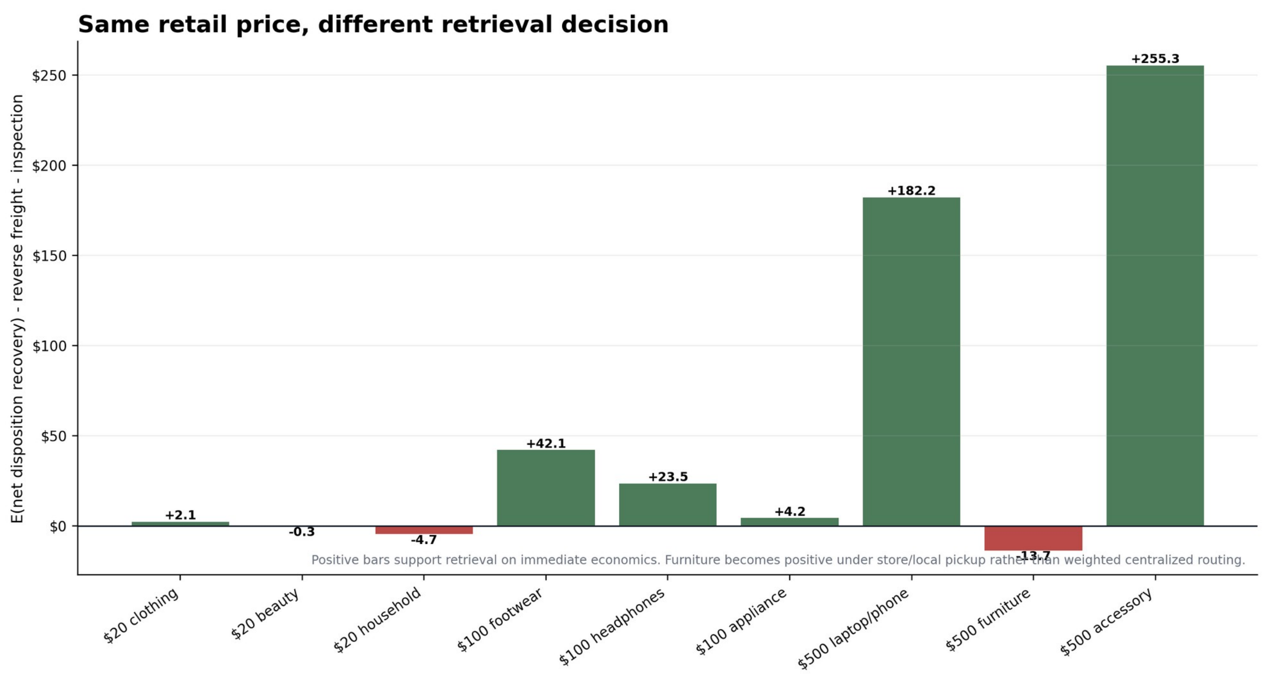
SOURCE-GROUNDED INVESTIGATION AND UNIT-ECONOMIC MODEL

Where Your Online Return Actually Goes

The reverse-logistics tax on online shopping

A product-level investigation of what survives after the refund: transportation, inspection, repair, liquidation, resale, fraud, ownership and environmental disposition.



Prepared from the two supplied evidence documents and their cited source records. No new external research was added.

Model date: July 22, 2026 | Base currency: U.S. dollars | Retail prices modeled: $20, $100 and $500

Contents

Reading the figures

All percentages labeled “modeled” are scenario outputs, not company disclosures. Source IDs in brackets map to the Source Ledger. The spreadsheet deliverable contains the full 1,701-row disposition engine and editable assumptions.

Executive analytical memo

Decision statement. The economic value of a return is set by the cost of learning what the item is, the cost of moving it, and the set of resale channels still legally and commercially available. Retail price matters, but value density, condition, time, fraud and contract structure often matter more.

The model’s original contribution is visible inside each price tier. At $20, the clothing item produces $2.11 of incremental retrieval value, while the beauty item is $-0.28 and the small household item is $-4.68. At $100, the same metric ranges from $4.22 for the appliance to $42.06 for footwear. At $500, the laptop/phone and premium accessory support recovery, but the weighted centralized furniture route is negative by $13.74; a local pickup route turns it positive. These are model results, not disclosed company averages.

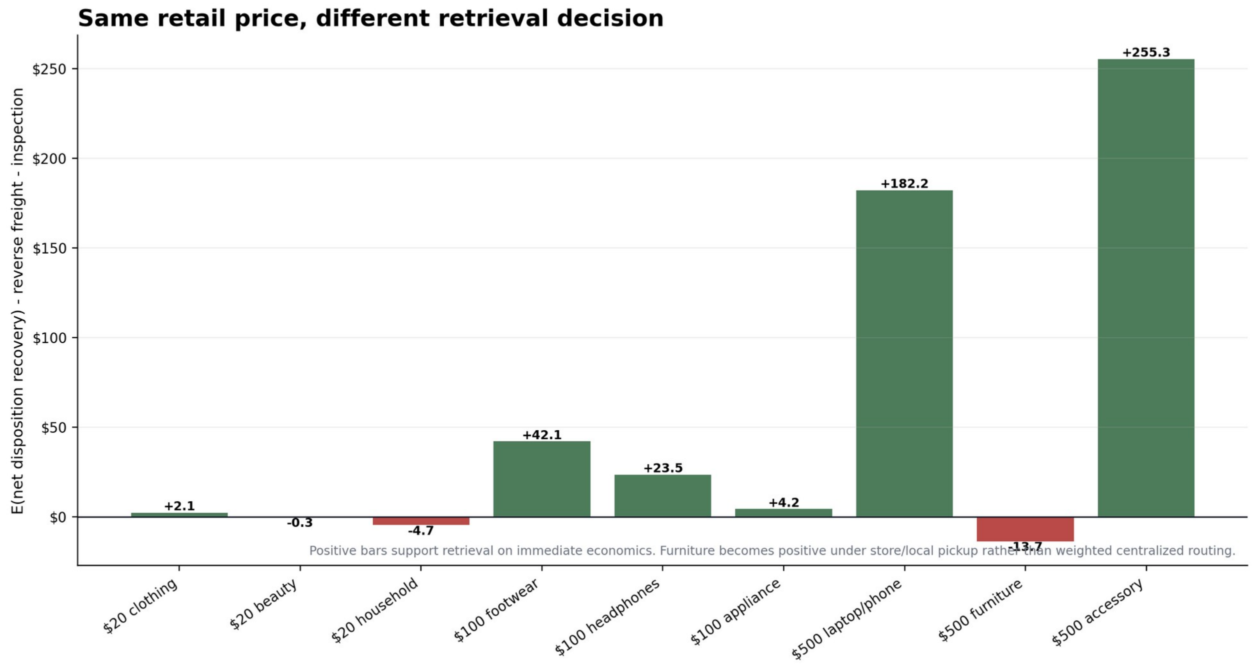


Exhibit A. Same retail price, different retrieval decision *Source: Model; assumptions in Appendix B*

Product	Price	E(net recovery)	Reverse freight	Inspection	Retrieve value	Return tax / return	Expected tax / order	Base action
Basic clothing ($20)	$20	$6.90	$3.62	$1.17	$2.11	$17.97	$4.49	Retrieve through store/drop-off; returnless for long parcel
Cosmetic/ personal-care ($20)	$20	$3.64	$3.23	$0.70	$-0.28	$20.31	$2.03	Returnless for parcel; retrieve via store return
Small household ($20)	$20	$3.42	$7.16	$0.93	$-4.68	$24.71	$2.97	Returnless for parcel; retrieve via store return
Footwear/ premium apparel ($100)	$100	$49.07	$5.14	$1.87	$42.06	$58.30	$17.49	Retrieve
Headphones/ small electronics ($100)	$100	$33.37	$5.91	$4.00	$23.46	$77.44	$9.29	Retrieve
Small appliance ($100)	$100	$22.34	$13.12	$5.00	$4.22	$96.23	$14.44	Retrieve
Laptop/ phone premium electronics ($500)	$500	$200.58	$8.20	$10.20	$182.18	$322.72	$32.27	Retrieve
Furniture ($500)	$500	$95.16	$98.90	$10.00	$-13.74	$514.04	$92.53	Route locally (store/local pickup); avoid long-haul/oversize
Premium apparel/accessory ($500)	$500	$269.18	$7.90	$6.00	$255.28	$248.57	$49.71	Retrieve

Table 1. Base-case unit economics for nine product archetypes *Source: Model. Price and product definitions are assignment inputs; remaining values use the Assumption Register.*

What the model says about margin

Under the required definition, product cost C, original fulfillment Fo and original payment cost P cancel from the dollar return tax because both the kept-sale and returned-sale cases bear them. They still determine post-return loss and the percentage of kept-sale contribution consumed by the return. A lower-margin product therefore experiences the same incremental dollar tax but a much larger percentage hit.

Eight findings

- A refund and a physical return are separate events. Amazon reports a refund liability and a distinct recovery asset; marketplace policies allow cash settlement before final physical disposition. [S01, S02, S05]
- Returnless refunds are economically rational when expected recovery does not cover reverse freight and inspection. In the base model, mailed beauty and low-value household returns fail that test; store return can still work because the logistics cost collapses. [S02, S07; Model]
- Value density explains the furniture result. The modeled $500 furniture item carries only about $3.60 of retail value per billable pound, versus more than $71 for the $500 laptop/phone. A weighted reverse-freight burden of $98.90 exceeds the furniture item's maximum economical freight of $85.16. [S17, S21-S24; Model]
- Inspection is an investment in information. The $100 headphones can support roughly 55 minutes of inspection at the modeled labor rate before retrieval turns negative; the $20 household item cannot support the two-minute base inspection under its weighted parcel route. [Model]
- Liquidation recovery and consumer resale price are different layers. The two public lots produce inferred bids of 14.6% and 19.6% of stated retail; consumer-facing refurbished electronics can sell far higher because a downstream operator has absorbed freight, testing, repair, warranty, listing and failed-unit risk. [S32, S33, S35-S37, P02]
- Buyer delivered cost is not retailer recovery. With explicit assumptions for buyer premium and freight, the two observed lots rise to 26.7% and 49.4% of stated retail at the buyer's dock, while estimated retailer net recovery after seller-side fees and prep falls near 10%-12%. [S36, S37, S49; Model]
- Fraud control clears a higher hurdle on premium goods. In the illustrative control scenario, extra inspection and false-positive costs are not justified for $100 footwear or headphones, but they are positive for the $500 electronics and accessory because loss given substitution is much larger. [S31; Model assumption]
- Sustainability claims are usually numerators without the denominator needed to calculate a customer-return disposition rate. Liquidation proves title transfer, not reuse; 'proper disposal' proves a policy outcome, not landfill, recycling or energy-recovery shares. [S04, S08, S30, P01, P02]

Investigative article

OPENING

A $100 pair of headphones is dropped at a nearby return counter. The customer's refund can post before the product reaches a return center. The item is consolidated with other returns, moved to a facility, opened, matched to a serial number and tested. That sequence is not clerical overhead. It is a bet: spend roughly $5.91 on reverse movement and $4.00 on intake and inspection in the base model, then decide whether the item can support open-box or refurbished proceeds.

The expected net disposition recovery is $33.37. Retrieval therefore adds $23.46 before the model's separate fraud-administration cost. But the original sale would have generated $46.20 of contribution; after the refund and recovery chain, the returned order lands at $-31.24. The return tax is $77.44. A successful recovery does not make the return profitable. It makes the loss smaller.

The same price does not produce the same decision. A $100 small appliance has only $4.22 of retrieval headroom because its package and testing costs are heavier. A $100 footwear return has $42.06, because it can move cheaply and often re-enter a controlled restock or outlet channel. Price is one input. The route is the outcome of a chain.

1. The refund does not tell you where the product went

The consumer sees money move. The merchandise can remain still. Walmart sellers can establish Keep It rules when return shipping is uneconomic. Amazon seller programs include returnless resolutions. eBay can require or enforce a refund through seller settlement while the seller remains the economic owner. These programs make the separation explicit: a platform can settle the customer claim without creating a recoverable product asset. [S02, S05, S07]

The accounting makes the split visible. Amazon reports return-allowance liabilities and a separate asset for rights to recover products from customers. Nike reports a sales-returns reserve separately from its inventory reserve. The refund obligation and the expected value of returned goods do not move one-for-one. [S01, S20]

> ### Four measures that cannot be substituted for one another
> Customer refund is R-K. Retailer exposure is the returned-order contribution after all original and reverse costs. Physical recovery describes whether usable product or material comes back. Environmental disposition describes resale, transfer, donation, recycling or disposal. A full refund can coexist with high physical recovery, low financial recovery, or an unknown final environmental endpoint.

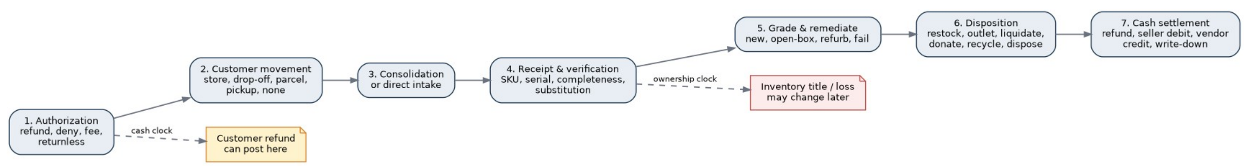


Exhibit 1. End-to-end return flow *Source: P01; S02-S07; S21*

2. The return decision engine

The retrieval decision is an expected-value calculation. The retailer does not need the product's full future value. It needs the probability-weighted, time-adjusted recovery after cleaning, testing, storage, selling fees, secondary transport and disposal to exceed reverse freight and the cost of learning the item's condition. The simplified rule is:

> **Immediate retrieval rule**
>
> E(Recovery if retrieved) - F_r - H > 0
>
> *Strategic value can override the immediate result: fraud deterrence, serial control, safety, evidence, vendor reimbursement, warranty and customer-account policy.*

The condition probability matters twice. First, it changes expected proceeds. Second, it changes which route is eligible. An unopened product can support primary restock. A lightly used device may justify refurbishment. An opened cosmetic can retain physical material while losing commercial resale eligibility. A substituted laptop can have almost no legitimate recovery but high evidentiary value. [S08, S11, S16, S29; Model]

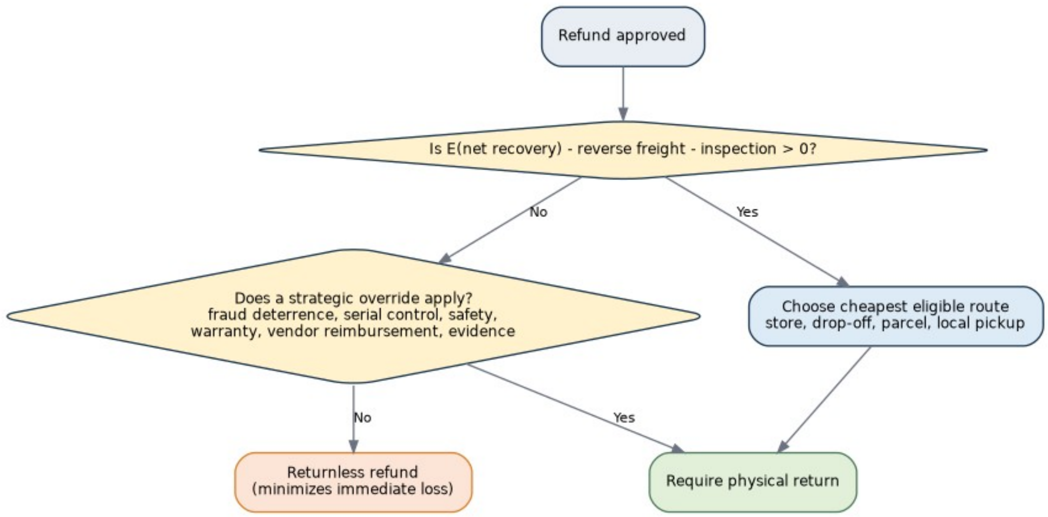


Exhibit 3. Returnless-refund decision tree *Source: S02; S07; P01; Model*

The model's break-even thresholds expose why retail price is not enough. The $20 clothing item needs about $9.18 of gross recovery conditional on receiving the correct item. The $20 household product needs $12.49, more than 62% of retail, because its parcel cost is so high. The $500 laptop/phone needs only about 11% of retail on the same measure. [Model]

3. Inside the return center

A return center manufactures information. Consolidation reduces transportation and per-unit receiving cost, but it can delay resale. Happy Returns markets five-day arrival and faster restocking, though those figures are vendor claims. Target's reverse-logistics role lists central return centers, donation, salvage, electronics recycling, vendor credits and inventory removals. Those materials prove the tasks and routes exist; they do not reveal throughput or route shares. [S04, S27]

Inspection is not one uniform step. Apparel can require tags, odor, wear, size and season checks. Electronics add serial identity, activation, battery health, function, accessories and data risk. Furniture adds structural condition, missing hardware, assembly state and packaging damage. Beauty turns on seal and integrity. The labor can be shorter than the transport, yet still exceed the product's net recovery on low-value goods. [S08, S11, S12, S16, P01]

The disposition decision is another expected-value problem. After safety and identity filters, the inventory owner compares only eligible routes and chooses the highest present-value net proceeds. Brand rules, channel capacity, contractual restrictions and labor queues can remove the apparent top option. [S06-S08, S11, S29; Model]

