Legal Remedies, Non-Conformities in Consumer Sales, and Vertical Differentiation

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Abstract

This paper examines the consequences of some remedies for non-conforming goods in online marketplaces, particularly in light of the European Union's Sale of Goods Directive (2019/771). We develop a model of vertical differentiation where consumer heterogeneity arises from differences in legal enforcement costs. Consumers face uncertainty about product quality and rely on seller-provided signals such as branding, reviews, and refund policies. Once a product is received, their decision to seek redress depends on individual enforcement costs, the level of the applicable substantive remedy, and legal accessibility to the remedies. We show that, counterintuitively, under some conditions stronger legal enforcement and higher remedies increase demand for lower-quality sellers, reshaping competitive dynamics in online markets.

JEL codes: D43; K12; L81; D18.

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1   Introduction

The rise of online marketplaces has transformed retail markets, offering consumers unprecedented access to a vast array of products. However, this expansion has also introduced new challenges, particularly regarding product quality and consumer protection.

Unlike traditional brick-and-mortar stores where consumers can directly inspect goods before purchase, online shoppers rely on signals such as branding, customer reviews, and refund policies to infer quality. Given this aggravated asymmetry of information, legal remedies are apt to play a crucial role in safeguarding consumers against substandard or misrepresented products. Yet, the effectiveness of these remedies is not uniform across consumers, as the cost of pursuing claims—both financial and procedural—substantially varies among individuals. This variation leads to a fundamental tradeoff between encouraging higher product quality and ensuring strong consumer protections.

The European Union's Sale of Goods Directive (2019/771) has tried to reinforce consumer rights by mandating effective legal remedies for defective products. The Directive strengthens consumer protections by ensuring that buyers have access to refunds, repairs, or replacements when products fail to meet quality standards. However, these protections impose costs on sellers, which may in turn influence their pricing strategies and product quality choices. While strong remedies enhance consumer trust in online markets, they may also lead some firms to reduce quality or exit the market altogether. The net effect of these regulations depends on the interaction between consumers' behavior, enforcement costs, and firms' incentives.

In this paper, we develop a theoretical model that captures the interplay between product quality, consumer heterogeneity in enforcement costs, and firms' strategic pricing and quality decisions. Our model extends the classic framework of vertical differentiation (Gabszewicz and Thisse, 1979) by incorporating legal remedies as an additional dimension of market competition. We consider a setting where consumers face varying costs of enforcing their rights, leading to a segmentation of the market based on both willingness to pay for quality and ability to claim remedies.

Our analysis reveals a key insight: the strength of consumer protection mechanisms directly affects the incentives to produce high-quality products in various ways. If enforcement costs are high, only a subset of consumers will pursue claims, reducing the overall effectiveness of legal remedies and allowing low-quality sell-

ers to persist. Conversely, very strong remedies may lead high-quality firms to preemptively raise prices or restrict product offerings to mitigate compliance risks, potentially reducing consumer welfare. This tension underscores the importance of calibrating consumer protection policies to strike a balance between incentivizing quality while ensuring accessibility to remedies without distorting market dynamics.

By deriving equilibrium pricing and demand functions, we explore how variations in remedy levels (r) and enforcement effectiveness (β) influence firm behavior and market outcomes. Our findings suggest that an optimal balance must be struck: excessively stringent remedies may deter low-quality entrants but could also reduce competitive pressure on high-quality firms, while weak enforcement may lead to market inefficiencies and consumer harm. These insights have direct policy implications for regulators seeking to enhance consumer protection without stifling competition or innovation in online marketplaces.

The remainder of this paper is structured as follows. Section 2 reviews the relevant literature on consumer protection, quality differentiation, and online market regulation. Section 3 presents our formal model. Section 4 derives the equilibrium conditions and explores comparative statics to examine the effects of policy interventions. Section 5 discusses the broader implications of our findings for each of the remedies envisaged in the EU Sales of Goods Directive. Section 6 provides some policy implications, and Section 7 concludes with potential directions for future research.

2   Literature Review

This paper contributes to several strands of literature at the intersection of law, economics, and consumer behavior in vertically differentiated markets. A relevant array of our analysis lies in the role of legal remedies in shaping the incentives of contracting parties under asymmetric information and incomplete enforcement. The economics of contract law has long emphasized that the type and structure of remedies—ranging from expectation damages and rescission to repair and replacement—critically influence *ex ante* behavior and market outcomes (Miceli, 1997; Bag, 2018). Legal remedies serve not merely to compensate but to deter opportunism and to encourage compliance, particularly in settings where monitoring is imperfect and ex post disputes are costly (Brooks and Stremitzer, 2011; Ganglmair, 2017, 2019).

Several contributions have analyzed the efficiency of different contractual reme-

dies and their effects on parties' incentives to invest or comply (e.g. Stremitzer, 2010; Schweizer, 2015). Friehe and Tröger (2012), for instance, investigate how the sequence in which remedies are available affects sellers' incentives and buyers' litigation strategies. More recently, Spier and Choi (2025) evaluate the relative efficiency of voidance and damages within a dyadic buyer–seller setting .Our paper departs from this literature by modeling consumer-side heterogeneity in enforcement costs as an explicit dimension of market segmentation. While prior work typically assumes that remedies are applied uniformly across buyers, we allow enforcement frictions to vary systematically across the population, capturing procedural burdens and individual legal literacy that shape access to redress.

This heterogeneity interacts with firm behavior in vertically differentiated markets, which has been studied extensively since Gabszewicz and Thisse (1979) and d'Aspremont, Gabszewicz, and Thisse (1979). In those models, firms compete on quality and price, with consumers differing in their willingness to pay for quality. We build on this foundation but introduce a different source of heterogeneity: instead of assuming that all consumers can credibly enforce contracts, we pose that enforcement ability itself varies and interacts with firm strategy. As a result, firms can segment the market not only by preferences but also by the legal vulnerability of consumers, leading to equilibrium configurations that depart sharply from traditional quality-tiered market structures.

In addition to the vertical differentiation literature, our analysis connects to work on information asymmetries in digital markets, where consumers often rely on noisy or endogenous signals—such as ratings, refund policies, and warranties—to infer product quality. In such environments, the legal infrastructure underpinning consumer rights plays an increasingly prominent signaling role. Remedies, in this view, act not only as post-contract enforcement tools but as pre-contractual market signals that influence consumer expectations and firms' reputational calculus. Our model endogenizes this institutional feature into the strategic environment, demonstrating how variations in remedy strength and enforcement accessibility can shift demand between high and low-quality sellers.

These theoretical insights are particularly salient in the context of online marketplaces, where regulatory differences across platforms and jurisdictions create diverse equilibrium environments. Strong remedy schemes, such as those employed by Amazon, may enhance consumer confidence and expand demand, yet may also enable the persistence of low-quality sellers by lowering the perceived cost of transacting with them. Conversely, more limited enforcement regimes—such as those observed on platforms like AliExpress—can incentivize consumers to self-select

into higher-quality purchases, thereby exerting upward pressure on equilibrium quality. Recent work on online reputation mechanisms and strategic disclosure underscores how enforcement constraints can lead firms to differentiate not only on price or quality, but also on the transparency and verifiability of promises (Tadelis, 2016; Lewis, 2011). Weak enforcement frameworks may disproportionately burden consumers with lower legal literacy or procedural access, reinforcing market segmentation and reducing the deterrent effect of legal remedies (Cafaggi and Iamiceli, 2010; Ben-Shahar and Schneider, 2011). While the literature has examined platform governance and buyer protection in fragmented ways (Nosko and Tadelis, 2015), our contribution integrates these concerns in a unified framework that explains how legal frictions may shape competition and welfare in the marketplace.

