Market Power and Firm-Level Welfare Incidence

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Abstract

Which firms' markup changes matter most for aggregate welfare costs? I derive marginal and finite firm incidence measures for total welfare cost (TWC), taking fixed cost recovery into account. Finite incidence measures the TWC reduction from moving one firm's markup to its cost recovery benchmark. I apply these measures to Belgian firm accounts covering 1985–2024. In 2024, the 100 largest firms by sales capture only 15.1 percent of summed positive finite incidence. The 100 firms ranked highest by incidence account for 82.7 percent, despite holding only 3.7 percent of sample sales. These effects come from separate firm resets and need not sum to the aggregate TWC. Pooling consecutive year pairs over the full sample period, 66.4 percent of firms initially in the top 1 percent by incidence remain there the following year, conditional on observation in both years. I compare finite incidence with rankings based on markups, sales, and profitability and find limited overlap. These indicators are therefore poor substitutes for incidence when identifying firms whose benchmark resets reduce TWC most.

Keywords: market power; markups; welfare incidence; misallocation; firm heterogeneity.
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1 Introduction

Evidence of rising markups (De Loecker et al., 2020) and of sales becoming concentrated among large firms (Autor et al., 2020) has renewed interest in the total welfare cost (TWC) of markups. An aggregate estimate alone, however, does not identify the individual markup changes with the largest welfare effects. Which firms' markup changes would reduce TWC most? Are these effects concentrated among a few firms or spread across many?

The firms that dominate sales or charge the highest markups need not be those whose markup reductions have the largest effects on TWC. The effect depends on the size of the markup reduction, the firm's initial sales, and how sales adjust across firms with different markups and costs.

I derive marginal and finite firm incidence measures that quantify how an individual markup change affects TWC. The TWC reference incorporates fixed cost recovery, since markups can help finance fixed inputs as well as generate profits (Abraham et al., 2024; De Loecker et al., 2026b). I therefore construct a cost recovery benchmark for each firm using estimated markups and firm accounting data, and evaluate TWC from the dispersion in markups relative to these benchmarks. Marginal incidence measures how this TWC responds to a small change in one firm's markup. Finite incidence instead considers resetting that markup to its benchmark. Conceptually, finite incidence is TWC before the reset minus its value afterwards, accounting for the reset size and sales reallocation.

I apply these measures to Belgian firm accounts covering 1985–2024. Over this period, the sales weighted average markup rises from 1.20 to 1.46, while fixed cost adjusted TWC rises from 1.04 to 10.03 log points. Recomputing TWC using only firms observed in both 1985 and 2024 yields a smaller increase. Firm incidence is highly concentrated. In 2024, the 100 firms ranked highest by finite incidence account for 82.7 percent of summed positive finite incidence, compared with only 15.1 percent for the 100 largest firms by sales. These finite effects come from separate firm resets and need not sum to aggregate TWC. High incidence also persists over time. Pooling consecutive year pairs over the sample period, 66.4 percent of firms initially in the top 1 percent by incidence remain there the following year, conditional on observation in both years.

Rankings based on sales, markups, and profitability miss many of the firms with the largest finite incidence. Averaging annual comparisons over 1985–2024, only 11 of the top 100 firms by sales also appear in the finite incidence top 100. The corresponding overlap is 24 firms for each of the rankings based on markups and operating profit, and 18 for EBIT margin.

The paper connects research on firm markups and market power with work on the welfare costs of misallocation. I use the production approach pioneered by Hall (1988) and developed for firm data by De Loecker and Warzynski (2012). De Loecker et al. (2018) and De Loecker et al. (2020) link firm markup patterns to aggregate developments in Belgium and the United States, respectively. Research on fixed inputs distinguishes the part of gross margins that finances these costs from profits (Abraham et al., 2024; De Loecker et al., 2026b). This distinction matters for incidence because equally high markups can imply different reset sizes when firms' cost recovery requirements differ.

The second strand asks how distortions translate into aggregate welfare costs, a question already examined by Harberger (1954) for monopoly. More recently, Hsieh and Klenow (2009) use producer data to infer output and capital distortions and quantify productivity gains from reallocation. I build on their allocation framework with measured markups as pricing wedges. Epifani and Gancia (2011) study how markup dispersion affects resource allocation and welfare. Edmond et al. (2023) distinguish losses from misallocation, the aggregate markup, and entry, and Hambur and Freestone (2025) apply their framework to Australia. De Loecker et al. (2026a) connect market power and business dynamism in a general equilibrium model. Baqaee and Farhi (2020) develop a general framework linking microeconomic distortions to aggregate productivity and quantify the aggregate cost of markup misallocation.

Building on this move from micro data to macro welfare costs, I return to the micro level to measure how individual firms' markup changes affect aggregate TWC. The theoretical contribution is to derive exact marginal and finite firm incidence measures. The firm experiment differs from the partial equilibrium losses estimated by Cowling and Mueller (1978) and the marginal aggregate output effects of plant input changes studied by Petrin and Sivadasan (2013). Here a complete markup reset allows sales to reallocate while rivals' markups remain distorted. The framework is deliberately parsimonious. It allows firm incidence to be computed from firm accounts and calibrated elasticities, without requiring firm level prices or physical quantities. These limited data requirements make the approach applicable across countries and industries where comparable accounts and suitable elasticity estimates are available. The empirical contribution is to identify and rank firms by the TWC reduction from their benchmark resets, document the concentration and persistence of these effects, and establish how their rankings differ from those based on conventional firm indicators.

Recent work by the European Commission and OECD researchers uses markups, profitability, and concentration to assess competition across industries (European Commission, 2024; Abele et al., 2025). Firm incidence adds a comparison of the welfare effects of specified markup reductions, both across the economy and within a sector. This infor-

mation can inform the economic priorities of competition authorities and policymakers seeking to reduce the welfare cost of markups.

Section 2 derives aggregate TWC and marginal and finite incidence. Section 3 describes the Belgian accounts and the construction of markups and cost recovery benchmarks. Section 4 documents the TWC trend, identifies the firms with the largest finite incidence, and examines concentration, persistence, and differences from conventional rankings. Section 5 tests how these conclusions depend on measurement and counterfactual assumptions. Section 6 discusses what firm comparisons add to aggregate welfare measurement.

2 Theoretical Framework

I first derive an exact constant elasticity of substitution (CES) welfare formula, then use it to define fixed cost adjusted TWC relative to an accounting cost recovery benchmark. Marginal incidence measures the sensitivity of TWC; finite incidence evaluates a firm's entire move to its benchmark. Both allow sales shares to adjust.

2.1 Environment and allocation

The allocation environment follows the horizontal CES example of Baqaee and Farhi (2020) and is closely related to the framework of Hsieh and Klenow (2009). I first consider a single sector economy and later apply its allocation framework within each sector g.

A representative household consumes N differentiated final goods with CES preferences (Dixit and Stiglitz, 1977),

$$C = \left(\sum_{i=1}^{N} \varphi_i^{1/\sigma} c_i^{(\sigma-1)/\sigma} \right)^{\sigma/(\sigma-1)}, \qquad \sigma > 1, \tag{2.1}$$

where C is aggregate consumption, c_i is consumption of variety i, $\varphi_i > 0$ is its demand shifter, and σ is the elasticity of substitution across varieties. The household supplies an inelastic endowment L of one primary factor, owns all firms, and receives profits as lump sum income. Firm i produces $c_i = A_i \ell_i$, where $A_i > 0$ is productivity and ℓ_i is its factor input. The factor market clears at $\sum_i \ell_i = L$. Technology is linear over the counterfactual range, so marginal cost is $\mathrm{mc}_i = w/A_i$, where w is the factor price. Productivities, demand shifters, and the active set are fixed. There are no intermediate inputs, taxes, foreign profit claims, or distributional welfare weights.

Let p_i be the price of variety i and $E = \sum_j p_j c_j$ nominal expenditure. Firm i's

expenditure share and gross markup are

$$\lambda_i \equiv \frac{p_i c_i}{E} = \frac{\varphi_i p_i^{1-\sigma}}{\sum_j \varphi_j p_j^{1-\sigma}}, \tag{2.2}$$

$$\mu_i \equiv \frac{p_i}{\mathrm{mc}_i}. \tag{2.3}$$

Because all sales are to final demand, λ_i also coincides with its Domar weight in this horizontal economy (Hulten, 1978). Factor market clearing implies

$$E = \frac{wL}{\sum_i \lambda_i/\mu_i}. \tag{2.4}$$

Thus fixing resources does not also fix nominal expenditure. With w as the numeraire, expenditure adjusts through aggregate profits while wL remains fixed.

I take firms' heterogeneous markups as given and evaluate the resulting allocation without imposing a pricing first order condition. Appendix A.2 compares this formulation with the output and capital distortions in Hsieh and Klenow (2009).

For measurement, each legal entity represents one composite variety in one sector. All prices, markup ratios, productivities, and shares are positive, and $\sigma_g > 1$ in every sector. Entity boundaries, quality, sector assignments, and demand parameters are held fixed. There are no capacity constraints, inventories, input price wedges, markdowns, entry, or dynamics; measured parameters are treated as known. These restrictions isolate static allocation. Appendix A.1 gives the full resource derivation, and Section 5.4 discusses the empirical scope.

2.2 Cost recovery and the reference allocation

A common markup $b > 0$ preserves efficient relative prices in the resource economy. Write the actual log wedge relative to that allocation as

$$z_i \equiv \log \mu_i - \log b. \tag{2.5}$$

Common markups implement the same intensive allocation, even if $b \neq 1$. But pricing at marginal cost would not finance positive fixed costs without transfers (Hotelling, 1938). The accounting reference asks a different question: how much of each firm's observed margin is required to recover its inferred fixed cost without a subsidy?

Let $R_i > 0$ be observed revenue and $F_i^+ \in [0, R_i)$ an inferred nonnegative fixed cost requirement. Define the benchmark as the smallest markup that balances the firm's

accounts at this revenue:

$$\mu_i^B \equiv \min\left\{m \geq 1 : (1 - m^{-1})R_i \geq F_i^+\right\} = \frac{1}{1 - F_i^+/R_i}. \tag{2.6}$$

Section 3.4 constructs F_i^+ from the markup and operating profit; Appendix B.4 derives the benchmark. It is not independent information about fixed costs. Nor does balance at observed revenue guarantee balance after sales adjust. The benchmark vector is held fixed in the baseline, and Section 5.2 examines revenue updates and counterfactual cost recovery.

The residual log wedge and its corresponding ratio are

$$\xi_i \equiv \log \frac{\mu_i}{\mu_i^B}, \tag{2.7}$$

$$\rho_i \equiv \frac{\mu_i}{\mu_i^B} = e^{\xi_i}. \tag{2.8}$$

Define effective productivity $\widetilde{A}_i = A_i/\mu_i^B$ and effective marginal cost $\widetilde{\text{mc}}_i = w/\widetilde{A}_i = \mu_i^B \text{mc}_i$. Then $p_i = \rho_i \widetilde{\text{mc}}_i$: observed prices and CES expenditure shares are unchanged. Equal residual wedges implement efficient relative prices in this transformed economy, not generally in the original economy with productivity A_i. I call the measure of dispersion in μ_i/μ_i^B, using benchmark adjusted costs as its reference, the *fixed cost adjusted total welfare cost (TWC)*. Unless qualified otherwise, TWC refers to this measure. It is not an additive component of the raw loss and need not be smaller. The two firm example below follows this construction through a markup reset.

The inferred fixed costs define this reference; they are not additional resources in the welfare theorem. Entry and product selection, through which fixed costs can affect efficiency (Spence, 1976; Mankiw and Whinston, 1986), are held fixed. A constrained planner benchmark would require a separate resource and financing problem, set out in Appendix B.4. For readability, I suppress the superscript B on ξ_i, ρ_i, $\mathcal{I}$, MWI_i, and finite incidence in the theory; empirical formulas restore it.

2.3 Exact welfare and the aggregate TWC

Let $\nu_i > 0$ be a price wedge relative to a fixed vector of marginal costs, and let ω_i be its observed expenditure share; in the single sector economy, $\omega_i = \lambda_i$. Define

$$A^\nu \equiv \sum_i \omega_i \nu_i^{\sigma-1}, \qquad B^\nu \equiv \sum_i \frac{\omega_i}{\nu_i}. \tag{2.9}$$

Theorem 1 (Exact welfare loss in the horizontal CES economy)**.** *Under the resource economy in Section 2.1, let $W(\boldsymbol{\nu})$ denote real consumption at wedges $\boldsymbol{\nu}$. Holding technology, demand shifters, factor supply, and varieties fixed,*

$$\boxed{\mathcal{L}^{\mathrm{E}}(\boldsymbol{\nu}) \equiv \log \frac{W(\mathbf{1})}{W(\boldsymbol{\nu})} = \frac{\log A^{\nu}}{\sigma - 1} + \log B^{\nu}.} \tag{2.10}$$

The loss is nonnegative and is zero if and only if all wedges are common.

Proof. See Appendix A.1.

The first term measures the price index relative to the efficient allocation; the second incorporates the resource balance in (2.4). Their combination accounts for both consumption prices and profit income. Observed wedges, shares, and demand curvature are sufficient: neither productivities nor demand shifters need to be estimated separately. Setting $\nu_i = \mu_i / b$ gives the original economy's loss, invariant to the common normalization b. I refer to this calculation as raw TWC. This welfare cost cannot be inferred from the average markup alone, since the same average can accompany different welfare outcomes (De Loecker and Eeckhout, 2026).

Applying the same result to the effective costs defined above gives

$$\mathcal{I}^{\mathrm{E}}(\boldsymbol{\rho}) = \frac{1}{\sigma - 1} \log \left(\sum_i \omega_i \rho_i^{\sigma - 1} \right) + \log \left(\sum_i \frac{\omega_i}{\rho_i} \right). \tag{2.11}$$

This TWC is exact in the transformed economy. It need not equal the welfare gain from moving actual markups to their benchmarks while holding original technologies and resources fixed. The difference concerns the cost reference, not whether that benchmark allocation is socially optimal. Both calculations reproduce observed prices and expenditure shares. The TWC takes wedge ratios $\boldsymbol{\rho}$ as its argument, with CES shares evaluated at those ratios. Where shares are shown as a separate argument, they specify the allocation used in the same formula.

The empirical calculation applies this expression within sectors. Define $\Lambda_g = \sum_{i \in g} \lambda_i$ and $\omega_{i|g} = \lambda_i / \Lambda_g$, and let

$$A_g^B \equiv \sum_{i \in g} \omega_{i|g} \rho_i^{\sigma_g - 1}, \qquad B_g^B \equiv \sum_{i \in g} \frac{\omega_{i|g}}{\rho_i}. \tag{2.12}$$

Aggregate TWC is the following fixed weighted sum of sector TWC:

$$\boxed{\mathcal{I}^{\mathrm{E}} = \sum_g \Lambda_g \left[\frac{\log A_g^B}{\sigma_g - 1} + \log B_g^B \right].} \tag{2.13}$$

Each term is an exact sector calculation. Their weighted sum, with Λ_g fixed, defines the empirical TWC rather than a multisector general equilibrium welfare theorem. Within sector shares depend only on relative prices, so they can be updated without solving for total expenditure. To translate those shares into revenues, the empirical baseline holds sector expenditure fixed. Revenue then changes in proportion to the firm's share. The resource economy in (2.4) instead determines expenditure endogenously. At a given price vector, the two expenditure assumptions give the same within sector shares but different revenue levels. The TWC uses those shares; the reported fixed expenditure revenues are not the revenue path from the resource economy. Cross sector substitution and factor price responses are separate questions.

For intuition, expanding the single sector TWC around $\boldsymbol{\rho} = \mathbf{1}$ yields

$$\mathcal{I}^{\mathrm{E}}(\boldsymbol{\rho}) = \frac{\sigma}{2}\mathrm{Var}_{\omega}(\log \rho_i) + o(\|\log \boldsymbol{\rho}\|^2). \tag{2.14}$$

This connects the exact expression to the dispersion logic of Hsieh and Klenow (2009) and the local aggregation results of Baqaee and Farhi (2020). Hsieh and Klenow also derive an exact CES aggregate productivity expression; their variance characterization of revenue productivity uses a lognormality assumption. Equation (2.14) is instead a local expansion in residual markup wedges. To carry both TWC measures through the incidence analysis, define

$$\bar{\xi}_g = \sum_{i \in g} \omega_{i|g} \xi_i, \qquad \tau_{i|g} = \xi_i - \bar{\xi}_g, \qquad V_g = \sum_{i \in g} \omega_{i|g} \tau_{i|g}^2.$$

The corresponding quadratic TWC is

$$\mathcal{I}^{\mathrm{Q}} = \frac{1}{2} \sum_{g} \sigma_g \Lambda_g V_g. \tag{2.15}$$

Both TWC measures are evaluated with the same CES expenditure shares at each allocation. I compute marginal and finite incidence for each, using the exact TWC for the headline results and the quadratic TWC for comparison. Multiplying all residual ratios in a sector by the same factor leaves both TWC measures unchanged: they measure relative distortions. Appendix A.3 explains the scope of this neutrality property (Kaplow, 2021).

2.4 Marginal incidence and firm rankings

A firm's incidence depends on how the entire allocation responds to its wedge, not just on its own markup or sales.[1] Each firm is evaluated separately, starting from the observed allocation. Hold rival markups, the benchmark vector, marginal costs, sector expenditure, and the active set fixed. Demand reallocates sales between the treated firm and its rivals; firms do not enter or exit. This conditional reallocation is not a comparison of isolated producer surplus triangles.[2] Under CES demand,

$$\frac{\mathrm{d}\omega_{i|g}}{\mathrm{d}\xi_k} = -(\sigma_g - 1)\omega_{i|g}\left(\mathbf{1}\{i = k\} - \omega_{k|g}\right), \qquad i, k \in g. \tag{2.16}$$

Reducing firm k's price increases its expenditure share and reduces those of all rivals in its sector.

Definition 1 (Marginal wedge incidence). For either formula, marginal incidence is the total derivative along this CES adjustment:

$$\mathrm{MWI}_k^s \equiv \frac{\mathrm{d}\mathcal{I}^s}{\mathrm{d}\xi_k}, \qquad s \in \{\mathrm{E}, \mathrm{Q}\}. \tag{2.17}$$

The derivative is taken in the direction of an increase in the log wedge. Positive marginal incidence means a small markup reduction lowers the TWC; negative marginal incidence means it raises the TWC. Because the benchmark is fixed, changing the log residual wedge changes the log markup by the same amount. The derivative with respect to the markup level is instead $\mathrm{d}\mathcal{I}^s/\mathrm{d}\mu_k = \mathrm{MWI}_k^s/\mu_k$.

Proposition 1 (Exact marginal incidence)**.** *For firm k in sector g,*

$$\boxed{\mathrm{MWI}_k^{\mathrm{E}} = \sigma_g \Lambda_g \omega_{k|g}\left(1 - \frac{\rho_k^{-1}}{B_g^B}\right).} \tag{2.18}$$

Writing $v_{k|g} = (\omega_{k|g}/\rho_k)/B_g^B$, equivalently,

$$\mathrm{MWI}_k^{\mathrm{E}} = \sigma_g \Lambda_g (\omega_{k|g} - v_{k|g}). \tag{2.19}$$

Proof. See Appendix A.4.

The derivation also separates the direct wedge change from sales reallocation. Here $v_{k|g}$ is the implied variable resource share in the *transformed* economy: $\widetilde{\mathrm{mc}}_k c_k = R_k/\rho_k$.

[1] Incidence here denotes a change in TWC, not the division of surplus between consumers and producers studied by Weyl and Fabinger (2013).

[2] A partial equilibrium Harberger triangle holds the surrounding market environment fixed. It is not, in general, an upper or lower bound on an individual firm's effect once expenditure reallocates across other distorted producers.

It is not the firm's observed COGS share. The difference $\omega_{k|g} - v_{k|g}$ measures expenditure relative to the resources attributed to this firm under the accounting reference. Demand curvature scales the response, and $\Lambda_g \omega_{k|g} = \lambda_k$ supplies its weight in the economy. For raw markups, this is the welfare loss counterpart of the log output derivative in the horizontal example of Baqaee and Farhi (2020). The residual calculation applies that derivative to the transformed costs.

Petrin and Levinsohn (2012) decompose aggregate productivity growth into technical efficiency and reallocation. Petrin and Sivadasan (2013) relate plant input gaps to the marginal output effect of an extra unit of input. Here the perturbation is a log markup change, with other firms' quantities responding through CES demand. Section 2.5 evaluates the complete benchmark reset by accumulating this changing marginal incidence.

Which firms have positive marginal incidence? The formula gives

$$\mathrm{MWI}_k^{\mathrm{E}} > 0 \quad \Longleftrightarrow \quad \rho_k > \frac{1}{B_g^B}. \tag{2.20}$$

The threshold is the sales weighted harmonic mean of residual markup ratios in the sector, not one. Being above one's own benchmark therefore does not alone establish that a marginal reduction lowers the TWC. What matters is the wedge relative to the sector's allocation. Moreover, $\sum_{k \in g} \mathrm{MWI}_k^{\mathrm{E}} = 0$, as a common proportional change leaves relative prices unchanged. Negative marginal incidence means a small markup reduction raises this TWC; it is not a recommendation to increase markups.

When do familiar rankings agree? Within the same observed sector, firms with equal sales shares are ordered by their residual ratios. At an equal residual ratio above $1/B_g^B$, the larger firm has greater positive incidence; below that threshold, size magnifies negative incidence. When both shares and wedges differ, a smaller firm can outrank a larger one if its wedge correction is sufficiently greater. Appendix A.4.1 derives the precise size threshold. Raw markups also omit differences in μ_i^B, and comparisons across sectors involve different B_g^B and potentially different σ_g. These conditions explain why sales, markups, and markup times sales need not recover the incidence ranking.

Marginal incidence of the quadratic TWC. Applying the same CES share response to (2.15) gives

$$\mathrm{MWI}_k^{\mathrm{Q}} = \sigma_g \Lambda_g \omega_{k|g} \tau_{k|g} - \frac{\sigma_g(\sigma_g - 1)}{2} \Lambda_g \omega_{k|g} \left(\tau_{k|g}^2 - V_g \right). \tag{2.21}$$

The first term is the direct change in dispersion; the second is the change from sales reallocation. Shares shift toward a firm as its markup falls, changing how much weight its residual wedge receives. Omitting the second term would hold sales weights fixed. Appendix A.4 derives the expression. It is the exact derivative of the quadratic TWC, not the exact CES derivative or its complete second order expansion.

2.5 Finite incidence and the benchmark reset

The main empirical question concerns a full move to the benchmark, not an equal infinitesimal change for every firm. For firm k, let

$$\xi_i^{(k)} = \begin{cases} 0, & i = k, \\ \xi_i, & i \neq k. \end{cases} \tag{2.22}$$

Definition 2 (Finite TWC incidence). Let $\rho_i^{(k)} = e^{\xi_i^{(k)}}$. For either formula, finite incidence is

$$\Delta\mathcal{I}_k^s \equiv \mathcal{I}^s(\boldsymbol{\rho}) - \mathcal{I}^s(\boldsymbol{\rho}^{(k)}), \qquad s \in \{\mathrm{E}, \mathrm{Q}\}, \tag{2.23}$$

with CES expenditure shares evaluated at each allocation.

The measure is the TWC before the reset minus the TWC after it. The reset moves μ_k to μ_k^B and changes its price by the factor ρ_k^{-1}. Rival markups, marginal costs, all benchmark markups, and sector expenditure remain fixed. In particular,

$$\frac{p_j^{(k)}}{p_j} = \frac{\mu_j^{(k)}}{\mu_j}\frac{\mathrm{mc}_j^{(k)}}{\mathrm{mc}_j} = 1, \qquad j \neq k. \tag{2.24}$$

Unchanged rival prices follow from these restrictions, not from CES alone. No firm need be atomistic. This controlled comparison isolates demand reallocation; strategic responses require a pricing game and additional conduct assumptions (Atkeson and Burstein, 2008; Edmond et al., 2015).

CES demand gives

$$\omega_{k|g}^{(k)} = \frac{\omega_{k|g}\rho_k^{\sigma_g - 1}}{D_{kg}}, \qquad \omega_{i|g}^{(k)} = \frac{\omega_{i|g}}{D_{kg}}, \quad i \in g,\ i \neq k, \tag{2.25}$$

where

$$D_{kg} = 1 - \omega_{k|g} + \omega_{k|g}\rho_k^{\sigma_g - 1}, \qquad J_{kg} = B_g^B - \frac{\omega_{k|g}}{\rho_k} + \omega_{k|g}\rho_k^{\sigma_g - 1}. \tag{2.26}$$

For a downward reset, $\rho_k > 1$: the treated firm's sales rise and every rival's sales fall because sector expenditure is fixed. With $\rho_k < 1$, the reset instead raises the markup.

The empirical analysis distinguishes these directions.

Proposition 2 (Exact finite incidence)**.** *For firm k in sector g,*

$$\boxed{\Delta\mathcal{I}_k^{\mathrm{E}} = \Lambda_g \left[\frac{\sigma_g}{\sigma_g - 1} \log D_{kg} + \log B_g^B - \log J_{kg} \right].} \tag{2.27}$$

Proof. See Appendix A.5.

The expression evaluates the TWC at the new allocation, including the treated firm's and all rivals' sales responses. A positive value means the reset lowers the TWC; resetting one wedge need not improve the allocation when other wedges remain distorted.

A two firm example. Consider a hypothetical sector with two firms, $\sigma = 3$, and initial revenue of 100 for each firm. Monetary values are in arbitrary units. The accounting identity $F_i = R_i(1 - 1/\mu_i) - \Pi_i^{\mathrm{op}}$ gives the fixed costs below; the benchmark is $\mu_i^B = (1 - F_i/R_i)^{-1}$. Firm 2's operating profit and fixed cost are both 50/3, rounded in the table.

	Firm 1	Firm 2
Observed revenue R_i	100.00	100.00
Observed markup μ_i	2.00	1.50
Recurring operating profit Π_i^{op}	30.00	16.67
Inferred fixed cost F_i	20.00	16.67
Accounting benchmark μ_i^B	1.25	1.20
Residual ratio ρ_i	1.60	1.25

Reset firm 1's markup from 2.00 to 1.25, holding marginal costs, both benchmarks, and firm 2's markup fixed. Firm 1's price falls by 37.5 percent. Equation (2.25) gives

$$\omega_1^{(1)} = \frac{0.5(2/1.25)^2}{0.5(2/1.25)^2 + 0.5} = 0.7191, \qquad \omega_2^{(1)} = 0.2809.$$

With sector expenditure fixed at 200, revenues become 143.82 and 56.18. Firm 1's residual ratio becomes one; firm 2's remains 1.25, but now receives less weight. The exact TWC falls from 2.2681 to 1.5530 log points, so firm 1's finite incidence is 0.7151 log points. Here log points equal 100 times the TWC, and the sector is the whole illustrative economy.

Evaluating the same price change against physical marginal costs gives a raw loss of 3.0721 before the reset and 1.0319 afterward, a gain of 2.0402 log points. Prices and sales shares follow the same path in both calculations. The difference is the reference used to evaluate that path: physical costs for the raw loss and benchmark adjusted costs for the

TWC. The revenue figures above assume fixed expenditure. In the resource economy, expenditure instead adjusts to satisfy the resource constraint.

Finite incidence of the quadratic TWC. Let $V_g^{(k)}$ be the variance of the reset wedges $\xi_i^{(k)}$, computed with the updated shares in (2.25). Then

$$\Delta\mathcal{I}_k^{\mathrm{Q}} = \mathcal{I}^{\mathrm{Q}}(\boldsymbol{\rho}) - \mathcal{I}^{\mathrm{Q}}(\boldsymbol{\rho}^{(k)}) = \frac{\sigma_g \Lambda_g}{2}\left(V_g - V_g^{(k)}\right). \tag{2.28}$$

Appendix A.5 derives a closed form for the updated variance. The exact and quadratic finite measures evaluate the same full reset, with identical counterfactual prices and CES sales shares for the treated firm and its rivals. They differ only in the formula used to evaluate that allocation.

The initial slope approximation is a separate step. For either formula, the link to marginal incidence is

$$\Delta\mathcal{I}_k^{s} = \int_0^{\xi_k} \mathrm{MWI}_k^{s}(u)\,\mathrm{d}u \approx \xi_k \mathrm{MWI}_k^{s}(\xi_k), \qquad s \in \{\mathrm{E}, \mathrm{Q}\}, \tag{2.29}$$

where u is the treated firm's intermediate log wedge and shares adjust along the path. The approximation uses the initial slope throughout; it discards curvature. Thus a large marginal effect need not imply a large finite effect: firms differ in the distance to their benchmark and in the change in incidence along that distance. Neither reported finite calculation replaces the full reset by this initial slope approximation. In particular, $\Delta\mathcal{I}_k^{\mathrm{Q}}$ is not generally equal to $\xi_k \mathrm{MWI}_k^{\mathrm{Q}}$.

Separate firm resets start from the same observed allocation, but end at different allocations. Their effects therefore need not sum to the aggregate TWC. Appendix A.5.1 gives the interaction identity, and Appendix A.6 reports an additive path allocation as an accounting check on concentration.

Section 5.2 evaluates the same markup targets against physical marginal costs rather than benchmark adjusted costs. It also considers expenditure and benchmark adjustments.

3 Data and Measurement

Implementing the incidence measures requires three firm characteristics: revenue, a markup, and a benchmark for fixed cost recovery. The accounts provide revenue and operating profit; two calibrations supply the output elasticity used to measure markups

and the demand elasticity governing sales reallocation. Appendix B documents the selection rules, accounting checks, and implementation details.

3.1 Data and analysis sample

I use the October 12, 2026 extract of the *Sequenza* database, which harmonizes Belgian unconsolidated statutory annual accounts.[3] A firm in this paper is a legal entity, not a consolidated group. The source records cover 1984–2024 and contain turnover, materials, payroll, assets, operating profit, and industry codes. The analysis covers 1985–2024. I exclude 1984 because its much smaller reporting population is not comparable to that observed from 1985 onward, as documented in Appendix B.1. Coverage in 2024 is provisional: the extract does not yet represent a complete filing population.

The analysis sample is narrower than the source database. It requires usable identifiers and industry codes, twelve month accounts, annual turnover above EUR 1,000, and the inputs needed for the markup calculation. I trim observations below the 1.5th or above the 98.5th percentile of markups within each year, then require a valid operating profit margin and an inferred fixed cost share below 0.95. The latter excludes benchmark markups of 20 or more. All headline objects use the resulting sample. Trimming limits extreme estimates; it does not establish that excluded accounts are erroneous, and it does not remove every markup below one.

Table 1 reports annual firm counts and the share of source sales retained in the analysis. The denominator includes all entities in the same extract with a valid identifier, twelve month accounts, and positive turnover, before industry and accounting restrictions. The analysis contains 3,185 firms and 43.1 percent of these sales in 1985, compared with 12,708 firms and 85.2 percent in 2024. These shares measure coverage of recorded sales, not of Belgian GDP. Appendix D.5 separately compares sample turnover with official turnover, including the divisions without a usable official denominator. Changing filing and industry coverage means that the panel's composition cannot be interpreted solely as economic entry and exit. Section 4.2 and Appendix C.3 examine its role in the aggregate trend.

[3]Sequenza: Belgian company accounts database.

Table 1: Firm counts and sales coverage

Year	Valid markup inputs	Analysis sample	Source sales retained (%)
1985	3,289	3,185	43.1
1990	4,540	4,391	49.8
2000	6,870	6,592	63.2
2010	12,388	11,817	80.8
2020	13,526	12,789	89.3
2024	13,398	12,708	85.2

Notes: Counts refer to Belgian legal entities in the October 12, 2026 Sequenza extract. Valid markup inputs precede trimming. The analysis sample additionally requires markups within the annual 1.5th and 98.5th percentiles, a valid operating profit margin, and $F_{it}^{+}/R_{it} < 0.95$. The final column divides analysis sales by all positive turnover recorded for entities with valid identifiers and twelve month accounts in that year; neither industry codes nor markup inputs are required in the denominator. Each entity appears at most once per year. Coverage in 2024 is provisional. Appendix B.1 reports coverage at each selection stage.

I construct profit margins from accounting levels rather than the vendor's rounded ratios. Appendix B.1 documents source corrections, historical checks, and sensitivity to warning flags and inconsistent combined cost fields. These flags are diagnostics rather than automatic baseline exclusions.

3.2 Markup measurement

The production approach links the markup to the output elasticity of a flexible input and its share in revenue (Hall, 1988; De Loecker and Warzynski, 2012). For input expenditure X_{it}, revenue R_{it}, and output elasticity θ_{it}^{X}, the identity is

$$\mu_{it} = \frac{\theta_{it}^{X}}{\alpha_{it}^{X}} = \theta_{it}^{X} \frac{R_{it}}{X_{it}}, \qquad \alpha_{it}^{X} = \frac{X_{it}}{R_{it}}. \tag{3.1}$$

The identity follows from cost minimization conditional on output and any predetermined inputs, with a differentiable production technology for a single output. The chosen input must have an interior, frictionless choice and a price the firm takes as given (De Loecker et al., 2020). Applying this identity to firm accounts treats each entity as a single output producer. This is an aggregation assumption, not a claim that every entity sells only one product; Appendix B.2 discusses its interpretation for firms with several products.

Accounting applications extend markup measurement to large panels (De Loecker et al., 2020, 2018). Here X_{it} combines materials [60] and payroll [62], denoted COGS for this exercise. These separately reported components provide a uniform construction from the statutory accounts; the inputs used are assumed to satisfy the flexible input

condition. Reported zero materials are retained when payroll is positive, subject to the boundary interpretation in Appendix B.2; missing materials are excluded, not treated as zero. Services [61] remain separate because this category combines heterogeneous expenses, including outsourced inputs and group charges documented in Appendix B.1.5. Exclusion does not imply that all services are fixed, nor does the COGS label establish comparability with every firm's own cost of sales.

I do not estimate a production function. Instead, let $K_{it} = K_{it}^T + K_{it}^I$ be tangible plus intangible fixed assets, and assign the following output elasticity proxy to each NACE two digit sector g and year t:

$$\theta_{gt}^X \equiv \text{median}_{i:g(i)=g} \left(\frac{X_{it}}{X_{it} + rK_{it}} \right), \qquad r = 0.10. \tag{3.2}$$

The median, calculated before markup trimming, limits the influence of extreme individual cost shares on the elasticity assigned to the sector. Pooling imposes a common elasticity within each sector and year while allowing it to vary across sectors and over time. The annual rate $r = 0.10$ converts book assets into a capital charge. It is a maintained calibration, not an estimated rental price. In the empirical formulas, μ_{it} denotes the calibrated markup obtained by substituting $\theta_{g(i)t}^X$ for the unobserved firm elasticity in (3.1).

Interpreting this cost share as an output elasticity requires additional assumptions: constant returns in scalable production, static optimality of all production inputs including capital, and adequate measurement of production costs and capital services, with fixed overhead separate (De Loecker and Eeckhout, 2026). The sector median must also be informative about firms in the cell. The markup identity does not require every input to be included in X_{it}; it requires the elasticity of that particular input bundle. A cost share proxy does not automatically recover that elasticity when economically relevant costs are omitted or misclassified.

Appendix B.2 specifies the eligibility filters and calibration. Section 5.1.1 varies the elasticity assignment to assess sensitivity to imposing a common elasticity within each sector and year.

3.3 Sectors, expenditure weights, and demand curvature

Each entity is assigned to its principal NACE 2008 two digit sector. Missing industry codes are filled from recorded classifications within the same firm's history, without replacing observed codes; entities without a usable classification are excluded. Appendix B.1 gives the filling rule. Industry coverage is less complete historically, especially for inactive entities. These sectors are maintained substitution groups, not independently delineated

product markets.

In 2024, the sample contains 84 divisions, with a median of 59 firms per division and a range from one to 2,456. Twelve divisions contain fewer than ten firms and account for 0.47 percent of sample sales. Table D.16 reports firm counts and sales for every division, alongside official turnover where available.

I treat total turnover as revenue from one composite variety. The accounts used here do not separate the entity's products or distinguish final from intermediate sales and domestic from export sales. For each year, define

$$\lambda_{it} = \frac{R_{it}}{\sum_j R_{jt}}, \qquad \Lambda_{gt} = \sum_{i:g(i)=g} \lambda_{it}, \qquad \omega_{it|g} = \frac{\lambda_{it}}{\Lambda_{gt}}, \tag{3.3}$$

where the denominator includes the analysis sample and $g(i)$ denotes the firm's sector in the year being evaluated. The weights are recomputed from each year's sample. Holding sector weights fixed during a markup reset does not hold them fixed across calendar years. These weights correspond to final expenditure shares in the horizontal model, but normalized turnover is not a literal measure of Belgian final demand or a production network weight. Markups, benchmarks and incidence are calculated for the same Belgian legal entities.

The baseline takes sector substitution elasticities from Dhyne et al. (2022) (DKM), who estimate substitution among suppliers using Belgian firm transactions. I map their 29 published sector groups to NACE divisions. The mapping covers 71 of the 84 divisions observed in 2024, accounting for 95.6 percent of sample sales. Uncovered divisions receive $\sigma^{\text{com}} = 3.34$, the 2024 sample sales weighted mean of the covered estimates. Both the sector estimates and this fallback remain fixed over 1985–2024. The common elasticity comparison assigns the same σ^{com} to every sector, separating sector heterogeneity from the choice of source and central value.

The common value is in the low single digit range used in related research: Hsieh and Klenow (2009) use 3, while the median between firm estimate in Hottman et al. (2016) (HRW) is 3.9. A weighted common comparator also has precedent in Ossa (2015), who uses a trade weighted substitution elasticity of 3.94. These studies concern different demand objects and markets; they support the magnitude, not identification of a Belgian aggregate elasticity. Here 3.34 is a transparent summary of the DKM sector estimates, not a separately estimated structural parameter.

Using Belgian supplier estimates improves geographic and sector coverage, but transporting them to the horizontal substitution groups remains an assumption: substitution among a buyer's existing suppliers need not equal substitution among all firms in a NACE division. The demand elasticity governs sales reallocation and is distinct from the output

elasticity θ^X_{gt} used to construct markups. Markups alone do not identify it without a conduct model. Section 5.1.3 compares the common calibration and estimates shifted up or down by one published standard error; Appendix B.3 documents the mapping, and Appendix D.3 reports HRW and GTAP comparisons.

3.4 Fixed costs and benchmark construction

The benchmark asks how much of the price margin is needed to cover inferred fixed costs at observed sales. It distinguishes that recovery requirement from the residual markup gap used in the incidence calculation. This is an accounting reference, not a markup chosen to maximize welfare or a guarantee of cost recovery after sales adjust.

Let Π^{op}_{it} be recurring EBIT: operating profit after recorded depreciation and amortization, but before interest and taxes and excluding nonrecurring items. I construct its margin as $m^{\text{op}}_{it} = \Pi^{\text{op}}_{it}/R_{it}$. Under the maintained constant marginal cost accounting relation, variable cost is R_{it}/μ_{it}, giving the inferred fixed cost requirement

$$F_{it} = \left(1 - \frac{1}{\mu_{it}}\right) R_{it} - \Pi^{\text{op}}_{it}. \tag{3.4}$$

Implied total variable cost differs from the observed materials plus payroll bill. The residual does not classify individual expenditures as fixed or variable.

Set $F^+_{it} = \max\{F_{it}, 0\}$. Applying the observed revenue benchmark in Section 2.2 gives

$$\mu^B_{it} = \frac{1}{1 - F^+_{it}/R_{it}}, \qquad 0 \le F^+_{it}/R_{it} < 0.95 \quad \text{in the analysis sample.} \tag{3.5}$$

When $F_{it} \ge 0$, the construction implies

$$\mu^B_{it} = \left(\frac{1}{\mu_{it}} + m^{\text{op}}_{it}\right)^{-1}, \qquad \frac{\mu_{it}}{\mu^B_{it}} = 1 + \mu_{it} m^{\text{op}}_{it}. \tag{3.6}$$

The benchmark thus transforms the markup and operating margin; it supplies no independent fixed cost information. If $F_{it} < 0$, truncation sets $\mu^B_{it} = 1$, without establishing that economic fixed costs are absent. For the named baseline and annual core tables, I report only firms with nonnegative inferred fixed costs before truncation. This is a reporting restriction, not a sample exclusion: all analysis firms remain in the demand system and in aggregate, concentration, persistence, and unrestricted ranking comparisons. Pooled leader tables apply the same rule to the pooled residual. Tables retaining unrestricted names for diagnostic comparisons are identified separately.

The fixed cost share restriction removes 2.20 percent of observations and 0.61 percent of sales from the sample entering that restriction in 2024. Appendix B.4 gives the

diagnostics and the sector and economy pooling alternatives. Published Belgian studies provide alternative fixed input estimates (Abraham et al., 2024; De Loecker et al., 2026b); Section 5.1.2 uses those estimates in a separate reference calibration. Appendix D.2.2 separately allows the recovery reference to cover a normal return on book capital after depreciation, without changing measured markups.

3.5 From measurement to incidence

The measured residual wedge is

$$\xi_{it}^{B} = \log \mu_{it} - \log \mu_{it}^{B}. \tag{3.7}$$

For each year, I compute the aggregate TWC and both marginal and full finite incidence under the exact CES and quadratic formulas in Sections 2.3 to 2.5. Under either formula, CES demand updates own and rival sales shares within the affected sector, while sector expenditure weights, the benchmark vector, and rival markups remain fixed. The quadratic finite effect evaluates the full reset; it is not the initial marginal effect multiplied by the markup gap. The raw comparison sets every benchmark markup to one.

The headline ranking uses exact finite effects. Section 4.3 and Appendix C.8 compare the two formulas for both marginal and finite incidence. Aggregate TWC and finite effects are dimensionless, with reported log points equal to 100 times their values; marginal incidence is the derivative per unit change in the log residual wedge. Appendix B.5 provides the annual formulas and implementation sequence.

4 Empirical Results

Residual dispersion rises more sharply than the average proportional markup gap. Firm incidence is concentrated and persistent. Its leading firms are not simply the largest sellers or those with the highest markups. In 2024, the finite incidence top 100 represent 3.7 percent of sample sales but account for 82.7 percent of summed positive finite effects.

The headline calculation uses the exact CES formula, the firm benchmark, and the DKM sector elasticities. I report both marginal incidence and full benchmark resets, and compare each with its quadratic counterpart. Superscripts E and Q distinguish the two formulas where necessary. Section 5 then examines the sensitivity of aggregate magnitudes, concentration, and named firm attribution separately.

Aggregate TWC and concentration statistics use the full analysis sample. Named leader tables additionally require nonnegative inferred fixed costs before truncation; firms

failing that condition remain in the calculations. Comparisons requiring a common sample state whether it changes the counterfactual economy or only eligibility for the ranking.

4.1 Markups and their benchmarks

The sales weighted mean markup rises from 1.20 in 1985 to 1.46 in 2024 (Panel A of Figure 1). Its direction is consistent with broader evidence on rising markups and earlier Belgian work, although levels are not directly comparable across samples and cost definitions (De Loecker et al., 2020, 2018). The average firm benchmark also rises, from 1.14 to 1.32. The average proportional gap above the accounting reference increases more modestly: Panel B gives 5.0 percent in 1985 and 8.5 percent in 2024.

The direction of a mean markup need not equal that of a mean price-cost margin. Over 1986–2014, the sales weighted markup rises from 1.259 to 1.403, but the sales weighted margin $1 - 1/\mu_{it}$ falls from 16.95 to 16.47 percent. Abraham et al. (2024) also estimate declining Belgian price-cost margins over these years, although their levels and estimator differ. Appendix C.2 compares the annual endpoints and explains why transforming the average markup would give the wrong margin comparison.

The lower pooled benchmarks reflect averaging recovery shares before converting them into markups, rather than averaging the firm benchmarks; they do not imply lower underlying fixed costs. None of the benchmarks is chosen to center observed markups. The zero mean restriction applies to the centered log wedge, not the ratio in Panel B (Appendix B.5).

With benchmarks held fixed, a common proportional markup increase within a sector leaves the conditional TWC unchanged.

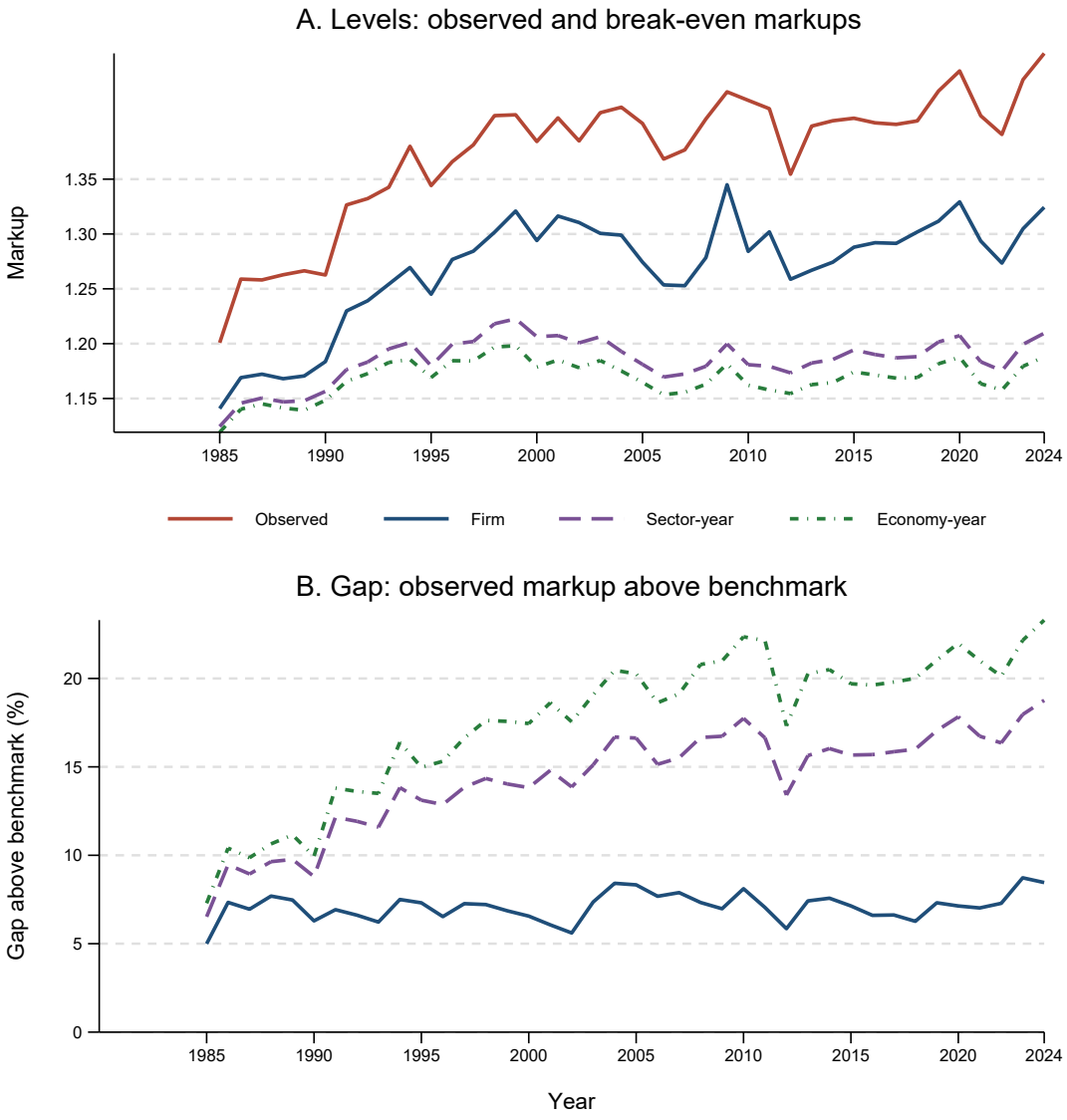


Figure 1: Observed markups and fixed cost benchmarks, 1985–2024. Panel A reports sales weighted averages of observed markups and benchmarks computed for firms, sectors, and the economy in each year. Panel B reports $100 \sum_i \lambda_{it}(\mu_{it}/\mu_{it}^B - 1)$ for each benchmark, not the ratio of average markups. Here λ_{it} is the firm's share of annual sample sales. Benchmarks recover inferred nonnegative fixed costs at observed sales. Coverage in 2024 is provisional.

4.2 Aggregate dispersion and its increase

The increase in dispersion is much larger than the change in the average proportional markup gap. The exact TWC based on $\xi_{it}^B = \log(\mu_{it}/\mu_{it}^B)$ increases from 1.04 to 10.03 log points between 1985 and 2024 (Figure 2). The raw comparison, based on $z_{it} = \log \mu_{it}$, rises from 4.03 to 25.51. The firm benchmark therefore lowers the measured level substantially but does not remove its increase.

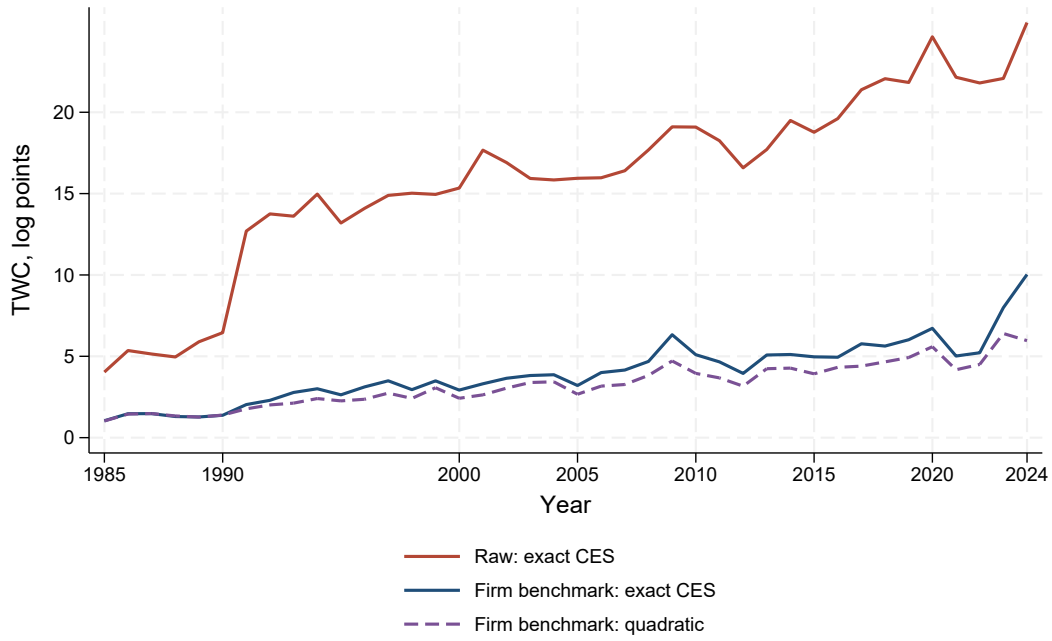


Figure 2: Aggregate dispersion under exact and quadratic formulas, 1985–2024. The red line evaluates raw TWC using the exact CES formula and wedges $\log \mu_{it}$. The solid blue and dashed purple lines use residual wedges $\log(\mu_{it}/\mu_{it}^B)$ under the exact TWC (2.13) and quadratic approximation (2.15). All series use sample sales weights and the DKM sector elasticities. Log points equal 100 times the dimensionless TWC; they are not percentages of Belgian income.

The quadratic approximation gives 1.02 log points in 1985 and 5.96 in 2024. It captures the direction of the increase but gives lower levels at both endpoints, with a larger difference in 2024.

Sector and economy benchmarks give exactly the raw series and are omitted from the graph. Each divides all markups within a sector by a common value, leaving relative wedges unchanged. A firm benchmark changes those relative wedges; its lower TWC here is an empirical finding, not a general property of heterogeneous benchmarks.