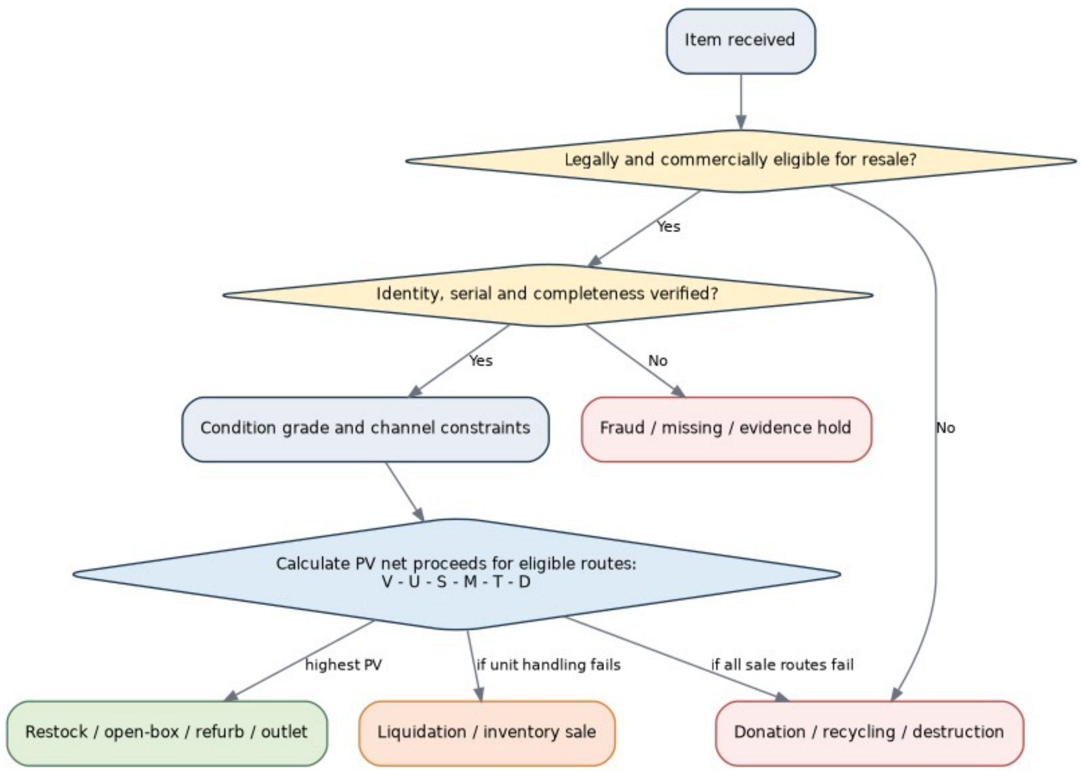
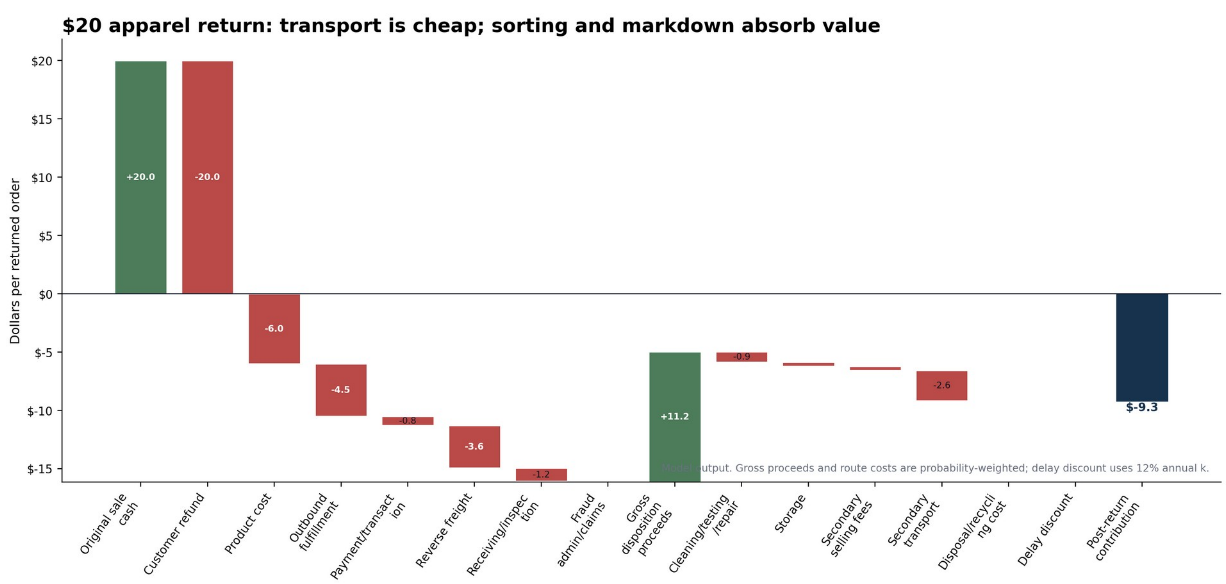


Exhibit 4. Disposition decision tree *Source: S06-S08; S11; S16; S29; Model*

4. Six products, six different routes

$20 clothing: cheap to ship, costly to sort

The modeled clothing item can be recovered when it comes back through a store or consolidated drop-off. Its base expected recovery is $6.90, against $3.62 of weighted reverse freight and $1.17 of inspection. The same item is barely uneconomic through a short parcel and clearly uneconomic through a long parcel. The model sends unopened and clean opened units back to stock, lightly used units to outlet, and damaged units to liquidation. Apparel auction evidence in the package sits in the low-to-mid teens of retail, while store return networks can preserve more value by avoiding parcel freight and delay. [S15, S18, S32; Model]



Apparel value waterfall ***Source: S15; S18; S32; Model***

$20 beauty: physical value without commercial value

An opened cosmetic can still contain almost all of the original material. That does not mean a retailer can sell it. Ulta states that used, damaged or expired returned products are not resold and are disposed of. FDA rules set a safety and labeling floor, but a retailer can adopt a stricter commercial standard. In the base model, only the 32% unopened share returns to stock; the balance is disposed or lost to a fraud/missing outcome. [S08, S16, S41; Model]

Under the weighted return route, retrieval value is $-0.28. Store intake remains positive, but a parcel return does not. The immediate economic answer is a returnless refund unless safety, evidence or abuse controls require possession. The environmental answer is not known from the phrase 'properly disposed.'

$100 headphones: testing buys a higher-value channel

Electronics justify a deeper look because the resale spread is larger. The modeled headphones allocate 47% of units to open-box resale, 13% to refurbishment and 12% to recycling, with 5% assigned to substitution or missing-return risk. A damaged but repairable unit supports up to $18.20 of refurbishment cost before liquidation becomes preferable; the model uses $12. [S11, S39; Model]

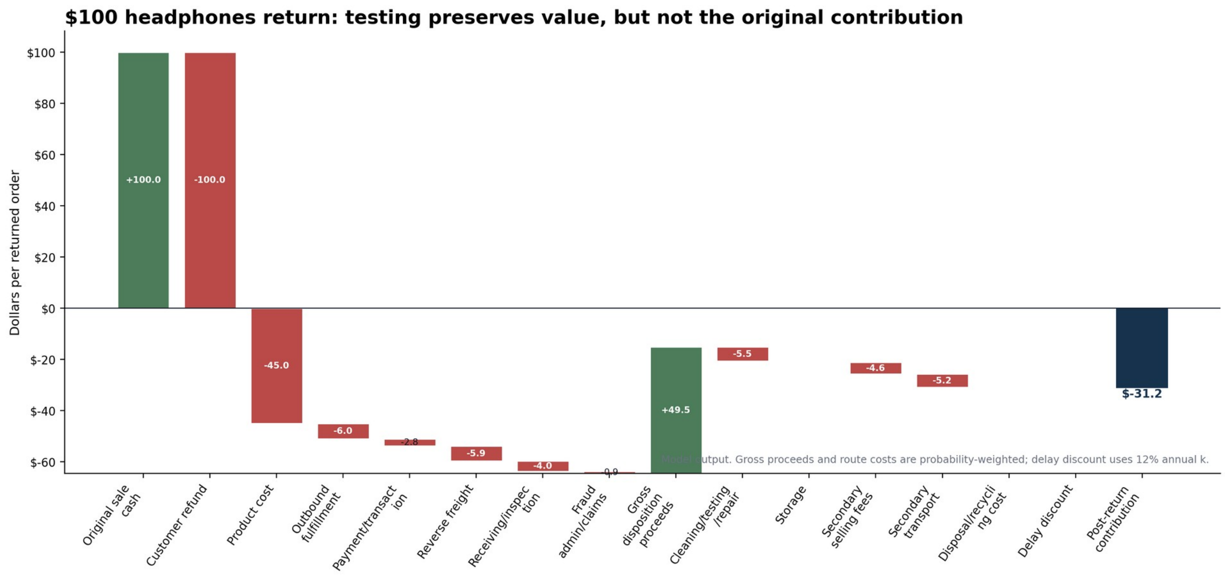


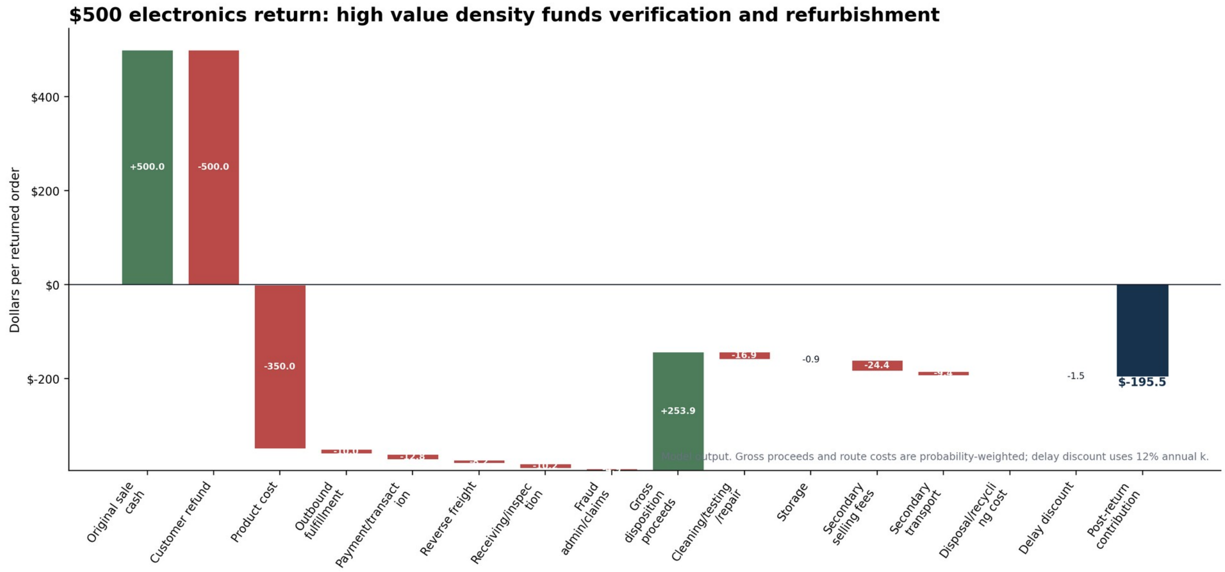
Exhibit 6. $100 headphones recovery waterfall ***Source: S11; S39; Model***

$100 small appliance: a narrow retrieval margin

The appliance is the fragile case inside the $100 tier. Its expected net recovery is $22.34, but weighted reverse freight and inspection consume $18.12. Retrieval remains positive by only $4.22. In the low-recovery scenario it turns negative. The damaged-condition repair budget is lower than the modeled repair cost, so liquidation wins even when every eligible route produces a weak result. The public microwave lot reinforces the low-recovery channel: its inferred winning bid was 14.6% of stated retail before buyer fees and freight. [S37; Model]

$500 laptop or phone: high value density funds control

The premium device is expensive to lose and cheap to move relative to its value. The model produces $182.18 of retrieval value after reverse freight and inspection. Damaged units route to refurbishment; the maximum economical refurbishment cost is $102.70, versus a $45 model input. Delay matters because the model depreciates premium electronics at 3.5% per month. The same economics make serial checks and fraud controls more defensible. [S11, S33, S35, S39; Model]



Premium electronics value waterfall *Source: S11; S33; S35; S39; Model*

$500 furniture: consumer value, negative centralized recovery value

Furniture demonstrates why ticket price can mislead. Wayfair discloses that many products need special handling and can be damaged in transit. WFS lists a big-and-bulky return-processing fee of $155 plus $0.80 per pound over 90 pounds, while UPS and FedEx tariffs expose additional-handling and large-package surcharges. The model's 48 x 20 x 20 inch package has a 138-pound DIM weight before rounding. [S12, S17, S21-S24]

The weighted reverse-freight assumption is $98.90, above the $85.16 maximum economical freight. The result is $-13.74. Store intake, short-distance routing and local pickup remain positive; long-distance parcel and oversize routes do not. Under a $25 fixed plus $1.25 per-mile local-routing proxy, the break-even distance is about 48 miles. [Model]

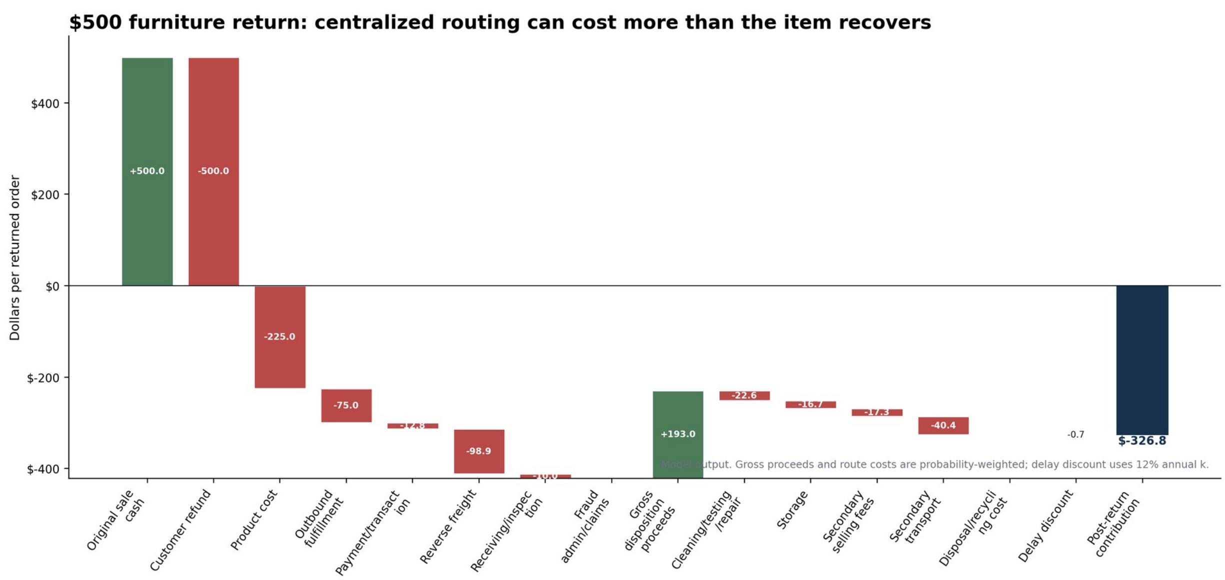


Exhibit 7. $500 furniture recovery waterfall *Source: S12; S17; S21-S24; S40; Model*

5. The market after the retailer

Liquidation is not one final market. National auction platforms sell pallets and truckloads. Regional wholesalers, bin stores, local auctions, repair shops, eBay sellers, social-commerce sellers, exporters, parts harvesters and scrap buyers take the next steps. B-Stock says it runs programs for major retailers; Liquidation.com combines returns with overstock, shelf pulls, salvage and other conditions. The inventory labels are not standardized enough to assume every lot is a pure customer-return sample. [S19, S28, S38, S42]

The downstream spread is payment for work and risk. The winning bid is not the buyer's cost. Buyer premium, freight, liftgate, residential delivery, unloading, inspection, repair, storage, failed units and resale-channel fees sit between the auction and the final consumer sale. Liquidation.com terms compress the window for description disputes, transferring manifest and quality risk to the buyer. B-Stock reseller case studies show that skilled operators can rebuild value, but they are survivor stories, not a random sample of buyer returns. [S44, S45, S47, S49]

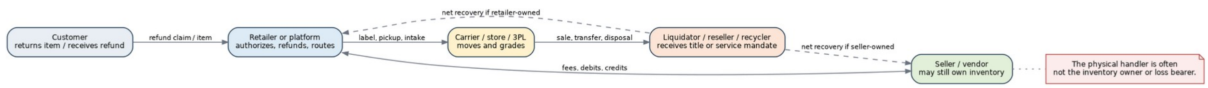


Exhibit 2. Ownership and loss allocation *Source: P01; S01-S07; S21; S45*

6. How much value survives

The public auction sample is too small to carry a market claim. It contains two completed Walmart/B-Stock lots. The microwave lot shows $7,004 of stated retail value, 102 units and an inferred final bid near $1,020, or 14.6%. The eBike lot shows $3,058 of stated retail value, 12 units and an inferred final bid near $600, or 19.6%. The exact conditions, buyer premium, seller settlement and freight were not public. [S36, S37]

The broader anchors are directionally consistent but not interchangeable. An apparel field study covering 11,879 auctions found 13.11% recovery for private label and 16.339% for national brands. Amazon's FBA Liquidations guidance says sellers typically recover 5%-10% of average selling price within that program. An industry review places mixed customer returns around 10%-30% of MSRP. Each denominator and inventory population differs. [S32, S35, S42]

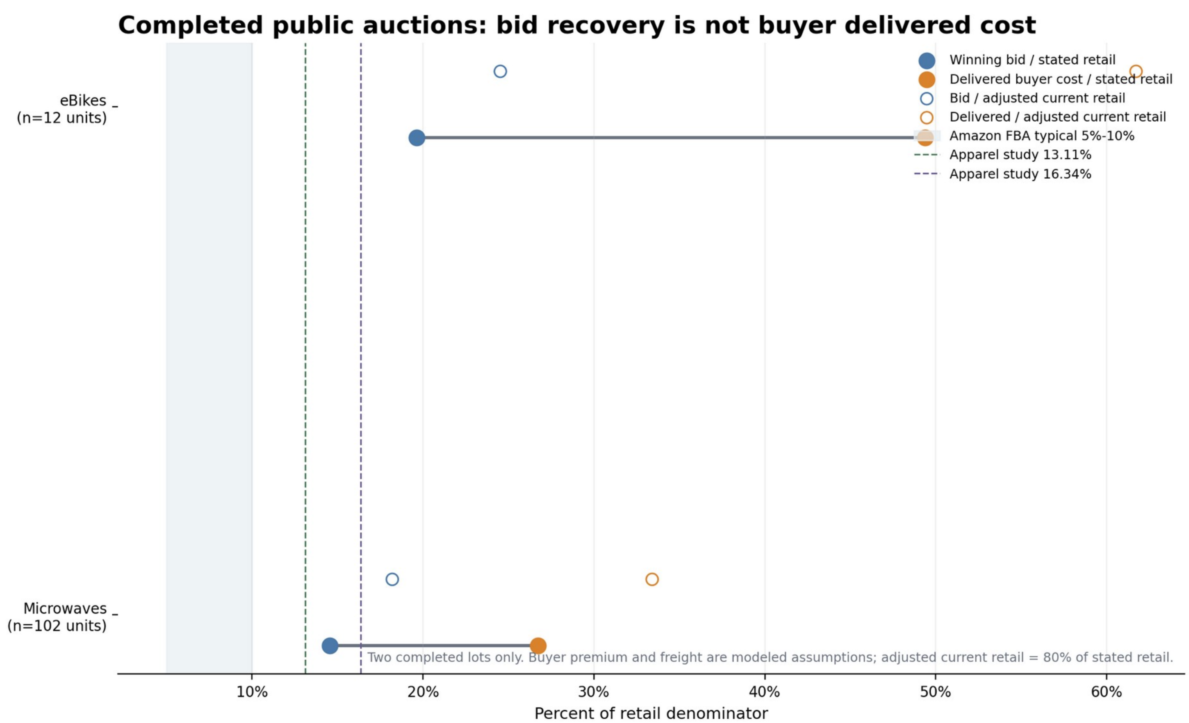


Exhibit 9. Auction recovery distribution *Source: S32; S35-S37; S42; model assumptions for delivered cost*

The buyer-cost adjustment is large. With a 10% buyer-premium assumption and modeled freight, the microwave lot's delivered cost is 26.7% of stated retail; the eBike lot reaches 49.4%. On an adjusted current-retail denominator equal to 80% of stated retail, the figures rise to 33.4% and 61.7%. Those are acquisition costs, not retailer recovery or reseller profit.

