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Can Intense Preferences Shape Markets? Preference Concentration and Product Survival

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Abstract

This paper studies how the distribution of preference intensity affects product survival. Consumers may have the same average valuation of a product attribute, yet differ sharply in how concentrated that valuation is across the population. I show that this distinction matters for market selection. In a differentiated-product economy with fixed operating costs, a product survives only if it attracts enough revenue to cover its fixed cost. When the revenue contribution of consumers is convex in preference intensity, concentrating a fixed aggregate valuation among fewer high-intensity consumers raises the revenue of high-attribute products. Thus, small groups of strongly attached consumers can sustain varieties that would fail under a more diffuse distribution of moderate preferences. In a ranked-attribute benchmark, this condition has a simple interpretation: the product benefits from concentration when it is sufficiently distant from the share-weighted center of the active product range. The paper also separates private survival from welfare and aggregate impact. Applications to green products and privacy-oriented digital services show that cleaner or more privacy-protective varieties improve aggregate outcomes only when they sufficiently displace dirtier or more data-intensive alternatives.

Keywords: preference concentration; product survival; behavioral heterogeneity; differentiated products; green preferences; privacy preferences.

JEL classifications: D11; D43; L11; L13; Q56

1. Introduction

Markets often depend not only on what consumers value on average, but also on how intensely some consumers value particular product attributes. A product may fail if many consumers attach moderate value to its distinguishing characteristic yet survive if a smaller group attaches very high value to the same characteristic. This distinction matters for markets in which some attributes are narrow in appeal but strong in attachment: environmental quality, privacy protection, ethical sourcing, local identity, authenticity, craftsmanship, or ideological fit.

This paper studies how the concentration of preferences for a focal product attribute affects product selection in a differentiated-product economy with fixed operating costs. Consumers differ in the intensity with which they value the focal attribute. Products differ in general appeal, productivity, fixed operating labor requirements, and the level of the focal attribute they offer. A product survives only if the revenue it attracts from consumers generates enough variable profit to cover its fixed operating cost. The central question is whether product survival depends only on the average valuation of the focal attribute, or whether the distribution of that valuation also matters.

The paper shows that preference concentration can be a market-selection force. Throughout the paper, "preference concentration" refers to the concentration of a fixed aggregate valuation among fewer high-intensity consumers. In statistical terms, the distribution of individual preference intensity becomes more dispersed, while its mean is held fixed. The term concentration is therefore used in an economic rather than purely statistical sense: the same aggregate preference mass is held by a smaller and more intensely attached group. Holding the average focal preference fixed, a more concentrated distribution of preferences can raise the revenue of high-attribute products when consumer revenue contributions are convex in preference intensity. In that case, intense consumers contribute more than proportionally to the revenue of the focal product. A smaller group of highly attached consumers may therefore generate more revenue than a larger group of moderately attached consumers with the same average preference. The underlying intuition is behavioral, while the consequence is industrial-organizational: once preference intensity is sufficiently high, the focal attribute can become central to product choice, shifting revenue toward high-attribute varieties and affecting which products survive.

The result is especially transparent when products can be ranked by the level of the focal attribute they embody. In that case, preference concentration raises the revenue of the highest-attribute product when that product is sufficiently far from the center of the active product range. Thus, a niche product in this paper is not simply a product with a small market share. It is a product that is sufficiently distinct in the focal-attribute dimension. When this is true, high-intensity consumers shift expenditure toward it more strongly as their preference intensity rises, increasing the revenue it attracts from the market.

The revenue gain has direct implications for product survival. Since firms must cover fixed operating costs, a concentration-induced increase in revenue can allow a focal product to survive even when the average focal preference in the population is unchanged. Thus, the market may sustain products aligned with intense niche demand that would disappear under a more diffuse distribution of the same total preference mass.

The paper also separates survival from welfare and aggregate impact. A product survives when it is privately profitable. Welfare, however, depends on the utility generated by the product and on the labor required to produce and operate it. Similarly, when the focal attribute is associated with an aggregate outcome, survival need not imply improvement. In green markets, concentrated environmental preferences may sustain cleaner varieties, but emissions fall only if green consumption sufficiently displaces brown consumption. In digital markets, concentrated privacy preferences may sustain low-data varieties, but aggregate data extraction falls only if privacy-oriented use sufficiently displaces data-intensive use.

The contribution is threefold. First, the paper identifies preference concentration as a determinant of product survival in differentiated-product markets with fixed operating costs. Second, it provides conditions under which concentration raises the revenue of high-attribute products. Third, it shows that the survival of socially or behaviorally salient varieties should not be confused with welfare improvement or with improvements in associated aggregate outcomes. This is not a segment-size result: the average valuation of the focal attribute is held fixed, and only the distribution of that valuation changes.

The rest of the paper is organized as follows. Section 2 presents the model. Section 3 derives the revenue, survival, and welfare results. Section 4 applies the framework to green preferences and privacy preferences. Section 5 concludes.

1.1 Related literature

This paper is related first to the literature on differentiated products, product variety, and entry under fixed costs. Dixit and Stiglitz (1977) provide the canonical framework for monopolistic competition and product diversity, while Spence (1976) and Mankiw and Whinston (1986) analyze the welfare properties of product variety and free entry. Mankiw and Whinston show that private entry decisions need not coincide with social optimality when entry involves fixed costs and business stealing. Our paper shares the focus on endogenous product survival under fixed costs, but asks a different question: how does the distribution of preference intensity affect which products survive? The novelty is not that entry may be excessive or insufficient, but that mean-preserving changes in the concentration of preferences can change product-level revenues and therefore the equilibrium product mix.

The model also builds on the characteristics approach to consumer demand. Lancaster (1966) shifted attention from goods as primitive objects of preference to goods as bundles of characteristics. In the present paper, each variety has general appeal and a focal attribute. Consumers differ in the intensity with which they value the focal attribute, so the same physical variety may have different perceived appeal across consumer types. This structure allows the paper to study how the distribution of attachment to a particular characteristic affects product-level revenue and survival.

The paper is also connected to work on identity, prosocial motivation, and socially salient consumption. Akerlof and Kranton (2000) show how identity can enter preferences and affect economic outcomes. Andreoni (1990) develops the idea of warm-glow giving, while Bénabou and Tirole (2006, 2010) analyze prosocial behavior, self-image, reputation, and corporate social responsibility. These contributions help motivate why some consumers may attach unusually high value to attributes such as ethical production, environmental performance, authenticity, or privacy. Our paper does not model the psychological origin of such preferences. Instead, it studies how the distribution of these preferences affects market selection.

The green-market application relates to the literature on private provision of public goods and environmentally differentiated consumption. Kotchen (2006) develops a model of green markets in which consumers may purchase impure public goods that jointly provide private consumption and environmental benefits, and shows that green markets can have beneficial or detrimental effects on environmental quality and welfare. Besley and Ghatak (2007) analyze corporate social responsibility as private provision or curtailment of public goods and public bads through firms. Binder and Blankenberg (2017) link green lifestyles to self-image and subjective well-being, providing a behavioral motivation for why environmental attributes may matter intensely for some consumers beyond their direct environmental consequences. Our contribution is complementary: rather than focusing on whether consumers value green behavior, we ask when concentrated environmental preferences allow cleaner varieties to survive, and when that survival translates into lower emissions.

The privacy application relates to the economics of privacy and data. Acquisti *et al.* (2016) survey theoretical and empirical work on the economics of privacy. Goldfarb and Tucker (2012) study how privacy regulation can affect data-based innovation, while Athey *et al.* (2017) document distortions in privacy choices and the privacy paradox. Marreiros *et al.* (2017) study information, inattention, and online privacy, showing that privacy behavior may depend on whether privacy concerns are made salient. Feri et al. (2016) study disclosure of personal information under privacy shocks. These contributions support the idea that privacy preferences may be heterogeneous, behaviorally mediated, and unevenly activated across consumers. Our contribution is narrower and more structural: privacy is treated as a product attribute, and the analysis asks whether concentrated privacy preferences can sustain low-data varieties and whether their survival reduces aggregate data extraction.