The 10.03 log point TWC describes dispersion relative to the specified accounting reference, not a causal gain from financing fixed costs or a share of Belgian income. Unlike the broader policy exercise in Edmond et al. (2023), it excludes the aggregate

markup distortion, entry, and transitional dynamics.

Sources of the increase. Of the 8.99 log point increase between 1985 and 2024, 6.84 points, or 76.0 percent, arise within sectors. Expenditure reallocation across the 73 sectors observed at both endpoints accounts for 2.10 points, or 23.3 percent; changes in sector coverage account for the remaining 0.06 points. Appendix C.3 gives the exact decomposition, its derivation and the sector contributions (Table C.2). More firms do not mechanically increase the TWC: identical copies with proportionately divided sales leave it unchanged. Different wedges or expenditure shares among newly observed firms can nevertheless change it.

An increase within sectors need not be an increase among continuing firms. Restricting both endpoints to the same 1,482 legal entities and renormalizing their weights gives a TWC of 0.90 in 1985 and 1.59 in 2024. Dispersion therefore rises within this fixed set, but its 0.69 log point increase is smaller than in the full sample. The restriction selects long lived firms; it is a composition check, not an estimate of the trend for all incumbents.

The full sample combines genuine entry and exit with changes in reporting and industry coverage. It cannot isolate their respective effects, a distinction related to the separation of demand, productivity, and selection in Foster et al. (2008). Appendix C.3 also separates the full TWC into components assigned to endpoint continuers and other firms, retaining the full comparison distribution.

4.3 Concentration of firm incidence

For full resets, the top 10 alone account for 64.2 percent of positive finite incidence (Figure 3). The denominator is 12.07 log points, the sum of positive effects from separate resets, not the aggregate TWC: these counterfactual effects need not add. Negative effects mean that the reset increases the TWC and remain in the underlying analysis; Appendix C.4 displays both signs. Raw markup wedges also yield concentrated incidence, with a top 100 share of 84.0 percent. The benchmark changes attribution without creating concentration by construction.

The concentration of incidence is not a restatement of sales concentration. The incidence top 100 hold only 3.7 percent of sample sales but make up 82.7 percent of summed positive incidence. Conversely, the sales top 100 hold 39.0 percent of sales but capture only 15.1 percent of positive incidence. The same contrast is already visible among the top ten. Size enters through expenditure weights, but it does not determine the ranking independently of the wedge and its sectoral comparison distribution. The result complements the granular view of aggregate outcomes (Gabaix, 2011; di Giovanni et al., 2014;

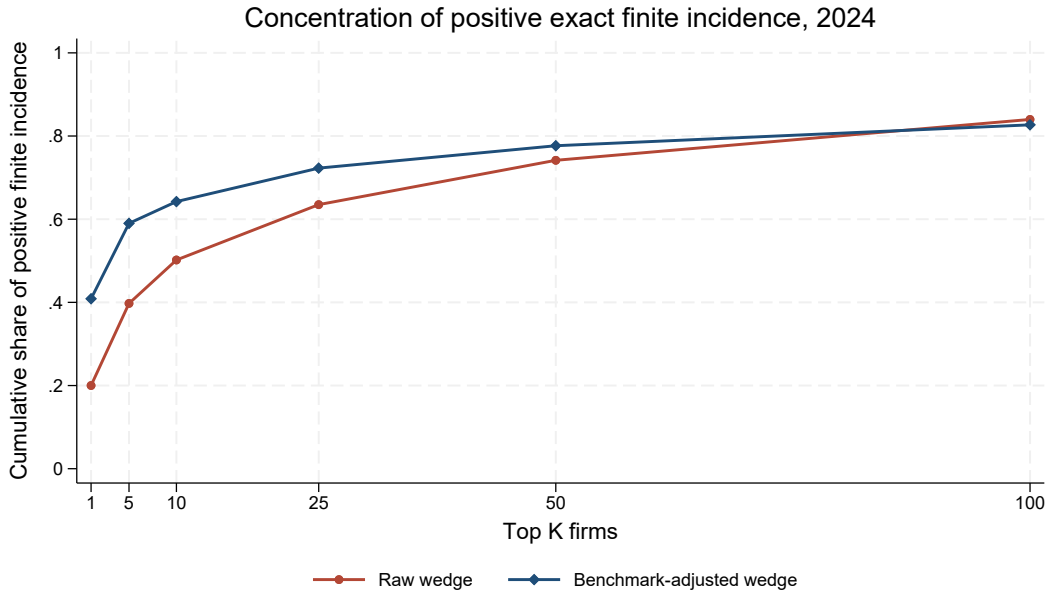


Figure 3: Concentration of positive exact finite incidence, 2024. Firms are ordered separately under raw wedges $\log \mu_{it}$ and residual wedges $\log(\mu_{it}/\mu_{it}^{B})$. Each curve divides the sum of the leading K positive effects by the sum of all positive effects under that definition, not by the aggregate TWC. Every reset updates own and rival sales shares within the sector, holding rival markups, benchmarks, and sector expenditure weights fixed; demand curvature follows the DKM sector calibration.

Carvalho and Grassi, 2019; Burstein et al., 2025): firms can matter disproportionately here without being the largest sellers. Hottman et al. (2016) decompose variation in firm sales into contributions from costs, product appeal, product scope, and markups. Demand also shapes the joint distribution of markups and sales (Mrázová et al., 2021), so neither variable alone isolates the allocation effect of a markup change.

Table 2: Concentration in sales and finite incidence, 2024

Ranking variable	Top-10 sales (%)	Top-100 sales (%)	Top-10 positive incidence (%)	Top-100 positive incidence (%)
Finite incidence	1.9	3.7	64.2	82.7
Sales	17.5	39.0	11.3	15.1

Notes: Each row selects firms using the ranking variable in the first column. Sales columns report the selected firms' share of annual sample sales. Incidence columns report their share of summed positive one-firm finite incidence under the baseline DKM sector calibration.

I compare small proportional markup changes with complete resets to the benchmark, using the marginal and finite incidence measures defined in Sections 2.4 and 2.5.

Influence is concentrated under both interventions, but more so under full resets. In 2024, the top 100 account for 53.3 percent of positive exact marginal incidence and 82.7 percent of positive exact finite incidence. A full reset incorporates both the firm's initial slope and the distance to its benchmark, with the slope changing as sales reallocate. It need not select the same firms as an equal small proportional reduction. The quadratic formulas preserve the broad concentration pattern but give lower top shares. Appendix C.8 reports the detailed comparison in Table C.10.

Concentration is not confined to separate resets. The additive Aumann–Shapley allocation (Aumann and Shapley, 1974) gives a top 100 share of 80.5 percent of positive allocations and shares 90 firms with the finite ranking. Appendix E.6 reports this path dependent comparison; it checks the attribution rule, not the underlying measurements.

4.4 Why simpler rankings differ

Averaging annual comparisons over 1985–2024, a markup ranking recovers 24 percent of the finite incidence top 100 and sales recovers 11 percent (Table 3). Multiplying markup by sales gives 18 percent; multiplying the benchmark ratio by sales gives 14 percent. Operating profit and EBIT margin recover 24 and 18 percent. These are comparisons with a specified counterfactual ranking, not evidence that the alternative metrics are poorly measured or unsuitable for other questions.

Marginal incidence also ranks firms differently because it answers a different question. $\mathrm{MWI}_{it}^{B,\mathrm{E}}$ is the exact TWC slope per unit change in firm i's benchmark-adjusted log wedge, whereas the finite exercise moves each firm by its own distance ξ_{it}^{B} to the benchmark. Ranking slopes alone recovers 38 percent of the finite-incidence top 100 and has a mean within-year Spearman rank correlation of 0.249. The first-order approximation to the same reset, $\xi_{it}^{B}\mathrm{MWI}_{it}^{B,\mathrm{E}}$, raises those statistics to 66 percent and 0.814. The initial derivative already includes marginal sales reallocation; the remaining difference arises because that derivative changes along the full reset. This initial slope approximation is distinct from evaluating a full reset under the quadratic TWC.

Table 3: Alternative rankings and finite incidence, 1985–2024

Alternative ranking	Mean top-100 overlap (%)	Mean Spearman rank correlation
Panel A. Accounting rankings		
Markup μ	24	0.216
Markup gap μ/μ^B	34	0.097
Sales	11	-0.221
$\mu\times$ sales	18	-0.145
$(\mu/\mu^B)\times$ sales	14	-0.191
Operating profit	24	-0.119
EBIT margin	18	0.144
Panel B. Counterfactual measures		
Raw finite effect	39	0.403
Marginal incidence	38	0.249
Initial slope reset $\xi_{it}^B \mathrm{MWI}_{it}^{B,\mathrm{E}}$	66	0.814

Notes: Entries are unweighted averages of annual statistics over 1985–2024. The target is the annual top 100 by exact finite incidence under the firm benchmark. Overlap is the percentage of that set also selected by each alternative. Spearman correlations use all annual firm ranks, not only the top 100. Operating profit excludes nonrecurring items; EBIT margin divides it by sales. Panel B uses exact CES objects. Marginal incidence includes the derivative of sales shares, and the initial slope reset multiplies it by the observed log gap.

The annual comparisons show that large sales, high markups, and high profits select different firms from the full benchmark reset. This is a statement about the specified intervention, not a universal ranking of firms' economic importance. The small price reductions in Table C.7 illustrate the distinction even among the baseline leaders.

This distinction matters when accounting indicators inform competition assessments. Kizior et al. (2018) use markups together with other indicators to identify service sectors in France that could be priorities for reform; Abele et al. (2025) combine indicators to assess competition across industries. Those exercises identify sectors for closer examination. The comparisons here address a complementary question: which individual firms' markup changes have the largest allocative effects? They do not evaluate those composite sector scorecards or identify anticompetitive conduct.

4.5 Leading firms and the size of the reset

Table 4 ranks positive finite effects among firms with nonnegative inferred fixed costs before truncation. Of the 12,708 analysis firms in 2024, 1,318 fail this reporting condition; they remain in all incidence calculations. The restricted top ten retains nine firms from the unrestricted top ten. Omega Pharma Innovation & Development drops out, and the entity administering the Left Bank development area enters tenth. The listed firms account for 61.4 percent of all positive finite incidence, compared with 64.2 percent for the unrestricted top ten. The reported top 100 retains 86 of the unrestricted top 100 and accounts for 78.1 percent of all positive finite incidence, compared with 82.7 percent without the reporting restriction. Neither comparison renormalizes sales shares or drops firms from the counterfactual economy. Each row refers to a Belgian legal entity in unconsolidated accounts, not its worldwide corporate group. Telix Innovations has sales of EUR 320 million and a markup 8.93 times its benchmark. Its full reset changes the TWC by 4.933 log points. GlaxoSmithKline Biologicals has much larger sales, EUR 7.9 billion, but a smaller ratio of 2.31 and a finite effect of 1.358 points. J.C. General Services ranks third in the reported list despite sales of EUR 93 million; its markup is 6.55 times its benchmark. Large gaps can therefore give firms with relatively modest sales substantial incidence.

These effects depend on more than multiplying sales by the gap. In these downward resets, lowering the treated firm's relative price expands its share and contracts rival shares, changing the weights on every residual wedge in its sector. The exact reset in (2.27) evaluates this distributional response. The centered wedge reported in the table describes the firm's initial position, rather than replacing that calculation.

The size of the reset matters even for the two leading firms. Under separate 1 percent price reductions, GSK Biologicals has an effect of 0.0274 log points, compared with 0.0022 for Telix. The full resets reverse their ordering, with effects of 1.358 and 4.933, respectively. Telix's full reset requires a 88.8 percent price reduction and raises its modeled sector sales share from 0.81 to 99.99 percent. GSK's share reaches 98.02 percent in its separate experiment. Table C.7 reports the same comparison for all firms in the unrestricted top ten. These responses explain why a full reset need not rank firms like a small common reduction. They also show how far the leading full effects extrapolate the maintained CES demand system beyond observed prices.

Table 4: Highest finite residual incidence with nonnegative inferred fixed costs, 2024

Rank	Legal entity	Sector	Sales	Sector share	μ/μ^B	$\tau^B_{it\|g}$	$100\Delta\mathcal{I}^{B,\mathrm{E}}_{it}$
1	TELIX INNOVATIONS	21 Pharmaceutical manufacturing	320	0.81	8.93	1.87	4.933
2	GlaxoSmithKline Biologicals	21 Pharmaceutical manufacturing	7,867	19.85	2.31	0.52	1.358
3	J.C. GENERAL SERVICES	64 Financial services	93	1.21	6.55	1.73	0.207
4	UCB PHARMA	46 Wholesale trade	4,211	2.30	1.72	0.49	0.207
5	BRUSSELS AIRPORT COMPANY	52 Warehousing; transport support	692	3.65	2.50	0.81	0.165
6	ARVAL BELGIUM	77 Rental and leasing	1,041	13.13	2.77	0.78	0.139
7	ELIA ASSET	35 Electricity, gas and steam	834	3.27	2.69	0.81	0.118
8	Lorelay Transport Chartering	30 Other transport equipment	146	5.47	2.98	0.90	0.105
9	argenx	72 Research and development	2,143	42.60	1.52	0.26	0.105
10	Maatschappij voor het haven-, grond- en industrialisatiebeleid van het Linkerscheldeoevergebied	84 Public administration; defence	21	2.22	8.93	2.27	0.080

Notes: Firms are ranked by benchmark-adjusted finite TWC incidence $\Delta\mathcal{I}^{B,\mathrm{E}}_{it}$ among firms with $F_{it} \geq 0$ before truncation and positive finite effects. Ranks are recomputed within this reporting set; effects and weights retain all 12,708 analysis firms. Sales are entity turnover in millions of euros and can include exports, intermediate sales, and transactions within groups. Sector share is the firm's sales share within its NACE two-digit sector, in percent. μ/μ^B is the observed markup relative to the firm-level fixed-cost benchmark. At the table's year $t = 2024$, $\tau^B_{it|g} = \xi^B_{it} - \bar{\xi}^B_{gt}$ is the firm's residual markup wedge relative to the sales-weighted sector mean. All rows use the baseline DKM sector demand elasticities. The incidence column reports $100\Delta\mathcal{I}^{B,\mathrm{E}}_{it}$, in log points under the exact CES TWC. A ratio below one means that the reset raises the firm's markup; a positive finite effect need not describe a markup reduction. Table E.35 in Appendix E.10.3 reports the table excluding markups below one.

All ten ratios exceed one, so these leading effects describe downward markup resets. The full sample also permits upward resets when markups lie below their benchmarks. Section 5.3 compares leading ranks across specifications and distinguishes unrestricted rankings from rankings that permit only downward resets.

Named ranks also require attention to the accounts. Table B.5 records the available source evidence and unresolved measurement questions for the unrestricted top ten. UCB's 2024 income includes a retrospective royalty adjustment. Omega Pharma Innovation & Development reports an intellectual property disposal, but its net contribution to profit has not been separately reconciled. Neither disclosure justifies automatically treating all other operating income as exceptional. Omega's inferred fixed cost is negative, so it is not reported in Table 4. This rule does not correct its accounts or exclude it from the baseline economy. Section 5.1.1 separately evaluates how the ranking changes with

the output elasticity used to measure markups.

4.6 Persistence of high incidence

I compare annual incidence ranks among firms observed in consecutive years to assess whether high incidence persists. Table 5 reports adjacent-year transition probabilities for firms observed in both t and $t+1$. A firm in the top 1 percent has a 66.4 percent probability of remaining in the top 1 percent, an 89.2 percent probability of remaining in the top 5 percent, and a 92.4 percent probability of remaining in the top 10 percent. A firm outside the top 10 percent has only a 3.3 percent probability of entering it in the next year. High incidence is therefore not solely a one-year tail event.

Table 5: Persistence of high incidence, 1985–2024

	Status in year $t+1$			
Status in year t	Top 1%	Top 5%	Top 10%	Top 100
Top 1%	66.4	89.2	92.4	64.4
Top 5%	17.6	67.2	82.1	18.7
Top 10%	9.1	40.7	68.7	9.8
Not top 10%	0.1	1.0	3.3	0.1

Notes: Entries are percentages pooling all observed adjacent firm and year pairs from 1985–1986 through 2023–2024. Status is defined using the full annual ranking of exact finite incidence, before restricting to firms observed in both years. Percentile groups overlap: the top 1 percent is included in the top 5 and top 10 percent, so neither rows nor columns sum to 100. Top 100 is a fixed count, not a percentile. Entry to and exit from the accounting panel are excluded from transition probabilities.

The median correlation of adjacent annual ranks is 0.630, indicating substantial movement within a persistent upper tail. Averaging incidence in successive, nonoverlapping windows also preserves persistence. The windows each contain five years, from 1985–1989 through 2020–2024. Among firms observed in every year of both windows, 58.9 percent of the top 1 percent remain there and 91.6 percent remain in the top 10 percent; the median rank correlation is 0.584. These results are not confined to single annual observations, but averaging cannot remove persistent measurement error or selection into continued observation. Tables C.8 and C.9 in Appendix C.7 report the annual and window comparisons.

5 Robustness and Scope

Table 6 separates three questions: how much the aggregate TWC changes, how concentrated positive finite incidence remains, and which firms retain their leading ranks. Concentration is more stable than TWC levels or firm identities. The external fixed input calibration produces the largest change in the TWC and retains the fewest leading firms, yet still assigns most positive finite incidence to the top 100. The principal specifications retain the EBIT based reference and therefore do not test this source of benchmark dependence.

The paired measurement comparisons recompute both the reference and the alternative on the same eligible firms. The annual core comparison below instead restricts eligibility for the ranking while retaining each specification's full annual counterfactual population. These operations answer different questions: removing firms from demand changes incidence, whereas restricting the candidate ranking alone does not. The principal comparisons use exact CES formulas; quadratic results are reported separately as approximation checks. Unless explicitly stated otherwise, the ranking evidence concerns full finite resets, not marginal incidence. Changes to the economic question itself, including actual price moves toward accounting targets, are interpreted separately.

Table 6: Sensitivity of the TWC and finite incidence, 2024

		TWC (log points)		Top 100 share (%)		
Alternative	Formula	Reference	Alternative	Reference	Alternative	Top 100 retained
Firm cost share	E	6.41	4.83	71.6	66.9	78
Five year smoothing	E	6.11	5.75	72.1	66.1	73
External fixed input shares	E	9.59	30.56	84.7	70.1	37
DKM common $\sigma = 3.34$	E	10.03	6.97	82.7	68.5	89
DKM estimates minus one SE	E	10.03	7.73	82.7	80.3	93
Nested CES, $\eta = 0.90$	E	10.03	9.99	82.7	81.5	94

Notes: E denotes exact CES evaluation of TWC; all rows use exact calculations. Each pair uses the same firm universe. The markup comparison contains 12,654 firms passing all measurement restrictions; the external reference comparison separately contains 12,423 firms; smoothing requires at least three observations in the trailing five years and retains 11,380 firms. Other rows use all 12,708 firms. Reference values are recomputed on each comparison sample. Top 100 shares divide the positive finite effects of each specification's own top 100 by its sum of positive finite effects; they are not shares of the aggregate TWC. Retained counts firms shared by the two top 100 sets. Nested CES incorporates allocation across sectors and expenditure reallocation relative to the conditional within sector TWC.

5.1 Measurement sensitivity

5.1.1 Markup measurement

I first vary the assignment of the flexible input's output elasticity. A high measured markup can reflect a large price wedge or an inappropriate assignment of the flexible input's output elasticity. The production approach gives $\mu_{it} = \theta_{it}^X / \alpha_{it}^X$, where $\alpha_{it}^X = X_{it}/R_{it}$ is observed but θ_{it}^X is not. If the elasticity is common within sector and year, it cancels from centered log markups:

$$\log \mu_{it} - \sum_{j \in g} \omega_{jt|g} \log \mu_{jt} = -\log \alpha_{it}^X + \sum_{j \in g} \omega_{jt|g} \log \alpha_{jt}^X. \tag{5.1}$$

This cancellation does not resolve heterogeneity in output elasticities or the dependence of the accounting benchmark on markup levels. Accounting ratios need not reveal the marginal products required to measure misallocation (Bils et al., 2021; Foster et al., 2016). Implications for markup measurement are discussed by Basu (2019); Berry et al. (2019); Bond et al. (2021); De Ridder et al. (2026).

I compare the industry and year median elasticity proxy with the firm specific total cost share construction discussed by De Loecker and Eeckhout (2026):

$$\theta_{it}^{X,\mathrm{CS}} = \frac{X_{it}}{X_{it} + rK_{it}}, \qquad \mu_{it}^{\mathrm{CS}} = \frac{R_{it}}{X_{it} + rK_{it}}. \tag{5.2}$$

Both assignments use the same demand groups, curvature, and counterfactual rule. The EBIT based benchmark is reconstructed at observed sales under each markup measure and then held fixed during each reset. Both are evaluated on the 12,654 firms passing all measurement restrictions. The exact TWC falls from 6.41 to 4.83 log points and top 100 finite concentration from 71.6 to 66.9 percent; 78 leading firms are retained. Table D.2 in Appendix D.1 reports marginal and finite effects under both E and Q, including the separate marginal ranking comparison.

The alternative accommodates differences in input mix, but imposes constant returns and static first order conditions for all measured inputs. It is a different measurement model, not a uniformly better estimator. Raval (2023) develops a distinct flexible cost share estimator; that estimator motivates allowing elasticity heterogeneity but is not the ratio implemented here.

These comparisons are particularly relevant for capital intensive entities. Elia Asset's 2024 measured markup of 5.97 is below the baseline upper cutoff of 13.08. It ranks eighth by finite incidence in the full sample, but its markup falls to 1.15 under firm cost share measurement and its finite incidence becomes negative. Trimming therefore does

not resolve the measurement issue. Its accounts illustrate transactions within a group and services outside the narrow COGS bundle; Table B.5 in Appendix B.1.5 documents the case. Supported NACE four digit pooling, diagnostic rank ranges, and accounting checks are reported in Appendix D.1; profitability provides a complementary diagnostic in Appendix C.5.2. No alternative assignment supplies independent evidence on every firm's technology.

5.1.2 The fixed cost reference

Concentration does not imply that the same firms dominate both rankings. The calculations with and without fixed cost adjustment share three of the top five firms, six of the top ten, and 36 of the top 100 in 2024. TELIX Innovations and GlaxoSmithKline Biologicals occupy the first two positions under both definitions. Beyond these leaders, accounting for fixed cost recovery substantially changes the attribution of incidence. Table D.7 in Appendix D.2.5 reports both ranks and effects for every firm appearing in either top ten.

The reference determines how much of an observed markup is attributed to cost recovery before residual dispersion is evaluated. Three checks examine smoothing of the recovery share, pooling of accounts over time, and a different assignment of fixed inputs.

First, I replace the current recovery share with its trailing five year mean, requiring at least three annual observations and using no future data. The markup measure, demand curvature, and reset rule are unchanged. On the eligible 2024 sample, which retains 95.8 percent of baseline sales, the mean benchmark changes from 1.307 to 1.301 and the exact TWC from 6.11 to 5.75 log points. Top 100 finite concentration falls from 72.1 to 66.1 percent, with rank correlation 0.74 and 73 leading firms retained. Smoothing changes the aggregate TWC little but changes which firms appear in the top ranks. Appendix D.2.1 gives the construction and annual comparisons.

Second, I pool revenue, implied variable costs, and recurring operating profits over five and ten fiscal years before reconstructing markups, cost recovery benchmarks, and sales weights. This differs from averaging annual incidence or smoothing only the benchmark. Each comparison uses the same firms within its horizon, not the full 2024 sample. With complete 2020–2024 histories, the matched annual TWC is 6.14 log points and the pooled TWC is 5.42; top 100 concentration changes from 75.3 to 77.8 percent, with 67 firms retained. Over 2015–2024, the corresponding TWC changes from 6.18 to 4.72 and 61 leading firms remain. Incidence remains concentrated after pooling, but the firms ranked highest depend on the accounting horizon. Appendix D.4 reports the construction, matched samples, and discount sensitivity. Complete histories select surviving entities with disclosed inputs; this is not an estimate of lifetime welfare.

Third, I transport the fixed input shares estimated for Belgian firms by Abraham et al. (2024) to capital charges, payroll, and materials. The source provides separate calibrations for one, five, and ten year adjustment horizons. Appendix D.2.3 gives the coefficients and construction. Published fractions are fixed across calendar years, while costs, recovery shares, and benchmarks vary with each firm's inputs and revenue. Longer horizons assign smaller fractions to fixed use. The markup measure and incidence formula are unchanged; each alternative reference is evaluated at observed revenue and held fixed during the reset. All references use the same 12,423 eligible firms.

Under the one year calibration, the sales weighted recovery share rises from 15.82 to 18.68 percent, whereas the mean benchmark moves from 1.32 to 1.24. Similar means conceal very different assignments: the rank correlation of recovery shares is -0.71. The exact TWC rises from 9.59 to 30.56 log points, and only 37 firms are shared by the top 100 sets. Their shares of positive finite incidence are nevertheless 84.7 and 70.1 percent. The five and ten year calibrations give the same qualitative contrast; full results appear in Appendix D.2.3.

Applying external shares based on a broader input definition neither replicates that estimator nor independently validates each firm's fixed costs. These comparisons do not establish which benchmark is preferable.

5.1.3 Demand curvature

Demand curvature governs the expenditure response to a given markup change. I first replace the DKM sector estimates by their common sales weighted summary, $\sigma^{\text{com}} = 3.34$. The sample, measured markups, benchmarks, and observed expenditure shares are unchanged. The 2024 TWC falls from 10.03 to 6.97 log points, and top 100 finite concentration falls from 82.7 to 68.5 percent. The common calibration retains 89 of the baseline top 100. This comparison uses one source and one missing sector rule; the difference reflects the location of sector elasticities relative to observed wedges and sales, not merely a different average parameter.

Next I shift each available DKM estimate down or up by one published standard error, leaving the fallback at 3.34. All lower estimates remain above one. The downward shift gives a TWC of 7.73 log points, top 100 concentration of 80.3 percent, and 93 of the baseline top 100 firms. The upward shift gives 12.00 log points, concentration of 83.6 percent, and 97 firms retained. These coordinated sensitivity exercises are not confidence intervals or joint statistical tests. These shifts do not quantify uncertainty from transporting supplier elasticities to the present demand system. Table D.9 in Appendix D.3 also reports the HRW common calibration and mapped GTAP elasticities. Those alternatives change the source and economic interpretation as well as numerical curvature;

they are not additional estimates of the same Belgian demand parameter.

Appendix D.3.2 adds the firm substitution estimates of Redding and Weinstein (2024), with an explicit industry mapping and fallback for uncovered sectors. On the same firms, the mapped calibration gives an TWC of 6.03 log points and retains 89 of the DKM top 100. Its own top 100 account for 64.7 percent of summed positive finite incidence. The appendix separates mapping sensitivity from changes in the source estimates.

The marginal result differs. In (2.18), a common σ multiplies exact marginal incidence while the other terms depend on observed residual ratios and expenditure shares. Holding those inputs fixed, changing that common value rescales exact marginal effects without changing their ranking. Finite resets need not preserve that ordering because curvature also determines expenditure shares at the new endpoint. This invariance of exact marginal ranks neither extends to heterogeneous changes in σ_g nor automatically applies to the quadratic marginal expression.

Sector heterogeneity still does not identify demand differences between firms within a sector. A high markup might instead reflect less elastic demand for that firm. The present CES system does not identify that channel. Backing an elasticity out of each markup would require a pricing model that is not imposed here; inserting those values into the common elasticity formula would not constitute a coherent demand extension.

5.1.4 Coverage and expenditure weights

Appendix D.5 examines four cumulative weight sensitivities: sample coverage, exports, imports, and export intensity by firm size. The final layer retains 81 of the baseline top 100 and preserves high concentration and persistence, while lowering the 2024 TWC from 10.03 to 5.58 log points. These comparisons are conditional on external sector matching and zero residual wedges for unobserved supply, not a complete domestic expenditure correction. They test the role of the expenditure denominator while retaining the observed firms' markups and benchmarks.

5.2 Counterfactual extensions

The baseline already adjusts the treated firm's and its rivals' sales shares within the sector. I next allow expenditure to move between sectors. Technologies, fixed costs in euros, actual rival markups, and all benchmark markups remain fixed in this comparison.

5.2.1 Substitution across sectors

An upper CES aggregator additionally permits expenditure to move across sectors. I set $\eta = 0.90$ following the consumption calibration in Baqaee and Farhi (2020), close to the homothetic final expenditure estimate of 0.89 in Herrendorf et al. (2013). I also use 0.13 and 0.50 from distinct specifications in Comin et al. (2021), and 1.00 as a Cobb–Douglas comparator. These are external calibrations, not estimates for Belgian NACE sectors; Appendix E.2 documents their sources and the restrictions involved in transporting them. This extension evaluates the exact nested CES TWC, incorporating allocation across sectors as well as within them. Both specifications use the same 2024 firms and within sector elasticities. The 2024 TWC changes from 10.03 to 9.99 log points; finite rank correlation is 0.97 and 94 leading firms are retained. Across the four calibrations, the TWC is 7.60–10.40 log points. Both the baseline and the extension use exact formulas; their difference reflects the scope of reallocation, not an approximation. Derivations and results are in Appendices A.8 and E.2.

5.2.2 Cost recovery and alternative resets

The benchmark covers inferred fixed costs at observed sales. It does not ensure that every firm remains profitable after a reset. Appendix E.5 reports the treated benchmark update, its combination with sector substitution, and the separate rival solvency and benchmark diagnostics. These extended checks change the reference or impose additional feasibility conditions; they do not enter the three principal specifications below.

Finally, moving actual prices to accounting targets while holding physical marginal costs fixed answers a different resource question from removing residual wedges. Its joint downward resets yield a sector weighted sum of exact one sector gains of 11.89 log points, and its one firm ranking retains 55 of the residual baseline's top 100. Neither the joint gain nor those ranks are an alternative estimate of the same TWC. Table E.6 in Appendix E.4 separates the objects. For the TWC, I also reset all firms in a sector jointly to their individual benchmarks. The ten largest sectors account for 77.2 percent of the aggregate TWC. Appendix E.3 reports these results and the interaction between simultaneous and separate firm resets.

5.3 Stable firm attribution

How much do the identities of high incidence firms depend on the maintained specification? I compare 2024 rankings under the NACE two digit baseline, firm cost share measurement, and nested CES with $\eta = 0.90$. The common sample contains 12,654

firms. All three use exact finite incidence and EBIT based fixed costs. Firm cost share measurement reconstructs observed and benchmark markups; benchmarks remain fixed within each counterfactual. This comparison does not require observation in earlier years and does not pool accounts across years.

Table 7: Stability of finite incidence rankings across principal specifications, 2024

Specification	Rank correlation	Top 100 retained	Top 100 share of positive incidence (%)
NACE 2 baseline	1.00	100	71.6
Firm cost share	0.94	78	66.9
Nested CES, $\eta = 0.90$	0.97	94	70.8

Notes: Each specification ranks the same 12,654 firms observed in 2024. Correlations are Spearman correlations with the baseline; retained counts firms common to the two top 100 lists. Concentration is each specification's top 100 share of summed positive finite effects. Incidence is evaluated against the full annual economy, not a restricted economy containing only the common ranking sample.

The measurement alternative retains 78 of the baseline top 100 firms; sector substitution retains 94. Top 100 concentration ranges from 66.9 to 71.6 percent. The intersection of all three top 100 lists contains 73 firms. Table E.15 reports the leading ten members whose baseline inferred fixed costs are nonnegative, alongside the complete intersection in Appendix E.8.

The annual comparison permits both directions of reset. For 24 members of this core, the reset raises the markup under both measurement specifications; all have positive finite incidence under the three models. Thus a large effect on TWC is not necessarily the effect of a markup reduction. Restricting candidates to $1 \leq \mu_i^{B,(m)} \leq \mu_i^{(m)}$ in 2024 leaves 9,239 firms and an intersection of 76. The larger count does not mean that the original core expands: only 49 firms belong to both intersections because the restriction changes every ranking.

Persistence is examined separately in Appendix E.9. Requiring downward resets in all five years and membership in every top 100 both in 2024 and for average annual incidence over 2020–2024 yields 57 firms. This is distinct from pooling accounts before computing incidence. Benchmark updates remain separate extensions in Appendix E.10.1. None of these intersections establishes robustness to every fixed cost measurement: the three principal models share the EBIT based reference, and agreement across them is not independent validation of firm accounts.

5.4 Scope and interpretation

Dynamics and innovation. The TWC evaluates static allocation, not the origin or lifetime social return of a firm's profits. Observed wedges need not identify primitive distortions (Haltiwanger et al., 2018; Ghatak and Mookherjee, 2025). Plant growth and costly input adjustment matter for interpreting observed allocations (Hsieh and Klenow, 2014; Asker et al., 2014), while competition, innovation, and entry connect market power to future productivity (Aghion et al., 2005; Akcigit and Ates, 2021; Peters, 2020). Intangible investment can lower marginal costs while raising fixed costs and changing entry incentives (De Ridder, 2024). In pharmaceuticals, long research horizons and the duration of patent protection affect incentives to develop treatments (Budish et al., 2015). These mechanisms lie outside the static TWC. The accounting reference does not identify a dynamically efficient markup or separate rents from returns to past research. Fixed outlays can themselves be choices that affect quality, market structure, and entry, as in Sutton (1991). Recognizing an observed recovery requirement does not establish that the expenditure was socially desirable, unavoidable, or independent of market power. The counterfactual holds those choices fixed rather than evaluating investment or entry deterrence.

Conduct and equilibrium adjustment. Rival sales adjust, but rival markups do not. Unchanged rival prices follow from the restrictions in (2.24), not from optimal CES pricing. Their response could amplify or attenuate incidence; the model does not identify that direction (Amiti et al., 2019). Treating a large entity does not require it to be atomistic, but makes this conduct restriction more consequential. Factor price responses, input market markdowns, capital adjustment costs, and input output propagation are also omitted. Allowing expenditure substitution across sectors does not supply these missing equilibrium margins. Endogenizing conduct and entry, as in De Loecker et al. (2026a), would address a broader equilibrium question than the conditional changes studied here. The cost recovery and joint feasibility checks in Appendix E.5 examine whether the modeled reallocations create operating deficits and impose constraints on new losses. These are financing diagnostics, not an exit model: a small aggregate deficit does not establish that no individual firm would leave the market.

Demand and measurement. Exact CES removes the quadratic approximation error conditional on the model, not uncertainty about demand away from observed prices. Demand shape matters for behavior and pass through (Mrázová and Neary, 2017); large implied sales responses make global CES particularly demanding for full resets. One linear price per entity also excludes quantity discounts, two part tariffs, and customer specific contracts (Bornstein and Peter, 2025). The sector elasticities are transferred from

Belgian supplier relationships to broader horizontal substitution groups. High curvature can imply very large reallocations in a full reset, particularly in pharmaceuticals; the common calibration, lower estimates, and partial resets assess this extrapolation without establishing capacity feasibility. Fixed cost recovery is inferred rather than observed independently. Alternative fixed input estimates use different identification and aggregation choices (Abraham et al., 2024; De Loecker et al., 2026b). The reported sensitivity ranges condition on those choices and treat parameters as known; they are not confidence intervals.

Entity boundaries and welfare interpretation. Unconsolidated accounts identify Belgian legal entities, not consolidated groups. They can include both parents and subsidiaries and transactions within groups. Table B.6 in Appendix B.1.6 documents why replacing them with group accounts also changes geography and cost definitions. Turnover mixes domestic and export, final and intermediate, and potentially multiple product sales. Foreign ownership further separates the domestic profit rebate assumption in the resource model from the empirical sample. The TWC neither measures that distributional channel nor gives total welfare relative to a social optimum.

The weight sensitivities in Section 5.1.4 do not recover firm specific trade flows or the markups of unobserved suppliers. They therefore cannot establish the domestic expenditure weights directly.

6 Conclusion

I develop marginal and finite firm incidence measures to quantify how individual markup changes affect aggregate TWC, taking fixed cost recovery into account. In the Belgian application, I identify and rank firms by the TWC reduction from their benchmark resets.

The effects of individual benchmark resets are highly concentrated. In 2024, the 100 firms with the largest positive finite incidence account for 82.7 percent of summed positive effects, compared with 15.1 percent for the 100 largest firms by sales. These are shares of separately evaluated resets, not additive shares of aggregate TWC. High incidence also persists across consecutive years among firms observed in both years. Concentration persists across specifications, but TWC levels and leading firms depend on demand elasticities and inferred fixed costs.

The parsimonious approach uses firm accounts and calibrated output and demand elasticities, without requiring firm level prices or physical quantities. This facilitates applications across countries and industries with comparable accounts and suitable elasticity estimates. The model's tractability comes at the cost of simplifying and restrictive assumptions. It holds technologies and rival markups fixed and abstracts from entry, exit, and investment responses.

Firm incidence can inform economic priorities by comparing the effects of specified markup changes, both across the economy and within sectors. For competition authorities and policymakers, it provides a welfare perspective alongside indicators of firm size, markups, and profitability. That perspective is limited to the reallocation associated with specified markup changes, so it does not establish misconduct or predict the full effect of an enforcement action.

A dynamic extension would connect the immediate allocative effects of markup reductions to their effects on investment, innovation, firm entry and exit, and future productivity. Applications across countries and industries would test whether high incidence is consistently concentrated and persistent, and whether the same types of firms have the largest impact on TWC.

References

Abele, C., Calligaris, S., Criscuolo, C., and Greppi, A. (2025). A scorecard of industry competition. OECD Science, Technology and Industry Working Papers 2025/16, OECD Publishing, Paris.

Abraham, F., Bormans, Y., Konings, J., and Roeger, W. (2024). Price-cost margins, fixed costs and excess profits. *The Economic Journal*, 134(663):2655–2684.

Aghion, P., Bloom, N., Blundell, R., Griffith, R., and Howitt, P. (2005). Competition and innovation: An inverted-U relationship. *The Quarterly Journal of Economics*, 120(2):701–728.

Aguiar, A., Chepeliev, M., Corong, E. L., McDougall, R., and van der Mensbrugghe, D. (2019). The GTAP data base: Version 10. *Journal of Global Economic Analysis*, 4(1):1–27.

Akcigit, U. and Ates, S. T. (2021). Ten facts on declining business dynamism and lessons from endogenous growth theory. *American Economic Journal: Macroeconomics*, 13(1):257–298.

Amiti, M., Itskhoki, O., and Konings, J. (2019). International shocks, variable markups, and domestic prices. *The Review of Economic Studies*, 86(6):2356–2402.

Arkolakis, C., Costinot, A., Donaldson, D., and Rodríguez-Clare, A. (2019). The elusive pro-competitive effects of trade. *The Review of Economic Studies*, 86(1):46–80.

Arkolakis, C., Costinot, A., and Rodríguez-Clare, A. (2012). New trade models, same old gains? *American Economic Review*, 102(1):94–130.

Asker, J., Collard-Wexler, A., and De Loecker, J. (2014). Dynamic inputs and resource (mis)allocation. *Journal of Political Economy*, 122(5):1013–1063.

Atkeson, A. and Burstein, A. (2008). Pricing-to-market, trade costs, and international relative prices. *American Economic Review*, 98(5):1998–2031.

Aumann, R. J. and Shapley, L. S. (1974). *Values of Non-Atomic Games*. Princeton University Press, Princeton, NJ.

Autor, D., Dorn, D., Katz, L. F., Patterson, C., and Van Reenen, J. (2020). The fall of the labor share and the rise of superstar firms. *The Quarterly Journal of Economics*, 135(2):645–709.

Baqaee, D. R. and Farhi, E. (2020). Productivity and misallocation in general equilibrium. *The Quarterly Journal of Economics*, 135(1):105–163.

Basu, S. (2019). Are price-cost markups rising in the United States? A discussion of the evidence. *Journal of Economic Perspectives*, 33(3):3–22.

Berry, S., Gaynor, M., and Scott Morton, F. (2019). Do increasing markups matter? Lessons from empirical industrial organization. *Journal of Economic Perspectives*, 33(3):44–68.

Bils, M., Klenow, P. J., and Ruane, C. (2021). Misallocation or mismeasurement? *Journal of Monetary Economics*, 124:S39–S56.

Bond, S., Hashemi, A., Kaplan, G., and Zoch, P. (2021). Some unpleasant markup arithmetic: Production function elasticities and their estimation from production data. *Journal of Monetary Economics*, 121:1–14.

Bornstein, G. and Peter, A. (2025). Nonlinear pricing and misallocation. *American Economic Review*, 115(11):3853–3908.

Budish, E., Roin, B. N., and Williams, H. (2015). Do firms underinvest in long-term research? Evidence from cancer clinical trials. *American Economic Review*, 105(7):2044–2085.

Burstein, A. T., Carvalho, V. M., and Grassi, B. (2025). Bottom-up markup fluctuations. *The Quarterly Journal of Economics*, 140(4):2619–2684.

Carvalho, V. M. and Grassi, B. (2019). Large firm dynamics and the business cycle. *American Economic Review*, 109(4):1375–1425.

Comin, D., Lashkari, D., and Mestieri, M. (2021). Structural change with long-run income and price effects. *Econometrica*, 89(1):311–374.

Cowling, K. and Mueller, D. C. (1978). The social costs of monopoly power. *The Economic Journal*, 88(352):727–748.

De Loecker, J. and Eeckhout, J. (2026). The macroeconomics of market power. *Annual Review of Economics*, 18:695–726.

De Loecker, J., Eeckhout, J., and Mongey, S. (2026a). Quantifying market power and business dynamism in the macroeconomy. Staff Report 688, Federal Reserve Bank of Minneapolis.

De Loecker, J., Eeckhout, J., and Unger, G. (2020). The rise of market power and the macroeconomic implications. *The Quarterly Journal of Economics*, 135(2):561–644.

De Loecker, J., Fuss, C., Quiller-Doust, N., and Treuren, L. (2026b). The anatomy of costs and firm performance: Evidence from Belgium. *International Journal of Industrial Organization*, 105:103264.

De Loecker, J., Fuss, C., and Van Biesebroeck, J. (2018). Markup and price dynamics: Linking micro to macro. Working Paper 357, National Bank of Belgium.

De Loecker, J., Goldberg, P. K., Khandelwal, A. K., and Pavcnik, N. (2016). Prices, markups, and trade reform. *Econometrica*, 84(2):445–510.

De Loecker, J. and Scott, P. T. (2026). Markup estimation using production and demand data: An application to the U.S. brewing industry. *The Review of Economic Studies*. Advance online publication.

De Loecker, J. and Warzynski, F. (2012). Markups and firm-level export status. *American Economic Review*, 102(6):2437–2471.

De Ridder, M. (2024). Market power and innovation in the intangible economy. *American Economic Review*, 114(1):199–251.

De Ridder, M., Grassi, B., and Morzenti, G. (2026). The hitchhiker's guide to markup estimation: Assessing estimates from financial data. *Econometrica*, 94(1):137–168.

Dhyne, E., Kikkawa, A. K., and Magerman, G. (2022). Imperfect competition in firm-to-firm trade. *Journal of the European Economic Association*, 20(5):1933–1970.

di Giovanni, J., Levchenko, A. A., and Méjean, I. (2014). Firms, destinations, and aggregate fluctuations. *Econometrica*, 82(4):1303–1340.

DiMasi, J. A., Grabowski, H. G., and Hansen, R. W. (2016). Innovation in the pharmaceutical industry: New estimates of R&D costs. *Journal of Health Economics*, 47:20–33.

Dixit, A. K. and Stiglitz, J. E. (1977). Monopolistic competition and optimum product diversity. *American Economic Review*, 67(3):297–308.

Döpper, H., MacKay, A., Miller, N. H., and Stiebale, J. (2025). Rising markups and the role of consumer preferences. *Journal of Political Economy*, 133(8):2462–2505.

Edmond, C., Midrigan, V., and Xu, D. Y. (2015). Competition, markups, and the gains from international trade. *American Economic Review*, 105(10):3183–3221.

Edmond, C., Midrigan, V., and Xu, D. Y. (2023). How costly are markups? *Journal of Political Economy*, 131(7):1619–1675.

Epifani, P. and Gancia, G. (2011). Trade, markup heterogeneity and misallocations. *Journal of International Economics*, 83(1):1–13.

European Commission (2024). Protecting competition in a changing world: Evidence on the evolution of competition in the EU during the past 25 years. Staff report, European Commission, Directorate-General for Competition, Luxembourg.

Foster, L., Grim, C., Haltiwanger, J., and Wolf, Z. (2016). Firm-level dispersion in productivity: Is the devil in the details? *American Economic Review*, 106(5):95–98.

Foster, L., Haltiwanger, J., and Syverson, C. (2008). Reallocation, firm turnover, and efficiency: Selection on productivity or profitability? *American Economic Review*, 98(1):394–425.

Gabaix, X. (2011). The granular origins of aggregate fluctuations. *Econometrica*, 79(3):733–772.

Ghatak, M. and Mookherjee, D. (2025). Misallocating misallocation? *Annual Review of Economics*, 17:511–538.

Hall, R. E. (1988). The relation between price and marginal cost in U.S. industry. *Journal of Political Economy*, 96(5):921–947.

Haltiwanger, J., Kulick, R., and Syverson, C. (2018). Misallocation measures: The distortion that ate the residual. Working Paper 24199, National Bureau of Economic Research.

Hambur, J. and Freestone, O. (2025). How costly are mark-ups in Australia? The effect of declining competition on misallocation and productivity. Research Discussion Paper 2025-05, Reserve Bank of Australia.

Harberger, A. C. (1954). Monopoly and resource allocation. *American Economic Review*, 44(2):77–87.

Herrendorf, B., Rogerson, R., and Valentinyi, Á. (2013). Two perspectives on preferences and structural transformation. *American Economic Review*, 103(7):2752–2789.

Hotelling, H. (1938). The general welfare in relation to problems of taxation and of railway and utility rates. *Econometrica*, 6(3):242–269.

Hottman, C. J., Redding, S. J., and Weinstein, D. E. (2016). Quantifying the sources of firm heterogeneity. *The Quarterly Journal of Economics*, 131(3):1291–1364.

Hsieh, C.-T. and Klenow, P. J. (2009). Misallocation and manufacturing TFP in China and India. *The Quarterly Journal of Economics*, 124(4):1403–1448.

Hsieh, C.-T. and Klenow, P. J. (2014). The life cycle of plants in India and Mexico. *The Quarterly Journal of Economics*, 129(3):1035–1084.

Hulten, C. R. (1978). Growth accounting with intermediate inputs. *The Review of Economic Studies*, 45(3):511–518.

Kaplow, L. (2021). Market power and income taxation. *American Economic Journal: Economic Policy*, 13(4):329–354.

Kizior, M., Simonis, D., Turkisch, E., and Vlachaki, I. (2018). Identifying priority service sectors for reforms in France. European Economy Economic Brief 035, European Commission, Directorate-General for Economic and Financial Affairs, Brussels.

Mankiw, N. G. and Whinston, M. D. (1986). Free entry and social inefficiency. *The RAND Journal of Economics*, 17(1):48–58.

Mrázová, M. and Neary, J. P. (2017). Not so demanding: Demand structure and firm behavior. *American Economic Review*, 107(12):3835–3874.

Mrázová, M., Neary, J. P., and Parenti, M. (2021). Sales and markup dispersion: Theory and empirics. *Econometrica*, 89(4):1753–1788.

OECD (2009). *Measuring Capital: OECD Manual 2009*. OECD Publishing, Paris, second edition.

Ossa, R. (2015). Why trade matters after all. *Journal of International Economics*, 97(2):266–277.

Peters, M. (2020). Heterogeneous markups, growth, and endogenous misallocation. *Econometrica*, 88(5):2037–2073.

Petrin, A. and Levinsohn, J. (2012). Measuring aggregate productivity growth using plant-level data. *The RAND Journal of Economics*, 43(4):705–725.

Petrin, A. and Sivadasan, J. (2013). Estimating lost output from allocative inefficiency, with an application to Chile and firing costs. *The Review of Economics and Statistics*, 95(1):286–301.

Raval, D. (2023). A flexible cost share approach to markup estimation. *Economics Letters*, 230:111262.

Redding, S. J. and Weinstein, D. E. (2024). Accounting for trade patterns. *Journal of International Economics*, 150:103910.

Spence, M. (1976). Product selection, fixed costs, and monopolistic competition. *The Review of Economic Studies*, 43(2):217–235.

Sutton, J. (1991). *Sunk Costs and Market Structure: Price Competition, Advertising, and the Evolution of Concentration*. MIT Press, Cambridge, MA.

Weyl, E. G. and Fabinger, M. (2013). Pass-through as an economic tool: Principles of incidence under imperfect competition. *Journal of Political Economy*, 121(3):528–583.

Appendix

Appendix A contains the theory and proofs. Appendix B describes the data and baseline measurement. Appendix C reports additional baseline results. Appendix D collects measurement robustness, including accounting horizons and coverage and trade weights. Appendix E contains counterfactual extensions and comparisons across specifications.

Question	Evidence
What is the TWC, and how does a firm reset change it?	Appendix A.1 and Appendix A.5
How close are the exact and quadratic calculations?	Appendix C.8, p. 99
What changes under the original resource reference?	Appendix E.4, p. 139
How far do the leading resets move prices and shares?	Appendix C.6, p. 96
What do original accounts establish about the leading firms?	Appendix B.1.5, p. 71
How do accounting horizons and alternative weights affect the results?	Appendix D.4 and Appendix D.5
Which firms remain highly ranked across specifications?	Appendix E.8 and Appendix E.9
How sensitive are the results to demand elasticities?	Appendix D.3 and Appendix D.3.2
What changes when benchmarks or sector expenditure adjust?	Appendix E, p. 133

A Theory and Proofs

Throughout, L denotes factor supply, E nominal expenditure, and W real consumption. $\mathcal{L}^{\mathrm{E}}$ is the exact one sector resource loss, while $\mathcal{I}^{\mathrm{E}}$ is the TWC and $\mathcal{I}^{\mathrm{Q}}$ its quadratic counterpart. Superscripts $\mathrm{N,E}$ and $\mathrm{N,Q}$ denote the exact nested TWC and its quadratic approximation. λ_i is the firm's aggregate sales share, Λ_g the sector share, and $\omega_{i|g}$ the share within its sector. The theory suppresses time indices and the residual objects' superscript B; empirical formulas restore them. A superscript (k) denotes firm k's reset; (g) denotes a joint reset of sector g. Neither is a time index.

A.1 Exact CES welfare and its local approximation

Proof of Theorem 1. Consider the one-sector horizontal economy in the main text. There is one fixed primary factor, labor, with supply L. Firm i transforms labor into its variety

according to

$$c_i = A_i \ell_i, \qquad \sum_i \ell_i = L.$$

The representative household owns all firms, receives profits lump-sum, and spends its income on the differentiated goods. Labor supply, productivities, demand shifters, and the set of varieties are fixed. There are no taxes, foreign profit claims, or distributional welfare weights. Let the wage be w. Technology is linear over the counterfactual range, with marginal cost w/A_i. Let $b > 0$ be a markup common to all firms, and let $z_i = \log \mu_i - \log b$. A common multiplier of all markups leaves the allocation unchanged. We can therefore evaluate welfare at the normalized markup vector $\boldsymbol{\nu} = e^{\boldsymbol{z}}$, where exponentiation is componentwise. Prices in that allocation are

$$p_i(z_i) = e^{z_i} \frac{w}{A_i}.$$

The vector $\boldsymbol{z}$ contains reduced-form relative-price wedges; no pricing first-order condition is imposed. In particular, the proof does not require the common monopolistic-competition markup $\sigma/(\sigma - 1)$ in Hsieh and Klenow (2009).