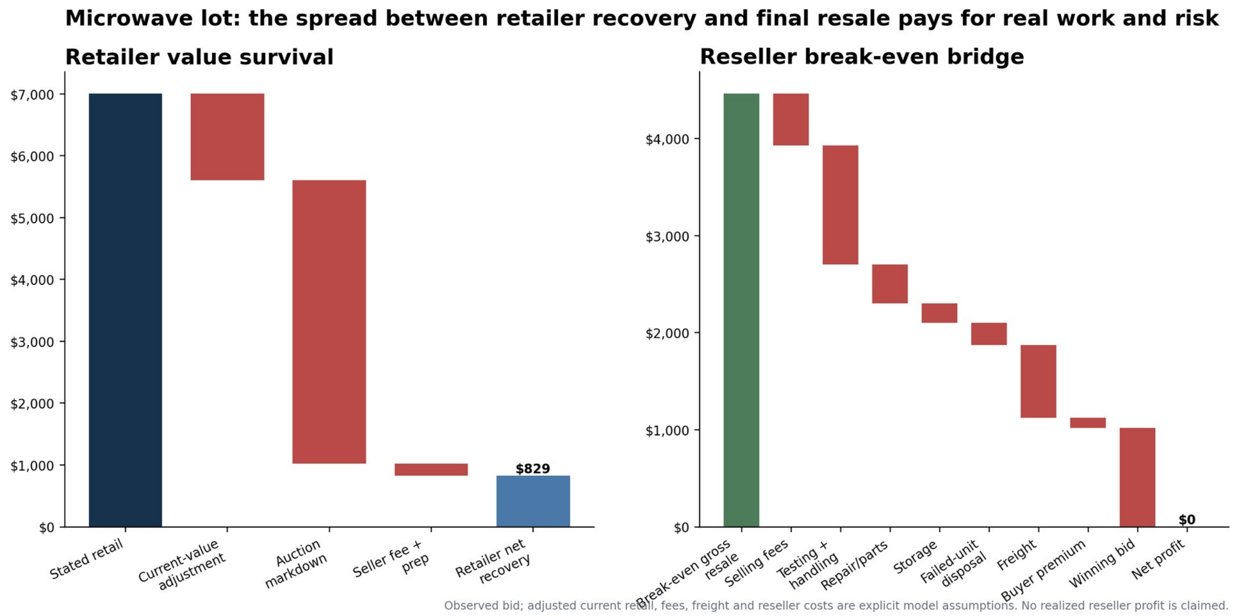


Exhibit 11. Retailer-to-reseller value waterfall *Source: S37; S45; S49; model assumptions*

7. The $20, $100 and $500 return

The nine-product grid isolates price from recoverability. Within each price tier, logistics, condition and channel change the retrieval decision more than price. The table reports the return tax as dollars per returned order and the expected tax across all orders using the modeled return rate.

Price	Product	Kept-sale contribution	Post-return contribution	Return tax / returned order	% of retail	% of kept contribution	Return rate	Expected tax / order	bps of sales
$20	Basic clothing item ($20)	$8.70	$-9.27	$17.97	89.9%	206.6%	25.0%	$4.49	2,246 bps
$20	Cosmetic/ personal-care item ($20)	$10.20	$-10.11	$20.31	101.6%	199.1%	10.0%	$2.03	1,016 bps
$20	Small household product ($20)	$6.70	$-18.01	$24.71	123.6%	368.8%	12.0%	$2.97	1,483 bps
$100	Footwear/ premium apparel ($100)	$55.20	$-3.10	$58.30	58.3%	105.6%	30.0%	$17.49	1,749 bps
$100	Headphones/ small electronics ($100)	$46.20	$-31.24	$77.44	77.4%	167.6%	12.0%	$9.29	929 bps
$100	Small appliance ($100)	$45.20	$-51.03	$96.23	96.2%	212.9%	15.0%	$14.44	1,444 bps
$500	Laptop/ phone premium electronics ($500)	$127.20	$-195.52	$322.72	64.5%	253.7%	10.0%	$32.27	645 bps
$500	Furniture product ($500)	$187.20	$-326.84	$514.04	102.8%	274.6%	18.0%	$92.53	1,851 bps
$500	Premium apparel/acce ssory ($500)	$325.20	$76.63	$248.57	49.7%	76.4%	20.0%	$49.71	994 bps

Table 2. Return tax by product archetype *Source: Model. Contribution margin is not GAAP gross margin.*

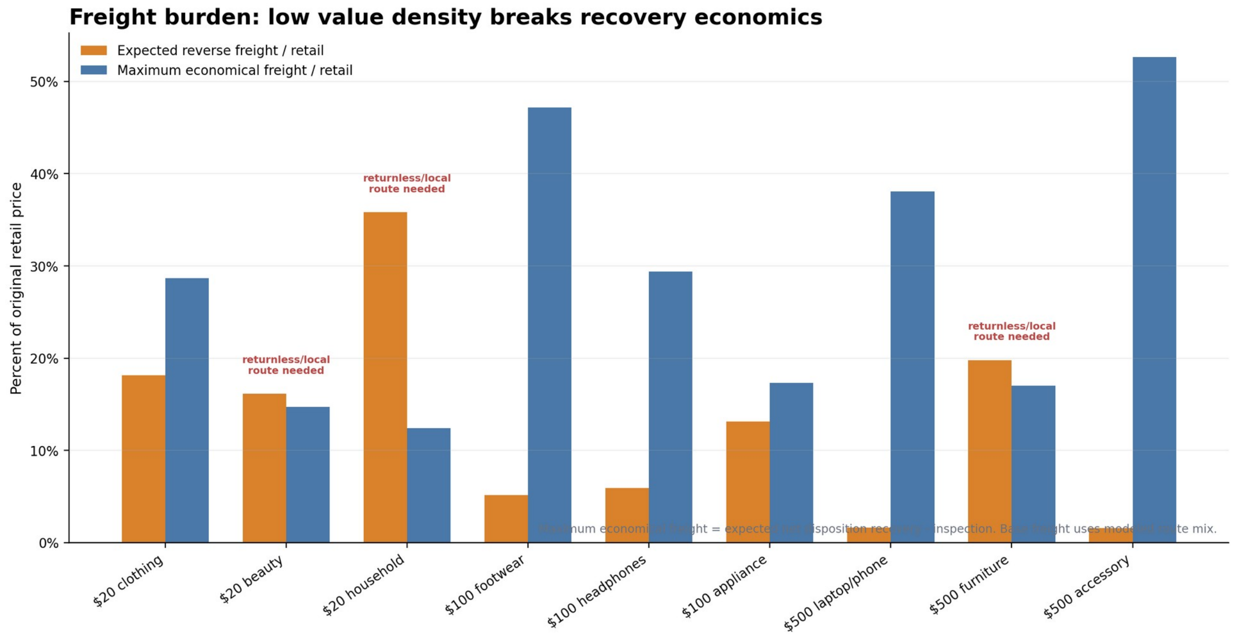


Exhibit 10. Freight burden by product type *Source: S17; S21-S26; Model*

The product-gross-margin sensitivity has a deliberately unusual result. Changing C does not change the dollar return tax under the required formula. It changes the kept-sale contribution denominator. For the $500 laptop/phone, the base return tax is 254% of kept-sale contribution; adding ten percentage points of product cost raises that ratio to roughly 418% without moving the dollar tax. The model therefore reports both dollars and percentages.

Largest adverse sensitivities by archetype (excluding return rate)

	$20 clothing	$20 beauty	$20 household	$100 footwear	$100 headphones	$100 appliance	$500 laptop/phone	$500 furniture	$500 accessory
#1	Resale markdown / re +$0.40/order	Condition mix +$0.17/order	Dimensional-weight ch +$0.34/order	Condition mix +$2.52/order	Resale markdown / re +$0.80/order	Condition mix +$0.88/order	Resale markdown / re +$3.39/order	Dimensional-weight ch +$8.75/order	Condition mix +$8.98/order
#2	Condition mix +$0.39/order	Resale markdown / re +$0.09/order	Negotiated freight disc +$0.25/order	Resale markdown / re +$2.51/order	Condition mix +$0.77/order	Dimensional-weight ch +$0.86/order	Condition mix +$3.11/order	Negotiated freight disc +$5.00/order	Resale markdown / reco +$8.64/order
#3	Dimensional-weight ch +$0.27/order	Dimensional-weight ch +$0.09/order	Reverse shipping cost +$0.21/order	Inspection labor +$0.55/order	Inspection labor +$0.49/order	Resale markdown / re +$0.76/order	Fraud probability +$1.74/order	Condition mix +$4.71/order	Fraud probability +$3.29/order
#4	Inspection labor +$0.24/order	Reverse shipping cost +$0.08/order	Condition mix +$0.13/order	Dimensional-weight ch +$0.50/order	Seller fees +$0.27/order	Inspection labor +$0.63/order	Seller fees +$1.21/order	Resale markdown / re +$4.70/order	Seller fees +$1.59/order
#5	Reverse shipping cost +$0.23/order	Negotiated freight disc +$0.08/order	Resale markdown / re +$0.12/order	Inventory holding peri +$0.43/order	Fraud probability +$0.25/order	Negotiated freight disc +$0.61/order	Inspection labor +$1.12/order	Reverse shipping cost +$4.45/order	Inspection labor +$1.25/order

Adverse shocks: higher costs/fees/fraud/delay, worse condition mix, or lower recovery. Product gross margin changes percentages, not dollar return tax.

Top adverse operational sensitivities by product *Source: Model*

8. Fraud changes the decision

Public fraud estimates are not clean inputs. The evidence package cites industry reports with different populations and definitions, including fraud, abuse and claims. The model therefore uses narrower confirmed substitution/counterfeit probabilities by product and labels them assumptions. It does not treat broad industry percentages as exact category rates. [S31, P01]

The fraud calculation separates lost recovery from incremental administration. A fraudulent or substituted condition receives zero legitimate disposition recovery, so the lost recovery already enters through Qj. The variable A contains only investigation, claims and related administration. This avoids charging the same missing product value twice.

> **Expected total fraud loss**
> p_f x (lost recovery versus correct item + fraud administration)
> *In the main post-return formula, lost recovery is inside Qj; only the administration component is subtracted as A.*

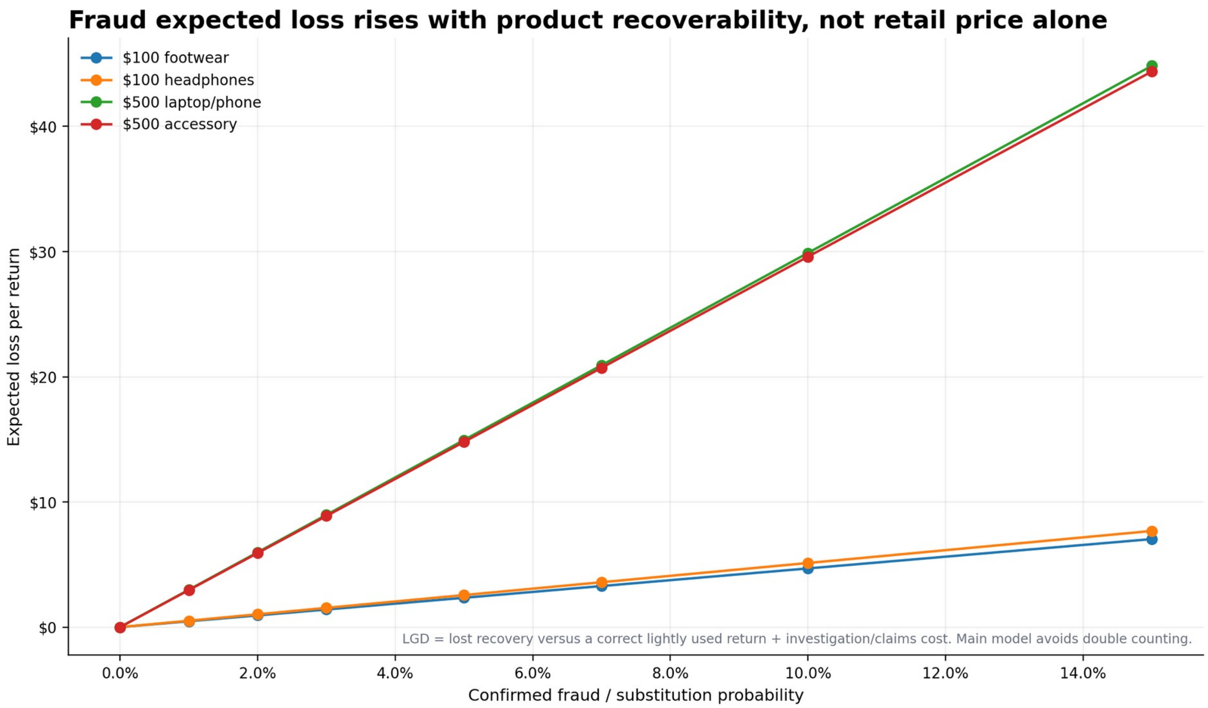


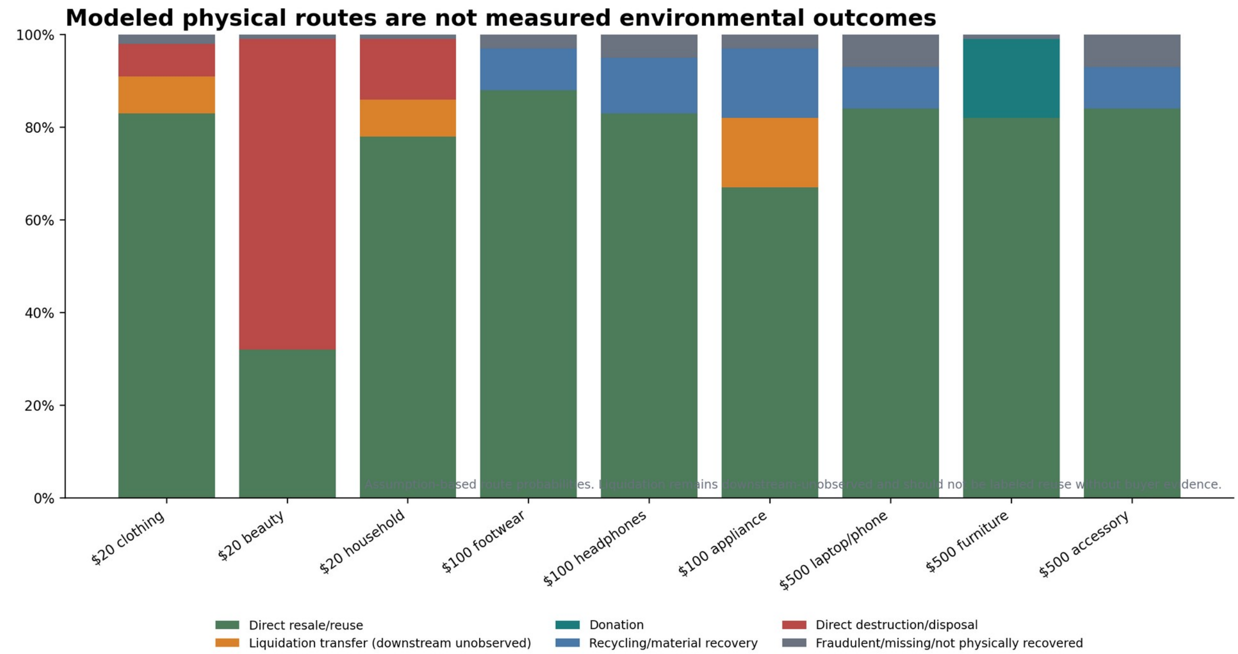
Exhibit 12. Fraud expected-loss sensitivity *Source: S31; Model assumptions*

Controls can cost more than they save. The illustrative control case adds inspection time, false-positive service cost and delayed-refund cost. It is negative for $100 footwear and headphones but positive for the $500 device and premium accessory. That is not a universal recommendation; it shows why the same fraud system should not be applied without product-level loss severity and customer-service costs.

9. Sustainability claims meet disposition economics

Financial recovery and environmental recovery can point in different directions. Opened beauty can retain material but lose resale eligibility. Furniture can retain consumer utility while becoming uneconomic to transport to a central facility. Liquidation can be the best financial route while leaving the final physical endpoint unobserved. Recycling can recover material while producing no positive net recovery to the inventory owner.

The public claims need denominator tests. Amazon reports nearly 391 million items resold or donated through seller services in 2024, but the cited disclosure does not isolate customer returns or provide a denominator. Ulta clearly states a no-resale and disposal policy for used, damaged or expired returns, but it does not provide the endpoint split. Target operational materials name donation, recycling and salvage without route volumes. [S04, S08, S30]



Modeled physical routes are not measured environmental outcomes ***Source: Model; route shares are assumptions***

Exhibit 13. Sustainability claims audit

Company/program	Claim/observation	Denominator?	Returns separated?	Final endpoint?	Audit finding	Confidence
Amazon seller recovery programs	Nearly 391 million items were resold or donated in the U.S. and Europe in 2024 through seller services including Grade & Resell and donation.	No	No	Not fully	Large numerator proves program scale, not a customer-return resale rate or net economic recovery rate.	High for the numerator; low for disposition-rate inference
Ulta Beauty returned merchandise	Used, damaged, or expired returned products are not resold and are properly disposed of.	No	The statement is return-specific, but no volume is given	No	Strong evidence of commercial-value loss after integrity breaks; insufficient to distinguish recycling, hazardous handling, incineration, or landfill.	High for no-resale policy; low for environmental endpoint
Target reverse-logistics operations	Operational materials reference donations, central return centers, electronics recycling, salvage, environmentally sensitive items, vendor credits, and inventory removals.	No	No	No	Confirms multiple routes exist, but job-task evidence cannot establish route shares or diversion performance.	Medium for route existence; low for quantities
B-Stock and liquidation transfers	Retailer programs move customer returns and other inventory through B2B auctions; case studies report recovery-rate improvements.	Usually no program-wide denominator in cited pages	Often mixed by lot or marketplace	Often no after auction sale	Financial transfer to a buyer is observable; final environmental disposition is usually not. Liquidation should not automatically be counted as reuse.	Medium for auction transfer; low for final endpoint
Modeled product archetypes	The model separates direct resale, liquidation transfer, donation, recycling, disposal, and missing/fraud outcomes.	Model denominator is one returned order	Yes by construction	Liquidation downstream remains unobserved	Useful for decision economics, not a measured corporate diversion rate.	Model-dependent

Exhibit 13. Sustainability claims audit ***Source: S04; S08; S30; P01; P02***

ENDING

The headphones from the opening are economically recoverable. The model's most likely route is open-box resale, with refurbishment for damaged-but-repairable units and recycling for the unsellable share. The retailer still loses most of the contribution the original sale would have produced. The customer's refund closes one transaction; the product remains inside another market where freight, testing, time and risk determine how much value survives, and who gets to keep it.