The paper therefore connects behavioral preference heterogeneity with product-market selection. Existing work has emphasized product variety, free entry, social preferences, green consumption, and privacy. The present paper adds a distributional mechanism: holding the average valuation of a focal attribute fixed, the concentration of that valuation can change product revenue and survival.

1.2 Behavioral interpretation of preference concentration

The central object in the paper is the distribution of preference intensity. Consumers may agree, on average, that a particular product attribute is valuable, but differ substantially in how strongly that attribute affects their choices. For some consumers, the attribute is secondary and may matter only at the margin. For others, it is central to product evaluation and may dominate otherwise important characteristics such as convenience, familiarity, price, or general appeal.

This distinction is especially relevant for attributes with behavioral, identity-based, ethical, or psychological content. Environmental quality, privacy protection, authenticity, ethical sourcing, local identity, craftsmanship, and ideological fit are not always valued as ordinary product characteristics. They may become salient or self-relevant for some consumers, while remaining weakly relevant for others. In such cases, the market effect of the attribute depends not only on its average valuation, but also on how intensely it is valued by the consumers for whom it is most important.

Preference concentration captures this idea. Throughout the paper, a more concentrated distribution means that a fixed aggregate valuation of the focal attribute is held by a smaller group of high-intensity consumers. In statistical terms, this corresponds to a mean-preserving increase in dispersion of the individual preference parameter. In economic terms, however, the same preference mass becomes more concentrated among consumers for whom the focal attribute is more behaviorally decisive.

This interpretation separates the paper from a standard market-size argument. The mechanism is not that a larger group of consumers values the focal attribute, nor that the average valuation of the attribute increases. Instead, the question is whether the same average valuation generates different market outcomes when it is distributed broadly across many moderate consumers or concentrated among fewer intense consumers. When high-intensity consumers shift expenditure toward focal products more than proportionally, this difference can affect product revenue and survival.

The behavioral content of the mechanism is therefore simple. Attributes that are weakly valued by many consumers may have limited market consequences, even when average concern appears substantial. By contrast, attributes that are strongly valued by a smaller group may sustain specialized products if those consumers treat the attribute as choice-defining. The model formalizes this channel by showing when preference concentration raises the revenue of high-attribute products and allows them to survive despite fixed operating costs.

2. The model

We consider a static general-equilibrium economy with a homogeneous numeraire sector and a differentiated-product sector. The differentiated sector contains a finite set of potential products. Each product is supplied by a single firm and is characterized by general appeal, productivity, and a focal attribute. Operating a differentiated product requires a product-specific fixed labor input. Consumers differ in the extent to which they value the focal attribute. The purpose of the model is to examine how the distribution of focal-preference intensity affects product demand, product survival, and the equilibrium product mix.

There is a continuum of consumers of total mass one. Consumers belong to one of H types, indexed by $h = 1, \ldots, H$. The mass of type-h consumers is $m_h > 0$, with $\sum_{h=1}^{H} m_h = 1$.

Each consumer supplies one unit of labor inelastically. Labor is the economy's only primary factor. The homogeneous numeraire good is produced one-for-one with labor and is chosen as the unit of account. Since the numeraire sector is active, its zero-profit condition implies $w = 1$. Profits, if any, are rebated lump-sum to consumers. Since preferences are quasi-linear and the numeraire is consumed in positive quantity, these transfers do not affect differentiated-product demands.

A type-h consumer has preferences

$$U_h = c_{0h} + u(C_h),$$

where c_{0h} is consumption of the numeraire and C_h is a composite of differentiated products. We use the isoelastic specification

$$u(C_h) = \begin{cases} \dfrac{\eta C_h^{1-\gamma}}{1-\gamma}, & if\ \gamma \neq 1 \\ \eta \ln C_h, & if\ \gamma = 1 \end{cases} \tag{1}$$

where $\eta > 0$, and $0 < \gamma \leq 1$. The parameter η scales demand for the differentiated composite, while γ governs the responsiveness of differentiated expenditure to the type-specific price index. The case $\gamma = 1$ gives constant differentiated expenditure, whereas $0 < \gamma < 1$ allows expenditure to increase when the perceived price index falls.

There are N potential differentiated products, indexed by $j = 1, \ldots, N$. Product j has general appeal $a_j > 0$, productivity $\phi_j > 0$, and focal attribute $z_j \in \mathbb{R}$. General appeal captures product characteristics valued broadly across consumers, such as reliability, convenience, familiarity, durability, design, or ease of use. The focal attribute captures a product characteristic valued especially by some consumers but not necessarily by all consumers. Examples include authenticity, ethical sourcing, local identity, privacy, craftsmanship, cultural attachment, ideological fit, or environmental quality.

Consumers differ in their private valuation of the focal attribute. Let $\rho_h \geq 0$ denote the focal-preference parameter of type h. The type-specific perceived appeal of product j is

$$\chi_{hj} = a_j e^{\rho_h z_j}. \tag{2}$$

One physical unit of product j therefore provides χ_{hj} effective units of differentiated consumption to type h. Thus, if $\rho_h = 0$, type-h consumers evaluate products only according to general appeal. If $\rho_h > 0$, products with higher values of the focal attribute

a

r

e

p

e

r

$$\bar{\rho} = \sum_{h=1}^{H} m_h \, \rho_h.$$

The central issue is whether product selection depends only on $\bar{\rho}$, or whether the distribution of ρ_h across consumer types matters.

For each type h, differentiated consumption is represented by the Lancaster-CES composite

$$C_h = \left[\sum_{j \in S} \left(\chi_{hj} q_{hj} \right)^{\frac{\varepsilon - 1}{\varepsilon}} \right]^{\frac{\varepsilon}{\varepsilon - 1}} \tag{3}$$

where $\varepsilon > 1$ is the elasticity of substitution across products, and $S \subseteq \{1, \dots, N\}$ is the set of active products. Product characteristics enter through χ_{hj}, so the same physical product may have different perceived appeal for different consumer types.

Since $\chi_{hj} q_{hj}$ is appeal-adjusted consumption, the effective price per appeal-adjusted unit of product j is p_j / χ_{hj}. Hence, the type-specific price index associated with the differentiated composite is

$$P_h = \left[\sum_{j \in S} \left(\frac{p_j}{\chi_{hj}} \right)^{1 - \varepsilon} \right]^{\frac{1}{1 - \varepsilon}}. \tag{4}$$

Given P_h, type h chooses differentiated consumption according to $u'(C_h) = P_h$. Using (1), this gives

$$C_h = \left(\frac{\eta}{P_h} \right)^{1/\gamma}.$$

Hence type-h expenditure on differentiated products is

$$X_h(P_h) = P_h C_h = \eta^{1/\gamma} P_h^{1 - \frac{1}{\gamma}}. \tag{5}$$

When $\gamma = 1$, differentiated expenditure is constant and equal to η. When $\gamma \neq 1$, differentiated expenditure responds to the type-specific price index. Thus, focal preferences may affect demand both by reallocating expenditure across products and by changing total differentiated expenditure.

