Pass-Through, Welfare, and Incidence under Product Returns in Perfect Competition

Draft notes

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1 Introduction

Who bears a tax, and how much of it passes through into the price, is the question of tax incidence (Weyl and Fabinger, 2013). A platform's commission is one example. Amazon deducts a referral fee from each sale, a commission of 15 percent of the sale price in many categories, so the seller receives the price net of the fee. This commission works like a sales tax, and we call it a tax from here on. Without returns, the pass-through and incidence of such a tax are well studied in the literature. Online sales, however, are often returned, with retailers expecting about one in five to come back.[1] On a kept sale the seller pays the whole tax. On a return the seller refunds the price in full and gets most of the tax back, but Amazon keeps part of it, at most 20 percent, or 3 percent of the price at a 15 percent rate.[2] Therefore the tax costs the seller different amounts on a kept sale and on a returned one. How much of this cost the seller can pass on to consumers depends on how purchases and returns respond to the price, and on how costly it is for the seller to handle a return. It is not clear how the pass-through and incidence change when the consumer's return decision is taken into account, and whether the platform should refund only part of the tax on a return. We study this in a competitive market, taking the tax schedule as given. Each buyer decides whether to buy and, after learning the fit, whether to keep the good, and the tax reaches both decisions only through the price.

A tax creates a wedge between what the buyer will pay and what the good costs the seller. Without returns, the wedge leads to underprovision on the purchase margin, because some beneficial trades do not happen. Returns add a second margin, the decision to keep the good, and a higher price can raise returns, because buyers who remain need a better fit to keep the good, or lower them, because the price changes who buys. It is therefore not clear whether the tax is still costly to society, as it is without returns, or in which direction the no-return results are biased when returns are ignored.

The paper asks who bears a tax that is partly refunded on returns and whether it is socially costly, for a small change in the tax. It takes four steps. First, how does the tax pass through into the price, and how do buyers and sellers divide the change in their own surplus? A rise in production cost and a rise in handling cost serve as benchmarks, since the first lowers the seller's margin on every unit, the second only on returned units, and the tax lies between the two. Second,

[1] National Retail Federation and Happy Returns, *2025 Retail Returns Landscape*, October 15, 2025, `https://nrf.com/research/2025-retail-returns-landscape`. The report estimates that 19.3 percent of online sales will be returned in 2025.

[2] Amazon, *Selling on Amazon pricing*, `https://sell.amazon.com/pricing`, and *North America selling fees*, `https://sell.amazon.com.sg/north-america/pricing`. Amazon calls the amount it keeps the refund administration fee, the lesser of five dollars or 20 percent of the referral fee.

counting the platform's revenue as part of social surplus, does any loss to society come from the decision to buy or from the decision to keep the good, and in which direction does that decision go wrong? Third, what is missed by ignoring returns and using the no-return results for this tax? Fourth, if the platform keeps a larger share of the tax on a refund, does society gain or lose? The answers depend only on the return rate and on how demand, supply, and returns respond to the price.

2 Model

We study the pass-through of a tax charged by the platform and of a cost increase, such as a rise in return handling cost or in production cost, in a homogeneous-good market under perfect competition with product returns. The product sells at list price p. Consumers indexed by i differ in return hassle κ_i, the disutility of sending the good back, and in the distribution G_i of post-purchase match quality u. After buying, type i draws $u \sim G_i$. In the baseline model, the refund is restricted to equal the list price, so the consumer's utility is $u - p$ when he keeps the product and $-\kappa_i$ when he returns it.

Individual consumer surplus from buying at price p is

$$cs_i(p) = \mathbb{E}_{u \sim G_i}\big[\max(u - p,\, -\kappa_i)\big].$$

Consumer i's purchase decision can be summarized by willingness to pay v_i, defined as the price solving $cs_i(v_i) = 0$. Type i buys if and only if $p \le v_i$. Across types, v_i has distribution F with density f, so gross demand is $D(p) = 1 - F(p)$.