Detailed methodology

Evidence protocol

The two supplied documents were treated as the primary record. No new external research was added. The source ledger consolidates the original URLs cited in the package. Where a needed model input was not disclosed, the model uses an explicit proxy or assumption with low, base and high cases. No interview-derived numeric input was used.

- Directly disclosed: filings, policy language, fee schedules and stated company metrics.
- Calculated from disclosed data: DIM weights, auction bid percentages and accounting comparisons.
- Market observation: public closed-auction fields and observed resale channels.
- Proxy: public fees or market bands used to approximate an undisclosed product-level cost.
- Assumption: condition mix, labor minutes, cost of goods, route shares, repair success and specific fraud probabilities.
- Interview-derived: none in the current model.

Definitions and formulas

Kept-sale contribution
R-C-F_o-P

Net recovery_j
V_j-U_j-S_j-M_j-T_j-D_j

PV recovery_j
Net recovery_j/(1+k)^(L_j/365)

Expected recovery
sum_j Q_j*PV recovery_j

Post-return contribution
K-C-F_o-P-F_r-H-A+E(Recovery)

Return tax per returned order
Kept-sale contribution - Post-return contribution

Expected return tax per order
p_r * Return tax per returned order

Retrieve rule

Retrieve when E(Recovery)-F_r-H > 0 before strategic overrides

Disposition rule
Choose eligible d maximizing PV net recovery

Model architecture

The model contains nine archetypes, seven conditions, seven logistics routes, nine dispositions and three composite recovery scenarios. For each product-condition pair, it calculates gross proceeds, repair/repack cost, storage, seller fees, secondary transport, disposal cost and delay. It selects the eligible route with the highest present-value net recovery. Condition probabilities then create Qj and expected recovery. The spreadsheet preserves all eligible and ineligible route rows so the selected path can be audited.

- Low recovery: worse condition mix, 12% lower gross recovery, 25% higher reverse freight, 20% higher labor, 50% longer holding, higher fees and depreciation, lower repair success.
- Base: category-calibrated assumptions anchored to the evidence package.
- High recovery: better condition mix, 8% higher gross recovery, 20% lower reverse freight, lower labor/fees, shorter holding, slower depreciation and higher repair success.

Cost treatment and double-counting controls

- Product cost C is subtracted once in post-return contribution and never inside recovery proceeds.
- Original outbound fulfillment Fo and original payment cost P are not subtracted inside disposition recovery. Secondary selling and shipping costs are M and T.
- Counterfeit/missing condition reduces E(Recovery) through Qj. A contains only incremental fraud administration/claims cost, not the lost recovery already captured by Qj.
- Storage S is physical storage/space cost. Capital delay is handled separately through PV discounting.
- Retailer recovery is not buyer delivered cost, and buyer delivered cost is not reseller profit.

Included costs

- Product cost; original fulfillment/shipping; original payment/transaction; reverse freight; receiving/inspection; cleaning/testing/repair/repack; physical storage; secondary selling fees; secondary transport; disposal/recycling cost; incremental fraud admin/claims; time discount.

Excluded costs

- Fixed corporate overhead; customer acquisition marketing; sales tax/VAT; income-tax effects; donation tax benefits; vendor allowances unless explicitly modeled; insurance/chargeback recoveries; customer lifetime-value effects; public-relations cost; environmental externalities; unobserved post-liquidation outcomes.

Returnless-refund and disposition thresholds

The break-even gross recovery conditional on receiving the correct product is calculated as total retrieval and fixed processing costs divided by the correct-item probability and one minus the effective selling-fee rate. The model also solves for maximum reverse freight, maximum inspection minutes, maximum refurbishment cost versus the next-best route, minimum correct-item probability and the retail price at which retrieval becomes economic for the same product form.

Unit-economic model and sensitivity

Low, base and high recovery cases

Product	Scenario	E recovery	Fr	H	Retrieve value	Return tax / return	Expected tax / order	bps
Basic clothing item ($20)	Low recovery	$3.11	$4.53	$1.40	$-2.83	$22.91	$5.73	2,863 bps
Basic clothing item ($20)	Base	$6.90	$3.62	$1.17	$2.11	$17.97	$4.49	2,246 bps
Basic clothing item ($20)	High recovery	$10.07	$2.90	$0.99	$6.17	$13.91	$3.48	1,738 bps
Cosmetic/ personal-care item ($20)	Low recovery	$0.96	$4.03	$0.84	$-3.91	$23.94	$2.39	1,197 bps
Cosmetic/ personal-care item ($20)	Base	$3.64	$3.23	$0.70	$-0.28	$20.31	$2.03	1,016 bps
Cosmetic/ personal-care item ($20)	High recovery	$6.09	$2.58	$0.60	$2.92	$17.11	$1.71	856 bps
Small household product ($20)	Low recovery	$0.73	$8.95	$1.12	$-9.34	$29.38	$3.53	1,763 bps
Small household product ($20)	Base	$3.42	$7.16	$0.93	$-4.68	$24.71	$2.97	1,483 bps
Small household product ($20)	High recovery	$6.15	$5.73	$0.79	$-0.38	$20.41	$2.45	1,225 bps
Footwear/ premium apparel ($100)	Low recovery	$31.48	$6.42	$2.24	$22.82	$77.54	$23.26	2,326 bps
Footwear/ premium apparel ($100)	Base	$49.07	$5.14	$1.87	$42.06	$58.30	$17.49	1,749 bps
Footwear/ premium apparel ($100)	High recovery	$63.70	$4.11	$1.59	$58.00	$42.36	$12.71	1,271 bps
Headphones/ small electronics ($100)	Low recovery	$18.07	$7.39	$4.80	$5.88	$95.02	$11.40	1,140 bps
Headphones/ small electronics ($100)	Base	$33.37	$5.91	$4.00	$23.46	$77.44	$9.29	929 bps
Headphones/ small electronics ($100)	High recovery	$48.25	$4.73	$3.40	$40.12	$60.78	$7.29	729 bps
Small appliance ($100)	Low recovery	$9.67	$16.41	$6.00	$-12.74	$113.19	$16.98	1,698 bps
Small appliance ($100)	Base	$22.34	$13.12	$5.00	$4.22	$96.23	$14.44	1,444 bps
Small appliance ($100)	High recovery	$36.06	$10.50	$4.25	$21.31	$79.14	$11.87	1,187 bps
Laptop/phone premium electronics ($500)	Low recovery	$123.07	$10.25	$12.24	$100.58	$404.32	$40.43	809 bps
Laptop/phone premium electronics ($500)	Base	$200.58	$8.20	$10.20	$182.18	$322.72	$32.27	645 bps
Laptop/phone premium electronics ($500)	High recovery	$275.85	$6.56	$8.67	$260.62	$244.28	$24.43	489 bps
Furniture product ($500)	Low recovery	$25.90	$123.62	$12.00	$-109.72	$610.02	$109.80	2,196 bps
Furniture product ($500)	Base	$95.16	$98.90	$10.00	$-13.74	$514.04	$92.53	1,851 bps
Furniture product ($500)	High recovery	$163.28	$79.12	$8.50	$75.66	$424.64	$76.44	1,529 bps
Premium	Low recovery	$181.83	$9.88	$7.20	$164.76	$339.09	$67.82	1,356 bps

Product	Scenario	E recovery	Fr	H	Retrieve value	Return tax / return	Expected tax / order	bps
apparel/accessory ($500)								
Premium apparel/accessory ($500)	Base	$269.18	$7.90	$6.00	$255.28	$248.57	$49.71	994 bps
Premium apparel/accessory ($500)	High recovery	$345.70	$6.32	$5.10	$334.28	$169.57	$33.91	678 bps

Table 3. Scenario results ***Source: Model***

Returnless-refund comparison

Product	Retrieved tax	Returnless tax	Retrieval advantage	Immediate rule	Strategic factors
Basic clothing item ($20)	$17.97	$20.00	$2.03	Retrieve	Account history, vendor credit, customer service
Cosmetic/personal-care item ($20)	$20.31	$20.00	$-0.31	Returnless	Safety/integrity and abuse controls
Small household product ($20)	$24.71	$20.00	$-4.71	Returnless	Account history, vendor credit, customer service
Footwear/premium apparel ($100)	$58.30	$100.00	$41.70	Retrieve	Serial/authentication and fraud deterrence
Headphones/small electronics ($100)	$77.44	$100.00	$22.56	Retrieve	Serial/authentication and fraud deterrence
Small appliance ($100)	$96.23	$100.00	$3.77	Retrieve	Account history, vendor credit, customer service
Laptop/phone premium electronics ($500)	$322.72	$500.00	$177.28	Retrieve	Serial/authentication and fraud deterrence
Furniture product ($500)	$514.04	$500.00	$-14.04	Returnless	Local routing and damage evidence
Premium apparel/accessory ($500)	$248.57	$500.00	$251.43	Retrieve	Serial/authentication and fraud deterrence

Table 4. Retrieved versus returnless refund ***Source: Returnless tax excludes strategic abuse, safety, customer-service and public-relations effects.***

Break-even thresholds

Product	Required gross recovery	Required % retail	Min correct-item probability	Modeled correct-item probability	Max inspection minutes	Max reverse freight	Price threshold	Max refurb cost
Basic clothing item ($20)	$9.18	45.9%	78.7%	98.0%	7.0	$5.73	$16.08	-
Cosmetic/personal-care item ($20)	$6.71	33.6%	103.3%	99.0%	0.9	$2.94	$20.91	-
Small household product ($20)	$12.49	62.4%	163.0%	99.0%	0.0	$2.49	$31.52	$-3.68
Footwear/premium apparel ($100)	$14.77	14.8%	23.9%	97.0%	94.1	$47.20	$24.25	$2.24
Headphones/small electronics ($100)	$24.68	24.7%	45.0%	95.0%	54.9	$29.37	$43.27	$18.20
Small appliance ($100)	$36.79	36.8%	85.6%	97.0%	18.4	$17.34	$87.63	$10.91
Laptop/phone premium electronics ($500)	$54.51	10.9%	18.6%	93.0%	339.5	$190.38	$81.49	$102.70
Furniture product ($500)	$209.34	41.9%	106.3%	99.0%	0.0	$85.16	$539.45	$-1.37
Premium apparel/accessory ($500)	$38.13	7.6%	10.7%	93.0%	435.5	$263.18	$46.42	$30.71

Table 5. Retrieval and processing thresholds ***Source: Model. Values above 100% probability indicate retrieval cannot break even under the current condition/recovery structure.***

Sensitivity findings

Return rate is the largest driver of expected tax per order because it scales the per-return tax directly. Operational rankings differ by category. Recovery markdown and condition mix dominate apparel and electronics. DIM charges and freight discount dominate low-value household goods and furniture. Fraud probability matters most for premium electronics and accessories. Seller fees matter where consumer-facing resale remains viable. Product gross margin changes percentage severity, not dollar return tax.

Product	#1	#2	#3	#4
Basic clothing item ($20)	Resale markdown / recovery (+$0.40)	Condition mix (+$0.39)	Dimensional-weight charges (+$0.27)	Inspection labor (+$0.24)
Cosmetic/personal-care item ($20)	Condition mix (+$0.17)	Resale markdown / recovery (+$0.09)	Dimensional-weight charges (+$0.09)	Reverse shipping cost (+ $0.08)
Small household product ($20)	Dimensional-weight charges (+$0.34)	Negotiated freight discount (+$0.25)	Reverse shipping cost (+ $0.21)	Condition mix (+$0.13)
Footwear/premium apparel ($100)	Condition mix (+$2.52)	Resale markdown / recovery (+$2.51)	Inspection labor (+$0.55)	Dimensional-weight charges (+$0.50)
Headphones/small electronics ($100)	Resale markdown / recovery (+$0.80)	Condition mix (+$0.77)	Inspection labor (+$0.49)	Seller fees (+$0.27)
Small appliance ($100)	Condition mix (+$0.88)	Dimensional-weight charges (+$0.86)	Resale markdown / recovery (+$0.76)	Inspection labor (+$0.63)
Laptop/phone premium electronics ($500)	Resale markdown / recovery (+$3.39)	Condition mix (+$3.11)	Fraud probability (+$1.74)	Seller fees (+$1.21)
Furniture product ($500)	Dimensional-weight charges (+$8.75)	Negotiated freight discount (+$5.00)	Condition mix (+$4.71)	Resale markdown / recovery (+$4.70)
Premium apparel/accessory ($500)	Condition mix (+$8.98)	Resale markdown / recovery (+$8.64)	Fraud probability (+$3.29)	Seller fees (+$1.59)

Table 6. Largest adverse sensitivities, excluding return rate ***Source: Dollar change in expected return tax per order under the defined adverse shock.***

Auction analysis

Completed-auction sample size: two. No open-auction observation was supplied or used. The package explicitly could not verify a broad unrestricted master file; the report therefore preserves lot-level fields, reports distribution statistics and avoids population claims.

Auction ID	Category	Status	Stated retail	Adjusted current retail	Winning bid	Buyer premium	Freight	Delivered cost	Units	Condition	Manifest
WMT-150184	Microwaves	Completed	$7,004	$5,603	$1,020	$102	$750	$1,872	102	Detailed condition not public; liquidation lot in customer-return channel	Partial public listing; full details login-gated
WMT-150245	eBikes	Completed	$3,058	$2,446	$600	$60	$850	$1,510	12	Detailed condition not public; liquidation lot in customer-return channel	Partial public listing; full details login-gated

Table 7. Completed auction master sample ***Source: S36, S37. Adjusted current retail, buyer premium and freight are assumptions.***

Metric	n	Min	P25	Median	Mean	P75	Max	Range
Auction bid % stated retail	2	14.6%	15.8%	17.1%	17.1%	18.4%	19.6%	5.1%
Delivered cost % stated retail	2	26.7%	32.4%	38.1%	38.1%	43.7%	49.4%	22.7%
Auction bid % adjusted current retail	2	18.2%	19.8%	21.4%	21.4%	22.9%	24.5%	6.3%
Delivered cost % adjusted current retail	2	33.4%	40.5%	47.6%	47.6%	54.6%	61.7%	28.3%
Retailer recovery after fees % stated retail	2	10.5%	10.8%	11.2%	11.2%	11.5%	11.8%	1.4%
Reseller break-even % stated retail	2	63.7%	72.2%	80.8%	80.8%	89.3%	97.9%	34.2%

Table 8. Distribution and dispersion ***Source: n=2; quartiles are interpolated and should not be read as stable distribution estimates.***

Benchmark	Sample/status	Recovery measure	Denominator	Generalizability	Sources
Apparel field study - private label	11,879 completed auctions across study; segment result	13.11% of retail	Original retail	Apparel/end-of-life only	S32
Apparel field study - national brands	11,879 completed auctions across study; segment result	16.339% of retail	Original retail	Apparel/end-of-life only	S32
Amazon FBA Liquidations typical range	Program guidance, not auction sample	5%-10% of average selling price	Average selling price	FBA Liquidations only	S35
AuctionMethod mixed customer-return range	Industry review	10%-30% of MSRP	MSRP	Secondary source; mixed conditions	S42
Observed microwave lot	1 completed public lot	14.6% bid / stated retail	Stated retail	Single lot	S37
Observed eBike lot	1 completed public lot	19.6% bid / stated retail	Stated retail	Single lot	S36

Table 9. Auction and liquidation benchmarks ***Source: S32; S35-S37; S42***

Category and operating-model comparison

Exhibit 8. Category comparison

Category	Return drivers	Return-rate evidence	Value density	Inspection	Safety	Fraud	Depreciation	Common disposition	Gross recovery	Net recovery	Returnless	Major uncertainty
Clothing and footwear	Fit, size, style, seasonality, wardrobing, missing tags or accessories	Broad online returns are high; ASOS policy tightens high-return behavior; Nordstrom says most returns flow through stores. Model: 20%-30%.	High for premium goods; moderate for low-price basics	Low-to-moderate per unit, but sorting, steaming, sizing and retagging are labor-heavy at scale	Low except hygiene-specific items	Moderate; wardrobing and counterfeit risk rise with price/brand	Moderate; season and fashion cycle matter	Restock, outlet/off-price, liquidation; donation for saleable but noncommercial units	56%-62%	34%-54%	Conditional for $20 parcel returns; uncommon for premium items	Condition mix, route shares, actual remarketing labor
Consumer electronics	Compatibility, buyer remorse, defects, activation, missing accessories, battery or data issues	No clean category population rate in package; model: 10%-12%.	High	High: serial, function, activation, battery, accessories, data sanitization	Recalled products, battery handling, data security	High for substitution and serial-controlled goods	High; model uses 3.0%-3.5% monthly	Open-box, refurbishment, outlet, recycling	50%-51%	33%-40%	Rare except very low-value accessories or account-specific exceptions	Diagnostic time, repair success, warranty cost, actual device age
Furniture and bulky home	Damage, color/fit mismatch, assembly issues, missing hardware, carrier damage	Vendor case material cites roughly 30% online furniture returns; model uses 18% for the selected item.	Low per cubic foot and per billable pound	Moderate, but space and handling are expensive	Structural integrity, recalls, sanitation for some categories	Low-to-moderate	Low-to-moderate, but dwell and damage compound	Local open-box/outlet, local pickup, liquidation, donation/salvage	39%-39%	19%-19%	High when only long-haul or oversize retrieval is available	Actual local routing, carrier discount, damage and assembly state
Cosmetics and personal care	Shade preference, reaction, damaged packaging, expiration or seal concerns	No clean category population rate in package; model uses 10%.	High physically, but commercial value can collapse on opening	Low time, high assurance burden	Integrity, contamination, labeling and retailer policy	Low-to-moderate	Moderate through shelf life and obsolescence	Restock only when sealed and trusted; otherwise disposal	32%-32%	18%-18%	Frequent on immediate economics for mailed returns, subject to abuse/safety controls	Definition and endpoint of 'properly disposed'
Small household goods	Fit/utility mismatch, low perceived quality, damage, missing parts	No category population rate in package; model: 12%-15%.	Often low, especially light-but-bulky goods	Low per unit, but often larger than liquidation value	Product-specific; electrical items need testing	Low-to-moderate	Low for basics; moderate for small appliances	Outlet, liquidation, donation/recycling, returnless refund	38%-40%	17%-22%	Likely for low-value parcel returns; less likely for appliances near stores	DIM-weight billing, actual consolidation cost, unit-level saleability
Third-party marketplace goods	Same product drivers as above, plus seller-policy mismatch and platform-enforced refunds	Contract- and category-specific; no defensible single rate	Product-specific	Platform or seller may inspect; economic owner may never touch the unit	Product-specific plus marketplace eligibility rules	Seller may bear fraud or dispute losses despite platform-controlled intake	Product-specific; settlement delay adds exposure	Platform restock, Grade & Resell, liquidation, returnless resolution, return to seller	Not modeled as one category	Contract-dependent	Seller-program election or platform rule	Title, fee, fault and recovery allocation in private contracts