The expenditure share of type h on product $j \in S$ is

$$s_{hj} = \frac{A_j e^{(\varepsilon - 1) \rho_h z_j}}{\sum_{k \in S} A_k \, e^{(\varepsilon - 1) \rho_h z_k}}, \tag{6}$$

where

$$A_j = \left(\frac{a_j}{p_j}\right)^{\varepsilon-1}.$$

Quantity demand by type h is therefore

$$q_{hj} = \frac{X_h(P_h)s_{hj}}{p_j}.$$

Aggregating across types, total demand for product j is

$$Q_j = \sum_{h=1}^{H} m_h\, q_{hj} = \frac{1}{p_j}\sum_{h=1}^{H} m_h\, X_h(P_h)s_{hj}.$$

Product revenue is

$$R_j = p_jQ_j = \sum_{h=1}^{H} m_h\, X_h(P_h)s_{hj}. \tag{7}$$

Equation (7) is the key demand object. Focal preferences affect revenue through two channels. First, they affect the expenditure share s_{hj}, shifting demand toward products with higher focal attributes. Second, they affect the type-specific price index P_h, which can change total differentiated expenditure $X_h(P_h)$. Since both s_{hj} and P_h are nonlinear functions of ρ_h, product revenue generally depends on the distribution of focal preferences, not only on the average preference $\bar{\rho}$.

Each product is produced by one firm. Firm j uses labor for variable production and requires a product-specific fixed operating labor input. Producing Q_j units requires Q_j/ϕ_j units of labor, where $\phi_j > 0$ is productivity. In addition, operating product j requires a fixed labor input $f_j > 0$. Total labor used by firm j is therefore

$$L_j = \frac{Q_j}{\phi_j} + f_j.$$

The fixed labor requirement captures product-specific activities such as design, setup, certification, distribution, compliance, or organizational support. Since it does not vary with

$$mc_j = \frac{1}{\phi_j}.$$

To close the model, we use the standard monopolistic-competition pricing approximation in the differentiated sector. Each active firm takes the type-specific price indices and aggregate differentiated expenditures as given, and therefore perceives a constant demand elasticity ε. The pricing rule is used to isolate the selection mechanism.[1] The main comparative statics operate through product-level revenue and

[1] The purpose of this assumption is not to study strategic pricing. It is to obtain a transparent revenue threshold for product survival and to focus on how preference concentration affects that threshold.

output, it

fixed-cost thresholds, not through strategic price interactions. Each firm internalizes the elasticity of demand for its own variety but treats its effect on aggregate price indices and type-level expenditure as negligible. The price of product j is therefore a constant markup over marginal cost:

$$p_j = \frac{\varepsilon}{\varepsilon - 1}\frac{1}{\phi_j}. \tag{8}$$

Since the wage is normalized to one, the fixed labor requirement f_j is also the firm's fixed operating cost in units of the numeraire. Firm j's profit is therefore

$$\pi_j = (p_j - mc_j)Q_j - f_j.$$

Using the markup rule, variable profi

$$\pi_j = \frac{1}{\varepsilon}R_j - f_j.$$

Product j is active if $\pi_j \geq 0$. Equivalently, product j survives if

$$R_j \geq \varepsilon f_j.$$

Using (7), the survival condition becomes

$$\sum_{h=1}^{H} m_h X_h(P_h) s_{hj} \geq \varepsilon f_j. \tag{9}$$

This is the model's central selection condition. A product survives if the expenditure it attracts across consumer types is sufficiently large for markup revenue to cover the product's fixed operating labor requirement. The analysis below therefore focuses on how the distribution of preference intensity changes product-level revenue and whether this revenue crosses the fixed-cost survival threshold.

Because expenditure shares and price indices depend on the active set, product survival is jointly determined. For a candidate active set S, prices are given by (8), price indices by (4), demands by the expressions above, and revenues by (7). A laissez-faire active set satisfies

$$R_j(S) \geq \varepsilon f_j \text{ for all } j \in S,$$

while any inactive product $k \notin S$ would fail to cover its fixed cost if introduced:

$$R_k(S \cup \{k\}) < \varepsilon f_k.$$

Total labor supply is one. Labor used in variable production is $\sum_{j \in S} Q_j / \phi_j$. Since the numeraire is produced one-for-one with labor, aggregate numeraire consumption is

$$c_0 = 1 - \sum_{j\in S} \frac{Q_j}{\phi_j} - \sum_{j\in S} f_j. \qquad (10)$$

We restrict attention to feasible active sets for which aggregate numeraire consumption is positive and consumers' numeraire consumption remains interior. The term Q_j/ϕ_j is variable labor used in production. The term f_j is the fixed operating labor. Since the wage and the price of the numeraire are normalized to one, f_j is also the fixed operating cost measured in numeraire units. Hence product survival uses labor that could otherwise be allocated to numeraire production.

Using the demand and pricing expressions, variable labor used by product j can be written as

$$\frac{Q_j}{\phi_j} = \frac{1}{p_j\phi_j} \sum_{h=1}^{H} m_h X_h(P_h) s_{hj}.$$

Since $p_j\phi_j = \varepsilon/(\varepsilon - 1)$, this becomes

$$\frac{Q_j}{\phi_j} = \frac{\varepsilon - 1}{\varepsilon} \sum_{h=1}^{H} m_h X_h(P_h) s_{hj}.$$

Given the pricing rule in (8), a laissez-faire equilibrium consists of an active product set S, prices and quantities $\{p_j, Q_j\}_{j\in S}$, type-specific demands $\{q_{hj}\}_{h,j}$, differentiated consumption levels $\{C_h\}_h$, price indices $\{P_h\}_h$, aggregate numeraire consumption c_0, and firm profits $\{\pi_j\}_{j\in S}$, such that consumers optimize, active firms satisfy the pricing rule, active products satisfy the survival condition (9), inactive products would earn negative profits if operated, and the resource constraint (10) holds..

$$W = c_0 + \sum_{h=1}^{H} m_h u(C_h).$$

Using the resource constraint, welfare can be written as

$$W = 1 - \sum_{j\in S} \frac{Q_j}{\phi_j} - \sum_{j\in S} f_j + \sum_{h=1}^{H} m_h u(C_h). \qquad (11)$$

The market survival condition depends on private revenue and fixed operating labor costs. The welfare contribution of a product, however, depends on its effect on differentiated-consumption utility and on the labor required to produce and operate it. Therefore, the privately selected product mix need not coincide with the welfare-maximizing product mix. This remains true even before introducing any externality associated with the focal attribute.

3. Results

This section studies how the distribution of focal-preference intensity affects product revenue, product survival, and welfare. The central result is that a mean-preserving increase in the concentration of focal preferences can raise the revenue of products with high focal attributes. The mechanism is not that the average focal preference is higher. Rather, when demand for a focal product is convex in preference intensity, a smaller group of highly attached consumers generates more revenue than a larger group of weakly attached consumers with the same average preference.

The analysis below is conducted for a candidate active set S. The comparative-static results identify how preference concentration affects product revenues and survival thresholds while holding the relevant candidate set fixed; they do not require uniqueness of the global active-set equilibrium.

The section proceeds in four steps. First, we characterize how focal preferences affect type-specific demand. Second, we derive a general concentration result based on the convexity of product-level revenue in focal-preference intensity. Third, we use a ranked focal-attribute benchmark to show how this convexity condition can be interpreted in an n-product active set. In that benchmark, concentration raises the revenue of the highest-attribute product when it is sufficiently separated from the share-weighted center of the active focal-attribute distribution. Fourth, we connect the revenue result to product survival and welfare.

For notational convenience, define

$$B_h(S) = \sum_{k \in S} A_k \, e^{(\varepsilon-1)\rho_h z_k}.$$

Then the type-specific price index can be written as

$$P_h(S) = B_h(S)^{-1/(\varepsilon-1)}.$$

The expenditure share of type h on product $j \in S$ is

$$s_{hj}(S) = \frac{A_j e^{(\varepsilon-1)\rho_h z_j}}{B_h(S)}.$$

For a consumer with focal-preference intensity ρ, let

$$r_j(\rho; S) \equiv X(P(\rho; S)) s_j(\rho; S)$$

denote that consumer's revenue contribution to product j. Product j's total revenue is therefore

$$R_j(S) = \sum_{h=1}^{H} m_h \, r_j(\rho_h; S). \tag{12}$$

Thus, the distribution of focal preferences affects product survival through the distribution of the type-specific revenue contributions $r_j(\rho_h; S)$.