Consumer i returns the item with probability $\phi_i(p) = \Pr(u < p - \kappa_i)$. Averaging it over consumers with the same willingness to pay v gives $\phi(v, p) \equiv \mathbb{E}\big[\phi_i(p) \;\big|\; v_i = v\big]$. The aggregate return rate $r(p)$ is derived by further taking the average over consumers who make a purchase at p, equal to

$$\frac{1}{D(p)} \int_p^\infty \phi(v, p)\, dF(v).$$

The return rate depends on how consumers purchase and on how each purchaser returns. The price shapes the return rate through both. Therefore, the effect of the price can be decomposed into a behavioral channel and a selection channel,

$$r'(p) = \underbrace{\frac{1}{D(p)} \int_p^\infty \frac{\partial \phi(v, p)}{\partial p}\, dF(v)}_{\text{Behavioral channel}} + \underbrace{\frac{f(p)}{D(p)}\big(r(p) - \phi(p, p)\big)}_{\text{Selection channel}},$$

The behavioral channel is the change in return probability holding the purchase cutoff fixed. A higher price lowers the utility of keeping, so purchasers return more often. The selection channel captures the change in who buys. Its sign is undetermined without additional assumptions. In general, this channel is non-positive because higher willingness to pay lowers the return probability, so buyers at the margin return more often than the average buyer and $\phi(p, p) \ge r(p)$.[3] The two channels then move $r'(p)$ in opposite directions. Below, $r'(p)$ is left unsigned.

Producer j takes the list price p and the return rate r as given and chooses quantity q_j at cost $C_j(q_j)$, with strictly increasing marginal cost. The platform charges an ad valorem tax at rate τ, so the seller keeps $(1 - \tau)p$ on a kept unit. On a returned unit the seller refunds the full price, so the buyer pays nothing. The seller pays net handling h on the good, which is gross handling cost

[3] As when $u = v_i + \varepsilon$, with ε independent of v_i and return hassle independent of v_i.

minus scrap value, and a share $\beta \in [0,1]$ of the tax is retained by the platform on each returned unit. The seller therefore loses $\beta\tau p + h$ on that returned unit.[4] We maintain $p + h > 0$, which holds whenever scrap value does not exceed list price. With return rate $r(p)$, the seller's expected payoff per unit is the effective margin

$$\mu(p, h, \tau, \beta) = \big(1 - r(p)\big)(1 - \tau)p - r(p)(\beta\tau p + h). \tag{1}$$

2.1 Welfare measure

Consumer surplus is the sum of individual consumer surplus over buyers who purchase. A tax or a cost shock affects consumer surplus only through the list price, and a higher list price changes it only through the units that are kept. The effect of the price through the selection channel is zero because a buyer at the purchase margin has zero individual consumer surplus. Its effect through the behavioral channel is also zero because keeping and returning give the same utility at the keep threshold. What remains is the direct effect of the price, and therefore

$$CS'(p) = -D(p)\big(1 - r(p)\big). \tag{2}$$

Producer surplus is the sum of firm profits $\mu q_j - C_j(q_j)$. A tax or a cost shock affects producer surplus only through the effective margin, and by the envelope theorem a one-dollar rise in the effective margin raises a firm's profit by the quantity it chooses. Aggregating quantity supplied over firms gives

$$\frac{dPS}{d\mu} = S(\mu), \tag{3}$$

where $S(\mu)$ is market supply.

3 Pass-through

We study pass-through of a production-cost increase, a handling-cost increase, and the platform's ad valorem tax, and denote these pass-throughs by the subscripts c, h, and τ. For the production-cost increase, we consider a parallel increase in marginal production cost, so marginal production cost is $C_j'(q_j) + c$. These three shocks shift supply but not demand, because consumers' purchase and return decisions respond only to the list price p.

Pass-through $\rho_x \equiv dp/dx$, for $x \in \{c, h, \tau\}$, is determined by the market clearing condition. Its general form is

$$m(p, x) \equiv D(p) - S\big(\mu(p, x), x\big). \tag{4}$$

Market clearing requires $m(p, x) = 0$. All three pass-throughs are evaluated at $\tau = 0$. Differentiating $m = 0$ gives

$$\rho_x = \frac{-S'(\mu)\,\mu_x - S_x}{S'(\mu)\,\mu_p - D'(p)}. \tag{5}$$

Here μ_p and μ_x are partial derivatives of $\mu(p, x)$, and S_x is the direct shift of supply at a fixed effective margin. The production-cost shock does not enter μ, so $\mu_c = 0$, yet a unit increase in c shifts supply as if μ fell by one unit, so $S_c = -S'(\mu)$. The handling cost and the tax have no direct effect on supply at a fixed effective margin, so $S_h = S_\tau = 0$. The handling cost reduces the effective margin when a consumer returns the product, so $\mu_h = -r(p)$. The tax reduces the seller's