Let $P(\boldsymbol{z})$ be the CES price index, E nominal expenditure, and

$$\lambda_i(\boldsymbol{z}) = \frac{\varphi_i p_i(z_i)^{1-\sigma}}{\sum_j \varphi_j p_j(z_j)^{1-\sigma}}$$

the expenditure share of firm i. Because $p_i c_i = e^{z_i} w \ell_i$, labor demand is

$$\ell_i = \frac{\lambda_i(\boldsymbol{z}) E}{e^{z_i} w}.$$

Labor-market clearing implies

$$\frac{wL}{E} = \sum_i \lambda_i(\boldsymbol{z}) e^{-z_i}. \tag{A.1}$$

At a fixed wage numeraire, expenditure is endogenous: $E = wL/\sum_i \lambda_i e^{-z_i}$. This is the resource closure used for the theorem, not a restriction that also fixes nominal expenditure. With domestic ownership and lump-sum profit rebates, real welfare is $W(e^{\boldsymbol{z}}) = E/P(\boldsymbol{z})$. Hence

$$W(e^{\boldsymbol{z}}) = \frac{wL}{P(\boldsymbol{z}) \sum_i \lambda_i(\boldsymbol{z}) e^{-z_i}}.$$

At the common benchmark, $z_i = 0$ for all i and $W^* = wL/P(\mathbf{0})$. The exact welfare loss is

$$\mathcal{L}^{\mathrm{E}}(e^{\boldsymbol{z}}) = \log \frac{W^*}{W(e^{\boldsymbol{z}})} = \log \frac{P(\boldsymbol{z})}{P(\mathbf{0})} + \log \left(\sum_i \lambda_i(\boldsymbol{z}) e^{-z_i} \right). \tag{A.2}$$

Let $\lambda_i^* \equiv \lambda_i(\mathbf{0})$ denote benchmark shares and define $S_1(\boldsymbol{z}) = \sum_i \lambda_i^* e^{(1-\sigma)z_i}$. CES demand gives

$$\log \frac{P(\boldsymbol{z})}{P(\mathbf{0})} = \frac{1}{1-\sigma} \log S_1(\boldsymbol{z}), \qquad \lambda_i(\boldsymbol{z}) = \frac{\lambda_i^* e^{(1-\sigma)z_i}}{S_1(\boldsymbol{z})}.$$

Substitution in (A.2) yields

$$\mathcal{L}^{\mathrm{E}}(e^{\boldsymbol{z}}) = \log \left(\sum_i \lambda_i^* e^{-\sigma z_i} \right) + \frac{\sigma}{1-\sigma} \log \left(\sum_i \lambda_i^* e^{(1-\sigma)z_i} \right). \tag{A.3}$$

The same expression can be written using shares observed at the distorted allocation. Let $\omega_i \equiv \lambda_i(\boldsymbol{z})$ and $\nu_i \equiv e^{z_i}$. Since $\omega_i = \lambda_i^* \nu_i^{1-\sigma}/S_1$, it follows that

$$\sum_i \omega_i \nu_i^{\sigma-1} = S_1^{-1}, \qquad \sum_i \frac{\omega_i}{\nu_i} = \frac{\sum_i \lambda_i^* \nu_i^{-\sigma}}{S_1}.$$

Substitution into (A.3) gives

$$\mathcal{L}^{\mathrm{E}}(\boldsymbol{\nu}) = \frac{1}{\sigma-1} \log \left(\sum_i \omega_i \nu_i^{\sigma-1} \right) + \log \left(\sum_i \frac{\omega_i}{\nu_i} \right), \tag{A.4}$$

which is (2.10). A common wedge implements the planner's intensive allocation in this one-factor economy, so $W(\mathbf{1}) \geq W(\boldsymbol{\nu})$ and the expression is nonnegative. It is zero only for common wedge vectors: applying strict Jensen's inequality to $x^{-1/(\sigma-1)}$, with $x_i = \nu_i^{\sigma-1}$ and positive weights ω_i, gives $B^\nu \geq (A^\nu)^{-1/(\sigma-1)}$, with equality only when all ν_i are equal. Observed shares, wedges, and σ are therefore sufficient for the exact loss. □

For any scalar q,

$$\log \left(\sum_i \lambda_i^* e^{q z_i} \right) = q\bar{z} + \frac{q^2}{2} \mathrm{Var}_{\lambda^*}(z_i) + o(\|\boldsymbol{z}\|^2),$$

where $\bar{z} = \sum_i \lambda_i^* z_i$. Applying this expansion with $q = -\sigma$ and $q = 1-\sigma$ makes the first-order terms cancel and gives

$$\mathcal{L}^{\mathrm{E}}(e^{\boldsymbol{z}}) = \frac{1}{2} \sigma \mathrm{Var}_{\lambda^*}(z_i) + o(\|\boldsymbol{z}\|^2),$$

which proves the local approximation in (2.14). Replacing benchmark shares by shares observed at the distorted allocation changes this second-order expression only through third- and higher-order terms.

This proof does not establish a heterogeneous vector $\boldsymbol{\mu}^B$ as a social optimum. For that vector, define $\xi_i = \log(\mu_i/\mu_i^B)$ and $\widetilde{A}_i = A_i/\mu_i^B$, and $\widetilde{\mathrm{mc}}_i = w/\widetilde{A}_i = \mu_i^B \mathrm{mc}_i$. Applying the

same algebra to prices $p_i = e^{\xi_i}\widetilde{\mathrm{mc}}_i$ defines the transformed-economy TWC

$$\mathcal{I}^{\mathrm{E}}(\boldsymbol{\rho}) = \frac{1}{\sigma - 1}\log\left(\sum_i \omega_i \rho_i^{\sigma-1}\right) + \log\left(\sum_i \frac{\omega_i}{\rho_i}\right), \qquad \rho_i = e^{\xi_i}.$$

The transformation changes the resource interpretation while preserving observed prices and expenditure shares. With a common benchmark it reproduces the original economy's relative welfare loss; otherwise it is the conditional accounting TWC defined in Section 2.2. Applying it sector by sector and fixing Λ_g gives (2.13). CES expenditure shares depend on relative prices, not on the level of expenditure, so the same share update can be used at fixed sector expenditure. This does not impose a joint resource balance across sectors and is not a multisector welfare theorem.

A.2 Relation to Hsieh and Klenow (2009)

Hsieh and Klenow (2009) combine capital and labor with heterogeneous output and capital distortions and a common structural markup in the CES pricing rule. Here a single primary factor keeps the allocation problem parsimonious, and measured markups themselves enter as heterogeneous pricing wedges. I do not separately infer output and capital distortions. I condition on markups without imposing a pricing first order condition. Equal substitution elasticities and sales shares therefore do not require equal markups. The framework evaluates the allocation associated with these wedges, without identifying their origins in conduct, contracts, or other frictions.

The distinction can be seen directly in the HK pricing rule. Suppressing their capital distortion, let τ_i^Y be the output wedge, with $1 - \tau_i^Y > 0$. Their rule is

$$p_i = \frac{\bar{\mu}}{1 - \tau_i^Y}\mathrm{mc}_i, \qquad \bar{\mu} = \frac{\sigma}{\sigma - 1}. \tag{A.5}$$

Removing the output wedge leaves the common structural markup $\bar{\mu}$; it does not set the gross markup to zero. Here the observed ratio p_i/mc_i is the pricing wedge being varied, rather than a separately identified output tax. A gross markup of one means marginal cost pricing. The benchmark experiment in Section 2.2 instead sets a firm's *residual log wedge* to zero, which means $\mu_i = \mu_i^B$.

A.3 Uniform markup effects

Multiplying every residual ratio in sector g by a common $c > 0$ multiplies A_g^B by $c^{\sigma_g - 1}$ and B_g^B by c^{-1}. The two changes cancel in (2.13). Equivalently, adding the same constant to every log residual wedge leaves relative prices unchanged. A uniform wedge within a

sector therefore leaves the exact TWC unchanged. The local variance formula has the same invariance because $\mathrm{Var}_{\omega_g}(\xi_i + \log c) = \mathrm{Var}_{\omega_g}(\xi_i)$.

This invariance is a property of the parsimonious horizontal benchmark, not a claim that uniform markups are welfare-neutral in all environments. A related proportional-markup neutrality result is derived by Kaplow (2021). A common markup can affect welfare through labor supply, entry and exit, investment and innovation, rent distribution, or aggregate level effects. Those channels are outside the static incidence object studied here.

A.4 Marginal incidence and its decomposition

Proof of Proposition 1. Suppress the sector subscript and let $q_i = \varphi_i \widetilde{A}_i^{\sigma-1} > 0$ collect firm i's demand shifter and effective productivity. With $\rho_i = e^{\xi_i}$, define

$$S(\boldsymbol{\rho}) = \sum_i q_i \rho_i^{1-\sigma}, \qquad T(\boldsymbol{\rho}) = \sum_i q_i \rho_i^{-\sigma}.$$

In this proof, $A^\rho = \sum_i \omega_i \rho_i^{\sigma-1}$ and $B^\rho = \sum_i \omega_i/\rho_i$ are the generic sufficient statistics evaluated at residual ratios. Restoring sector indices gives the moments A_g^B and B_g^B used in the main text. The derivation in Section A.1 gives

$$W(\boldsymbol{\rho}) = L \frac{S(\boldsymbol{\rho})^{\sigma/(\sigma-1)}}{T(\boldsymbol{\rho})}.$$

The expenditure and effective variable resource shares at the observed allocation are

$$\omega_i = \frac{q_i \rho_i^{1-\sigma}}{S(\boldsymbol{\rho})}, \qquad v_i = \frac{q_i \rho_i^{-\sigma}}{T(\boldsymbol{\rho})} = \frac{\omega_i/\rho_i}{B^\rho}.$$

Here v_i is a resource share in the transformed economy. Its expenditure counterpart is $\widetilde{\mathrm{mc}}_i c_i = R_i/\rho_i$, not the observed accounting COGS bill or the original economy's variable cost R_i/μ_i. Differentiating log welfare with respect to $\xi_k = \log \rho_k$ yields

$$\frac{\partial \log W}{\partial \xi_k} = -\sigma\omega_k + \sigma v_k.$$

Because the loss is $\log W(\mathbf{1}) - \log W(\boldsymbol{\rho})$,

$$\frac{\mathrm{d}\mathcal{I}^{\mathrm{E}}}{\mathrm{d}\xi_k} = \sigma(\omega_k - v_k) = \sigma\omega_k \left(1 - \frac{\rho_k^{-1}}{B^\rho}\right). \tag{A.6}$$

Multiplying by Λ_g and restoring sector subscripts proves (2.18). □

This is a total derivative: both the treated firm's share and every rival share follow the CES system as ξ_k changes.

The chain rule decomposes the total derivative as follows. Let $h_i \equiv (\omega_i \rho_i^{\sigma-1})/A^\rho$, the share at the common-wedge reference implied by the same primitives. If the observed-share representation in (A.4) is differentiated first holding $\boldsymbol{\omega}$ fixed, the direct term is $h_k - v_k$. The remaining sales-reallocation term is

$$\sigma(\omega_k - v_k) - (h_k - v_k).$$

Their sum is (A.6). This decomposition is algebraic; the economically relevant incidence is the total derivative, not either term in isolation.

Derivative of the quadratic TWC. For sector g, let $\bar{\xi}_g = \sum_{i \in g} \omega_{i|g} \xi_i$, $\tau_{i|g} = \xi_i - \bar{\xi}_g$, and $V_g = \sum_{i \in g} \omega_{i|g} \tau_{i|g}^2$ as in the main text. Differentiating the variance along the CES share system gives

$$\begin{aligned} \frac{\mathrm{d}V_g}{\mathrm{d}\xi_k} &= \sum_{i \in g} \frac{\mathrm{d}\omega_{i|g}}{\mathrm{d}\xi_k} \tau_{i|g}^2 + 2 \sum_{i \in g} \omega_{i|g} \tau_{i|g} \left(\mathbf{1}\{i = k\} - \frac{\mathrm{d}\bar{\xi}_g}{\mathrm{d}\xi_k} \right) \\ &= 2\omega_{k|g}\tau_{k|g} - (\sigma_g - 1)\omega_{k|g} \left(\tau_{k|g}^2 - V_g \right). \end{aligned} \tag{A.7}$$

The derivative of the mean cancels because $\sum_{i \in g} \omega_{i|g} \tau_{i|g} = 0$. Multiplication by $\sigma_g \Lambda_g / 2$ proves (2.21). The direct term differentiates the wedges at fixed weights; the other term differentiates the weights. Summing across firms gives $\sum_{k \in g} \mathrm{MWI}_k^{\mathrm{Q}} = 0$, consistently with uniform wedge neutrality. This calculation differentiates the defined variance TWC exactly. It does not restore the higher order terms omitted when the exact CES TWC was replaced by its quadratic approximation.

A.4.1 Sign and ranking implications

Equation (2.18) can be written as

$$\mathrm{MWI}_i^{\mathrm{E}} = \sigma_g \Lambda_g \omega_{i|g} \left(1 - \frac{\rho_i^{-1}}{B_g^B} \right).$$

Since $\sigma_g \Lambda_g \omega_{i|g} > 0$, its sign is that of $1 - (\rho_i B_g^B)^{-1}$. This proves (2.20), including zero incidence at $\rho_i = 1/B_g^B$. By definition, $1/B_g^B$ is the expenditure weighted harmonic mean of the residual ratios. Also, $\sum_i \omega_{i|g} = \sum_i v_{i|g} = 1$ implies that marginal incidences sum to zero within the sector.

For two firms in the same observed sector, the common positive factor $\sigma_g \Lambda_g$ cancels:

$$\mathrm{MWI}_k^{\mathrm{E}} > \mathrm{MWI}_\ell^{\mathrm{E}} \quad \Longleftrightarrow \quad \omega_{k|g}\left(1 - \frac{1}{\rho_k B_g^B}\right) > \omega_{\ell|g}\left(1 - \frac{1}{\rho_\ell B_g^B}\right). \tag{A.8}$$

At equal shares, the right side orders firms by ρ_i, since $1 - (\rho B_g^B)^{-1}$ is strictly increasing in ρ for the common observed B_g^B. This is a comparison across firms at one allocation, not a counterfactual that holds shares fixed as a markup changes. At equal ratios above $1/B_g^B$, incidence increases with size; at equal ratios below it, greater size makes incidence more negative. At the threshold both incidences are zero.

If both incidences are positive, the exact size condition is

$$\mathrm{MWI}_k^{\mathrm{E}} > \mathrm{MWI}_\ell^{\mathrm{E}} \quad \Longleftrightarrow \quad \frac{\omega_{k|g}}{\omega_{\ell|g}} > \frac{1 - (\rho_\ell B_g^B)^{-1}}{1 - (\rho_k B_g^B)^{-1}}. \tag{A.9}$$

For a smaller firm k to outrank ℓ, it must have a higher residual ratio and satisfy this inequality. The positivity restriction is needed before dividing by the wedge corrections. Raw markup comparisons additionally omit heterogeneity in μ_i^B. Across sectors, the corrections involve different B_g^B and the incidence scale is $\sigma_g \lambda_i$. These observations establish the ranking implications in Section 2.4.

A.5 Finite incidence and the local approximation

Proof of Proposition 2. Consider a single sector, so that $\omega_i = \lambda_i$ and its elasticity is σ. Under CES demand,

$$\omega_i = \frac{\varphi_i p_i^{1-\sigma}}{\sum_j \varphi_j p_j^{1-\sigma}}.$$

Consider the counterfactual that resets firm k's wedge from ξ_k to zero while holding all other wedges fixed. Since prices move one-for-one with markup wedges, the log price change for firm k relative to the baseline is $-\xi_k$, while the log price change for every other firm is zero. Hence

$$\left(\frac{p_k^{(k)}}{p_k}\right)^{1-\sigma} = \exp\{(1-\sigma)(-\xi_k)\} = \exp\{(\sigma-1)\xi_k\}.$$

Using the baseline shares as sufficient statistics for the demand weights, the counterfactual share of firm k is

$$\omega_k^{(k)} = \frac{\omega_k \exp((\sigma-1)\xi_k)}{\omega_k \exp((\sigma-1)\xi_k) + \sum_{j \neq k} \omega_j} = \frac{\omega_k \exp((\sigma-1)\xi_k)}{1 - \omega_k + \omega_k \exp((\sigma-1)\xi_k)}.$$

For $i \neq k$,

$$\omega_i^{(k)} = \frac{\omega_i}{1 - \omega_k + \omega_k \exp((\sigma - 1)\xi_k)}.$$

These are the single sector versions of (2.25).

Let $\xi_k^{(k)} = 0$ and $\xi_i^{(k)} = \xi_i$ for all $i \neq k$. In the sector-level implementation, the same calculation is performed within firm k's sector. If $g(k) = g$, the counterfactual within-sector shares are

$$\begin{aligned}
\omega_{k|g}^{(k)} &= \frac{\omega_{k|g} \exp((\sigma_g - 1)\xi_k)}{1 - \omega_{k|g} + \omega_{k|g} \exp((\sigma_g - 1)\xi_k)}, \\
\omega_{i|g}^{(k)} &= \frac{\omega_{i|g}}{1 - \omega_{k|g} + \omega_{k|g} \exp((\sigma_g - 1)\xi_k)} \quad i \in g,\ i \neq k.
\end{aligned}$$

Define B_g^B as in (2.12) and

$$D_{kg} = 1 - \omega_{k|g} + \omega_{k|g}\rho_k^{\sigma_g - 1}, \qquad J_{kg} = B_g^B - \frac{\omega_{k|g}}{\rho_k} + \omega_{k|g}\rho_k^{\sigma_g - 1}.$$

Using $\rho_k^{(k)} = 1$, the moments at the new shares satisfy $(A_g^B)^{(k)} = A_g^B / D_{kg}$ and $(B_g^B)^{(k)} = J_{kg}/D_{kg}$. Substitution into the sector TWC gives

$$\Delta \mathcal{I}_k^{\mathrm{E}} = \Lambda_g \left[\frac{\sigma_g}{\sigma_g - 1} \log D_{kg} + \log B_g^B - \log J_{kg} \right]. \tag{A.10}$$

This is (2.27). □

The expression updates the treated firm's and every same-sector rival's expenditure share exactly under CES, while holding Λ_g, rival prices and markups, and the benchmark vector fixed. It is exact for the transformed residual economy, not welfare relative to a heterogeneous social optimum in the original resource economy. Each one-firm reset also uses a different counterfactual allocation, so these effects need not add to $\mathcal{I}^{\mathrm{E}}$.

Finite reset of the quadratic TWC. The same reset and CES shares determine the quadratic finite effect. Because the treated wedge is zero at the endpoint and every rival's share is divided by D_{kg}, the updated first and second moments are

$$\bar{\xi}_g^{(k)} = \frac{\bar{\xi}_g - \omega_{k|g}\xi_k}{D_{kg}}, \qquad \sum_{i \in g} \omega_{i|g}^{(k)} (\xi_i^{(k)})^2 = \frac{V_g + \bar{\xi}_g^2 - \omega_{k|g}\xi_k^2}{D_{kg}}.$$

Hence

$$V_g^{(k)} = \frac{V_g + \bar{\xi}_g^2 - \omega_{k|g}\xi_k^2}{D_{kg}} - \left(\frac{\bar{\xi}_g - \omega_{k|g}\xi_k}{D_{kg}} \right)^2. \tag{A.11}$$

All other sectors are unchanged. Subtracting the endpoint quadratic TWC from its initial value therefore proves (2.28). The formula also applies to a sector with a single firm, for which both variances are zero. Its only approximation is the choice of the quadratic TWC in place of the exact CES TWC; it does not linearize the price move or freeze expenditure shares.

Joint sector reset. Now reset every firm in sector g simultaneously. Let $\xi_i^{(g)} = 0$ for all $i \in g$ and hold wedges outside g fixed. Because firm i's price changes by the factor $\exp(-\xi_i)$, define

$$D_g = \sum_{j \in g} \omega_{j|g} \exp((\sigma_g - 1)\xi_j)\,.$$

The counterfactual within-sector shares are

$$\omega_{i|g}^{(g)} = \frac{\omega_{i|g} \exp((\sigma_g - 1)\xi_i)}{D_g}. \tag{A.12}$$

Thus all treated firms' sales adjust jointly. The final residual wedge is zero for every firm in the sector, so the counterfactual exact TWC is zero regardless of the counterfactual shares. With Λ_g fixed, the joint effect is therefore

$$\boxed{\Delta\mathcal{I}_g^{\mathrm{E}} = \Lambda_g \left[\frac{\log A_g^B}{\sigma_g - 1} + \log B_g^B\right].} \tag{A.13}$$

Summing (A.13) across sectors reproduces the aggregate TWC in (2.13). By contrast, $\sum_{i \in g} \Delta\mathcal{I}_i^{\mathrm{E}}$ generally differs from $\Delta\mathcal{I}_g^{\mathrm{E}}$ because each one-firm effect uses a different counterfactual distribution of sales shares. Their difference is the interaction reported in the empirical appendix.

Initial slope approximation for either formula. The marginal incidence measure gives an endpoint approximation to finite incidence. For $s \in \{\mathrm{E}, \mathrm{Q}\}$, let $\mathrm{MWI}_k^s(u)$ denote marginal incidence evaluated along the path where firm k's wedge takes the intermediate value u, with the associated CES shares recomputed at that value and other wedges held fixed. Then

$$\Delta\mathcal{I}_k^s = \int_0^{\xi_k} \mathrm{MWI}_k^s(u)\,\mathrm{d}u.$$

Integration by parts gives the exact remainder of the endpoint approximation:

$$\Delta\mathcal{I}_k^s = \xi_k \mathrm{MWI}_k^s(\xi_k) - \int_0^{\xi_k} u\,\frac{\mathrm{dMWI}_k^s(u)}{\mathrm{d}u}\,\mathrm{d}u. \tag{A.14}$$

If the slope derivative is bounded in magnitude by M over the path, the absolute approximation error is at most $M\xi_k^2/2$. Thus

$$\Delta\mathcal{I}_k^s \approx \xi_k \mathrm{MWI}_k^s(\xi_k)$$

is an approximation in absolute terms for small resets or nearly constant incidence along the path. It does not guarantee small relative error near an allocation where the first derivative vanishes. In particular, the full finite reset of the quadratic TWC need not equal its initial slope times the wedge. The empirical comparison evaluates the full finite expressions under both formulas rather than applying this additional approximation.

A.5.1 Interaction and nonadditivity

Let $\widehat{\mathcal{I}}_g^{\mathrm{E}}(\boldsymbol{\xi}_g)$ denote sector g's contribution to the aggregate TWC, including its fixed weight Λ_g, as a function of log wedges after substituting the CES share system.

Proposition 3 (Interaction and nonadditivity)**.** *Let Z_k set coordinate k of $\boldsymbol{\xi}_g$ to zero. Define $\Delta_k = \widehat{\mathcal{I}}_g^{\mathrm{E}}(\boldsymbol{\xi}_g) - \widehat{\mathcal{I}}_g^{\mathrm{E}}(\mathsf{Z}_k\boldsymbol{\xi}_g)$, Δ_ℓ analogously, and $\Delta_{k\ell} = \widehat{\mathcal{I}}_g^{\mathrm{E}}(\boldsymbol{\xi}_g) - \widehat{\mathcal{I}}_g^{\mathrm{E}}(\mathsf{Z}_k\mathsf{Z}_\ell\boldsymbol{\xi}_g)$. Here $\Delta_k = \Delta\mathcal{I}_k^{\mathrm{E}}$ and $\Delta_{k\ell}$ denotes the joint two firm effect. Then*

$$\Delta_k + \Delta_\ell - \Delta_{k\ell} = \int_0^{\xi_k}\int_0^{\xi_\ell} \frac{\partial^2}{\partial u\,\partial v}\widehat{\mathcal{I}}_g^{\mathrm{E}}(u, v, \boldsymbol{\xi}_{-k\ell})\,\mathrm{d}v\,\mathrm{d}u. \tag{A.15}$$

Separate effects equal the joint effect if and only if this integrated interaction is zero.

Proof of Proposition 3. Fix the residual wedges of all firms other than k and ℓ and write

$$\mathcal{F}(u, v) \equiv \widehat{\mathcal{I}}_g^{\mathrm{E}}(u, v, \boldsymbol{\xi}_{-k\ell}).$$

CES shares are smooth at strictly positive prices, so $\mathcal{F}$ is twice continuously differentiable on the rectangle joining $(0, 0)$ and (ξ_k, ξ_ℓ). From the definitions of the separate and joint resets,

$$\begin{aligned}\Delta_k + \Delta_\ell - \Delta_{k\ell} &= \mathcal{F}(\xi_k, \xi_\ell) - \mathcal{F}(0, \xi_\ell) - \mathcal{F}(\xi_k, 0) + \mathcal{F}(0, 0)\\ &= \int_0^{\xi_k}\int_0^{\xi_\ell} \frac{\partial^2\mathcal{F}(u, v)}{\partial u\,\partial v}\,\mathrm{d}v\,\mathrm{d}u,\end{aligned}$$

where the second equality follows by applying the fundamental theorem of calculus successively in the two coordinates. This is (A.15). If k and ℓ belong to different sectors under the baseline closure, the aggregate TWC is the sum of sector terms with fixed Λ_g; each term contains at most one of the two coordinates. The mixed derivative is then

zero. Within a sector, the moments and CES shares depend on the full wedge vector, so there is no such restriction. □

A.6 An additive path allocation check

The one-firm finite effects answer separate counterfactual questions and need not add to aggregate $\mathcal{I}^{\mathrm{E}}$. For comparison, this subsection constructs one additive accounting allocation using the Aumann–Shapley path formula (Aumann and Shapley, 1974). It does not replace the finite object used for the headline ranking, and its economic content depends on the path chosen below.

Let $\boldsymbol{\xi}(s) = s\boldsymbol{\xi}$, for $s \in [0,1]$, be the radial path from the benchmark vector to the observed residual wedges. Starting from the observed within-sector shares at $s = 1$, CES demand implies

$$\omega_{i|g}(s) = \frac{\omega_{i|g}(1)\exp((\sigma_g - 1)(1-s)\xi_i)}{\sum_{j\in g}\omega_{j|g}(1)\exp((\sigma_g - 1)(1-s)\xi_j)}.$$

Thus the path recomputes every firm's share as all residual prices move, while holding sector expenditure shares and the benchmark vector fixed. Let $\lambda_i(s) = \Lambda_{g(i)}\omega_{i|g(i)}(s)$ and let $\widehat{\mathcal{I}}^{\mathrm{E}}(\boldsymbol{\xi}) \equiv \mathcal{I}^{\mathrm{E}}(e^{\boldsymbol{\xi}}, \boldsymbol{\lambda}(\boldsymbol{\xi}))$ denote the composed TWC after substituting the CES share system. Define the path allocation to firm i as

$$\mathcal{A}_i^{\mathrm{E}}(\boldsymbol{\xi}) = \xi_i \int_0^1 \frac{\partial \widehat{\mathcal{I}}^{\mathrm{E}}(\boldsymbol{\xi}(s))}{\partial \xi_i(s)}\,\mathrm{d}s = \xi_i \int_0^1 \mathrm{MWI}_i^{\mathrm{E}}(\boldsymbol{\xi}(s))\,\mathrm{d}s. \tag{A.16}$$

The coordinate derivative in the integrand is the total derivative with respect to ξ_i after CES shares have been substituted. It is therefore the marginal incidence formula evaluated at the intermediate wedge vector and its associated shares, not a fixed-share partial derivative. By the chain rule,

$$\sum_i \mathcal{A}_i^{\mathrm{E}}(\boldsymbol{\xi}) = \int_0^1 \sum_i \xi_i \frac{\partial \widehat{\mathcal{I}}^{\mathrm{E}}(\boldsymbol{\xi}(s))}{\partial \xi_i(s)}\,\mathrm{d}s \tag{A.17}$$

$$= \int_0^1 \frac{\mathrm{d}}{\mathrm{d}s}\widehat{\mathcal{I}}^{\mathrm{E}}(\boldsymbol{\xi}(s))\,\mathrm{d}s = \widehat{\mathcal{I}}^{\mathrm{E}}(\boldsymbol{\xi}) - \widehat{\mathcal{I}}^{\mathrm{E}}(\mathbf{0}) = \mathcal{I}^{\mathrm{E}}(e^{\boldsymbol{\xi}}). \tag{A.18}$$

The last equality uses $\widehat{\mathcal{I}}^{\mathrm{E}}(\mathbf{0}) = \mathcal{I}^{\mathrm{E}}(\mathbf{1}) = 0$. Hence the allocation adds exactly to the maintained exact CES TWC. The identity is mathematical, not a claim that firm effects are technologically separable.

The adding-up identity requires specifying a joint path. The radial path moves every residual wedge by the same proportion and allocates the interaction terms encountered along that path. A different path can produce different firm allocations because expenditure shares and centered wedges are endogenous to the entire wedge vector. By contrast,

$\Delta\mathcal{I}_i^{\mathrm{E}}$ asks what happens when firm i alone is reset from the observed allocation. The empirical analysis therefore keeps the finite reset as its incidence object. The path allocation checks whether concentration also appears under an additive attribution rule. Section E.6 reports that comparison.

A.7 Alternative target interpretation and counterfactual closure

The preceding subsections derive the maintained exact TWC and its incidence measures. This subsection derives a different exercise used in Section 5.2: moving actual prices to accounting targets while retaining the original marginal costs. Fix sector g, suppress its subscript, and write $\omega_i = \omega_{i|g}$ and $\sigma = \sigma_g$. The *actual-target* interpretation evaluates welfare in the original resource economy. Let

$$B^{\mu} = \sum_i \frac{\omega_i}{\mu_i}, \qquad D_k^{\mu} = 1 - \omega_k + \omega_k(\rho_k)^{\sigma-1},$$

and

$$J_k^{\mu} = B^{\mu} - \frac{\omega_k}{\mu_k} + \frac{\omega_k}{\mu_k}(\rho_k)^{\sigma}. \tag{A.19}$$

Holding actual marginal costs fixed and changing only firm k's price from $\mu_k \mathrm{mc}_k$ to $\mu_k^B \mathrm{mc}_k$ gives

$$\Delta_k^{\mathrm{T,E}} = \frac{\sigma}{\sigma - 1} \log D_k^{\mu} + \log B^{\mu} - \log J_k^{\mu}, \tag{A.20}$$

before multiplication by the sector expenditure share. Unlike the residual finite effect in (A.10), this expression counts the resource effects of the heterogeneous target vector. It does not require that vector to be socially optimal; it only treats it as the endpoint of the price change.

More generally, let T be any set of firms reset simultaneously in one sector, define $a_i = \mu_i'/\mu_i$ for $i \in T$ and $a_i = 1$ otherwise, and set

$$D_T^{\mu} = \sum_i \omega_i a_i^{1-\sigma}, \qquad J_T^{\mu} = \sum_i \frac{\omega_i}{\mu_i} a_i^{-\sigma}. \tag{A.21}$$

The exact one-sector resource gain for that joint reset is

$$\Delta_T^{\mathrm{T,E}} = \frac{\sigma}{\sigma - 1} \log D_T^{\mu} + \log B^{\mu} - \log J_T^{\mu}. \tag{A.22}$$

Equation (A.20) is the special case with $T = \{k\}$ and $a_k = 1/\rho_k$. The empirical simultaneous-reset calculations evaluate (A.22) within each sector and report $\sum_g \Lambda_g \Delta_{T_g,g}^{\mathrm{T,E}}$. This is a sector-sales-weighted collection of exact one-sector resource comparisons. With-

out a specified multisector resource aggregator, it is not an exact welfare change for one integrated economy.

The actual-target calculation also determines nominal expenditure and sales. Writing E' and R_i' for their counterfactual values,

$$\frac{E'}{E} = \frac{B^\mu D_k^\mu}{J_k^\mu}, \qquad \frac{R_k'}{R_k} = \frac{B^\mu(\rho_k)^{\sigma-1}}{J_k^\mu}, \tag{A.23}$$

$$\frac{R_j'}{R_j} = \frac{B^\mu}{J_k^\mu} \quad (j \neq k), \qquad \frac{c_k'}{c_k} = \frac{B^\mu(\rho_k)^\sigma}{J_k^\mu}. \tag{A.24}$$

Thus the treated firm's quantity and sales and every same-sector rival's sales change even though rival prices and markups do not. These responses combine within-sector substitution with the change in nominal sector expenditure required by resource clearing. Sectoral substitution is added separately in Section E.2.

Finally, the sales-consistent target keeps the treated firm's inferred fixed cost F_k^+ fixed in euros. If $f_k = F_k^+/R_k$ and m denotes the candidate target, it solves

$$\left(1 - \frac{1}{m}\right) \frac{B^\mu(\mu_k/m)^{\sigma-1}}{B^\mu - \omega_k/\mu_k + (\omega_k/\mu_k)(\mu_k/m)^\sigma} = f_k. \tag{A.25}$$

For a downward reset, this equation has a unique root on $[1, \mu_k]$. To see this, put $a = B^\mu - \omega_k/\mu_k \geq 0$ and $b = \omega_k \mu_k^{\sigma-1} > 0$. The left side is

$$\frac{G_k(m)}{R_k} = \frac{B^\mu \mu_k^{\sigma-1}(m-1)}{am^\sigma + b}.$$

It is zero at one and exceeds f_k at the observed μ_k whenever $\mu_k > \mu_k^B$. For $a > 0$, its derivative has the sign of $am^{\sigma-1}[\sigma - (\sigma-1)m] + b$, whose derivative is $-a\sigma(\sigma - 1)m^{\sigma-2}(m-1) < 0$ for $m > 1$. Cost recovery therefore first increases and then decreases: with the upper endpoint still above the requirement, only its increasing branch can cross that requirement on $[1, \mu_k]$. If $a = 0$, cost recovery is strictly increasing. If $f_k = 0$, the selected target is one. Uniqueness on this bracket does not assert global uniqueness over all markups. Denote this selected solution by m_k^{T}, where T labels the actual-target calculation with resource clearing.

Only the treated target and its resulting sales are solved jointly. The actual and benchmark markups of all rivals remain fixed. Recomputing a rival's accounting benchmark after its sales change would alter the residual reference vector but would not alter actual welfare because the rival's price is unchanged. None of these exercises adds strategic repricing, endogenous marginal costs, entry, or dynamics.

Table A.1: Resource and expenditure closure in the one sector exact CES comparisons

Object	Baseline TWC	Fixed actual target	Sales consistent actual target
Evaluated technology	Transformed, $\widetilde{A}_i$	Original, A_i	Original, A_i
Treated markup	μ_k^B	μ_k^B	Solved target m_k^{T}
Treated benchmark	Fixed	Fixed	Jointly solved
Nominal sector expenditure	Fixed for the reported sales response	Adjusts by resource clearing	Adjusts by resource clearing
Resource closure	TWC evaluated at CES shares; no new resource balance imposed on nominal sales	Fixed factor supply and factor price numeraire	Same as fixed actual target
Own and rival sales	CES shares at fixed expenditure	CES shares and endogenous expenditure	CES shares and endogenous expenditure
Rival prices and actual markups	Fixed	Fixed	Fixed
Rival benchmarks	Fixed	Fixed	Fixed
Accounting fixed costs	Used to set the reference	Used to set the target	Treated F_k^+ fixed in euros

Notes: Every column changes one firm's price and holds marginal costs, varieties, and demand parameters fixed. The first column evaluates the exact TWC in a fixed transformed economy; its expenditure shares do not require a nominal expenditure closure. Reported revenue changes use fixed sector expenditure. Columns two and three instead impose the original one sector resource balance in (A.23)–(A.24). Accounting fixed costs are not additional resources in any of these welfare calculations. Sector weights Λ_g are fixed when aggregating the one sector comparisons. Appendix A.8 adds sector expenditure reallocation at fixed total nominal expenditure. The revenue updated residual exercise in Appendix A.9 is distinct from the final column: it changes the transformed accounting reference and holds nominal expenditure fixed, rather than imposing the original resource balance.

A.8 Nested CES and cross-sector substitution

This subsection extends the conditional demand system by allowing expenditure to move across sectors. The nested constant-elasticity structure is standard in differentiated-product demand (Dixit and Stiglitz, 1977). Comin et al. (2021) study sector substitution in a nonhomothetic demand system; the extension here instead maintains a homothetic upper nest and uses the external calibrations documented in Appendix E.2. Superscript N denotes objects recomputed under this nested demand system. Define the lower-tier composites by

$$C_g = \left(\sum_{i:g(i)=g} \varphi_{i|g}^{1/\sigma_g} c_i^{(\sigma_g-1)/\sigma_g} \right)^{\sigma_g/(\sigma_g-1)}, \qquad \sigma_g > 1.$$

Let these composites enter an upper-tier CES aggregator,

$$C = \left(\sum_g \beta_g^{1/\eta} C_g^{(\eta-1)/\eta} \right)^{\eta/(\eta-1)}, \tag{A.26}$$

where $\beta_g > 0$, $\eta > 0$ is the elasticity of substitution across sectors, and the displayed formula applies for $\eta \neq 1$. At $\eta = 1$, I use its Cobb–Douglas limit, with the β_g normalized to sum to one. The sector price index and aggregate price index are

$$P_g = \left(\sum_{i:g(i)=g} \varphi_{i|g} p_i^{1-\sigma_g} \right)^{1/(1-\sigma_g)}, \qquad P = \left(\sum_g \beta_g P_g^{1-\eta} \right)^{1/(1-\eta)}.$$

Consequently,

$$\omega_{i|g} = \frac{\varphi_{i|g} p_i^{1-\sigma_g}}{\sum_{j:g(j)=g} \varphi_{j|g} p_j^{1-\sigma_g}}, \qquad \Lambda_g = \frac{\beta_g P_g^{1-\eta}}{\sum_h \beta_h P_h^{1-\eta}}, \qquad \lambda_i = \Lambda_{g(i)} \omega_{i|g(i)}.$$

Exact TWC and marginal incidence. Impose the one factor resource economy of Appendix A.1 on these preferences. Technologies are linear, factor supply is fixed, profits accrue to the household, and the factor price is the numeraire. For residual wedges, hold transformed productivity $\widetilde{A}_i = A_i/\mu_i^B$ fixed. Using the sufficient statistics in (2.12), define

$$\mathcal{B}^B = \sum_g \Lambda_g B_g^B, \qquad \mathcal{S}_\eta^B = \sum_g \Lambda_g (A_g^B)^{(\eta-1)/(\sigma_g-1)}.$$

The exact nested TWC is

$$\mathcal{I}^{\mathrm{N,E}} = \begin{cases} \dfrac{\log \mathcal{S}_\eta^B}{\eta - 1} + \log \mathcal{B}^B, & \eta \neq 1, \\ \displaystyle\sum_g \Lambda_g \frac{\log A_g^B}{\sigma_g - 1} + \log \mathcal{B}^B, & \eta = 1. \end{cases} \tag{A.27}$$

To establish the identity, let a superscript 0 denote efficient prices in the transformed economy. CES duality gives $P_g^0/P_g = (A_g^B)^{-1/(\sigma_g-1)}$ and hence $P^0/P = (\mathcal{S}_\eta^B)^{1/(1-\eta)}$. Resource clearing gives $E\mathcal{B}^B = wL$, whereas $E^0 = wL$. Since $W = E/P$, $\log(W^0/W) = -\log(P^0/P) + \log \mathcal{B}^B$, which proves the first branch; its continuous limit gives the second. No latent demand or productivity shifter is required beyond observed shares, residual markups, and calibrated elasticities. The TWC is zero for common residual markups and reduces to the exact one sector formula when only one sector is present.

With benchmarks fixed, differentiation gives exact marginal incidence for $k \in g$:

$$\mathrm{MWI}_k^{\mathrm{N,E}} = \frac{\mathrm{d}\mathcal{I}^{\mathrm{N,E}}}{\mathrm{d}\xi_k} = \frac{\lambda_k}{\mathcal{B}^B}\left[\eta\mathcal{B}^B + (\sigma_g - \eta)B_g^B - \frac{\sigma_g}{\rho_k}\right]. \tag{A.28}$$

Indeed, $\partial \log P / \partial \log \rho_k = \lambda_k$ and

$$\frac{\partial \mathcal{B}^B}{\partial \log \rho_k} = \lambda_k\left[(\sigma_g - \eta)B_g^B + (\eta - 1)\mathcal{B}^B - \frac{\sigma_g}{\rho_k}\right].$$

Combining these derivatives proves (A.28).

Quadratic approximation. Define the mean and variance of residual wedges within each sector:

$$\bar{\xi}_g = \sum_{i:g(i)=g} \omega_{i|g}\xi_i, \qquad V_g = \sum_{i:g(i)=g} \omega_{i|g}(\xi_i - \bar{\xi}_g)^2.$$

Under the same resource assumptions, start at the efficient reference and set prices to $p_i(\epsilon) = p_i(0)e^{\epsilon\xi_i}$. In the following expansion, means, variances, and shares without an argument are evaluated at $\epsilon = 0$. Define

$$m = \sum_g \Lambda_g \bar{\xi}_g, \qquad V_{\mathrm{W}} = \sum_g \Lambda_g V_g, \qquad V_{\mathrm{B}} = \sum_g \Lambda_g(\bar{\xi}_g - m)^2,$$

and

$$\mathcal{H} = \sum_g (\sigma_g - 1)\Lambda_g V_g + (\eta - 1)V_{\mathrm{B}}.$$

Here subscripts W and B denote within and between sector variance, not welfare or the benchmark superscript B.

Expansion of the lower price indices, followed by the upper price index, gives

$$\log \frac{P_g(\epsilon)}{P_g(0)} = \epsilon\bar{\xi}_g - \frac{\epsilon^2}{2}(\sigma_g - 1)V_g + o(\epsilon^2), \tag{A.29}$$

$$\log \frac{P(\epsilon)}{P(0)} = \epsilon m - \frac{\epsilon^2}{2}\mathcal{H} + o(\epsilon^2). \tag{A.30}$$

The price index alone is not the welfare loss. Let

$$\mathcal{B}(\epsilon) = \sum_i \lambda_i(\epsilon)e^{-\epsilon\xi_i}.$$

Resource clearing implies $E(\epsilon)\mathcal{B}(\epsilon) = wL$. Consequently, with $\mathcal{B}(0) = 1$,

$$\log \frac{W(\mathbf{1})}{W(e^{\epsilon\boldsymbol{\xi}})} = \log \frac{P(\epsilon)}{P(0)} + \log \mathcal{B}(\epsilon).$$

To expand the second term, differentiate the nested shares:

$$\frac{\lambda_i'(0)}{\lambda_i} = -(\sigma_g - 1)(\xi_i - \bar{\xi}_g) - (\eta - 1)(\bar{\xi}_g - m), \qquad i \in g.$$

Because $\sum_i \lambda_i' = \sum_i \lambda_i'' = 0$, this implies

$$\mathcal{B}'(0) = -m, \qquad \mathcal{B}''(0) = m^2 + V_{\mathrm{W}} + V_{\mathrm{B}} + 2\mathcal{H}.$$

It follows that

$$\log \mathcal{B}(\epsilon) = -\epsilon m + \frac{\epsilon^2}{2}\left(V_{\mathrm{W}} + V_{\mathrm{B}} + 2\mathcal{H}\right) + o(\epsilon^2).$$

Combining the price and resource terms cancels the first order effect:

$$\log \frac{W(\mathbf{1})}{W(e^{\epsilon\boldsymbol{\xi}})} = \frac{\epsilon^2}{2}\left[\sum_g \sigma_g \Lambda_g V_g + \eta V_{\mathrm{B}}\right] + o(\epsilon^2). \tag{A.31}$$

This establishes the quadratic welfare approximation under the stated resource closure. Evaluating its quadratic form at observed shares defines

$$\mathcal{I}^{\mathrm{N,Q}} = \frac{1}{2}\sum_g \sigma_g \Lambda_g V_g + \frac{1}{2}\eta\left[\sum_g \Lambda_g \bar{\xi}_g^2 - \left(\sum_g \Lambda_g \bar{\xi}_g\right)^2\right]. \tag{A.32}$$

Along the small wedge path, replacing reference shares by observed shares changes the quadratic term only at third and higher order. This local result does not bound the error for large wedges. Equation (A.32) is retained for intuition and approximation checks; the principal nested calculations use (A.27). The first term prices dispersion among firms within sectors. The second prices dispersion in sector-average wedges. If all nests have the same elasticity, the expression reduces by the law of total variance to the one-level formula.

Exact finite resets and the expenditure closure. Consider resetting firm k, with $g(k) = g$, from ξ_k to zero. Its price changes by the factor $\exp(-\xi_k)$ when the benchmark and marginal cost are held fixed. Using the denominator in (2.26),

$$D_{kg} = 1 - \omega_{k|g} + \omega_{k|g}\exp((\sigma_g - 1)\xi_k).$$

The within-sector shares are those in (2.25), and the sector price index changes by

$$\frac{P_g^{(k)}}{P_g} = D_{kg}^{1/(1-\sigma_g)}. \tag{A.33}$$

Let

$$M_k = \left(\frac{P_g^{(k)}}{P_g} \right)^{1-\eta}, \qquad H_k = 1 - \Lambda_g + \Lambda_g M_k.$$

The counterfactual sector shares are

$$\Lambda_g^{(k)} = \frac{\Lambda_g M_k}{H_k}, \qquad \Lambda_h^{(k)} = \frac{\Lambda_h}{H_k}, \quad h \neq g. \tag{A.34}$$

Counterfactual firm shares are $\lambda_i^{(k)} = \Lambda_{g(i)}^{(k)} \omega_{i|g(i)}^{(k)}$. The finite nested-CES effect is

$$\Delta \mathcal{I}_k^{\mathrm{N,E}} = \mathcal{I}^{\mathrm{N,E}}(\boldsymbol{\rho}, \boldsymbol{\lambda}) - \mathcal{I}^{\mathrm{N,E}}(\boldsymbol{\rho}^{(k)}, \boldsymbol{\lambda}^{(k)}), \tag{A.35}$$

where all sufficient statistics in (A.27) are recomputed. In the treated sector,

$$(A_g^B)^{(k)} = \frac{A_g^B}{D_{kg}}, \qquad (B_g^B)^{(k)} = \frac{B_g^B - \omega_{k|g}/\rho_k + \omega_{k|g}\rho_k^{\sigma_g - 1}}{D_{kg}};$$

the other sectors' moments are unchanged. Substitution of these moments and (A.34) proves the implemented endpoint formula. Thus the reset changes the treated firm's sales, its same-sector rivals' sales, and the economic weights of every sector. The benchmark markups and total nominal expenditure remain fixed in the nominal revenue calculation. This closure is unchanged from the quadratic exercise: revenue ratios equal expenditure share ratios. The resource identity provides the exact TWC, not a different revenue rule. Homotheticity makes demand shares independent of total expenditure. With a fixed benchmark vector, these same shares support the stated resource economy, where nominal expenditure instead satisfies $E^{(k)}/E = \mathcal{B}^B/(\mathcal{B}^B)^{(k)}$. This distinction matters when benchmarks depend on revenue: that extension continues to hold total nominal expenditure fixed and compares exact TWC evaluations with different accounting references. Demand shifters, elasticities, marginal costs, and every rival's observed markup also remain fixed; the extension adds cross-sector demand reallocation, not strategic pricing responses.

For a joint reset of every firm in sector g, the within-sector price-index ratio is

$$\frac{P_g^{(g)}}{P_g} = \left[\sum_{i \in g} \omega_{i|g} \exp((\sigma_g - 1)\xi_i) \right]^{1/(1-\sigma_g)}.$$

Define $M_g = (P_g^{(g)}/P_g)^{1-\eta}$ and $H_g = 1 - \Lambda_g + \Lambda_g M_g$. The exact joint reset has $(A_g^B)^{(g)} = (B_g^B)^{(g)} = 1$ and

$$\Lambda_g^{(g)} = \frac{\Lambda_g M_g}{H_g}, \qquad \Lambda_h^{(g)} = \frac{\Lambda_h}{H_g} \quad (h \neq g).$$

The exact nested joint effect is

$$\Delta\mathcal{I}_g^{\mathrm{N,E}} = \mathcal{I}^{\mathrm{N,E}}(\boldsymbol{\rho}, \boldsymbol{\lambda}) - \mathcal{I}^{\mathrm{N,E}}(\boldsymbol{\rho}^{(g)}, \boldsymbol{\lambda}^{(g)}). \tag{A.36}$$

Unlike (A.13), these sector effects need not add to the aggregate nested TWC. Its price and resource terms link sectors nonlinearly; when $\eta \neq 1$, each reset also changes sector expenditure shares.

When $\eta = 1$, the Cobb–Douglas limit of (A.34) leaves nominal sector shares unchanged. The nested conditional TWC still includes allocation across sectors. Its difference from the exact conditional within sector TWC is then

$$\log\left(\sum_g \Lambda_g B_g^B\right) - \sum_g \Lambda_g \log B_g^B \geq 0$$

by Jensen's inequality. The quadratic counterpart contains the between sector variance in (A.32). Therefore, $\eta = 1$ reproduces the baseline share restriction but not the baseline economic environment, which deliberately omits cross-sector misallocation.

A.9 Revenue-updated fixed-cost recovery targets

Superscript SA denotes the revenue-updated treated-firm target. It allows demand and that accounting target to adjust jointly; it does not denote a strategic or full general-equilibrium response.

The baseline firm-level benchmark is

$$\mu_k^B = (1 - f_k)^{-1}, \qquad f_k = F_k^+ / R_k.$$

It uses observed revenue. Consider instead a reset of firm k, with $g(k) = g$, in which its break-even markup is evaluated at the sales generated by that same reset. Holding marginal cost fixed, the firm's relative price change is $\widetilde{\mu}_k^B/\mu_k$. CES demand therefore gives

$$\widetilde{\omega}_{k|g} = \frac{\omega_{k|g}(\widetilde{\mu}_k^B/\mu_k)^{1-\sigma_g}}{1 - \omega_{k|g} + \omega_{k|g}(\widetilde{\mu}_k^B/\mu_k)^{1-\sigma_g}}. \tag{A.37}$$

Because sector expenditure is fixed, counterfactual revenue satisfies $\widetilde{R}_k/R_k = \widetilde{\omega}_{k|g}/\omega_{k|g}$. The nonnegative fixed-cost requirement F_k^+ remains fixed in euros; only its share of counterfactual revenue changes. The fixed-cost recovery share and break-even target must consequently satisfy

$$\widetilde{f}_k = f_k \frac{\omega_{k|g}}{\widetilde{\omega}_{k|g}}, \qquad \widetilde{\mu}_k^B = (1 - \widetilde{f}_k)^{-1}. \tag{A.38}$$

Equations (A.37) and (A.38) form a scalar fixed point. When $\mu_k > \mu_k^B$, evaluating the system at the observed-sales target raises the firm's sales and lowers its fixed-cost share. To make the bracket explicit, let $x = \widetilde{f}_k$, $f = f_k$, and $\omega = \omega_{k|g}$. Substitution gives

$$x = f\left[\omega + (1-\omega)\mu_k^{1-\sigma_g}(1-x)^{1-\sigma_g}\right]. \tag{A.39}$$

For $\mu_k > \mu_k^B = (1-f)^{-1}$, $0 < f < 1$, and $0 < \omega < 1$, the left side minus the right side is negative at $x = 0$ and positive at $x = f$, so continuity gives a root on $[0, f]$. Write that difference as $H(x)$. Its curvature is

$$H''(x) = -f(1-\omega)\mu_k^{1-\sigma_g}\sigma_g(\sigma_g - 1)(1-x)^{-\sigma_g - 1} < 0.$$

Strict concavity and the endpoint signs imply exactly one crossing in $(0, f)$: after a second crossing a concave function could not be positive at f. Bisection on $[0, f]$ therefore selects a unique target below the observed revenue benchmark. This is a branch result, not global uniqueness. Indeed, $H(x) \to -\infty$ as $x \to 1$, so another root exists above f. The selected root is the smaller recovery share and thus the smaller markup; the higher root is not used. If $f = 0$, the target is one; if $\omega = 1$, the recovery share remains f. These statements concern downward resets $\mu_k > \mu_k^B$ and do not assert feasibility of upward resets or joint solvency of rivals. Appendix E.5 reports the empirical coverage checks.

