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Repair or replace? A Market-Based Analysis of Household Appliance Repair Viability in France and Belgium

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Abstract

Repair price strongly shapes consumer decisions between repair and replacement. High repair prices relative to the cost of new products often deter repair, driving premature replacement and electronic waste. This study assesses the economic viability of repair for washing machines (WMs) and vacuum cleaners (VCs) in France and Belgium using real market data and two willingness-to-pay-for-repair (WTPR) models. Case studies of six representative appliances show a consistent pattern: low-cost products fall far outside consumers' repair thresholds, mid-range models sit in borderline zones, and only high-end units remain economically repairable. Threshold analysis shows that repair becomes viable only at higher purchase prices, generally €300-€1,000 depending on the WTPR model, repair prices, and product tier. A market-wide Monte Carlo simulation confirms these trends. Only 5% of Belgian WMs and 16% of French WMs fall within viable repair thresholds. For VCs, around 67% of VCs sold in France and Belgium are unlikely to be repaired. Scaled to 2024 sales, this equates to roughly 3.5 million appliances in France and 1.3 million in Belgium, effectively steered toward replacement. The study offers a scalable method for estimating national repair rates and highlights the need for improved WTPR models to support emerging EU repair policies.

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1. Introduction

Repair rates for out-of-warranty consumer electronics and household appliances remain too low to meaningfully support a circular economy [1]. High repair prices, poor access to spare parts, and product designs that hinder repairability continue to push consumers toward replacement, even among those with environmental motivations [2]. The European Union, and France in particular, are often viewed as policy leaders in promoting repair and tackling electronic waste [3]. However, despite this reputation, actual out-of-warranty repair activity remains limited. In 2019, the professional repair rate for electrical and electronic equipment (EEE) outside the warranty period in France stood at just 10%, based on an estimated 94 million failures and 9.4 million completed repairs [4]. This gap is starker when broken down by product type: large household appliances (LHA) had a 16.1% repair rate, while small household appliances (SHA) fared far worse at just 4.6% [4], [5], [6]. These figures contrast sharply with in-warranty repair rates, which typically range from 30% to 40% across categories [7], [8]. The low out-of-warranty repair rate in France can be attributed to a mix of technical, economic, and informational barriers. Roskladka et al. [9] identified five major obstacles to washing machine repair, ranked by impact: high diagnosis and repair prices, limited spare parts availability, missing or unclear repair manuals, insufficient repair service access, and the time burden on consumers. Of these, repair prices were found to be the most critical, a conclusion echoed across multiple studies [10], [11], [12], [13]. When replacement appears more affordable or convenient, consumer willingness to choose repair drops significantly [12]. For SHAs, low purchase prices make professional repair unattractive, likely explaining France's 4.6% out-of-warranty repair rate. Spare parts represent the second major barrier [9]. In 46% of cases, repairs could not proceed due to part unavailability, and in 20% of cases, parts were deemed too costly [14], [15], [16]. The third group of barriers involves the lack of repair documentation and the limited availability of nearby repair services [9]. The scarcity

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of accessible repair options adds further friction, making replacement the default option for many.

Existing studies have examined consumer repair attitudes and product lifetime extension, but few have quantified repair viability using real market data. This paper addresses that gap by assessing repair likelihood in France (FR) and Belgium (BE) using product prices, repair prices, and two willingness-to-pay-for-repair (WTPR) models.

2. Methodology

Repair viability is defined by whether repair prices fall within a consumer's WTPR threshold. A two-stage approach was used. Stage 1 applies the WTPR models to six representative appliances. Stage 2 scales the analysis using Monte Carlo simulation based on weighted purchase-price distributions and fitted repair-price distributions.

