $f^A = \bar{f}^A$ is

$$\begin{aligned} \lim_{f^A \searrow \bar{f}^A} \frac{d\Pi^A}{df^A} &= \lim_{f^A \searrow \bar{f}^A} \left\{ (N - m_A)f^A g(\Delta^*_{bind}) \frac{d\Delta^*_{bind}}{df^A} + (N - m_A)G(\Delta^*_{bind}) \right\} \\ &> \lim_{f^A \searrow \bar{f}^A} \left\{ -(N - m_A)^2 f^A g(\Delta^*_{bind}) + (N - m_A)G(\Delta^*_{bind}) \right\} \\ &> \lim_{f^A \searrow \bar{f}^A} \left\{ -(N - m_A)\lambda(\Delta^*_{nobind}) g(\Delta^*_{bind}) + (N - m_A)G(\Delta^*_{bind}) \right\} \\ &= 0 \end{aligned}$$

where the first inequality used (40), the second inequality used the definition of $\bar{f}^A$, and the final equality used $\lim_{f^A \searrow \bar{f}^A} \Delta^*_{bind} = \Delta^*_{nobind}$ and continuity. Therefore, the profit function is initially flat in f^A until $f^A = \bar{f}^A$, and then becomes locally increasing for $f^A > \bar{f}^A$ that are sufficiently close to $\bar{f}^A$. Therefore, it is never optimal to choose $f^A < \bar{f}^A$, regardless of f^B.

E Details of Section 6.3

Suppose we add an additional strategic multihoming producer l who can potentially sell at both retail channels, whose product value is denoted as u_l^k at each channel. Suppose $u_l^A = u_l^B = u_l$ for simplicity. The main results of this Online Appendix are the following:

- In the reseller configuration, producer l will price at $w_l^A = w_l^B = u_l$, and so the existence of this reseller does not affect our equilibrium outcome. The analysis has been provided in the main text.
- In the marketplace configuration, producer l will generally want to set a lower price at the channel that has a lower fee, whenever the fee difference is large enough. This creates potential non-quasiconcavity in each intermediary's objective function when it deviates with a very low fee. Nonetheless, such a large fee difference is infeasible for the intermediaries if N is large enough (while fixing the number of non-fringe producers $N - m_k$).

□ **Multihoming pricing.** The multihoming producer l's profit is

$$\pi_l = (p_l^A - f^A)G(\Delta) + (p_l^B - f^B)(1 - G(\Delta)),$$

where

$$\Delta = z + \sum_{i \in \mathcal{N}} p_i^B - \sum_{i \in \mathcal{N}} p_i^A - \left(p_l^A - p_l^B\right).$$

We know that producer l can strictly increase its profit by raising both prices simultaneously, as long as doing so is feasible. So, we must have either $p_l^A = u_l$ or $p_l^B = u_l$, depending on the margin that seller l can earn in each channel.

Case 1: suppose $f^B - f^A \geq 0$**.** Then l can earn a larger margin at channel A: $u_l - f^A > u_l - f^B$. Therefore, we must have $p_l^B = u_l$ and $p_l^A < u_l$. The pricing problem simplifies to

$$\begin{aligned} \pi_l &= (p_l^A - f^A - u_l + f^B)G(\Delta) + u_l - f^B \\ \Delta &= z + \sum_{i \in \mathcal{N}} p_i^B - \sum_{i \in \mathcal{N}} p_i^A + u_l - p_l^A. \end{aligned}$$

This is a standard pricing problem except that we have an extra "marginal cost term" $u_l - f^B$ representing that whenever l makes sales in channel A it foregoes revenue in channel B. We then obtain:

$$\begin{aligned} p_l^A &= u_l - \max\{f^B - f^A - \lambda(\Delta^*), 0\} \\ p_l^B &= u_l \end{aligned}$$

Intuitively, $f^B - f^A - \lambda(\Delta^*)$ represents the extent to which the producer reduces its channel-A price to steer consumers toward channel A.