At the solution, firm k has zero residual wedge and rivals' sales shares are

$$\widetilde{\omega}_{j|g} = \omega_{j|g}\frac{1-\widetilde{\omega}_{k|g}}{1-\omega_{k|g}}, \qquad j \in g,\ j \neq k.$$

The revenue-updated specification holds rivals' observed and benchmark markups fixed, sets $\widetilde{\xi}_k = 0$, and recomputes the exact TWC from these shares. Let $s_k^R = (1-\widetilde{\omega}_{k|g})/(1-\omega_{k|g})$ and use the observed moments A_g^B, B_g^B from (2.12). The counterfactual moments are

$$\begin{aligned}\widetilde{A}_g^{B,\mathrm{SA}} &= s_k^R\left[A_g^B - \omega_{k|g}e^{(\sigma_g-1)\xi_k}\right] + \widetilde{\omega}_{k|g},\\ \widetilde{B}_g^{B,\mathrm{SA}} &= s_k^R\left[B_g^B - \omega_{k|g}e^{-\xi_k}\right] + \widetilde{\omega}_{k|g}.\end{aligned}$$

The own terms use $e^{\widetilde{\xi}_k} = 1$; all rival residual wedges remain unchanged. Substituting these moments into the exact TWC gives

$$\Delta\mathcal{I}_k^{\mathrm{E,SA}} = \Lambda_g\left[\frac{1}{\sigma_g - 1}\log\frac{A_g^B}{\widetilde{A}_g^{B,\mathrm{SA}}} + \log\frac{B_g^B}{\widetilde{B}_g^{B,\mathrm{SA}}}\right]. \tag{A.40}$$

This is the implemented difference between two exact TWC evaluations, not a difference between quadratic variances. Since the treated firm's accounting reference changes, it is not a welfare comparison holding the transformed technology fixed. For a sector

containing only the treated firm, TWC is zero at both endpoints and no rival scaling is needed.

An all-rival accounting rebasing also changes each rival's fixed-cost benchmark while holding every F_j^+ fixed in euros. Define $f_j = F_j^+/R_j$ for each rival and let $s_k^R = (1 - \widetilde{\omega}_{k|g})/(1 - \omega_{k|g})$ denote the common rival-revenue scaling factor. Since $\widetilde{R}_j/R_j = s_k^R$ for $j \neq k$,

$$\widetilde{f}_j = \frac{f_j}{s_k^R}, \qquad \widetilde{\mu}_j^B = \left(1 - \frac{f_j}{s_k^R}\right)^{-1}, \qquad \widetilde{\xi}_j = \log\left[\mu_j \left(1 - \frac{f_j}{s_k^R}\right)\right]. \tag{A.41}$$

This object exists only if $f_j < s_k^R$ for every rival. When the condition fails, the markup reset leaves at least one rival with revenue below its fixed cost. Even when it exists, the benchmark vector now depends on which firm is treated. It is not a general-equilibrium response: rivals' observed markups remain fixed while the accounting yardstick against which those markups are measured changes.

The treated-firm target can also be combined with the nested-CES demand system. Let

$$D_{kg}^{\mathrm{SA}} = 1 - \omega_{k|g} + \omega_{k|g}(\widetilde{\mu}_k^B/\mu_k)^{1-\sigma_g}.$$

The within-sector share is given by (A.37), while the sector price and expenditure shares satisfy

$$\frac{\widetilde{P}_g}{P_g} = (D_{kg}^{\mathrm{SA}})^{1/(1-\sigma_g)}, \qquad \widetilde{\Lambda}_g = \frac{\Lambda_g(\widetilde{P}_g/P_g)^{1-\eta}}{1 - \Lambda_g + \Lambda_g(\widetilde{P}_g/P_g)^{1-\eta}}. \tag{A.42}$$

Counterfactual revenue now changes along both margins:

$$\frac{\widetilde{R}_k}{R_k} = \frac{\widetilde{\Lambda}_g}{\Lambda_g}\frac{\widetilde{\omega}_{k|g}}{\omega_{k|g}}.$$

The combined fixed point is therefore

$$\widetilde{\mu}_k^B = \left[1 - f_k \frac{\Lambda_g \omega_{k|g}}{\widetilde{\Lambda}_g \widetilde{\omega}_{k|g}}\right]^{-1}. \tag{A.43}$$

To establish existence without assuming uniqueness, let $R_k(m)$ be the positive revenue implied by nested demand at candidate markup m, holding total nominal expenditure fixed. Define

$$G_k(m) = (1 - m^{-1})R_k(m).$$

For $F_k^+ > 0$ and $\mu_k > \mu_k^B$, continuity gives $G_k(1) = 0 < F_k^+$ and $G_k(\mu_k) = (1 - \mu_k^{-1})R_k > F_k^+$. Hence there is a root in $(1, \mu_k)$. When $F_k^+ = 0$, the target is one. Unlike the fixed sector expenditure proof, these endpoint signs alone do not establish a unique root or identify the smallest feasible markup.

A sufficient condition for uniqueness on this bracket is $1 + (m-1)[1 - \varepsilon_k(m)] > 0$ throughout it, since

$$G_k'(m) = \frac{R_k(m)}{m^2}\{1 + (m-1)[1 - \varepsilon_k(m)]\},$$

where nested demand implies the quantity elasticity

$$\varepsilon_k(m) = \sigma_g[1 - \omega_{k|g}(m)] + \omega_{k|g}(m)\{\eta[1 - \Lambda_g(m)] + \Lambda_g(m)\}.$$

I do not impose or claim to verify this sufficient condition for every firm. The computation bisects the recovery share $x = 1 - 1/m$ on $[0, 1 - 1/\mu_k]$, corresponding to $m \in [1, \mu_k]$, and reports the residual of the selected fixed point; convergence verifies the selected root, not uniqueness, optimality, or rival solvency. I then recompute the exact nested TWC in (A.27), using the updated sector weights and the treated sector's moments from (A.40) with its nested within sector shares. Rivals' benchmark markups remain fixed; only their sales shares and the economic weights of all sectors change.

Both the nested TWC and (A.40) are exact. To separate the numerical role of expenditure feedback, I compare the nested reset with an evaluation of the same TWC formula and η, but fixing Λ_g at observed values. Write $\mathcal{I}^{\mathrm{N,E}}(\boldsymbol{\rho}, \boldsymbol{\omega}, \boldsymbol{\Lambda}; \eta)$ for (A.27), and let $\widetilde{\boldsymbol{\rho}}^{\mathrm{SA}} = e^{\widetilde{\boldsymbol{\xi}}^{\mathrm{SA}}}$ be the updated residual ratios. The matched effect is

$$\begin{aligned}\Delta\mathcal{I}_k^{\mathrm{N,E,SA;fix}} = {} & \mathcal{I}^{\mathrm{N,E}}(\boldsymbol{\rho}, \boldsymbol{\omega}, \boldsymbol{\Lambda}; \eta) \\ & - \mathcal{I}^{\mathrm{N,E}}(\widetilde{\boldsymbol{\rho}}^{\mathrm{SA}}, \widetilde{\boldsymbol{\omega}}^{\mathrm{SA}}, \boldsymbol{\Lambda}; \eta),\end{aligned} \tag{A.44}$$

where the target and within sector shares solve (A.38). Comparing this effect with the nested reset changes expenditure reallocation and its feedback into the treated target, but neither the TWC formula nor its elasticity coefficient. The fixed share endpoint is a controlled TWC evaluation, not an equilibrium under the same upper CES preferences. Except at $\eta = 1$ or unchanged relative sector prices, holding sector shares fixed violates the upper demand system. A second comparison uses the exact conditional within sector TWC from (A.40); it changes both the scope of the TWC and the expenditure closure. Neither comparison mixes exact and quadratic endpoints. Quadratic calculations are retained separately to assess approximation error. In all cases, updating the accounting reference changes transformed technology; exact endpoint evaluation does not turn that rebasing into a welfare comparison with a fixed reference.

B Data and Baseline Measurement

B.1 Firm-level data and variable construction

B.1.1 Source variables and selection rules

The source is the October 12, 2026 Sequenza extract. I remove surrounding spaces from the firm identifier and require the prefix BE followed by fifteen digits, a recorded fiscal year, and turnover above EUR 1,000. The reporting period must equal twelve months; records with a missing period are excluded. If tangible and intangible fixed assets are both missing, I drop the record. If only one component is missing, I set that component to zero. The capital check applies to their sum, not separately to each component: a negative sum is excluded, and the cost share filter in Section B.2 also excludes zero combined capital. The final markup inputs require reported nonnegative materials and strictly positive labor costs. A reported zero material expenditure is eligible; missing expenditures are excluded rather than replaced by zero. Cost of goods sold is their sum:

$$X_{it} = M_{it} + \mathrm{LC}_{it}.$$

Here M_{it} denotes material costs and LC_{it} denotes labor costs; the latter notation avoids confusion with factor supply L and real consumption W in the theoretical model. Each legal entity is assigned to its principal NACE sector and treated as one composite variety. Total turnover is used because the accounts do not identify separate products or split revenue into final, intermediate, domestic, and export sales. Normalized sample turnover is therefore the empirical analogue of final expenditure under the horizontal model, rather than a direct national expenditure measure. Treating materials [60] and payroll [62] as one flexible bundle is a maintained measurement assumption; uniform construction does not establish that the bundle has the same economic content in every sector.

Table B.1: Inputs used in measurement

Object	Source code	Unit and construction	Missing values and zeros
Entity and year	Provider identifiers	Legal entity; fiscal year	Invalid identifier or missing year excluded; one record per entity and year.
Reporting period	Filing metadata	Months reported	Exactly twelve required; missing excluded.
Sector $g(i)$	Principal NACE 2008	First two digits	Fill within entity history without replacing reported codes; remaining missing codes excluded.
Revenue R_{it}	70	Annual euros	Missing or turnover at most EUR 1,000 excluded.
Materials M_{it}	60	Annual euros	Reported nonnegative value required; zero is allowed, missing is excluded.
Payroll LC_{it}	62	Annual euros	Strictly positive required in the markup sample.
Capital K_{it}	21 and 22/27	Intangible plus tangible book assets, euros	Both missing: exclude; one missing: set it to zero. Combined capital must be positive.
Operating profit Π^{op}_{it}	9901, excluding nonrecurring items	Annual euros; margin is $\Pi^{\mathrm{op}}_{it}/R_{it}$	Missing level cannot define the benchmark. Reported zeros are retained, subject to source validation.
Depreciation	630	Annual euros; added to operating profit for the EBITDA diagnostic	Missing remains missing in that diagnostic; not used to infer baseline F_{it}.
Source flags	Provider metadata	Corrected account; warning indicator	Retained for sensitivity, not automatic baseline exclusions; missing flags are coded as unflagged.

Notes: Monetary flows refer to the reporting year; capital is a book stock. Baseline COGS is $X_{it} = M_{it} + \mathrm{LC}_{it}$. The operating profit margin is constructed from recurring operating profit and turnover, rather than taken from the provider's reported EBIT ratio. The treatment of nonrecurring items is documented below. Filling one missing capital component with zero is a maintained convention, not evidence of a reported zero.

After the initial identifier, reporting period, turnover, and component checks, I fill missing principal NACE 2008 codes within each firm's recorded history. I first sort years in descending order and carry available codes backward, then sort in ascending order and carry codes forward into remaining gaps. Observed classifications are never replaced. The baseline groups firms by the first two NACE digits; records still lacking a usable code are excluded. This procedure uses available history, including later records, rather than

identifying the firm's historical activity independently. The provider reports incomplete industry coverage for inactive entities.

If multiple observations remain for an entity in the same fiscal year, I retain the observation with the largest turnover before constructing the markup. The provider's indicator of corrected annual accounts is preserved as a diagnostic; it is not a rule selecting the latest corrected filing. Each entity therefore contributes at most one observation per year.

The markup sample is trimmed within fiscal year. Let μ_{it}^0 denote the untrimmed markup computed from the procedure in Section B.2. I drop observations below the 1.5th percentile or above the 98.5th percentile of the within-year distribution of μ_{it}^0. This rule is applied symmetrically to limit the influence of extreme markup estimates; it does not establish that each excluded account is misreported. The percentiles are unweighted and pooled across sectors within each fiscal year. Observations exactly at either threshold are retained; the procedure removes observations rather than winsorizing their markups. Output elasticity proxies are calibrated before trimming and are not recalibrated on the retained sample. It does not exclude every markup below one, nor identify internal group transactions or determine which accounting expenses are economically variable.

B.1.2 Historical coverage and operating profit validation

The source covers fiscal years 1984–2024; the analysis begins in 1985. The September 2026 Sequenza extract repaired the former zero coding of operating profit around 1995. I construct the EBIT margin as operating profit excluding nonrecurring items divided by turnover and retain the vendor-provided ratio only as a source diagnostic. As Table B.2 shows, the underlying EBIT level is effectively complete among markup-eligible observations in 1985, 1986, 1995, and 1996. The sales-weighted constructed margins are 4.01, 4.85, 4.18, and 3.63 percent, respectively, and extreme-margin observations have negligible sales weight. The exclusion of 1984 reflects a historical coverage break: recorded turnover in twelve month accounts with sales above EUR 1,000 rises from EUR 23 billion in 1984 to EUR 239 billion in 1985. Applying the same cleaning rules leaves only 383 analysis firms in 1984, compared with 3,185 in 1985 and 3,325 in 1986. Among the 279 firms observed in both 1984 and 1985, the exact TWC, with sales weights renormalized within this sample, changes from 0.44 to 0.43 log points. The increase from 0.52 to 1.04 in the changing sample should therefore not be read as an economic trend. The 1985 start is applied to all calculations unless a particular exercise requires a shorter period of data availability.

Table B.2: Validation of refreshed operating-profit margins

Year	Eligible firm-years	EBIT coverage (%)	Zero firms (%)	Zero sales (%)	Sales with EBIT margin > 100% (%)	Mean EBIT margin (%)
1985	3,289	100.0	0.0	0.0	0.002	4.01
1986	3,435	100.0	0.0	0.0	0.002	4.85
1995	5,815	100.0	0.0	0.0	0.004	4.18
1996	5,836	100.0	0.0	0.0	0.002	3.63

Notes: Markup-eligible observations satisfy the accounting-input requirements for the untrimmed COGS markup. EBIT coverage is the share for which operating profit excluding nonrecurring items and turnover permit the margin to be constructed. Zero-EBIT firm and sales shares are conditional on that construction. The penultimate column is the share of eligible sales attached to a constructed EBIT margin above one. The final column is the sales-weighted constructed EBIT margin. The 1995 and 1996 rows verify the repaired boundary; the 1985 and 1986 rows verify that the earlier extreme margin anomaly is absent. No pre-1985 observation enters the analysis sample.

B.1.3 Analysis sample and source sales coverage

All headline objects are computed on a single analysis sample. Starting from the trimmed markup sample, I require a valid operating-profit margin, $\Pi^{\text{op}}_{it}/R_{it}$, and impose the fixed-cost benchmark restriction described in Section B.4. The resulting analysis sample is used for average markups, benchmark markups, aggregate TWC measures, marginal incidence, finite effects, concentration, persistence, and ranking comparisons.

Table B.3 separates coverage of source sales from the subsequent selection of observations. The source denominator uses the same extract and fiscal year as the numerator. It includes every entity with a valid identifier, twelve month accounts, and strictly positive turnover, without requiring an industry code, markup inputs, or an operating profit measure. It does not impose the EUR 1,000 analysis threshold. I retain the largest turnover if an entity has multiple records in a year; in the active extract no such duplicates remain after these source eligibility checks. Every analysis observation matches this source population and its recorded sales. Coverage losses can reflect industry availability and accounting requirements together; the table does not identify their separate causal effects or measure coverage of national final expenditure.

Table B.3: Sample construction and source sales coverage

Panel A. Sales retained at each selection stage

Year	Source entities	Valid markup inputs (%)	After trimming (%)	Analysis (%)
1985	54,837	43.7	43.1	43.1
1990	87,042	50.4	49.8	49.8
2000	97,090	64.2	63.3	63.2
2010	77,853	82.2	81.0	80.8
2020	46,339	91.8	90.2	89.3
2024	42,184	87.7	85.8	85.2

Panel B. Firm counts

Year	Untrimmed	Trimmed	Pre-benchmark	Analysis
1985	3,289	3,191	3,191	3,185
1990	4,540	4,404	4,404	4,391
2000	6,870	6,664	6,664	6,592
2010	12,388	12,018	12,018	11,817
2020	13,526	13,122	13,122	12,789
2024	13,398	12,998	12,994	12,708

Notes: The source is the October 12, 2026 Sequenza extract. Source entities have valid identifiers, twelve month accounts, and positive turnover, with at most one record per entity and year. All percentages in Panel A divide retained sales by total turnover of these source entities in the same year, before industry and accounting restrictions; they are not retention rates relative to the preceding stage. Valid markup inputs correspond to the untrimmed sample in Panel B. Trimming removes markups outside the annual 1.5th and 98.5th percentiles. The pre-benchmark sample also requires a valid operating profit margin and the inputs for benchmark construction. The analysis sample further requires $F_{it}^{+}/R_{it} < 0.95$. Coverage in 2024 is provisional.

B.1.4 Source quality and filing revisions

The source warning flag and the discrepancy between code 60/61 and the sum of codes 60 and 61 are retained as diagnostics, not automatic exclusions. The warning flag does not identify which particular input is affected, and the baseline bundle excludes services [61]. Table B.4 therefore evaluates these restrictions separately. Excluding warning records retains 94.9 percent of 2024 sales, changes the exact TWC from 10.03 to 10.38 log points, and retains 97 of the baseline top 100 firms. Agreement under these restrictions does not identify the economic content of the cost bundle.

Table B.4: Sensitivity to source accounting quality restrictions

Sample	2024 sales retained (%)	2024 TWC	Largest annual change	Top-100 share (%)	Rank correlation	Top-100 overlap
All analysis observations	100.0	10.03	0.00	82.7	1.000	100
Exclude Sequenza warning records	94.9	10.38	0.67	83.5	0.984	97
Exclude code 60/61 gaps above 1 percent	100.0	10.03	0.32	82.7	1.000	100
Apply both source quality restrictions	94.9	10.38	0.67	83.5	0.984	97

Notes: The TWC and largest annual change are in log points. The latter is the maximum absolute difference from the baseline TWC over 1985–2024. Concentration is the 2024 share of summed positive finite incidence made up by each specification's top 100. Rank correlations and overlap compare 2024 firm incidence with the baseline. The warning restriction excludes records flagged by Sequenza's unified warning indicator. The component-gap restriction excludes records for which the absolute discrepancy between reported code 60/61 and the sum of codes 60 and 61 exceeds one percent. Because the baseline COGS bundle uses code 60 plus labor and does not use code 61, the latter is a conservative source-consistency diagnostic rather than a change to the measured baseline input. Missing reconciliation diagnostics are not treated as failures.

Filing vintages and correction coverage. According to the provider, Sequenza uses machine-readable accounts, including PDF submissions only if transcribed by the NBB, and replaces earlier records when corrections are received. This does not guarantee that the extract incorporates every later disclosure or revised comparative. For Telix Innovations, the extract's 2022 operating profit of EUR 22,574,340 agrees with the original 2022 accounts (p. 7). The 2023 accounts (pp. 7 and 21) instead report a 2022 comparative loss of EUR 839,921 after reversing EUR 23,414,260.70 of capitalised research and development expenditure; they expressly state that the 2022 accounts will not be reopened. The later comparative also supplies 2022 turnover and combined purchases and services absent from the original filing and extract, but no separate materials figure. This is a difference between filing vintages, not evidence of a transcription error in the original record or an omitted corrected 2022 filing. Subsequent NBB transcription of the PDF submission is unverified. The extract is retained unchanged; these targeted checks do not establish population-wide revision coverage.

B.1.5 Accounting evidence for the unrestricted leading firms

Table B.5 consolidates the available source evidence for the unrestricted baseline top ten, including Omega, which is omitted from the named reporting table because its inferred fixed cost is negative. A recorded filing, reconciliation of selected entries, and an economic interpretation of those entries are different levels of verification. The table states what remains unresolved rather than treating a retained document as a completed audit.

Table B.5: Accounting evidence for the unrestricted leading firms, 2024

Legal entity	Source evidence	Unresolved interpretation
Telix Innovations	Other operating income is EUR 1.975 million, 0.62 percent of turnover; the government operating grants line is zero. [pp. 8, 26]	The remaining income is not decomposed. General grant recognition policies do not establish its actual composition. Earlier comparative revisions are discussed in Appendix B.1.4.
GSK Biologicals	Disclosures distinguish royalties, reimbursements and research support. Research costs incurred since 2016 are amortized within the year; licenses and development costs follow other schedules. [pp. 47, 57–58]	Recurring income need not be proportional to own turnover. Research recognition and amortization do not identify technological fixed costs.
Omega Pharma Innovation & Development	The management report describes an intellectual property disposal. Other operating income is EUR 166.563 million, against turnover of EUR 46.343 million. [pp. 8, 38]	The disposal's net profit contribution and the report's presentation difference from statutory totals are not reconciled. Removing the entire income line would not be a verified correction.
J.C. General Services	The original 2024 individual filing is retained; it is denominated in US dollars. [2024 filing]	A complete income component review is not reported here. Retaining the filing does not validate the firm's cost technology or equate this legal entity with its group.
UCB Pharma	Research is undertaken for group intellectual property holders. A retrospective royalty arrangement produces EUR 98 million of additional operating income in 2024. [pp. 49–50]	The current year and prior year components are not separately identified. The royalty base must not be equated with this entity's own turnover.
Brussels Airport Company	The original individual accounts are retained. [2024 filing]	A complete income component review is not reported here. Source availability alone does not identify fixed and variable costs.

Continued on the next page

Accounting evidence for the leading firms (continued)

Legal entity	Source evidence	Unresolved interpretation
Arval Belgium	Turnover, materials, payroll and operating profit reconcile within one euro. The valuation rules describe long term vehicle rental and depreciation based on expected residual values. [pp. 8, 36]	Accounting reconciliation does not establish the output elasticity or the marginal cost of expanding a rental fleet.
Elia Asset	The management report identifies EUR 809.4 million billed to Elia Transmission Belgium under transfer pricing, including installation operations, technical costs and seconded personnel. [p. 60]	This operating income breakdown is not a transaction by transaction reconciliation to turnover. These billings reflect transactions within the group, so they cannot be treated as evidence of prices or costs in transactions with independent customers.
Lorelay Transport Chartering	Turnover, materials, payroll and operating profit reconcile within one euro. The accounts identify Allseas ownership and ship valuation rules. [pp. 8, 18, 34]	The correspondence between this activity and NACE 30, and hence the demand elasticity assigned to it, requires further verification. The disclosure alone does not establish a classification error.
argenx	The filing is in US dollars. Government operating support accounts for 80.4 percent of other operating income. Recognition policies distinguish research support, milestones and royalties. [pp. 8, 28, 42]	Policies do not identify the remaining income components or show that receipts vary proportionally with own turnover. Currency must be aligned before comparing reported amounts.

Notes: Rows follow the baseline full reset ranking. Sources are original individual accounts filed at the NBB, with links to the relevant filings and PDF pages. This is a targeted review, not an audit of all accounting entries or independent fixed cost measurement. No income item, sector classification or sample observation is changed.

Outside the top ten, Safran Aero Boosters reports that research and development expenditure is normally expensed, with capitalization conditional on expected future value [2024 individual accounts, p. 43]. Like the leading firm disclosures, this is evidence about accounting recognition, not a direct classification of costs by their response to output.

B.1.6 Individual and consolidated account boundaries

Consolidation removes internal transactions but also changes the measured economic unit. Table B.6 compares the 2024 individual accounts of Elia Asset and UCB Pharma with the corresponding group reports. Elia Transmission Belgium includes Elia Asset, Elia Engineering and Elia Re; its services include purchases of ancillary grid services. UCB's report covers foreign subsidiaries as well as the Belgian entity, and its reported cost of sales includes production overhead and amortization. These are comparisons of accounting boundaries, not alternative estimates of Belgian firm markups.

Table B.6: Revenue in individual and consolidated accounts, 2024

Entity	Accounts	Revenue (EUR m)
Elia Asset	Individual	834.0
Elia Transmission Belgium	Group	1,257.7
UCB Pharma	Individual	4,211.5
UCB Group	Group	6,152.0

Notes: Revenue is code 70 turnover in the individual accounts and reported consolidated revenue in the group accounts. Consolidation changes the set of entities covered and eliminates internal transactions; the difference between the two revenue figures therefore cannot be interpreted solely as internal sales. The group figures do not replace any observation in the Belgian sample. Sources: original individual filings described in Section B.1.5; Elia Transmission Belgium, 2024 report, printed pp. 176, 185, 201 and 232; and UCB, 2024 report, pp. 215, 220, 230 and 292.

Consolidation alone therefore does not identify which costs vary with output. Nor can worldwide group revenue be treated as the revenue of its Belgian entities. A consolidated ranking would require a complete ownership mapping, removal of overlapping entities, a consistent geographic perimeter and aligned cost definitions before recomputing all weights and benchmarks. These comparisons do not establish misreporting or provide a consolidated ranking for Belgium.

B.2 COGS-based markup measurement

Following Hall (1988) and De Loecker and Warzynski (2012), the markup calculation uses the production-approach identity

$$\mu_{it} = \theta_{it}^{X} \frac{R_{it}}{X_{it}},$$

where R_{it} is revenue, X_{it} is expenditure on the flexible input bundle, and θ_{it}^X is its output elasticity. In the baseline implementation, X_{it} is materials [60] plus payroll [62]. Services [61] are excluded. The bundle is denoted COGS but need not coincide with a firm's own reported cost of sales. The identity follows from cost minimization for a single output with a differentiable technology, conditional on output and predetermined inputs. The input choice must be interior and free of adjustment frictions, with the firm taking its input price as given. This identifies private marginal cost; it does not require suppliers to price at their own marginal costs or expenditure to equal social opportunity cost. Input price taking instead excludes a price response to the firm's own purchases (De Loecker et al., 2020, Section II.B and footnote 13). For materials plus payroll, the first order condition must hold for each strictly positive input. Summing these conditions gives the bundle's expenditure and its output elasticity, defined by scaling both quantities together while holding other inputs fixed. A reported zero materials input cannot satisfy an interior materials condition. For such observations, the maintained boundary interpretation requires a finite one sided production derivative at zero, so the materials contribution to the bundle's output elasticity is zero, as is its expenditure share. The identity then uses the positive payroll input's first order condition. This interpretation requires genuine nonuse rather than nondisclosure or an omitted materials expenditure; the accounts alone do not verify that distinction. It does not identify the bundle's output elasticity, which is calibrated separately below.

The single output representation is an aggregation assumption, not a restriction of the sample to firms selling one product. For firms with several products and different product markups, a scalar firm markup requires additional aggregation structure. Unconsolidated accounts do not resolve this issue. De Loecker et al. (2016) develop a product level extension using price and quantity information; the present calibration does not implement that extension.

The underlying identity is distinct from the calibration used to implement it. I do not estimate a production function. I assign a sector and year output elasticity proxy to the COGS bundle; this is not a demand elasticity. Let

$$K_{it} = K_{it}^T + K_{it}^I$$

denote tangible plus intangible book fixed assets. The annual rate $r = 0.10$ is a maintained calibration converting these assets into a capital charge, not an estimated rental price. Define the COGS share in the measured cost base as

$$\chi_{it} = \frac{X_{it}}{X_{it} + rK_{it}}.$$

Using this share as an output elasticity proxy requires constant returns in scalable produc-

tion and static optimality of all production inputs, including capital, without adjustment frictions (De Loecker and Eeckhout, 2026). The measured cost base must capture the relevant production costs, with fixed overhead separate, and rK_{it} must proxy capital services. These conditions are stronger than those of the markup identity, which allows other inputs to be predetermined and does not require constant returns. The identity need not include every input in X_{it}, but it requires the elasticity of precisely that bundle. Its validity therefore does not establish that the cost share proxy recovers the required elasticity when omitted expenses include variable inputs. Assigning a common elasticity within each sector and year also assumes that the median cost share is informative about each firm's output elasticity. I drop observations with missing χ_{it}, with $\chi_{it} \leq 0$ or $\chi_{it} \geq 1$, and with $\chi_{it} < 0.10$. The 0.10 lower bound is a sample cleaning restriction, not a requirement of the markup identity or a parameter calibrated from the literature. It applies to the share of measured production costs, not the share of revenue. The sector-year elasticity proxy is the median of this cost share within industry-year cells:

$$\theta^X_{gt} = \text{median}_{i:g(i)=g}\, \chi_{it}.$$

The median is calculated before markup trimming. If the industry and year median is unavailable, I use the corresponding year median. With μ_{it} now denoting the calibrated empirical measure, the markup is

$$\mu_{it} = \theta^X_{g(i)t} \frac{R_{it}}{X_{it}}.$$

The paper does not propose a new markup estimator. Production applications with price information (De Loecker et al., 2016) and joint production and demand evidence (De Loecker and Scott, 2026) provide information not available in this accounting calibration. Demand based evidence also shows why markup movements alone need not identify changes in conduct (Döpper et al., 2025). Alternative markup estimates can enter the same incidence mapping, but uniform construction over time is not by itself validation of the measured price to marginal cost gaps. Section 5.1.1 assesses sensitivity to the output elasticity assigned to each firm while retaining the same input bundle.

B.3 Expenditure weights, sectors, and demand elasticities

The horizontal model implies that expenditure weights are revenue shares and, in the absence of intermediate-input links, coincide with Domar weights (Hulten, 1978). For each year,

$$\lambda_{it} = \frac{R_{it}}{\sum_j R_{jt}}.$$

These are the empirical counterparts of the model's expenditure shares. I do not use value-added weights in the baseline because the horizontal model has no intermediate-input network; introducing value added as the weight would mix the current final-demand benchmark with a different production structure. For the sector-level TWC objects, let $g(i)$ denote the firm's sector,

$$\Lambda_{gt} = \sum_{i:g(i)=g} \lambda_{it}, \qquad \omega_{it|g} = \frac{\lambda_{it}}{\Lambda_{gt}}.$$

The aggregate sector weight Λ_{gt} scales the TWC of within-sector dispersion, while $\omega_{it|g}$ determines each firm's position inside the sectoral wedge distribution.

The baseline uses the 29 supplier substitution estimates by sector in Table 3 of Dhyne et al. (2022). Their estimates concern substitution among suppliers within sectoral aggregates of intermediate inputs in Belgian trade between firms. I assign each published sector group estimate to its component NACE two-digit divisions. This mapping covers 71 of the 84 divisions in the 2024 analysis sample, representing 95.6 percent of sample sales. It does not estimate a separate elasticity for each division. Transporting these supplier estimates to the horizontal accounting model is a maintained demand calibration, not a replication of their production network, bilateral pricing, or equilibrium counterfactuals.

Let $\mathcal{C}$ denote the divisions covered by the source, $v(g)$ their published sector group, and $S_{g,2024}$ their sales in the 2024 analysis sample. The common comparator and the fallback for uncovered divisions are

$$\sigma^{\text{com}} = \sum_{g \in \mathcal{C}} \frac{S_{g,2024}}{\sum_{h \in \mathcal{C}} S_{h,2024}} \widehat{\sigma}_{v(g)} \simeq 3.34. \tag{B.1}$$

Thus the baseline assigns $\sigma_g = \widehat{\sigma}_{v(g)}$ when $g \in \mathcal{C}$ and $\sigma_g = \sigma^{\text{com}}$ otherwise. Calculations retain the unrounded common mean. Both the source estimates and the fallback are fixed over 1985–2024 and across sample restrictions; they are not reweighted each year or for each robustness sample. The weights in (B.1) are normalized covered sample sales, not official national weights or weights from the source study. The common value is a descriptive calibration rather than a structurally estimated aggregate elasticity or an average preserving the TWC.

Using a common curvature as a comparison has precedents with different economic objects. Hsieh and Klenow (2009) set substitution between plant value-added varieties to $\sigma = 3$; Hottman et al. (2016) estimate a median between-firm elasticity of 3.9 in United States consumer product groups. Ossa (2015) uses a common substitution elasticity of 3.94, weighted across industries by trade, in his aggregate gains from trade comparison. The elasticities still concern different substitution margins, and averaging them need not

preserve welfare.

Observed markups determine the wedge; the external calibration determines the curvature assigned to it. The local accounting panel lacks the price, quantity, and instrumental variable information needed to estimate that curvature independently. Markups cannot be inverted into demand elasticities without a conduct model. Common within-sector CES curvature jointly determines own- and cross-price substitution; replacing it by unrelated firm-specific elasticities would require a different demand system. Table D.9 compares the DKM baseline with a common elasticity, both standard error shifts, and HRW and GTAP robustness calibrations.

B.4 Fixed-cost benchmark construction

This appendix describes how I construct the fixed-cost benchmark markup used in the baseline TWC objects. It addresses the accounting tension between marginal-cost pricing and fixed-cost recovery (Hotelling, 1938); it does not claim that break-even pricing is socially optimal. Let R_{it} denote firm revenue, μ_{it} the estimated markup over marginal cost, Π_{it}^{op} operating profit, and F_{it} fixed cost. The maintained accounting relation is

$$\Pi_{it}^{\text{op}} = R_{it} - \text{VC}_{it} - F_{it}.$$

The markup estimate implies a variable-cost bill

$$\text{VC}_{it} = \frac{R_{it}}{\mu_{it}},$$

which requires average variable cost to equal marginal cost. Under the maintained linear technology, variable cost is $\text{mc}_{it}c_{it}$, so $R_{it}/\mu_{it} = p_{it}c_{it}/(p_{it}/\text{mc}_{it}) = \text{mc}_{it}c_{it}$. Constancy of marginal cost only in a neighborhood of observed output would not suffice: total variable cost integrates marginal cost from zero to that output. With nonlinear technology, the difference would enter the inferred fixed cost. Thus this is an identifying restriction, not a consequence of the definition of a markup. Substituting this expression into the profit identity gives

$$F_{it} = \left(1 - \frac{1}{\mu_{it}}\right) R_{it} - \Pi_{it}^{\text{op}}.$$

Dividing by revenue,

$$\frac{F_{it}}{R_{it}} = \left(1 - \frac{1}{\mu_{it}}\right) - \frac{\Pi_{it}^{\text{op}}}{R_{it}}.$$

The inferred fixed cost is the amount consistent with the estimated markup and observed operating profit margin. It is not a direct accounting classification of each cost item, and it inherits any measurement error in markups and operating profits. It is not inserted as

an additional real resource requirement in the welfare theorem. The active set is fixed, and the baseline uses F_{it} only to define an accounting reference for the intensive-margin comparison.

Before imposing $\mathrm{VC}_{it} = R_{it}/\mu_{it}$, the profit identity determines only $\mathrm{VC}_{it} + F_{it}$. Any reallocation $(\mathrm{VC}_{it}, F_{it}) \mapsto (\mathrm{VC}_{it} + z, F_{it} - z)$ that leaves both components nonnegative preserves the same revenue and operating profit. The maintained markup and cost assumptions select one decomposition; it is not independently identified by those two accounting observations. Smoothing recovery shares addresses transitory variation, while updating them at counterfactual sales addresses cost recovery. Neither operation adds information separating fixed from variable expenditure.

In the empirical implementation, negative implied fixed-cost requirements are set to zero for the purpose of constructing benchmark markups:

$$F_{it}^{+} = \max\{F_{it}, 0\}.$$

Implied fixed costs are negative when operating profit exceeds markup-implied variable profit. Measurement error in profits or markups can produce this outcome. These values should not imply a benchmark markup below one.

For a benchmark pool h in year t, define

$$F_{ht}^{+} = \sum_{i:h(i)=h} F_{it}^{+}, \qquad R_{ht} = \sum_{i:h(i)=h} R_{it}.$$

The fixed-cost recovery share is $f_{ht} = F_{ht}^{+}/R_{ht}$. When $0 \leq f_{ht} < 1$, the break-even benchmark markup is

$$\mu_{ht}^{B} = \frac{1}{1 - f_{ht}}.$$

This is the markup that would exactly recover the group's implied fixed-cost requirement if applied uniformly to the group's revenue base. It should be read as an accounting benchmark, not as a claim about optimal conduct or regulation. For the firm-level case, this also derives the minimum in (2.6). Indeed, $G_i(m) = (1 - m^{-1})R_i$ is continuous and strictly increasing on $m \geq 1$, with $G_i(1) = 0$ and $\lim_{m\to\infty} G_i(m) = R_i$. For $F_i^{+} \in [0, R_i)$, the unique solution to $G_i(m) = F_i^{+}$ is $m = (1 - F_i^{+}/R_i)^{-1}$. The feasible set is all markups weakly above this value, so it is the unique minimum self-financing markup. This proof is an entity-level accounting result at observed revenue.

A constrained planner benchmark would instead require endogenous revenue and an explicit treatment of the resources used by fixed costs. With the active set fixed and no

transfers across firms, a candidate problem has the form

$$\max_{\boldsymbol{\mu}\geq\mathbf{1}} W(\boldsymbol{\mu}) \quad \text{subject to} \quad (1-\mu_i^{-1})R_i(\boldsymbol{\mu}) \geq F_i \quad \text{for every } i. \tag{B.2}$$

Demand, resource costs, ownership, and feasible transfers must be specified jointly. Allowing subsidies across firms replaces the entity constraints by an aggregate funding restriction and can change the allocation. Accounting records alone do not identify either problem. In particular, the observed-revenue minimum in (2.6) is not its solution, and it does not establish that every firm remains solvent after a counterfactual sales adjustment.

For the firm-level pool $h = i$, define $m_{it}^{\text{op}} = \Pi_{it}^{\text{op}}/R_{it}$. If the untruncated implied fixed cost is nonnegative, direct substitution yields

$$1 - \frac{F_{it}}{R_{it}} = \frac{1}{\mu_{it}} + m_{it}^{\text{op}}, \qquad \mu_{it}^{B} = \left(\frac{1}{\mu_{it}} + m_{it}^{\text{op}}\right)^{-1}, \qquad \frac{\mu_{it}}{\mu_{it}^{B}} = 1 + \mu_{it} m_{it}^{\text{op}}.$$

Thus the benchmark-adjusted markup ratio is a transformation of the estimated markup and operating margin, not a third independently measured object. A zero operating margin sets $\mu_{it}^{B} = \mu_{it}$ whenever the implied fixed cost is positive, whereas the truncation for a negative implied fixed cost sets $\mu_{it}^{B} = 1$. This dependence is also why measurement errors in markups or EBIT propagate into both the wedge and its benchmark. The mapping $h(i)$ assigns firms to benchmark pools and is distinct from the sector mapping $g(i)$. The firm-level benchmark sets $h(i) = i$, the sector-level benchmark sets $h(i) = g(i)$, and the economy-level benchmark places all firms in a common group. The main text uses the firm-level benchmark; the sector- and economy-level benchmarks are reported as comparisons because they smooth fixed-cost recovery requirements over broader groups.

The recovery share is invariant to a common change in the year's nominal unit: for any aggregate price index P_t,

$$\frac{F_{ht}^{+}/P_t}{R_{ht}/P_t} = \frac{F_{ht}^{+}}{R_{ht}}.$$

Inflation and aggregate nominal growth therefore do not mechanically generate the fixed-cost recovery series. Changing sample composition can still matter. Figure D.4 separates these issues. Panel A compares the analysis-sample series with a fixed-sector-composition series and a chained annual-continuers series. The fixed-sector series holds NACE two-digit weights constant; the continuers series chains within-firm changes among firms observed in adjacent years. Panel B reports the level of implied fixed costs per firm in constant 2020 euros, both in the analysis sample and among firms observed in every year from 1985 through 2024. I deflate these levels with the Belgian total economy output price index from Eurostat, with 2020 as the base year, available from 1995 in the ex-

tract.[4] Because this strict balanced panel selects long-lived survivors and covers roughly one-quarter to two-fifths of annual sales, I use it as a coverage diagnostic rather than as the preferred sample.

Appendix D.2.4 reports these comparisons.

An alternative would be to use the accounting ratio $R_{it}/\mathrm{TC}_{it}^{\mathrm{op}}$, where $\mathrm{TC}_{it}^{\mathrm{op}} = R_{it} - \Pi_{it}^{\mathrm{op}}$ denotes accounting operating costs. I do not use this object as the benchmark markup because it is an average-cost markup. Including fixed costs in the denominator prevents this ratio from separating the markup over marginal cost from the margin needed to recover fixed costs. Another alternative would classify individual accounting cost items as fixed or variable. These accounts do not consistently distinguish fixed from variable expenditure across sectors. Belgian estimates of fixed input shares and detailed fixed and variable cost expenditure use different aggregation and identifying assumptions (Abraham et al., 2024; De Loecker et al., 2026b). I use the former to calibrate fixed input shares in Section D.2.3. These estimates do not directly measure each firm's fixed costs.

The firm benchmark diverges as the implied fixed cost recovery share approaches one and has no finite solution when that share reaches one. The analysis sample imposes the stricter empirical restriction of excluding observations with

$$\frac{F_{it}^{+}}{R_{it}} \geq 0.95.$$

At this cutoff the firm-level benchmark markup would be at least 20, so the observation would be governed by an implausibly large benchmark rather than by the residual markup wedge of interest. The restriction is applied before all baseline headline objects are recomputed on the same annual sample. Separate robustness exercises state their additional sample restrictions.

Table B.7 reports the frequency and importance of this restriction. The excluded observations are rare and have little sales weight.

[4] Eurostat, national accounts by industry.

Table B.7: Fixed-cost benchmark sample restriction

Year	Excluded firm-years	Observation share	Sales share	Quadratic raw TWC share
1985	6	0.19	0.01	0.17
1990	13	0.30	0.02	0.11
2000	72	1.08	0.26	2.58
2010	201	1.67	0.15	3.29
2020	333	2.54	0.91	5.29
2024	286	2.20	0.61	4.41

Notes: The table reports selected years for the restriction that removes observations with implied fixed-cost recovery share $F_{it}^{+}/R_{it} \geq 0.95$. Observation and sales shares are percentages of the pre-benchmark sample in the same year. Quadratic raw TWC share is the percentage of the pre-restriction quadratic within-sector markup-dispersion TWC accounted for by the excluded observations' variance contributions. It is not an exact CES TWC share or the TWC change from imposing the restriction.

B.5 Construction of TWC and incidence objects

Each year is evaluated separately. I first construct the calibrated markup μ_{it}, then the firm benchmark μ_{it}^{B} in Section B.4, and retain the analysis sample. Revenue shares are normalized on that sample using (3.3). For each retained firm, define

$$\xi_{it}^{B} = \log \mu_{it} - \log \mu_{it}^{B}, \qquad \rho_{it}^{B} = \exp(\xi_{it}^{B}) = \frac{\mu_{it}}{\mu_{it}^{B}}.$$

The raw comparison sets every benchmark to one and uses $z_{it} = \log \mu_{it}$. The baseline uses the fixed sector-specific DKM calibration, including its common fallback for uncovered divisions, described in Appendix B.3.

Aggregate TWC and centering. For each sector and year, the exact sufficient statistics are

$$A_{gt}^{B} = \sum_{i:g(i)=g} \omega_{it|g} (\rho_{it}^{B})^{\sigma_g - 1}, \qquad B_{gt}^{B} = \sum_{i:g(i)=g} \frac{\omega_{it|g}}{\rho_{it}^{B}}. \tag{B.3}$$

The exact fixed cost adjusted TWC is

$$\mathcal{I}_{t}^{B,\mathrm{E}} = \sum_{g} \Lambda_{gt} \left[\frac{\log A_{gt}^{B}}{\sigma_g - 1} + \log B_{gt}^{B} \right]. \tag{B.4}$$

For the quadratic comparison, define

$$\bar{\xi}^B_{gt} = \sum_{i:g(i)=g} \omega_{it|g}\xi^B_{it}, \qquad \tau^B_{it|g} = \xi^B_{it} - \bar{\xi}^B_{gt},$$
$$V^B_{gt} = \sum_{i:g(i)=g} \omega_{it|g}(\tau^B_{it|g})^2.$$

The centering identity is

$$\sum_{i:g(i)=g} \omega_{it|g}\tau^B_{it|g} = 0 \qquad \text{for every sector and year.} \tag{B.5}$$

The zero is the sales weighted mean of the *centered log residual wedge*, not the unweighted mean of wedges or the arithmetic mean of μ_{it}/μ^B_{it}. Equivalently, $\exp(\tau^B_{it|g})$ has a sales weighted geometric mean of one; its arithmetic mean exceeds one whenever there is positive dispersion. The local quadratic comparison is

$$\mathcal{I}^{B,\mathrm{Q}}_t = \frac{1}{2}\sum_g \sigma_g \Lambda_{gt} V^B_{gt}. \tag{B.6}$$

Both TWC measures are retained, together with their marginal and finite incidence measures. The exact TWC supplies the headline results; the quadratic TWC supplies the approximation comparison in Section C.8.

Marginal and finite incidence. For firm i in sector g, exact marginal incidence is

$$\mathrm{MWI}^{B,\mathrm{E}}_{it} = \sigma_g \Lambda_{gt}\omega_{it|g}\left(1 - \frac{(\rho^B_{it})^{-1}}{B^B_{gt}}\right). \tag{B.7}$$

This is the total derivative after substituting the CES share system, not a derivative holding firm sales weights fixed. A positive value means that a marginal reduction in the firm's log residual wedge lowers the TWC.

For the quadratic TWC, the corresponding total derivative is

$$\mathrm{MWI}^{B,\mathrm{Q}}_{it} = \sigma_g \Lambda_{gt}\omega_{it|g}\tau^B_{it|g} - \frac{\sigma_g(\sigma_g - 1)}{2}\Lambda_{gt}\omega_{it|g}\left[(\tau^B_{it|g})^2 - V^B_{gt}\right]. \tag{B.8}$$

The second term incorporates CES sales reallocation. This is the annual implementation of (2.21), not a fixed weight derivative.

Finite incidence resets only firm i's residual log wedge to zero. Let $\boldsymbol{\rho}^{B,(i)}_t$ denote the resulting ratio vector, with firm i's ratio set to one, and $\boldsymbol{\lambda}^{(i)}_t$ the CES updated shares. Then

$$\Delta\mathcal{I}^{B,\mathrm{E}}_{it} = \mathcal{I}^{B,\mathrm{E}}_t(\boldsymbol{\rho}^B_t, \boldsymbol{\lambda}_t) - \mathcal{I}^{B,\mathrm{E}}_t(\boldsymbol{\rho}^{B,(i)}_t, \boldsymbol{\lambda}^{(i)}_t). \tag{B.9}$$

To evaluate the finite effect, define

$$D_{igt} = 1 - \omega_{it|g} + \omega_{it|g}(\rho_{it}^B)^{\sigma_g - 1}, \qquad J_{igt} = B_{gt}^B - \frac{\omega_{it|g}}{\rho_{it}^B} + \omega_{it|g}(\rho_{it}^B)^{\sigma_g - 1}.$$

The closed form is

$$\Delta\mathcal{I}_{it}^{B,\mathrm{E}} = \Lambda_{gt}\left[\frac{\sigma_g}{\sigma_g - 1}\log D_{igt} + \log B_{gt}^B - \log J_{igt}\right]. \tag{B.10}$$

For the quadratic calculation, I instead evaluate

$$\Delta\mathcal{I}_{it}^{B,\mathrm{Q}} = \frac{\sigma_g \Lambda_{gt}}{2}\left[V_{gt}^B - (V_{gt}^B)^{(i)}\right], \tag{B.11}$$

where $(V_{gt}^B)^{(i)}$ is the variance after the same full reset, with the updated shares. Its closed form is (A.11) with annual subscripts and residual wedges restored. Neither finite measure is computed as $\xi_{it}^B \mathrm{MWI}_{it}^{B,s}$, which would impose the initial slope approximation for $s \in \{\mathrm{E}, \mathrm{Q}\}$.

The share update in (2.25) adjusts both the treated firm's and its sector rivals' expenditure shares. The sector expenditure share Λ_{gt}, rival markups, and the entire benchmark vector remain fixed. Each firm's counterfactual starts from the same observed allocation; resets are not applied sequentially.

The aggregate TWC and finite effects are dimensionless; reported log points equal 100 times their values. Marginal incidence is in TWC units per unit change in the log residual wedge. The headline rankings use exact finite effects and are compared with full finite resets of the quadratic TWC. Finite incidence under either formula is not an additive allocation of the aggregate TWC, and the reported concentration shares use summed positive finite incidence as their denominator.

C Additional Baseline Results

This appendix reports the distributions, aggregate decomposition, ranking comparisons and firm diagnostics supporting Section 4. Measurement sensitivity is collected in Appendix D; alternative counterfactuals and specification agreement are in Appendix E.

C.1 Markup distributions and weighting

Figure C.1 shows the distribution of COGS-based markups after the baseline cleaning and trimming rules. Figure C.2 reports average markups under alternative weighting schemes. These figures describe the cleaned, annually trimmed markup sample before the EBIT availability and fixed cost benchmark restrictions.

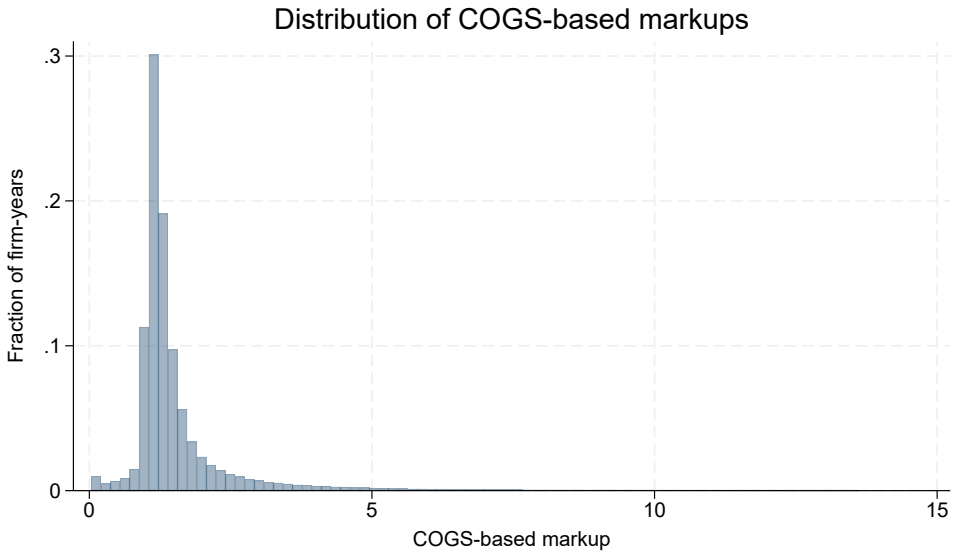


Figure C.1: Distribution of COGS-based markups after baseline cleaning and trimming

Notes: The figure pools firm-years from 1985 through 2024 after the annual 1.5th and 98.5th percentile markup trim, but before the EBIT availability and fixed cost benchmark restrictions. Bars show unweighted firm-year frequencies. Markups are dimensionless price–marginal-cost ratios computed from the COGS proxy in Equation (3.1).