2.1. Stage 1 - Case Study Analysis

2.1.1. Appliance Selection

Six appliances were selected for the case study: three washing machines (WMs), representing LHAs, and three vacuum cleaners (VCs), representing SHAs. Each category included an entry-level, mid-range, and high-end model. Where possible, equivalent models available in both France and Belgium were chosen to ensure comparability. For each appliance, purchase prices, extended-warranty prices, and repairability/durability indices were collected from major retailers. Price data reflect a snapshot taken on 07/08/25, and where available, were supplemented with price histories from July 2024 to July 2025 from price tracking websites in the two countries. Repair/Durability indices, which indicate to consumers how repairable/durable a product is, were taken from the French Indice de Réparabilité (for SHAs/VCs) and the French Indice de Durabilité (for LHAs/WMs). Belgium's Repair index was only available for VCs at the time of writing.

2.1.2. Repair Market Mapping

Repair service options for LHA and SHA were mapped across original equipment manufacturers (OEMs), retailers, and independent repairers. Collected data included quote-rejection fees, labour rates, inclusion of spare parts, and repair warranties. For the WTPR analysis, the mean values of repair in France and Belgium for LHA and SHA are used.

2.1.3. Customer Willingness-to-pay-for-repair (WTPR)

Two WTPR models were used to estimate consumer repair decisions. The first (1) uses Adler and Hlavacek's 1976 price sensitivity formula [17], which assigns higher relative repair costs to cheaper products and lower ones to expensive items, using a piecewise linear equation. The unmodified equations create discontinuities at the €100 and €200 thresholds, where small price differences can produce sharply different WTPR values. These jumps are a known limitation but were retained for consistency with the literature.

- ≤ €100: WTPR = €6.95 + 21.1% of price.
- €100-200: WTPR = €38.05 + 7.4% of price.
- ≥ €200: WTPR = €48.04 + 7.0% of price.

The second method (2), developed by Fachbach et al., is based on survey data on household appliance repair behaviour. It estimates WTPR as 30.72% of the purchase price, with a large standard deviation (SD = 17.66%) reflecting wide variation in consumer preferences [18]. The SD isn't applied in Figure 1 below, but is discussed at the end of *Section 3.2.3*.

- WTPR = 30.72% of product price

WTPR estimates from both models were compared with mean repair prices for each appliance type in France and Belgium, excluding spare-part costs. Repair outcomes were classified as "likely" when the repair price was below 90% of WTPR, "borderline" between 90% and 110%, and "unlikely" above 110%. Extended warranty viability was assessed using the warranty-to-purchase-price ratio: below 10% "likely," 10% to 20% "borderline," and above 20% "unlikely".

2.2. Stage 2 - Market-Wide Simulation

To extend beyond individual case studies, a market-level approach was applied, as shown in Figure 1.



Figure 1: Market-Wide Simulation methodology

First, national sales volumes and average prices were obtained from official 2024 data. Retailer and price-tracking catalogues were then scraped to construct initial purchase-price datasets, with products taken in the order displayed online, which generally reflects sales popularity. Because unweighted averages often overestimated market prices, particularly when high-priced, low-volume models appeared frequently, a reverse exponential weighting was applied to produce price distributions that aligned with national benchmarks.

Repair-price distributions were derived from Belgian retailer data and adjusted for France based on differences in fixed-price repair schemes. Several probability distributions were fitted to both purchase- and repair-price datasets, with the Akaike Information Criterion (AIC) and closeness of fitted means guiding distribution selection. A Monte Carlo simulation was then run by sampling a purchase price and a repair price from the fitted distributions for each iteration. For every sampled purchase price, WTPR was calculated and compared with the sampled repair price to classify the outcome as likely, borderline, or unlikely to be repaired. Aggregated results generated national repair-likelihood estimates for WMs and VCs, which were compared against national sales data.

3. Results and Discussion

3.1. Case study Appliances Selected

For WMs, entry-level models were the cheapest Proline units (€199 BE, €229 FR), mid-range models were the most popular Bosch units (€499 BE, €399 FR), and high-end models were the most expensive Miele machines (€2,299 BE, €2,699 FR). For VCs, the tiers follow the same logic: the cheapest Proline models (€50 BE, €40 FR), the most popular Dyson units (around €279), and the most expensive Samsung models (€1,099 BE, €1,349 FR). These models capture the lowest-priced, most popular, and highest-priced options on major French and Belgian retailer sites at the time of writing.