In sum, this paper introduces a novel mechanism by which legal remedies affect market structure through the channel of heterogeneous consumer enforcement costs. By embedding this heterogeneity into a vertical differentiation model, we offer comparative statics and policy implications that inform the ongoing debate over optimal consumer protection design, particularly under the EU Sale of Goods Directive (2019/771). Our results suggest that increasing remedy levels or enforcement strength can have non-monotonic effects on market quality, depending on the distribution of enforcement frictions across consumers and the strategic responses of firms. This contributes to the broader literature on how legal institutions interact with market forces in complex, information-asymmetric environments.

3   Model

We build our model upon the general framework established by Gabszewicz and Thisse (1979), which provides a foundational approach to vertical differentiation. Their model considers a market where firms offer products of different quality levels, and consumers are heterogeneous in their willingness to pay for quality. The key insight of their paper is that higher-quality goods command a price premium, and consumers self-select based on their valuation of quality: those with a higher willingness to pay choose superior products, while those with a lower willingness to pay opt for lower-quality alternatives. The equilibrium in their model typically leads to price and quality segmentation, where firms strategically position their products to maximize profits given the distribution of consumer preferences.

In our setting, we consider a market where a single good can be produced from two different firms with quality levels, q_1 and q_2, where $q_1 \geq q_2$. However, unlike

in Gabszewicz and Thisse (1979), consumer heterogeneity in our model does not stem from differences in willingness to pay for quality but rather from variations in the costs associated with initiating legal remedies. This shift introduces a new dimension of strategic interaction, as consumers must weigh not only the expected quality of the good but also their ability and willingness to enforce their rights in case of a dispute and how much they expect to get from pursuing a legal remedy.

Consumers, when purchasing a product online, observe the price but do not directly observe the product quality. Instead, they rely on signals such as branding, reviews, and voluntary refund policies or warranties offered by sellers, or eventually the platform in charge of the online marketplace. These mechanisms serve as imperfect substitutes for direct quality observation, shaping consumer expectations and purchasing decisions.

Once the product is received, consumers may attempt to ascertain its quality right away, or simply start using the product to reveal its performance levels. If a consumer perceives it to be substandard, she may choose to file a claim for a remedy. However, the decision to seek redress is influenced by individual differences in legal and procedural costs, including the time, effort, and financial burden required to inspect or use the product promptly and/or to bring and pursue a claim. This introduces an additional layer of complexity compared to traditional vertical differentiation models, as firms must account for both the perceived quality of their products and the claims brought by consumers when designing their pricing and quality strategies.

Each consumer is characterized by a cost parameter θ_i, which represents consumer's sensitivity to the risk of defect, including the costs of discovering quality and pursuing remedies.[1] We assume that θ is uniformly distributed over $[0, \bar{\theta}]$.

In addition, we introduce two key parameters to characterize the legal and enforcement environment. r, represents the level of the remedy, which captures the amount of the refund or compensation available to consumers who successfully claim a remedy. The second, β, represents the level of enforcement, which determines the effectiveness and accessibility of legal mechanisms that allow consumers to enforce their rights. These parameters shape consumer behavior by influencing both the incentives to seek redress and the expected benefits of doing so.

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[1]Quick reaction by consumers clearly enhances their legal position. Art. 3.7 of Directive 2019/771 provides that Member States may grant the consumer any remedy if the non-conformity of the good is found by the consumer shortly (i.e. in less than thirty days) after delivery, and free of the constraints arising from the hierarchy of remedies and the specific conditions for their exercise contained in the Directive.

Consumers derive utility:

$$U_c(q) = q + (1 - \alpha_H^j)\beta[r - \theta_i] - p_j.$$

The quality q of the product follows a probability distribution in which:

For seller 1:
$$q_1 = \overline{q} \text{ with probability } \alpha_H^1 = 1.$$

For seller 2:
$$q_2 = \begin{cases} \overline{q} & \text{with probability } \alpha_H^2, \\ \underline{q} & \text{with probability } (1 - \alpha_H^2). \end{cases}$$

$\overline{q}$ is the level of conformity or quality of the good required by the legal system, and that $\underline{q}$ bar falls short of that level.

Assuming $\alpha_H^1 = 1$, seller 1 always offers high quality, while seller 2's quality remains uncertain.

$$U_c(q_1) = \overline{q} - p_1$$

The consumer's utility from purchasing from seller 2 can be written as:

$$U_c(q_2) = \alpha_H^2 \overline{q} + (1 - \alpha_H^2)\underline{q} + (1 - \alpha_H^2)\beta \left[r - \theta\right] - p_2.$$

3.1 Consumer Choice and Indifference Condition

A consumer is indifferent between purchasing from seller 1 and seller 2 if:

$$\overline{q} - p_1 = \alpha_H^2 \overline{q} + (1 - \alpha_H^2)\underline{q} + (1 - \alpha_H^2)\beta \left[r - \tilde{\theta}\right] - p_2.$$

Rearranging, we obtain the threshold cost level $\tilde{\theta}$ at which consumers are indifferent:

$$\tilde{\theta} = \frac{p_1 - p_2 - (1 - \alpha_H^2)(\overline{q} - \underline{q} - \beta r)}{\beta(1 - \alpha_H^2)}.$$

Consumers with $\theta \geq \tilde{\theta}$ choose seller 1, and those with $\theta < \tilde{\theta}$ choose seller 2.

3.2 Demand Functions

The market demand is normalized to unity (i.e., $D_1(p_1, p_2) + D_2(p_1, p_2) = 1$). Thus, the demand functions for each seller can be expressed as:

$$D_1(p_1, p_2) = \frac{\overline{\theta} - \tilde{\theta}}{\overline{\theta}}.$$

$$D_2(p_1, p_2) = \frac{\tilde{\theta}}{\overline{\theta}},$$

3.3 Sellers' Pricing and Equilibrium

For convenience, define

$$A \equiv (1 - \alpha_H^2)(\overline{q} - \underline{q} - \beta r)$$

and

$$K \equiv \overline{\theta}\beta(1 - \alpha_H^2).$$

Then the demand functions can be rewritten as

$$D_1(p_1, p_2) = 1 - \frac{p_1 - p_2 - A}{K}, \qquad D_2(p_1, p_2) = \frac{p_1 - p_2 - A}{K}.$$

Each seller maximizes its profit:

$$\pi_1 = D_1(p_1, p_2)(p_1 - c_1) = \left[1 - \frac{p_1 - p_2 - A}{K}\right](p_1 - c_1),$$

$$\pi_2 = D_2(p_1, p_2)(p_2 - c_2) = \frac{p_1 - p_2 - A}{K}(p_2 - c_2).$$

Seller 1: Differentiating π_1 with respect to p_1:

$$\frac{\partial \pi_1}{\partial p_1} = -\frac{1}{K}(p_1 - c_1) + \left[1 - \frac{p_1 - p_2 - A}{K}\right] = 0.$$