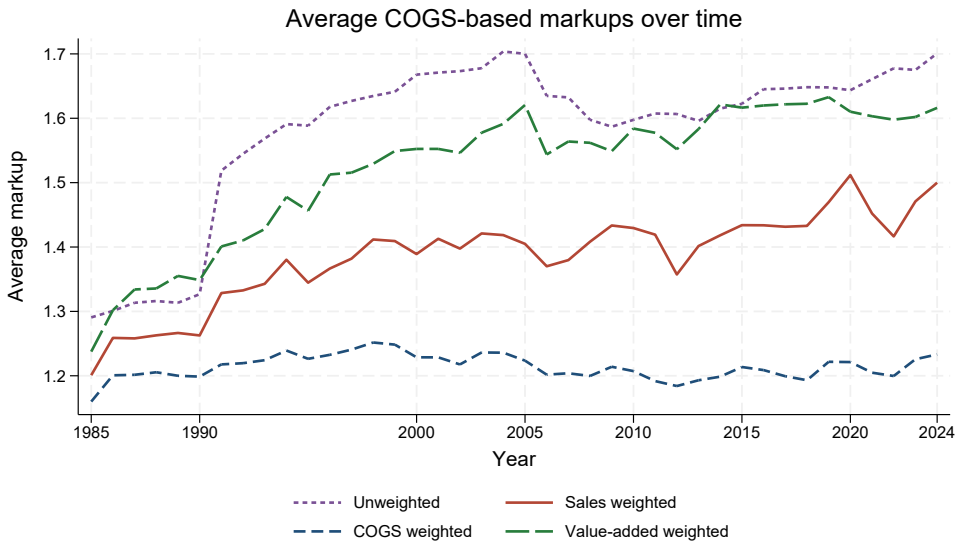


Figure C.2: Average COGS-based markups under alternative weighting schemes

Notes: Each line reports an annual mean over the 1985–2024 cleaned, annually trimmed markup sample before the EBIT availability and fixed cost benchmark restrictions. The weighting schemes are unweighted, sales weighted, COGS weighted, and value added weighted. The value added weight is proxied by the labor bill plus the calibrated capital charge. These descriptive alternatives change only the aggregation of the same trimmed markup input; the baseline TWC uses sales weights.

C.2 Comparison with Belgian price-cost margin estimates

The price-cost margin and the gross markup contain the same information for an individual firm, but their weighted means need not move together. With annual sample sales weights λ_{it},

$$\overline{\text{PCM}}_t = \sum_i \lambda_{it} \left(1 - \frac{1}{\mu_{it}}\right) = 1 - \sum_i \frac{\lambda_{it}}{\mu_{it}} \leq 1 - \frac{1}{\sum_i \lambda_{it}\mu_{it}} \tag{C.1}$$

The inequality is strict when positive weight firms have different markups; it becomes an equality when their markups are common. The mean margin is a transformation of the sales weighted harmonic markup, not the arithmetic mean in Figure 1. Changing dispersion can therefore accompany an increase in the arithmetic mean and a decrease in the mean margin.

Table C.1: Markups and price-cost margins over the common period, 1986–2014

Measure	1986	2014	Change
This paper: mean markup (ratio)	1.259	1.403	+0.144
This paper: mean price-cost margin (%)	16.95	16.47	-0.47
Abraham et al.: estimated price-cost margin (%)	28.10	22.20	-5.90

Notes: The first two rows use the unchanged baseline incidence sample and current annual sales weights, including the annual 1.5 percent trim in each markup tail. The markup is a price to marginal cost ratio; its change is in ratio units. Margins are percentages of revenue and their changes are percentage points. The last row reproduces unsmoothed yearly estimates in Online Appendix Table 4 of Abraham et al. (2024), not the moving averages plotted in their Figure 1. Their regression estimates use sales weights but are not arithmetic averages of the firm margins constructed here. The comparison aligns years and the definition of a margin, not the underlying samples or estimators.

Both margin series decline over these endpoints, while their levels and changes differ substantially. The samples, input definitions, and estimators differ. Rising average markups can coexist with falling average margins. Agreement on that pattern does not validate individual markup estimates.

C.3 Long-run decomposition and firm composition

The decomposition in Table C.2 separates changing sector dispersion from changing expenditure shares. Define $\mathcal{I}_{gt}^{B,\mathrm{E}} = (\sigma_g - 1)^{-1} \log A_{gt}^B + \log B_{gt}^B$ as the exact sector TWC before applying its expenditure weight, so that $\mathcal{I}_t^{B,\mathrm{E}} = \sum_g \Lambda_{gt} \mathcal{I}_{gt}^{B,\mathrm{E}}$. For endpoints t_0 and t_1, let $\bar{\Lambda}_g = (\Lambda_{gt_0} + \Lambda_{gt_1})/2$ and $\overline{\mathcal{I}}_g^{B,\mathrm{E}} = (\mathcal{I}_{gt_0}^{B,\mathrm{E}} + \mathcal{I}_{gt_1}^{B,\mathrm{E}})/2$. Then

$$\mathcal{I}_{t_1}^{B,\mathrm{E}} - \mathcal{I}_{t_0}^{B,\mathrm{E}} = \sum_g \bar{\Lambda}_g \left(\mathcal{I}_{gt_1}^{B,\mathrm{E}} - \mathcal{I}_{gt_0}^{B,\mathrm{E}} \right) + \sum_g \overline{\mathcal{I}}_g^{B,\mathrm{E}} \left(\Lambda_{gt_1} - \Lambda_{gt_0} \right). \tag{C.2}$$

Suppressing the superscripts B, E for this identity only,

$$\begin{aligned} \Lambda_{gt_1} \mathcal{I}_{gt_1} - \Lambda_{gt_0} \mathcal{I}_{gt_0} = {} & \frac{\Lambda_{gt_0} + \Lambda_{gt_1}}{2} \left(\mathcal{I}_{gt_1} - \mathcal{I}_{gt_0} \right) \\ & + \frac{\mathcal{I}_{gt_0} + \mathcal{I}_{gt_1}}{2} \left(\Lambda_{gt_1} - \Lambda_{gt_0} \right). \end{aligned} \tag{C.3}$$

Summing (C.3) across sectors gives (C.2). The first term changes within-sector dispersion at the average endpoint expenditure share. The second changes sector expenditure shares at the average endpoint dispersion cost. The averages divide the interaction term equally and make the decomposition invariant to which endpoint is treated as the base. The same product identity applies to the quadratic TWC after replacing $\mathcal{I}_{gt}^{B,\mathrm{E}}$ by $\sigma_g V_{gt}^B/2$,

but the reported decomposition uses the exact CES TWC. This is descriptive accounting within the October 2026 source vintage, not a causal decomposition or an attribution of revisions between data vintages.

Seventy-three sectors are observed in both 1985 and 2024. Eleven are observed only in 2024 and one only in 1985, giving 85 sectors in the endpoint union. For a sector with zero weight at one endpoint, its observed $\mathcal{I}_{gt}^{B,\mathrm{E}}$ is carried to that endpoint. Its within-sector change is then zero and its entire component is assigned to sector coverage. Dispersion is unobserved when a sector has zero sample weight, so this part of the decomposition depends on the imputation rule. Coverage entry adds 0.060286 log points and exit subtracts 0.000004, a net 0.06 log points of the 8.99 log point aggregate increase.

Table C.2: Sources of the increase in residual dispersion, 1985–2024

Component	Change (log points)	Share of total change (%)
Within-sector residual-wedge dispersion	6.84	76.0
Expenditure reallocation across common sectors	2.10	23.3
Sectors observed at only one endpoint	0.06	0.7
Total change	8.99	100.0

Notes: The table decomposes the exact firm benchmark adjusted TWC $\mathcal{I}_t^{B,\mathrm{E}}$ using (C.2) in Appendix C.3. Within sector dispersion changes at average endpoint expenditure shares; expenditure shares change at average endpoint sector TWC values. For a sector observed at only one endpoint, its observed TWC is carried to the zero weight endpoint, assigning its entire change to sector coverage. Components add exactly.

Table C.3 reports the ten largest sectoral increases. Basic pharmaceuticals have the largest net change, 4.68 log points. Their measured expenditure-share component is 2.23 points, while their within-sector component is 2.45 points. The increases in wholesale trade, electricity and gas, and warehousing primarily reflect greater dispersion within those sectors.

Table C.3: Sectors with the largest increases in the TWC, 1985–2024

Sector	Total change	Within-sector component	Sector-share and coverage component
21 Basic pharmaceuticals	4.68	2.45	2.23
52 Warehousing and transport support	0.52	0.63	-0.11
72 Scientific research and development	0.43	0.22	0.21
64 Financial services	0.40	0.78	-0.38
46 Wholesale trade	0.31	0.31	0.00
35 Electricity and gas	0.30	0.38	-0.08
77 Rental and leasing	0.19	0.11	0.07
62 Computer programming and consultancy	0.16	0.10	0.06
70 Head offices; management advice	0.13	0.10	0.03
30 Other transport equipment	0.12	0.09	0.02

Notes: Entries are log points of the fixed cost adjusted TWC. Sectors are ordered by their total component in the change in $\mathcal{I}_t^{B,\mathrm{E}}$. The final two columns are the components in (C.3); they sum to the first column. Negative entries indicate that the corresponding channel offsets the sector's total increase. The sector-share and coverage component includes share changes among common sectors and coverage entry and exit. The table reports the ten largest increases, not all sectors.

The sector decomposition does not hold the set of observed firms fixed. I therefore supplement it with an endpoint continuing firm diagnostic. At each endpoint year, use the radial path in Appendix A.6: all firms' residual wedges move jointly from zero to their observed values, with sector expenditure weights fixed and CES shares updated along the path. The additive allocation is

$$\mathcal{A}_{it}^{B,\mathrm{E}} = \xi_{it}^{B} \int_0^1 \mathrm{MWI}_{it}^{B,\mathrm{E}}(s\boldsymbol{\xi}_t^{B})\,\mathrm{d}s, \qquad \sum_i \mathcal{A}_{it}^{B,\mathrm{E}} = \mathcal{I}_t^{B,\mathrm{E}}. \tag{C.4}$$

This is $\mathcal{A}_i^{\mathrm{E}}$ from (A.16) with the year and benchmark indices restored. Marginal incidence is evaluated at the full intermediate wedge vector and its associated CES shares. The identity follows by integrating the derivative of $\mathcal{I}_t^{B,\mathrm{E}}(e^{s\boldsymbol{\xi}_t^{B}})$ from $s = 0$ to $s = 1$; the initial TWC is zero. Computation uses Simpson's rule with 200 intervals. These signed allocations add to the exact TWC; they are not squared wedge exposures or separate firm reset effects. Their values depend on the chosen joint path.

Let $\mathcal{C}$ contain the 1,482 legal entities observed in both 1985 and 2024. The first three rows of Table C.4 split the full-sample TWC into $\sum_{i\in\mathcal{C}} \mathcal{A}_{it}^{B,\mathrm{E}}$ and the component assigned to all other firms. The split is additive within each endpoint, but the continuer component still uses the comparison distribution from the full observed population. The fourth row

instead removes all other firms and recomputes sector and firm weights within $\mathcal{C}$. It is a balanced-sample TWC, not a component of the full-sample TWC.

Table C.4: Endpoint continuing-firm diagnostic, 1985 and 2024

Object	1985	2024	Change
Full-sample TWC	1.04	10.03	8.99
Endpoint continuers' additive component	0.64	0.16	-0.49
Other firms' additive component	0.40	9.87	9.48
Balanced-continuers TWC	0.90	1.59	0.69
Endpoint continuers' sales share	64.56	34.47	-30.09

Notes: TWC levels, additive components, and their changes are in log points. The sales-share row is in percent and its change is also in percentage points. Endpoint continuers are the 1,482 legal entities observed in both years. The first three rows use the full population and the radial allocation in (C.4), and the second and third rows add to the first in each year. The balanced-continuers TWC renormalizes all weights within the endpoint-continuing sample. *Other firms* combines genuine entry and exit with differences in historical reporting and industry coverage; it is not a structural entry effect.

C.4 Distribution of firm incidence

Figure C.3 compares raw and benchmark-adjusted marginal incidence. Figures C.4 and C.5 display the baseline exact finite effects without removing the tails. Of 12,708 firms, 7,167 have positive effects, 5,539 have negative effects, and two have zero effects at numerical precision. Among positive effects, 91.4 percent are at most 0.001 log points. The sum of all positive effects is 12.07 log points, the denominator of the concentration shares in Section 4.3; these are separate resets, not additive contributions to the aggregate TWC.

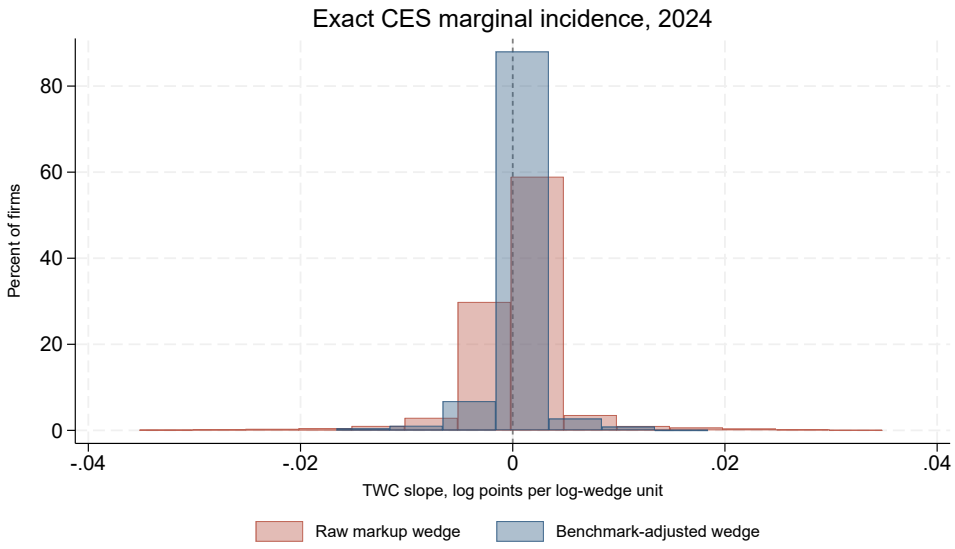


Figure C.3: Raw and fixed-cost benchmark-adjusted marginal wedge incidence, 2024

Notes: The histograms use the 2024 analysis sample, NACE two-digit substitution groups, sales weights, and the baseline DKM sector elasticities and fixed fallback. The horizontal axis is the derivative of the TWC in log points per unit change in the firm's log wedge, that is, $100\text{MWI}_{it}^{B,\text{E}}$ for the benchmark adjusted series. Each distribution is displayed between its own first and ninety-ninth percentiles.

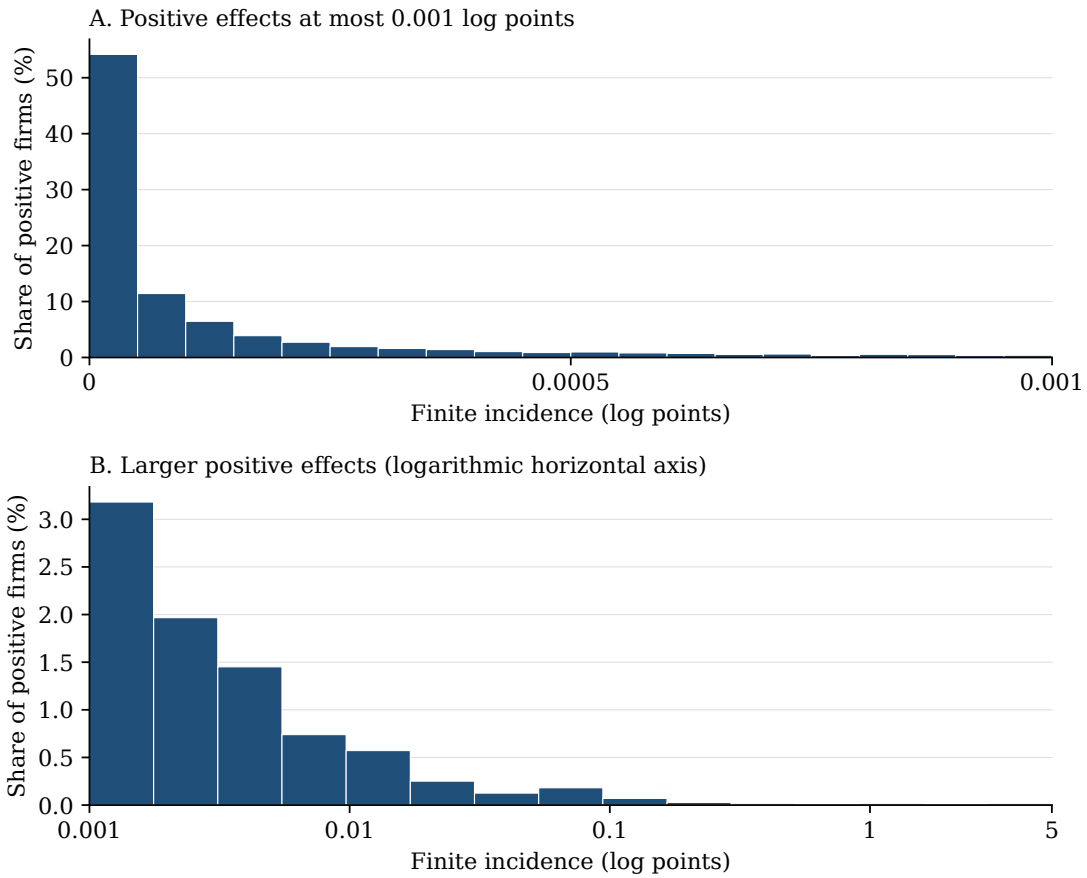


Figure C.4: Distribution of positive finite incidence, 2024

Notes: Both panels use the same denominator of 7,167 firms with positive baseline exact finite incidence. Each firm appears once: Panel A covers effects at most 0.001 log points, and Panel B covers larger effects on a logarithmic horizontal axis. Bar heights are percentages of positive firms, not density per unit on the horizontal axis. No positive effects are excluded. Each reset holds benchmarks and rival markups fixed and updates own and rival CES expenditure shares within the sector.

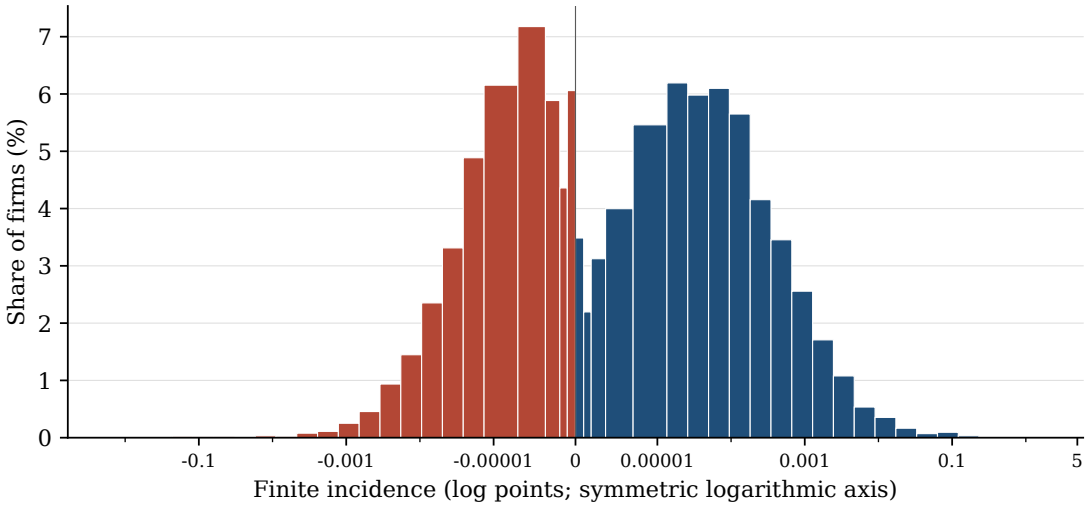


Figure C.5: Full distribution of finite incidence, 2024

Notes: All 12,708 baseline firms are included. Negative effects mean that the unilateral reset raises the fixed cost adjusted TWC. Bar heights are percentages of all firms, not a density. The horizontal axis is linear between −0.00001 and 0.00001 log points and logarithmic outside that interval, separately on each side of zero. The two numerical zeros enter the bin starting at zero. This display changes neither the sample nor the finite incidence calculation.

C.5 Comparisons with alternative rankings

C.5.1 Marginal, finite, and alternative rankings

In year t, exact marginal incidence is the observed slope $\mathrm{MWI}_{it}^{B,\mathrm{E}} = \mathrm{d}\mathcal{I}_t^{B,\mathrm{E}}/\mathrm{d}\xi_{it}^B$ along the CES share response. The exact finite benchmark reset instead integrates this slope over a firm-specific interval:

$$\Delta\mathcal{I}_{it}^{B,\mathrm{E}} = \int_0^{\xi_{it}^B} \mathrm{MWI}_{it}^{B,\mathrm{E}}(u)\,\mathrm{d}u.$$

Ranking firms by $\mathrm{MWI}_{it}^{B,\mathrm{E}}$ alone therefore compares TWC slopes per unit of the wedge, not the TWC reductions from firm-specific benchmark resets. The initial slope approximation to the latter is $\xi_{it}^B \mathrm{MWI}_{it}^{B,\mathrm{E}}$. Table 3 in the main text reports the corresponding annual comparisons. Multiplying the initial slope by the firm's log distance to the benchmark raises its mean rank correlation with full finite incidence from 0.249 to 0.814. The remaining difference reflects the changing derivative along the reset. The same distinction is illustrated for the leading firms in Table C.7.

Table C.5 reports a pooled firm-year version of the ranking-overlap exercise. This comparison ranks firm-years together across the full panel rather than selecting a separate

top 100 in each year.

Table C.5: Alternative rankings in the pooled panel, 1985–2024

Alternative ranking	Top-100 overlap	Rank correlation
Markup μ	0	0.220
Markup gap μ/μ^B	4	0.107
Sales	0	-0.188
$\mu\times$ sales	10	-0.111
$(\mu/\mu^B)\times$ sales	5	-0.159
Operating profit	22	-0.083
EBIT margin	0	0.165
Raw finite effect	33	0.384
Marginal incidence	39	0.240
Initial slope reset $\xi_{it}^B \mathrm{MWI}_{it}^{B,\mathrm{E}}$	51	0.825

Notes: The target set is the pooled top 100 firm-years by the exact benchmark adjusted finite effect, not 100 distinct entities. Each finite effect resets one firm's markup to its fixed accounting benchmark and updates CES shares within its sector. Top 100 overlap counts firm-years also selected by each alternative. Rank correlations are Spearman correlations over the pooled 1985–2024 sample. Raw finite effects set every benchmark to one; marginal incidence and its initial slope reset use the exact TWC.

C.5.2 Profitability as an alternative diagnostic

A profit rate is not sales divided by total cost. Let $\mathrm{TC}_{it}^{\mathrm{econ}}$ denote all economic costs and $\Pi_{it}^{\mathrm{econ}} = R_{it} - \mathrm{TC}_{it}^{\mathrm{econ}}$ denote economic profit. The economic profit rate and the sales-to-total-cost ratio are

$$\pi_{it}^{\mathrm{econ}} = \frac{\Pi_{it}^{\mathrm{econ}}}{R_{it}} = 1 - \frac{\mathrm{TC}_{it}^{\mathrm{econ}}}{R_{it}}, \qquad \frac{R_{it}}{\mathrm{TC}_{it}^{\mathrm{econ}}} = \frac{1}{1-\pi_{it}^{\mathrm{econ}}}, \tag{C.5}$$

whenever total cost is positive. The second object is a price–average-cost ratio and is a monotone transformation of the first; neither is a price–marginal-cost markup.

De Loecker et al. (2020) define net economic profits as sales minus variable inputs, overhead measured by SG&A, and the user cost of balance-sheet capital. Let $P_{it}^V V_{it}$ denote expenditure on variable inputs, H_{it} overhead, K_{it} the capital stock, and r_t its user cost. Their profit rate can be written

$$\pi_{it}^{\mathrm{DEU}} = 1 - \frac{P_{it}^V V_{it}}{R_{it}} - \frac{H_{it}}{R_{it}} - \frac{r_t K_{it}}{R_{it}}. \tag{C.6}$$

The Belgian accounts do not report an SG&A item comparable across all firms. I infer cash overhead as $H_{it} = R_{it} - X_{it} - \text{EBITDA}_{it}$, where X_{it} is the COGS bundle used in markup estimation. With the same empirical user-cost assumption $r_t = r = 0.10$ as in the markup construction, the empirical analogue is

$$\widehat{\pi}_{it}^{\text{DEU}} = \frac{\text{EBITDA}_{it} - rK_{it}}{R_{it}}. \tag{C.7}$$

This is a close accounting analogue rather than an exact replication: the QJE application observes SG&A directly and constructs a time-varying user cost of capital. I exclude observations with nonpositive implied total cost and trim the first and ninety-ninth percentiles of the profit-rate distribution within year. This additional profit rate trim applies only to this diagnostic; it does not alter the baseline markup sample. The comparison uses the paper's 1985–2024 analysis period. In 2024, 12,454 firms remain, representing 99.7 percent of analysis-sample sales.

Table C.6 compares profitability rankings with exact finite TWC incidence. The economic profit rate recovers 18.4 percent of the incidence top 100 and has an average rank correlation of 0.10. Ranking firms by the level of economic profit gives 22.0 percent overlap but a rank correlation of -0.16. These profit measures select substantially different firms from the finite incidence ranking.

Table C.6: Profitability rankings and exact firm-level TWC incidence

Alternative ranking	Mean top-100 overlap (%)	Mean rank correlation
EBIT margin	17	0.128
Economic profit rate	18	0.099
Economic profit	22	-0.161

Notes: Entries are averages over 1985–2024. The target is the within-year ranking by the exact finite TWC effect. The economic profit rate is $(\text{EBITDA} - rK)/R$; economic profit is its product with sales. The comparison sample requires positive implied total cost and removes the annual first and ninety-ninth percentiles of the economic profit rate. Rank correlations are Spearman correlations.

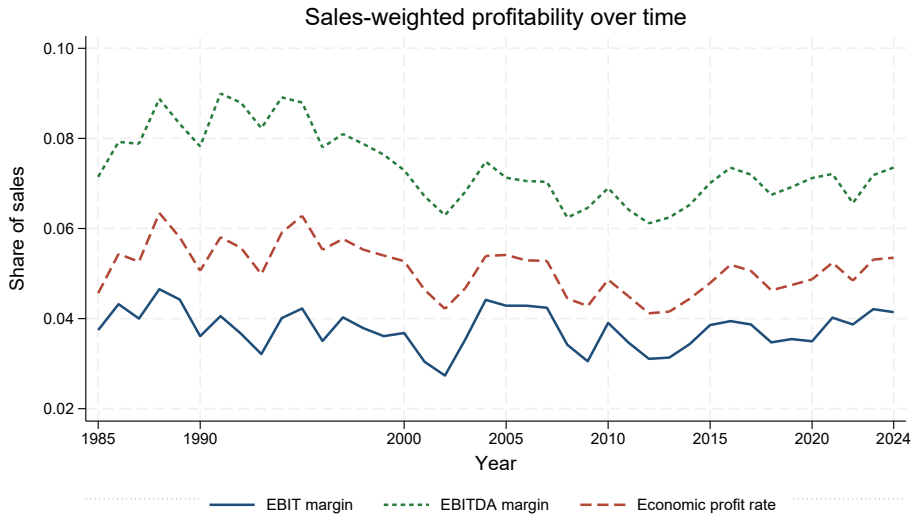


Figure C.6: Sales-weighted profitability measures over time

Notes: The solid line is EBIT divided by sales, the short-dashed line is EBITDA divided by sales, and the dashed line is the economic profit rate $(\text{EBITDA} - rK)/R$. All series cover 1985–2024 and use sales weights and the cleaned economic-profit-rate sample. The capital user cost is 10 percent.

C.6 Leading firms and the size of the reset

Table C.7 holds the unrestricted baseline top ten fixed and compares their full resets with a common 1 percent price reduction. With marginal costs fixed, the price and markup change by the same proportion. The small reduction is capped at the firm's benchmark, although the cap binds for none of these ten firms. This is a common proportional price reduction, not the common fraction of each log gap used in Table E.1.

For a treated firm i in sector g, write $a_i = p_i'/p_i = \mu_i'/\mu_i$. The full reset sets $a_i = 1/\rho_i$, while the small reduction sets $a_i = 0.99$ for every firm in this table. The updated share is

$$\omega_{i|g}' = \frac{\omega_{i|g} a_i^{1-\sigma_g}}{1 + \omega_{i|g}(a_i^{1-\sigma_g} - 1)}. \tag{C.8}$$

Rival shares divide by the same denominator; rival markups, all benchmarks and sector expenditure remain fixed.

Table C.7: Unrestricted leading firms under small reductions and full resets, 2024

				Sector share (%)		Incidence (log points)	
Rank	Legal entity	σ_g	Full price cut (%)	Observed	Full reset	1% price cut	Full reset
1	TELIX INNOVATIONS	7.32	88.8	0.81	99.99	0.0022	4.933
2	GlaxoSmithKline Biologicals	7.32	56.7	19.85	98.02	0.0274	1.358
3	OMEGA PHARMA INNOVATION & DEVELOPMENT	4.91	86.2	0.92	95.56	0.0002	0.418
4	J.C. GENERAL SERVICES	3.34	84.7	1.21	49.76	0.0003	0.207
5	UCB PHARMA	2.98	41.8	2.30	6.43	0.0053	0.207
6	BRUSSELS AIRPORT COMPANY	3.46	60.0	3.65	26.49	0.0015	0.165
7	ARVAL BELGIUM	2.81	63.9	13.13	48.93	0.0018	0.139
8	ELIA ASSET	2.88	62.9	3.27	17.85	0.0015	0.118
9	Lorelay Transport Chartering	5.14	66.4	5.47	84.18	0.0005	0.105
10	argenx	4.91	34.2	42.60	79.25	0.0037	0.105

Notes: Rows follow the unrestricted full reset ranking, not a new ranking for the small reduction. Unlike Table 4, this diagnostic retains firms with negative inferred fixed costs, including Omega Pharma Innovation & Development. The full price cut is $100(1 - \mu_i^B/\mu_i)$. Sector shares refer to the sampled NACE two digit division, not measured product market shares. Each counterfactual changes one firm separately, holding marginal costs, rival markups, benchmark markups and sector expenditure fixed. The last two columns report the exact reduction in the fixed cost adjusted TWC multiplied by 100. Neither column sums to the aggregate TWC, and the counterfactual shares must not be added across rows. All 12,708 firms remain in the demand system. J.C. General Services uses the common fallback elasticity of 3.34; the other rows use mapped DKM estimates.

GSK Biologicals has greater incidence than Telix under the small common reduction, but Telix has the larger full reset effect. Thus their full ranking does not follow from their initial slopes alone. Three of the ten separate full resets give the treated firm more than 95 percent of its sampled sector's sales. These are implications of constant demand curvature, fixed marginal costs and unchanged rival prices over the entire reset. They are not forecasts of feasible expansion. The partial reset exercise in Appendix E.1 assesses concentration closer to the observed allocation; it does not independently validate capacity or the transferred demand elasticities.

C.7 Annual and multiyear persistence

Table C.8 reports adjacent-year rank correlations for four firm rankings: sales, markups, marginal incidence, and finite effects. Median adjacent year rank correlations are 0.712 for marginal incidence and 0.630 for finite incidence, compared with 0.978 for sales and 0.903 for markups.

Table C.8: Adjacent-year rank correlations of firm rankings

Object	Median	Mean	p25	p75
Sales	0.978	0.977	0.976	0.980
Markup	0.903	0.898	0.891	0.912
Marginal incidence	0.712	0.711	0.687	0.727
Benchmark-adjusted finite effect	0.630	0.632	0.607	0.661

Notes: Each row reports the distribution across adjacent calendar years of rank correlations for the indicated firm-level ranking. Marginal incidence is the local derivative of the TWC. The finite-effect ranking is based on the counterfactual reset of each firm's benchmark-adjusted markup gap.

Annual ranks may inherit transitory variation from accounting data. I therefore also rank firms by their average benchmark-adjusted finite effect in non-overlapping five year windows: 1985–1989, 1990–1994, 1995–1999, 2000–2004, 2005–2009, 2010–2014, 2015–2019, and 2020–2024. The balanced specification requires a firm to appear in every year of each window being compared. A second specification requires at least three observations per window. Table C.9 shows that smoothing annual incidence does not remove persistence. Under the balanced specification, 58.9 percent of top-1-percent firms remain in the top 1 percent in the next window and 91.6 percent remain in the top 10 percent. The median adjacent-window rank correlation is 0.584.

Table C.9: Persistence under non-overlapping multi-year averages

Ranking frequency	$1\% \to 1\%$	$1\% \to 10\%$	$5\% \to 5\%$	$10\% \to 10\%$	Median rank corr.
Annual firm-year ranking	66.4	92.4	67.2	68.7	0.630
Multi-year average, balanced	58.9	91.6	59.2	60.7	0.584
Multi-year average, at least three years	57.9	89.7	59.2	62.1	0.595

Notes: Entries in the four transition columns are percentages. The annual row uses adjacent calendar years. Multi-year rows rank firms by their average finite TWC effect in the non-overlapping windows listed in the text; every window contains five years. "Balanced" requires a firm to appear in every year of both adjacent windows. The alternative requires at least three observations in each window. Transition probabilities pool adjacent window pairs, while the final column reports the median rank correlation across the seven pairs.

A direct comparison of annual ranks in t and $t + 5$ answers a different question: it lengthens the persistence horizon but does not smooth annual measurement. Under that comparison, the median rank correlation falls to 0.421; 47.3 percent of top-1-percent firms remain in the top 1 percent five years later and 81.0 percent remain in the top 10

percent. The comparison with Table C.9 distinguishes persistence in annual ranks from persistence in ranks based on five year averages.

C.8 Exact and approximate incidence

The TWC in Section 2.3 evaluates markups relative to their firm benchmarks, treating those benchmarks as part of effective marginal costs. This convention does not make a heterogeneous benchmark welfare neutral in the original resource economy. In 2024, the exact TWC is 10.03 log points, compared with 5.96 under its local quadratic approximation. Exact and quadratic one-firm finite effects have a rank correlation of 0.93 and 84 firms in common across their top 100 sets. The exact top 100 account for 82.7 percent of positive incidence. Finite incidence is highly concentrated under both the exact and quadratic formulas.

Table C.10: Marginal and finite incidence under both formulas, 2024

	Top 100 share (%)		Exact versus quadratic	
Incidence	Exact	Quadratic	Rank correlation	Top 100 overlap
Marginal incidence	53.3	49.8	0.93	77
Full benchmark reset	82.7	77.3	0.93	84

Notes: All calculations use the 12,708 analysis firms in 2024, firm benchmarks, and the DKM sector elasticities. Each share divides the sum of the largest 100 positive values by the sum of all positive values of that measure, not by the aggregate TWC. Marginal values are the total derivatives in (2.18) and (2.21); finite values use the full resets in (2.27) and (2.28). Rank correlations are Spearman correlations over all firms. Overlap counts firms in both top 100 sets within the indicated row; it does not compare marginal with finite rankings.

The quadratic calculation gives top 100 shares of 49.8 percent for marginal incidence and 77.3 percent for finite incidence. Its ranks correlate with the exact ranks at 0.93 and 0.93, respectively, retaining 77 and 84 firms in the corresponding top 100. The approximation captures the broad concentration pattern while understating its magnitude. Headline firm rankings use the exact full reset.

These comparisons change the formula used to evaluate the same reset. Appendix E.4 separately changes the welfare reference and examines resource gains from actual markup targets.

Table C.11 compares exact and quadratic incidence rankings and their persistence. Panel A compares the quadratic and exact TWC measures separately for the marginal

derivative and the finite reset. The exact marginal ranking has a 2024 rank correlation of 0.927 with the quadratic marginal ranking and retains 77 of its top 100 firms; the corresponding finite statistics are 0.926 and 84. Panel B shows that persistence is essentially unchanged. At the one-year horizon, top-decile retention is 69.4 percent under the quadratic TWC and 68.7 percent under the exact TWC. At the five-year horizon, the corresponding figures are 53.6 and 52.0 percent. Here the five year horizon compares annual ranks five years apart, not ranks based on five year averages.

Table C.11: Marginal incidence, finite incidence, and persistence under exact and quadratic TWC measures

Panel A: Quadratic versus exact incidence rankings

Incidence object	2024 rank corr.	2024 top 100 overlap	Annual mean rank corr.	Annual mean top 100 overlap
Marginal incidence	0.93	77	0.94	82.7
Finite one-firm incidence	0.93	84	0.95	88.6

Panel B: Persistence of finite incidence

Endpoint TWC	Horizon (years)	Matched firm pairs	Top decile retention	Median annual rank corr.
Exact CES baseline	1	316,444	68.7	0.63
Local quadratic	1	316,444	69.4	0.64
Exact CES baseline	5	233,390	52.0	0.42
Local quadratic	5	233,390	53.6	0.44

Notes: Panel A compares rankings computed on the same firm-year observations. Marginal incidence is the derivative of the relevant TWC with respect to one firm's log residual wedge. Finite incidence resets one firm to its benchmark and updates all same-sector CES expenditure shares. The quadratic finite calculation uses the variance at both allocations, not the initial marginal slope times the reset distance. Panel B links each firm's annual finite-incidence rank to its rank one or five years later. Top-decile retention conditions on membership in the initial year's top decile. Rank correlations are first computed separately for each available year pair; the table reports their median.

C.8.1 Numerical verification

The endpoint checks compare the moment shortcuts with the full counterfactual firm distribution. For all 12,708 firms in 2024, the exact and quadratic residual incidence shortcuts each reproduce their corresponding full distribution calculation within 10^{-10} TWC units. The exact nested benchmark updates also agree within 10^{-10}, and independently reconstructed treated targets agree within 10^{-10} in markup units.

Symmetric wedge perturbations also check the analytical exact and quadratic marginal formulas against their own CES share responses in Table D.2. The additive path integration error is reported separately in Appendix E.6. A separate test reconstructs nested

CES welfare directly from primitive technologies and preferences with heterogeneous sector elasticities. It agrees with (A.27) within 2.73×10^{-15}; symmetric perturbations agree with its analytical derivative within 1.62×10^{-10}. The test also checks common wedge neutrality, the one sector reduction, and the Cobb–Douglas limit. Full distribution recalculations for every 2024 firm under all four upper elasticities reproduce the fixed benchmark nested finite effects within 9.36×10^{-15}. A further test verifies the quadratic resource expansion. These checks establish numerical agreement, not the validity of the elasticity calibration, fixed cost identification, or economic closure. Exact and quadratic results need not agree.

D Measurement Robustness

These comparisons vary markup measurement, the accounting reference, demand elasticities, accounting horizons, and expenditure weights. Each paired measurement comparison reports its sample and holds the counterfactual mapping fixed unless stated otherwise.

D.1 Markup measurement and production heterogeneity

The baseline estimator replaces the firm-level COGS share in total measured production costs,

$$\chi_{it} = \frac{X_{it}}{X_{it} + rK_{it}},$$

with its NACE two-digit industry-year median before applying the production-approach markup identity. I report two alternatives. The pooled alternative uses the NACE four-digit median when the cell is supported. To prevent small cells from generating noisy elasticities, a cell must contain at least 20 firms in that year; unsupported cells inherit the closest supported parent estimate, first at NACE three digits and then at NACE two digits. The second alternative follows the firm-specific total-cost share calculation discussed by De Loecker and Eeckhout (2026) and sets $\theta_{it}^{X,\mathrm{CS}} = \chi_{it}$ for each firm-year. The resulting markup is

$$\mu_{it}^{\mathrm{CS}} = \chi_{it}\frac{R_{it}}{X_{it}} = \frac{R_{it}}{X_{it} + rK_{it}}.$$

This construction prevents differences in COGS intensity from entering markups solely through inverse revenue shares. It instead requires constant returns to scale and treats all measured inputs, including capital services, as satisfying static first-order conditions. Overhead is not included in measured production costs. Raval (2023) instead develops a flexible cost-share estimator under additional technology and pooling assumptions. That estimator motivates allowing output elasticities to differ across firms, but it is not the literal entity-level ratio used in this appendix.

I vary the assignment of output elasticities while holding the demand model and markup reset rule fixed. I begin with the same cleaned untrimmed panel, trim each method's markup distribution at its annual 1.5th and 98.5th percentiles, and retain the intersection. I then require the fixed-cost recovery share to be below 0.95 under every method. NACE two-digit demand elasticities, substitution groups, expenditure weights and counterfactual rules are held fixed. Each markup assignment reconstructs the EBIT based benchmark at observed sales before holding it fixed in a reset. Let $\mathcal{M}$ contain the three assignments. Their diagnostic rank envelope is

$$\mathcal{R}_{it} = \left[\min_{m\in\mathcal{M}} \mathrm{rank}_{it}^{(m)}, \max_{m\in\mathcal{M}} \mathrm{rank}_{it}^{(m)}\right]. \tag{D.1}$$

This range reflects sensitivity to the assignment, not a confidence interval or identified set: the models share the underlying accounts and do not exhaust possible technologies.

Table D.1: Incidence under alternative COGS elasticity assignments, 2024

Elasticity assignment	Sales-weighted μ	TWC	Rank correlation	Top-100 overlap (%)
NACE 2 industry-year	1.45	6.41	1.00	100
Supported NACE 4	1.44	6.32	0.98	97
Firm-specific cost share	1.39	4.83	0.94	78

Notes: All rows use the intersection of observations that survive the annual 1.5th and 98.5th percentile trims and satisfy the fixed-cost benchmark restriction under the three accounting models. A NACE four-digit cell is supported when it contains at least 20 firms; otherwise it inherits the closest supported parent elasticity, first at NACE three digits and then at NACE two digits. Welfare substitution groups and demand elasticities remain at NACE two digits. The TWC is exact and reported in log points. Rank correlations are Spearman correlations of exact benchmark adjusted finite effect ranks. Top-100 overlap is measured relative to the NACE two-digit baseline.

Table D.2 separates sensitivity of the marginal derivative from that of the finite reset. In each row, the formula and 12,654 firm universe are fixed; only the elasticity assignment and its associated EBIT based benchmark change. The exact marginal ranking retains 87 of the top 100, with concentration changing from 53.2 to 51.7 percent. The quadratic comparisons retain 89 firms for marginal incidence and 79 for finite incidence. The quadratic finite calculation recomputes CES shares at the full reset, rather than multiplying the initial marginal effect by the reset distance. Symmetric numerical perturbations of each firm's wedge verify the analytical E and Q marginal expressions with the corresponding share response.

Table D.2: Markup measurement sensitivity of marginal and finite incidence, 2024

		Top 100 share (%)			
Incidence	Formula	Industry median	Firm cost share	Rank correlation	Top 100 retained
Marginal	E	53.2	51.7	0.96	87
Marginal	Q	45.3	43.2	0.95	89
Finite	E	71.6	66.9	0.94	78
Finite	Q	70.2	65.5	0.94	79

Notes: E and Q are the exact and quadratic TWC measures. Marginal incidence is the derivative allowing CES shares to adjust; finite incidence is the full reset to the specification's fixed accounting benchmark. Both markup assignments use the same 12,654 firms and the same baseline DKM sector elasticities and fixed fallback. For each incidence object and formula, concentration divides that specification's top 100 positive effects by its sum of positive effects, not by the aggregate TWC. Correlations are Spearman correlations between the industry median and firm cost share assignments; retained counts firms shared by their top 100 sets. Selection ties are resolved by company ID.

The 2024 comparison contains 12,654 firms. Seventy-eight firms are in the top 100 under all three accounting models, and 125 enter the top 100 under at least one. The sign of the finite effect is stable for 12,070 firms. The median best-to-worst rank span is 134 positions; its ninetieth percentile is 770. These rank spans should be interpreted relative to the 12,654 comparison firms rather than as percentage changes in incidence.

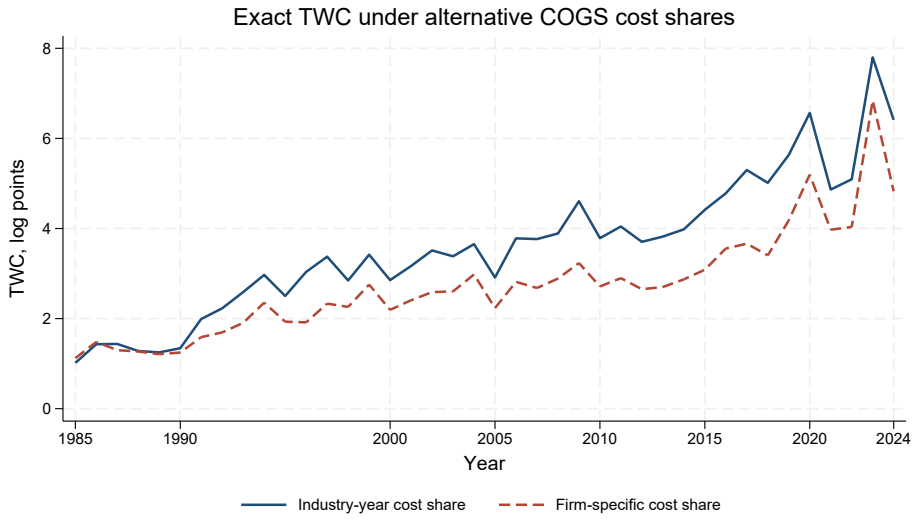


Figure D.1: TWC measures under alternative COGS cost-share estimators

Notes: The solid line assigns all firms in an industry-year the median COGS share in production costs. The dashed line uses each firm's own COGS share, so that $\mu_{it}^{\mathrm{CS}} = R_{it}/(X_{it} + rK_{it})$. Both series use the intersection sample satisfying method-specific trimming and fixed-cost benchmark restrictions. Sales weights, NACE two-digit substitution groups, sector demand elasticities, and the finite TWC counterfactual are held fixed across estimators.

D.2 Alternative fixed cost measurements

D.2.1 Smoothing the firm fixed-cost reference

The annual EBIT measure can contain transitory accounting variation. To test whether this variation drives the benchmark, define the trailing recovery share

$$\bar{f}_{it}^{(5)} = \frac{1}{n_{it}} \sum_{s \in \mathcal{T}_{it}} f_{is}, \qquad \mathcal{T}_{it} = \{s \in \{t-4, \ldots, t\} : f_{is} \text{ observed}\}, \qquad n_{it} = |\mathcal{T}_{it}|, \quad \text{(D.2)}$$

where $f_{is} = F_{is}^{+}/R_{is}$. I require $n_{it} \geq 3$ and set $\mu_{it}^{B,(5)} = (1 - \bar{f}_{it}^{(5)})^{-1}$. The construction uses the current and four preceding years, never future information. It averages the dimensionless annual recovery shares rather than nominal fixed-cost levels, so a common annual price deflator does not affect it.

For every year, I retain firms for which the smoothed reference is defined and recompute both the current-year and smoothed calculations on that same sample. The matched comparisons follow below.

Matched results. The trailing reference uses at least three observations from the current and four preceding years. The current and smoothed references are compared on the same eligible sample. In 2024, 11,380 firms remain and represent 95.8 percent of sales in the full analysis sample. The two sales-weighted mean benchmarks are almost identical, 1.307 and 1.301. The exact TWC falls modestly from 6.11 to 5.75 log points, and the top-100 concentration share falls from 72.1 to 66.1 percent. The finite-incidence rank correlation is 0.74 and 73 firms appear in both top 100 sets.

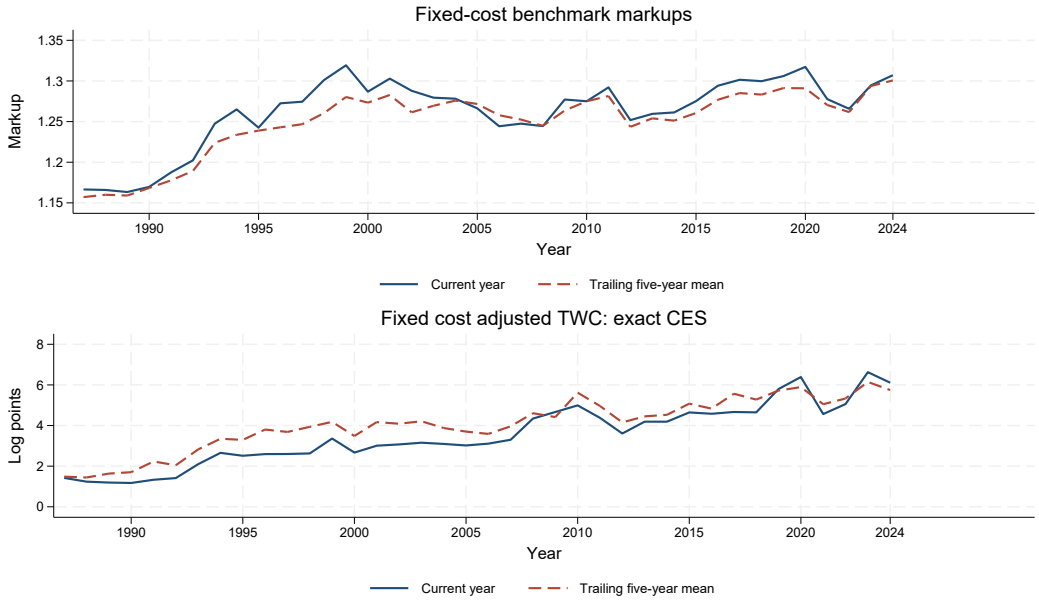


Figure D.2: Current and smoothed firm fixed-cost references. Panel A reports the sales-weighted mean benchmark markup. Panel B reports the aggregate exact CES TWC. The current-year and trailing five-year calculations in each year use the same firms, require at least three observed annual recovery shares in the current and four preceding years, and recompute all expenditure weights on that shared sample.

Table D.3: Sensitivity to smoothing the firm fixed-cost reference, 2024

Reference	Mean benchmark	TWC	Top 100 share	Rank correlation	Top 100 overlap
Current-year recovery share	1.307	6.11	72.1	1.00	100
Trailing five-year mean	1.301	5.75	66.1	0.74	73

Notes: Both rows use the 11,380 smoothing-eligible firms observed in 2024. They account for 95.8 percent of analysis-sample sales. Rank correlation and overlap compare finite TWC incidence with the current-year reference. Top-100 concentration is the share of summed positive finite incidence assigned to the first 100 firms under each row's own ranking. The TWC is exact and is reported in log points; mean benchmarks are sales weighted. Benchmark vectors are fixed during each full reset.

D.2.2 Allowing for a normal return on capital

Recurring EBIT deducts recorded depreciation but not the required return to capital. The baseline recovery reference therefore does not impose zero economic profit. Although a capital charge enters the cost share used to calibrate the markup, the accounting identity in (3.4) still implies that total inferred costs are revenue less recurring EBIT before truncation. Including capital in the markup calibration does not, by itself, add a normal return to those costs.

This exercise augments the recovery requirement by

$$N_{it}(\kappa) = \kappa K_{it}, \qquad F_{it}^{+}(\kappa) = \max\{F_{it} + N_{it}(\kappa), 0\}, \qquad \mu_{it}^{B}(\kappa) = \frac{1}{1 - F_{it}^{+}(\kappa)/R_{it}}, \quad \text{(D.3)}$$

where K_{it} is the current book value of tangible and intangible fixed assets and κ is an annual required return after depreciation. Here F_{it} is the untruncated baseline residual. Equivalently, the calculation replaces recurring EBIT by $\Pi_{it}^{\text{op}} - N_{it}$ before applying the zero floor. Where the floor does not bind, the reference satisfies

$$\left(1 - \frac{1}{\mu_{it}^{B}(\kappa)}\right) R_{it} - F_{it} = N_{it}(\kappa). \quad \text{(D.4)}$$

It leaves the normal return, rather than zero operating profit, at observed sales. If the floor binds, the imputed operating surplus is at least this allowance. This is a change in the recovery reference, not an increase in physical fixed inputs or an additional resource loss.