[4] Amazon's refund administration fee is this rule for a referral fee. On a return Amazon keeps the lesser of \$5 or 20 percent of the referral fee, and gives the rest back to the seller. When the \$5 cap does not bind, $\beta = 0.2$.

effective margin on each purchase, but a return restores the share $1-\beta$ of that tax, so $\mu_\tau = -\theta$ where $\theta \equiv p\big[1-(1-\beta)r(p)\big]$. Substituting these into (5) gives the three pass-throughs,

$$\rho_c = \frac{S'(\mu)}{S'(\mu)\,\mu_p - D'(p)}, \qquad \rho_h = r(p)\,\rho_c, \qquad \rho_\tau = \theta\,\rho_c, \tag{6}$$

In the classical model without returns, a unit tax rate and a unit production-cost increase create the same per-dollar wedge, so $\rho_\tau = p\,\rho_c$ differs from ρ_c only by the ad valorem scaling p. With returns, each shock shifts the supply curve to the left by $S'(\mu)$ times a scale factor. The factor is 1 for production cost, r for handling cost, and θ for the tax. Since supply and demand are locally linear, pass-through depends only on how far the supply curve shifts. That shift is proportional to the factor, so each pass-through is ρ_c scaled by its factor. Since ρ_h and ρ_τ are scalings of ρ_c, below we focus on ρ_c. The signs of ρ_h and ρ_τ are the same.

These pass-throughs take a more transparent form in price elasticities, which also exposes the role of returns. Let $\mu_p^0 \equiv \mu_p\big|_{\tau=0}$ be the slope of the effective margin with respect to price at zero tax. The demand and supply elasticities are

$$\varepsilon_D(p) \equiv \frac{pD'(p)}{D(p)} < 0, \qquad \varepsilon_S(p) \equiv S'(\mu)\,\mu_p^0\,\frac{p}{S(\mu)}.$$

The supply elasticity ε_S has the sign of μ_p^0. With no returns, $\mu_p^0 = 1$ and the supply elasticity is positive. With returns, the supply elasticity can be negative if the return rate is an increasing function of price. When the behavioral channel dominates, a higher price raises the return rate, reduces the effective margin, and lowers quantity supplied.

Multiplying numerator and denominator of ρ_c by $p/S(\mu)$ gives the elasticity form,

$$\rho_c = \frac{\varepsilon_S(p)/\mu_p^0}{-\varepsilon_D(p) + \varepsilon_S(p)}. \tag{7}$$

The pass-through ρ_c is the ratio of the excess-demand gap a cost increase opens to the rate at which a price change closes it. A production-cost increase reduces supply by $S'(\mu)$ and opens excess demand of that size. An increase in the list price closes that gap at rate $S'(\mu)\,\mu_p^0 - D'(p)$. Compared to the classical no-return formula, which sets $\mu_p^0 = 1$, the returns formula scales the pass-through by $1/\mu_p^0$. When μ_p^0 is above unity, one dollar of list price restores more than one dollar of effective margin, so a smaller price movement closes the gap. When $0 < \mu_p^0 < 1$, the return rate rises in price and one dollar of list price restores less than one dollar of effective margin, so the price must move more and pass-through is larger than the classical value. When μ_p^0 is negative, the effective margin decreases in the list price, and the sign of pass-through depends on the magnitudes of the elasticities. In particular, negative pass-through can happen when supply is more elastic than demand in absolute value, so lowering the price raises supply by more than it raises demand and clears the excess demand. This is in sharp contrast to the model without returns, where pass-through is always positive. The following two results summarize the findings.