Case 2: suppose $f^B - f^A < 0$**.** An analogous argument shows

$$\begin{aligned} p_l^A &= u_l \\ p_l^B &= u_l - \max\{f^A - f^B - \mu(\Delta^*), 0\}. \end{aligned}$$

□ **Stage-1 pricing.** For each given f^B, we denote the critical levels of f^A below which the producer sets $p_l^A < u_l$ as follows:

$$\begin{aligned} \bar{f}_{down}^A &\equiv f^B - \lambda(\bar{\Delta}_{down}) \\ \text{where } \bar{\Delta}_{down} &\equiv z + (N - m_B)\mu\left(\bar{\Delta}_{down}\right) + m_A\lambda(\bar{\Delta}_{down}), \end{aligned}$$

where $\bar{\Delta}_{down}$ is defined by substituting $f^A - f^B = -\lambda(\Delta)$ into the definition of Δ^* around the region where $p_l^A = p_l^B = u_l$. Likewise, define the critical levels of f^A above which the producer sets $p_l^B < u_l$ as follows:

$$\begin{aligned} \bar{f}_{up}^A &\equiv f^B + \mu(\bar{\Delta}_{up}) \\ \text{where } \bar{\Delta}_{up} &\equiv z - m_B\mu\left(\bar{\Delta}_{up}\right) - (N - m_A)\lambda(\bar{\Delta}_{up}), \end{aligned}$$

where $\bar{\Delta}_{up}$ is defined by substituting $f^A - f^B = \mu(\Delta)$ into the definition of Δ^*.

Consider intermediary A's maximizing its profit: $\Pi^A = (N+1)f^A G(\Delta^*)$, in which

$$\Delta^* = \left\{ \begin{array}{cc} z + Nf^B + (N-m_B)\mu(\Delta^*) - Nf^A - (N-m_A)\lambda(\Delta^*) - \overbrace{(f^A - f^B - \mu(\Delta^*))}^{\text{new}, >0} & \text{if } f^A - f^B > \mu(\bar{\Delta}_{up}) \\ z + Nf^B + (N-m_B)\mu(\Delta^*) - Nf^A - (N-m_A)\lambda(\Delta^*) & \text{if } f^A - f^B \in [-\lambda(\bar{\Delta}_{down}), \mu(\bar{\Delta}_{up})] \\ z + Nf^B + (N-m_B)\mu(\Delta^*) - Nf^A - (N-m_A)\lambda(\Delta^*) + \underbrace{(f^B - f^A - \lambda(\Delta^*))}_{\text{new}, >0} & \text{if } f^A - f^B < -\lambda(\bar{\Delta}_{down}) \end{array} \right\}$$

where the new objects come from pricing of the multihoming seller l. This indicates a potential non-quasiconcavity problem because the demand function Δ^* is not smooth in f_A (recall it is still continuous and decreasing in f_A). That is, starting from $f^A < f^B - \lambda(\bar{\Delta}_{down})$, it kinks up when f^A just passes $f^A = f^B - \lambda(\bar{\Delta}_{down})$. Then, it kinks down again when f^A just passes $f^A = f^B + \mu(\bar{\Delta}_{up})$.

□ **Scenario 1 (small asymmetry between channels).** Starting from the mm equilibrium we characterized in the main text, we find the condition ensures that the existing equilibrium remains valid with the addition of the multihoming seller l. Obviously, this requires seller l to set $p_l^A = p_l^A = u_l$, which requires on the equilibrium path that

$$f_{mm}^{A*} - f_{mm}^{B*} \in \left[-\lambda(\bar{\Delta}_{down}), \mu(\bar{\Delta}_{up})\right],$$

which holds if the extent of asymmetry is not sufficiently large. We also assume $\Delta_{mm}^* \geq 0$ without loss of generality.

Consider intermediary A's deviation incentive. The fact that the demand kinks down at $f^A > f_{mm}^{B*} + \mu(\bar{\Delta}_{up})$ means there is no incentive to deviate upward. Meanwhile, a meaningful downward deviation (i.e., induce a change in l's pricing) requires setting $f^A < f_{mm}^{B*} - \lambda(\bar{\Delta}_{down})$, and we can rule it out. Formally, recall

$$f_{mm}^{B*} = \frac{\mu(\Delta_{mm}^*)}{N}(1 + (N-m_A)\lambda'(\Delta_{mm}^*) - (N-m_B)\mu'(\Delta_{mm}^*).$$

This is a fully pinned down object that is decreasing in N (this is equivalent to having more fringe producers without changing m_A and m_B), and $\lim_{N\to\infty} f^{B*} = 0$.