I report $\kappa \in \{0, 0.03, 0.05, 0.10\}$ as illustrative sensitivity values, not estimates of firms' required returns. A normal return and depreciation are distinct components of the user cost of capital (OECD, 2009). Accordingly, κ is not the gross 10 percent capital charge used in the markup calibration, nor a discount rate for pooling accounts over time. This exercise does not measure full economic profit: book capital omits unrecorded intangible investment, and recorded depreciation need not equal economic depreciation. It also does not model risk, innovation, entry, or capital accumulation.

The annual markup trimming, measured markups, and DKM demand elasticities remain unchanged. At each allowance, I retain the existing condition $F_{it}^{+}(\kappa)/R_{it} < 0.95$. Exact CES residual incidence is then recomputed. During each firm reset, own and rival sales shares adjust within the sector; capital stocks, sector expenditure, rivals' actual markups, and the entire benchmark vector remain fixed. The benchmark vector changes between allowance scenarios, not in response to sales within a reset.

Table D.4: Normal return allowances and exact residual incidence, 2024

Annual allowance	Firms	TWC	Top 10 share	Top 100 share	Rank correlation	Top 100 overlap
A. Admissible sample at each allowance						
0%	12,708	10.03	64.2	82.7	1.000	100
3%	12,657	9.80	64.3	82.0	0.896	90
5%	12,591	9.63	65.6	82.2	0.875	87
10%	12,436	9.90	65.0	81.9	0.764	81
B. Identical firms across all allowances						
0%	12,436	9.42	67.8	83.4	1.000	100
3%	12,436	9.26	68.2	83.2	0.949	95
5%	12,436	9.24	68.3	83.0	0.908	91
10%	12,436	9.90	65.0	81.9	0.764	81

Notes: Log points equal 100 times the exact fixed cost adjusted TWC in (2.13). Concentration shares are percentages of summed positive finite incidence under each row's own ranking. Panel A uses all baseline firms satisfying the recovery share restriction at the indicated allowance. Its correlations and overlaps compare each row with the zero allowance reference recomputed on that row's same firms. Panel B holds the firms fixed across all four allowances within the year; correlations and overlaps compare with its first row. All expenditure weights are recomputed on the indicated sample. Rank correlations are Spearman correlations. Separate firm resets are not additive components of the TWC.

Panel A of Table D.4 retains every admissible firm at each allowance. To separate the reference change from sample composition, Panel B uses the 12,436 firms that pass the restriction at every allowance in 2024. This excludes 272 firms, representing 0.89 percent of baseline sales. Their exclusion alone moves the zero allowance TWC from 10.03 to 9.42 log points. On this identical sample, the 5 percent allowance changes the TWC to 9.24 and retains 91 of the zero allowance top 100. At 10 percent, the corresponding figures are 9.90 and 81 firms.

The TWC need not fall monotonically with the allowance. Different capital intensities shift the relative markup distribution unevenly. The unrestricted incidence calculation also includes firms whose benchmark exceeds their observed markup: their full reset raises rather than lowers the markup. On the common sample, these upward resets account for 9.9 percent of summed positive incidence without the allowance and 15.6 percent at 10 percent. This is why the high allowance is reported as a sensitivity scenario rather than a preferred correction.

Table D.5: Leading firms under normal return allowances, 2024

		Annual normal return allowance			
Rank	Firm	0%	3%	5%	10%
1	TELIX INNOVATIONS	4.933	4.987	5.043	5.133
2	GlaxoSmithKline Biologicals	1.358	1.267	1.221	1.036
3	OMEGA PHARMA INNOVATION & DEVELOPMENT	0.418	0.432	0.442	0.471
4	J.C. GENERAL SERVICES	0.207	0.218	0.232	0.239
5	UCB PHARMA	0.207	0.198	0.192	0.179

Notes: Entries are exact finite residual incidence in aggregate log points. Each column uses its own admissible sample, as in Panel A of Table D.4. Firm identities and their order are unchanged across allowances. Changes in magnitudes include both the reference change and the sample adjustment; Panel B of the preceding table isolates the reference change on identical firms.

The leading five firms remain the same and in the same order (Table D.5). Using the sample admissible at every allowance within each year, the 5 percent TWC rises from 0.96 log points in 1985 to 9.24 in 2024. This comparison holds firms fixed across allowance scenarios within a year, not across calendar years. Over 2020–2024, conditional annual top 100 retention is 64.7 percent without the allowance and 63.1 percent at 5 percent. Rankings by average incidence over those five years share 92 of their top 100 firms, requiring at least three annual observations. Thus the allowance preserves high concentration, persistence, and the leading identities, while affecting some rankings farther down the distribution.

D.2.3 External fixed-input calibration

The baseline fixed-cost requirement in (3.4) is jointly determined by the estimated markup and EBIT. As a distinct robustness exercise, I transport the pooled fixed-input shares estimated by Abraham et al. (2024) to the expenditures observed in this paper. Let $C_{it}^K = rK_{it}^T$ denote tangible-capital services, $C_{it}^L = \mathrm{LC}_{it}$ the labor bill, and $C_{it}^M = M_{it}$ material expenditure. For adjustment horizon h, define

$$F_{it}^{\mathrm{EXT},h} = s_K^h C_{it}^K + s_L^h C_{it}^L + s_M^h C_{it}^M, \qquad f_{it}^{\mathrm{EXT},h} = \frac{F_{it}^{\mathrm{EXT},h}}{R_{it}}, \qquad \mu_{it}^{B,\mathrm{EXT},h} = \frac{1}{1 - f_{it}^{\mathrm{EXT},h}}. \tag{D.5}$$

The transported coefficients are

Horizon	s_K^h	s_L^h	s_M^h
One year	0.625	0.173	0.232
Five years	0.478	0.155	0.214
Ten years	0.449	0.107	0.177

The longer-horizon estimates classify less of each input as fixed, consistent with quasi-fixed inputs adjusting over time. I keep each coefficient vector constant across calendar years. Fixed-cost levels nevertheless vary at the firm-year level because input expenditures vary, and both $f_{it}^{\mathrm{EXT},h}$ and $\mu_{it}^{B,\mathrm{EXT},h}$ also respond to sales. This is an external calibration, not a reestimation of firm-level fixity. The source estimator delivers common or subgroup coefficients rather than a fixed-input share for every firm-year. The source paper also reports calendar-year estimates, but its estimation sample ends in 2014. I do not extrapolate those estimates through 2024.

The coefficients are external, but their application to each firm's accounts is still an identifying assumption about input use. The resulting reference is not direct measurement of that firm's fixed cost, and agreement with the baseline mean benchmark cannot validate the allocation of fixed costs across firms.

The implementation uses the paper's $r = 0.10$ and applies s_M^h to code-60 materials. Abraham et al. (2024) use a broader measure of intermediate expenditure and a constructed user cost of capital. I apply their published fixed input shares to the existing sample and cost definitions. This tests sensitivity to the fixed cost rule without replicating their estimator. I require all four references to satisfy $0 \leq f_{it} < 0.95$ and recompute all weights on the resulting intersection sample.

The empirical comparisons hold each benchmark fixed at its observed-sales value during the finite reset. This keeps the robustness exercise one dimensional: it changes the measurement of F_{it} without simultaneously changing the counterfactual closure. If benchmark feedback is added, the same fixed point as in Section A.9 applies after replacing F_i^+ by $F_i^{\mathrm{EXT},h}$. The fixed-cost level remains constant in euros; only counterfactual revenue, the recovery share, and the treated firm's benchmark markup change.

The benchmark and incidence comparisons follow below.

Matched results. Using the transported coefficients and intersection sample defined above, this comparison changes the reference at observed sales and holds it fixed during each reset.

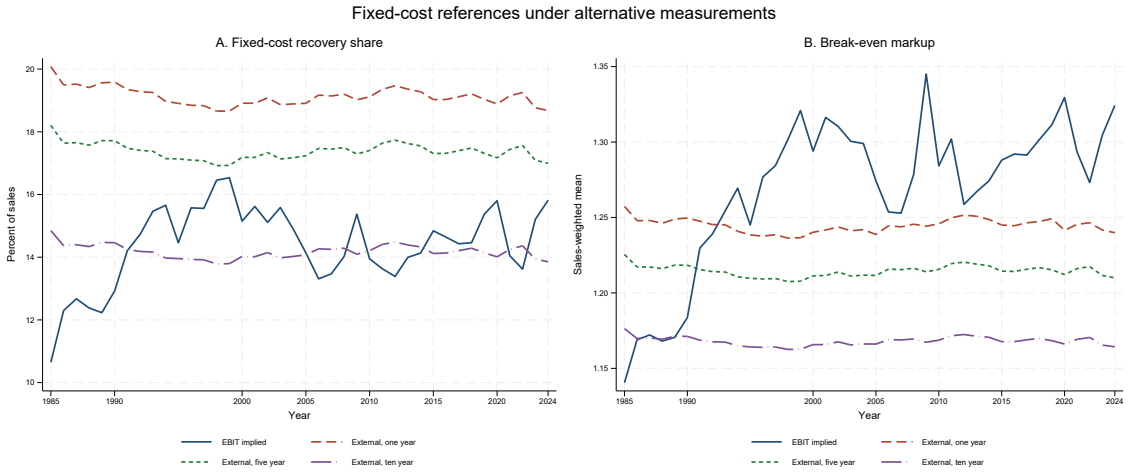


Figure D.3: Fixed-cost recovery shares and break-even markups under alternative references. Panel A reports aggregate fixed-cost requirements divided by aggregate sales. Panel B reports sales-weighted mean break-even markups. The EBIT-implied series follows (3.4). The external series apply the one-, five-, and ten-year fixed-input coefficients in (D.5) to each firm's annual input expenditures. Every line uses the intersection sample on which all four references are defined.

Table D.6: Fixed-cost reference sensitivity, 2024

Panel A: Fixed-cost requirements and benchmark markups

Reference	Fixed costs (% of sales)	Mean benchmark	Median benchmark	Recovery-share rank correlation	$\mu_i < \mu_i^B$ (% of firms)
EBIT implied	15.82	1.324	1.209	1.00	24.3
External, one year	18.68	1.240	1.214	-0.71	43.3
External, five year	17.00	1.210	1.190	-0.73	39.9
External, ten year	13.86	1.164	1.147	-0.70	33.6

Panel B: Consequences for residual incidence

Reference	TWC (log points)	Top-100 positive incidence (%)	Incidence rank correlation	Top-100 overlap
EBIT implied	9.59	84.7	1.00	100
External, one year	30.56	70.1	0.28	37
External, five year	29.94	71.2	0.28	38
External, ten year	28.67	73.3	0.25	38

Notes: All rows use the same 12,423 legal entities. Means are sales weighted; medians and the fraction below the benchmark are unweighted. Rank correlations are Spearman correlations with the EBIT-implied reference. Panel B uses the exact TWC and exact finite resets, with benchmark vectors fixed. The top-100 concentration denominator is summed positive one-firm finite incidence under the reference in that row. Overlap is the number of firms also in the EBIT-implied top 100. The markup measure, demand curvature, NACE two-digit substitution groups, and finite-reset mapping are otherwise held fixed.

The similarity of two aggregate benchmark means is not evidence that the firm-level references agree. In 2024, the EBIT-implied and one-year external benchmarks have sales-weighted means of 1.32 and 1.24, while their recovery shares have rank correlation -0.71. The local variance identity clarifies why the external TWC can exceed the raw TWC. For $z_i = \log \mu_i$ and $b_i = \log \mu_i^B$, within each sector

$$\mathrm{Var}_{\omega_g}(z_i - b_i) = \mathrm{Var}_{\omega_g}(z_i) + \mathrm{Var}_{\omega_g}(b_i) - 2\mathrm{Cov}_{\omega_g}(z_i, b_i),$$

where all moments use the sector's observed sales shares $\omega_{i|g}$. An externally calibrated benchmark that is negatively associated with the observed markup raises the quadratic TWC through the covariance term. The identity gives no ordering of the exact CES TWC measures; those comparisons require evaluating the exact formula on the matched sample. The exercise therefore does not independently validate the baseline TWC level or individual ranking. Its narrower result is that positive incidence remains highly concentrated even under a very different fixed-cost assignment.

D.2.4 Fixed costs and sample composition

The price and composition adjustments follow Appendix B.4. The recovery share rises from 10.66 percent in 1985 to 15.82 percent in 2024 in the analysis sample. Holding sector composition fixed gives an increase of 5.19 percentage points, while the annual-continuers series increases by 4.04 percentage points. In the strict balanced panel, the share increases more modestly, from 9.69 to 13.05 percent. Thus the increase is present in the full sample and under all three composition adjustments, although its magnitude is smaller among the same long-lived firms observed throughout the 40-year period. Over the years supported by the output deflator, real fixed costs per firm rise from 7.28 million 2020 euros in 1995 to 9.36 million in 2024 in the analysis sample and from 17.91 to 31.53 million among the balanced-panel firms. Fixed costs per firm measure expenditure levels. The recovery share measures those costs relative to revenue.

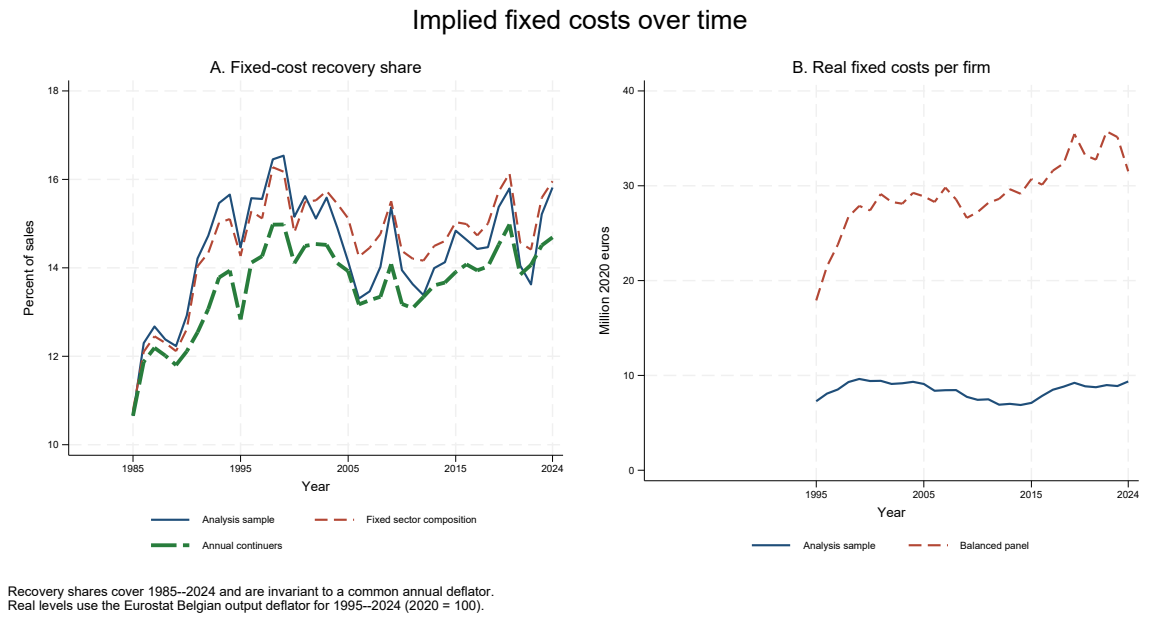


Figure D.4: Implied fixed costs, prices, and sample composition

Notes: Panel A reports implied positive fixed costs F_{it}^{+} as a percentage of sales. The analysis-sample series is $100 \sum_i F_{it}^{+} / \sum_i R_{it}$. The fixed-sector-composition series uses time-average annual sales shares for the 72 NACE two-digit sectors observed in all 40 years; these sectors account for at least 97.8 percent of annual analysis-sample sales. The annual-continuers series is anchored at the 1985 analysis-sample level and chains adjacent-year changes among firms observed in both years, using the average of their sales shares in the two years as fixed pairwise weights. Panel B divides F_{it}^{+} by the Eurostat Belgian total-economy gross-output deflator (2020 = 100) before calculating the mean per firm; this deflator is available from 1995 onward. The balanced panel contains the 728 firms observed in every year from 1985 through 2024. Their sales coverage varies over time, so this balanced panel is a composition check, not a representative sample of all firms. Because the numerator and denominator in Panel A are expressed in the same year's euros, a common annual deflator cancels from the recovery share.

D.2.5 Rankings with and without fixed cost adjustment

Table D.7 distinguishes concentration of incidence from agreement about which firms have the largest effects. Without adjustment, the finite effect resets a firm's markup to one and evaluates the raw CES loss. With adjustment, it resets the markup to its fixed cost benchmark and evaluates the TWC. The same firms, observed sales, estimated markups, and demand elasticity enter both calculations; the reference and reset differ.

The lists share three of the top five firms, six of the top ten, and 36 of the top 100. YARA BELGIUM SA illustrates the role of cost recovery: its observed markup is 6.61 and its benchmark is 5.76. Adjustment reduces its finite effect from 0.5530 to 0.0005 log points and moves its rank from ninth to 1,091st. Adjustment need not lower every firm's

effect. OMEGA PHARMA INNOVATION & DEVELOPMENT has a benchmark of one under both calculations, but its effect changes from 0.1185 to 0.4177 log points. Other firms' benchmarks change the sector's reference distribution even when the treated firm's own reset is unchanged. These are comparisons of different counterfactual objects, not two estimates of an identical effect.

Table D.7: Firm rankings with and without fixed cost adjustment, 2024

	Without adjustment		With adjustment	
Firm	Rank	Effect	Rank	Effect
A. Top ten with benchmark adjustment				
TELIX INNOVATIONS	1	5.4535	1	4.9334
GlaxoSmithKline Biologicals	2	2.9317	2	1.3578
OMEGA PHARMA INNOVATION & DEVELOPMENT	35	0.1185	3	0.4177
J.C. GENERAL SERVICES	51	0.0883	4	0.2073
UCB PHARMA	4	0.8354	5	0.2067
BRUSSELS AIRPORT COMPANY	17	0.2747	6	0.1649
ARVAL BELGIUM	7	0.6046	7	0.1385
ELIA ASSET	10	0.3996	8	0.1177
Lorelay Transport Chartering	62	0.0673	9	0.1051
argenx	8	0.5918	10	0.1048
B. Additional firms in the top ten without adjustment				
DHL GLOBAL FORWARDING (BELGIUM)	3	0.8854	203	0.0039
HENRI ESSERS EN ZONEN INTERNATIONAAL TRANSPORT	5	0.7265	1,045	0.0005
ANTWERP TERMINAL SERVICES	6	0.6983	12,362	-0.0001
YARA BELGIUM SA	9	0.5530	1,091	0.0005

Overlap: top 5: 3 of 5; top 10: 6 of 10; top 100: 36 of 100.

Notes: The table covers the union of the two top ten lists, with each firm shown once. Ranks order all 12,708 firms by descending signed exact finite incidence. Effects are in log points, or 100 times the reduction in the relevant log welfare TWC. Without adjustment, all benchmark markups equal one; with adjustment, the references are the firm cost recovery benchmarks. Each reset reallocates own and rival sales shares within the sector, holding rival markups, the benchmark vector, marginal costs, and sector expenditure fixed, using the baseline DKM sector elasticities and fixed fallback. Negative effects raise the relevant TWC. Overlap counts firms appearing in both top K lists; there are no ties in either top 100.

D.3 Alternative elasticities and samples

D.3.1 Calibration comparisons

The baseline transports the supplier estimates by sector of Dhyne et al. (2022), with the mapping and fixed fallback in Appendix B.3. The within-source comparisons change either sector heterogeneity or the estimated elasticity levels. The common DKM calibration sets every division's elasticity to σ^{com} in (B.1); it removes sector heterogeneity without changing the mean weighted by 2024 sample sales. The lower and upper calibrations shift each of the 29 source group estimates down or up by one reported standard error and apply that value to every mapped division. Uncovered divisions retain the unchanged fallback σ^{com}. All resulting elasticities exceed one. These coordinated shifts are sensitivity exercises, not confidence intervals or joint statistical tests. They do not use a covariance matrix for the source estimates.

The remaining comparisons change the external demand evidence. The common HRW calibration uses the median between-firm elasticity of 3.9 estimated by Hottman et al. (2016) for United States consumer products. The mapped GTAP vector draws on the GTAP 10 database (Aguiar et al., 2019). Its Armington substitution margin concerns geographic sources, not Belgian suppliers or legal entities. These are appendix robustness exercises, not alternative estimates of an identical demand parameter. All rows hold observed firms, markups, benchmarks, and sales weights fixed; only demand curvature changes.

Table D.8 crosses these calibrations with the level at which fixed costs are pooled. A benchmark pooled across the economy or within a sector is constant within each substitution group and therefore leaves the exact conditional TWC equal to the raw TWC. Only firm-specific benchmarks change relative residual wedges within sectors. Under the DKM baseline, the TWC is 25.51 log points under either pooled reference and 10.03 log points under the firm reference.

Table D.8: Elasticity calibration and benchmark aggregation, 2024

	Fixed cost benchmark		
Elasticity calibration	Economy	Sector	Firm
DKM sector (baseline)	25.51	25.51	10.03
DKM common ($\sigma = 3.34$)	25.26	25.26	6.97
DKM sector (-1 SE)	20.20	20.20	7.73
DKM sector ($+1$ SE)	31.22	31.22	12.00
HRW common ($\sigma = 3.9$)	32.93	32.93	9.20
GTAP sector	42.39	42.39	13.27
GTAP common ($\sigma = 4.64$)	45.31	45.31	12.81

Notes: Entries are exact conditional CES TWC levels in log points on the same 12,708 firms and 84 divisions in 2024. Economy and sector benchmarks apply $(1 - \sum_i F_i^+ / \sum_i R_i)^{-1}$ at the indicated aggregation level; the firm column uses $(1 - F_i^+/R_i)^{-1}$. The first two columns also equal the raw TWC because a common within-sector benchmark does not change relative wedges. This invariance concerns the conditional within-sector TWC, not welfare with endogenous expenditure across sectors. The common DKM value, $\sigma^{\text{com}} \simeq 3.34$, is the fixed mean weighted by covered sample sales in 2024. The common GTAP value is the mean of its mapped vector weighted by 2024 sample sales, approximately 4.64. Calculations retain unrounded values. Both DKM standard error shifts retain the baseline fallback in uncovered divisions. All rows use the same observed sales, markups, and inferred fixed costs.

Table D.9: DKM demand curvature and alternative elasticity calibrations, 2024

Curvature calibration	TWC (log points)	Top 10 share (%)	Top 100 share (%)	Top-100 overlap	Rank correlation
DKM sector (baseline)	10.03	64.2	82.7	100	1.00
DKM common ($\sigma = 3.34$)	6.97	35.6	68.5	89	1.00
DKM sector (-1 SE)	7.73	62.3	80.3	93	1.00
DKM sector ($+1$ SE)	12.00	63.1	83.6	97	1.00
HRW common ($\sigma = 3.9$)	9.20	37.8	72.8	81	1.00
GTAP sector	13.27	53.6	79.9	75	0.99

Notes: The reference for overlap and Spearman rank correlations is the sector-specific DKM baseline, including the fixed fallback for uncovered divisions. The common DKM row uses $\sigma^{\text{com}} \simeq 3.34$ in every division, retaining its unrounded value in calculations. Both DKM standard error shifts change mapped source estimates only, leaving the fallback fixed. HRW and GTAP rows are external robustness calibrations. Every row evaluates the exact CES TWC and full one-firm resets with own and rival within-sector sales shares updated. Top shares divide the leading positive effects by summed positive finite incidence in that row, not by the aggregate TWC. Log points equal 100 times the dimensionless TWC.

Table D.9 distinguishes sector heterogeneity, source uncertainty, and alternative external demand calibrations. The common DKM row is a comparator, not the baseline:

it lowers the TWC from 10.03 to 6.97 log points and the top-100 share from 82.7 to 68.5 percent, while retaining 89 of the baseline top 100 firms. Subtracting one source standard error gives a TWC of 7.73 log points, a top-100 share of 80.3 percent, and 93 shared firms. Adding one source standard error gives 12.00 log points, 83.6 percent, and 97 shared firms. HRW and mapped GTAP give TWC values of 9.20 and 13.27 log points and retain 81 and 75 of the baseline top 100, respectively.

D.3.2 Redding and Weinstein elasticities

For comparison with the DKM baseline, I use the estimates of Redding and Weinstein (2024). RW estimate substitution across firm divisions within goods industries from United States imports over 1997–2011. This is the relevant nest for the present comparison, rather than substitution across products within a firm or across sectors. Their aggregate sector elasticity of 1.364 is therefore not a common within sector parameter. Using RW here requires transferring estimates across countries, buyers, and industry definitions; it does not directly estimate demand for Belgian firms.

Industry mapping and uncovered sectors. An author supplied correspondence identifies all 81 industry estimates by their 2007 NAICS four digit codes. I map these codes through the official Census NAICS–ISIC concordance and the United Nations ISIC–NACE concordance.[5] The nonstandard Census waste and scrap category is excluded. For the goods mapping, I retain links to NACE divisions 01–32 other than mining support services (09) and printing (18). Each source estimate receives weight equal to the inverse of its number of distinct official NACE destinations, normalized within the receiving division. These are mapping weights, not estimated expenditure shares. Incidental concordance links to services do not establish that goods elasticities describe demand for an entire service division.

The resulting vector covers 25 of the 84 divisions observed in 2024, representing 31.8 percent of sample sales. Uncovered divisions receive $\sigma_{\mathrm{RW}}^{\mathrm{com}} = 3.264$, the mean of the mapped division estimates weighted by their 2024 Belgian sample sales. The same value is assigned to every division in the RW common comparison. Both vectors are fixed over 1985–2024. Thus 68.2 percent of sales receive a fallback, not a sector estimate from RW. By comparison, DKM covers 71 divisions and 95.6 percent of sales. The common values summarize each source on its own covered support; they are not structural aggregate elasticities, nor do the two means use identical sectors.

[5] The concordances are the Census Bureau's 2007 NAICS to ISIC Revision 4 technical correspondence and the United Nations ISIC Revision 4 to NACE Revision 2 correspondence.

Aggregate costs and finite incidence. Table D.10 uses the same 12,708 firms, measured markups, firm benchmarks, and initial expenditure weights in every row. Only demand curvature changes. Each finite reset updates own and rival sales shares within the sector; rival markups, all benchmarks, and sector expenditure remain fixed. The exact TWC falls from 10.03 under DKM to 6.03 log points under mapped RW. The top 10 share falls from 64.2 to 28.3 percent, and the top 100 share from 82.7 to 64.7 percent. Rankings nevertheless share 4 of the top 5, 8 of the top 10, and 89 of the top 100, with a full sample Spearman correlation of 0.996. Within RW, the common and sector calibrations share 99 of the top 100. Large rank overlap therefore coexists with economically important differences in magnitudes and concentration.

Table D.10: DKM and RW elasticity calibrations on the same firms, 2024

Calibration	Common value	TWC	Top 10 share	Top 100 share	Top 100 overlap
DKM common	3.338	6.97	35.6	68.5	89
DKM sector (baseline)	–	10.03	64.2	82.7	100
RW common	3.264	6.71	35.1	68.0	90
RW mapped goods	–	6.03	28.3	64.7	89

Notes: The TWC uses the exact CES formula and firm fixed cost benchmarks, in log points. Concentration shares are percentages of summed positive finite incidence, not shares of the aggregate TWC. Overlap counts common firms with the DKM sector top 100. The sector rows use the corresponding common value in uncovered divisions. All calculations retain unrounded elasticities. DKM denotes Dhyne et al. (2022); RW denotes Redding and Weinstein (2024).

Pharmaceutical manufacturing accounts for most of the level difference. Its mapped elasticity falls from 7.32 to 2.36, and its contribution to the aggregate TWC from 4.94 to 0.67 log points. Telix Innovations' finite incidence falls from 4.933 to 0.238 log points; GSK's falls from 1.358 to 0.342. Telix's implied sales multiplier falls from 123.8 to 17.2, although the latter still entails a substantial extrapolation under constant marginal cost. These changes do not arise from remeasuring either firm's markup or fixed costs.

The upward trend and substantial persistence remain. The RW TWC rises from 0.90 in 1985 to 6.03 in 2024, compared with 1.04 to 10.03 under DKM. Across the four annual transitions from 2020 to 2024, 237 of 351 top 100 firms observed in the following year remain in its top 100 (67.5 percent), compared with 229 of 353 (64.9 percent) under DKM. These counts pool firm transitions, not distinct firms. Rankings by average incidence among firms observed in all five years share 85 of the top 100. This is a separate elasticity comparison, not a redefinition of the principal specification core.

Mapping and source uncertainty. Table D.11 reports five qualifications to the goods mapping. Retaining only source industries whose entire official correspondence falls within one NACE division covers 16 divisions and 18.2 percent of sales; their estimates receive equal weights within each division. A second variant weights goods links equally. Both variants recompute their own sales weighted common fallback. The next two rows shift each available source estimate by minus or plus one reported bootstrap standard error, retain the mapping weights, and leave the fallback at 3.264. These coordinated perturbations are not confidence intervals for the aggregate results. Finally, replacing only covered goods elasticities while retaining DKM everywhere else isolates the effect of that replacement from changing uncovered sectors.

Table D.11: Sensitivity of the RW calibration to mapping and source estimates

RW calibration	TWC	Top 10 share	Top 100 share	Top 100 overlap
Mapped goods	6.03	28.3	64.7	89
Only unambiguous industry links	6.78	35.4	68.5	89
Equal weights on goods links	5.87	28.6	64.4	90
Mapped goods: minus one SE	5.87	27.3	64.3	89
Mapped goods: plus one SE	6.22	29.6	65.2	90
Mapped goods: DKM elsewhere	5.65	32.6	67.2	99

Notes: Same 2024 firms and counterfactual as Table D.10. TWC levels are log points; concentration shares are percentages of summed positive finite incidence. All overlaps are relative to the DKM sector baseline. SE denotes the reported bootstrap standard error of an individual RW firm substitution estimate. The final row retains each division's DKM assignment wherever the goods mapping provides no RW estimate.

D.3.3 Raw dispersion after excluding markups below one

Figure D.5 retains the baseline DKM sector elasticities and fixed fallback and recomputes the raw TWC after excluding markups below one. This diagnostic complements the fixed-cost TWC in Figure 2.

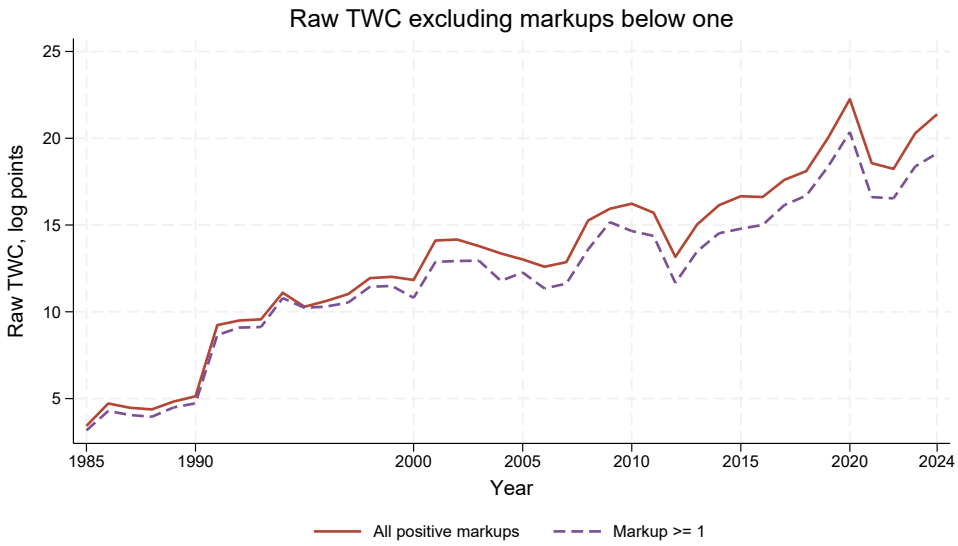


Figure D.5: Quadratic raw markup dispersion after excluding markups below one

Notes: Both series evaluate the quadratic TWC using sales weights, the baseline DKM sector elasticities and fixed fallback, and raw log markups. They are not the exact raw series in the main text. The solid line includes all positive markups in the cleaned, annually trimmed markup sample with assigned demand elasticities, before the EBIT availability and fixed cost benchmark restrictions. The dashed line excludes firm-years with $\mu_{it} < 1$ and renormalizes firm and sector sales weights within each year.

D.4 Pooling accounts over time

A high annual profit may follow years of expenditure incurred before revenue is realized. To examine the sensitivity of incidence to that accounting timing, I pool the underlying flows before constructing markups and cost recovery benchmarks. This changes both the measured markup and its reference, unlike the benchmark smoothing exercise in Appendix D.2.1. It also differs from the averages of annual incidence used to measure persistence. The resulting pooled cross section is a measurement diagnostic, not the allocation of an intertemporal economy.

Windows and selection. The starting universe is the maintained 2024 sample. The windows are fiscal 2020–2024 and 2015–2024. Each firm must have all five or ten twelve month accounts, observed nonnegative revenue, recurring EBIT, nonnegative materials and payroll with a positive combined expenditure, the existing sector and year input elasticity, and a stable observed two digit sector equal to its 2024 sector. Missing observations are not zeros and are not imputed. Known zero revenue in a historical year is permitted, but pooled revenue must be positive. I exclude histories with an unexplained

gap or overlap exceeding 14 days between the anniversary of one closing date and the next closing date. Small variations consistent with 52 or 53 week accounts are retained. Deflation and discounting follow fiscal year labels, not exact closing dates; some fiscal 2024 accounts close in 2025.

Earlier observations that failed the annual capital or input share filters, or annual markup trimming, can reenter when the required inputs are disclosed. This avoids discarding early loss years merely because their annual ratios are unusual. The existing sector and year input elasticity is not reestimated on this selected sample, and no additional trimming of pooled markups is imposed. Consequently, a pooled markup can exceed the annual trimming limits. The five year sample contains 9,864 firms, representing 89.2 percent of baseline 2024 sales; the ten year sample contains 7,651 firms and 78.2 percent of sales. These are different cohorts. Each annual reference is recomputed on exactly the entities retained in its pooled comparison, including both sector and within sector weights.

Construction. Let D_t be the Belgian total economy output deflator with 2020 equal to 100, $h \in \{5, 10\}$ the horizon, $t_0(h) = 2025 - h$, and d a real discount rate. Define

$$a_{th}(d) = \frac{100}{D_t}(1+d)^{-(t-t_0(h))}, \qquad \mathrm{VC}_{it} = \frac{X_{it}}{\theta^X_{gt}}, \tag{D.6}$$

$$\widetilde{Z}_i^{h,d} = \sum_{t=t_0(h)}^{2024} a_{th}(d) Z_{it}, \qquad Z \in \{R, \mathrm{VC}, \Pi^{\mathrm{op}}\}. \tag{D.7}$$

Here X_{it} is the maintained materials plus payroll bundle and $g = g(i)$ is the firm's sector, held constant over the pooling window. The same weights apply to all three flows. Define the signed pooled residual as $\widetilde{F}_i^{h,d} = \widetilde{R}_i^{h,d} - \widetilde{\mathrm{VC}}_i^{h,d} - \widetilde{\Pi}_i^{\mathrm{op},h,d}$. The pooled objects are

$$\widetilde{\mu}_i^{h,d} = \frac{\widetilde{R}_i^{h,d}}{\widetilde{\mathrm{VC}}_i^{h,d}}, \qquad \widetilde{F}_i^{h,d,+} = \max\{\widetilde{F}_i^{h,d}, 0\}, \tag{D.8}$$

$$\widetilde{\mu}_i^{B,h,d} = \left(1 - \frac{\widetilde{F}_i^{h,d,+}}{\widetilde{R}_i^{h,d}}\right)^{-1}, \qquad \widetilde{\rho}_i^{h,d} = \frac{\widetilde{\mu}_i^{h,d}}{\widetilde{\mu}_i^{B,h,d}}. \tag{D.9}$$

The nonnegative fixed cost restriction is applied after pooling, so negative annual accounting residuals can offset positive ones. I retain the existing domain restriction $\widetilde{F}_i^{h,d,+}/\widetilde{R}_i^{h,d} < 0.95$; failures are excluded rather than assigned a capped benchmark. Dividing all pooled sales by $\sum_t (1+d)^{-(t-t_0(h))}$ gives annual equivalent sales. This denominator is common within a balanced window and cancels from every sales share. Firm histories of different lengths are never compared using unadjusted lifetime totals.

The exact CES TWC and separate finite resets are evaluated using the pooled ra-

tios and sales weights, with the maintained DKM sector elasticities and the unchanged missing sector fallback. Within each reset, own and rival sales shares adjust; rival actual markups, all benchmark markups, and sector expenditure shares remain fixed. The TWC is recomputed from the pooled cross section, not summed or averaged across annual TWC values.

Table D.12: Pooling accounts: matched annual and historical comparisons

	2020–2024		2015–2024	
	2024	Pooled	2024	Pooled
TWC (log points)	6.14	5.42	6.18	4.72
Top 10 concentration (%)	45.7	48.3	50.3	46.7
Top 100 concentration (%)	75.3	77.8	79.3	81.7
Top 5 overlap with matched 2024		4		3
Top 10 overlap with matched 2024		7		8
Top 100 overlap with matched 2024		67		61
Rank correlation with matched 2024		0.706		0.635

Notes: Each pair uses the same firms: 9,864 over five years and 7,651 over ten years. Constant 2020 prices; zero real discounting. The annual reference is recomputed on the comparison sample. Concentration divides each specification's largest positive finite effects by its sum of all positive finite effects. Overlap counts names in common; rank correlation is Spearman's correlation across all firms in the matched sample. These are not additive shares of the aggregate TWC.

Table D.12 separates the pooled comparison from the selection needed to construct it. The full 2024 TWC is 10.03 log points, whereas the matched annual references are 6.14 and 6.18. Their differences from the pooled values cannot be read as representative changes for all firms. Holding 2024 sales weights fixed while using pooled markups and benchmarks gives 5.60 and 4.84 log points, respectively. Thus changes in the accounting ratios account for much of the reduction within each cohort.

Discount sensitivity. Zero real discounting is the descriptive reference, not an estimate of the opportunity cost of capital. Positive rates discount every flow to the start of the window, giving later revenue, costs, and profits less weight than earlier flows. The 10 percent capital charge used in input measurement is not itself an intertemporal discount rate. For context, DiMasi et al. (2016) use 10.5 percent real to capitalize pharmaceutical research expenditure; that financing calculation does not identify a common social discount rate for these sectors. Table D.13 holds the eligible firms fixed across all five tested rates. This restriction explains the slightly different zero rate results from Table D.12.

Table D.13: Pooled accounts: sensitivity to the real discount rate

Window	Rate (%)	TWC (log points)	Top 100 share (%)	Overlap with pooled 0%	Overlap with matched 2024
Five years	0	5.42	77.84	100	67
Five years	3	5.41	77.72	99	67
Five years	5	5.40	77.65	99	67
Five years	10	5.40	77.49	97	66
Five years	10.5	5.41	77.47	97	66
Ten years	0	4.67	81.77	100	62
Ten years	3	4.71	81.95	100	62
Ten years	5	4.76	82.09	99	62
Ten years	10	4.90	82.48	96	60
Ten years	10.5	4.92	82.53	95	60

Notes: All rates use the same 9,863 firms for five years or 7,644 firms for ten years. A firm must satisfy benchmark feasibility at every tested rate. The two overlap columns count shared top 100 names against different references. Constant prices and exact CES finite resets. Concentration is defined as in Table D.12.

Firm identities and scope. Table D.14 lists the leading firms under zero real discounting, requiring $\widetilde{F}_i^{h,0} \geq 0$ before truncation. Aggregate TWC and ranking comparisons above retain the full matched cohorts. Omega Pharma Innovation and Development qualifies after five year pooling, although its 2024 residual is negative. It ranks fifth over five years but 315th over ten years, when its pooled benchmark is close to its pooled markup. C-Power leads the ten year ranking with a pooled markup of 31.26. Its earlier observations, restored from outside the annual filtered sample, have very low flexible expenditure relative to revenue. Pooling does not establish whether these unusually low expenditures reflect low input requirements or incomplete cost measurement. Telix is absent because its earlier filings do not separately disclose the materials input needed for a complete history (see the filing-vintage discussion); its exclusion is not a finding of zero incidence. The exercise also does not distinguish domestic sales from exports or group transactions. It is conditional on survival, reporting, and sector continuity, and omits entry, exit, and the timing of investment returns outside the window. Incidence remains concentrated, but the TWC level and the firms ranked highest depend on the accounting horizon.

Table D.14: Leading finite incidences from pooled accounts

	2020–2024		2015–2024	
Rank	Firm	Incidence	Firm	Incidence
1	GSK Biologicals	1.196	C - Power	0.852
2	UCB PHARMA	0.260	GSK Biologicals	0.320
3	J.C. General Services	0.246	UCB PHARMA	0.240
4	T-POWER	0.241	T-POWER	0.215
5	Omega Pharma Innovation and Development	0.233	Brussels Airport Company	0.145
6	C - Power	0.203	J.C. General Services	0.125
7	ELIA ASSET	0.138	KORIAN BELGIUM	0.108
8	ARVAL BELGIUM	0.097	ELIA ASSET	0.105
9	Ford Credit Belgium	0.081	ARVAL BELGIUM	0.087
10	Maatschappij voor het haven-, grond- en industrialisatiebeleid van het Linkerscheldeoevergebied	0.075	SEA-TANK 510	0.083

Notes: Finite incidence in log points, using the zero discount cohorts of Table D.12. Each firm's pooled markup is separately reset to its pooled cost recovery benchmark. Reported ranks require nonnegative pooled inferred fixed costs before truncation and positive finite incidence. The restriction does not remove firms from the counterfactual economy or change the unrestricted statistics in the preceding tables. The two windows use different firm universes; cross horizon rank changes need not reflect only a change in accounting horizon.

D.5 Sample coverage and trade exposure

This exercise asks whether concentration and persistence depend on normalizing sales within the observed sample. Four cumulative layers change the weights, holding measured markups, fixed cost benchmarks, and the baseline DKM sector elasticities unchanged. The fallback for uncovered divisions remains $\sigma^{\text{com}} \simeq 3.34$, computed from covered 2024 analysis-sample sales as in (B.1); it is not recalculated using completed turnover, trade-adjusted weights, or historical sales. Calculations retain the unrounded common mean. All layers use the exact CES TWC and finite reset calculation in (2.13) and (2.27). Own and rival sales shares adjust within each reset; the external exposure calibration and sector expenditure weights are held fixed during that reset. The exercise does not estimate firm export demand or foreign profit ownership.[6]

[6]The gains from trade in Arkolakis et al. (2012) and Arkolakis et al. (2019) are equilibrium comparisons. Here external trade exposure changes the weights used to evaluate unilateral markup resets; no trade cost shock or equilibrium trade response is modeled.

The additional sources are Eurostat Belgian structural business statistics for 2024, domestic and import use tables at basic prices for 2022, and goods and services trade by enterprise size for 2024.[7] Supply and use tables include intermediate as well as final expenditure. Applying product trade shares to industries is a calibration, not an exact match of firm markets. All 84 sample divisions receive a trade coefficient, but this numerical coverage does not establish comparable populations or valuation in every division. In particular, trade margins in wholesale and retail are not turnover, financial output requires distinct valuation, and market enterprise coverage need not match nonmarket activity. The results are therefore weight sensitivity tests, not identified corrections to total Belgian welfare.

Sample sales and official turnover. Table D.15 compares sample sales with official turnover for selected sections and a common nonfinancial scope. Within sections B–N excluding finance, together with division 95, sample sales are 61.9 percent of official turnover. This is not a share of Belgian GDP or domestic sales: both turnover measures include exports. Nor is it a direct measure of the fraction of firms observed. The sample consists of legal entities, whereas structural business statistics use statistical enterprises.

Table D.16 reports all 84 divisions represented in the 2024 sample, including divisions without an available official total. Seventy-seven have positive published totals, and sample sales exceed the official total in seven of them. Those ratios are shown without capping. They indicate differences in population, classification, or reporting that cannot be resolved by adding an omitted sales mass. The completion rule below therefore uses official totals only where they provide a usable denominator.

[7] Eurostat datasets: business statistics by activity, business statistics by size, use tables at basic prices, goods trade by activity and size, and services trade by activity and size.

Table D.15: Sample sales and official turnover, 2024

Sector	EUR billion		Sample/official
	Sample	Official	(%)
Manufacturing	295.9	353.3	83.8
Electricity and gas	25.5	59.2	43.2
Construction	40.3	105.9	38.0
Wholesale and retail trade	340.4	573.3	59.4
Transport and storage	42.4	65.6	64.7
Accommodation and food services	5.3	23.4	22.4
Stated nonfinancial scope	872.0	1,409.4	61.9

Notes: The six sections are selected examples, not an exhaustive decomposition of the total. The stated nonfinancial scope is NACE sections B–N excluding K, plus division 95. Sample sales use the maintained analysis sample; official turnover comes from Eurostat structural business statistics. No export subtraction or import addition is applied.

Table D.16: Firm counts and turnover by sample division, 2024

NACE	Division	Firms	EUR billion		Ratio
			Sample	Official	(%)
01	Agriculture and hunting	94	3.044	–	–
02	Forestry and logging	9	0.085	–	–
03	Fishing and aquaculture	1	0.001	–	–
07	Metal ore mining	1	1.034	C	–
08	Other mining and quarrying	38	1.362	0.984	138.5
09	Mining support services	1	0.016	0.022	69.9
10	Food manufacturing	419	54.778	73.750	74.3
11	Beverages	51	4.484	8.979	49.9
12	Tobacco products	6	1.490	0.515	289.5
13	Textiles	88	3.133	4.372	71.6
14	Wearing apparel	22	1.211	0.735	164.6
15	Leather products	3	0.024	0.057	43.1
16	Wood and cork products	62	3.262	4.700	69.4
17	Paper products	56	5.412	5.819	93.0
18	Printing and recorded media	57	1.437	2.333	61.6
19	Coke and refined petroleum	11	52.489	43.962	119.4
20	Chemicals	229	35.519	42.576	83.4
21	Pharmaceutical manufacturing	45	39.636	48.554	81.6
22	Rubber and plastic products	148	7.171	9.350	76.7
23	Nonmetallic mineral products	171	7.743	11.100	69.8

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Table D.16 (continued)

NACE	Division	Firms	EUR billion		Ratio
			Sample	Official	(%)
24	Basic metals	85	19.770	24.662	80.2
25	Fabricated metal products	310	13.189	15.276	86.3
26	Electronics and optical products	85	4.803	4.472	107.4
27	Electrical equipment	59	4.324	4.426	97.7
28	Machinery and equipment	179	11.622	15.281	76.1
29	Motor vehicle manufacturing	50	16.829	17.705	95.1
30	Other transport equipment	20	2.670	2.211	120.8
31	Furniture	48	1.013	2.154	47.0
32	Other manufacturing	50	2.138	3.426	62.4
33	Machinery repair; installation	70	1.749	6.860	25.5
35	Electricity, gas and steam	59	25.537	59.175	43.2
36	Water supply	16	3.197	3.284	97.4
37	Sewerage	18	1.522	1.224	124.4
38	Waste and materials recovery	150	6.027	7.560	79.7
39	Remediation services	5	0.295	0.945	31.2
41	Building construction	373	14.364	37.836	38.0
42	Civil engineering	150	11.841	16.888	70.1
43	Specialised construction	503	14.074	51.184	27.5
45	Vehicle trade and repair	727	104.110	131.584	79.1
46	Wholesale trade	2,456	183.196	326.444	56.1
47	Retail trade	634	53.118	115.298	46.1
49	Land transport	440	14.955	24.184	61.8
50	Water transport	25	1.512	3.064	49.3
51	Air transport	13	3.367	5.470	61.6
52	Warehousing; transport support	375	18.931	26.649	71.0
53	Postal and courier services	21	3.655	6.221	58.8
55	Accommodation	95	1.834	4.344	42.2
56	Food and beverage services	92	3.418	19.099	17.9
58	Publishing	48	2.021	2.811	71.9
59	Film, sound and music	49	0.940	2.764	34.0
60	Broadcasting	8	1.020	1.446	70.5
61	Telecommunications	43	11.228	12.185	92.1
62	IT programming and consultancy	375	13.242	30.116	44.0
63	Information services	66	3.781	4.183	90.4
64	Financial services	493	7.681	38.226	20.1
65	Insurance and pension funding	5	0.073	49.737	0.1
66	Finance and insurance support	74	2.297	21.332	10.8
68	Real estate	239	6.627	19.924	33.3
69	Legal and accounting services	90	2.362	16.319	14.5
70	Head offices; management advice	554	14.575	38.375	38.0
71	Architecture and engineering	209	8.873	15.719	56.4
72	Research and development	58	5.030	7.020	71.7
73	Advertising and market research	111	5.813	6.069	95.8
74	Other professional services	30	1.222	2.881	42.4
75	Veterinary services	9	0.120	1.414	8.5

Continued on next page

Table D.16 (continued)

NACE	Division	Firms	EUR billion		Ratio
			Sample	Official	(%)
77	Rental and leasing	127	7.924	13.067	60.6
78	Employment services	117	10.258	12.057	85.1
79	Travel agencies; tour operators	39	2.037	4.499	45.3
80	Security and investigation	40	1.417	1.862	76.1
81	Building and landscape services	137	4.277	11.593	36.9
82	Office and business support	216	5.861	10.083	58.1
84	Public administration; defence	23	0.962	–	–
85	Education	152	1.526	2.270	67.2
86	Human health	136	17.715	43.577	40.7
87	Residential care	228	3.799	7.673	49.5
88	Nonresidential social work	157	1.985	2.737	72.5
90	Arts and entertainment	35	0.516	2.867	18.0
91	Libraries, archives and museums	9	0.093	0.385	24.1
92	Gambling and betting	19	2.536	3.890	65.2
93	Sports and recreation	70	1.721	5.081	33.9
94	Membership organisations	53	12.817	–	–
95	Computer and household repair	4	0.124	0.272	45.4
96	Other personal services	51	0.921	4.057	22.7
97	Households as employers	14	0.257	–	–

Notes: All 12,708 sample firms in 84 divisions are included. Ratios divide sample sales by official turnover; figures may differ from ratios calculated using rounded entries. C denotes a confidential official total, and – denotes no available total in the retrieved statistics. Neither denotes zero. The financial divisions (64–66) are displayed but are not used to complete turnover because their valuation differs. The remaining population and classification qualifications apply to every row, not only to ratios above 100 percent. Division titles are abbreviated.

Layer 1: complete resident turnover. Let $S_g = \sum_{i \in g} R_i$ be sample sales and T_g completed resident turnover. I use official turnover when it is available, at least as large as sample sales, and outside finance; otherwise $T_g = S_g$. Official totals are used in 67 divisions, with sample totals retained in the remaining 17.[8] Observed within sector weights become $\omega_{i|g} = R_i/T_g$, and sector weights become $\Lambda_g = T_g / \sum_h T_h$. The omitted resident mass $1 - S_g/T_g$ has residual markup $\rho = 1$. This assumption makes an omitted supplier's own reset zero; it does not leave the sector TWC unchanged, because the omitted mass changes its moments and weights. No omitted mass is treated as one large

[8]The fallback divisions are NACE 01, 02, 03, 07, 08, 12, 14, 19, 26, 30, 37, 64, 65, 66, 84, 94, and 97. The fallback avoids negative omitted sales or an unsupported financial denominator; it does not establish complete coverage. Ten of the 67 official totals concern divisions where the correspondence between market enterprises and the sample population remains unverified.

firm in the rankings.

Layer 2: remove exports proportionally. Let e_g be exports of domestic output divided by total domestic supply in the use tables. I assign this export share to all resident suppliers in the division, including the omitted mass. Retained resident sales are $E_g = (1 - e_g)T_g$ and $\Lambda_g = E_g / \sum_h E_h$. Within sector weights remain R_i/T_g: proportional removal changes sector importance, not the relative weights of resident firms within a sector. Official turnover in Layer 1 includes exports, so this is a separate adjustment.