3.1 Focal preferences and type-specific demand

For any two products $j, k \in S$, the ratio of type-h expenditure shares is

$$\frac{s_{hj}}{s_{hk}} = \frac{A_j}{A_k} e^{(\varepsilon-1)\rho_h(z_j - z_k)}.$$

Hence,

$$\frac{\partial}{\partial \rho_h} \ln\left(\frac{s_{hj}}{s_{hk}}\right) = (\varepsilon - 1)(z_j - z_k). \tag{13}$$

A higher focal-preference parameter therefore shifts expenditure toward products with higher focal attributes. This is the composition effect.

Focal preferences may also affect total expenditure on differentiated products. Let

$$\bar{z}_h(S) = \sum_{k \in S} s_{hk}\,(S) z_k$$

denote the expenditure-weighted average focal attribute for type h. Since $P_h(S) = B_h(S)^{-1/(\varepsilon-1)}$,

$$\frac{\partial \ln P_h(S)}{\partial \rho_h} = -\bar{z}_h(S).$$

Using

$$X_h(P_h) = \eta^{1/\gamma} P_h^{1-\frac{1}{\gamma}},$$

and defining

$$\delta \equiv \frac{1}{\gamma} - 1 \geq 0,$$

we obtain

$$\frac{\partial \ln X_h(P_h)}{\partial \rho_h} = \delta \bar{z}_h(S).$$

Combining the composition effect and the expenditure effect gives

$$\frac{\partial \ln r_j(\rho_h; S)}{\partial \rho_h} = (\varepsilon - 1)\big[z_j - \bar{z}_h(S)\big] + \delta \bar{z}_h(S). \tag{14}$$

Equation (14) is the basic marginal-revenue expression. The first term captures the reallocation of expenditure toward products whose focal attribute exceeds the type-specific average. The second term captures the market-size effect: when $0 < \gamma < 1$, changes in the type-specific price index affect total differentiated expenditure. In the logarithmic case, $\gamma = 1$, we have $\delta = 0$, so only the composition effect remains.

The interpretation is useful. A consumer with stronger focal preferences gives more weight to products with high z_j. If high-attribute products are sufficiently separated from the expenditure-weighted center of the active product set, a further increase in ρ can have an accelerating effect on their revenue contribution. This is the source of the concentration result below.

3.2 Preference concentration and product revenue

We now ask whether a more concentrated distribution of focal preferences can raise product revenue while leaving the average focal preference unchanged.

Let D and C be two distributions of ρ with the same mean. We say that C is more concentrated than D if C is a mean-preserving spread of D. Thus, the average focal preference is unchanged, but preferences are more dispersed: more mass is placed on low and high values of ρ.

The key object is the curvature of $r_j(\rho; S)$. If this function is convex, then intense focal consumers contribute disproportionately to the revenue of product j. Concentrating a fixed average preference among fewer but more intense consumers then increases revenue.

Proposition 1. Preference concentration and product revenue. *Fix an active set S. If $r_j(\rho; S)$ is convex in ρ over the relevant range of focal-preference intensities, then a mean-preserving increase in the concentration of focal preferences weakly increases product j's revenue. If $r_j(\rho; S)$ is strictly convex and the concentration change is non-degenerate, the revenue increase is strict.*

$$R_j(S) = \sum_h m_h \, r_j(\rho_h; S).$$

Since C is a mean-preserving spread of D, it dominates D in the convex order. Therefore, for any convex $r_j(\rho; S)$,

$$E_C[r_j(\rho; S)] \geq E_D[r_j(\rho; S)].$$

Strict convexity and a non-degenerate spread imply strict inequality. Since product revenue is the expectation of $r_j(\rho; S)$ over the distribution of ρ, this implies $R_j^C(S) \geq R_j^D(S)$, with strict inequality under strict convexity and a non-degenerate spread.

■

Proposition 1 is the basic distributional result. It shows that the average focal preference is not sufficient for predicting product revenue. If the revenue contribution of a consumer is convex in preference intensity, then moving preference mass from moderate consumers to more intense consumers raises expected revenue. Intense consumers do not merely buy proportionally more of the focal product; they shift expenditure toward it at an increasing rate. In this sense, preference concentration matters because it changes the revenue productivity of a fixed aggregate preference mass.

We next characterize this convexity condition. Let

$$\bar{z}(\rho; S) = \sum_{k \in S} s_k\,(\rho; S) z_k$$

and let

$$V_z(\rho; S) = \sum_{k \in S} s_k\,(\rho; S)[z_k - \bar{z}(\rho; S)]^2$$

be the expenditure-weighted variance of focal attributes among active products.

Differentiating (14), we obtain

$$\frac{r_j''(\rho; S)}{r_j(\rho; S)} = \left[(\varepsilon - 1)\big(z_j - \bar{z}(\rho; S)\big) + \delta \bar{z}(\rho; S)\right]^2 + (\varepsilon - 1)(\delta - \varepsilon + 1)V_z(\rho; S).$$

Thus, $r_j(\rho; S)$ is convex whenever

$$\left[(\varepsilon - 1)\big(z_j - \bar{z}(\rho; S)\big) + \delta \bar{z}(\rho; S)\right]^2 \geq (\varepsilon - 1)(\varepsilon - 1 - \delta)V_z(\rho; S), \qquad (15)$$

where the right-hand side is relevant only when $\delta < (\varepsilon - 1)$. If $\delta \geq (\varepsilon - 1)$, the convexity condition is automatically satisfied.

Corollary 1. High-focal products. *For a fixed active set S, products with sufficiently high focal attributes have convex type-specific revenue contributions and therefore benefit from a mean-preserving increase in focal-preference concentration. A sufficient condition is*

$$z_j \geq \left(1 - \frac{\delta}{\varepsilon - 1}\right) \bar{z}(\rho; S) + \sqrt{\frac{\varepsilon - 1 - \delta}{\varepsilon - 1}} \sqrt{V_z(\rho; S)} \qquad (16)$$

for all relevant ρ, when $\delta < \varepsilon - 1$. If $\delta \geq \varepsilon - 1$, $r_j(\rho; S)$ is convex for all products.

Corollary 1 identifies which products are most likely to benefit from preference concentration. These are not necessarily the products with the largest initial market shares. They are products whose focal attribute is sufficiently high relative to the expenditure-weighted average attribute in the active product set. Such products are most exposed to the behavior of high-intensity consumers: when focal preferences become strong, expenditure shifts toward them disproportionately.

3.3 A ranked focal-attribute benchmark

The general convexity condition can be made more transparent by considering an active set in which products can be ranked according to the level of the focal attribute they embody. Let the active set be $S = \{1, \dots, n\}$, and index products so that

$$z_1 \geq z_2 \geq \cdots \geq z_n.$$

Thus, product 1 has the highest level of the focal attribute, product 2 the second highest, and so on. The distances between adjacent products are not assumed to be equal. Products may also differ arbitrarily in general appeal, productivity, prices, and fixed operating requirements.

$$\Delta \equiv z_1 - z_n > 0$$

denote the total range of focal attributes in the active set, and define the normalized focal-attribute coordinate

$$\beta_j \equiv \frac{z_j - z_n}{\Delta}.$$

$$\beta_1 = 1, \beta_n = 0, \beta_j \in [0,1].$$

The variable β_j measures the position of product j in the active focal-attribute range. It is not a rank index: it preserves the actual distances between products in focal-attribute space.