Result 1 (Negative pass-through)**.** *We have $\rho_c < 0$ if and only if $\varepsilon_S < 0$ ($\mu_p^0 < 0$) and $|\varepsilon_S| > -\varepsilon_D$.*

Result 2. *Relative to the correct returns-adjusted ρ_c, the classical no-return pass-through formula overestimates pass-through when $\mu_p^0 > 1$, agrees with it when $\mu_p^0 = 1$, and underestimates it when $0 \le \mu_p^0 < 1$.*

Result 2 can be linked to the handling cost and which channel of $r'(p)$ dominates. The effective margin is likely to be above one when the selection channel dominates and the handling cost is

large, and to fall below one when the behavioral channel dominates and the handling cost is large. Differentiating the effective margin at $\tau = 0$ gives $\mu_p^0 = 1 - r(p) - (p + h)\, r'(p)$. A strong selection channel has $r'(p) < 0$, so a higher price lowers the return rate and saves handling cost, pushing μ_p^0 above one, whereas a strong behavioral channel has $r'(p) > 0$, so a higher price raises the return rate and adds handling cost, pushing μ_p^0 below one. A larger handling cost amplifies both effects.

4 Local incidence

Having established how prices respond to different shocks, we turn to local incidence, defined as the ratio of the change in consumer surplus to the change in producer surplus for a small shock x. Before a discussion of the incidence, it is useful to visualize consumer surplus and producer surplus in a graph.

Figure 1 shows demand, the inverse supply curve, consumer surplus, producer surplus, and how the inverse supply curve moves after a production-cost increase. The inverse supply curve gives the price required to supply a given quantity. Consumer surplus is the area between gross demand $D(p)$ and returns $D(p)r(p)$ above p. Producer surplus is the area to the left of the supply curve and below p, between zero and p. For a unit production-cost increase, quantity supplied decreases at a fixed price, and the reduction is the same as a one-unit fall in the effective margin. To supply the same quantity, the price must adjust by $1/\mu_p^0$, so that the effective margin rises by exactly one unit to counteract the production-cost increase.

The left panel shows the case where the selection channel of the return rate is stronger than the behavioral channel, so that $r(p)$ falls with p. This can be seen from the graph as returns $D(p)r(p)$ taking a smaller share of gross demand $D(p)$ at a higher p. A higher p screens out consumers with a high return probability, so the effective margin improves and the seller supplies more. A positive slope means $\mu_p^0 > 0$. A unit production-cost increase shifts the inverse supply curve up by $1/\mu_p^0$ at a given quantity, and the equilibrium price rises.

The right panel shows the case where the behavioral channel of the return rate is stronger than the selection channel, so that $r(p)$ rises with p. This can be seen from the graph as returns $D(p)r(p)$ taking a larger share of gross demand $D(p)$ at a higher p. A higher p raises the return probability for purchasers, which lowers the effective margin and reduces the quantity the seller supplies. The inverse supply curve is hump-shaped. It is not profitable to supply at a high p, because the return rate is so high that almost any sale leads to a return. It is also not profitable to supply at a low p, because the low profit margin is not enough to cover the production cost. On the downward-sloping region, $\mu_p^0 < 0$. A unit production-cost increase shifts the inverse supply curve down by $1/|\mu_p^0|$ at a given quantity, and the equilibrium price falls.

One observation is that the incidence is the same for the three shocks. Intuitively, at a fixed price each shock reduces quantity supplied as if the effective margin had fallen. The three falls differ only in magnitude. Supply and demand are locally linear, so pass-through and the quantity change depend only on that magnitude. The changes in consumer surplus and producer surplus are both locally linear in how far the supply curve shifts, and that magnitude cancels in the ratio. Mathematically, let $Q \equiv D(p)$ and $r \equiv r(p)$ denote the equilibrium gross quantity and the return rate. A shock x affects consumer surplus only through the price, so $\frac{dCS}{dx} = -Q(1 - r)\rho_x$. This change scales with ρ_x and hence with the local supply shift. Producer surplus, written as a function of x, is

$$PS(x) = \int_0^{\mu(p(x),x)} S(z, x)\, dz.$$

A shock x affects producer surplus through pass-through, through the direct effect on the effec-