Multiplying through by K yields:

$$-(p_1 - c_1) + K - (p_1 - p_2 - A) = 0,$$

or

$$2p_1 - p_2 - c_1 - A = K.$$

Thus, seller 1's reaction function is:

$$p_1(p_2) = \frac{1}{2}\left(p_2 + c_1 + A + K\right).$$

Seller 2: Differentiating π_2 with respect to p_2:

$$\frac{\partial \pi_2}{\partial p_2} = -\frac{1}{K}(p_2 - c_2) + \frac{p_1 - p_2 - A}{K} = 0.$$

Multiplying by K and rearranging gives:

$$-(p_2 - c_2) + (p_1 - p_2 - A) = 0,$$

$$p_1 + c_2 - A - 2p_2 = 0,$$

so that

$$p_2(p_1) = \frac{1}{2}\left(p_1 + c_2 - A\right).$$

Nash Equilibrium

Substituting seller 2's reaction function into that of seller 1:

$$p_1 = \frac{1}{2}\left(\frac{1}{2}(p_1 + c_2 - A) + c_1 + A + K\right).$$

Multiply both sides by 2:

$$2p_1 = \frac{1}{2}(p_1 + c_2 - A) + c_1 + A + K.$$

Multiply by 2:

$$4p_1 = p_1 + c_2 - A + 2c_1 + 2A + 2K.$$

Collecting terms:

$$3p_1 = 2c_1 + c_2 + A + 2K,$$

$$p_1^* = \frac{2c_1 + c_2 + A + 2K}{3}.$$

Substituting p_1^* into seller 2's reaction function:

$$p_2 = \frac{1}{2}\left(p_1^* + c_2 - A\right) = \frac{1}{2}\left(\frac{2c_1 + c_2 + A + 2K}{3} + c_2 - A\right).$$

Writing with a common denominator:

$$p_2 = \frac{1}{2}\left(\frac{2c_1 + c_2 + A + 2K + 3c_2 - 3A}{3}\right) = \frac{1}{2}\left(\frac{2c_1 + 4c_2 - 2A + 2K}{3}\right),$$

$$p_2^* = \frac{2c_1 + 4c_2 - 2A + 2K}{6} = \frac{c_1 + 2c_2 - A + K}{3}.$$

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Nash Equilibrium:

$$\boxed{\begin{aligned} p_1^* &= \frac{2c_1 + c_2 + A + 2K}{3}, \\ p_2^* &= \frac{c_1 + 2c_2 - A + K}{3}, \end{aligned}}$$

with

$$A = (1 - \alpha_H^2)(\bar{q} - \underline{q} - \beta r) \quad \text{and} \quad K = \bar{\theta}\beta(1 - \alpha_H^2).$$

At the Nash equilibrium, the threshold cost level is given by

$$\tilde{\theta}^* = \frac{p_1^* - p_2^* - (1 - \alpha_H^2)(\bar{q} - \underline{q} - \beta r)}{\beta(1 - \alpha_H^2)} = \frac{p_1^* - p_2^* - A}{\beta(1 - \alpha_H^2)},$$

with

$$A \equiv (1 - \alpha_H^2)(\bar{q} - \underline{q} - \beta r)$$

and the auxiliary term

$$K \equiv \bar{\theta}\beta(1 - \alpha_H^2).$$

Given the equilibrium prices

$$p_1^* = \frac{2c_1 + c_2 + A + 2K}{3} \quad \text{and} \quad p_2^* = \frac{c_1 + 2c_2 - A + K}{3},$$

we can compute the equilibrium threshold as

$$\tilde{\theta}^* = \frac{p_1^* - p_2^* - A}{\beta(1 - \alpha_H^2)} = \frac{c_1 - c_2 - A + K}{3\beta(1 - \alpha_H^2)}.$$

Since total market demand is normalized (i.e., $D_1(p_1, p_2) + D_2(p_1, p_2) = 1$), the equilibrium demands are

$$D_1^* = 1 - \frac{\tilde{\theta}^*}{\bar{\bar{\theta}}}, \qquad D_2^* = \frac{\tilde{\theta}^*}{\bar{\bar{\theta}}}.$$

Finally, the equilibrium profits for each seller are given by

$$\pi_1^* = D_1^* \left(p_1^* - c_1\right),$$

$$\pi_2^* = D_2^* \left(p_2^* - c_2\right).$$

4   Comparative Statics

We now analyze the impact of changes in the enforcement parameter β and the remedy level r on equilibrium outcomes. Recall that the threshold $\tilde{\theta}^*$ is defined as:

$$\tilde{\theta}^* = \frac{p_1^* - p_2^* - A}{\beta(1 - \alpha_H^2)},$$

where the term A is given by:

$$A = (1 - \alpha_H^2)(\bar{q} - \underline{q} - \beta r),$$

and $K = \bar{\theta}\beta(1 - \alpha_H^2)$. Substituting for p_1^* and p_2^*:

$$\tilde{\theta}^* = \frac{c_1 - c_2 - A + K}{3\beta(1 - \alpha_H^2)}. \tag{1}$$

Expanding A and K:

$$\tilde{\theta}^* = \frac{c_1 - c_2 - (1 - \alpha_H^2)(\bar{q} - \underline{q} - \beta r) + \bar{\theta}\beta(1 - \alpha_H^2)}{3\beta(1 - \alpha_H^2)}. \tag{2}$$

Rearrange:

$$\tilde{\theta}^* = \frac{c_1 - c_2}{3\beta(1 - \alpha_H^2)} - \frac{\bar{q} - \underline{q}}{3\beta} + \frac{r + \bar{\theta}}{3}. \tag{3}$$

Since $D_2 = \frac{\tilde{\theta}^*}{\bar{\theta}}$, we obtain:

$$D_2 = \frac{1}{\bar{\theta}}\left(\frac{c_1 - c_2}{3\beta(1 - \alpha_H^2)} - \frac{\bar{q} - \underline{q}}{3\beta} + \frac{r + \bar{\theta}}{3} \right). \tag{4}$$

4.1   Effect on the demand of an increase on β

Differentiating:

$$\frac{dD_2}{d\beta} = \frac{1}{\bar{\theta}}\left(-\frac{c_1 - c_2}{3\beta^2(1 - \alpha_H^2)} + \frac{\bar{q} - \underline{q}}{3\beta^2} \right). \tag{5}$$

Factor out $\frac{1}{3\beta^2}$:

$$\frac{dD_2}{d\beta} = \frac{1}{3\beta^2\bar{\theta}}\left((\bar{q} - \underline{q}) - \frac{c_1 - c_2}{1 - \alpha_H^2} \right). \tag{6}$$

4.2 Interpretation

For D_2 to increase with β, we require:

$$(\overline{q} - \underline{q}) > \frac{c_1 - c_2}{1 - \alpha_H^2}. \tag{7}$$

This condition should always hold and it can be interpreted that seller 1 is more efficient than seller 2. In other words, the difference in quality compensates for the difference in costs.

Thus, D_2 increases with β if the quality gap $\overline{q} - \underline{q}$ is large relative to the cost difference between firms.

This finding may appear counterintuitive at first, as stronger enforcement is generally expected to deter low-quality sellers and shift demand toward higher-quality alternatives. However, it can be understood by considering the strategic responses of both firms and consumers.

Stronger enforcement increases the likelihood that consumers can successfully claim remedies when they receive a low-quality product. However, this does not always discourage low-quality sellers. Instead, when the quality gap is sufficiently large, stronger enforcement can make low-quality products more attractive to consumers who anticipate that they can claim compensation or refunds if the product fails to meet expectations. This safety net effectively lowers the perceived risk of purchasing from low-quality sellers, thereby increasing D_2.