Layer 3: add retained imports. Let m_g be imports retained domestically divided by total domestic absorption. Both numerator and denominator exclude exports, including reexports of imported supply. The expenditure proxy and observed weights are

$$E_g = \frac{(1 - e_g)T_g}{1 - m_g}, \qquad \omega_{i|g} = (1 - m_g)\frac{R_i}{T_g}, \qquad \Lambda_g = \frac{E_g}{\sum_h E_h}. \tag{D.10}$$

The import mass m_g also receives $\rho = 1$. Together with the omitted resident mass, it enters the exact CES moments but is not ranked as a firm. This imposes zero residual wedges on unobserved supply; it does not identify its actual markups or fixed costs.

Layer 4: allow export intensity to vary with firm size. This layer replaces proportional export removal, without subtracting exports again or changing the sector totals from Layer 3. Firm employment assigns four classes: fewer than 10, 10–49, 50–249, and at least 250. External trade and turnover data provide a relative export propensity h_{gb} for each available sector and size class. Allocated exports satisfy

$$X_i^{\exp} = R_i \min\{1, a_g h_{g,b(i)}\}, \qquad \sum_{i \in g \cup \{o\}} X_i^{\exp} = e_g T_g, \qquad \omega_{i|g} = \frac{R_i - X_i^{\exp}}{E_g}, \tag{D.11}$$

where $X_i^{\exp}$ denotes allocated exports, distinct from input expenditure X_{it}; o denotes omitted resident sales, $R_o = T_g - S_g$, and a_g is chosen to match the sector export total. Thus no supplier exports more than its sales. Goods profiles use division data where available and section data otherwise; services profiles use available sections.[9] These profiles

[9]For each compatible goods or services component, I divide exports by turnover in the size class and in the corresponding all size group. The relative propensity is the sum of the available class ratios divided by the sum of their all size ratios. A component is used only when the class ratio lies between zero and one and the all size ratio is positive and at most one. The 10–49 turnover denominator requires both constituent size cells. Missing employment, missing compatible profiles, and omitted resident sales receive propensity one. A numerical floor of 10^{-8} on propensities ensures that the sector export constraint can be met. Sample employment is measured in full time equivalents, while official size classifications need not use that exact measure.

allow heterogeneous exposure but do not identify individual exporters or nonexporters. No firm specific geographic disclosures are used.

Persistence with a fixed external calibration. For 2015–2024, I freeze the 2024 coverage ratio $c_g = S_g/T_g$, the 2022 trade shares, and the 2024 size profiles. Annual firm sales, residual markups, and employment classes retain their observed values, and completed resident turnover is $T_{gt} = S_{gt}/c_g$. This isolates sensitivity to a common external calibration rather than reconstructing historical exports or coverage. Each layer uses the same annual firms within the 84 divisions represented in 2024.[10] Annual top 100 retention conditions on observation in the next year, after ranking the full annual sample. The five year comparison ranks mean annual incidence in 2015–2019 and 2020–2024 among the same 7,130 firms observed in all ten years. Incidence is computed in the full annual allocation before selecting that balanced panel.

[10]This restriction excludes one firm in NACE 06 in each year from 2015 through 2021 from all five temporal comparisons. It does not change the maintained analysis sample or the 2024 comparison.

Table D.17: Sample coverage and trade exposure: four cumulative weight sensitivities

	Baseline	(1) Coverage	(2) Exports	(3) Imports	(4) Size profile
Panel A. Levels and rankings in 2024					
Aggregate TWC ($100\mathcal{I}^{\mathrm{E}}$)	10.03	7.29	4.07	5.49	5.58
Top 10 concentration (%)	64.2	66.9	31.5	60.1	60.6
Top 100 concentration (%)	82.7	84.2	66.6	81.0	81.5
Top 5 overlap with baseline	5	5	3	4	4
Top 10 overlap with baseline	10	10	8	10	9
Top 100 overlap with baseline	100	96	86	85	81
Rank correlation with baseline	1.000	0.878	0.872	0.797	0.786
Panel B. Persistence, 2015–2024					
Annual top 100 retention (%)	67.8	69.2	70.2	70.6	70.9
Median annual rank correlation	0.672	0.688	0.693	0.706	0.706
Five year top 100 retention (%)	64	64	63	65	66
Five year rank correlation	0.645	0.685	0.700	0.736	0.732

Notes: All columns use exact CES residual incidence, the same measured markups and firm benchmarks, and the baseline DKM sector elasticities with the unchanged fallback for uncovered divisions. Columns (1)–(4) cumulatively complete resident turnover, remove exports, add retained imports, and replace proportional export removal with a size profile. Unobserved resident and imported supply have $\rho = 1$; no individual disclosure adjustments are used. Panel A covers 12,708 observed firms in 84 divisions in 2024. The TWC is in log points. Concentration is the share of summed positive finite effects in each column's own ranking; overlaps count common firms in the indicated lists. Rank correlations are Spearman correlations over all observed firms. Panel B holds external coverage and exposure parameters fixed. Annual retention pools retained top 100 firms over those observed in the following year across nine adjacent pairs; annual rank correlation is the median over those pairs, using common firms. Five year retention compares the top 100 mean incidence rankings in 2015–2019 and 2020–2024 within the balanced panel of 7,130 firms; its rank correlation uses all balanced firms. These diagnostics do not estimate a historical trade adjusted TWC trend.

The TWC falls from 10.03 log points to 7.29 after coverage completion and to 4.07 after proportional export removal (Table D.17). Adding retained imports raises it to 5.49, and the size profile raises it further to 5.58. The cumulative sequence is therefore not monotone. Top 100 concentration is 82.7 percent in the baseline and 66.6–84.2 percent across the layers. The final layer has concentration of 81.5 percent and retains four of the baseline top five, nine of the top ten, and 81 of the top 100; its rank correlation with the baseline is 0.786. Annual top 100 retention ranges from 69.2 to 70.9 percent across the layers, compared with 67.8 percent in the baseline. Between the two five year windows,

retention is 63–66 percent compared with 64 percent. Concentration and persistence remain substantial, but aggregate levels and firm rankings depend on the weights. This conclusion is conditional on the external matching and zero residual wedges assigned to unobserved supply.

E Counterfactual Extensions

The following exercises vary the size and scope of the reset, the welfare reference, expenditure reallocation, accounting target feedback, or the allocation of the aggregate TWC. The final comparisons assess ranking agreement across measurement and counterfactual specifications. None adds strategic repricing. The resource and expenditure closures are distinguished in Appendix A.7.

E.1 Partial firm resets

Full resets can require the CES demand system to extrapolate far from observed prices and quantities. To assess whether concentration depends on that extrapolation, I close a fraction a of one firm's positive log markup gap:

$$\mu_i(a) = \mu_i^{1-a}(\mu_i^B)^a, \qquad a \in \{0.01, 0.05, 0.10, 0.25, 0.50, 1\}. \tag{E.1}$$

Each firm is treated separately. The diagnostic evaluates the same 9,417 firms with $\mu_i > \mu_i^B$ in 2024 at every reset size, while all 12,708 firms remain in the demand system. Unlike the simultaneous intervention in Figure E.3, the outcome here is the exact fixed cost adjusted TWC, with sector expenditure held fixed. Benchmark markups, rival markups, marginal costs, and demand elasticities also remain fixed; own and rival sales adjust within the affected sector.

Table E.1 shows that concentration is already high near the observed allocation. Closing 1 percent of the log gap gives a top 100 share of 76.9 percent, compared with 89.7 percent under a full reset. The median quantity multiplier among the respective top 100 rises from 1.03 to 23.57. At a 10 percent reset the largest multiplier is 4.85; under a full reset, 71 of the top 100 imply more than a tenfold expansion and the maximum exceeds three thousand five hundred. Thus concentration does not require the largest extrapolations, although full reset magnitudes and identities remain sensitive to the maintained demand response. These are model implications, not forecasts.

Table E.1: Concentration and implied output responses under partial firm resets, 2024

Log gap closed (percent)	Positive incidence share (percent)		Top 100 overlap with full reset	Output multiplier	
	Top 10	Top 100		Median	Maximum
1	55.6	76.9	76	1.03	1.17
5	56.9	78.0	77	1.14	2.21
10	58.9	79.4	78	1.30	4.85
25	68.0	84.9	80	1.91	44.04
50	77.7	90.4	86	4.36	330.09
100	72.1	89.7	100	23.57	3,582.09

Notes: Each row resets one firm at a time according to (E.1), with the baseline DKM sector elasticities and fixed fallback. The intervention set contains 9,417 firms whose observed markup exceeds their fixed cost benchmark; all 12,708 firms remain in sector expenditure shares. Firms are ranked anew at each reset size by the exact reduction in the fixed cost adjusted TWC. Concentration divides the positive effects of the leading firms by the sum of all positive individual effects at that reset size, not by the aggregate TWC. Overlap counts firms shared by that row's top 100 and the full reset top 100. Output multipliers are counterfactual quantity divided by observed quantity for the treated firms in that row's top 100, conditional on fixed sector expenditure, marginal costs, rival prices, and benchmark markups. Closing 10 percent of a log gap is not a uniform 10 percent markup cut. The full reset concentration differs from the main unrestricted ranking because this table excludes upward interventions, not their firms from demand.

E.2 Cross-sector substitution

I set $\eta = 0.90$ following the consumption elasticity calibration in Baqaee and Farhi (2020). Their consumption parameter θ_0, not their capital and labor substitution parameter η, corresponds to the upper nest here. The value is also close to the homothetic final expenditure estimate of 0.89 in Herrendorf et al. (2013), Table 1, column 3. Those authors find a worse fit when income effects are excluded; their estimate therefore supplies a calibration reference, not evidence that homotheticity is innocuous.

Table E.2 reports the alternatives and their sources. The two lower values come from the nonhomothetic demand system in Comin et al. (2021). I transport only the substitution parameter, retaining unit income elasticities in the present extension. The values come from different sector aggregations and specifications; they are not confidence bounds around 0.90. None is estimated for Belgian NACE sectors. In particular, a parameter for broad final expenditure categories need not coincide with one for the gross sales sector composites used here.

Table E.2: Calibration of substitution across sectors

η	Source and interpretation
0.90	Preferred extension: consumption calibration in Baqaee and Farhi (2020); close to the homothetic final expenditure estimate of 0.89 in Herrendorf et al. (2013).
0.50	Comin et al. (2021): world sample, three sectors, with trade controls, author final manuscript Table 3, column 2.
0.13	Comin et al. (2021): OECD sample, ten sectors, author final manuscript Table 12.
1.00	Analytical Cobb–Douglas comparator: sector expenditure shares remain fixed when relative sector prices change.

Notes: η is the substitution elasticity among sector composites in (A.26). All exercises retain the homothetic upper nest and the baseline DKM within-sector elasticities, including the fixed fallback for uncovered divisions. The Comin, Lashkari, and Mestieri table numbers refer to the authors' final manuscript dated June 12, 2020, linked to the 2021 publication. The parameter choices are external calibrations, not Belgian estimates or a statistical confidence interval.

This extension evaluates the exact nested CES TWC at both endpoints, using the same transformed costs. For each firm-year, I first perform the within-sector reset in (2.25). I then apply (A.33) and (A.34) to recompute the sector price index and all sector expenditure shares. Finally, I recompute the exact moments in (A.27). At $\eta = 0.90$, the 2024 nested TWC is 9.99 log points, compared with 10.03 for the exact within sector TWC. The finite incidence rankings have correlation 0.97 and share 94 of their top 100 firms. Across the four calibrations, the TWC ranges from 7.60 to 10.40 log points, rank correlations from 0.96 to 1.00, and top 100 overlap from 94 to 95 firms. The top 100 account for 76.1 to 82.2 percent of positive finite incidence, compared with 82.7 percent under the exact within sector comparator. Table E.3 reports the matched comparisons.

Table E.3: Substitution across sectors: TWC and finite incidence, 2024

Specification	η	TWC (log points)	Rank correlation	Top 100 overlap	Top 100 share (%)
Within sector	–	10.03	1.00	100	82.7
Nested CES	0.13	7.60	1.00	95	76.1
Nested CES	0.50	8.59	0.99	95	78.7
Nested CES	0.90	9.99	0.97	94	81.5
Nested CES	1.00	10.40	0.96	94	82.2

Notes: All rows use exact CES TWC measures, the 2024 analysis sample of 12,708 firms, the baseline DKM sector elasticities and fixed fallback, and fixed firm benchmarks. The within sector row averages conditional sector losses. Each nested row uses (A.27) and updates sector expenditure shares after each separate firm reset. Correlations are Spearman correlations with the within sector finite ranking; overlap counts common firms in the two top 100 sets. Shares divide the positive incidence of each row's top 100 by that row's total positive incidence. The $\eta = 1$ row fixes expenditure shares but still includes allocation across sectors, so it need not equal the within sector row. Calibration sources are in Table E.2.

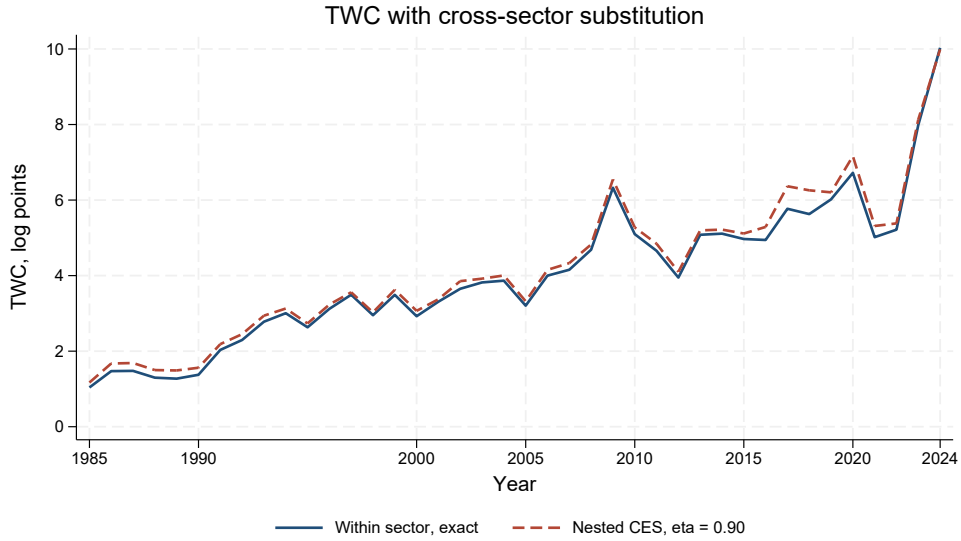


Figure E.1: Exact TWC with cross-sector substitution

Notes: Both lines use exact CES formulas. The solid line averages conditional within sector residual losses. The dashed line uses $\eta = 0.90$ and includes allocation across sectors in (A.27). The plotted levels evaluate observed allocations; expenditure shares are recomputed for the finite incidence comparisons in Table E.3. Both series use the same analysis sample, firm-level fixed-cost benchmark markups, and baseline DKM within-sector elasticities and fixed fallback.

The quadratic expression in (A.32) remains useful for interpreting the role of within and between sector dispersion. It is not used for the principal nested rankings. At $\eta = 0.90$, its TWC is 6.27 log points instead of 9.99, and its finite ranking shares 83 of the exact ranking's top 100 firms. Table E.4 isolates this formula comparison by holding the allocation, benchmarks, and share updates fixed.

Table E.4: Exact and quadratic nested CES calculations, 2024

η	Exact TWC (log points)	Quadratic TWC (log points)	Finite rank correlation	Top 100 overlap
0.13	7.60	6.01	0.889	82
0.50	8.59	6.13	0.900	82
0.90	9.99	6.27	0.910	83
1.00	10.40	6.30	0.912	83

Notes: Both calculations use the 12,708 analysis firms in 2024, fixed firm benchmarks, baseline DKM sector elasticities and fixed fallback, and identical nested CES share updates after each separate full reset. The exact TWC is (A.27); its quadratic approximation is (A.32). Rank correlation is Spearman's correlation between the two finite effect rankings, and overlap counts firms in both top 100 sets. Neither finite effect is approximated by the initial slope times the reset distance.

E.3 Joint sector benchmark resets

For each NACE two-digit sector, I jointly set every firm's residual wedge to zero and recompute all within-sector expenditure shares using (A.12). Under fixed sector expenditure, the effect is the sector component in (A.13); these effects add exactly to the 2024 aggregate TWC of 10.03 log points. The ten largest account for 77.2 percent of that total. The nested calculation additionally updates the sector price index and every sector expenditure share using (A.36). Its ranking correlation with the fixed-expenditure effects is 0.997, and eight sectors are shared by the two top ten sets.

Basic pharmaceuticals alone accounts for 4.94 log points. The sector comparison uses exact CES formulas throughout. The nested TWC incorporates allocation across sectors as well as the expenditure response, so this is a comparison of specifications, not an isolated test of expenditure feedback.

The joint reset is distinct from summing one-firm incidence. In the exact baseline, the signed sum of separate effects is 10.68 log points, compared with 10.03 log points for the joint sector effects. The resulting aggregate interaction, joint minus separate, is -0.65 points. At the sector level, interactions can have either sign. This convention is the reverse of the separate minus joint difference in the two firm identity of Proposition 3. This

difference arises because each one-firm calculation starts from the observed allocation, whereas the joint calculation allows all firms' prices and shares to move together.

Table E.5: Joint sector benchmark resets and nonadditivity, 2024

	Fixed sector expenditure			Nested CES, $\eta = 0.90$		
Sector	Joint	Separate	Interaction	Joint	Separate	Interaction
21 Basic pharmaceuticals	4.937	5.133	-0.196	4.662	5.341	-0.679
52 Warehousing and transport support	0.545	0.732	-0.186	0.537	0.730	-0.193
72 Scientific research and development	0.433	0.689	-0.257	0.416	0.670	-0.253
64 Financial services	0.412	0.675	-0.263	0.401	0.673	-0.272
46 Wholesale trade	0.410	0.364	0.046	0.400	0.366	0.034
35 Electricity and gas	0.341	0.288	0.053	0.349	0.332	0.017
77 Rental and leasing	0.191	0.176	0.014	0.193	0.194	-0.001
49 Land transport	0.169	0.186	-0.016	0.177	0.196	-0.019
62 Computer programming and consultancy	0.164	0.165	-0.001	0.162	0.168	-0.006
70 Head offices and management consultancy	0.141	0.141	-0.000	0.139	0.142	-0.003

Notes: Entries are log points of the fixed cost adjusted TWC. The joint effect resets every firm's residual wedge in the sector to zero simultaneously. *Separate* sums the one-firm reset effects, each evaluated from the observed allocation, including negative effects. This differs from the positive effects denominator used for concentration. Interaction equals joint minus separate. Sectors are ordered by the fixed-sector-expenditure joint effect, and the ten largest are reported. Benchmark markups remain fixed. Because firms below their benchmarks are moved upward, this is a joint benchmark reset rather than necessarily a markup reduction for every firm.

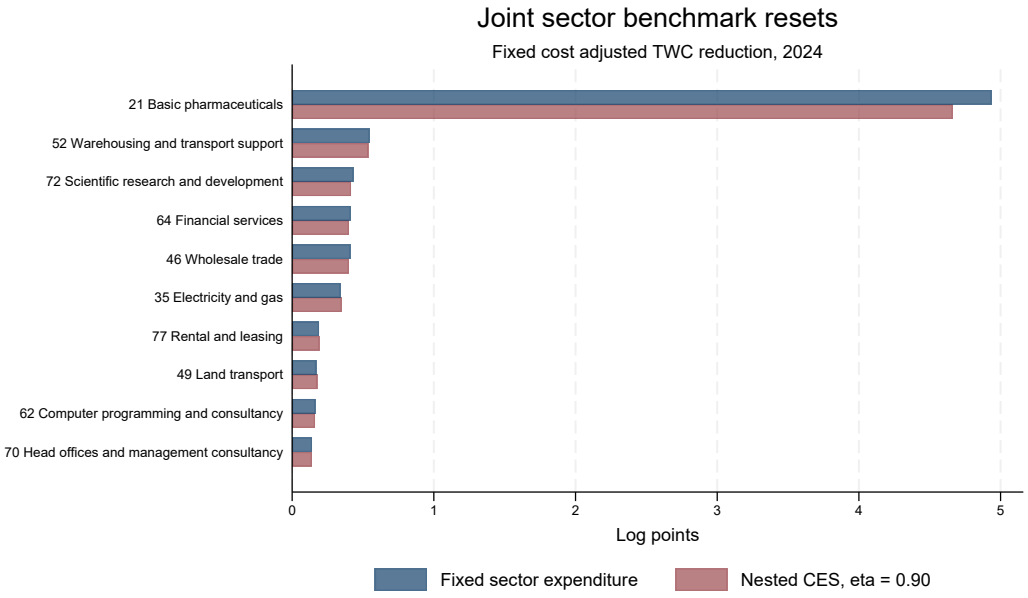


Figure E.2: Conditional TWC effects of joint sector benchmark resets, 2024

Notes: Bars report the reduction in the TWC when every residual wedge in the indicated sector is reset to zero simultaneously. The blue bars hold sector expenditure fixed. The red bars use nested CES with $\eta = 0.90$ and update expenditure across all sectors. The figure reports the ten largest sectors under the fixed-expenditure baseline. The substitution groups are NACE two-digit accounting sectors, not antitrust market definitions.

E.4 Resource gains from actual markup targets

The resource comparison derived in Appendix A.7 changes the welfare reference as well as the interpretation of the reset.

The three interpretations in Table E.6 differ in both the reference and the intervention. The welfare gain from reducing several firms' actual markups to their accounting benchmarks is a different object from the sum of their separately evaluated TWC effects.

Table E.6: Three exact CES benchmark interpretations, 2024

Object	Reference or destination	Value (log points)	Firm exercise
Exact TWC	Conditional accounting reference	10.03	Separate firm reset
Exact raw loss	Common markup	25.51	–
Exact actual target gain	Accounting destination	11.89	Joint reductions only

Notes: The raw loss evaluates observed markups relative to a common markup vector in the original one-sector resource economies. The TWC absorbs each firm's heterogeneous accounting benchmark into effective costs and measures the remaining distortion. The actual target gain holds marginal costs fixed and jointly reduces every positive markup gap to its accounting destination within each sector. The reported value is the sum of sector expenditure weighted exact one-sector gains, not a welfare change for a single integrated multisector economy. The quadratic local approximation is 5.96 log points in 2024; the exact residual baseline is 10.03.

The actual-target calculation asks a different question: it changes actual prices from $\mu_i \mathrm{mc}_i$ toward $\mu_i^B \mathrm{mc}_i$ while holding marginal costs fixed. A simultaneous full reset of every positive-gap firm generates a sector-sales-weighted sum of exact one-sector resource gains equal to 11.89 log points in 2024. Allowing firms below their benchmark to move upward as well gives 12.72 log points. These sums are not an exact welfare change for a single multisector economy; (A.22) defines their aggregation. The reductions-only one-firm effects have a rank correlation of 0.44 with the residual-wedge baseline and a 55 percent top-100 overlap. Hence the concentration result remains, but the identity of leading firms depends materially on whether the benchmark is a normalization or an actual price target.

Figure E.3 traces the actual-target comparison over time for four intervention sizes. The response is nonlinear: in 2024, closing one quarter of each positive log gap yields a 2.90 log point sector-weighted resource gain, compared with 11.89 log points under a full reset. The exact finite calculation allows marginal incidence to vary along the reset, rather than extrapolating from its initial value.

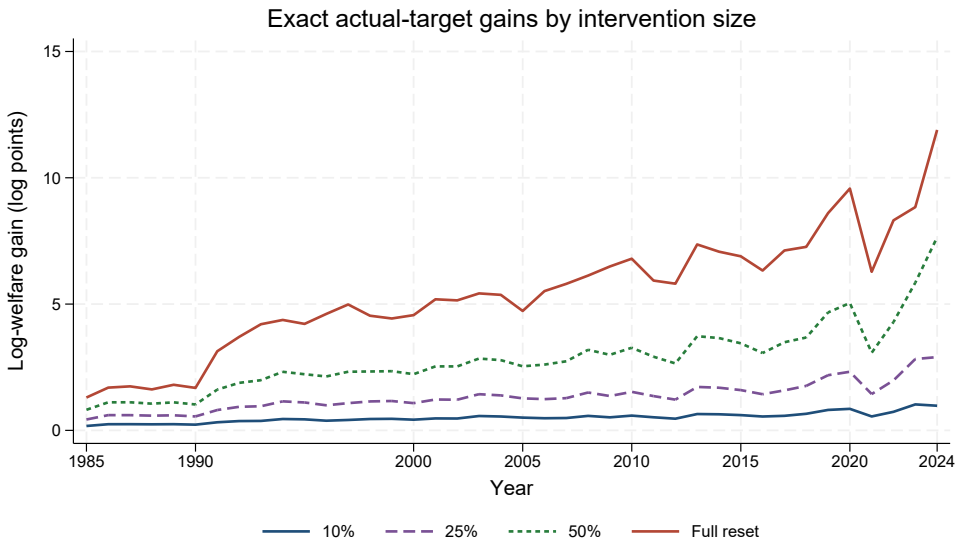


Figure E.3: Sector-weighted exact one-sector resource gains along fixed-target reset paths, 1985–2024

Notes: Each line reports the annual sum of sector-sales-weighted one-sector resource gains when the stated percentage of every positive log markup gap is closed simultaneously. At dose a, a firm with $\mu_i > \mu_i^B$ moves to $\mu_i' = \mu_i^{1-a}(\mu_i^B)^a$; firms at or below their benchmark do not move. The vertical axis is in log points. Each sector calculation is exact within its one-sector CES resource model, but the sum is not an exact multisector welfare change. CES demand adjusts all firms' expenditure shares and nominal sales within each affected sector. Every positive-gap firm moves jointly, including firms that are rivals within a sector; actual markups remain fixed only for firms that do not move. Benchmark markups, marginal costs, sector definitions, and demand elasticities remain fixed.

I also replace the observed-sales target with the exact nominal-sales-consistent fixed point in (A.25). As Table E.7 shows, a solution exists for every 2024 positive-gap firm and all solutions are locally stable. The median benchmark falls by 4.04 percent and the median treated-firm sales increase is 31.18 percent. The ranking nevertheless changes relative to the fixed exact target: the rank correlation is 0.63 and top-100 overlap is 61 percent.

Table E.7: Exact one-sector nominal-sales-consistent benchmark diagnostics, 2024

Diagnostic	Value
Positive-gap firms	9417
Converged fixed points (percent)	100.0
Locally stable fixed points (percent)	100.0
Median benchmark change (percent)	-4.04
Median treated-firm sales change (percent)	31.18
75th percentile sales change (percent)	131.15
Rank correlation with fixed target	0.63
Top-100 overlap with fixed target (percent)	61

Notes: The sample contains firms with $\mu_i > \mu_i^B$. Fixed costs remain fixed in euros, while the treated firm's target markup and exact CES nominal sales are solved jointly. Local stability means that the absolute slope of the accounting fixed-point map is below one at the solution. Rank statistics compare one-firm exact actual-target resource effects using fixed and sales-consistent targets. Rival sales adjust, but rival actual and benchmark markups remain fixed.

The upper tail of the implied sales response is much larger than the median. The seventy-fifth percentile is 131.1 percent, and several leading firms imply increases of one or more orders of magnitude. These observations are listed in Table E.8. The fixed point is internally consistent with the maintained CES model, but the magnitudes require the same elasticity to extrapolate far beyond the observed allocation while capacity, marginal costs, rival prices, product quality, and market boundaries remain fixed. I therefore treat this exercise as a stress test of the accounting benchmark, not as the preferred counterfactual or a forecast of feasible firm growth.

Table E.8: Leading exact sales-consistent actual-target effects, 2024

Firm	Markup μ_i	Observed target	Adjusted target	Sales change (percent)	Fixed rank	Adjusted rank
TELIX INNOVATIONS	11.97	1.34	1.00	7,900	1	1
GlaxoSmithKline Biologicals	3.99	1.73	1.13	266	2	2
DHL GLOBAL FORWARDING (BELGIUM)	9.27	8.01	1.05	1,914	60	3
UCB PHARMA	2.94	1.71	1.07	531	3	4
HENRI ESSERS EN ZONEN INTERNATIONAAL TRANSPORT	7.92	7.67	1.05	1,697	211	5
ANTWERP TERMINAL SERVICES	9.29	8.59	1.03	2,720	128	6
ARVAL BELGIUM	8.86	3.19	1.16	395	4	7
argenx	6.74	4.43	1.60	106	5	8
YARA BELGIUM SA	6.61	5.76	1.02	3,563	84	9
ELIA ASSET	5.97	2.22	1.05	1,122	6	10

Notes: Firms are ordered by the exact actual-target welfare effect using the nominal-sales-consistent target m_i^{T}. Sales changes are relative to observed nominal sales and follow (A.23). The final two columns give ranks among 2024 positive-gap firms under the fixed and sales-consistent exact targets. Extremely large sales responses diagnose the limits of a global CES counterfactual; they are not interpreted as firm-level forecasts.

E.5 Revenue-updated fixed-cost benchmarks

This appendix reports specifications 4 and 5 of the extended comparison. Specification 4 solves the treated firm's benchmark jointly with its new sales, holding sector expenditure fixed. Specification 5 combines that benchmark update with nested CES sector substitution at $\eta = 0.90$. Both keep fixed costs in euros, rival actual markups, and rival benchmarks fixed. The three principal specifications in the main text hold benchmarks fixed within each reset; these two extensions do not define the main persistent core.

Each positive gap firm is considered in a separate counterfactual. Its new recovery share F_i^+/R_i' changes because revenue changes, not because fixed costs change. Firms without a positive gap retain the original benchmark rule. The collection of treated targets is not one jointly implemented allocation.

For every firm with a positive residual markup gap, I solve (A.38) by bisection. A solution is obtained for every such firm-year. In 2024, these firms account for 74.1 percent of the analysis sample. The sales-weighted benchmark markup falls from 1.32 under the observed-sales construction to 1.15 under the revenue-updated target. The median benchmark change is -4.08 percent, while the median treated-firm sales change is 31.41 percent. The exact TWC is recomputed at each endpoint using (A.40). Its finite effects have a rank correlation of 0.82 with the fixed benchmark baseline and a top 100 overlap of

49 percent. Top 100 concentration changes from 82.7 percent under the fixed benchmark baseline to 75.9 percent under the treated benchmark update. These are shares of summed positive finite effects, not shares of the aggregate TWC.

The all-rival accounting rebasing in (A.41) holds every fixed-cost requirement F_{jt}^{+} fixed in euros but additionally recomputes each rival's recovery share $F_{jt}^{+}/\widetilde{R}_{jt}$ and break-even benchmark after its sales change. It has finite benchmarks for 97.2 percent of the 2024 positive-gap counterfactuals. In the remaining cases, at least one rival's counterfactual revenue falls below its inferred fixed cost, so no finite break-even markup exists. This is an economic failure of the static accounting counterfactual, not numerical nonconvergence. Among cases with finite benchmarks, the rank correlation with the baseline is 0.32, and only 11 percent of the baseline top 100 remain in the top 100. This sharper sensitivity reflects the fact that an intervention then changes both the allocation and the reference wedges against which that allocation is evaluated. Rivals' actual markups do not respond in this calculation, and the resulting benchmark vector depends on which firm is treated. The exercise is therefore not a general-equilibrium solution. For this reason, the treated benchmark extension keeps rivals' benchmark markups fixed and treats the all-rival rebasing as a diagnostic.

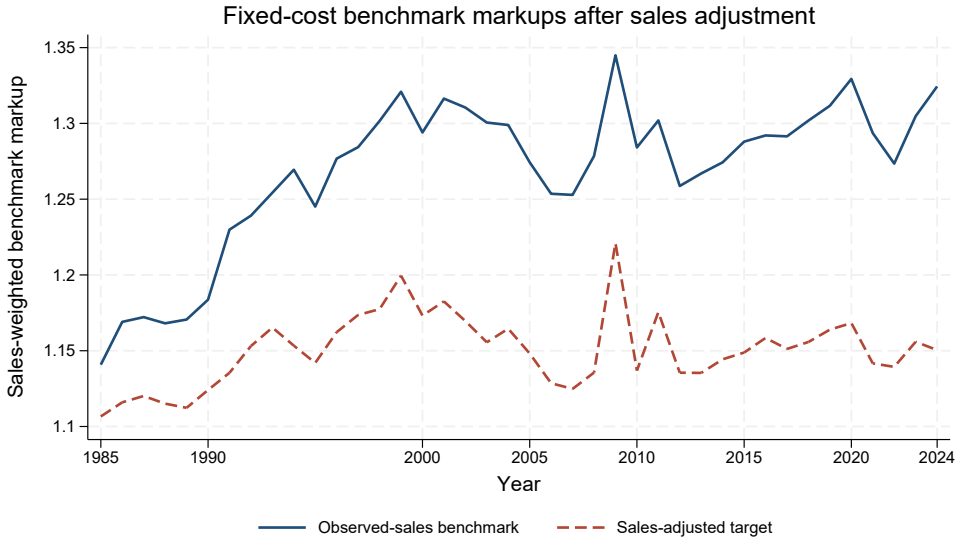


Figure E.4: Fixed-cost benchmark markups after adjusting treated-firm sales

Notes: The solid line is the sales-weighted average firm-level benchmark $\mu_{it}^{B} = (1 - F_{it}^{+}/R_{it})^{-1}$ computed from observed sales. The dashed line replaces the target of each positive-gap firm with the solution to (A.38); firms without a positive gap retain their observed-sales benchmark. Sector expenditure and within-sector elasticities are held at their baseline values.

Combining benchmark adjustment and cross-sector substitution. I next solve (A.43) using the preferred upper-tier elasticity, $\eta = 0.90$. Cross-sector reallocation has little effect on the endogenous target. In 2024, the sales-weighted target is 1.150 in the within-sector model and 1.151 under nested CES. Among positive-gap firms, the median sector-expenditure response is -0.002 percent and median treated-firm revenue rises by 31.40 percent.

Table E.9 separates the numerical role of the expenditure response using the matched exact comparison in (A.44). Both sides retain the same nested TWC and $\eta = 0.90$; only expenditure reallocation and its feedback into the treated target differ. The rank correlation is 0.993 and 99 of the top 100 firms are retained. Comparing instead with the exact within sector TWC gives a correlation of 0.976 and an overlap of 97 firms. That comparison changes the scope of the TWC as well as expenditure. The fixed share comparator is a TWC diagnostic, not an equilibrium under unchanged upper CES preferences. In this matched comparison, expenditure feedback changes the ranking little once the treated benchmark adjusts.

Table E.9: Matched comparisons of revenue updated finite incidence, 2024

Fixed expenditure comparator	Rank correlation	Top 100 overlap
Same nested TWC, fixed sector shares	0.993	99
Within sector exact TWC	0.976	97

Notes: Both rows compare with the exact nested CES reset at $\eta = 0.90$, which updates all sector expenditure shares and solves the treated firm's benchmark jointly with its revenue. The comparator fixes sector expenditure and solves the corresponding treated target. The first row evaluates the identical exact nested formula at a fixed share endpoint outside the maintained upper demand system; the second uses the exact conditional within sector TWC. Fixed costs in euros and rivals' actual and benchmark markups remain fixed. Benchmark feedback is applied to firms with positive initial residual gaps; other firms retain their original benchmark and undergo the same reset rule in both calculations. Correlations are Spearman correlations across all 2024 firms, and overlap counts firms shared by the two top 100 sets. Neither row is a comparison with the exact main specification.

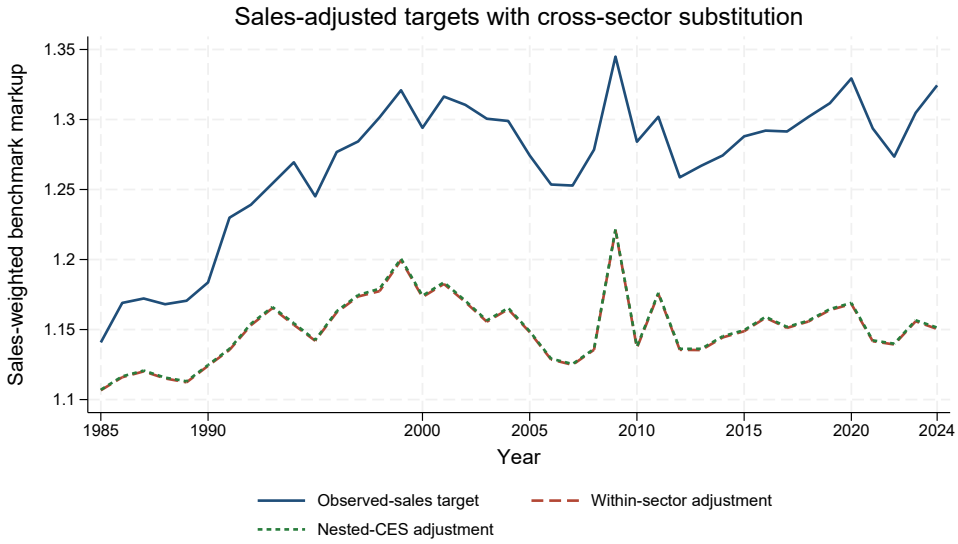


Figure E.5: Revenue-updated targets with cross-sector substitution

Notes: The solid line is the observed-sales fixed-cost benchmark. The dashed line jointly solves the treated firm's target and within-sector sales share while holding Λ_{gt} fixed. The short-dashed line also updates the sector price index and all sector expenditure shares under nested CES with $\eta = 0.90$. All series are sales-weighted averages; rivals' benchmark markups remain fixed in both counterfactual specifications.

Financial coverage after a reset. Existence of a finite benchmark does not establish nonnegative profit at the actual counterfactual markup. Holding each F_j^+ fixed in euros, define the accounting profit after resetting firm k as

$$\widetilde{\Pi}_{j|k} = \left(1 - \frac{1}{\widetilde{\mu}_{j|k}}\right) \widetilde{R}_{j|k} - F_j^+, \qquad \widetilde{\mu}_{j|k} = \mu_j \quad \text{for } j \neq k. \tag{E.2}$$

For an unchanged rival, write $f_j = F_j^+/R_j$ and $s_{j|k} = \widetilde{R}_{j|k}/R_j$. Its updated benchmark is finite when $f_j < s_{j|k}$, whereas covering variable and fixed costs requires $(1-1/\mu_j)s_{j|k} \geq f_j$. Recomputing the benchmark alone does not enforce this stronger condition or change the rival's actual price.

Table E.10 evaluates 9,417 separate downward resets in 2024, keeping all 12,708 firms in the counterfactual population. A new loss is counted only for a firm with nonnegative initial model profit $(1 - 1/\mu_j)R_j - F_j^+$. There are 3,290 initial model losses, compared with 2,580 recorded operating losses: truncating inferred fixed costs at zero means that model profit need not equal reported EBIT. The initial losses are not attributed to a counterfactual intervention. The same baseline top 100 downward interventions are used under every closure in Panel B; this is not the unrestricted ranking that also permits

upward resets.

Table E.10: New rival losses following separate downward markup resets, 2024

		Resets with a new rival loss (%)		Financial deficit (basis points)	
Target and expenditure closure	Resets	Any	Loss > 1% of rival sales	Median	95th pct.
A. All downward resets					
Fixed target	9,417	28.3	1.9	0.000	0.000
Updated own target	9,417	42.4	7.6	0.000	0.060
Updated target, nested CES	9,417	43.1	7.8	0.000	0.066
B. Largest 100 baseline downward resets					
Fixed target	100	100.0	79.0	0.122	6.771
Updated own target	100	100.0	90.0	1.117	25.173
Updated target, nested CES	100	100.0	90.0	1.211	26.049

Notes: A reset reduces the treated firm's actual markup to its observed or revenue updated benchmark, holding every fixed cost in euros and every rival's actual markup fixed. Sector expenditure is fixed in the first two rows of each panel; nested CES updates sector expenditure at $\eta = 0.90$ with total nominal expenditure fixed. All use the baseline DKM sector elasticities and fixed fallback. "Any" counts interventions causing a previously nonloss making model rival to lose money; the next column requires a new loss exceeding one percent of that rival's initial sales. Numerical losses below 10^{-10} of initial firm sales are ignored. Rivals are defined by NACE two digit model sectors, not independently verified product markets. The deficit sums the new rival shortfalls within each separate intervention and divides by total initial sample revenue, in basis points (bp); quantiles include interventions with zero deficits. This is not a welfare loss or the cost of a modeled subsidy program. Deficits across separate interventions are not added. Panel B fixes the treated firms to the largest 100 baseline downward effects, not each alternative's own top 100.

None of the treated firms incurs a loss under the three closures in the table. Updating its own benchmark enforces break even at its new sales; the lower target can nevertheless remove more revenue from rivals. With fixed sector expenditure, new rival losses can arise even though every rival's updated benchmark remains finite. The all rival accounting rebasing has the same actual markups and revenues as the own updated calculation, hence the same financial consequences. These diagnostics do not impose joint financial sustainability. Short run losses need not cause immediate exit when fixed costs are sunk, and small financial deficits do not bound the error in a welfare counterfactual.

A constraint preventing new losses. Consider instead the largest downward move that does not turn an initially nonloss making firm into a loss making firm. Let $\mathcal{V}_0 =$

$\{j : (1 - 1/\mu_j)R_j - F_j^+ \geq 0\}$ and consider firm k with $\mu_k > \mu_k^B$. All firms remain in CES demand, including those outside $\mathcal{V}_0$; their initial losses are neither attributed to nor required to be eliminated by the intervention. Fixed costs in euros, rivals' actual markups, marginal costs and sector expenditure remain fixed. This restriction is an additional accounting constraint, not a consequence of the maintained CES model or a welfare maximizing policy.

For a candidate actual markup $m \in [m_k^0, \mu_k]$, the intended endpoint m_k^0 is either μ_k^B or the revenue updated own target from Section A.9. Define

$$\psi_k(m) = \left(\frac{\mu_k}{m}\right)^{\sigma_g - 1}, \qquad D_k(m) = 1 + \omega_{k|g}\big[\psi_k(m) - 1\big]. \tag{E.3}$$

Here $\psi_k(m)$ is the CES demand multiplier, not the price ratio m/μ_k. Own revenue is multiplied by $\psi_k(m)/D_k(m)$ and same sector rival revenue by $1/D_k(m)$. Hence a protected rival with $f_j = F_j^+/R_j > 0$ requires

$$D_k(m) \leq \frac{1 - 1/\mu_j}{f_j}, \qquad j \in \mathcal{V}_0 \cap g, \quad j \neq k. \tag{E.4}$$

Write $\overline{D}_k$ for the minimum of these bounds, with value infinity when there is no protected rival with positive fixed costs. Initially nonloss making rivals have bounds weakly above one. Since $D_k(m)$ falls as m rises, the lowest feasible markup is

$$m_k^{\mathrm{J}} = \max\left\{ m_k^0,\ \mu_k \left(\frac{\omega_{k|g}}{\overline{D}_k - 1 + \omega_{k|g}} \right)^{1/(\sigma_g - 1)} \right\}, \tag{E.5}$$

where the second term is zero if $\overline{D}_k = \infty$. This proves existence: $m = \mu_k$ leaves the initial allocation unchanged and satisfies every imposed constraint. A protected breakeven rival with positive fixed costs implies $\overline{D}_k = 1$ and rules out any reduction.

The treated firm's own profit is also nonnegative throughout the relevant interval. At the observed benchmark, its variable profit margin is f_k and its revenue weakly exceeds observed revenue. At the revenue updated endpoint, it breaks even by construction. More generally, its profit has the same sign as

$$m(1 - f_k\omega_{k|g}) - 1 - \frac{f_k(1 - \omega_{k|g})}{\mu_k^{\sigma_g - 1}} m^{\sigma_g}.$$

This expression is concave for $\sigma_g > 1$ and nonnegative at both endpoints, so it is nonnegative between them. Rivals with zero fixed costs and nonnegative initial profit cannot become loss making when revenue is scaled by a positive factor. Firms outside the sector do not change. Together these observations establish the constraint for all of $\mathcal{V}_0$. They

do not impose profitability on the remaining firms.

Table E.11: Downward markup reductions subject to no new model losses, 2024

	Full target reached (%)			
Intended endpoint	All downward resets	Baseline top 100	Median move in top 100 (%)	Top 100 overlap
Observed benchmark	71.7	0.0	12.5	54
Revenue updated own target	57.6	0.0	8.2	54

Notes: Each row evaluates 9,417 separate downward resets with all 12,708 analysis firms retained in CES demand and the baseline DKM sector elasticities and fixed fallback. The constraint protects initially nonloss making model firms; 3,290 firms with initial model losses remain unconstrained. Numerical zero is an initial model profit within 10^{-10} of initial revenue. Fixed costs, rival actual markups and sector expenditure remain fixed. The median achieved move is $100 \log(\mu_k/m_k^{\mathrm{J}})/\log(\mu_k/m_k^{0})$ among the original 100 largest baseline downward effects. Overlap compares the constrained ranking with that baseline downward top 100, not the unrestricted ranking that also allows upward resets. Both constrained rankings evaluate the exact TWC holding the entire observed benchmark vector fixed; the second row changes the intended endpoint, not the TWC reference. It is therefore not the accounting rebasing exercise in (A.40). Every protected firm's counterfactual profit is checked, and TWC changes are verified by recomputing all sector shares and moments.

The distinction between small aggregate shortfalls and strict individual coverage matters most at the top. None of the baseline top 100 downward resets can reach their observed benchmarks, and the median feasible move covers 12.5 percent of the intended log markup reduction. A rival with a small positive margin can bind even when its loss would be small relative to aggregate sales. This sensitivity also depends on the maintained NACE two digit grouping, which is not an independently established product market. The exercise changes the intervention being ranked; it does not revise the baseline full reset or identify a socially optimal markup.

E.6 Additive path accounting check

The baseline finite effects do not add because each firm is reset in a different counterfactual allocation. To check whether concentration also appears under an additive rule, I compute the path allocation in Section A.6. The radial path scales all residual wedges from zero to their observed values, recomputes CES expenditure shares at every point, and integrates marginal incidence using Simpson's rule with 200 intervals.

The allocation sums to 10.030617543863 log points, compared with a 2024 aggregate TWC of 10.030617543296 log points; the difference is 5.7×10^{-10} log points. Positive allocations sum to 10.50 log points and negative allocations to -0.47 log points. The signed values therefore add to the aggregate TWC even though the positive shares plotted in Figure E.6 use positive incidence as their denominator.

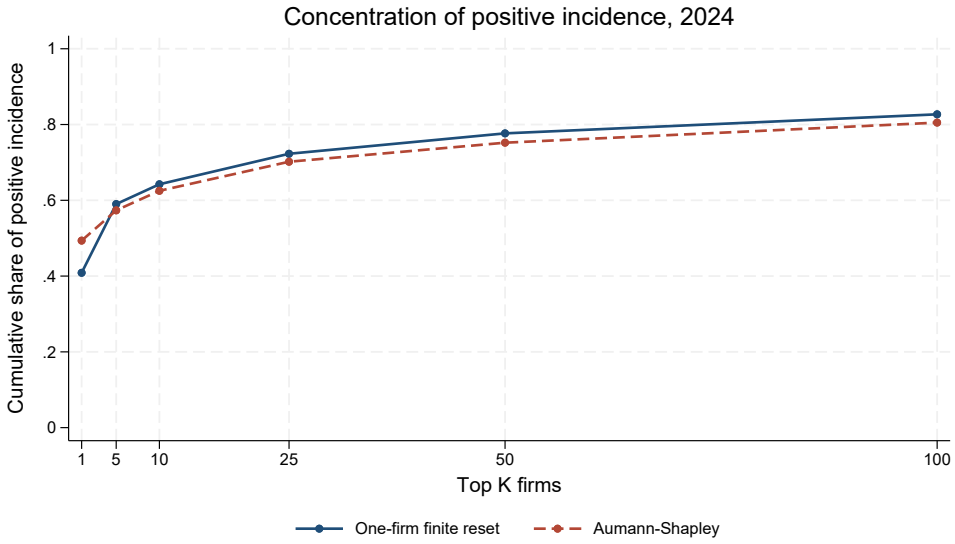


Figure E.6: Concentration under finite resets and additive path incidence, 2024. For each measure, firms with positive incidence are ordered by their own incidence value. The curves report the cumulative share of positive incidence assigned to the first K firms. The finite measure resets one firm from the observed allocation. The Aumann–Shapley measure moves all residual wedges proportionally from their benchmarks and allocates the resulting aggregate TWC along that path.

Table E.12: Finite reset and additive path incidence, 2024

Measure	Top 10 share (%)	Top 100 share (%)	Rank correlation	Top-10 overlap	Top-100 overlap
One-firm finite reset	64.2	82.7	1.000	10	100
Aumann–Shapley path allocation	62.5	80.5	0.842	9	90

Notes: Concentration shares use positive incidence as the denominator. Rank correlation is Spearman's correlation across 12,708 firms. Overlap counts firms shared with the finite-reset ranking. The finite row is the reference and therefore has correlation one and complete overlap. The Aumann–Shapley allocations sum to aggregate $\mathcal{I}$ along the specified radial path; the separate one-firm finite effects answer different counterfactuals. Because other joint paths can produce different allocations, this table is an accounting comparison rather than an alternative headline estimand. The path and adding-up identity are derived in Section A.6.

E.7 Concentration across specifications

Table E.13 compares finite reset effects under six measurement and counterfactual specifications. The top 100 account for between 66.9 and 71.6 percent of positive finite incidence in 2024, while adjacent-year retention ranges from 60.3 to 68.8 percent. Agreement about individual firms requires separate comparisons of their rankings.

Table E.13: Concentration and persistence across comparable specifications

Specification	Top-100 share (%)	Adjacent-year retention (%)
NACE 2 industry-year	71.6	63.1
Supported NACE 4	71.5	63.1
Firm-specific cost share	66.9	60.3
Nested CES, $\eta = 0.90$	70.8	64.5
Sales-adjusted target	71.2	68.4
Nested CES and sales-adjusted target	70.5	68.8

Notes: The top-100 share is the percentage of positive finite incidence accounted for by the top 100 firms in 2024. Adjacent-year retention is the percentage of top-100 firm-years whose firm remains in the top 100 in the next calendar year, conditional on being observed in that year, pooling consecutive-year transitions from 1985 to 2024. Ranks and concentration are evaluated on the same accounting-envelope candidate panel, with ranks recomputed within year; the effects retain their model-specific underlying CES demand populations. The comparison therefore does not isolate pure model changes. Every specification uses exact CES calculations; the two nested CES calculations set $\eta = 0.90$. Revenue updating changes the treated firm's fixed cost target; the final row combines both changes.

E.7.1 Concentration across years and specifications

I also report annual sensitivity comparisons over 1985–2024. Panel B of Table E.14 reports their averages over this period. Replacing the sector elasticities by common curvature $\sigma_g \equiv 6$ for all g leaves rankings comparatively close to the baseline. Raw markup wedges produce the largest aggregate TWC and the lowest rank agreement. Excluding the flagged network-related and innovation-intensive divisions lowers both the aggregate TWC and concentration but does not reorder retained firms.

The 2024 comparisons in Panel A of Table E.14 complement the paired measurement and reference comparisons in Table 6. Raw wedges answer the unadjusted dispersion question. Excluding whole divisions changes the sample but cannot reorder retained firms when their effects are rescaled by a common factor.