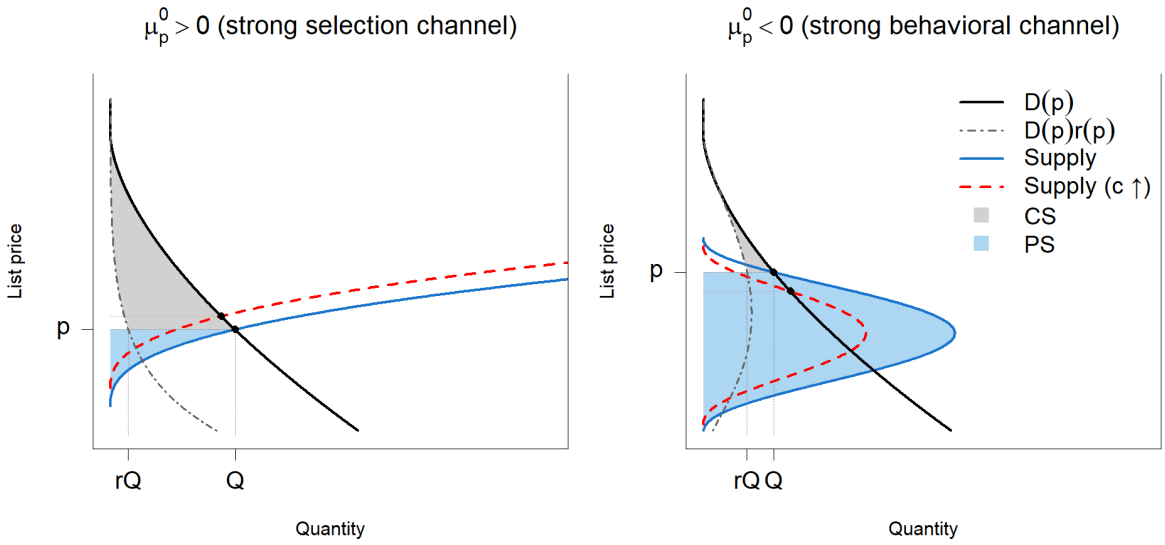


Figure 1: Consumer surplus, producer surplus, and supply after a production-cost increase.

tive margin, holding the price fixed, and through a shift of the supply curve, holding the price and the margin fixed. Differentiating in x and using $S\big(\mu(p(x),x),x\big) = Q$ gives $dPS/dx = Q\,d\mu(p(x),x)/dx + \Sigma_x$, where $\Sigma_x \equiv \int_0^{\mu(p(x),x)} (\partial S(z,x)/\partial x)\,dz$. Because $d\mu(p(x),x)/dx = \mu_p^0 \rho_x + \mu_x$,

$$\frac{dPS}{dx} = Q\mu_p^0\rho_x + Q\mu_x + \Sigma_x. \tag{8}$$

Table 1 shows that the joint effect of these three channels is also proportional to pass-through and to the degree of the local supply shift.

Shock x	ρ_x	μ_x	Σ_x	dCS/dx	dPS/dx	I_x
Production cost c	ρ_c	0	$-Q$	$-Q(1-r)\rho_c$	$Q(\mu_p^0\rho_c - 1)$	$\dfrac{(1-r)\rho_c}{1-\mu_p^0\rho_c}$
Handling cost h	$r\rho_c$	$-r$	0	$-Q(1-r)r\rho_c$	$Qr(\mu_p^0\rho_c - 1)$	$\dfrac{(1-r)\rho_c}{1-\mu_p^0\rho_c}$
Tax τ	$\theta\rho_c$	$-\theta$	0	$-Q(1-r)\theta\rho_c$	$\theta Q(\mu_p^0\rho_c - 1)$	$\dfrac{(1-r)\rho_c}{1-\mu_p^0\rho_c}$

Table 1: Local incidence for each shock. The tax column is evaluated at a zero rate.

The local incidence ratio is therefore the same for the three shocks. The next result formalizes this and shows that the common ratio is positive.