For each focal-preference intensity ρ, define the expenditure-share-weighted mean position

$$\beta(\rho; S) \equiv \sum_{j \in S} s_j\,(\rho; S)\beta_j,$$

and the corresponding share-weighted variance

$$V_\beta(\rho; S) \equiv \sum_{j \in S} s_j\,(\rho; S)\big[\beta_j - \beta(\rho; S)\big]^2.$$

To simplify notation, in the remainder of this subsection we write β for $\beta(\rho; S)$ and V_β for $V_\beta(\rho; S)$ whenever no confusion can arise. We also write

$$\bar{z} \equiv \bar{z}(\rho; S) = z_n + \Delta\beta, \qquad d_1 \equiv z_1 - \bar{z} = \Delta(1 - \beta).$$

Thus, $\bar{z}$ is the expenditure-share-weighted center of the active focal-attribute distribution, while d_1 is the distance of the highest-attribute product from that center. Since

$$z_j = z_n + \Delta\beta_j,$$

$$\bar{z} = z_n + \Delta\beta, V_z(\rho; S) = \Delta^2 V_\beta, z_1 - \bar{z} = d_1.$$

Using the general curvature expression, the curvature of the revenue contribution of the highest-attribute product is

$$r_1''(\rho; S) = r_1(\rho; S)\{[(\varepsilon - 1)d_1 + \delta\bar{z}]^2 + (\varepsilon - 1)(\delta - \varepsilon + 1)\Delta^2 V_\beta\}.$$

Hence the revenue contribution of product 1 is convex in ρ whenever

$$[(\varepsilon - 1)d_1 + \delta\bar{z}]^2 + (\varepsilon - 1)(\delta - \varepsilon + 1)\Delta^2 V_\beta \geq 0. \quad (17)$$

Condition (17) has a direct interpretation. The term d_1 measures the distance between the highest-attribute product and the expenditure-weighted center of the active focal-attribute distribution. The term V_β measures the share-weighted dispersion of active products around that center. Thus, the relevant condition is not that product 1 has a small market share, but that it is sufficiently far from the market's current focal-attribute center relative to the dispersion of focal attributes among active products. We can therefore state the ranked-attribute result as follows.

Proposition 2. Concentration and revenue for the highest-attribute product. *Fix an active set $S = \{1, \dots, n\}$ and suppose products are ordered by their focal attribute,*

$$z_1 \geq z_2 \geq \cdots \geq z_n.$$

$$\Delta = z_1 - z_n > 0, \qquad \beta_j = \frac{z_j - z_n}{\Delta}.$$

$$[(\varepsilon - 1)d_1 + \delta\bar{z}]^2 + (\varepsilon - 1)(\delta - \varepsilon + 1)\Delta^2 V_\beta \geq 0$$

for all relevant focal-preference intensities ρ, then a mean-preserving increase in the concentration of focal preferences weakly raises the revenue of product 1. The increase is strict if the concentration change is non-degenerate and the inequality is strict over a set of positive measure.

$$z_j = z_n + \Delta\beta_j,$$

$$\bar{z} = z_n + \Delta\beta$$

$$V_z(\rho; S) = \Delta^2 V_\beta.$$

$$z_1 - \bar{z} = d_1.$$

Substituting these expressions into the general curvature formula gives

$$r_1''(\rho; S) = r_1(\rho; S)\{[(\varepsilon - 1)d_1 + \delta\bar{z}]^2 + (\varepsilon - 1)(\delta - \varepsilon + 1)\Delta^2 V_\beta\}.$$

The assumed inequality therefore implies that $r_1(\rho; S)$ is convex in ρ over the relevant range of focal-preference intensities. *Proposition 1* then implies that any mean-preserving increase in the concentration of focal preferences weakly raises the expected revenue contribution of product 1, and therefore weakly raises R_1. If the concentration change is non-degenerate and the inequality is strict over a set of positive measure, the increase is strict.

■

Proposition 2 gives the convexity condition a geometric interpretation. In the ranked-attribute benchmark, the highest-attribute product benefits from preference concentration when it is sufficiently far from the share-weighted center of the active focal-attribute distribution. The result therefore formalizes what it means for a product to be niche in this model. A niche product is not simply a product with a small market share. It is a product located far enough in focal-attribute space that high-intensity consumers move toward it at an accelerating rate.

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$$\delta \geq \varepsilon - 1,$$

v

then the variance term in (17) is non-negative. Since the first term in (17) is a square, $r_1(\rho; S)$ is convex for all ρ. In this case, preference concentration weakly raises the revenue of the highest-attribute product without requiring any additional restriction on the position of that product in the active attribute distribution.

Second, consider the logarithmic case, $\delta = 0$. Then type-level differentiated expenditure is fixed, and condition (17) becomes

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$$(\varepsilon - 1)^2 {d_1}^2 - (\varepsilon - 1)^2 \Delta^2 V_\beta \geq 0.$$

e

Since $d_1 = \Delta(1 - \beta)$, this is equivalent to,

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$$1 - \beta \geq \sqrt{V_\beta}.$$

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Thus, in the logarithmic case, the revenue contribution of the highest-attribute product is convex in focal-preference intensity if and only if the product lies at least one share-weighted standard deviation above the expenditure-weighted center of the active focal-attribute distribution. When this condition holds, increases in preference intensity shift expenditure toward the highest-attribute product at an increasing rate. Concentrating a fixed average level of focal preference among more intense consumers

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then raises the revenue of the product located at the top of the focal-attribute distribution.

3.4 A fixed-mean concentration experiment

The preceding propositions can be expressed through a simple fixed-mean concentration experiment. Let $\lambda \in (0,1]$ denote the fraction of consumers with positive focal-preference intensity. Suppose a fraction λ of consumers has focal-preference intensity

$$\rho_H = \frac{\bar{\rho}}{\lambda},$$

while the remaining fraction $1 - \lambda$ has $\rho = 0$. The average focal preference is therefore constant and equal to $\bar{\rho}$. A reduction in λ represents a mean-preserving increase in preference concentration: the same aggregate preference mass is concentrated among a smaller group of consumers.

For product j, revenue under this distribution is

$$R_j(\lambda; S) = \lambda r_j\left(\frac{\bar{\rho}}{\lambda}; S\right) + (1 - \lambda) r_j(0; S). \tag{18}$$

If $r_j(\rho; S)$ is convex over the relevant range of preference intensities, then $R_j(\lambda; S)$ is decreasing in λ. Hence, as λ falls and preferences become more concentrated, product j's revenue rises.

Proposition 3. Fixed-mean concentration and high-attribute revenue. *Under the fixed-mean concentration experiment in (18), a reduction in λ raises product j's revenue whenever $r_j(\rho; S)$ is convex over the relevant range of preference intensities. In the ranked focal-attribute benchmark of Section 3.3, a reduction in λ raises the revenue of the highest-attribute product whenever condition (17) holds for all $\rho \in [0, \bar{\rho}/\lambda]$.*

Proof. Differentiating (18) with respect to λ, and writing $x = \bar{\rho}/\lambda$, gives

$$\frac{dR_j(\lambda; S)}{d\lambda} = r_j(x; S) - x r_j'(x; S) - r_j(0; S).$$

Convexity of $r_j(\rho; S)$ implies

$$r_j(0; S) \geq r_j(x; S) - x r_j'(x; S).$$

$$\frac{dR_j(\lambda; S)}{d\lambda} \leq 0.$$

Thus, a reduction in λ weakly raises product j's revenue. If $r_j(\rho; S)$ is strictly convex over a set of positive measure, the revenue increase is strict.