3.2. Repair Options and Provider Pricing

In both France and Belgium, consumers typically access repair services through one of three main provider types: original equipment manufacturers (OEMs), independent repairers, and retailers. Notably, France has introduced a national "repair bonus" scheme, which subsidises appliance repair prices, €50 for washing machines and €40 for vacuum cleaners [19], [20]. These discounts have been applied in the analysis and tables presented below.

3.2.1. LHA Repair Options

For LHAs, repairs typically begin with a call-out and in-person quote. If rejected, fees range from €69-150, creating a notable upfront barrier and directly affecting willingness-to-pay-for-a-quote (WTPQ). When this fee exceeds a customer's tolerance, many decide not to initiate the repair process at all. Some providers offer rejection vouchers, though these often incentivise replacement rather than repair.

Repair pricing structures differ substantially across countries. In Belgium, OEMs and independent repairers generally use variable, time-based pricing, making repair costs uncertain and potentially escalating. In France, most providers use fixed-price repair schemes, offering more predictable costs. This predictability is further reinforced by the national repair bonus, which provides an immediate discount on eligible repairs and effectively lowers the perceived financial risk for consumers. Spare parts are typically charged separately, except under certain premium fixed-price packages. OEM services tend to be the most expensive but include longer warranties; independent repairers are cheaper with short warranties; and retailers offer mid-range prices and warranty terms. The relative country-specific mean repair prices for WM and VC were used in the WTPR calculation. SI-1 summarises these structures and prices across both countries, as well as briefly describing the repair subscription models.

3.2.2. SHA Repair Options

For SHAs, such as VCs, professional repair options are far more limited than for LHAs. OEMs and retailers typically offer flat-rate repair services, generally between €80 and €107, while independent repairers rarely service these products. Unlike LHAs, customers must physically transport or post the appliance to a retailer/OEM repair centre. After inspection, the repair provider issues a repair quote that the customer must accept or reject. This again relates to WTPQ, since customers must still pay a minimum amount to obtain a quote, which can deter many SHAs from entering the repair process.

In Belgium, VanDen Borre charges €107 for SHA repairs, including parts. In France, Darty offers a flat-rate repair of €80, excluding parts. Community initiatives such as Herstel Hub in Leuven, Belgium [21] provide lower-cost alternatives but are excluded from the main analysis.

3.2.3. Customer WTPR

Table 1 presents the WTPR estimates for each appliance based on the (1) Adler & Hlavacek and (2) Fachbach et al. models, classifying the likelihood of repair acceptance when compared to the prevailing repair prices. For WMs, the mean out-of-warranty repair prices used for comparison were €96 (15-minute repair) and €155 (60-minute repair) in Belgium, and €86 under France's fixed-price repair schemes. For VCs, repair prices of €107 in Belgium and €80 in France were applied. Based on these prices, the Adler and Hlavacek model generally requires purchase prices above €600-€1,000 before repair becomes economically viable, while the proportional model by Fachbach et al. produces lower thresholds of roughly €300-€400, depending on the appliance.

The case-study outcomes follow these thresholds closely. Low-cost WMs and VCs were almost always classified as "unlikely" to be repaired, regardless of country, with one exception being the Proline WM using the second WTPR method applied in France. Repair prices frequently equalled 50-100% of the purchase price, far above both WTPR estimates, leaving no realistic repair pathway. Repair/durability indices were also lowest in this tier (5.7-6.7), though still mid-range overall. Extended warranty ratios were high (43-126%), leading to uniformly "unlikely" warranty decisions.