Result 3. *For production cost, handling cost, and the tax, the local incidence ratio is identical and positive.*

$$I_x = \frac{(1-r)\rho_c}{1-\mu_p^0\rho_c} > 0. \tag{9}$$

Proof. Since $1 - r > 0$, the ratio is positive if ρ_c has the same sign as $1 - \mu_p^0\rho_c$. Multiplying the pass-through formula (7) by μ_p^0 gives $\mu_p^0\rho_c = \varepsilon_S/(\varepsilon_S - \varepsilon_D)$. This exceeds one if and only if $\varepsilon_S < 0$ and $|\varepsilon_S| > -\varepsilon_D$. Result 1 states that this is the necessary and sufficient condition for $\rho_c < 0$. □

For a unit increase in production cost, the numerator $(1-r)\rho_c$ is the per-unit consumer loss on kept units. The denominator $1-\mu_p^0\rho_c$ is the per-unit producer loss. Before the price adjusts, the direct effect through the supply curve shift lowers producer surplus by Q. The indirect price pass-through effect moves the effective margin by $\mu_p^0\rho_c$ per unit, and the envelope $dPS/d\mu = Q$ restores producer surplus by $Q\mu_p^0\rho_c$. Together, the net change in producer surplus is $Q(\mu_p^0\rho_c - 1)$.

The incidence is positive even when pass-through is negative because the recovery from the indirect price pass-through effect more than offsets the direct loss from the supply curve shift. With negative pass-through, the new equilibrium price is lower and quantity demanded is higher. Market clearing requires the new equilibrium quantity supplied to exceed the original quantity. The price channel must therefore raise quantity supplied by more than the initial decrease caused by the inward shift of the supply curve. This implies that the price channel raises the effective margin by more than one unit, so the denominator is negative when pass-through is negative. The reasoning in the opposite direction holds for positive pass-through.

The result has a striking implication that a production cost increase can be Pareto-improving. The uniformly positive incidence ratio means consumer and producer surplus always move together, regardless of the sign of pass-through. When pass-through is negative, raising production cost, handling cost, or the tax lowers the price, reduces return rates, and saves enough handling costs to more than offset the direct resource drain. Both consumers and producers benefit. When pass-through is positive, all three shocks reduce both surpluses, as in the classical model, where $\mu_p^0 = 1$ and $\rho_c > 0$.

4.1 First-order effect on joint surplus and ex-ante ex-post decomposition

A unit rise in production cost changes joint surplus, the sum of consumer and producer surplus $W \equiv CS + PS$, by $-Q\Lambda$. The factor Λ adjusts quantity sold for the return rate's response to price. This change is the sum of the consumer and producer changes in Table 1, namely $-Q(1-r)\rho_c$ and $Q(\mu_p^0\rho_c - 1)$. Adding them gives

$$\frac{dW}{dc} = -Q(1-r)\rho_c + Q(\mu_p^0\rho_c - 1). \tag{10}$$

At a zero tax, $\mu_p^0 = 1 - r(p) - (p+h)r'(p)$. The kept-unit pieces $(1-r)\rho_c$ therefore cancel, and what remains is

$$\frac{dW}{dc} = -Q\Lambda, \qquad \Lambda \equiv 1 + r'(p)(p+h)\rho_c. \tag{11}$$

The one in Λ is the loss from units that are no longer sold. The term $r'(p)(p+h)\rho_c$ is the further change from units switched between keep and return. The induced change in the return rate is $r'(p)\rho_c$, and each switched unit costs $p+h$. That second term is zero when returns are shut down, so with returns it is a first-order effect that the classical formula misses.

Handling cost and the tax scale this change by r and by θ. In the same table, their consumer and producer changes equal the production-cost changes multiplied by those factors. Both pieces of Λ therefore scale, and

$$\frac{dW}{dh} = -Qr\Lambda, \qquad \frac{dW}{d\tau} = -Q\theta\Lambda. \tag{12}$$

Freezing the return rate separates an ex-ante rectangle on the purchase margin from an ex-post term on the keep-or-return margin. With $r'(p) = 0$, the factor Λ equals one. A unit production-cost increase then shifts supply up by one dollar at every quantity. The price changes in consumer and producer surplus cancel, and joint surplus falls by the rectangle of height one and width Q. Handling cost leaves the rectangle Qr, and the tax leaves the rectangle $Q\theta$. The gap between the

actual change $-Q\Lambda$ and this rectangle is the ex-post term $-Q\,r'(p)(p+h)\rho_c$, scaled by r or by θ for the other two shocks.