Table E.14: Sensitivity of finite incidence concentration

Panel A: 2024

Specification	TWC (log points)	Top 10 share (%)	Top 100 share (%)	Top 100 overlap (%)	Rank correlation
Baseline	10.03	64.2	82.7	100.0	1.00
Higher common curvature ($\sigma = 6$)	21.50	33.6	80.3	52.0	0.99
Raw markup wedge ($\mu^B = 1$)	25.51	50.2	84.0	36.0	0.28
Exclude flagged network and innovation divisions	4.06	28.1	57.4	66.0	1.00

Panel B: Annual averages, 1985–2024

Specification	TWC (log points)	Top 10 share (%)	Top 100 share (%)	Top 100 overlap (%)	Rank correlation
Baseline	4.00	42.0	75.2	100.0	1.00
Common demand curvature ($\sigma = 6$)	12.64	38.6	83.4	65.5	0.99
Raw markup wedge ($\mu^B = 1$)	15.92	39.0	83.9	38.6	0.40
Exclude flagged network and innovation divisions	3.13	37.5	72.4	78.4	1.00

Notes: Every row evaluates exact finite incidence from a full reset with CES shares updated within sectors. Concentration divides the largest positive effects by summed positive finite incidence, not by the aggregate TWC. Overlap is the percentage of the baseline top 100 also selected by each alternative. Rank correlations are Spearman correlations with the baseline on retained firms. Panel B takes the unweighted mean of each annual statistic. The raw comparison sets $\mu_i^B = 1$; the common-curvature comparison sets $\sigma_g = 6$. The final row excludes NACE 21, 35, 36, 49, 52, and 72 and normalizes expenditure on retained sectors. That restriction changes coverage but preserves the ordering of retained firms, whose effects receive the same rescaling.

E.8 Annual specification agreement and reset direction

The main annual intersection contains 73 firms among 12,654 common observations in 2024. It imposes neither a direction of reset nor observation in earlier years. Table E.15 reports its leading members with nonnegative baseline inferred fixed costs. Table E.16 reports the complete intersection and the baseline reset direction. For 24 members, both the baseline and firm cost share resets raise the markup; all have positive finite incidence under every principal specification.

For the separate question of markup reductions, restrict the 2024 candidates to firms satisfying, under every principal specification m,

$$1 \leq \mu_{it}^{B,(m)} \leq \mu_{it}^{(m)}. \tag{E.6}$$

The benchmark floor already imposes $\mu^B \geq 1$ in this application. The additional restriction therefore principally excludes firms below their benchmarks. Reranking the 9,239

eligible firms yields 76 common top 100 firms. Only 49 belong to the original annual intersection: the restriction removes 24 of its members and permits other firms to enter the reranked lists. Incidence itself is unchanged; the candidate universe, not the counterfactual economy, changes.

Table E.15: Leading firms in the annual core across three principal specifications, 2024

Legal entity	NACE sector	Sales (EUR m)	μ	μ^B	Baseline rank	Rank range across specifications
GlaxoSmithKline Biologicals	21 Pharmaceutical manufacturing	7,866.5	3.99	1.73	1	1
J.C. GENERAL SERVICES	64 Financial services	93.0	7.37	1.13	3	3–4
UCB PHARMA	46 Wholesale trade	4,211.5	2.94	1.71	4	3–4
BRUSSELS AIRPORT COMPANY	52 Warehousing; transport support	691.7	5.26	2.11	5	5–26
ARVAL BELGIUM	77 Rental and leasing	1,040.6	8.86	3.19	6	6–66
Lorelay Transport Chartering	30 Other transport equipment	146.1	3.44	1.16	8	7–8
argenx	72 Research and development	2,143.0	6.74	4.43	9	5–9
T-POWER	35 Electricity, gas and steam	74.4	10.09	1.67	11	11–35
Atlas Copco Airpower	28 Machinery and equipment	2,545.3	1.85	1.17	14	8–14
SHURGARD BELGIUM	52 Warehousing; transport support	24.6	9.29	1.59	15	15–44

Notes: The core contains 73 firms in the top 100 under every principal specification in 2024. Each row is a Belgian legal entity in unconsolidated accounts. All ranks use the common 12,654 firm sample. Sales, markups and benchmarks are 2024 baseline values. Rows are ordered by median rank, then worst rank and firm identifier, omitting firms with negative baseline inferred fixed costs. This reporting rule does not change core membership or the displayed unrestricted comparison ranks. Resets may raise or lower markups. The rank range covers the three specifications in Table 7.

Table E.16: Annual core under the three principal specifications, 2024

	Firm	NACE sector	Rank range	Reset
1	GlaxoSmithKline Biologicals	21 Pharmaceutical manufacturing	1	Down
2	OMEGA PHARMA INNOVATION & DEVELOPMENT	72 Research and development	2	Down
3	J.C. GENERAL SERVICES	64 Financial services	3–4	Down
4	UCB PHARMA	46 Wholesale trade	3–4	Down
5	BRUSSELS AIRPORT COMPANY	52 Warehousing; transport support	5–26	Down
6	ARVAL BELGIUM	77 Rental and leasing	6–66	Down
7	Lorelay Transport Chartering	30 Other transport equipment	7–8	Down
8	argenx	72 Research and development	5–9	Down
9	T-POWER	35 Electricity, gas and steam	11–35	Down

Continued on next page

Table E.16 continued

	Firm	NACE sector	Rank range	Reset
10	Atlas Copco Airpower	28 Machinery and equipment	8–14	Down
11	SHURGARD BELGIUM	52 Warehousing; transport support	15–44	Down
12	COMPAGNIE BELGE DE MANUTENTION	52 Warehousing; transport support	16–22	Down
13	MAATSCHAPPIJ VOOR HET INTERCOMMUNAAL VERVOER TE BRUSSEL	49 Land transport	6–20	Up
14	Bureau van Dijk Electronic Publishing	62 IT programming and consultancy	9–19	Down
15	SIFACO GROUP	12 Tobacco products	10–20	Down
16	STERIGENICS BELGIUM (Petit Rechain)	72 Research and development	11–21	Down
17	INTERNATIONAL CAR OPERATORS	52 Warehousing; transport support	16–23	Down
18	SAFRAN AERO BOOSTERS	30 Other transport equipment	15–24	Down
19	ABLYNX	72 Research and development	12–26	Up
20	DE VLAAMSE WATERWEG	52 Warehousing; transport support	13–29	Up
21	OPERATEUR DE TRANSPORT DE WALLONIE	49 Land transport	14–28	Up
22	B.O.E.M.M.	64 Financial services	19–31	Down
23	SEA-TANK 510	52 Warehousing; transport support	27–52	Down
24	Tog Mor Transport Chartering	30 Other transport equipment	30–38	Up
25	VLAAMSE INSTELLING VOOR TECHNOLOGISCH ONDERZOEK	72 Research and development	20–35	Up
26	KWF PAESEN	64 Financial services	30–53	Down
27	McDonalds Restaurants Belgium	82 Office and business support	17–36	Down
28	PLUXEE BELGIUM	88 Nonresidential social work	31–44	Down
29	KORIAN BELGIUM	87 Residential care	29–35	Down
30	AON BELGIUM	66 Finance and insurance support	18–37	Down
31	LIGHTHOUSE INTELLIGENCE	62 IT programming and consultancy	25–41	Up
32	Familiehulp	88 Nonresidential social work	28–55	Up
33	SEA-TANK 300	52 Warehousing; transport support	21–39	Down
34	MAGOTTEAUX INTERNATIONAL	64 Financial services	24–43	Down
35	ANTWERP EUROTERMINAL	52 Warehousing; transport support	38–77	Down
36	NLMK CLABECQ	24 Basic metals	42–50	Up
37	ASSOCIATION CHRETIENNE DES INSTITUTIONS SOCIALES ET DE SANTE	86 Human health	28–47	Up
38	AGRISTO	46 Wholesale trade	32–52	Down
39	PSA Breakbulk	52 Warehousing; transport support	47–53	Down
40	FLUXYS BELGIUM	49 Land transport	43–57	Down
41	Cerba Research	86 Human health	27–52	Up
42	IPPAS INVEST	17 Paper products	34–57	Up
43	Euronext Brussels	66 Finance and insurance support	33–55	Down
44	Worldline e-Commerce Solutions	70 Head offices; management advice	49–58	Up
45	ACCOR HOTELS BELGIUM	55 Accommodation	23–59	Down
46	HEX - RAYS	62 IT programming and consultancy	48–61	Down
47	HQ1	82 Office and business support	38–62	Down
48	DPG Media Services	62 IT programming and consultancy	58–64	Down
49	KINEPOLIS GROUP	59 Film, sound and music	37–63	Down
50	Anheuser-Busch InBev	70 Head offices; management advice	55–65	Down
51	IMMOWEB	73 Advertising and market research	51–69	Down

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Table E.16 continued

	Firm	NACE sector	Rank range	Reset
52	Ford Credit Belgium	64 Financial services	40–67	Down
53	Stellantis e-Transmissions	26 Electronics and optical products	49–69	Up
54	CENTRUM VOOR MEDISCHE ANALYSE	86 Human health	39–70	Down
55	EUROPORTS TERMINALS GENT	52 Warehousing; transport support	66–76	Down
56	VEMOD	64 Financial services	56–76	Down
57	Bayer Agriculture	20 Chemicals	46–77	Up
58	TCR INTERNATIONAL	77 Rental and leasing	45–79	Down
59	BNP Paribas Fortis Factor	64 Financial services	43–80	Down
60	IMPERIAL LOGISTICS	52 Warehousing; transport support	42–81	Up
61	STIBBE	69 Legal and accounting services	54–82	Down
62	CAUTIONNEMENT COLLECTIF DES TRAVAUX PUBLICS ET PRIVES-GEMEENSCHAPPELIJKE BORGSTELLINGEN VOOR OPENBARE EN PRIVE WERKEN	66 Finance and insurance support	65–79	Down
63	Eval Europe	46 Wholesale trade	68–87	Down
64	DELVAUX CREATEUR	47 Retail trade	61–86	Up
65	TRENDMINER	70 Head offices; management advice	80–85	Up
66	PARKWIND	71 Architecture and engineering	62–88	Up
67	SOLVAY	20 Chemicals	59–91	Up
68	Envisan	42 Civil engineering	63–93	Down
69	Drylock Technologies	70 Head offices; management advice	81–90	Down
70	Organisme national des déchets radioactifs et des matières fissiles enrichies	38 Waste and materials recovery	60–97	Up
71	DPD (BELGIUM)	49 Land transport	73–95	Up
72	Eleven Sports Network	60 Broadcasting	72–96	Up
73	BIOCARTIS	86 Human health	69–99	Up

Notes: Ranks use the common annual candidate sample. The range covers the baseline, firm cost share and nested CES specifications. Up and Down refer to the baseline markup change to its benchmark, not to the sign of incidence. Sector descriptions concern Belgian legal entities.

E.9 The persistent core under three principal specifications

The main comparison retains the NACE two digit baseline, firm cost share measurement, and nested CES with $\eta = 0.90$. All three use exact finite incidence and the EBIT based fixed cost construction. Benchmarks remain fixed within each counterfactual, including under sector substitution. Firm cost share measurement reconstructs both observed and benchmark markups before evaluating the reset. The benchmark update extensions are assessed separately in Appendix E.5 and in the extended five specification comparison below.

Before imposing a reset direction, the following comparison ranks five year average annual incidence among all balanced firms. It is distinct from the annual comparison in the main text.

Table E.17: Stability of five year average finite incidence rankings

Specification	Rank correlation	Top 100 retained	Top 100 share of positive incidence (%)
NACE 2 baseline	1.00	100	73.8
Firm cost share	0.95	84	70.5
Nested CES, $\eta = 0.90$	0.97	96	72.7

Notes: Finite effects are averaged over 2020–2024 before ranking the 9,372 firms observed in every year. Correlations are Spearman correlations with the NACE two digit baseline; retained counts firms shared by the two top 100 sets. Concentration is each specification's top 100 share of summed positive average finite effects. All rows use exact CES calculations; the nested CES row sets $\eta = 0.90$. These rows summarize overall specification stability rather than isolate one mechanism. All retain the EBIT based fixed cost construction. The external calibration and smoothed reference are not included.

The balanced panel contains 9,372 firms observed in every year from 2020 to 2024. Requiring $1 \leq \mu_{it}^{B,(m)} \leq \mu_{it}^{(m)}$ in all five years and all three principal specifications retains 4,875 firms. Incidence still measures the effect of a reset against the full annual economy; the eligibility restriction changes the candidate ranking universe only. Average incidence means the arithmetic average of the five annual effects, not incidence computed from pooled accounts. Tied effects receive their average rank.

The top 100 intersection contains 85 firms using five year average incidence and 78 using 2024 incidence. The 57 firms common to both intersections form the principal persistent core. All 57 have positive incidence in at least four of five years under every principal specification. Of these, 50 also enter each model's annual top 100 in at least three years. They account for 98.8 percent of the core's summed baseline average incidence. These annual checks use the same eligible candidate universe in each year.

Adding treated benchmark feedback and its combination with nested CES leaves the eligible universe unchanged in this data vintage, but reduces the two intersections to 55 and 49 firms and the persistent core to 35. The larger principal core therefore reflects fewer specification requirements, not additional firms in the candidate universe. The extended comparison and its separate entity applicability audit are retained in Appendix E.10.2.

Table E.18: Persistent core under the three principal specifications

	Firm	NACE sector	Five year rank range	2024 rank range
1	GlaxoSmithKline Biologicals	21 Pharmaceutical manufacturing	1	1
2	J.C. GENERAL SERVICES	64 Financial services	2	2–3
3	UCB PHARMA	46 Wholesale trade	3	2–3
4	ARVAL BELGIUM	77 Rental and leasing	5–43	4–28
5	SEA-TANK 510	52 Warehousing; transport support	6–22	15–23
6	SIFACO GROUP	12 Tobacco products	4–7	6–10
7	Bureau van Dijk Electronic Publishing	62 IT programming and consultancy	7–9	5–9
8	Atlas Copco Airpower	28 Machinery and equipment	5–10	4–6
9	STERIGENICS BELGIUM (Petit Rechain)	72 Research and development	8–11	7–11
10	PLUXEE BELGIUM	88 Nonresidential social work	12–16	14–21
11	SHURGARD BELGIUM	52 Warehousing; transport support	13–37	7–20
12	AON BELGIUM	66 Finance and insurance support	9–16	10–18
13	NOORD NATIE TERMINALS	52 Warehousing; transport support	14–78	8–43
14	Euronext Brussels	66 Finance and insurance support	10–17	16–24
15	KORIAN BELGIUM	87 Residential care	19–20	13–17
16	SEA-TANK 300	52 Warehousing; transport support	13–21	11–19
17	ASPIRAVI	35 Electricity, gas and steam	22–32	25–57
18	MAGOTTEAUX INTERNATIONAL	64 Financial services	14–24	12–20
19	IMMOWEB	73 Advertising and market research	17–27	22–27
20	FLUXYS BELGIUM	49 Land transport	23–30	20–25
21	SAFRAN AERO BOOSTERS	30 Other transport equipment	18–28	8–13
22	INTERNATIONAL CAR OPERATORS	52 Warehousing; transport support	20–29	9–12
23	CENTRUM VOOR MEDISCHE ANALYSE	86 Human health	15–30	17–28
24	BIOSTOOM OOSTENDE	35 Electricity, gas and steam	25–32	71–81
25	OOSTVLAAMS MILIEUBEHEER	38 Waste and materials recovery	26–33	40–41
26	STIBBE	69 Legal and accounting services	23–37	24–34
27	MEDISCH LABO MEDINA	86 Human health	24–42	33–48
28	SARENS	49 Land transport	39–45	53–64
29	ADVARIO STOLTHAVEN ANTWERP	52 Warehousing; transport support	36–58	30–45
30	SEA-TANK TERMINAL ANTWERP	52 Warehousing; transport support	40–50	71–87
31	BNP Paribas Fortis Factor	64 Financial services	27–47	19–33
32	COCA-COLA EUROPACIFIC PARTNERS BELGIUM	47 Retail trade	34–52	31–42
33	AGRISTO	46 Wholesale trade	36–51	15–23
34	CAPSUGEL BELGIUM	20 Chemicals	39–53	63–82
35	DANTRONIC	64 Financial services	38–58	35–47
36	BLITZ	93 Sports and recreation	50–63	76–80
37	Go4Jobs Holding	64 Financial services	47–62	59–81
38	AYANO GROUP	23 Nonmetallic mineral products	42–60	55–69
39	DUVEL MOORTGAT	11 Beverages	40–61	51–67
40	Satellic	82 Office and business support	56–63	47–51
41	Melexis Technologies	26 Electronics and optical products	48–67	29–41
42	TCR INTERNATIONAL	77 Rental and leasing	61–66	21–34
43	SD Worx People Solutions	70 Head offices; management advice	52–71	42–50
44	TotalEnergies OneTech Belgium	72 Research and development	44–72	46–71

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Table E.18 continued

	Firm	NACE sector	Five year rank range	2024 rank range
45	CAUTIONNEMENT COLLECTIF DES TRAVAUX PUBLICS ET PRIVES-GEMEENSCHAPPELIJKE BORGSTELLINGEN VOOR OPENBARE EN PRIVE WERKEN	66 Finance and insurance support	64–76	27–33
46	LUXILON INDUSTRIES	20 Chemicals	54–75	41–52
47	Clinisys	58 Publishing	53–76	48–60
48	Drylock Technologies	70 Head offices; management advice	78–85	36–38
49	Eval Europe	46 Wholesale trade	71–79	30–36
50	Liege airport	52 Warehousing; transport support	72–80	67–83
51	BELFIUS COMMERCIAL FINANCE	64 Financial services	68–86	38–50
52	FIMASER	64 Financial services	69–88	44–58
53	EG	46 Wholesale trade	75–91	61–87
54	VENHOLD	64 Financial services	74–92	32–45
55	SOFT AND INFORMATICS COMPANY	62 IT programming and consultancy	83–90	60–74
56	Envisan	42 Civil engineering	79–94	26–39
57	SWEET LOGISTICS	49 Land transport	84–99	49–62

Notes: Each range covers the baseline, firm cost share, and nested CES specifications. All ranks use the 4,875 eligible firms. Rows are ordered by median five year rank, then worst five year rank and company identifier. Sector descriptions refer to the recorded NACE classification of the Belgian legal entity. Inclusion is conditional on the common accounting reference and does not constitute independent validation of a firm's accounts.

E.10 Named firms under the extended five specification comparison

These tables distinguish overlap across specifications, persistence across years, and verification against source accounts. The downward reset comparison requires $1 \leq \mu_{it}^{B} \leq \mu_{it}$ under every included specification; it does not replace the unrestricted analysis sample. Throughout this subsection, the extended set adds treated benchmark feedback and its nested CES combination to the three principal specifications. Its persistent core contains 35 firms; the main text's 57 firm core and its complete list are reported separately in Appendix E.9.

E.10.1 Multi-year validation of named firms

An annual intersection answers whether a firm's rank is robust to model choices in one year, but it can still reflect transitory accounting movements. I therefore average each firm's finite effect over 2020–2024 before ranking it. The extended validation uses the 9,372 firms observed in all five years; an at-least-three-year sample checks that the result is not an artifact of the balanced-panel requirement. The five extended specifications are the NACE two-digit baseline, the firm-specific cost share, nested-CES substitution, the revenue-updated treated-firm benchmark, and their combination. The supported NACE four-digit assignment remains a separate pooling diagnostic because it barely changes the baseline ranks. All five extended specifications retain the EBIT based fixed cost construction; neither the external fixed input calibration nor the smoothed reference enters this intersection. All five extended specifications use exact CES calculations. This comparison cannot tell us how much each adjustment contributes to a change in rank.

Table E.19: Coverage and intersections in the multi-year named-firm validation

Coverage rule	Firms	Accounting intersection	Extended intersection	Extended union	Top-100 share range (%)
All five years	9,372	84	48	161	70.1–73.8
At least three years	13,048	79	37	174	62.8–67.0

Notes: Finite effects are averaged over the available years from 2020 through 2024 and then ranked within the indicated sample. The accounting intersection requires top-100 status under the NACE two-digit and firm-specific cost-share assignments. The extended intersection requires top-100 status under all five extended specifications; the union counts firms in at least one. The final column reports the range, across the five specifications, of the share of positive average incidence accounted for by each specification's own top 100.

Benchmark updating produces the largest change in top 100 membership. Table E.20 shows that the supported NACE four-digit assignment retains 96 baseline top-100 firms, the firm-specific cost-share model retains 84, and nested CES retains 96. The revenue-updated and combined models retain 60 and 61. Yet every specification continues to produce a concentrated distribution of incidence.

Table E.20: Five-year-average rank stability by specification

Specification	Rank correlation	Baseline top 100 retained	Top-100 share of positive incidence (%)
NACE 2 baseline	1.00	100	73.8
Supported NACE 4	0.98	96	73.5
Firm-specific cost share	0.95	84	70.5
Nested CES, $\eta = 0.90$	0.97	96	72.7
Sales-adjusted target	0.86	60	71.0
Nested CES and sales-adjusted target	0.83	61	70.1

Notes: The sample contains the 9,372 firms observed in every year from 2020 through 2024. Firm-level finite effects are averaged over the five years before ranks are computed. Rank correlations are Spearman correlations with the NACE two-digit baseline. The top-100 share is calculated using each row's own ranking and positive incidence. Every row uses exact CES formulas, with $\eta = 0.90$ in the two nested specifications. All rows retain the EBIT based fixed cost construction, so this is not a test of robustness to the external fixed input reference.

Time averaging smooths the ranking but does not mechanically reproduce the 2024 ordering. Table E.21 compares each five-year-average ranking with its 2024 counterpart on the same balanced firm universe. Top-100 overlap ranges from 62 to 78 percent, and rank correlations range from 0.74 to 0.82. Forty-eight firms lie in the top 100 under all five extended average rankings; 28 also lie in the top 100 under all five corresponding 2024 rankings.

Table E.21: Five-year-average and 2024 incidence ranks

Specification	Rank correlation	Top-100 overlap (%)
NACE 2 industry-year	0.74	64
Supported NACE 4	0.74	63
Firm-specific cost share	0.75	64
Nested CES, $\eta = 0.90$	0.75	62
Sales-adjusted target	0.82	78
Nested CES and sales-adjusted target	0.82	77

Notes: Both rankings use the same 9,372 firms observed in every year from 2020 through 2024. The first rank averages firm-level finite effects over the five years before ranking; the second uses only 2024 finite effects. Rank correlations are Spearman correlations. Top-100 overlap is the number of firms appearing in both top-100 sets.

Table E.22 reports the complete 28-firm unrestricted persistent core. Membership requires inclusion in every top 100 under the five selected specifications and both ranking

horizons, within the balanced five year sample. This intersection is not an identified set. It excludes the external fixed input calibration and the smoothed reference from its defining specification set. Rows are ordered by median five-year-average rank; * marks firms whose average observed markup is below one.

Table E.22: Unrestricted persistent core across specifications and time

Firm	NACE sector	Baseline average rank	Five-year rank range	2024 rank range
GlaxoSmithKline Biologicals	21 Basic pharmaceuticals	1	1–1	1–1
J.C. GENERAL SERVICES	64 Financial services	2	2–3	2–6
UCB PHARMA	46 Wholesale trade	3	3–4	2–9
SIFACO GROUP	12 Tobacco products	7	6–22	7–34
Bureau van Dijk Electronic Publishing	62 Computer programming and consultancy	10	9–26	6–30
Atlas Copco Airpower	28 Machinery and equipment n.e.c.	11	7–30	5–28
SEA-TANK 510	52 Warehousing and transport support	6	6–35	18–36
ARVAL BELGIUM	77 Rental and leasing	5	5–68	4–47
STERIGENICS BELGIUM (Petit Rechain)	72 Scientific research and development	12	10–16	8–15
MAATSCHAPPIJ VOOR HET INTERCOMMUNAAL VERVOER TE BRUSSEL*	49 Land transport	13	4–34	4–31
OPERATEUR DE TRANSPORT DE WALLONIE*	49 Land transport	15	11–46	11–56
PLUXEE BELGIUM	88 Social work	20	15–35	21–46
VLAAMSE INSTELLING VOOR TECHNOLOGISCH ONDERZOEK*	72 Scientific research and development	18	14–51	15–64
AON BELGIUM	66 Finance and insurance support	19	13–25	14–26
Euronext Brussels	66 Finance and insurance support	21	15–40	25–70
SEA-TANK 300	52 Warehousing and transport support	26	19–27	16–39
SHURGARD BELGIUM	52 Warehousing and transport support	16	16–56	7–31
MAGOTTEAUX INTERNATIONAL	64 Financial services	29	21–41	18–36
KORIAN BELGIUM	87 Residential care	25	24–34	21–42
ABLYNX	72 Scientific research and development	39	26–43	9–47
ASSOCIATION CHRETIENNE DES INSTITUTIONS SOCIALES ET DE SANTE*	86 Human health	32	20–84	20–86
INTERNATIONAL CAR OPERATORS	52 Warehousing and transport support	36	5–39	3–13
FLUXYS BELGIUM	49 Land transport	28	28–49	26–45
DE VLAAMSE WATERWEG*	52 Warehousing and transport support	30	12–85	10–56
Familiehulp*	88 Social work	37	17–92	18–98

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Table E.22 continued

Firm	NACE sector	Baseline average rank	Five-year rank range	2024 rank range
SAFRAN AERO BOOSTERS	30 Other transport equipment	35	28–81	12–41
ASPIRAVI	35 Electricity and gas	27	27–63	39–99
ADVARIO STOLTHAVEN ANTWERP	52 Warehousing and transport support	54	44–92	47–80

Table E.23 complements the intersection by reporting the highest-ranked baseline firms that leave at least one extended top 100. Large rank ranges can originate in the firm's markup measurement, or in the reordering of the full firm distribution under the revenue-updated benchmark. The range is therefore an audit flag, not evidence that its largest or smallest endpoint is the true rank.

Table E.23: Selected baseline top-100 firms outside the extended intersection

Firm	NACE sector	Average sales (EUR m)	Average markup	Capital cost share (%)	Own versus pooled elasticity (%)	Baseline rank	Extended rank range
ELIA ASSET	35 Electricity and gas	703	5.77	80.2	-79.7	4	4–547
NOORD NATIE TERMINALS	52 Warehousing and transport support	49	10.27	69.1	-68.5	17	7–130
ING LEASE BELGIUM	64 Financial services	107	6.57	82.4	-81.9	22	9–1089
IPPAS INVEST	17 Paper products	76	0.33	2.5	0.3	41	29–117
OOSTVLAAMS MILIEUBEHEER	38 Waste treatment and materials recovery	17	6.24	23.9	-19.6	42	41–112
Regnology FRR Belgium	62 Computer programming and consultancy	78	3.52	16.5	-16.2	43	43–124
Anheuser-Busch InBev	70 Head offices and management consultancy	1,309	3.10	11.6	-10.0	44	36–109
Bayer Agriculture	20 Chemicals	11	0.10	6.8	-4.4	45	30–126
JOHN COCKERILL DEFENSE	25 Fabricated metal products	187	1.94	5.2	-3.6	46	34–118
SEA-TANK 700 B	52 Warehousing and transport support	39	7.98	76.6	-76.5	47	17–443

Notes: Values are averages over 2020–2024 for firms observed in all five years. The elasticity column is the percentage difference between the firm-specific COGS cost share and the NACE two-digit industry-year assignment; negative values indicate a lower firm-specific elasticity. The rank range spans the five extended specifications. Firms are ordered by baseline rank.

Mechanical model-applicability flags. The annual accounts do not identify public ownership, regulatory status, or a firm's relevant product market. I therefore do not assign those attributes from company names. Table E.24 instead reports four transparent flags available in the analysis data. Network-related divisions are NACE 35, 36, 49, and 52; the innovation-intensive flag covers NACE 21 and 72. Capital intensity is flagged at the ninetieth percentile of the balanced sample. These categories overlap and are diagnostic rather than exclusion rules.

Table E.24: Model-applicability flags among highly ranked firms

Flag	Balanced sample	Baseline top 100	Five-specification core	Unrestricted persistent core
Observed markup below one	812	17	7	6
Capital cost share in sample top decile	937	49	25	16
Network-related NACE division	663	21	13	10
Pharmaceuticals or R&D	78	6	5	4

Notes: The balanced sample contains 9,372 firms observed in every year from 2020 through 2024. The five-specification core contains 48 firms; the unrestricted persistent core contains the 28 firms that also rank in every 2024 top 100. Flags are not mutually exclusive. The table does not classify public ownership or establish that every firm in a flagged division is regulated.

Observed markups below one. There cannot be a firm with both the observed and benchmark markup below one in the maintained implementation. Negative inferred fixed-cost requirements are set to zero, so $F_i^+ \geq 0$ and $\mu_i^B = [1 - F_i^+/R_i]^{-1} \geq 1$ by construction. The empirically relevant case is instead $\mu_i < 1 \leq \mu_i^B$. Using five year averages, this pattern occurs for 812 firms in the balanced sample, 17 firms in the baseline top 100, seven in the five-specification core, and six in the unrestricted persistent core.

Table E.25 reports the ten highest baseline ranks among these observations. In a year with a negative residual wedge, resetting the markup to μ_i^B raises the firm's markup. A positive average finite effect in this table is a reduction in the model's residual dispersion, not evidence of a policy gain from lowering that firm's price-cost margin. These rows are retained to keep the accounting sample and estimand common, but they should not support a literal recommendation to increase markups. The one-year ranking after excluding $\mu < 1$ observations is reported in Section E.10.3.

Table E.25: Leading firms with observed average markups below one, 2020–2024

Firm	NACE sector	Average sales (EUR m)	μ	μ^B	μ/μ^B	Average finite effect (log pt.)	Baseline rank	Extended rank range	Unrestricted core
MAATSCHAPPIJ VOOR HET INTERCOMMUNAAL VERVOER TE BRUSSEL	49 Land transport	243	0.31	1.00	0.31	0.051	13	4–34	Yes
OPERATEUR DE TRANSPORT DE WALLONIE	49 Land transport	102	0.22	1.00	0.22	0.034	15	11–46	Yes
VLAAMSE INSTELLING VOOR TECHNOLOGISCH ONDERZOEK	72 Scientific research and development	72	0.67	3.21	0.21	0.029	18	14–51	Yes
SOLVAY	20 Chemicals	79	0.27	1.00	0.27	0.022	24	18–71	No
DE VLAAMSE WATERWEG	52 Warehousing and transport support	53	0.49	2.10	0.25	0.019	30	12–85	Yes
ASSOCIATION CHRETIENNE DES INSTITUTIONS SOCIALES ET DE SANTE	86 Human health	64	0.26	1.00	0.26	0.018	32	20–84	Yes
Familiehulp	88 Social work	67	0.15	1.00	0.15	0.016	37	17–92	Yes
IPPAS INVEST	17 Paper products	76	0.33	1.00	0.33	0.014	41	29–117	No
Bayer Agriculture	20 Chemicals	11	0.10	1.00	0.10	0.012	45	30–126	No
De Werkvennootschap	68 Real estate	55	0.19	1.00	0.19	0.012	49	34–123	No

Notes: Values are averages over 2020–2024 for firms observed in all five years. Firms are selected from the baseline top 100 and ordered by baseline rank. The rank range spans the five extended specifications. The finite effect is measured in log points of the fixed cost adjusted TWC and closes the annual residual markup wedge. Each reset raises the markup when that year's markup is below its benchmark; the displayed averages do not impose the same direction in every year.

E.10.2 Downward-reset rankings

The unrestricted residual-wedge ranking includes firms for which closing the wedge raises the markup. To construct the counterpart relevant for named-firm statements about markup reductions, I require $1 \leq \mu_{it}^{B,(m)} \leq \mu_{it}^{(m)}$ in every year from 2020 through 2024 and under every extended specification m. The benchmark is the specification-specific target: the observed-sales target for the baseline and nested-CES models, the firm-specific target under the firm cost-share model, and the jointly solved target under the two revenue-updated models. I impose the condition before calculating any rank and then recompute all top-100 sets on the restricted common universe. The finite effects continue to use

the full annual accounting economy, including ineligible firms in sector shares and rival moments; the restriction changes only which firms can enter the named-firm ranking.

Table E.26 reports the resulting selection and core counts. The condition retains 4,875 firms, or 52.0 percent of the balanced sample. Fifty-five firms lie in every five-year-average top 100, 49 lie in every 2024 top 100, and 35 lie in both intersections. Twenty-one of these firms also belong to the unrestricted 28-firm persistent core. The restricted universe changes the eligible firms and their ranks, so its intersection need not be a subset of the unrestricted core.

Table E.26: Construction of the downward-reset persistent core

Selection or ranking criterion	Firms
Balanced 2020–2024 firms	9,372
Downward-reset balanced firms	4,875
Share of balanced firms retained (%)	52.0
Top 100 under all five average ranks	55
Top 100 under all five 2024 ranks	49
Persistent downward-reset core	35
Overlap with unrestricted persistent core	21

Notes: The balanced sample requires observation in every year from 2020 through 2024. A downward-reset firm additionally satisfies $1 \leq \mu_{it}^{B,(m)} \leq \mu_{it}^{(m)}$ in every year under all five extended specifications. The persistent core is the intersection of every specification's five-year-average and 2024 top 100 after ranks are recomputed on the restricted universe. The final row reports overlap with the unrestricted 28-firm persistent core.

Table E.27 shows rank correlations of 0.80–0.98 across specifications and top-100 concentration of 82.4–86.8 percent. Updating the treated firm's benchmark produces the largest reordering, but each model continues to place most positive incidence in a small set of firms.

Table E.27: Specification stability on the downward-reset sample

Specification	Rank correlation	Baseline top 100 retained	Top-100 share of positive incidence (%)
NACE 2 baseline	1.00	100	86.8
Firm-specific cost share	0.98	88	84.3
Nested CES, $\eta = 0.90$	0.97	97	86.6
Sales-adjusted target	0.84	64	82.8
Nested CES and sales-adjusted target	0.80	64	82.4

Notes: Finite effects are averaged over 2020–2024 and ranked among the 4,875 downward-reset firms. Rank correlations are Spearman correlations with the NACE two-digit baseline. "Retained" counts firms in both the baseline and indicated top 100. The last column uses each specification's own ranking and positive incidence. Nested CES uses $\eta = 0.90$.

Table E.28 compares each five-year-average rank with its 2024 counterpart on the same restricted firm universe. Rank correlations range from 0.81 to 0.89, and 69–80 firms remain in the corresponding top 100. Thus, the 35-firm core requires both specification robustness and persistence; it is not produced by the directional restriction alone.

Table E.28: Five-year-average and 2024 ranks on the downward-reset sample

Specification	Rank correlation	Top-100 overlap (%)
NACE 2 baseline	0.82	72
Firm-specific cost share	0.81	69
Nested CES, $\eta = 0.90$	0.83	72
Sales-adjusted target	0.88	80
Nested CES and sales-adjusted target	0.89	78

Notes: Both rankings use the 4,875 firms satisfying the downward-reset condition in every year and extended specification. The first rank averages finite effects over 2020–2024; the second uses 2024 outcomes. Rank correlations are Spearman correlations. Since each set contains 100 firms, the overlap count also equals the reported percentage.

Table E.29 reports the complete 35-firm intersection. The displayed markups and benchmark markups are averages from the NACE two-digit baseline; eligibility is nevertheless checked separately in every year and extended specification. This core additionally requires firms to remain highly ranked under the two specifications that update the treated firm's benchmark after sales change. It does not replace the unrestricted sample used to measure aggregate residual-wedge dispersion.

Table E.29: Persistent downward-reset core across specifications and time

Firm	NACE sector	Average sales (EUR m)	μ	μ^B	Baseline average rank	Five-year rank range	2024 rank range
GlaxoSmithKline Biologicals	21 Basic pharmaceuticals	7,058	4.10	1.97	1	1–1	1–1
J.C. GENERAL SERVICES	64 Financial services	84	8.11	1.11	2	2–2	2–5
UCB PHARMA	46 Wholesale trade	3,598	3.56	1.96	3	3–3	2–7
SIFACO GROUP	12 Tobacco products	37	5.64	1.38	7	4–18	6–25
Bureau van Dijk Electronic Publishing	62 Computer programming and consultancy	343	3.61	1.31	9	7–21	5–23
SEA-TANK 510	52 Warehousing and transport support	43	8.41	2.02	6	6–22	15–23
Atlas Copco Airpower	28 Machinery and equipment n.e.c.	2,201	1.81	1.16	10	5–25	4–21
ARVAL BELGIUM	77 Rental and leasing	755	8.43	3.61	5	5–43	4–28
STERIGENICS BELGIUM (Petit Rechain)	72 Scientific research and development	33	4.04	1.38	11	8–14	7–12
NOORD NATIE TERMINALS	52 Warehousing and transport support	49	10.27	3.21	14	6–78	3–43
AON BELGIUM	66 Finance and insurance support	259	7.13	3.03	15	9–20	10–20
PLUXEE BELGIUM	88 Social work	83	3.45	1.79	16	12–28	14–32
Euronext Brussels	66 Finance and insurance support	31	7.14	1.47	17	10–31	16–43
KORIAN BELGIUM	87 Residential care	32	6.42	2.43	20	19–27	13–30
INTERNATIONAL CAR OPERATORS	52 Warehousing and transport support	179	7.04	4.09	28	4–29	2–12
SEA-TANK 300	52 Warehousing and transport support	40	5.78	2.51	21	13–22	11–29
SHURGARD BELGIUM	52 Warehousing and transport support	21	7.12	1.58	13	13–37	7–20
MAGOTTEAUX INTERNATIONAL	64 Financial services	48	4.22	1.49	24	14–32	12–27
FLUXYS BELGIUM	49 Land transport	603	3.02	2.13	23	23–30	20–33
IMMOWEB	73 Advertising and market research	49	4.52	1.44	25	17–55	22–64
SAFRAN AERO BOOSTERS	30 Other transport equipment	636	1.53	1.14	27	18–54	8–30
CENTRUM VOOR MEDISCHE ANALYSE	86 Human health	97	3.03	1.46	29	15–52	17–62
ASPIRAVI	35 Electricity and gas	67	4.73	1.67	22	22–45	25–57
OOSTVLAAMS MILIEUBEHEER	38 Waste treatment and materials recovery	17	6.24	1.38	31	26–72	40–87

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Table E.29 continued

Firm	NACE sector	Average sales (EUR m)	μ	μ^B	Baseline average rank	Five-year rank range	2024 rank range
ADVARIO STOLTHAVEN ANTWERP	52 Warehousing and transport support	93	3.59	1.85	36	33–58	30–45
STIBBE	69 Legal and accounting services	58	8.58	2.13	35	23–79	24–66
SEA-TANK TERMINAL ANTWERP	52 Warehousing and transport support	29	5.72	2.28	40	25–50	48–87
MEDISCH LABO MEDINA	86 Human health	104	2.38	1.35	38	24–81	33–100
SARENS	49 Land transport	219	1.95	1.34	39	39–76	53–70
COCA-COLA EUROPACIFIC PARTNERS BELGIUM	47 Retail trade	1,367	1.88	1.53	47	34–98	31–86
BLITZ	93 Sports and recreation	11	5.96	2.30	63	43–63	76–92
TCR INTERNATIONAL	77 Rental and leasing	69	6.92	3.25	66	40–66	21–42
DUVEL MOORTGAT	11 Beverages	336	2.82	2.06	61	40–82	51–67
BELFIUS COMMERCIAL FINANCE	64 Financial services	38	5.41	2.91	83	22–86	11–50
FIMASER	64 Financial services	20	3.63	1.81	84	69–88	44–82

Firm-year validation of the named core. The directional restriction fixes the sign of the markup change, not the sign of its TWC effect in every year. Because incidence depends on the full sector allocation, lowering an above-benchmark markup can still raise the exact TWC in a particular model and year. I therefore audit the 35 firms using the annual finite-effect signs and ranks that underlie their five-year averages. Table E.30 reports nested criteria; none is used to redefine the headline ranking.

All 35 firms have positive finite effects in at least four of five years under every extended specification. Thirty-two also rank in the annual top 100 in at least three years under every specification, and they account for 99.5 percent of baseline incidence within the 35-firm core. The deliberately harsher requirement of a positive effect in all 25 model-year cells retains 34 firms. Requiring both an always-positive effect and annual-rank persistence retains 31 firms and 51.7 percent of core incidence. These nested diagnostics show why the core is a robustness classification rather than a claim that every annual model-specific effect has the same sign.

Table E.30: Nested validation criteria for the downward-reset persistent core

Criterion	Firms	Original top 10 retained	Share of core incidence (%)
Downward-reset persistent core	35	10	100.0
Positive in at least four of five years in every model	35	10	100.0
Positive finite effect in every model-year	34	9	52.2
At least three annual top-100 appearances in every model	32	10	99.5
Four-of-five sign and annual-rank criteria	32	10	99.5
Both sign and annual-rank criteria	31	9	51.7
Minimum markup-to-benchmark ratio at least 1.05	35	10	100.0

Notes: The first row is the 35-firm intersection in Table E.29. A model-year is one of five extended specifications in one year from 2020 through 2024. Annual-rank persistence requires at least three annual top-100 appearances under each specification. The final column sums the NACE two-digit baseline five-year-average finite effects satisfying each criterion and divides by their sum among all 35 firms. The criteria are validation diagnostics and do not alter the estimation sample or recompute the ranking.

Table E.31: Descriptive attention flags within the downward-reset persistent core

Diagnostic	Firms
Minimum $\mu/\mu^B < 1.05$	0
Minimum $\mu/\mu^B < 1.10$	1
One year supplies over 40% of a five-year effect	12
Sales coefficient of variation above 0.50	1
Annual rank envelope wider than 100 places	12
Own–pooled elasticity gap above 25 log points	12
Maximum fixed-cost recovery share above 75%	5
Five-year or 2024 rank envelope reaches 90–100	3
Fewer than three annual top-100 appearances in a model	3
Five-digit NACE code changes during 2020–2024	0
Two-digit NACE division changes during 2020–2024	0
Negative EBIT margin in at least one year	0
Nonpositive finite effect in at least one model-year	1

Notes: Each count is calculated among the 35 firms and is descriptive rather than an exclusion rule. The annual rank envelope spans all five specifications and all five years, with ranks recomputed among the 4,875 downward-reset firms. The own–pooled elasticity gap is 100 times the absolute log difference between the firm-specific COGS cost share and the NACE two-digit industry-year elasticity. A nonpositive finite effect is compatible with a downward markup reset when the reset increases the dispersion of residual wedges around the sectoral mean.

Table E.32: Firm-year validation of the downward-reset persistent core

Firm	Minimum μ/μ^B	Peak year	Largest annual effect share (%)	Minimum top-100 years	Annual rank span	Maximum own–pooled elasticity gap (log points)	Sales CV
GlaxoSmithKline Biologicals	1.13	2023	36.2	4	4,873	23.5	0.21
J.C. GENERAL SERVICES	6.55	2020	26.0	5	4	3.6	0.08
UCB PHARMA	1.67	2022	30.4	5	5	8.3	0.12
SIFACO GROUP	3.51	2021	28.5	5	20	9.6	0.07
Bureau van Dijk Electronic Publishing	1.98	2023	36.2	5	49	19.5	0.27
SEA-TANK 510	2.10	2020	60.1	5	40	118.7	0.04
Atlas Copco Airpower	1.50	2024	25.2	5	26	0.4	0.17
ARVAL BELGIUM	1.32	2024	35.1	5	63	136.4	0.26
STERIGENICS BELGIUM (Petit Rechain)	2.50	2023	29.5	5	18	11.5	0.16
NOORD NATIE TERMINALS	1.60	2024	41.9	4	101	130.2	0.14
AON BELGIUM	1.43	2022	32.0	4	157	2.3	0.41

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Table E.32 continued

Firm	Minimum μ/μ^B	Peak year	Largest annual effect share (%)	Minimum top-100 years	Annual rank span	Maximum own–pooled elasticity gap (log points)	Sales CV
PLUXEE BELGIUM	1.59	2022	23.2	5	24	6.4	0.16
Euronext Brussels	4.29	2020	30.0	5	35	2.4	0.05
KORIAN BELGIUM	1.66	2021	45.2	5	45	59.1	0.08
INTERNATIONAL CAR OPERATORS	1.28	2024	58.2	4	122	22.3	0.21
SEA-TANK 300	1.08	2023	35.4	4	2,158	28.2	0.05
SHURGARD BELGIUM	2.21	2024	41.0	5	62	85.2	0.12
MAGOTTEAUX INTERNATIONAL	2.04	2022	40.5	5	64	4.0	0.28
FLUXYS BELGIUM	1.18	2020	30.9	5	49	72.1	0.32
IMMOWEB	2.63	2021	25.6	5	53	12.7	0.11
SAFRAN AERO BOOSTERS	1.18	2024	50.6	4	149	1.2	0.31
CENTRUM VOOR MEDISCHE ANALYSE	1.92	2021	28.2	5	48	5.9	0.13
ASPIRAVI	1.38	2023	46.9	4	209	70.7	0.29
OOSTVLAAMS MILIEUBEHEER	2.86	2020	27.9	5	69	27.4	0.16
ADVARIO STOLTHAVEN ANTWERP	1.54	2021	34.2	5	50	55.4	0.04
STIBBE	3.78	2023	22.4	5	72	1.1	0.10
SEA-TANK TERMINAL ANTWERP	1.77	2020	67.1	4	123	39.1	0.15
MEDISCH LABO MEDINA	1.46	2021	39.6	4	147	4.9	0.20
SARENS	1.23	2023	38.6	5	76	20.2	0.22
COCA-COLA EUROPACIFIC PARTNERS BELGIUM	1.20	2020	25.2	3	78	3.6	0.12
BLITZ	2.24	2020	36.7	5	64	14.3	0.08
TCR INTERNATIONAL	1.25	2024	62.2	2	925	126.4	0.28
DUVEL MOORTGAT	1.28	2020	29.7	4	79	3.4	0.12
BELFIUS COMMERCIAL FINANCE	1.57	2022	49.8	2	215	2.9	0.60
FIMASER	1.52	2020	54.1	2	263	3.2	0.16

Notes: Peak year is the year of the largest baseline finite effect. The largest annual effect share is maximized across specifications and uses the sum of the firm's positive annual effects under the corresponding specification as denominator. Minimum top-100 years is the smallest number of annual top-100 appearances across the five models. The annual rank span covers all 25 model-year cells. The elasticity gap and sales coefficient of variation are also calculated over 2020–2024.

Source-verified interpretation flags. Accounting records do not identify regulatory status, ownership objectives, or the economic role of an unconsolidated legal entity. I therefore reviewed the eight core firms for which names, NACE assignments, or busi-

ness models raised a specific interpretation issue. Table E.33 records the cited activity and the reason for caution. This limited review is not a classification of the remaining firms and does not determine inclusion. It establishes, for example, that Fluxys Belgium is a tariff-regulated network operator, while Aspiravi operates in renewable electricity generation. It also identifies legal entities whose NACE division is a poor summary of current activity, including UCB Pharma, Pluxee Belgium, and Sterigenics Belgium (Petit Rechain). Regulatory status and the firm's actual activity require separate assessment before these rankings can inform policy.

Table E.33: Source-verified review of economically sensitive core firms

Firm	Externally described activity	Interpretation flag	Documentation
GlaxoSmithKline Biologicals	vaccine manufacturing and R&D	dynamic profits	source
UCB PHARMA	global biopharmaceutical activity	activity code; dynamic profits	source
STERIGENICS BELGIUM (Petit Rechain)	contract sterilization and laboratory testing	activity code	source
PLUXEE BELGIUM	employee-benefit and voucher issuance services	activity code	source
MAGOTTEAUX INTERNATIONAL	headquarters engineering and administration	activity code; legal-entity role	source
FLUXYS BELGIUM	natural-gas transmission and storage infrastructure	regulated network; government link; dynamic profits	source
ASPIRAVI	renewable electricity generation	government link	source
SARENS	crane rental heavy lifting and engineered transport	role clarification only	source

Notes: The table covers only entities selected for an external review because of a specific ex ante interpretation issue. "Activity code" means that the externally described activity is not well summarized by the paper's NACE two-digit label; it does not assert that the official registered code is erroneous. "Government link" records documented municipal or state ownership and does not classify the entity as a government agency. "Dynamic profits" marks activities for which current operating profit may be a particularly incomplete measure of fixed-cost recovery. Sources are official company, regulator, government, or industry-cluster pages, accessed July 30, 2026.

Figure D.1 plots the aggregate TWC under the baseline and the alternative that uses each firm's own cost share to calibrate the input elasticity. The firm-specific series is generally lower, consistent with part of the baseline dispersion reflecting heterogeneous input mixes. Its finite-effect ranking nevertheless has a 2024 correlation of 0.94 with the baseline, and 78 of the baseline top 100 firms remain in the top 100.

A firm-level model-applicability diagnostic. Elia Asset is retained in the 2024 analysis sample: its measured markup of 5.97 is below the annual 98.5th percentile of

13.08. It ranks eighth by baseline finite incidence in the full sample. On the matched measurement sample, its rank changes from seventh under sector pooling to 12,634 under firm cost shares, with a markup of 1.15 and negative finite incidence. This comparison concerns the mapping from accounts to economic inputs, not a finding that the reported accounts are incorrect. Its group transactions, documented in Section B.1.5, illustrate why reported accounting categories need not coincide with an economically appropriate input bundle.

Table E.34 separately recomputes every expenditure weight and sector moment after removing the electricity and gas sector, NACE 35. The exact TWC falls from 10.03 to 9.96 log points. Removing only Elia Asset instead gives 9.94 log points. These exclusions recompute the comparison distribution; they are not the firm's separate benchmark reset.

Table E.34: Aggregate sensitivity to excluding electricity and gas, 2024

Sample	Firms	Sales-weighted μ	Raw TWC	Benchmark adjusted TWC
Full analysis sample	12,708	1.46	25.51	10.03
Excluding NACE 35	12,649	1.46	24.96	9.96

Notes: Each row recomputes total and sector sales, firm and sector expenditure shares, sales-weighted markups, and both TWC measures on the stated 2024 sample. NACE 35 covers electricity, gas, steam, and air conditioning supply. The benchmark column uses firm-level fixed-cost benchmark markups.

E.10.3 Excluding markups below one

Table E.35 reports the highest-incidence firms after excluding observations with markups below one from the eligible ranking. All ten firms in the unrestricted top 10 have markups above one, so this restriction leaves their identities and ordering unchanged. This diagnostic isolates the markup restriction and retains negative inferred fixed costs. It is not the restricted reporting list in Table 4.

Table E.35: Markup restriction diagnostic, retaining negative inferred fixed costs, 2024

Rank	Firm	Sector	Sales	μ	μ^B	$100\Delta\mathcal{I}^{B,\mathrm{E}}_{i,2024}$
1	TELIX INNOVATIONS	21 Basic pharmaceuticals	320	11.97	1.34	4.933
2	GlaxoSmithKline Biologicals	21 Basic pharmaceuticals	7,867	3.99	1.73	1.358
3	OMEGA PHARMA INNOVATION & DEVELOPMENT	72 Scientific research and development	46	7.25	1.00	0.418
4	J.C. GENERAL SERVICES	64 Financial services	93	7.37	1.13	0.207
5	UCB PHARMA	46 Wholesale trade	4,211	2.94	1.71	0.207
6	BRUSSELS AIRPORT COMPANY	52 Warehousing and transport support	692	5.26	2.11	0.165
7	ARVAL BELGIUM	77 Rental and leasing	1,041	8.86	3.19	0.139
8	ELIA ASSET	35 Electricity and gas	834	5.97	2.22	0.118
9	Lorelay Transport Chartering	30 Other transport equipment	146	3.44	1.16	0.105
10	argenx	72 Scientific research and development	2,143	6.74	4.43	0.105

Notes: The table ranks firms by benchmark-adjusted finite TWC effects among observations with $\mu \geq 1$. Effects retain the full baseline demand population; only eligibility for the ranking changes. Sales are millions of euros. The incidence column reports $100\Delta\mathcal{I}^{B,\mathrm{E}}_{i,2024}$, in log points of the fixed cost adjusted TWC.