Mid-range products showed borderline viability. WTPR values (€68-153) were closer to repair prices, and outcomes differed by method, with the Fachbach et al. model frequently shifting decisions into "likely." French models benefited from lower, fixed repair prices, while Belgian outcomes remained less favourable. Repairability indices improved (7.3-8.9) but did not offset cost barriers, and warranty ratios (18-30%) still produced mostly unlikely or borderline decisions.

High-end appliances were consistently "likely" to be repaired across both countries, along with high repair/durability indices. High WTPR values (€209-829) remained above mean repair prices under both repair durations, and low warranty ratios (6-13%) made both repair and extended cover likely.

Repair indices varied only slightly across products (2.2 points for WMs, 3.4 for VCs), meaning even the cheapest models received mid-range ratings despite clear economic barriers to repair. The second WTPR method has a large SD (17.66%), meaning that if the SD is applied, then at the lower bound, almost all appliances become "unlikely," while at the upper bound, nearly all become "likely," regardless of repair price. This wide variability limits its predictive value and is why it was excluded from section *3.3 Market-Wide Application.*

Table 1: Overview of case study models for WMs and VCs in France and Belgium, showing WTPR estimates using (1) Adler & Hlavacek; (2) Fachbach et al. and resulting warranty/repair decisions. Repair decision is based on mean 15/60min repair price for the relevant country/product

Price range	Country	Model	Supplier	Purchase Price (07/08/25)	Purchase Price History (€)	Repair/ Durability index	Extended Warranty price ratio	WTPR (1), (2)	Extended Warranty decision	Repair Decision 15min (1), (2)	Repair Decision 60min (1), (2)	Ref
Washing Machines (WMs)												
Cheapest	BE	Proline FP6120D WH	VanDen Borre	€ 199	N/A	N/A	65%	€ 53, € 61		Unlikely		[22]
	FR		Darty	€ 229	210 - 233 - 250	6.7 (Dura)	43%	€ 64, € 70	Unlikely	Unlikely, Borderline	Unlikely, Likely	[23], [24]
Mid-range/ Popular	BE	Bosch WGE03400FG	VanDen Borre	€ 499	479 - 549 - 729	N/A	26%	€ 83, € 153	Unlikely	Borderline, Likely	Unlikely, Borderline	[22], [25]
	FR	Bosch WAN28258FR	Cdiscount	€ 399	325 - 427 - 489	8.9 (Dura)	18%	€ 76, € 123	Borderline	Borderline, Likely	Borderline, Likely	[24], [26]
Most expensive	BE	Miele WQ 10000	VanDen Borre	€ 2299	2249 - 2379 - 2499	N/A	6%	€ 209, € 706		Likely		[22], [25]
	FR		Boulanger	€ 2699	2699 - 2707 - 2849	8.9 (Dura)	7%	€ 237, € 829		Likely		[24], [27]
Vacuum cleaners (VCs)												
Cheapest	BE	Proline BVC2LB	VanDen Borre	€ 39	N/A	6.1	126%	€ 15, € 12		Unlikely		[22]
	FR		Darty	€ 49	N/A	5.7	N/A	€ 17, € 15		Unlikely		[23]
Mid-range/ Popular	BE	Dyson V8 Advanced	VanDen Borre	€ 279	266 - 340 - 399	7.3	25%	€ 68, € 86	Unlikely	Unlikely, Borderline		[22], [25]
	FR		Darty		249 - 320 - 389	7.3	30%		Unlikely	Borderline, Likely		[23], [24]
Most expensive	BE	Samsung Jet Ultra - VS90F40EEK	VanDen Borre	€ 1099	1099 - 1233 - 1347	8.7	6%	€ 125, € 338		Likely		[22], [25]
	FR		Darty	€ 1349	917 - 1156 - 1349	9.5	13%	€ 142, € 414	Borderline	Likely		[23], [24]

3.3. Market-Wide Application

National sales volumes for 2024 were 2.8 million WMs and 3.0 million VCs in France, and 0.6 million WMs and 1.0 million VCs in Belgium [28], [29]. Retailer and price-tracker catalogues (Idealo for France, VanDen Borre and Krefel for Belgium) were scraped to construct initial price datasets. These lists were taken in the order displayed on retailer websites, which typically corresponds to sales popularity. However, the unweighted means of these datasets did not match national averages, particularly in Belgium, where a large number of high-priced, low-volume models skewed the mean upward, as shown in Table 2.