At the same time, consumers who might have previously taken the risk of purchasing low-quality goods due to their lower price may now reconsider their choices. Knowing that enforcement is strong, they anticipate that low-quality sellers are more likely to be held accountable. However, if these sellers respond by either raising their prices (to cover the cost of frequent refunds) or exiting, consumers who value reliability will naturally shift toward high-quality alternatives, increasing D_1.

From the firm's perspective, low-quality sellers may remain in the market by adjusting their pricing strategy or by leveraging the stronger enforcement environment to attract risk-tolerant consumers. If these sellers expect consumers to claim remedies but also anticipate that some claims will not materialize due to procedural frictions, they may still find it profitable to operate. Additionally, if enforcement mechanisms primarily focus on financial compensation rather than product repair and replacement, low-quality sellers can persist by internalizing refund costs within their pricing structure.

At the same time, consumers who were previously deterred by uncertainty regarding remedies may now be more willing to engage with low-quality sellers, knowing that they have a higher likelihood of recourse. This effect is particularly pronounced in online marketplaces where refund policies are typically robust for a number of reasons. For example, platforms like Amazon and eBay provide guarantees that protect buyers, which can paradoxically sustain demand for lower-quality goods. In such cases, consumers rationally choose the cheaper alternative, relying on the platform's policies to mitigate the negative consequences from exposure to low-quality goods.

This trend is also visible in ride-sharing and gig economy platforms like Uber and Airbnb, where stronger consumer protection policies do not always eliminate lower-quality service providers. Instead, they can lead to an increase in demand for budget-friendly options, as consumers factor in the improved enforcement when making purchasing decisions. For example, Airbnb's strict refund policies may encourage more bookings of lower-rated properties, as travelers feel reassured that they can receive compensation in case of subpar accommodations.

Thus, the observed increase in D_2 highlights a nuanced effect of enforcement policies: while they enhance consumer protection, they do not necessarily eliminate demand for low-quality sellers. Instead, by reducing the perceived risk of engaging with these sellers, stronger enforcement can, under certain conditions, sustain or even increase their market presence.

4.3   Effect on the demand of an increase on r

In the baseline case $\phi = 0$, we now explain why the remedy level r does not affect demand when seller 2 internalizes the expected cost of compensating consumers.

Recall the consumer utility from purchasing from seller 2:

$$U_c(q_2) = \alpha_H^2 \overline{q} + (1 - \alpha_H^2)\underline{q} + (1 - \alpha_H^2)\beta(r - \theta) - p_2.$$

Now, suppose seller 2 internalizes the expected compensation cost. Then this expected cost,

$$(1 - \alpha_H^2)\beta r,$$

is added to their marginal cost. That is, define:

$$\tilde{c}_2 \equiv c_2 + (1 - \alpha_H^2)\beta r.$$

When computing the indifference condition between seller 1 and seller 2, we have:

$$\bar{q} - p_1 = \alpha_H^2 \bar{q} + (1 - \alpha_H^2)\underline{q} + (1 - \alpha_H^2)\beta(r - \tilde{\theta}) - p_2.$$

Rearranging to solve for the threshold $\tilde{\theta}$:

$$\tilde{\theta} = \frac{p_1 - p_2 - (1 - \alpha_H^2)(\bar{q} - \underline{q} - \beta r)}{\beta(1 - \alpha_H^2)}.$$

However, note that this expression includes r because p_2 is still treated as exogenous. Once we replace c_2 with the internalized cost $\tilde{c}_2$ in the equilibrium prices, the term $(1 - \alpha_H^2)\beta r$ reappears in p_2^*, and therefore cancels in the numerator:

$$p_2^* = \frac{c_1 + 2\tilde{c}_2 - A + K}{3} = \frac{c_1 + 2[c_2 + (1 - \alpha_H^2)\beta r] - A + K}{3}.$$

This introduces a term $2(1 - \alpha_H^2)\beta r$ in p_2^*, while $A = (1 - \alpha_H^2)(\bar{q} - \underline{q} - \beta r)$ also depends on r.

Substituting both expressions into the threshold formula:

$$\tilde{\theta}^* = \frac{p_1^* - p_2^* - A}{\beta(1 - \alpha_H^2)}.$$

After substituting and simplifying, all terms involving r cancel. The resulting expression is:

$$\tilde{\theta}^* = \frac{c_1 - c_2}{3\beta(1 - \alpha_H^2)} - \frac{\bar{q} - \underline{q}}{3\beta} + \frac{\bar{\theta}}{3}.$$

Notice that r has fully dropped out. Hence, the demand function becomes:

$$D_2^* = \frac{\tilde{\theta}^*}{\bar{\theta}} = \frac{1}{\bar{\theta}}\left(\frac{c_1 - c_2}{3\beta(1 - \alpha_H^2)} - \frac{\bar{q} - \underline{q}}{3\beta} + \frac{\bar{\theta}}{3}\right),$$

which clearly does not depend on r.

This result shows that when seller 2 internalizes the expected cost of compensation, the remedy level r no longer affects demand. It enters into the price decision through seller 2's effective marginal cost, but consumers still face prices that reflect those internalized costs. Since the compensation value and cost cancel out, the marginal consumer's decision is unaffected by r.

The reason why the remedy level r does not affect demand—when seller 2 internalizes the expected compensation cost—can be understood intuitively: increasing r simply acts as an increase in seller 2's marginal cost.

More precisely, since only consumers of low type may seek remedies, and with probability $(1 - \alpha_H^2)$, seller 2 expects to pay a compensation of size r with probability β. Therefore, seller 2 anticipates an expected compensation cost of:

$$(1 - \alpha_H^2)\beta r.$$

If this is internalized, then seller 2's effective marginal cost becomes:

$$\tilde{c}_2 = c_2 + (1 - \alpha_H^2)\beta r.$$

From the consumer's perspective, however, nothing changes. The price they face includes this cost adjustment, but their expected utility also includes a benefit from the same compensation (captured by the term $(1 - \alpha_H^2)\beta(r - \theta)$). At the margin, these two effects cancel out in the indifference condition.

Therefore, the consumer's choice between seller 1 and seller 2 remains unchanged. What changes is only seller 2's pricing behavior to pass on the expected compensation cost. In essence, *remedy levels act as a marginal cost increase for seller 2, and if internalized, they do not distort the demand function.*

5 Pass-Through of Expected Remedies and Additional Seller Costs

This section extends the baseline model by allowing seller 2 to incur an additional *per-unit* cost when remedies are strengthened. Specifically, besides internalizing the buyer's expected compensation $(1 - \alpha_H^2)\beta r$, seller 2 also faces an incremental non-compensatory cost $\phi \beta r$, with $\phi \geq 0$. This term captures logistics, customer-service, legal, diagnostic, and downtime frictions that are not directly transferred to the consumer but that rise with the remedy level r and the enforcement strength β.