Then, any meaningful downward deviation is indeed infeasible if $f_{mm}^{B*} - \lambda(\bar{\Delta}_{down}) < 0$. This is equivalent to:

$$\lambda(\bar{\Delta}_{down}) > \frac{\mu(\Delta_{mm}^*)}{N}(1 + (N-m_A)\lambda'(\Delta_{mm}^*) - (N-m_B)\mu'(\Delta_{mm}^*))$$

We note that $\bar{\Delta}_{down} > \Delta_{mm}^*$ by construction (A deviates downward), and so it is sufficient to have:

$$N > \frac{1}{\lambda(\Delta_{mm}^*)}\mu(\Delta_{mm}^*)(1 + (N-m_A)\lambda'(\Delta_{mm}^*) - (N-m_B)\mu'(\Delta_{mm}^*)). \quad (42)$$

Observe that the numerator of RHS of (42) is decreasing in Δ_{mm}^* by Assumption 1 while the denominator is increasing. Analogously, the condition to rule out B's deviation is:

$$N > \frac{1}{\mu(\Delta_{mm}^*)}\lambda(\Delta_{mm}^*)(1 + (N-m_A)\lambda'(\Delta_{mm}^*) - (N-m_B)\mu'(\Delta_{mm}^*)), \quad (43)$$

where we used $\hat{\Delta} < \Delta^*_{mm}$, which holds by construction regarding B's deviation. Given $\Delta^*_{mm} \geq 0$, we observe that (43) is stronger than (42) because $\frac{1}{\mu(\Delta^*_{mm})} > \frac{1}{\lambda(\Delta^*_{mm})}$.

In sum, (43) is what we need to ensure the existing equilibrium is still valid. Moreover, the RHS of (43) is independent of N so we can always choose large enough N to make sure (43) holds. Moreover, in the special case of $\Delta^*_{mm} = 0$, then (43) simplifies to

$$
\begin{aligned}
& N > \frac{\mu(0)}{\lambda(0)}(1 + (N - m_A)\lambda'(0) - (N - m_B)\mu'(0)) \\
\iff \quad & N > 1 + (m_B - m_A)\lambda'(0). \qquad (44)
\end{aligned}
$$

which is relatively mild (e.g., if $m_A = m_B$ then this just requires $N > 1$).

☐ **Scenario 2 (strong asymmetry between channels)**. Suppose on the equilibrium path, we have $\Delta^*_{mm} \geq 0$ and that

$$f^{A*}_{mm} - f^{B*}_{mm} < -\lambda(\bar{\Delta}_{down})$$

(Note the case of $f^{A*}_{mm} - f^{B*}_{mm} > \mu(\Delta^*_{mm})$ can be handled analogously). In this case, intermediary A might deviate to $f^A > f^{B*}_{mm} - \lambda(\bar{\Delta}_{down})$ because the demand kinks up when f^A just passes $f^A = f^B - \lambda(\bar{\Delta}_{down})$. Again, a large N rules out this possibility:

$$f^{A*}_{mm} - f^{B*}_{mm} = \frac{\lambda(\Delta^*_{mm}) - \mu(\Delta^*_{mm})}{N}(1 + (N - m_A)\lambda'(\Delta^*_{mm}) - (N - m_B)\mu'(\Delta^*_{mm})).$$

Note that $f^{A*}_{mm} - f^{B*}_{mm} \to 0$ if $N \to \infty$ (while fixing the number of non-fringe producers $N - m_k$). It follows that we can rule out situation where $f^{A*}_{mm} - f^{B*}_{mm} < -\lambda(\bar{\Delta}_{down}) < 0$. That is, a large N allows us to rule out Scenario 2 and focus on Scenario 1 (where we have shown that large N rules out deviations).