Table 2: Retailer catalogue datasets versus market benchmarks

Dataset	N of products	Observed mean	National/ Target Mean [28], [29]	Ref
FR WM	144	€ 534	€ 560	[24]
BE WM	128	€ 825	€ 517	[22], [30]
FR VC	95	€ 268	€ 167	[24]
BE VC	202	€ 298	€ 174	[22], [30]

To correct this, an exponential weighting procedure was applied as shown in Figure 2. The first listed product received the highest weight, and weights decreased exponentially for subsequent models. The weighting parameter (σ) was iteratively adjusted until the weighted mean for each dataset approached the Statista target. This approach compensates for missing sales-volume data and produced more realistic distributions than the unweighted or linear alternatives. Using the weighted price lists, a synthetic dataset of 10,000 purchases was generated for each country and product category.

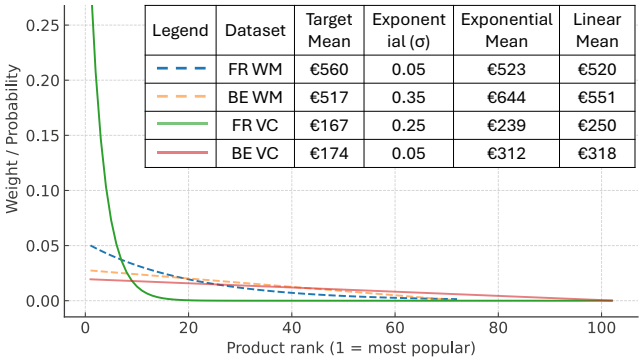

Figure 2: Exponential fitted to WM and VC price data

Several standard distribution types were fitted to the weighted datasets, with the Log Gamma providing the best fit (lowest AIC and closest mean). These fitted distributions were then used as the purchase-price input for the simulation.

Repair-price distributions were constructed using accepted WM repair quotes from VanDen Borre. Because equivalent French data were not available, the Belgian distribution was adjusted by the observed €14 difference between VanDen Borre and Darty repair prices to generate a proxy French distribution. For VCs, fixed-price repair schemes from Section 3.2.2 meant that €107 for Belgium and €80 for France were used directly. The resulting purchase and repair-price distributions for WMs are shown in Figure 3.

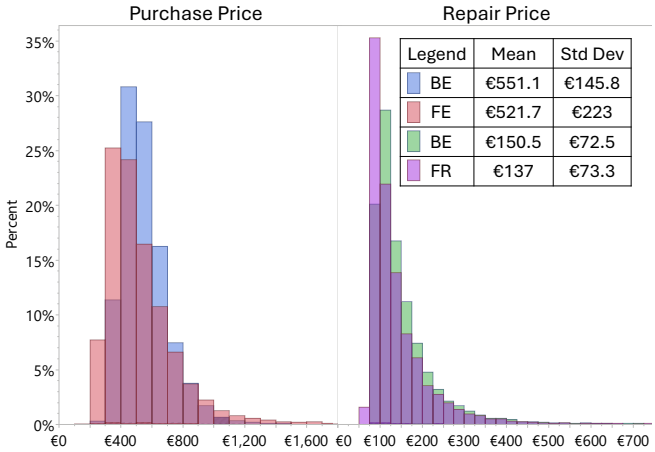

Figure 3: WM Fitted purchase price distributions after weighting and WM Repair Price distribution for BE and FR

Next, a Monte Carlo simulation with 10,000 iterations was run for WMs and VCs for BE and FR. Convergence checks showed that category proportions stabilised well before 10,000 iterations, with differences below ±1%. Each iteration sampled a purchase price from the fitted Log Gamma distribution and calculated a WTPR value using only the (1) Adler & Hlavacek formula. Repair prices were independently sampled from the fitted repair-price distribution (or fixed VC price) and compared with the sampled WTPR to classify the likely repair decision in each case. These outcomes, together with their application to 2024 national sales, are shown in Table 3.