Setup and Equilibrium with $\phi > 0$

Let the effective marginal cost of seller 2 be

$$\tilde{c}_2^\phi \equiv c_2 + (1 - \alpha_H^2)\beta r + \phi \beta r.$$

The demand system and the definitions of $A \equiv (1 - \alpha_H^2)(\bar{q} - \underline{q} - \beta r)$ and $K \equiv \bar{\theta} \beta (1 - \alpha_H^2)$ are unchanged because they are determined by consumers' expected compensation and not by the seller's private cost. Solving the same Bertrand game as in Section 3 yields equilibrium prices:

$$p_1^{\phi *} = \frac{2c_1 + \tilde{c}_2^\phi + A + 2K}{3}, \qquad p_2^{\phi *} = \frac{c_1 + 2\tilde{c}_2^\phi - A + K}{3}.$$

Hence, the *price pass-through* of the remedy to seller 2 is

$$\frac{\partial p_2^{\phi *}}{\partial r} = \frac{2}{3} \frac{\partial \tilde{c}_2^\phi}{\partial r} - \frac{1}{3} \frac{\partial A}{\partial r} = \frac{2}{3} \beta \big[(1 - \alpha_H^2) + \phi \big] + \frac{1}{3} \beta (1 - \alpha_H^2)$$
$$= \beta (1 - \alpha_H^2) + \frac{2}{3} \beta \phi.$$

When $\phi = 0$, the pass-through equals $\beta(1 - \alpha_H^2)$, i.e., *one-to-one* with the buyer's expected compensation. When $\phi > 0$, pass-through strictly exceeds one-to-one by $\frac{2}{3}\beta\phi$, so p_2 rises faster with r than the consumer's protection does.

Effect on the Cutoff and D_2

The indifference cutoff remains $\tilde{\theta} = (p_1 - p_2 - A)/\big(\beta(1 - \alpha_H^2)\big)$. Substituting the equilibrium prices above yields

$$\tilde{\theta}_\phi^* = \frac{c_1 - \tilde{c}_2^\phi - A + K}{3\beta(1 - \alpha_H^2)}, \qquad D_2^{\phi *} = \begin{cases} \tilde{\theta}_\phi^* / \bar{\theta} & \text{under the uniform case,} \\ F(\tilde{\theta}_\phi^*) & \text{for a general distribution } F. \end{cases}$$

Differentiating with respect to r gives

$$\frac{\partial \tilde{\theta}_\phi^*}{\partial r} = -\frac{\phi}{3(1 - \alpha_H^2)} < 0,$$

since $\partial \tilde{c}_2^\phi / \partial r = \beta \big[(1 - \alpha_H^2) + \phi \big]$ and $\partial A / \partial r = -\beta(1 - \alpha_H^2)$. Therefore,

$$\frac{\partial D_2^{\phi *}}{\partial r} = \begin{cases} -\dfrac{\phi}{3\bar{\theta}(1 - \alpha_H^2)} & \text{if } F \text{ is uniform,} \\ -f(\tilde{\theta}_\phi^*) \dfrac{\phi}{3(1 - \alpha_H^2)} & \text{for a general } F, \end{cases}$$

which is *strictly negative* for any $\phi > 0$ and interior market split ($f(\tilde{\theta}_\phi^*) > 0$). Intuitively, extra non-compensatory frictions borne by the seller amplify the price response to r without adding consumer surplus at the purchase stage, so the threshold shifts toward seller 1 and the low-quality seller's demand falls.

Benchmark and Connection with Section 6

Setting $\phi = 0$ collapses $\tilde{c}_2^{\phi}$ to $c_2 + (1 - \alpha_H^2)\beta r$ and immediately delivers $\partial\tilde{\theta}^*/\partial r = 0$ and $\partial D_2^*/\partial r = 0$, reproducing the neutrality of r obtained in the baseline model. The next section shows that these qualitative conclusions remain valid under an arbitrary F and then embeds the marketplace/liability extensions. =================

6 Robustness check

Let consumer heterogeneity in enforcement or claiming costs be distributed according to an arbitrary cumulative distribution function $F(\theta)$, with density $f(\theta) > 0$ on its support. No shape restriction beyond absolute continuity is imposed.

Consumers compare expected utilities between the two sellers. For seller 1, the expected utility is

$$U_1 = \mathbb{E}[q_1] - p_1,$$

whereas for seller 2 it is

$$U_2 = \mathbb{E}[q_2] + (1 - \alpha_H^2)\beta\,(r - \theta) - p_2.$$

The indifference threshold $\tilde{\theta}$ is defined by the condition $U_1 = U_2$. Solving this equality gives

$$(1 - \alpha_H^2)\beta\,(r - \tilde{\theta}) = \Delta q + (p_2 - p_1), \qquad \Delta q \equiv \mathbb{E}[q_1] - \mathbb{E}[q_2] \geq 0.$$

Demands then correspond to the share of consumer types on each side of the cutoff:

$$D_2 = F(\tilde{\theta}), \qquad D_1 = 1 - F(\tilde{\theta}).$$

From the threshold expression

$$\tilde{\theta} = r - \frac{\Delta q + (p_2 - p_1)}{(1 - \alpha_H^2)\beta},$$

we compute comparative statics. Differentiating with respect to β yields

$$\frac{\partial\tilde{\theta}}{\partial\beta} = \frac{\Delta q + (p_2 - p_1)}{(1 - \alpha_H^2)\beta^2},$$

and differentiating with respect to r gives

$$\frac{\partial\tilde{\theta}}{\partial r} = 1.$$

Proposition 1 (Demand-Agnostic Direction of Effects). Assume an interior market split (i.e., $f(\tilde{\theta}) > 0$) and that $\Delta q + (p_2 - p_1) > 0$, meaning that the high-quality seller retains a net advantage at posted prices. Then

$$\frac{\partial D_2}{\partial \beta} = f(\tilde{\theta})\frac{\partial \tilde{\theta}}{\partial \beta} \geq 0, \qquad \frac{\partial D_2}{\partial r} = f(\tilde{\theta})\frac{\partial \tilde{\theta}}{\partial r} = f(\tilde{\theta}) > 0.$$

Remark (role of ϕ). The result above abstracts from cost pass-through. If seller 2 bears additional per-unit costs $\phi\beta r$ (Section 5), the derivative with respect to r acquires a negative component via prices:

$$\frac{\partial D_2}{\partial r} = f(\tilde{\theta})\frac{\partial \tilde{\theta}}{\partial r} = -f(\tilde{\theta})\frac{\phi}{3(1-\alpha_H^2)}.$$

Thus, the neutrality result ($\partial D_2/\partial r = 0$) is recovered when $\phi = 0$, whereas $\frac{\partial D_2}{\partial r} < 0$ for any $\phi > 0$.

Hence, stronger enforcement (β) and higher remedy (r) shift demand toward the low-conformity seller, regardless of the shape of $F(\cdot)$.

Intuition. Both β and r compress effective vertical differentiation by insuring consumers against non-conformities. This moves the indifference cutoff $\tilde{\theta}$ upward, thereby increasing D_2.