Exhibit 8. Category comparison *Source: P01; P02; Model*

Company and platform comparison

Company/platform	Merchandise	Policy anchor	Network/inspection	Disposition	Loss allocation
Amazon retail and FBA	General merchandise; mixes Amazon-owned and third-party	FBA outsources returns to Amazon. Seller programs include Returnless	Amazon says FBA stores, picks, packs, ships, and processes returns across	Primary restock; Grade & Resell used-condition relisting; FBA Liquidations;	Amazon retail carries return liabilities and recovery assets on its

Company/platform	Merchandise	Policy anchor	Network/inspection	Disposition	Loss allocation
	inventory	Resolutions, Liquidations, and Grade & Resell. Seller-fulfilled refunds now give four calendar days from return-delivery scan before automated refunds.	hundreds of fulfillment centers.	donation/resell claims in sustainability report; auction visibility through Amazon Liquidation Auctions on B-Stock.	own books; FBA programs imply sellers remain economically exposed for their own inventory and fees.
Walmart and WFS	General merchandise, marketplace, grocery-adjacent, bulky categories	Most Walmart-owned items: 90 days. Marketplace seller items: generally 30 days, with electronics and major-appliance exceptions.	WFS sends return labels to Walmart fulfillment centers for inspection and handling. Sellers can set Keep It rules.	Primary restock where feasible; WFS inspection; seller-directed keep-it; visible liquidation channel through Walmart Liquidation Auctions on B-Stock.	Walmart covers return shipping only for Walmart-at-fault WFS returns; sellers pay return processing otherwise. Big & bulky return fees are explicit.
Target and Target Plus	Large omnichannel retailer with store-heavy network plus partner marketplace	Most unopened Target items in new condition: 90 days. Target Plus partner items: mostly 30 days, returned to Target in store or by mail.	Store reverse-logistics role references Central Return Center, donations, electronics recycling, transfers, salvage, inventory removals, vendor credits, and ESIM logs.	Restock, CRC routing, donation, electronics recycling, salvage, vendor credit, inventory removals.	Platform experience is consumer-facing, but vendor credits and partner differences matter behind the scenes. Partner items physically come back to Target, but contractual loss-sharing is more fragmented than for owned inventory.
Best Buy and marketplace partners	Electronics-heavy retailer with open-box and partner marketplace features	Standard window is short; some categories are nonreturnable once opened, including bodily-fluid-interacting goods and many marketplace entertainment goods.	Policy differentiates Best Buy inventory and Marketplace Seller inventory; marketplace restrictions and packaging requirements are explicit.	New restock, open-box, refurbished, pre-owned, recycling, and marketplace-partner-specific flows.	Short windows and opened-item restrictions reduce recoverability risk. Vendor allowances are economically important in inventory and cost of sales.
Wayfair	Furniture and bulky home goods, high ship-cost and damage exposure	Wayfair public help pages are less transparent in scraped text, but its SEC disclosures emphasize customer returns risk and large-item special handling.	SEC filing says many products are large, need special handling, and can be damaged in transit; logistics footprint includes warehouses, consolidation centers, cross-docks, and last-mile facilities.	Restock where undamaged; open-box and closeout paths exist commercially, but public contract-level disclosure is thin; liquidation likely on bulky/problem inventory.	Freight and transit-damage economics dominate; resale delays are especially costly in large home categories.
IKEA	Furniture and home goods with high flat-pack share plus mattresses	Unopened products: 365 days. Open products: 180 days. Mattresses: one exchange within 90 days.	Heavy store network changes reverse economics versus pure e-commerce furniture.	Re-entry to stock for unopened or fit-for-sale goods; exchange program for mattresses; secondary or disposal routes still needed for damaged/opened goods.	Flat-pack format improves recoverability versus assembled furniture, but mattress flows are separate and replacement-heavy.
Ulta Beauty	Beauty, cosmetics, personal care	Returned-merchandise policy is blunt: used, damaged, or expired products are not resold and are disposed of.	Store-centric network reduces mail handling for many returns, but the key issue is not routing, it is resale eligibility.	Limited primary restock for unused compliant goods; nonstandard beauty returns go to disposal, not resale.	Here the loss is often the product cost plus handling, with little secondary recovery once product integrity is uncertain.
Nike	DTC apparel and footwear with brand control	60-day return or exchange window with proof of purchase; some products must remain sealed or cannot be returned.	Brand-controlled DTC network improves authorization and fraud checks.	Restock as new when condition passes; likely factory/outlet or recommerce for other items, though Nike does not publicly publish a full return-disposition ladder.	Nike carries both a sales-related reserve and a separate inventory reserve, showing both refund and inventory-value exposure.
ASOS	Apparel-heavy e-commerce with high return incidence	Original-condition rule, typically 28 days. Fair-use policy applies, and some high-return customers face a £3.95 deduction.	Centralized parcel returns; customer feedback box in return flow; brand-partner items can have separate processing times.	New-condition restock where possible; markdown, outlet, partner return, or disposal where not.	ASOS has been explicit that tighter return economics improved profitability and order quality, especially in high-return segments.
eBay	Marketplace, mostly seller-owned inventory	Sellers can automate returns and immediate refunds. After inspection, seller completes refund; if a dispute goes against seller, eBay can deduct seller funds.	No platform-owned reverse network in the Amazon/WFS sense; routing depends on listing and program.	Return to seller, relist, payment-dispute refund without physical recovery in some cases; eBay Refurbished provides a distinct resale channel.	Seller usually funds the loss unless seller protections apply. eBay can seek reimbursement from seller payouts or on-file payment methods.

Table 10. Company and platform operating evidence *Source: P01 company dossiers; source IDs in Source Ledger*

Ownership and loss allocation by operating model

Operating model	Inventory owner	Refund payer	Freight payer	Processing payer	Disposition controller	Recovery recipient	Fraud-loss bearer	Write-down bearer	Environmental reporting entity	Confidence
Vertically	Retailer	Retailer	Retailer or customer	Retailer	Retailer	Retailer	Retailer	Retailer	Retailer;	High

Operating model	Inventory owner	Refund payer	Freight payer	Processing payer	Disposition controller	Recovery recipient	Fraud-loss bearer	Write-down bearer	Environmental reporting entity	Confidence
integrated retailer			under policy						downstream processors may report their own operations	
Brand selling direct to consumer	Brand	Brand	Brand or customer by policy	Brand or contracted 3PL	Brand within contract/SLA	Brand	Brand	Brand	Brand for product claims; logistics vendor for operational footprint	High-medium
Marketplace first-party retail	Platform retailer	Platform retailer	Platform retailer, customer, or vendor allowance depending fault/policy	Platform retailer	Platform retailer	Platform retailer; vendor credits may offset loss	Platform retailer, subject to carrier/vendor recovery	Platform retailer	Platform retailer for owned inventory	High
Marketplace third-party fulfillment	Third-party seller	Platform-facing process, economically seller in many cases	Seller for non-platform-fault returns; platform for protected/fault cases	Seller through program fees or platform under exceptions	Platform operationally; seller elects program options	Seller net of fees	Seller unless protection or platform-at-fault rule applies	Seller	Ambiguous: seller owns inventory, platform operates facility and may make program claims	Medium-high
Merchant-fulfilled marketplace sale	Seller	Seller, sometimes enforced/debited by platform	Seller/customer under listing and platform rules	Seller	Seller	Seller	Seller unless marketplace protection applies	Seller	Seller; platform may report only limited program data	High
Vendor-supported retailer	Usually retailer after purchase; title may vary	Retailer to customer	Retailer initially; vendor may reimburse defect/fault costs	Retailer or vendor under allowance/return-to-vendor terms	Retailer, vendor, or shared by contract	Retailer unless vendor credit or return-to-vendor transfers economics	Usually retailer for customer fraud; vendor for validated defect obligations	Retailer net of vendor allowances/credits	Depends on title and contractual responsibility	Medium
Consignment	Consignor until sale or contractual title transfer	Retailer/platform to customer, then settled with consignor under contract	Contract-specific	Contract-specific; often retailer charges consignor	Consignor or retailer within agreed rules	Consignor net of commission/fees	Contract-specific; often consignor for merchandise, retailer for process failure	Consignor before title transfer	Owner/consignor for product outcome; processor for operations	Low-medium
Reverse-logistics service contract	Client retailer/brand/seller	Client or platform	Client, passed through or bundled	Client pays service fee	3PL within SLA; client retains policy authority	Client, net of service and channel fees	Client unless service-level guarantee shifts defined losses	Client	Client for product claims; 3PL may report handling/diversion metrics	Medium-low
Inventory-purchase arrangement	Retailer until bulk sale; liquidator after title transfer	Retailer/seller before inventory sale	Negotiated: seller-delivered, buyer pickup, or embedded in price	Liquidator after purchase; retailer may pay prep	Liquidator after title transfer	Retailer gets fixed sale proceeds; liquidator keeps downstream upside	Retailer before title transfer; liquidator bears manifest/sell-through risk after purchase subject to claims rights	Retailer through discounted sale, then liquidator on purchased inventory	Ambiguous after title transfer; retailer may count transfer without observing endpoint	Medium
Auction agency model	Retailer/seller until auction sale closes	Retailer/seller	Upstream owner to sale point or buyer after sale, per terms	Owner and/or agent fee	Agent runs auction; owner sets program constraints; buyer controls after title transfer	Owner receives bid proceeds net of seller-side fees; agent receives fees	Owner until title transfer; buyer takes manifest and resale risk subject to narrow dispute rights	Owner until sale; buyer thereafter	Owner may report liquidation transfer; final endpoint rests with buyer and is often unobserved	Medium

Table 11. Ownership and loss-allocation ledger *Source: P01; contractual archetypes labeled by confidence*

Fraud analysis detail

Product	Base p_f	Lost recovery	Admin/claims	LGD	Expected total fraud loss	Inside Qj	Separate A
Footwear/ premium apparel ($100)	3.0%	$34.90	$12.00	$46.90	$1.41	$1.05	$0.36
Headphones/ small electronics ($100)	5.0%	$33.22	$18.00	$51.22	$2.56	$1.66	$0.90
Laptop/phone premium electronics ($500)	7.0%	$228.93	$70.00	$298.93	$20.93	$16.03	$4.90
Premium apparel/accessory ($500)	7.0%	$240.92	$55.00	$295.92	$20.71	$16.86	$3.85

Table 12. Expected fraud loss and double-counting control ***Source: S31; Model assumptions***

Product	Base p_f	Controlled p_f	Avoided loss	Inspection cost	False-positive cost	Delay/service cost	Total control cost	Net benefit
Footwear/ premium apparel ($100)	3.0%	1.5%	$0.70	$0.93	$0.20	$0.75	$1.88	$-1.18
Headphones/ small electronics ($100)	5.0%	2.5%	$1.28	$2.00	$0.38	$1.00	$3.38	$-2.09
Laptop/ phone premium electronics ($500)	7.0%	3.0%	$11.96	$3.40	$0.75	$1.50	$5.65	$6.31
Premium apparel/accessory ($500)	7.0%	3.0%	$11.84	$3.00	$0.75	$1.25	$5.00	$6.84

Table 13. Illustrative aggressive-control economics ***Source: All control parameters are assumptions, not disclosures.***

Calculation appendix

Product inputs

Product	R	C	C/R	Fo	P	DIM lb	Billable lb	Value/ billable lb	Inspect min	Labor/hr	Return rate	Depreciation /mo	Fraud p
Basic clothing item ($20)	$20	$6.00	30.0%	$4.50	$0.80	1.2	2	$10.00	2.5	$28	25.0%	2.0%	2.0%
Cosmetic/ personal-care item ($20)	$20	$5.00	25.0%	$4.00	$0.80	1.0	2	$10.00	1.5	$28	10.0%	1.5%	1.0%
Small household product ($20)	$20	$7.00	35.0%	$5.50	$0.80	27.6	28	$0.71	2.0	$28	12.0%	0.5%	1.0%
Footwear/ premium apparel ($100)	$100	$35.00	35.0%	$7.00	$2.80	6.0	7	$14.29	4.0	$28	30.0%	2.0%	3.0%
Headphones/ small electronics ($100)	$100	$45.00	45.0%	$6.00	$2.80	2.9	3	$33.33	8.0	$30	12.0%	3.0%	5.0%
Small appliance ($100)	$100	$42.00	42.0%	$10.00	$2.80	21.8	22	$4.55	10.0	$30	15.0%	1.0%	3.0%
Laptop/ phone premium electronics ($500)	$500	$350.00	70.0%	$10.00	$12.80	6.7	7	$71.43	18.0	$34	10.0%	3.5%	7.0%
Furniture product ($500)	$500	$225.00	45.0%	$75.00	$12.80	138.1	139	$3.60	20.0	$30	18.0%	0.7%	1.0%
Premium apparel/accessory ($500)	$500	$150.00	30.0%	$12.00	$12.80	8.3	9	$55.56	10.0	$36	20.0%	1.5%	7.0%

Appendix Table A1. Product inputs *Source: R fixed by assignment. Other inputs are assumptions/proxies unless noted.*

Base condition-to-disposition selections

Product	Condition	Q	Selected disposition	Gross proceeds	U	S	M	T	D	Days	PV recovery	Q x PV
Basic clothing item ($20)	Unopened	20.0%	Restock as new	$19.87	$0.32	$0.15	$0.56	$4.50	$0.00	10	$14.30	$2.86
Basic clothing item ($20)	Opened but unused	28.0%	Restock as new	$18.87	$0.64	$0.15	$0.53	$4.50	$0.00	10	$13.01	$3.64
Basic clothing item ($20)	Lightly used	28.0%	Outlet/off-price	$5.71	$1.65	$0.53	$0.29	$1.12	$0.00	35	$2.11	$0.59
Basic clothing item ($20)	Damaged but repairable	8.0%	Liquidation	$0.88	$0.54	$0.75	$0.13	$0.75	$0.00	50	$-1.27	$-0.10
Basic clothing item ($20)	Incomplete	7.0%	Outlet/off-price	$3.96	$2.25	$0.53	$0.20	$1.12	$0.00	35	$-0.14	$-0.01
Basic clothing	Counterfeit or	2.0%	Fraudulent/	$0.00	$0.00	$0.30	$0.00	$0.00	$0.00	20	$-0.30	$-0.01

Product	Condition	Q	Selected disposition	Gross proceeds	U	S	M	T	D	Days	PV recovery	Q x PV
item ($20)	substituted		missing									
Basic clothing item ($20)	Unsellable	7.0%	Destruction/ landfill	$0.00	$0.10	$0.22	$0.00	$0.00	$0.75	15	$-1.07	$-0.07
Cosmetic/ personal-care item ($20)	Unopened	32.0%	Restock as new	$19.90	$0.16	$0.10	$0.56	$4.00	$0.00	10	$15.04	$4.81
Cosmetic/ personal-care item ($20)	Opened but unused	14.0%	Destruction/ landfill	$0.00	$0.32	$0.15	$0.00	$0.00	$1.25	15	$-1.71	$-0.24
Cosmetic/ personal-care item ($20)	Lightly used	18.0%	Destruction/ landfill	$0.00	$0.44	$0.15	$0.00	$0.00	$1.25	15	$-1.83	$-0.33
Cosmetic/ personal-care item ($20)	Damaged but repairable	5.0%	Destruction/ landfill	$0.00	$0.72	$0.15	$0.00	$0.00	$1.25	15	$-2.11	$-0.11
Cosmetic/ personal-care item ($20)	Incomplete	3.0%	Destruction/ landfill	$0.00	$0.60	$0.15	$0.00	$0.00	$1.25	15	$-1.99	$-0.06
Cosmetic/ personal-care item ($20)	Counterfeit or substituted	1.0%	Fraudulent/ missing	$0.00	$0.00	$0.20	$0.00	$0.00	$0.00	20	$-0.20	$-0.00
Cosmetic/ personal-care item ($20)	Unsellable	27.0%	Destruction/ landfill	$0.00	$0.20	$0.15	$0.00	$0.00	$1.25	15	$-1.59	$-0.43
Small household product ($20)	Unopened	18.0%	Restock as new	$19.97	$0.32	$0.20	$0.56	$5.50	$0.00	10	$13.35	$2.40
Small household product ($20)	Opened but unused	25.0%	Outlet/off-price	$7.56	$1.20	$0.70	$0.38	$1.50	$0.00	35	$3.74	$0.93
Small household product ($20)	Lightly used	25.0%	Outlet/off-price	$6.36	$1.65	$0.70	$0.32	$1.50	$0.00	35	$2.17	$0.54
Small household product ($20)	Damaged but repairable	10.0%	Outlet/off-price	$3.58	$2.70	$0.70	$0.18	$1.50	$0.00	35	$-1.48	$-0.15
Small household product ($20)	Incomplete	8.0%	Liquidation	$0.97	$0.60	$1.00	$0.15	$1.00	$0.00	50	$-1.75	$-0.14
Small household product ($20)	Counterfeit or substituted	1.0%	Fraudulent/ missing	$0.00	$0.00	$0.40	$0.00	$0.00	$0.00	20	$-0.40	$-0.00
Small household product ($20)	Unsellable	13.0%	Destruction/ landfill	$0.00	$0.25	$0.30	$0.00	$0.00	$0.75	15	$-1.29	$-0.17
Footwear/ premium apparel ($100)	Unopened	18.0%	Restock as new	$99.33	$0.60	$0.25	$2.78	$7.00	$0.00	10	$88.42	$15.92
Footwear/ premium apparel ($100)	Opened but unused	26.0%	Restock as new	$94.36	$1.20	$0.25	$2.64	$7.00	$0.00	10	$83.01	$21.58
Footwear/ premium apparel ($100)	Lightly used	28.0%	Outlet/off-price	$42.98	$3.30	$0.88	$2.15	$1.88	$0.00	35	$34.40	$9.63
Footwear/ premium apparel ($100)	Damaged but repairable	9.0%	Outlet/off-price	$24.17	$5.40	$0.88	$1.21	$1.88	$0.00	35	$14.65	$1.32
Footwear/ premium apparel ($100)	Incomplete	7.0%	Outlet/off-price	$18.80	$4.50	$0.88	$0.94	$1.88	$0.00	35	$10.50	$0.73
Footwear/ premium apparel ($100)	Counterfeit or substituted	3.0%	Fraudulent/ missing	$0.00	$0.00	$0.50	$0.00	$0.00	$0.00	20	$-0.50	$-0.01
Footwear/	Unsellable	9.0%	Recycling/scrap	$1.95	$0.25	$0.88	$0.00	$1.50	$0.50	35	$-1.16	$-0.10