F Details of the uniform distribution specification

In this Appendix, we present the equilibrium outcome of the uniform distribution specification (1) for all four configurations of business models $\omega \in \{rr, mm, mr, rm\}$. Based on Propositions 1, 2, and Lemma 2, we derive

$$
\begin{aligned}
\Delta^*_{rr} &= \frac{2z - 3\bar{\theta}\,(m_B - m_A)}{6\,(2N - m_A - m_B + 1)} \\
\Delta^*_{mm} &= \frac{2z - \bar{\theta}\,(m_B - m_A)}{6\,(2N - m_A - m_B + 1)} \\
\Delta^*_{rm} &= \frac{2z - \theta\left(N^2 - 1 - (N + 2 - m_B)m_A - (N - 2)m_B\right)}{4(2N - m_A - m_B) + 2(N - m_A)(N - m_B)} \\
\Delta^*_{mr} &= \frac{2z - \theta\left(N^2 + 1 - (N + 2 + m_B)m_A - (N - 2)m_B\right)}{4(2N - m_A - m_B) + 2(N - m_A)(N - m_B)}.
\end{aligned}
$$

Then, interiority of equilibrium requires $\Delta^* \in [-\frac{\bar{\theta}}{2}, \frac{\bar{\theta}}{2}]$. The corresponding profits are

$$\begin{aligned}
\Pi_{rm}^{A*} &= \frac{1}{4\bar{\theta}}\left(\bar{\theta}+2\Delta_{rm}^*\right)^2, \\
\Pi_{mm}^{A*} &= \frac{1+2N-m_A-m_B}{4\bar{\theta}}\left(\bar{\theta}+2\Delta_{mm}^*\right)^2, \\
\Pi_{rr}^{A*} &= \frac{1}{4\bar{\theta}}\left(\bar{\theta}+2\Delta_{rr}^*\right)^2, \\
\Pi_{mr}^{A*} &= \frac{2+m_A}{4\bar{\theta}}\left(\bar{\theta}+2\Delta_{mr}^*\right)^2.
\end{aligned}$$

Focusing on configurations rr and mm, we have

$$\begin{aligned}
\Delta_{rr}^* &\in [-\frac{\bar{\theta}}{2}, \frac{\bar{\theta}}{2}] \Leftrightarrow z \in \left[-3\bar{\theta}\left(\frac{1}{2}+N-m_B\right), 3\bar{\theta}\left(\frac{1}{2}+N-m_A\right)\right] \\
\Delta_{mm}^* &\in [-\frac{\bar{\theta}}{2}, \frac{\bar{\theta}}{2}] \Leftrightarrow z \in \left[-3\bar{\theta}\left(\frac{1}{2}+\frac{3N-2m_B-m_A}{3}\right), 3\bar{\theta}\left(\frac{1}{2}+\frac{3N-m_B-2m_A}{3}\right)\right].
\end{aligned}$$

A sufficient condition for both to hold is

$$z \in \left[-3\bar{\theta}\left(\frac{1}{2}+N-\min\{m_B,m_A\}\right), 3\bar{\theta}\left(\frac{1}{2}+N-\max\{m_B,m_A\}\right)\right],$$

as stated in the text.

Under configurations mm and rr, the retail prices are given by

$$\begin{aligned}
P_{rr}^{A*} &= \frac{(1+3N-3m_A)(2z+(3+6N-6m_B)\overline{\theta})}{6(2N-m_A-m_B+1)}, \\
P_{rr}^{B*} &= \frac{(1+3N-3m_B)(-2z+(3+6N-6m_A)\overline{\theta})}{6(2N-m_A-m_B+1)}, \\
P_{mm}^{A*} &= \frac{(1+3N-2m_A-m_B)(2z+(3+6N-2m_A-4m_B)\overline{\theta})}{6(2N-m_A-m_B+1)}, \\
P_{mm}^{B*} &= \frac{(1+3N-2m_B-m_A)(-2z+(3+6N-2m_B-4m_A)\overline{\theta})}{6(2N-m_A-m_B+1)}.
\end{aligned}$$

and the equilibrium profits are

$$\begin{aligned}
\Pi_{rr}^{A*} &= \frac{(2z+(3+6N-6m_B)\overline{\theta})^2}{36(2N-m_A-m_B+1)^2\overline{\theta}}, \quad \Pi_{rr}^{B*} = \frac{(-2z+(3+6N-6m_A)\overline{\theta})^2}{36(2N-m_A-m_B+1)^2\overline{\theta}}, \\
\Pi_{mm}^{A*} &= \frac{(2z+(3+6N-2m_A-4m_B)\overline{\theta})^2}{36(2N-m_A-m_B+1)\overline{\theta}}, \; \Pi_{mm}^{B*} = \frac{(-2z+(3+6N-2m_B-4m_A)\overline{\theta})^2}{36(2N-m_A-m_B+1)\overline{\theta}}.
\end{aligned}$$