Table 3: Simulation outcomes: Repair outcome by country and product based on 2024 sales

	Repair Unlikely	Repair Borderline	Repair Likely	Out-of-warranty repair rate 2019 [4]	# Likely repaired
FR WM	60.5%	23.3%	16.2%	16.1%	458,460
BE WM	71.4%	23.4%	5.1%	N/A	31,868
FR VC	59.3%	29.2%	11.5%	4.6%	351,900
BE VC	89.6%	7.9%	2.5%	N/A	25,092

For WMs, 60.5% of French units and 71.4% of Belgian units were classified as unlikely to be repaired. Around 23% in both countries fell into the borderline category, where the decision between repair and replacement is finely balanced. The share of units likely to be repaired was 16.2% in France and 5.1% in Belgium, closely matching the 2019 benchmark for France (16.1%) [4]. No equivalent benchmark is available for Belgium. For VCs, the results are even more skewed toward replacement, with 67% deemed unlikely to repair. In France, 59.3% of units were unlikely to be repaired, and only 11.5% were likely to be repaired. In Belgium, nearly 90% of units fell into the unlikely-to-repair category, leaving just 2.5% likely to be repaired. These results can be compared to the 2019 French benchmark for SHA (4.6%) [4], though no Belgian data is available.

4. Conclusion

This study estimated repair decisions for out-of-warranty washing machines (WMs) and vacuum cleaners (VCs) in France and Belgium using case studies and market-wide simulations based on two willingness-to-pay-for-repair (WTPR) models. Threshold analysis showed that repair becomes viable only once appliances reach relatively high purchase prices, typically above €300-€400 under the Fachbach model and above €600-€1,000 under Adler and Hlavacek. In the case studies, entry-level appliances were almost always unlikely to be repaired, mid-range products fell into borderline outcomes, and only high-end appliances consistently showed viable repair prospects. Extended warranties followed the same pattern, rarely viable for low-cost appliances but more acceptable for premium models. Repair/durability indices also correlated with price, but their narrow range meant even the cheapest products received mid-tier ratings, limiting the discriminatory power of current scoring systems. National differences were clear: France's fixed-price repair schemes and repair bonus reduced repair prices and shifted several mid-range appliances into the likely-to-repair category, while Belgium's variable pricing and lack of subsidies made repair less favourable.

The market-wide simulations confirmed these trends. Using the Adler and Hlavacek model, only 5% of Belgian WMs and 16% of French WMs sold in 2024 were likely to be repaired, and over 67% of VCs in both countries fell into the unlikely-to-repair category. Scaled nationally, this represents more than 3.5 million WMs and VCs in France and around 1.3 million in Belgium each year. These appliances are likely to be replaced not because they cannot be repaired, but because repair is economically irrational under current market conditions.

This study offers a scalable way to estimate repair rates using purchase-price distributions and WTPR modelling, with results closely matching French repair data. Key limitations remain: average repair prices may not capture provider or fault-specific variation; purchase-price distributions use retailer catalogue order as a proxy for sales popularity, which can introduce bias; the French repair-price distribution is based on an adjusted Belgian dataset; and current WTPR models omit factors such as appliance age, fault, and product value.

Future research should focus on consumers' willingness to pay for a quote (WTPQ), which is the first barrier to initiating repair, and develop improved WTPR models that take into account appliance age, type, and fault condition. A better understanding of both WTPQ and WTPR would support more accurate estimates of out-of-warranty repair behaviour and help strengthen the design and evaluation of EU repair policies.

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