Product	Condition	Q	Selected disposition	Gross proceeds	U	S	M	T	D	Days	PV recovery	Q x PV
premium apparel ($100)												
Headphones/ small electronics ($100)	Unopened	14.0%	Restock as new	$98.99	$0.80	$0.20	$2.77	$6.00	$0.00	10	$88.94	$12.45
Headphones/ small electronics ($100)	Opened but unused	21.0%	Open-box resale	$70.20	$5.60	$0.50	$8.42	$6.60	$0.00	25	$48.69	$10.23
Headphones/ small electronics ($100)	Lightly used	26.0%	Open-box resale	$54.75	$8.00	$0.50	$6.57	$6.60	$0.00	25	$32.83	$8.53
Headphones/ small electronics ($100)	Damaged but repairable	13.0%	Refurbished resale	$37.36	$12.00	$0.90	$4.86	$7.60	$0.00	45	$11.83	$1.54
Headphones/ small electronics ($100)	Incomplete	9.0%	Outlet/off-price	$13.90	$6.00	$0.70	$0.69	$1.50	$0.00	35	$4.95	$0.45
Headphones/ small electronics ($100)	Counterfeit or substituted	5.0%	Fraudulent/ missing	$0.00	$0.00	$0.40	$0.00	$0.00	$0.00	20	$-0.40	$-0.02
Headphones/ small electronics ($100)	Unsellable	12.0%	Recycling/scrap	$4.83	$0.50	$0.70	$0.00	$1.20	$0.75	35	$1.66	$0.20
Small appliance ($100)	Unopened	12.0%	Restock as new	$99.67	$1.20	$0.50	$2.79	$10.00	$0.00	10	$84.91	$10.19
Small appliance ($100)	Opened but unused	20.0%	Open-box resale	$64.46	$7.00	$1.25	$7.73	$11.00	$0.00	25	$37.18	$7.44
Small appliance ($100)	Lightly used	25.0%	Open-box resale	$50.28	$10.00	$1.25	$6.03	$11.00	$0.00	25	$21.82	$5.46
Small appliance ($100)	Damaged but repairable	15.0%	Liquidation	$7.38	$1.80	$2.50	$1.11	$2.50	$0.00	50	$-0.52	$-0.08
Small appliance ($100)	Incomplete	10.0%	Outlet/off-price	$13.34	$9.00	$1.75	$0.67	$3.75	$0.00	35	$-1.80	$-0.18
Small appliance ($100)	Counterfeit or substituted	3.0%	Fraudulent/ missing	$0.00	$0.00	$1.00	$0.00	$0.00	$0.00	20	$-0.99	$-0.03
Small appliance ($100)	Unsellable	15.0%	Recycling/scrap	$3.95	$1.00	$1.75	$0.00	$3.00	$1.25	35	$-3.01	$-0.45
Laptop/phone premium electronics ($500)	Unopened	12.0%	Restock as new	$494.10	$1.60	$0.30	$13.83	$10.00	$0.00	10	$466.91	$56.03
Laptop/phone premium electronics ($500)	Opened but unused	18.0%	Open-box resale	$378.59	$12.60	$0.75	$45.43	$11.00	$0.00	25	$306.42	$55.16
Laptop/phone premium electronics ($500)	Lightly used	26.0%	Open-box resale	$295.30	$18.00	$0.75	$35.44	$11.00	$0.00	25	$228.34	$59.37
Laptop/phone	Damaged but	18.0%	Refurbished	$210.46	$45.00	$1.55	$27.36	$16.00	$0.00	52	$118.63	$21.35

Product	Condition	Q	Selected disposition	Gross proceeds	U	S	M	T	D	Days	PV recovery	Q x PV
premium electronics ($500)	repairable		resale									
Laptop/phone premium electronics ($500)	Incomplete	10.0%	Outlet/off-price	$83.46	$15.00	$1.05	$4.17	$3.00	$0.00	35	$59.58	$5.96
Laptop/phone premium electronics ($500)	Counterfeit or substituted	7.0%	Fraudulent/ missing	$0.00	$0.00	$0.60	$0.00	$0.00	$0.00	20	$-0.60	$-0.04
Laptop/phone premium electronics ($500)	Unsellable	9.0%	Recycling/scrap	$38.37	$2.00	$1.05	$0.00	$2.40	$2.00	35	$30.59	$2.75
Furniture product ($500)	Unopened	8.0%	Restock as new	$498.83	$4.00	$5.00	$13.97	$60.00	$0.00	10	$414.57	$33.17
Furniture product ($500)	Opened but unused	18.0%	Open-box resale	$337.52	$21.00	$15.62	$40.50	$55.00	$0.00	31	$203.41	$36.61
Furniture product ($500)	Lightly used	22.0%	Open-box resale	$276.77	$30.00	$15.62	$33.21	$55.00	$0.00	31	$141.55	$31.14
Furniture product ($500)	Damaged but repairable	22.0%	Outlet/off-price	$100.22	$36.00	$21.88	$5.01	$25.00	$0.00	44	$12.17	$2.68
Furniture product ($500)	Incomplete	12.0%	Outlet/off-price	$77.95	$30.00	$21.88	$3.90	$25.00	$0.00	44	$-2.79	$-0.33
Furniture product ($500)	Counterfeit or substituted	1.0%	Fraudulent/ missing	$0.00	$0.00	$10.00	$0.00	$0.00	$0.00	20	$-9.94	$-0.10
Furniture product ($500)	Unsellable	17.0%	Donation	$0.00	$2.50	$15.00	$0.00	$30.00	$0.00	30	$-47.06	$-8.00
Premium apparel/accessory ($500)	Unopened	18.0%	Restock as new	$497.49	$2.00	$0.25	$13.93	$12.00	$0.00	10	$467.85	$84.21
Premium apparel/accessory ($500)	Opened but unused	24.0%	Restock as new	$472.61	$4.00	$0.25	$13.23	$12.00	$0.00	10	$441.76	$106.02
Premium apparel/accessory ($500)	Lightly used	26.0%	Open-box resale	$308.10	$15.00	$0.62	$36.97	$13.20	$0.00	25	$240.43	$62.51
Premium apparel/accessory ($500)	Damaged but repairable	8.0%	Refurbished resale	$190.02	$25.00	$1.12	$24.70	$21.20	$0.00	45	$116.36	$9.31
Premium apparel/accessory ($500)	Incomplete	8.0%	Outlet/off-price	$106.60	$12.00	$0.88	$5.33	$3.00	$0.00	35	$84.48	$6.76
Premium apparel/accessory ($500)	Counterfeit or substituted	7.0%	Fraudulent/ missing	$0.00	$0.00	$0.50	$0.00	$0.00	$0.00	20	$-0.50	$-0.03
Premium apparel/accessory ($500)	Unsellable	9.0%	Recycling/scrap	$9.83	$1.00	$0.88	$0.00	$2.40	$1.00	35	$4.50	$0.41

Appendix Table A2. Base condition engine ***Source: Full eligible-route matrix for low/base/high scenarios is in the spreadsheet.***

Logistics scenarios

Product	Logistics scenario	Reverse freight	E recovery	Inspection	Retrieve value	Return tax	Retrieve?
Basic clothing item ($20)	Store return	$1.25	$6.90	$1.17	$4.48	$15.60	Yes
Basic clothing item ($20)	Nearby drop-off + consolidation	$3.00	$6.90	$1.17	$2.73	$17.35	Yes
Basic clothing item ($20)	Short-distance parcel	$5.75	$6.90	$1.17	$-0.02	$20.10	No
Basic clothing item ($20)	Long-distance parcel	$8.50	$6.90	$1.17	$-2.77	$22.85	No

Product	Logistics scenario	Reverse freight	E recovery	Inspection	Retrieve value	Return tax	Retrieve?
Basic clothing item ($20)	Oversize shipment	$30.00	$6.90	$1.17	$-24.27	$44.35	No
Basic clothing item ($20)	Local pickup	$25.00	$6.90	$1.17	$-19.27	$39.35	No
Basic clothing item ($20)	Pallet liquidation	$0.75	$6.90	$1.17	$4.98	$15.10	Yes
Cosmetic/personal-care item ($20)	Store return	$1.00	$3.64	$0.70	$1.94	$18.09	Yes
Cosmetic/personal-care item ($20)	Nearby drop-off + consolidation	$2.75	$3.64	$0.70	$0.19	$19.84	Yes
Cosmetic/personal-care item ($20)	Short-distance parcel	$5.25	$3.64	$0.70	$-2.31	$22.34	No
Cosmetic/personal-care item ($20)	Long-distance parcel	$7.75	$3.64	$0.70	$-4.81	$24.84	No
Cosmetic/personal-care item ($20)	Oversize shipment	$25.00	$3.64	$0.70	$-22.06	$42.09	No
Cosmetic/personal-care item ($20)	Local pickup	$20.00	$3.64	$0.70	$-17.06	$37.09	No
Cosmetic/personal-care item ($20)	Pallet liquidation	$0.50	$3.64	$0.70	$2.44	$17.59	Yes
Small household product ($20)	Store return	$1.50	$3.42	$0.93	$0.99	$19.05	Yes
Small household product ($20)	Nearby drop-off + consolidation	$3.50	$3.42	$0.93	$-1.01	$21.05	No
Small household product ($20)	Short-distance parcel	$7.25	$3.42	$0.93	$-4.76	$24.80	No
Small household product ($20)	Long-distance parcel	$11.50	$3.42	$0.93	$-9.01	$29.05	No
Small household product ($20)	Oversize shipment	$32.00	$3.42	$0.93	$-29.51	$49.55	No
Small household product ($20)	Local pickup	$30.00	$3.42	$0.93	$-27.51	$47.55	No
Small household product ($20)	Pallet liquidation	$1.00	$3.42	$0.93	$1.49	$18.55	Yes
Footwear/premium apparel ($100)	Store return	$1.75	$49.07	$1.87	$45.45	$54.91	Yes
Footwear/premium apparel ($100)	Nearby drop-off + consolidation	$4.00	$49.07	$1.87	$43.20	$57.16	Yes
Footwear/premium apparel ($100)	Short-distance parcel	$7.50	$49.07	$1.87	$39.70	$60.66	Yes
Footwear/premium apparel ($100)	Long-distance parcel	$11.00	$49.07	$1.87	$36.20	$64.16	Yes
Footwear/premium apparel ($100)	Oversize shipment	$35.00	$49.07	$1.87	$12.20	$88.16	Yes
Footwear/premium apparel ($100)	Local pickup	$30.00	$49.07	$1.87	$17.20	$83.16	Yes
Footwear/premium apparel ($100)	Pallet liquidation	$1.25	$49.07	$1.87	$45.95	$54.41	Yes
Headphones/small electronics ($100)	Store return	$1.75	$33.37	$4.00	$27.62	$73.28	Yes
Headphones/small electronics ($100)	Nearby drop-off + consolidation	$4.25	$33.37	$4.00	$25.12	$75.78	Yes
Headphones/small electronics ($100)	Short-distance parcel	$7.25	$33.37	$4.00	$22.12	$78.78	Yes
Headphones/small electronics ($100)	Long-distance parcel	$10.50	$33.37	$4.00	$18.87	$82.03	Yes
Headphones/small electronics ($100)	Oversize shipment	$30.00	$33.37	$4.00	$-0.63	$101.53	No
Headphones/small electronics ($100)	Local pickup	$25.00	$33.37	$4.00	$4.37	$96.53	Yes
Headphones/small electronics ($100)	Pallet liquidation	$1.00	$33.37	$4.00	$28.37	$72.53	Yes

Product	Logistics scenario	Reverse freight	E recovery	Inspection	Retrieve value	Return tax	Retrieve?
Small appliance ($100)	Store return	$2.25	$22.34	$5.00	$15.09	$85.36	Yes
Small appliance ($100)	Nearby drop-off + consolidation	$5.50	$22.34	$5.00	$11.84	$88.61	Yes
Small appliance ($100)	Short-distance parcel	$10.50	$22.34	$5.00	$6.84	$93.61	Yes
Small appliance ($100)	Long-distance parcel	$17.00	$22.34	$5.00	$0.34	$100.11	Yes
Small appliance ($100)	Oversize shipment	$38.00	$22.34	$5.00	$-20.66	$121.11	No
Small appliance ($100)	Local pickup	$35.00	$22.34	$5.00	$-17.66	$118.11	No
Small appliance ($100)	Pallet liquidation	$2.50	$22.34	$5.00	$14.84	$85.61	Yes
Laptop/phone premium electronics ($500)	Store return	$2.25	$200.58	$10.20	$188.13	$316.77	Yes
Laptop/phone premium electronics ($500)	Nearby drop-off + consolidation	$5.00	$200.58	$10.20	$185.38	$319.52	Yes
Laptop/phone premium electronics ($500)	Short-distance parcel	$9.50	$200.58	$10.20	$180.88	$324.02	Yes
Laptop/phone premium electronics ($500)	Long-distance parcel	$14.50	$200.58	$10.20	$175.88	$329.02	Yes
Laptop/phone premium electronics ($500)	Oversize shipment	$40.00	$200.58	$10.20	$150.38	$354.52	Yes
Laptop/phone premium electronics ($500)	Local pickup	$35.00	$200.58	$10.20	$155.38	$349.52	Yes
Laptop/phone premium electronics ($500)	Pallet liquidation	$2.00	$200.58	$10.20	$188.38	$316.52	Yes
Furniture product ($500)	Store return	$8.00	$95.16	$10.00	$77.16	$423.14	Yes
Furniture product ($500)	Nearby drop-off + consolidation	$25.00	$95.16	$10.00	$60.16	$440.14	Yes
Furniture product ($500)	Short-distance parcel	$60.00	$95.16	$10.00	$25.16	$475.14	Yes
Furniture product ($500)	Long-distance parcel	$110.00	$95.16	$10.00	$-24.84	$525.14	No
Furniture product ($500)	Oversize shipment	$180.00	$95.16	$10.00	$-94.84	$595.14	No
Furniture product ($500)	Local pickup	$65.00	$95.16	$10.00	$20.16	$480.14	Yes
Furniture product ($500)	Pallet liquidation	$25.00	$95.16	$10.00	$60.16	$440.14	Yes
Premium apparel/accessory ($500)	Store return	$2.50	$269.18	$6.00	$260.68	$243.17	Yes
Premium apparel/accessory ($500)	Nearby drop-off + consolidation	$5.25	$269.18	$6.00	$257.93	$245.92	Yes
Premium apparel/accessory ($500)	Short-distance parcel	$9.75	$269.18	$6.00	$253.43	$250.42	Yes
Premium apparel/accessory ($500)	Long-distance parcel	$15.00	$269.18	$6.00	$248.18	$255.67	Yes
Premium apparel/accessory ($500)	Oversize shipment	$42.00	$269.18	$6.00	$221.18	$282.67	Yes
Premium apparel/accessory ($500)	Local pickup	$40.00	$269.18	$6.00	$223.18	$280.67	Yes
Premium apparel/accessory ($500)	Pallet liquidation	$2.00	$269.18	$6.00	$261.18	$242.67	Yes

Appendix Table A3. Logistics scenarios ***Source: Pallet liquidation is a secondary transfer-cost scenario, not a customer return method.***

Exhibits and chart specifications

#	Title	Format	Core fields	Analytical point	Primary sources
1	End-to-end return flow	Process diagram	Authorization; movement; consolidation; verification; grading; disposition; settlement	Refund timing and product ownership move on different clocks.	P01; S02-S07; S21
2	Ownership and loss-allocation diagram	Swimlane diagram	Customer; retailer/platform; seller/vendor; carrier/3PL; liquidator/reseller; waste handler	Physical handler, inventory owner, refund payer, and loss bearer often differ.	P01; S01-S07; S21; S45
3	Returnless-refund decision tree	Decision tree	Expected net recovery; reverse freight; inspection; correct-item probability; strategic overrides	Returnless refunds minimize immediate loss when retrieval value is negative, but policy can override.	S02; S07; P01; model
4	Disposition decision tree	Decision tree	Safety; identity; condition; eligible channels; maximum PV net proceeds	No universal recovery rate; route is an argmax subject to constraints.	S06-S08; S11; S16; S29; model
5	$20 product recovery waterfall	Waterfall	Small household returned order vs returnless alternative	DIM freight and handling can make a physically useful item uneconomic to retrieve.	S17; S21-S26; P02; model
6	$100 product recovery waterfall	Waterfall	Headphones: refund, reverse costs, testing, open-box/refurb proceeds	Testing preserves enough value to justify retrieval, but most original contribution is lost.	S11; S39; model
7	$500 product recovery waterfall	Waterfall	Furniture under weighted centralized route; local-route comparison	High ticket price does not protect recovery when value density is low.	S12; S21-S24; S40; model
8	Category comparison	Table	Drivers; rates; value density; inspection; safety; fraud; depreciation; route; recovery; uncertainty	Category constraints, not price alone, determine value survival.	P01; P02; model
9	Auction recovery distribution	Dot/interval plot	Bid/stated; bid/adjusted; delivered/stated; delivered/adjusted; benchmark bands	Retailer recovery and buyer delivered cost are different; n=2 lot sample remains nonrepresentative.	S32; S35-S37; S42; model assumptions
10	Freight burden by product type	Scatter/bar chart	Billable weight; value per billable lb; reverse freight % retail; max economical freight	Value density explains more than sticker price for parcel and bulky goods.	S17; S21-S26; model
11	Retailer-to-reseller value waterfall	Two-stage bridge	Stated retail; adjusted current retail; retailer net recovery; buyer delivered cost; reseller processing; break-even proceeds	Downstream spread pays for freight, labor, risk, and selling costs; it is not pure profit.	S36; S37; S45; S49; model assumptions
12	Fraud expected-loss sensitivity	Line chart / table	p_f; LGD; lost recovery; admin cost; false-positive/control scenario	Aggressive controls clear the hurdle on premium goods more readily than on $100 apparel or headphones.	S31; P01; model assumptions
13	Sustainability claims audit	Audit matrix	Claim; denominator; returns-only?; third-party?; recycling definition; destruction; endpoint observability	Program numerators do not establish customer-return diversion rates.	S04; S08; S30; P01; P02
14	Evidence-confidence table	Heat-mapped table	Claim/input; evidence type; directness; confidence; model use; limitation	Strong evidence covers policies and fees; weak evidence covers route shares and labor.	Source ledger

Exhibit 14. Evidence-confidence table

Claim/input	Evidence type	Directness	Confidence	Model use	Main limitation	Sources
Amazon return liability and return asset are separate accounting balances	SEC filing	Direct disclosure	High	Supports separation of refund obligation and recovery asset	Company-wide balance, not unit route share	S01
Nike sales-return reserve is distinct from inventory reserve	SEC filing	Direct disclosure	High	Supports refund vs inventory-value distinction	Not category-unit economics	S20
WFS standard and big-and-bulky return fees	Official fee schedule	Direct disclosure	High	Reverse handling/freight anchors	Program-specific and may change	S21
UPS/FedEx/USPS list-price surcharges and DIM mechanics	Official tariff/guidance	Direct disclosure	High for tariff; medium for realized cost	Freight proxy and dimensional-weight sensitivity	Large merchants negotiate discounts	S17; S22-S26
Amazon FBA Liquidations typical 5%-10% recovery	Official seller communication	Direct program claim	High within program	Liquidation downside anchor	Not representative of all retailers/categories	S35
Apparel online-auction recovery of 13.11%-16.339%	Academic field study	Observed sample of 11,879 auctions	Medium-high	Apparel liquidation recovery anchor	Older, end-of-life inventory, category-specific	S32
Public microwave and eBike auction bid recovery	Closed auction pages	Observed/inferred from next bid increment	Medium-high for arithmetic	Two lot-level checks	n=2; final fee/freight/condition hidden	S36; S37
Open-box/refurbished consumer resale can retain 57%-85% of retail	Observed storefronts summarized in package	Market observation	Medium	Final consumer-facing recovery ceilings	Not retailer first-sale recovery; selection of clean units	S33; P02
Condition mix by product archetype	Model assumption	Not disclosed	Low-medium	Primary probability weights Qj	Needs interviews or retailer data	P01; P02
Inspection and refurbishment minutes/costs	Model assumption/proxy	Not disclosed	Low	H and U	Named evidence gap; category operators needed	P01
Category-specific confirmed fraud probabilities	Model assumption calibrated below broad industry estimates	Not disclosed	Low-medium	Counterfeit/missing Qj and fraud sensitivity	Public reports mix fraud, abuse, claims and error	S31; P01
Customer-return environmental route shares	Corporate claims and operational clues	Mostly numerator/program existence	Low	Qualitative audit only	Missing denominators and final downstream endpoint	S04; S08; S30; P01
Marketplace title and exact loss allocation at each processing stage	Policies and program rules	Partly inferential	Medium-low	Ownership/loss-allocation table	Private contracts and settlement rules not supplied	S02; S05-S07; S21; P01

Exhibit 14. Evidence-confidence table ***Source: Source Ledger***

Assumption register

All entries below are model inputs, not company disclosures, unless the classification says otherwise. Low and high mean favorable and adverse bounds only where the row's direction is obvious; percentage discounts use the literal low/base/high value shown.