∎

Proposition 3 translates the convex-order result into a simple market experiment. The average focal preference is fixed, but the number of consumers who carry that preference falls. Those consumers therefore become more intense. If the product's revenue contribution is convex in preference intensity, this reallocation raises revenue. The result captures the central economic idea of the paper: a smaller but more attached consumer group can be more valuable to a focal product than a larger but weakly attached group with the same aggregate preference mass.

Example. Consider an active set with three products ordered by their focal attribute:

$$z_1 = 1, z_2 = \frac{1}{2}, z_3 = 0.$$

L

$$s_j(\rho; S) = \frac{B_j e^{\rho z_j}}{\sum_{k=1}^{3} B_k\, e^{\rho z_k}},$$

$$B_1 = 1, B_2 = 3, B_3 = 6.$$

These B_j's summarize the non-focal components of demand, such as general appeal and price. Product 1 has the highest focal attribute, but it is not the dominant product when focal preferences are weak.

Compare two distributions with the same mean focal preference $\bar{\rho} = 1$. Under the diffuse distribution, all consumers have $\rho = 1$. Under the concentrated distribution, half of consumers have $\rho = 0$and half have $\rho = 2$. Both distributions have mean one.

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$$R_1^D = s_1(1; S) \simeq 0.199.$$

$$R_1^C = \frac{1}{2} s_1(0; S) + \frac{1}{2} s_1(2; S) \simeq \frac{1}{2}(0.100) + \frac{1}{2}(0.343) = 0.222.$$

Thus, holding the average focal preference fixed, concentration raises the revenue of the highest-attribute product. The example illustrates the selection mechanism in an n-product setting: preference concentration reallocates revenue toward the product located at the top of the focal-attribute distribution, even though average focal preference is unchanged.

Figure 1 illustrates the same fixed-mean concentration experiment over a wider range of values. For each pair $(\lambda, \bar{\rho})$, a fraction λ of consumers has focal-preference intensity $\rho = \bar{\rho}/\lambda$, while the remaining fraction $1 - \lambda$ has $\rho = 0$. Hence the average focal preference remains fixed at $\bar{\rho}$, while lower values of λ correspond to greater concentration of the same aggregate preference mass. The figure plots the resulting revenue gain of the highest-attribute product relative to the diffuse benchmark in which all consumers have $\rho = \bar{\rho}$.

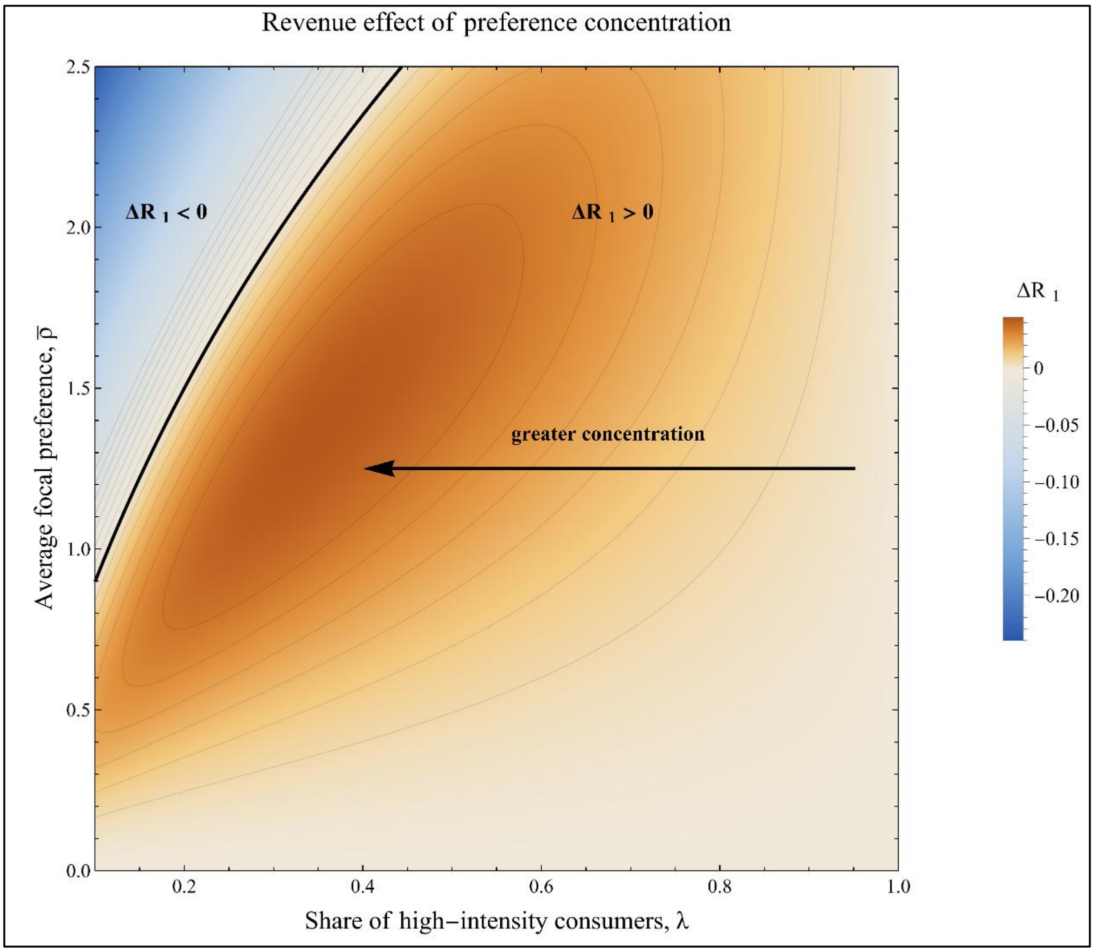

Figure 1. Revenue effect of preference concentration. The figure plots ΔR_1, the revenue gain of the highest-attribute product relative to the diffuse benchmark. The solid black curve is the zero-effect locus. Warmer shades indicate $\Delta R_1 > 0$, while cooler shades indicate $\Delta R_1 < 0$. The arrow indicates the direction of greater preference concentration.

The figure highlights two points. First, preference concentration can raise the revenue of the highest-attribute product even though the average focal preference is unchanged. This is the region in which the stronger attachment of high-intensity consumers dominates the smaller size of that group. Second, the effect is not mechanical. When the high-intensity group becomes too small, concentration may reduce revenue relative to the diffuse benchmark. The concentration mechanism is therefore conditional: it operates when high-intensity consumers shift expenditure toward the focal product strongly enough to offset the reduction in the mass of such consumers.

3.5 Product survival

Product survival follows from the revenue threshold. Because prices are determined by the markup rule, the relevant selection margin is whether preference concentration raises product-level revenue enough to cover fixed operating labor requirements. Product j survives if

$$R_j(S) \geq \varepsilon f_j.$$

Therefore, if concentration raises the revenue of a high-attribute product, it expands the range of fixed operating labor requirements under which that product is viable.

Proposition 4. Concentration and high-attribute product survival. *Suppose a more concentrated distribution of focal preferences raises product j's revenue from R_j^D to R_j^C, with*

$$R_j^C > R_j^D.$$

Then, for any fixed operating labor requirement satisfying

$$\frac{R_j^D}{\varepsilon} < f_j \leq \frac{R_j^C}{\varepsilon}, \tag{19}$$

product j survives under the concentrated distribution but not under the diffuse distribution. In the ranked focal-attribute benchmark of Section 3.3, concentration can sustain the highest-attribute product whenever condition (17) holds over the relevant range of focal-preference intensities.

Proof. The product survives under the concentrated distribution if $R_j^C \geq \varepsilon f_j$, and fails under the diffuse distribution if $R_j^D < \varepsilon f_j$. These two inequalities are equivalent to (19).