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Best responses rely on the slope of the demand share with respect to own price:

$$\frac{\partial D_1}{\partial p_1} = -\frac{f(\tilde{\theta})}{(1-\alpha_H^2)\beta}, \qquad \frac{\partial D_2}{\partial p_2} = -\frac{f(\tilde{\theta})}{(1-\alpha_H^2)\beta}.$$

The first-order conditions (for an interior equilibrium) imply generalized Lerner-type rules:

$$p_1 - c_1 = \frac{(1-\alpha_H^2)\beta}{f(\tilde{\theta})}D_1, \qquad p_2 - c_2 - \kappa_2 = \frac{(1-\alpha_H^2)\beta}{f(\tilde{\theta})}D_2.$$

The term κ_2 represents the expected remedy cost per unit for seller 2:

$$\kappa_2 \equiv \begin{cases} (1-\alpha_H^2)\,\mathbb{E}[\text{payout}|\text{claim}] \cdot \Pr(\text{claim}), & \text{seller-liable,} \\ 0, & \text{platform-liable.} \end{cases}$$

Under a uniform distribution F on $[0, \bar{\theta}]$, the density is $f(\tilde{\theta}) = 1/\bar{\theta}$, so the Lerner margins reduce to $(p_1 - c_1) = KD_1$ and $(p_2 - c_2 - \kappa_2) = KD_2$, with

$$K = (1-\alpha_H^2)\beta\bar{\theta}.$$

These coincide with the closed-form expressions derived in the paper. More generally, for any F, the qualitative conclusions about how β and r reallocate demand and compress perceived quality differences remain unchanged.

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The same reasoning extends beyond share-based cutoff demand systems.

In a **logit** model with taste shocks ε_j, the mean utility of seller 2 shifts by $(1 - \alpha_H^2)\beta(r - \theta)$, so the choice probability s_2 increases in β, regardless of the scale or independence-of-irrelevant-alternatives structure.

In a **CES or isoelastic** framework, the term $(1 - \alpha_H^2)\beta(r - \theta)$ acts as a quality shifter. The Marshallian demand for seller 2 is therefore increasing in this shifter, and thus also in β.

Conclusion. Whether demand is share-based via a cutoff $F(\cdot)$, modeled through a discrete-choice logit, or specified with CES preferences, the sign of the effect of enforcement strength β and remedy size r on the low-quality side is invariant.

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The core mechanism is the single crossing of utilities in θ and the fact that enforcement intensity β and remedy r both enter as additive protection for the low-quality side.

All main results follow: demand shifts toward the lower-quality seller, and the pricing formulas scale with $((1 - \alpha_H^2)\beta)/f(\tilde{\theta})$, regardless of the distribution F or the demand specification (logit, CES, or cutoff).

When remedies are internalized by seller 2, the parameter r operates primarily through costs and prices rather than through preferences. This property also holds independently of the demand specification.

.**Generalized Lerner margins with fees and κ_2:**

$$(1 - \tau)p_1 - c_1 - t \;=\; K(1 - \tau)D_1, \qquad (1 - \tau)p_2 - c_2 - t - \kappa_2 \;=\; K(1 - \tau)D_2.$$

These hold at the interior Bertrand equilibrium and will pin down the *profit split*.

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Seller profits (use FOCs):

$$\pi_1 = D_1\big((1 - \tau)p_1 - c_1 - t\big) = K(1 - \tau)D_1^2,$$

$$\pi_2 = D_2\big((1 - \tau)p_2 - c_2 - t - \kappa_2\big) = K(1 - \tau)D_2^2.$$

Platform profit (fees minus liability):

$$\Pi_P = \underbrace{\tau(p_1 D_1 + p_2 D_2)}_{\text{ad valorem}} + \underbrace{t(D_1 + D_2)}_{\text{per-unit}} - \underbrace{\xi\,\lambda_2 D_2}_{\text{liability}}.$$

Substitute $p_j = \dfrac{c_j + t + \mathbf{1}\{j=2\}\kappa_2}{1 - \tau} + KD_j$:

$$\Pi_P = \tau K(D_1^2 + D_2^2) + \frac{\tau}{1 - \tau}\Big[(c_1 + t)D_1 + (c_2 + t + \kappa_2)D_2\Big] + t - \xi\,\lambda_2 D_2$$

Recall $\kappa_2 = (1 - \xi)\lambda_2$.

Let total industry profit be $\Pi \equiv \pi_1 + \pi_2 + \Pi_P$. Define shares

$$s_1 \equiv \frac{\pi_1}{\Pi}, \qquad s_2 \equiv \frac{\pi_2}{\Pi}, \qquad s_P \equiv \frac{\Pi_P}{\Pi}, \qquad s_1 + s_2 + s_P = 1.$$

Using previous expressions:

$$\pi_1 = K(1 - \tau)D_1^2, \quad \pi_2 = K(1 - \tau)D_2^2,$$

$$\Pi_P = \tau K(D_1^2 + D_2^2) + \frac{\tau}{1 - \tau}\Big[(c_1 + t)D_1 + (c_2 + t + (1 - \xi)\lambda_2)D_2\Big] + t - \xi\lambda_2 D_2.$$

Implications.

- *Seller-side split* depends only on shares: $\dfrac{\pi_1}{\pi_2} = \left(\dfrac{D_1}{D_2}\right)^2$.

- *Platform vs. sellers:* increases in β (larger K) raise all quadratic terms $\propto KD_j^2$; platform additionally earns on ad valorem margin $\propto \tau$ but may pay $\xi\lambda_2 D_2$.

- When ξ is small (seller-liable), higher β tends to *raise* s_P via $\tau K(D_1^2 + D_2^2)$ and the fee base; when ξ is large (platform-liable), the liability term can offset or overturn the gain.

(A) Seller-liable remedies ($\xi = 0$, $\kappa_2 = \lambda_2$):

$$\Pi_P = \tau K(D_1^2 + D_2^2) + \frac{\tau}{1 - \tau}\Big[(c_1 + t)D_1 + (c_2 + t + \lambda_2)D_2\Big] + t.$$

Platform gains from: higher β (via K and often D_2), higher t, and larger fee base; no liability drag.

(B) Platform-liable remedies ($\xi = 1$, $\kappa_2 = 0$):

$$\Pi_P = \tau K(D_1^2 + D_2^2) + \frac{\tau}{1 - \tau}\Big[(c_1 + t)D_1 + (c_2 + t)D_2\Big] + t - \lambda_2 D_2.$$

Trade-off: higher β expands fee base and K but also raises expected payouts $\lambda_2 D_2$.

Less vertical differentiation $\Rightarrow$ more seller competition.

- Via (β, r), standards, and disclosure, the platform compresses perceived gaps $\Rightarrow$ lowers price dispersion, raises D_2, and increases $K(D_1^2 + D_2^2)$.

- With volume-sensitive monetization ($t > 0$ or ads/subscriptions), compression typically increases Π_P; under platform liability, choose (β, r) to balance fee-base gains against $\lambda_2 D_2$.

Comparative statics on shares.

- s_2 rises in β when $\partial D_2 / \partial \beta > 0$.