Result 4 (Ex-ante and ex-post decomposition)**.**

$$\frac{dW}{dc} = -Q - Q\,r'(p)(p+h)\rho_c, \tag{13}$$

$$\frac{dW}{dh} = -Qr - Qr\,r'(p)(p+h)\rho_c, \tag{14}$$

$$\frac{dW}{d\tau} = -Q\theta - Q\theta\,r'(p)(p+h)\rho_c. \tag{15}$$

The first term in each line is the ex-ante rectangle. The second term is the ex-post return-rate term.

The ex-post term offsets the rectangle, amplifies it, or reverses the change in joint surplus, and these cases line up with the sign of pass-through. Offsetting means $0 < \Lambda < 1$, amplification means $\Lambda > 1$, and reversal means $\Lambda < 0$. Because $dW/dc = -Q\Lambda$, joint surplus falls when Λ is positive and rises when Λ is negative. Result 3 says that the two surpluses move together. They fall when $\rho_c > 0$ and rise when $\rho_c < 0$, so Λ has the same sign as ρ_c.

When the selection channel dominates, the ex-post term offsets part of the rectangle and cannot reverse the loss. Then $r'(p) < 0$, so $\mu_p^0 > 0$. Strictly increasing marginal cost gives $\rho_c > 0$, and the list price rises. The higher price screens out frequent returners, so the return rate falls. The product $r'(p)\rho_c$ is therefore negative, and the ex-post term $-Q\,r'(p)(p+h)\rho_c$ is a gain. The gain cuts the loss from Q to $Q\Lambda$ with $0 < \Lambda < 1$. Both surpluses still fall, so the gain cannot overturn the loss.

When the behavioral channel dominates and pass-through is positive, the ex-post term amplifies the rectangle. Then $r'(p) > 0$ and $\rho_c > 0$. The list price rises and the return rate rises with it, so $r'(p)(p+h)\rho_c$ is positive, $\Lambda > 1$, and $-Q\,r'(p)(p+h)\rho_c$ is a further loss. The added loss is larger when $r'(p)$ or h is larger.

When pass-through is negative, the ex-post term reverses the rectangle and joint surplus rises. Result 1 requires $\mu_p^0 < 0$ and therefore $r'(p) > 0$. The list price falls and the return rate falls with it, so $-Q\,r'(p)(p+h)\rho_c$ is again a gain. Because $\Lambda < 0$, the gain is larger than the rectangle Q, and joint surplus rises by $Q|\Lambda|$. The rise is larger when $r'(p)(p+h)|\rho_c|$ is larger.

The no-return formula keeps the rectangle and omits the ex-post term, so its entire error is that omission. For a production-cost increase it reports a loss of Q against the true change $-Q\Lambda$. The report overestimates the loss when selection dominates, because $Q\Lambda$ is smaller than Q and still positive. It underestimates the loss when the behavioral channel dominates and pass-through is positive, because $Q\Lambda$ exceeds Q. It has the wrong sign when pass-through is negative, because joint surplus rises by $Q|\Lambda|$.

Result 5 (No-return joint-surplus bias)**.** *Consider a unit production-cost increase. Relative to the returns-adjusted change $dW/dc = -Q\Lambda$, the ex-ante formula $dW/dc = -Q$*

(i) overestimates the joint-surplus loss if and only if $r'(p) < 0$, in which case $0 < \Lambda < 1$;

(ii) underestimates the joint-surplus loss if and only if $r'(p) > 0$ and $\rho_c > 0$, in which case $\Lambda > 1$;

(iii) overestimates the joint-surplus loss with the wrong sign if and only if $r'(p) > 0$ and $\rho_c < 0$. It reports a loss of Q when joint surplus rises by $Q|\Lambda|$.

For a handling-cost shock the same cuts compare $-Qr\Lambda$ with $-Qr$. For the tax they compare $-Q\theta\Lambda$ with $-Q\theta$.