■

Proposition 4 converts the revenue effect into a product-selection result. Preference concentration matters for market structure only when the induced revenue gain crosses the fixed-cost threshold. If the fixed operating requirement lies between the variable profit generated under diffuse preferences and the variable profit generated under concentrated preferences, the product fails in the diffuse market but survives in the concentrated market. Thus, concentration affects product survival not by raising the average valuation of the focal attribute, but by changing how a fixed aggregate valuation is distributed across consumers and therefore how much revenue the focal product can attract.

3.6 Product survival versus social desirability

The previous results establish a positive product-market effect: concentration can raise the revenue of high-attribute products and make them viable. This does not imply that the induced product mix is welfare maximizing.

For a given active set S, welfare is

$$W(S)=1-\sum_{j\in S}\frac{Q_j}{\phi_j}-\sum_{j\in S}f_j+\sum_{h=1}^{H}m_h\,u(C_h(S)).$$

Using the markup rule,

$$\frac{Q_j}{\phi_j}=\frac{\varepsilon-1}{\varepsilon}R_j(S),$$

so welfare can be written as

$$W(S)=1-\frac{\varepsilon-1}{\varepsilon}\sum_{j\in S}R_j\,(S)-\sum_{j\in S}f_j+\sum_{h=1}^{H}m_h\,u(C_h(S)). \tag{20}$$

Private survival depends on markup revenue:

$$\frac{1}{\varepsilon}R_j(S)\geq f_j.$$

Social desirability depends on the change in differentiated-consumption utility relative to the labor required to produce and operate the product.

Let S be an active set not containing product j. Product j is privately viable as a one-product entry deviation if

$$\frac{1}{\varepsilon}R_j(S\cup\{j\})\geq f_j. \tag{21}$$

Let

$$\Delta W_j(S)=W(S\cup\{j\})-W(S)$$

be the welfare change from adding product j. Adding product j is socially desirable if and only if

$$\Delta W_j(S)\geq 0. \tag{22}$$

The private and social conditions need not coincide. Preference concentration affects the private revenue side of the survival condition, but it does not necessarily increase the social surplus generated by the product by the same amount.

Remark 1. Private survival and social desirability need not coincide. *A concentration-induced increase in focal-product revenue can make product j privately viable without necessarily making it socially desirable. Private viability is governed by markup revenue,*

$$\frac{1}{\varepsilon}R_j(S\cup\{j\})\geq f_j,$$

whereas social desirability depends on the full change in aggregate utility net of variable and fixed labor costs,

$$\Delta W_j = W(S \cup \{j\}) - W(S).$$

Since these two objects are not ordered in general, either form of divergence may occur. Product j is privately viable but welfare reducing if

$$\frac{1}{\varepsilon} R_j(S \cup \{j\}) \geq f_j \textit{ and } \Delta W_j < 0.$$

Conversely, product j is socially desirable but privately non-viable if

$$\frac{1}{\varepsilon} R_j(S \cup \{j\}) < f_j \textit{ and } \Delta W_j > 0.$$

The wedge arises because firms base survival on private markup revenue, while welfare depends on the utility gains from the product, the variable labor used in production, and the fixed labor required to operate it.

Thus, preference concentration has a clear positive implication for product-market selection but not a general normative implication. It can push a focal product across the private survival threshold, but whether this improves welfare depends on the social value of the induced product mix. Concentration may support a variety that is privately profitable but socially wasteful, or it may still be insufficient to sustain a variety that would be socially valuable.

4. Applications

We now consider two applications in which the focal attribute has a natural economic interpretation. In both cases, we keep the production side of the model unchanged: varieties require labor to be produced, and fixed costs are fixed labor requirements. The applications do not introduce additional technologies, network effects, or fixed environmental/data burdens. They only reinterpret the differentiated attribute and study how the survival of particular varieties affects an associated aggregate outcome.

4.1 Green preferences and environmental product selection

Consider a differentiated branch in which varieties differ in environmental performance. Let g_j denote the greenness of variety j, and let $e_j = e(g_j)$ denote its emissions intensity, with

$$e'(g_j) < 0.$$

Thus, greener varieties have lower emissions per unit of output. For clarity, compare a green variety G with a brown variety B, where

$$g_G > g_B, \qquad e_G < e_B.$$

The green variety may be less attractive along the general-appeal dimension, may require more labor per unit, or may involve a larger fixed labor requirement. Its survival is therefore not automatic. If F_G is the fixed labor requirement of the green variety, then G survives whenever its operating profit covers its fixed labor cost:

$$(p_G - mc_G)Q_G \geq F_G. \tag{23}$$

This is the private survival condition. Concentrated green preferences matter because they can raise the willingness to pay and demand generated by consumers who attach high value to g_G, thereby making condition (23) hold.

But survival of G is not the same thing as lower emissions. Let Q_B^0 denote brown output when G is absent. Let Q_B^1 and Q_G denote brown and green output when G survives. Aggregate emissions from these varieties are

$$E^0 = e_B Q_B^0$$

without the green variety, and

$$E^1 = e_B Q_B^1 + e_G Q_G$$

with the green variety. The change in emissions is therefore

$$\Delta E = E^1 - E^0 = e_G Q_G - e_B(Q_B^0 - Q_B^1). \tag{24}$$

Define the displacement rate

$$\sigma_G = \frac{Q_B^0 - Q_B^1}{Q_G}.$$

This measures how much brown consumption is displaced by each unit of green consumption. Then

$$\Delta E = (e_G - \sigma_G e_B)Q_G. \tag{25}$$

Hence emissions fall if and only if

$$\sigma_G > \frac{e_G}{e_B}. \tag{26}$$

This is the environmental condition. It is distinct from the survival condition. Condition (23) asks whether the green variety is privately viable. Condition (26) asks whether the green variety displaces enough brown consumption to reduce aggregate emissions.

The distinction is important. If G is much cleaner than B, then e_G/e_B is small, and only modest displacement is needed for emissions to fall. But if the green variety is only slightly cleaner, or if its demand mostly expands total consumption in the differentiated branch rather than replacing brown consumption, then emissions may rise even though the surviving variety is greener.

This expansion effect is possible even when the green variety is more expensive. Consumers with sufficiently strong green preferences may shift expenditure toward the differentiated branch once a variety matching their preferences becomes available. In that case, green output Q_G may be positive and profitable, while brown output falls only slightly. Formally, this corresponds to a low value of σ_G. If

$$\sigma_G < \frac{e_G}{e_B},$$

then

$$\Delta E > 0.$$

Thus, the application provides a sharp implication:

$$\text{green-variety survival} \;\; \not\Rightarrow \;\; \text{lower emissions.}$$

Concentrated green preferences can sustain a cleaner variety, but emissions fall only when the cleaner variety sufficiently substitutes for dirtier varieties. The mechanism is therefore not a general argument that green consumerism is always environmentally effective. It identifies the precise condition under which green niche survival translates into lower emissions.

With several brown varieties, the same logic applies. Let $\mathcal{B}$ be the set of brown varieties whose quantities are affected by the survival of G. Then emissions fall when

$$\sum_{j \in \mathcal{B}} e_j \left(Q_j^0 - Q_j^1\right) > e_G Q_G. \tag{27}$$

That is, the emissions avoided through reduced brown consumption must exceed the emissions generated by the green variety itself. The two-variety condition (26) is the special case in which the displaced brown output has common emissions intensity e_B.

4.2 Privacy preferences and data extraction

A second application concerns digital goods and services that differ in their degree of privacy protection. Privacy preferences are especially suitable for this mechanism because average stated concern may coexist with weak average behavior, while a smaller group of privacy-intensive consumers may be willing to switch products or pay for low-data alternatives. Let l_j denote the privacy level of variety j. Higher l_j means stronger privacy protection, less tracking, or more limited use of personal data. Let $d_j = d(l_j)$ denote the data-extraction intensity of variety j, with

$$d'(l_j) < 0.$$

Thus, more privacy-protective varieties extract less data per unit of use.