Assumption	Scope	Low	Base	High	Units	Classification	Justification	Effect	Sources
Annual cost of capital (k)	All products	8.0%	12.0%	18.0%	% per year	Assumption	Discount delayed recovery; public package does not disclose product-level hurdle rates.	Higher k reduces long-dated recovery, especially refurbishment and furniture.	P01
Negotiated freight discount vs list/proxy	Discountable parcel/oversize routes	20.0%	40.0%	60.0%	% discount	Assumption/ proxy	Carrier list rates are public but large-merchant realized rates are not.	Higher discount lowers reverse freight; effect is largest for low-value bulky goods.	S21-S26; P01
Payment/ transaction cost	Original sale	2.2% + $0.20	2.5% + $0.30 rounded	3.2% + $0.30	$/order	Assumption	Evidence package does not provide merchant-specific payment economics.	Changes kept and post-return contribution equally; cancels from return-tax dollars under the specified formula.	P01
Secondary-market seller fee	Open-box/ refurbished resale	8.0%	12.0%	18.0%	% of proceeds	Proxy	Varies by marketplace and channel; liquidation fee anchored at 15% in Amazon program.	Reduces recovery, more material for high-value electronics and accessories.	S35; P02
Liquidation fee	Liquidation route	10.0%	15.0%	20.0%	% of proceeds	Proxy	Amazon FBA Liquidations discloses 15%; other contracts vary.	Lowers retailer recovery but does not equal buyer premium.	S35
Adjusted current retail factor for public lots	Auction analysis	65.0%	80.0%	90.0%	% of stated retail	Assumption	Stated retail/MSRP can be stale or inflated; no line-item manifest available.	Lower adjusted value raises bid and delivered-cost percentages on the economically relevant denominator.	P02; S48
Buyer premium	Auction analysis	5.0%	10.0%	15.0%	% of winning bid	Assumption	Public pages confirm a buyer fee but do not expose the exact rate for the observed lots.	Raises buyer delivered cost; does not necessarily reduce retailer proceeds.	P02; S49
Seller-side auction/agency fee	Auction analysis	0.0%	5.0%	10.0%	% of winning bid	Assumption	Retailer-specific agent settlement is not public.	Reduces estimated retailer net recovery.	P02
Return-center labor mix	Disposition processing	0.75	1.00	1.50	x base cost	Assumption	Public filings do not disclose inspection or diagnostic minutes.	Matters most where item-level testing is intensive or retail value is low.	P01
Holding-period multiplier	All disposition routes	0.50	1.00	2.00	x base days	Assumption	Actual dwell time and queueing are undisclosed.	Raises physical storage cost and compounds depreciation/discounting.	P01; S27
Refurbishment success	Refurbishable products	50.0%	65%-85% by category	90.0%	% successful	Assumption/ proxy	Public channels prove refurbishment exists but do not disclose success rates.	Changes whether repair beats outlet or liquidation.	S11; S33; S39; P02
Restocking fee or non-refundable charge (K)	Base cases	0.00	0.00	15% of R sensitivity	$/order	Assumption	Base model does not assume a retained fee without product-specific evidence.	Reduces customer refund and dollar return tax one-for-one.	P01
Landed	Basic clothing	$4.00	$6.00	$8.00	$	Assumption	No product-	Does not	P01; P02

Assumption	Scope	Low	Base	High	Units	Classification	Justification	Effect	Sources
product cost (C)	item ($20)						level COGS supplied; calibrated to category margin structure.	change return-tax dollars under the specified incremental formula, but changes post-return loss and tax as % of kept contribution.	
Outbound fulfillment and shipping (Fo)	Basic clothing item ($20)	$3.38	$4.50	$6.08	$	Proxy	Calibrated to package size and public carrier/WFS anchors; actual negotiated rates unknown.	Changes kept and post-return contribution equally; does not change incremental return-tax dollars unless used again as secondary transport.	S17; S21-S26
Return rate (p_r)	Basic clothing item ($20)	18.8%	25.0%	31.2%	% of orders	Assumption/ proxy	Category-specific population rates are not consistently disclosed; broad online and furniture anchors used.	Scales expected return tax per order linearly.	S34; S40; P01
Inspection minutes	Basic clothing item ($20)	1.88	2.50	3.75	minutes	Assumption	Labor minutes are a named research gap.	Can flip retrieval decisions for low-value items.	P01
Monthly product depreciation	Basic clothing item ($20)	1.0%	2.0%	4.0%	% per month	Proxy/ assumption	Electronics market evidence supports faster depreciation; other categories use lower proxies.	Penalizes slow resale and refurbishment.	S39; P02
Confirmed substitution/counterfeit probability	Basic clothing item ($20)	0.0%	2.0%	4.0%	% of returns	Assumption	Industry estimates combine fraud, abuse, and claims and are not category-specific; model uses narrower confirmed-event probabilities.	Reduces expected recovery and can justify serial/authentication controls.	S31; P01
Landed product cost (C)	Cosmetic/ personal-care item ($20)	$3.00	$5.00	$7.00	$	Assumption	No product-level COGS supplied; calibrated to category margin structure.	Does not change return-tax dollars under the specified incremental formula, but changes post-return loss and tax as % of kept contribution.	P01; P02
Outbound fulfillment and shipping (Fo)	Cosmetic/ personal-care item ($20)	$3.00	$4.00	$5.40	$	Proxy	Calibrated to package size and public carrier/WFS anchors; actual negotiated rates unknown.	Changes kept and post-return contribution equally; does not change incremental return-tax dollars unless used again as secondary transport.	S17; S21-S26
Return rate (p_r)	Cosmetic/ personal-care item ($20)	7.5%	10.0%	12.5%	% of orders	Assumption/ proxy	Category-specific population rates are not consistently disclosed; broad online and furniture anchors used.	Scales expected return tax per order linearly.	S34; S40; P01
Inspection minutes	Cosmetic/ personal-care item ($20)	1.12	1.50	2.25	minutes	Assumption	Labor minutes are a named research gap.	Can flip retrieval decisions for low-value items.	P01

Assumption	Scope	Low	Base	High	Units	Classification	Justification	Effect	Sources
Monthly product depreciation	Cosmetic/ personal-care item ($20)	0.8%	1.5%	3.0%	% per month	Proxy/ assumption	Electronics market evidence supports faster depreciation; other categories use lower proxies.	Penalizes slow resale and refurbishment.	S39; P02
Confirmed substitution/counterfeit probability	Cosmetic/ personal-care item ($20)	0.0%	1.0%	2.0%	% of returns	Assumption	Industry estimates combine fraud, abuse, and claims and are not category-specific; model uses narrower confirmed-event probabilities.	Reduces expected recovery and can justify serial/authentication controls.	S31; P01
Landed product cost (C)	Small household product ($20)	$5.00	$7.00	$9.00	$	Assumption	No product-level COGS supplied; calibrated to category margin structure.	Does not change return-tax dollars under the specified incremental formula, but changes post-return loss and tax as % of kept contribution.	P01; P02
Outbound fulfillment and shipping (Fo)	Small household product ($20)	$4.12	$5.50	$7.43	$	Proxy	Calibrated to package size and public carrier/WFS anchors; actual negotiated rates unknown.	Changes kept and post-return contribution equally; does not change incremental return-tax dollars unless used again as secondary transport.	S17; S21-S26
Return rate (p_r)	Small household product ($20)	9.0%	12.0%	15.0%	% of orders	Assumption/ proxy	Category-specific population rates are not consistently disclosed; broad online and furniture anchors used.	Scales expected return tax per order linearly.	S34; S40; P01
Inspection minutes	Small household product ($20)	1.50	2.00	3.00	minutes	Assumption	Labor minutes are a named research gap.	Can flip retrieval decisions for low-value items.	P01
Monthly product depreciation	Small household product ($20)	0.2%	0.5%	1.0%	% per month	Proxy/ assumption	Electronics market evidence supports faster depreciation; other categories use lower proxies.	Penalizes slow resale and refurbishment.	S39; P02
Confirmed substitution/counterfeit probability	Small household product ($20)	0.0%	1.0%	2.0%	% of returns	Assumption	Industry estimates combine fraud, abuse, and claims and are not category-specific; model uses narrower confirmed-event probabilities.	Reduces expected recovery and can justify serial/authentication controls.	S31; P01
Landed product cost (C)	Footwear/ premium apparel ($100)	$25.00	$35.00	$45.00	$	Assumption	No product-level COGS supplied; calibrated to category margin structure.	Does not change return-tax dollars under the specified incremental formula, but changes post-return loss and tax as % of kept contribution.	P01; P02
Outbound fulfillment and shipping (Fo)	Footwear/ premium apparel ($100)	$5.25	$7.00	$9.45	$	Proxy	Calibrated to package size and public carrier/WFS anchors; actual	Changes kept and post-return contribution equally; does not change	S17; S21-S26

Assumption	Scope	Low	Base	High	Units	Classification	Justification	Effect	Sources
							negotiated rates unknown.	incremental return-tax dollars unless used again as secondary transport.	
Return rate (p_r)	Footwear/ premium apparel ($100)	22.5%	30.0%	37.5%	% of orders	Assumption/ proxy	Category-specific population rates are not consistently disclosed; broad online and furniture anchors used.	Scales expected return tax per order linearly.	S34; S40; P01
Inspection minutes	Footwear/ premium apparel ($100)	3.00	4.00	6.00	minutes	Assumption	Labor minutes are a named research gap.	Can flip retrieval decisions for low-value items.	P01
Monthly product depreciation	Footwear/ premium apparel ($100)	1.0%	2.0%	4.0%	% per month	Proxy/ assumption	Electronics market evidence supports faster depreciation; other categories use lower proxies.	Penalizes slow resale and refurbishment.	S39; P02
Confirmed substitution/counterfeit probability	Footwear/ premium apparel ($100)	0.0%	3.0%	6.0%	% of returns	Assumption	Industry estimates combine fraud, abuse, and claims and are not category-specific; model uses narrower confirmed-event probabilities.	Reduces expected recovery and can justify serial/authentication controls.	S31; P01
Landed product cost (C)	Headphones/ small electronics ($100)	$35.00	$45.00	$55.00	$	Assumption	No product-level COGS supplied; calibrated to category margin structure.	Does not change return-tax dollars under the specified incremental formula, but changes post-return loss and tax as % of kept contribution.	P01; P02
Outbound fulfillment and shipping (Fo)	Headphones/ small electronics ($100)	$4.50	$6.00	$8.10	$	Proxy	Calibrated to package size and public carrier/WFS anchors; actual negotiated rates unknown.	Changes kept and post-return contribution equally; does not change incremental return-tax dollars unless used again as secondary transport.	S17; S21-S26
Return rate (p_r)	Headphones/ small electronics ($100)	9.0%	12.0%	15.0%	% of orders	Assumption/ proxy	Category-specific population rates are not consistently disclosed; broad online and furniture anchors used.	Scales expected return tax per order linearly.	S34; S40; P01
Inspection minutes	Headphones/ small electronics ($100)	6.00	8.00	12.00	minutes	Assumption	Labor minutes are a named research gap.	Can flip retrieval decisions for low-value items.	P01
Monthly product depreciation	Headphones/ small electronics ($100)	1.5%	3.0%	6.0%	% per month	Proxy/ assumption	Electronics market evidence supports faster depreciation; other categories use lower proxies.	Penalizes slow resale and refurbishment.	S39; P02
Confirmed substitution/counterfeit probability	Headphones/ small electronics ($100)	0.0%	5.0%	10.0%	% of returns	Assumption	Industry estimates combine fraud, abuse, and claims and are not category-specific; model	Reduces expected recovery and can justify serial/authentication controls.	S31; P01

Assumption	Scope	Low	Base	High	Units	Classification	Justification	Effect	Sources
							uses narrower confirmed-event probabilities.		
Landed product cost (C)	Small appliance ($100)	$32.00	$42.00	$52.00	$	Assumption	No product-level COGS supplied; calibrated to category margin structure.	Does not change return-tax dollars under the specified incremental formula, but changes post-return loss and tax as % of kept contribution.	P01; P02
Outbound fulfillment and shipping (Fo)	Small appliance ($100)	$7.50	$10.00	$13.50	$	Proxy	Calibrated to package size and public carrier/WFS anchors; actual negotiated rates unknown.	Changes kept and post-return contribution equally; does not change incremental return-tax dollars unless used again as secondary transport.	S17; S21-S26
Return rate (p_r)	Small appliance ($100)	11.2%	15.0%	18.8%	% of orders	Assumption/ proxy	Category-specific population rates are not consistently disclosed; broad online and furniture anchors used.	Scales expected return tax per order linearly.	S34; S40; P01
Inspection minutes	Small appliance ($100)	7.50	10.00	15.00	minutes	Assumption	Labor minutes are a named research gap.	Can flip retrieval decisions for low-value items.	P01
Monthly product depreciation	Small appliance ($100)	0.5%	1.0%	2.0%	% per month	Proxy/ assumption	Electronics market evidence supports faster depreciation; other categories use lower proxies.	Penalizes slow resale and refurbishment.	S39; P02
Confirmed substitution/counterfeit probability	Small appliance ($100)	0.0%	3.0%	6.0%	% of returns	Assumption	Industry estimates combine fraud, abuse, and claims and are not category-specific; model uses narrower confirmed-event probabilities.	Reduces expected recovery and can justify serial/authentication controls.	S31; P01
Landed product cost (C)	Laptop/phone premium electronics ($500)	$300.00	$350.00	$400.00	$	Assumption	No product-level COGS supplied; calibrated to category margin structure.	Does not change return-tax dollars under the specified incremental formula, but changes post-return loss and tax as % of kept contribution.	P01; P02
Outbound fulfillment and shipping (Fo)	Laptop/phone premium electronics ($500)	$7.50	$10.00	$13.50	$	Proxy	Calibrated to package size and public carrier/WFS anchors; actual negotiated rates unknown.	Changes kept and post-return contribution equally; does not change incremental return-tax dollars unless used again as secondary transport.	S17; S21-S26
Return rate (p_r)	Laptop/phone premium electronics ($500)	7.5%	10.0%	12.5%	% of orders	Assumption/ proxy	Category-specific population rates are not consistently disclosed; broad online and furniture anchors used.	Scales expected return tax per order linearly.	S34; S40; P01

Assumption	Scope	Low	Base	High	Units	Classification	Justification	Effect	Sources
Inspection minutes	Laptop/phone premium electronics ($500)	13.50	18.00	27.00	minutes	Assumption	Labor minutes are a named research gap.	Can flip retrieval decisions for low-value items.	P01
Monthly product depreciation	Laptop/phone premium electronics ($500)	1.8%	3.5%	7.0%	% per month	Proxy/ assumption	Electronics market evidence supports faster depreciation; other categories use lower proxies.	Penalizes slow resale and refurbishment.	S39; P02
Confirmed substitution/counterfeit probability	Laptop/phone premium electronics ($500)	0.0%	7.0%	14.0%	% of returns	Assumption	Industry estimates combine fraud, abuse, and claims and are not category-specific; model uses narrower confirmed-event probabilities.	Reduces expected recovery and can justify serial/authentication controls.	S31; P01
Landed product cost (C)	Furniture product ($500)	$175.00	$225.00	$275.00	$	Assumption	No product-level COGS supplied; calibrated to category margin structure.	Does not change return-tax dollars under the specified incremental formula, but changes post-return loss and tax as % of kept contribution.	P01; P02
Outbound fulfillment and shipping (Fo)	Furniture product ($500)	$56.25	$75.00	$101.25	$	Proxy	Calibrated to package size and public carrier/WFS anchors; actual negotiated rates unknown.	Changes kept and post-return contribution equally; does not change incremental return-tax dollars unless used again as secondary transport.	S17; S21-S26
Return rate (p_r)	Furniture product ($500)	13.5%	18.0%	22.5%	% of orders	Assumption/ proxy	Category-specific population rates are not consistently disclosed; broad online and furniture anchors used.	Scales expected return tax per order linearly.	S34; S40; P01
Inspection minutes	Furniture product ($500)	15.00	20.00	30.00	minutes	Assumption	Labor minutes are a named research gap.	Can flip retrieval decisions for low-value items.	P01
Monthly product depreciation	Furniture product ($500)	0.4%	0.7%	1.4%	% per month	Proxy/ assumption	Electronics market evidence supports faster depreciation; other categories use lower proxies.	Penalizes slow resale and refurbishment.	S39; P02
Confirmed substitution/counterfeit probability	Furniture product ($500)	0.0%	1.0%	2.0%	% of returns	Assumption	Industry estimates combine fraud, abuse, and claims and are not category-specific; model uses narrower confirmed-event probabilities.	Reduces expected recovery and can justify serial/authentication controls.	S31; P01
Landed product cost (C)	Premium apparel/accessory ($500)	$100.00	$150.00	$200.00	$	Assumption	No product-level COGS supplied; calibrated to category margin structure.	Does not change return-tax dollars under the specified incremental formula, but changes post-return loss and tax as % of kept contribution.	P01; P02