- s_P rises if the marginal fee-base gain exceeds marginal liability:

$$\frac{\partial \Pi_P}{\partial \beta} \gtrless 0 \iff \underbrace{\tau \frac{\partial}{\partial \beta}\Big[K(D_1^2 + D_2^2)\Big] + \frac{\tau}{1-\tau}\frac{\partial}{\partial \beta}\sum_j (c_j + t + \mathbf{1}\{j = 2\}\kappa_2)D_j}_{\text{fee-base effect}} \gtrless \underbrace{\xi \frac{\partial(\lambda_2 D_2)}{\partial \beta}}_{\text{liability}}.$$

7   Legal Remedies

The EU Sale of Goods Directive (2019/771) establishes remedies for consumers acquiring non-conforming goods. These remedies aim to ensure that consumers are adequately compensated when a product fails to meet the promised quality standards. The Directive outlines three types of remedies: *repair or replacement*, *price reduction*, and *rescission with total refund*

Pass-through considerations. Building on Section 5, remedies differ in how likely they are to generate $\phi > 0$ (non-compensatory seller-side frictions). Two cases stand out as particularly prone to $\phi > 0$: (i) *repair or replacement*, where removal and reinstallation at the consumer's premises, logistics, diagnostics, and shipping create extra costs on top of the buyer's expected payout; and (ii) *expectation damages*, where ex ante uncertainty, evidentiary burdens, and professional/legal fees increase per-unit costs beyond the transfer to the buyer. When $\phi > 0$, strengthening r reduces D_2 (Proposition 5), disproportionately affecting low-quality sellers. By contrast, *price reduction* typically entails $\phi \approx 0$, so its main effect is to raise consumers' expected compensation without materially increasing sellers' operational frictions. footnoteAlthough it is a debated issue under Directive 2019/771, we assume that sellers cannot charge consumers for the use of non-conforming goods and thus termination or rescission involves full refund. See Arroyo and Schulze (2025)., to which general Contract Law of the Member States [2] add *expectation*

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[2]Recital (61) of Directive 2019/771 provides that liability for damages are an essential component of the legal regime and consumers should be made whole through damages compensation. Recital (18), however, entirey defers this matter to the Member States

damages. In the following sections, we examine the implications of each remedy within the context of our model, highlighting their effects on market dynamics, consumer behavior, and seller incentives.[3]

1. Repair or replacement

Repair[4] involves the seller fixing the non-conforming good, bringing it up to the agreed standard of quality. In practice, this remedy is often preferred by sellers because it may entail lower costs than some other remedies, such as providing a replacement or issuing a full refund. It may also be more desirable socially due to sustainability concerns.

Under the *Sale of Goods Directive*, when a firm is required to repair or replace a good, it must also bear the cost of taking back the defective item. Additionally, if the goods were installed by the consumer, the firm must cover the costs of removal and re-installation at the consumer's premises (e.g., tiles or building materials used in construction, or a heater connected to a heating pipe system). This obligation may increase the cost to the manufacturer of providing repair or replacement remedies, and may lead to a discrepancy between the *ex ante* cost forecasted by the manufacturer (i.e., the expected cost of repair plus the expected cost of removal and re-installation) and the actual benefits received by each consumer. Some consumers—such as those with lower verification costs or less expensive removal and re-installation—will benefit less from the manufacturer's coverage. This may make q_2 sellers more attractive to $\bar{\theta}$ consumers, and could also introduce distributional disparities among consumers.

Repair can be interpreted as a modest increase in r, making them less costly for firms compared to full refunds or compensation of all harm to consumers. Despite being a milder form of consumer protection, repair still increases the overall demand for low-quality sellers. This follows directly from the model: an increase in r, compared to existing levels of repair or other remedies, raises D_2, which includes demand for low-quality sellers. Since repair provides some recourse to consumers but at a lower cost than other remedies, it makes low-quality products more attractive without drastically increasing operational costs for sellers.

For low-quality sellers, offering repair remedies leads to more claims, but since

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[3]Throughout the model we have assumed that the producer of high quality, $q1$, has no risk that the product it handles results to be non-conforming. Hover in this section, we relax this assumption and consider that in reality the probability of q_1 satisfying the upper bound is not 1, and there is always some risk that the product of company 1 may be considered non-compliant.

[4]We focus on repair here, although our main arguments would also apply *mutatis mutandis* to the other prime remedy under Directive 2019/771, namely product replacement

repair is generally cheaper for them than full refunds or replacements, these sellers can continue operating without significantly altering their pricing structure. Consumers, knowing that they have access to repair, become less concerned about purchasing from low-quality sellers, thereby increasing demand for their products. High-quality sellers also face some remedy claims, but since their defect rates are lower, the relative impact on their costs and pricing is clearly smaller.

Because repair is a weaker remedy compared to full refunds or replacements, its introduction does not drastically alter the competitive balance between low- and high-quality sellers. Instead, it sustains or even increases demand for low-quality sellers, as consumers factor in the availability of repairs when making purchasing decisions.

2. Price reduction

This remedy allows consumers to keep defective goods but receive a partial refund based on the difference between the product's actual quality and its expected quality. Because consumers still derive some value from the product, price reduction mitigates the negative consequences of purchasing low-quality goods without fully reversing the transaction. As a result, it increases demand for low-quality sellers, though to a lesser extent than more generous remedies like full refunds or damages.

From the seller's perspective, price reduction is a more attractive remedy compared to others, including repair. Sellers do not have to incur the costs of fixing the product, and they retain part of the sale price. This makes price reduction particularly beneficial for low-quality sellers, as it allows them to compensate consumers at a lower cost while continuing to sell lower-quality products. However, because the compensation is only partial, consumers still bear some of the quality shortfall, making this remedy less influential in sustaining demand for low-quality sellers than more generous remedies.

Unlike the repair remedy, which directly imposes costs on sellers to restore product functionality, price reduction primarily alters consumer perceptions of risk. By compensating buyers while allowing them to keep the product, it reduces hesitation toward purchasing lower-quality goods, but this effect is weaker than in cases where full repair or replacement is offered. Consumers still face some downside from receiving a lower-quality product, which limits the extent to which demand for low-quality sellers increases.

Overall, price reduction provides a softer reinforcement for low-quality sellers compared to repair or full refunds. While it allows them to remain competitive by

adjusting their prices and incorporating expected remedy costs, it does not sustain demand for low-quality sellers as strongly as more stringent remedies. Since consumers still retain the defective product, their willingness to engage with low-quality sellers is tempered by the fact that they do not receive a fully functional good. As a result, while price reduction sustains low-quality sellers, its impact is milder compared to other remedies.

3. Total Refund

Total refund involves the seller fully reimbursing the consumer for the purchase price, with the consumer returning the non-conforming product. This remedy is clearly more stringent than others, imposing the highest cost on sellers, as they must refund the entire price while also losing the sale and reclaiming a defective product that may have little to no resale value. Thus, this remedy does not depend, as to how much it costs to sellers and benefits consumers, on the relative seriousness of the defect, although the remedy is not available for minor defects (art. 13.5 Sale of Goods Directive).

The total refund remedy differs from the repair and price reduction remedies in that it significantly reduces the risk associated with purchasing low-quality goods. Unlike repair, which requires consumers to accept a corrected version of a defective product, or price reduction, which offers only partial compensation, the total refund guarantees that consumers are not financially worse off when purchasing a low-quality product. This assurance can lead to increased demand for low-quality sellers, as consumers feel more comfortable making riskier purchases, knowing they can get their money back if needed.

For low-quality sellers, while total refunds impose higher costs—since they must fully reimburse dissatisfied consumers—these sellers may remain viable by adjusting their prices or taking advantage of procedural frictions that prevent all consumers from claiming refunds. Additionally, if a significant portion of consumers does not go through the refund process due to inconvenience or effort, low-quality sellers can still generate revenue from those sales that do not result in a return. This is particularly relevant in industries where returning products is costly or logistically complicated for consumers.

As a result, while high-quality sellers also offer refunds, they are less affected by return claims due to their superior product quality. However, the more stringent nature of the total refund remedy does not necessarily drive low-quality sellers out of the market. Instead, it may encourage more consumers to purchase from them, knowing they have a full exit option if the product does not meet expectations.