Consider a privacy-protective variety P and a mainstream data-intensive variety M, where $l_P > l_M$, and $d_P < d_M$. As in the green application, the privacy-protective variety may be costly to sustain. It may have a lower general appeal, a smaller user base, or a higher labor requirement. Let F_P denote its fixed labor requirement. Then P survives if

$$(p_P - mc_P)Q_P \geq F_P. \tag{28}$$

This is again a private survival condition. Concentrated privacy preferences can make (28) hold by generating sufficient demand from consumers who place high value on privacy protection.

Now consider the effect of P's survival on aggregate data extraction. Let Q_M^0 denote usage of the mainstream data-intensive variety when P is absent. Let Q_M^1 and Q_P denote usage when P survives. Aggregate data extraction from these varieties is

$$D^0 = d_M Q_M^0$$

without the privacy-protective variety, and

$$D^1 = d_M Q_M^1 + d_P Q_P$$

with the privacy-protective variety. Hence

$$\Delta D = D^1 - D^0 = d_P Q_P - d_M(Q_M^0 - Q_M^1). \tag{29}$$

Define the displacement rate

$$\sigma_P = \frac{Q_M^0 - Q_M^1}{Q_P}.$$

Then

$$\Delta D = (d_P - \sigma_P d_M)Q_P. \tag{30}$$

Aggregate data extraction falls if and only if

$$\sigma_P > \frac{d_P}{d_M}. \tag{31}$$

This condition mirrors the green application. The survival of a privacy-protective digital variety reduces aggregate data extraction only if it sufficiently displaces use of data-intensive varieties.

The implication is again sharp:

privacy-oriented variety survival $\not\Rightarrow$ lower aggregate data extraction.

If the privacy-oriented product mostly attracts users away from the data-intensive product, then aggregate data extraction falls. But if it mainly expands total use of the differentiated digital branch, or if displacement of the data-intensive variety is weak, then aggregate data extraction need not fall. A low-data product still has positive data intensity unless $d_P = 0$. Therefore, if it adds usage without sufficiently reducing usage of high-data alternatives, total data extraction can increase.

The important point is that this application does not require additional assumptions about platform strategy, network effects, advertising markets, or privacy externalities. Data extraction is treated as an attribute-linked outcome: varieties with higher privacy protection have lower data intensity, and aggregate data extraction depends on the equilibrium composition of demand. The model's selection mechanism determines whether the privacy-protective variety survives; condition (31) determines whether its survival reduces aggregate data extraction.

With several data-intensive varieties, the condition generalizes in the same way. Let $\mathcal{M}$ be the set of data-intensive varieties affected by the survival of P. Then aggregate data extraction falls when

$$\sum_{j\in\mathcal{M}} d_j \,(Q_j^0 - Q_j^1) > d_P Q_P. \tag{32}$$

That is, the reduction in data extraction from displaced data-intensive use must exceed the data extraction generated by the privacy-protective variety itself.

4.3 Selection versus impact

The two applications separate two margins that are often conflated. The first is the selection margin: whether a variety with a socially or behaviorally salient attribute survives in the differentiated branch. The second is the impact margin: whether the survival of that variety improves the associated aggregate outcome.

For green varieties, the selection condition is

$$(p_G - mc_G)Q_G \geq F_G,$$

whereas the emissions condition is

$$\sigma_G > \frac{e_G}{e_B}.$$

For privacy-protective varieties, the selection condition is

$$(p_P - mc_P)Q_P \geq F_P,$$

whereas the data-extraction condition is

$$\sigma_P > \frac{d_P}{d_M}.$$

Preference concentration can help satisfy the first condition in each case. It can make green or privacy-oriented varieties profitable enough to survive. But it does not automatically satisfy the second condition. The aggregate effect depends on displacement: cleaner or more privacy-protective varieties improve the associated outcome only when they sufficiently replace dirtier or more data-intensive varieties.

This is the main lesson of the applications. Concentrated preferences may sustain niche varieties with desirable attributes, but the survival of such varieties is not itself enough to establish environmental or data-related improvement. Market selection and aggregate impact are distinct.

4.4 Behavioral and empirical implications

The analysis yields several testable implications. The central comparative static is not about the average valuation of the focal attribute, but about the distribution of preference intensity around that average. Across markets or product categories with similar average valuation of a focal attribute, high-attribute products should obtain larger revenue shares when preference intensity is more concentrated in the upper tail of the consumer distribution.

A second implication concerns product position. The effect of preference concentration should be strongest for products located far from the share-weighted center of the active product space. In the ranked benchmark, these are the products whose focal attribute is sufficiently distinct from the attributes embodied by more mainstream varieties. The model therefore predicts that concentration should matter most for products that are not merely differentiated, but differentiated in the direction valued by high-intensity consumers.

A third implication is that product survival and aggregate impact should be empirically separated. The survival of green, privacy-oriented, or otherwise focal-attribute-intensive varieties is evidence that concentrated preferences can solve a private revenue problem. It is not, by itself, evidence that environmental quality, privacy protection, or social surplus has improved. Such a conclusion requires evidence that the surviving variety displaces dirtier, less privacy-protective, or otherwise inferior alternatives.

These implications could be tested in choice experiments. An experimental design could hold the average stated valuation of an attribute fixed while varying the distribution of preference intensity across subjects. The model predicts that high-attribute products should obtain higher revenue shares under the more concentrated distribution, especially when they are located far from the center of the product space. The same logic could be taken to market data by comparing product categories with similar average stated concern but different upper-tail intensity. In both cases, the relevant empirical outcome is not only whether focal varieties survive, but also whether their survival changes substitution patterns relative to less focal-attribute-intensive alternatives.

5. Conclusion

This paper has studied how the concentration of preferences for a focal product attribute affects product selection in a differentiated-product economy with fixed operating costs. Consumers differ in the intensity with which they value a product characteristic that is not equally important to all consumers. Products differ in general appeal, productivity, fixed operating labor requirements, and the level of the focal attribute. Products survive only if the revenue they attract from consumers generates enough variable profit to cover their fixed operating costs.

The central result is that product selection depends not only on the average strength of focal preferences, but also on their distribution. When the revenue contribution of consumers is convex in preference intensity, a mean-preserving increase in preference concentration raises the revenue of high-attribute products. In the ranked focal-attribute benchmark, this convexity has a simple interpretation: the highest-attribute product benefits from concentration when it is sufficiently separated from the share-weighted center of the active attribute distribution. Concentrated preferences can therefore sustain varieties that would not survive under a more diffuse distribution with the same average preference.

The paper also separates this market-selection effect from welfare and aggregate impact. A product may become privately viable because concentrated consumers generate enough revenue to cover its fixed cost, but private viability need not coincide with social desirability. Welfare depends on the utility generated by the product and on the labor required to produce and operate it. Similarly, in green and privacy-related markets, the survival of a desirable variety does not automatically improve the associated aggregate outcome. Emissions fall only if green consumption sufficiently displaces brown consumption; data extraction falls only if privacy-oriented use sufficiently displaces data-intensive use.

The main message is therefore simple. Differentiated-product markets respond not only to average preferences, but also to the concentration of preference intensity. Small groups of high-intensity consumers can sustain high-attribute products that diffuse moderate preferences cannot sustain. This helps explain the persistence of specialized varieties with environmental, ethical, privacy-related, cultural, or identity-based attributes. At the same time, niche survival should not be confused with welfare improvement or aggregate impact. Preference concentration is a market-selection force; its normative implications depend on displacement, resource costs, and the welfare value of the varieties that survive.

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