Assumption	Scope	Low	Base	High	Units	Classification	Justification	Effect	Sources
Outbound fulfillment and shipping (Fo)	Premium apparel/accessory ($500)	$9.00	$12.00	$16.20	$	Proxy	Calibrated to package size and public carrier/WFS anchors; actual negotiated rates unknown.	Changes kept and post-return contribution equally; does not change incremental return-tax dollars unless used again as secondary transport.	S17; S21-S26
Return rate (p_r)	Premium apparel/accessory ($500)	15.0%	20.0%	25.0%	% of orders	Assumption/ proxy	Category-specific population rates are not consistently disclosed; broad online and furniture anchors used.	Scales expected return tax per order linearly.	S34; S40; P01
Inspection minutes	Premium apparel/accessory ($500)	7.50	10.00	15.00	minutes	Assumption	Labor minutes are a named research gap.	Can flip retrieval decisions for low-value items.	P01
Monthly product depreciation	Premium apparel/accessory ($500)	0.8%	1.5%	3.0%	% per month	Proxy/ assumption	Electronics market evidence supports faster depreciation; other categories use lower proxies.	Penalizes slow resale and refurbishment.	S39; P02
Confirmed substitution/counterfeit probability	Premium apparel/accessory ($500)	0.0%	7.0%	14.0%	% of returns	Assumption	Industry estimates combine fraud, abuse, and claims and are not category-specific; model uses narrower confirmed-event probabilities.	Reduces expected recovery and can justify serial/authentication controls.	S31; P01

Appendix Table B1. Assumption register ***Source: Model***

Research limitations

1. Public route shares by category are not disclosed. The model's condition and disposition probabilities are assumptions, not measured retailer outcomes.
2. Inspection time, testing time, cleaning/repack labor, repair success, and physical storage cost are not disclosed in the package. They are explicit proxies with low/base/high cases.
3. Carrier list prices and WFS fees are visible; large-retailer negotiated freight rates are not. Freight results should be read as scenario economics, not invoices.
4. The completed-auction sample contains two public lots. It is adequate for arithmetic examples, not category medians or population inference.
5. Winning bids on the two B-Stock pages are inferred from the next required bid increment. Buyer premium, seller-side fees, and freight are not public for those exact transactions.
6. Stated retail value can exceed current realizable retail. The auction model applies an 80% base adjustment and reports both denominators.
7. Liquidation is a transfer of title, not proof of reuse. Final sale, export, parts harvesting, recycling, and disposal after auction are generally unobserved.
8. Fraud benchmarks in public reports combine different definitions. The model uses narrower category-specific assumptions and does not present them as industry disclosures.
9. The model treats A as incremental fraud administration/claims cost. Lost recovery from a counterfeit or missing return enters through the fraud condition probability, preventing double counting.
10. Fixed corporate overhead, marketing acquisition cost, tax effects, vendor allowances, insurance recoveries, customer lifetime-value changes, and environmental externalities are excluded unless separately stated.
11. Return tax is a contribution concept, not GAAP gross margin. C, Fo, and P cancel from dollar return tax under the user's specified formula but still affect post-return contribution and denominator-based metrics.
12. No new external research was added. All factual evidence and market observations come from the two supplied evidence files and their cited source lists.

Fact-check checklist

Check	Status	Owner	Notes
Every material factual claim has a source ID	Complete in draft; publication editor should re-run	Fact checker	Bracket citations map to Source Ledger.
All modeled inputs labeled disclosed/calculated/market observation/interview/proxy/assumption	Complete	Model reviewer	No interview-derived numeric input was used.
Retail price, MSRP/stated retail, current retail, retailer recovery, reseller revenue and profit remain separate	Complete	Model reviewer	Auction sheets preserve both stated and adjusted current retail denominators.
Product cost is not subtracted twice	Complete	Model reviewer	C appears once in post-return contribution and not inside recovery proceeds.
Customer refund is separated from retailer accounting exposure	Complete	Article editor	Refund = R-K; post-return contribution includes cost and recovery.
Physical recovery is separated from environmental disposition	Complete	Sustainability reviewer	Liquidation transfer remains an unobserved downstream outcome.
Open auctions excluded from completed-auction statistics	Complete	Data reviewer	No open-auction rows were supplied; open sheet is explicitly empty.
Observed auction final bids verified behind login	Open item	Data reporter	Public page supports inferred final bid from next required increment; obtain authenticated

Check	Status	Owner	Notes
			confirmation before publication.
Buyer premium and seller-side auction fee verified for each observed lot	Open item	Data reporter	Current model uses 10% buyer premium and 5% seller-side fee assumptions.
Auction freight quotes replaced with origin-destination quotes	Open item	Logistics reporter	Base freight is an explicit assumption with low/high sensitivity.
ASOS, Amazon seller-refund, Walmart/WFS and carrier policies rechecked immediately before publication	Open item	Policy fact checker	Policies and fees can change after the evidence package date.
NIST media-sanitization and USPS damaged-battery original links added	Open item	Regulatory fact checker	The package cites the rules in synthesis but does not include the original URLs in its source list.
Ulta disposal endpoint defined	Open item	Sustainability reporter	Policy establishes no resale and disposal, not landfill/recycling split.
Marketplace contracts obtained for title, fee and recovery allocation	Open item	Contracts reporter	Public policies are not enough for legal ownership at every stage.
Inspection minutes and refurbishment success validated with operators	Open item	Interviews lead	Highest-impact model gap for electronics and low-value goods.
Route shares by category obtained or uncertainty kept visible	Complete in model as assumptions	Editor	Do not relabel model route shares as company disclosures.
Return-rate benchmark methodologies kept non-comparable	Complete	Fact checker	Avoid combining Appriss and NRF fraud/return figures.
All calculations independently recalculated	Pending final workbook QA	Model reviewer	Check formulas, signs, basis points and percentage denominators.

Appendix Table C1. Fact-check checklist ***Source: Open items should be resolved before external publication.***

Source ledger

No new external sources were added. The ledger unifies the two supplied documents and their cited originals. URLs are printed for source verification; model assumptions cite source IDs rather than implying disclosure.

ID	Title	URL	Source type	Primary?	Use	Confidence	New research?
P01	Where Your Online Return Actually Goes - Executive evidence package	Local uploaded file	Evidence package / synthesis	No - synthesis of cited originals	Policies, operating models, cost anchors, ownership, regulation, sustainability, fraud	High as package record; varies by underlying source	No
P02	The Market After the Refund	Local uploaded file	Evidence package / synthesis	No - synthesis of cited originals	Liquidation recovery, auction observations, reseller economics, archetype ranges	High as package record; limited sample for auctions	No
S01	Amazon 2025 Form 10-K	https://www.sec.gov/Archives/edgar/data/1018724/000101872426000004/amzn-20251231.htm	SEC filing	Yes	Return liability and recovery asset; Amazon retail accounting	High	No
S02	Walmart Marketplace Learn - Add a Keep It Rule	https://marketplacelearn.walmart.com/guides/Order%20management/Returns%20%26%20refunds/Add-a-Keep-It-Rule	Official seller policy	Yes	Returnless-refund rules and seller control	High	No
S03	Target returns help	https://www.target.com/help/articles/returns-exchanges/returns	Official consumer policy	Yes	Target and Target Plus customer return routing	High	No
S04	Target Reverse Logistics Expert role	https://corporate.target.com/jobs/w43/09/reverse-logistics-expert	Official job posting	Yes	CRC, donation, salvage, electronics recycling, vendor credits; tasks only, not throughput	Medium-high	No
S05	eBay - Refunding buyers	https://www.ebay.com/help/selling/managing-returns-refunds/refunding-buyers?id=5182	Official marketplace policy	Yes	Inspection/refund sequence and seller fund deductions	High	No
S06	Amazon FBA Grade & Resell announcement	https://sellercentral.amazon.com/seller-forums/discussions/t/e53f277f-a59a-4b86-aceb-df824793e2a3	Official seller communication	Yes	Used-condition grading channel and seller of record	High for program existence	No
S07	Amazon FBA Liquidations help	https://sellercentral.amazon.com/help/hub/reference/external/GYVCG5Q3BEJ6MLMF	Official seller program	Yes	Liquidation disposition channel	High	No
S08	Ulta Beauty guest services - returns	https://www.ulta.com/guestservices/all	Official consumer policy	Yes	No resale of used, damaged, or expired returned products; disposal	High	No
S09	Amazon FBA overview	https://sell.amazon.com/fulfillment-by-amazon	Official seller program	Yes	Platform processing of seller returns	High	No
S10	Walmart standard return policy	https://www.walmart.com/help/article/walmart-standard-return-policy/adc0dfb692954e67a4de206fb8d9e03a	Official consumer policy	Yes	Return windows and marketplace exceptions	High	No
S11	Best Buy return and exchange policy	https://www.bestbuy.com/site/help-topics/return-exchange-policy/pcmcat260800050014.c?id=pcmcat260800050014	Official consumer policy	Yes	Opened-item restrictions and condition channels	High	No
S12	Wayfair 2025 Form 10-K	https://www.sec.gov/Archives/edgar/data/1616707/000161670726000027/w-20251231.htm	SEC filing	Yes	Bulky-product handling, transit damage, network footprint	High	No

ID	Title	URL	Source type	Primary?	Use	Confidence	New research?
S13	IKEA U.S. return policies	https://www.ikea.com/us/en/customer-service/returns-claims/	Official consumer policy	Yes	Open/unopened return windows and store-network counterexample	High	No
S14	Nike return policy	https://www.nike.com/help/a/returns-policy	Official consumer policy	Yes	DTC apparel return rules	High	No
S15	ASOS return policy	https://www.asos.com/customer-care/returns-refunds/what-is-your-returns-policy/	Official consumer policy	Yes	Fair-use policy and high-return-customer fee	High	No
S16	FDA - Cosmetics and U.S. law	https://www.fda.gov/cosmetics/cosmetics-laws-regulations/cosmetics-us-law	Regulator guidance	Yes	Cosmetics safety and labeling legal floor	High	No
S17	UPS shipping dimensions and weight	https://www.ups.com/us/en/support/shipping-support/shipping-dimensions-weight	Official carrier guidance	Yes	DIM divisor and dimensional-weight mechanics	High	No
S18	Nordstrom 2024 Form 10-K	https://www.sec.gov/Archives/edgar/data/72333/000007233325000039/jwn-20250201.htm	SEC filing	Yes	Majority of returns through stores	High	No
S19	Amazon Liquidation Auctions on B-Stock	https://bstock.com/auctions/amazon/	Liquidation marketplace	Market observation	Channel existence	Medium	No
S20	Nike 2025 Form 10-K	https://www.sec.gov/Archives/edgar/data/320187/000032018725000047/nke-20250531.htm	SEC filing	Yes	Sales returns reserve and inventory reserve	High	No
S21	Walmart Fulfillment Services fees	https://marketplacelearn.walmart.com/guides/Walmart%20Fulfillment%20Services%20%28WFS%29/WFS%20basics/WFS-fees	Official seller fee schedule	Yes	Standard and big-and-bulky return-processing cost anchors	High	No
S22	UPS 2026 daily rates	https://assets.ups.com/adobe/assets/urn%3Aaaid%3Aaem%3A356d938a-4f0a-4c71-b50e-bdd890f50b47/original/as/daily-rates-us-en.pdf	Official carrier tariff	Yes	Residential, additional-handling, and large-package surcharge anchors	High for list rates; medium for realized merchant cost	No
S23	FedEx 2026 Service Guide	https://www.fedex.com/content/dam/fedex/us-united-states/services/Service_Guide_2026.pdf	Official carrier guide	Yes	Residential surcharge anchor	High for list rates	No
S24	FedEx 2026 surcharge and fee changes	https://www.fedex.com/content/dam/fedex/us-united-states/services/surcharge_and_fee_changes_2026.pdf	Official carrier tariff	Yes	Packaging-based additional handling	High for list rates	No
S25	USPS Notice 123	https://pe.usps.com/text/dmm300/notice123.htm	Official postal price schedule	Yes	Flat-rate reverse-shipping anchors	High	No
S26	USPS 2026 temporary transportation-related price change	https://about.usps.com/newsroom/national-releases/2026/0325-usps-announces-transportation-related-time-limited-price-change.htm	Official postal announcement	Yes	Current temporary price uplift	High	No
S27	Happy Returns product claims	https://happyreturns.com/	Vendor marketing	Vendor claim	Consolidation speed and restocking-time claim	Low-medium	No
S28	Walmart Liquidation Auctions on B-Stock	https://bstock.com/auctions/walmart/	Liquidation marketplace	Market observation	Channel existence and public listings	Medium	No
S29	CPSC - Stop online sale of recalled products	https://www.cpsc.gov/Business--Manufacturing/Business-Education/ResaleThrift-Stores-Information-Center/Stop-Online-Sale-of-Recalled-Products	Regulator guidance	Yes	Recalled goods cannot be offered for sale	High	No

ID	Title	URL	Source type	Primary?	Use	Confidence	New research?
S30	Amazon 2024 Sustainability Report	https://sustainability.aboutamazon.com/2024-amazon-sustainability-report.pdf	Company sustainability report	Yes for company claim	391 million items resold or donated claim and denominator audit	High for claim; limited comparability	No
S31	Appriss Retail 2024 Consumer Returns report	https://apprissretail.com/resources/2024-consumer-returns-report/	Sponsor-generated industry report	Survey/report	Fraud and return-rate headline benchmarks	Medium-low due definitions and sponsorship	No
S32	Online auction field study of end-of-life apparel inventory	https://www.researchgate.net/publication/222881906_Can_retailers_get_higher_prices_for_end-of-life_inventory_through_online_auctions	Academic field study	Yes for study sample	11,879 auctions; 13.11% private-label and 16.339% national-brand recovery	Medium-high; category- and period-specific	No
S33	Apple Certified Refurbished store	https://www.apple.com/shop/refurbished	Official resale storefront	Market observation	Final consumer-facing refurbished price up to roughly 85% of new	High for observed channel; not retailer liquidation recovery	No
S34	NRF and Happy Returns 2024 retail returns release	https://nrf.com/media-center/press-releases/nrf-and-happy-returns-report-2024-retail-returns-total-890-billion	Industry association / vendor report	Survey estimate	2024 return volume and rate context	Medium	No
S35	Amazon seller communication - FBA Liquidations typical recovery	https://sellercentral.amazon.com/seller-forums/discussions/t/7baf9138523e2e98ec8eb5f91875dd80	Official seller communication	Yes for program claim	Typical 5%-10% of average selling price and fee structure	High within program; low generalizability	No
S36	B-Stock Walmart eBikes lot 150245	https://walmart.bstock.com/auction/auction/view/id/150245/	Completed auction observation	Market observation	12 units, $3,058 stated retail, inferred ~$600 bid	Medium-high for visible fields; freight/fees hidden	No
S37	B-Stock Walmart microwaves lot 150184	https://walmart.bstock.com/auction/auction/view/id/150184/	Completed auction observation	Market observation	102 units, $7,004 stated retail, inferred ~$1,020 bid	Medium-high for visible fields; freight/fees hidden	No
S38	Liquidation.com marketplace	https://www.liquidation.com/	Liquidation marketplace	Market observation	Mixed condition taxonomy and market structure	Medium	No
S39	B-Stock - State of B2B Recommerce recap	https://bstock.com/blog/the-state-of-b2b-recommerce-a-recap/	Marketplace analysis	Vendor analysis	Electronics recovery ranking and depreciation observations	Medium	No
S40	B-Stock - Furniture e-commerce returns	https://bstock.com/blog/bigger-buys-bigger-returns-bigger-challenges-for-furniture-e-commerce/	Marketplace analysis / case study	Vendor analysis	Furniture return-rate claim and recovery improvement case study	Medium-low for population inference	No
S41	Sephora returns and exchanges	https://www.sephora.com/beauty/returns-exchanges	Official consumer policy	Yes	Beauty returns including gently used products	High	No
S42	AuctionMethod retail liquidation industry report	https://www.auctionmethod.com/hubfs/blog-files/Comprehensive%20Report%20on%20the%20Retail%20Liquidation%20Auction%20Industry.pdf	Industry review	No	10%-30% mixed-return range and bin-store operating observations	Low-medium	No
S43	B-Stock Austin liquidation auctions	https://bstock.com/auctions/united-states/texas/austin-tx/	Liquidation marketplace	Market observation	Buyer-market/channel visibility	Medium	No
S44	B-Stock reseller case study - Jim Rowe	https://bstock.com/blog/how-jim-rowe-filled-a-shopping-desert-with-costco-returns/	Vendor case study	Interview/case	Downstream reseller labor and channel creation	Low-medium; survivor bias	No
S45	Liquidation.com terms and conditions	https://www.liquidation.com/c/terms.html	Marketplace contract terms	Yes	Manifest-dispute timing and buyer risk transfer	High for terms	No
S46	B-Stock / JCPenney centralized returns case	https://www.linkedin.com/posts/bstocksolutions_case-study-how-jcpenney-scaled-its-b2b-resale-activity-7480644364512169984-7ZdR	Vendor case-study promotion	Company claim	Recovery pricing improvement and buyer competition	Low-medium	No

ID	Title	URL	Source type	Primary?	Use	Confidence	New research?
S47	B-Stock reseller case study - Shannon Jean	https://bstock.com/blog/an-uncommon-life-in-reselling-meet-shannon-jean/	Vendor case study	Interview/case	Reseller scale, repair and resale economics	Low-medium; survivor bias	No
S48	B-Stock listing factors and recovery modeling	https://bstock.com/blog/what-factors-make-or-break-your-listings-b-stock-uses-data-predictive-modeling-to-find-out/	Marketplace analysis	Vendor analysis	Manifest/information and current-value denominator cautions	Medium	No
S49	Amazon U.S. Liquidation Auctions shipping	https://bstock.com/amazon/shipping/	Marketplace shipping terms	Yes for marketplace rules	Liftgate, residential, unloading, and freight accessorials	High for stated terms	No

Appendix Table D1. Unified source ledger ***Source: P01 and P02 are the supplied evidence documents; S01-S49 are their cited originals.***

Publication note

The model is designed to be edited, not treated as a black box. The accompanying spreadsheet contains the product inputs, condition mixes, logistics costs, disposition economics, route selections, returnless comparison, sensitivities, auction calculations, fraud controls, ownership ledger, source ledger and fact-check register. Any publication should preserve the distinction between observed facts, market examples and modeled assumptions.