Proof. The three cases above give the direct statements. For the converses, suppose $0 < \Lambda < 1$. Then $\rho_c > 0$ and $r'(p)\rho_c < 0$, so $r'(p) < 0$. This is (i). Suppose $\Lambda > 1$. Then $r'(p)\rho_c > 0$, and $\Lambda > 0$ forces $\rho_c > 0$, so $r'(p) > 0$. This is (ii). Suppose $\Lambda < 0$. Then $\rho_c < 0$ and therefore $r'(p) > 0$. This is (iii). The tax multiplies the true change and the benchmark by θ. This factor is positive because $\theta = p[1 - (1 - \beta)r] \geq p(1 - r)$ and $1 - r > 0$. The handling-cost comparison is unchanged when $r > 0$. □

For the tax, adding platform revenue cancels the ex-ante rectangle and leaves the ex-post term as the social effect. The platform receives τp on a kept sale and $\beta\tau p$ on a return, so revenue is $G = \tau\theta Q$. Social surplus is $V \equiv W + G$. At a zero tax, marginal revenue equals the rectangle θQ. Adding it to $dW/d\tau = -Q\theta\Lambda$ gives

$$\frac{dV}{d\tau} = -Q\theta\Lambda + \theta Q = -Q\theta\, r'(p)(p + h)\rho_c. \tag{16}$$

The surviving term is θ times the ex-post term. Without returns, $r'(p) = 0$ and $\theta = p$, so an infinitesimal tax only transfers pQ to the platform and social surplus does not change. With returns, society gains when the tax lowers the return rate and loses when the tax raises it. The gain occurs when selection dominates and when pass-through is negative. The loss occurs when the behavioral channel dominates and pass-through is positive. At a zero tax, β does not enter ρ_c, because the retained share multiplies τ in the effective margin. A larger β raises θ and scales the social effect. The sign does not change.

5 Global Incidence

The tax row of Table 1 is the derivative at a zero rate. It is not the integrand for a finite change in τ.

A finite production-cost or handling-cost change integrates that shock's row in the same table, with the row re-evaluated at the current equilibrium.

Along such a path, the global incidence ratio $I_{x_0}^{x_1} \equiv \Delta CS/\Delta PS$, when $\Delta PS \neq 0$, is the weighted average of the local ratio implied by $dCS/dx = I(x)\, dPS/dx$,

$$I_{x_0}^{x_1} = \int_{x_0}^{x_1} I(x)\, \omega(x)\, dx, \tag{17}$$

where $\omega(x) \equiv (dPS/dx)/\Delta PS$.

The global ratio can be negative, even though $I(x)$ is positive at every point on the path. If dPS/dx changes sign along the path, the weights $\omega(x)$ take both signs, and the weighted average of positive local ratios can be negative. A finite production-cost or handling-cost change therefore need not preserve the sign of local incidence.

A Welfare bias in primitives

Result 5 has an equivalent statement in elasticities. Recall $\varepsilon_r(p) \equiv p\, r'(p)/r(p)$ and $\mu_p^0 = 1 - r(p) - r'(p)(p+h)$. Then $r'(p)(p+h) = \varepsilon_r(p)\, r(p)\, (p+h)/p$, so

$$\mu_p^0 > 0 \iff \varepsilon_r(p) < \frac{p}{p+h}\,\frac{1-r(p)}{r(p)}, \tag{18}$$

In these elasticities, Result 5 reads as follows.

(i) overestimation iff $\varepsilon_r(p) < 0$;

(ii) underestimation iff $\varepsilon_r(p) > 0$ and either $\mu_p^0 \geq 0$, or both $\mu_p^0 < 0$ and $|\varepsilon_S| < -\varepsilon_D$;

(iii) overestimation with wrong sign (predicted loss, actual gain) iff $\mu_p^0 < 0$ and $|\varepsilon_S| > -\varepsilon_D$.

Proof. By Result 5, overestimation with $0 < \Lambda < 1$ is $r' < 0$, underestimation is $r' > 0$ with $\rho_c > 0$, and overestimation with wrong sign is $r' > 0$ with $\rho_c < 0$. Since ε_r has the same sign as r', write these in ε_r. For (i), $\varepsilon_r < 0$ forces $\mu_p^0 > 1 - r > 0$ and hence $\rho_c > 0$, so $0 < \Lambda < 1$. When $\mu_p^0 = 0$ and $r(p) < 1$, the derivative $r'(p)$ is positive, $\varepsilon_S = 0$, and $\rho_c = S'(\mu)/(-D'(p)) > 0$, so that case is in (ii). Result 1 translates the sign of ρ_c into conditions on μ_p^0 and $|\varepsilon_S| \gtrless -\varepsilon_D$: with $\varepsilon_r > 0$ this is (ii), and $\rho_c < 0$ is (iii). □

References

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