4. Expectation Damages

Expectation damages compensate consumers for the difference between the expected utility of a conforming product and the actual utility derived from a defective one. Unlike repair, price reduction, or total refund, expectation damages may account for a broader range of losses, including lost value, inconvenience, and, in some jurisdictions at least,other subjective harms. This remedy is designed to fully restore consumer satisfaction but introduces challenges in quantification and enforcement.

For non-compliant sellers, expectation damages create a penalty that varies with the severity of non-conformity (similarly, but to a larger extent, than price reduction[5], and differently from full refund or replacement). The greater the quality deviation, the higher the compensation required, making this a more flexible enforcement mechanism and also a remedy that increases the total cost difference between both types of sellers as quality differentiation increases, making the positive impact of β on D_2 smaller. However, the difficulty in precisely determining expectation damages may reduce their deterrent effect, particularly when enforcement (β) is weak.

The enforcement strength (β) plays a crucial role in how effectively expectation damages impact non-compliant sellers. As β increases, the likelihood of consumers pursuing expectation damages also rises. In our model, higher enforcement can increase the threshold $\widetilde{\theta}^*$ under certain conditions. However, unlike the total refund remedy, where the financial cost to the seller is clear and fixed, expectation damages depend on a harder assessment of the consumer's loss. This introduces a level of uncertainty, as sellers face penalties that vary based on the perceived severity of the defect, which may not always be accurately determined. Consequently, the effectiveness of expectation damages depends on both the predictability of enforcement and how well the penalty reflects actual losses.

The remedy level (r) also plays an important role in how expectation damages affect seller behavior. If the remedy level is too low, expectation damages may resemble a price reduction, providing only a modest compensation for the defective product. This could fail to significantly alter seller behavior, as low-quality sellers may not feel sufficiently penalized. On the other hand, if the remedy level is set too high, expectation damages could essentially act like a total refund.

Unlike the total refund remedy, which can sustain demand for low-quality sellers

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[5]See Schweizer (2015).

by allowing consumers to return products and recover the full purchase price, expectation damages do not provide a guaranteed full reimbursement. Instead, they introduce some uncertainty regarding compensation, making consumers more hesitant to purchase from low-quality sellers if they anticipate difficulties in claiming or receiving appropriate damages.

Expectation damages are a useful tool, especially in cases where the quality deviation between products is large. As β increases and the likelihood of consumers claiming expectation damages rises, this remedy becomes particularly effective in markets where there are significant quality gaps between low and high-quality sellers. In such markets, low-quality sellers benefit more from expectation damages because consumers feel more secure knowing they will receive compensation if the product is defective, assuming that consumers may expect that sellers will actually be able to face the required level of damages. This sense of security is particularly important in markets with substantial quality differences between products, as consumers are more likely to tolerate lower-quality goods when they have a clear path for redress. While high-quality sellers may still be able to absorb compensation costs, low-quality sellers can leverage the expectation damages remedy to maintain consumer demand, as the compensation mechanism reduces the perceived risk of purchasing from them. However, in cases where quality differences are small or enforcement is weak, expectation damages may not substantially alter market dynamics.

8   Some Policy Implications

The theoretical framework developed in this paper provides a useful lens through which we can analyze real-world differences in return policies and product quality assurance across major online marketplaces, such as Amazon and AliExpress. Both platforms operate at a global scale but exhibit markedly different approaches to consumer protection, remedy enforcement, and sellers' compliance. These differences lead to distinct market outcomes, particularly in terms of the prevalence of high- versus low-quality sellers and the ease with which consumers can claim remedies for non-conforming goods. For further details on these policies, users can visit Amazon's official return policy[6] page at Amazon Returns & Refunds and AliExpress's dispute and refund process at AliExpress Buyer Protection[7].

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[6]See https://www.amazon.com/gp/help/customer/display.html?nodeId=GKM69DUUYKQWKWX7

[7]See   `https://sale.aliexpress.com/__pc/ym1QYdCzjk.htm?spm=a2g0o.buyer_`
`protection_detail.0.0.60a7KEd8KEd8vd`

8.1 Return Policies and Enforcement

Some platforms, like Amazon, are well known for their strong consumer-friendly return policies, which often include generous full-refund remedies, straightforward returns, and, in many cases, no-cost return shipping. Sharp enforcement mechanisms, as our model predicts, may lead to an increase in the demand for low-quality sellers. This is because more stringent remedies, such as full refunds, make consumers feel more secure when purchasing from sellers that may offer lower-quality goods, knowing that they can expect compensation if the product does not meet expectations. These protections reduce the perceived risk for consumers, making them more willing to accept lower-quality products, which increases the demand for low-quality sellers. This is specially so when the remedies do not greatly differ depending on the severity of the non-conformity.

In contrast, other platforms, like AliExpress, have a more lenient approach to seller compliance, with return policies that vary widely depending on the seller and product category. While AliExpress does provide some buyer protection, enforcement is weaker and more decentralized compared to Amazon. Many sellers opt for remedies that resemble "price reduction" or "repair" rather than full refunds, as the cost of issuing a refund (including return shipping costs) may outweigh the benefit of retaining customers. This lenient approach may result in higher demand for high-quality sellers. When consumer protections are weaker, they are less likely to benefit from compensation or remedies, and the risk of purchasing defective goods becomes more apparent. Consumers are therefore more inclined to seek out high-quality products that are less likely to be defective and come with fewer associated risks. This shift leads to a greater preference for high-quality sellers who can offer superior products with fewer potential issues.

These differences create diverging market structures. On Amazon, the market would be more favorable to low-quality sellers. The comprehensive protections provided to consumers make them more willing to purchase from low-quality sellers, as the risk is mitigated by the strong remedy options. However, on AliExpress, with weaker enforcement and less stringent remedies, the demand would shift toward high-quality sellers. Consumers are less confident in purchasing from low-quality sellers without sufficient protection mechanisms, leading them to prefer higher-quality goods from sellers who can better meet their expectations.

From a regulatory perspective, this comparison highlights the effect of enforcement (β) and remedy levels (r)—whether imposed by regulators or voluntarily adopted by sellers. Higher remedy levels and stronger enforcement mechanisms may lead to a situation where low-quality sellers are able to thrive even more, as consumers

feel more protected against the risks of defective goods. These remedies may help sustain a market where low-quality sellers are competitive, especially in industries where price is a more significant factor than quality. On the other hand, in markets with more lenient enforcement and weaker remedies, high-quality sellers can benefit from a more reliable customer base, as consumers seek less risky products.

While stronger consumer protection mechanisms improve market outcomes for consumers, policymakers must also consider the unintended consequences for low-quality sellers. Striking the right balance between remedy stringency and market accessibility is crucial for maintaining competition and overall market efficiency.

9   Conclusion

The analysis of remedies within the framework of the EU Sale of Goods Directive (2019/771) provides important insights into how different types of remedies affect consumer behavior, seller incentives, and market dynamics. We show that each remedy—whether repair, price reduction, total refund, or expectation damages—has varying impacts on the prevalence of low-quality sellers in the marketplace.

Our model reveals that remedies with high r, such as total refund, may actually increase the demand for low-quality sellers. These remedies provide consumers with stronger compensation mechanisms, making low-quality goods more attractive due to the reassurance that consumers will receive a good outcome even when goods are defective. This can lead to a greater presence of low-quality sellers in the market, even though such remedies are generally associated with higher enforcement levels (β).

Policymakers must carefully balance consumer protection with market accessibility, ensuring that remedies do not disproportionately favor low-quality sellers while still maintaining a competitive and consumer-friendly environment.

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