National Accounting Review

NAR, 8(4): 539–552.
DOI: 10.3934/NAR.2026022
Received: 22 May 2026
Revised: 18 September 2026
Accepted: 08 October 2026
Published: 28 October 2026

https://www.aimspress.com/journal/NAR

Research article

Expanding the input–output price equation to alternative market structures

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Abstract: The widely used Leontief price model assumes perfect competition, under which producers cannot influence prices. Despite its restrictive assumptions, it offers computational simplicity and serves as a benchmark for evaluating economy-wide price effects of technological change, making it particularly well-suited for policy analysis. In this paper, we developed an alternative calculation of input–output prices incorporating the presence of market power through the estimation of industry-specific markups and allowing for pure profits. By comparing two contrasting pricing scenarios within the input–output framework, perfect competition as a lower bound and monopoly power as an upper bound, the proposed approach expands traditional interindustry price analysis and provides a consistent input–output accounting basis for evaluating price and welfare effects across non-competitive market structures.

Keywords: economy-wide price effects; competitive pricing; monopoly pricing; markups; input–output models; national accounting

JEL Codes: C63, C67, D42, D57

1. Introduction

The Input–output (I–O) price model relies on the structure reported in I–O tables to calculate price indices for all goods and services. One of its key advantages is its ability to capture the full range of underlying interdependencies. Any change in costs at one node in the network will have repercussions throughout the system, and the I–O price model is capable of evaluating these effects at the level of commodity disaggregation in the data. This feature makes these models particularly useful as quantitative tools for policy evaluation and the assessment of systemic effects.

Within this framework, value-added accounts play a central role in the construction of the price model. In particular, most empirical I–O tables include an account labeled "Gross Operating Surplus" (GOS), which records all types of capital income. Typically, the GOS reported for each sector is interpreted as income associated with capital services, treated on par with the income received by workers for providing labor services to firms. Accordingly, just as wages are represented by the expression $w*Lab$, payments for capital services are represented by $r*Cap$, where w and r denote the unit prices of labor and capital services, respectively, and Lab and Cap represent the volume of labor and capital inputs. Because all payments to inputs and primary factors must be consistently recorded within the cost structure, a competitive pricing model, as is standard in the I–O literature, adopts the assumption that GOS$=r*Cap$, since pure profits cannot exist under perfect competition.

An alternative pricing regime emerges when firms possess some degree of market power. In this theoretical scenario, each firm (i.e., each branch in the I–O context) organizes the production of its output to maximize profits. The economic theory of monopoly is well established: Profit maximization in each branch requires setting prices such that marginal revenue equals marginal cost. When some degree of market power is present, pure profits will emerge. Nonetheless, I–O tables do not provide information about the decomposition of GOS into the portion that constitutes payments for capital services proper and the portion that represents pure profits arising from market power.

Incorporating two alternative methods for price determination, perfect competition and monopoly, would endow the I–O price model with greater flexibility and enhanced descriptive capacity by establishing a range of possible price changes, with a lower bound (competitive) and an upper bound (monopolistic). Any other market structure (e.g., oligopoly) would necessarily fall within this interval, providing a useful framework for evaluating policy-relevant pricing scenarios.

As far as we are aware, applications of I–O price models in the literature have consistently relied on the assumption of perfectly competitive markets as their sole alternative. Among the first significant contributions, Melvin (1979) examined the effects on resource allocation of an ad-valorem income tax applied to returns on capital, while McElroy et al. (1982) explored the distributional effects of variations in the prices of goods, induced by changes in the components of value-added. Other applications of the I–O price model include McKean and Taylor (1991), who studied the effects of changes in primary inputs on prices; Derrick and Scott (1993), who examined the price effects of sales taxes; Shariffy (2013), who evaluated the role of implicit subsidies in energy goods; and Villegas et al. (2024), who studied the potential impact of a tourist tax. These applications illustrate the versatility of input–output price models in analyzing economy-wide pricing effects under different policy and market scenarios.

Regarding extensions of the basic price model, still under competitive behavior, Roland-Holst and Sancho (1995) used a Social Accounting Matrix (SAM) to enlarge the underlying influence circuits and proposed a decomposition that enables the identification and measurement of their quantitative weight, whereas Cardenete et al. (2024) examined the possible reciprocal connections between prices and quantities to overcome the implicit dichotomy in the basic interindustry model. An introductory presentation of the standard competitive price model and its properties can be found in Miller and Blair (2022). Outside the competitive paradigm, the literature is extremely scarce. A notable exception is Moiseev (2025), who studied price formation under monopoly using a multisectoral model with linear demand functions and an input–output production structure. In this model, which is closer to a general equilibrium model than to an input–output setting, the level of profits is assumed to be proportional to value-added. Our modeling approach is considerably simpler than Moiseev's, as it focuses on the cost structure but does not assume a proportional relationship. Conceptually, the main contribution of this study is therefore to endogenously determine sectoral markups using constraints imposed by microeconomic theory.

In Section 2, we detail the methodology that enables the implementation of a modified price model based on monopoly power. In Section 3, we present some comparative policy-relevant insights using I–O data for the Spanish economy. In Section 4, we conclude the paper.

2. Methodology

2.1 Profit allocation

We analyze an I–O economy with *n* profit maximizing monopolistic firms, each one supplying a distinct good. As is standard in I–O analysis, we assume that production takes place under a constant-returns-to-scale (CRS) technology, so that marginal and average costs coincide (i.e., $mc_i = ac_i$).

The adaption of the I–O price model to monopoly power requires, as a preliminary step, distinguishing within the reported volume of GOS the portion that corresponds to pure profits. If this figure is available, markups can be calculated as a proportional increase above marginal costs.

To address this issue, we propose the following procedure, which, to the best of our knowledge, has not been used in the I–O literature. Profit maximization under monopoly power requires that the price elasticity of demand e_i satisfies $e_i < -1$. We recall the Hicks-Allen (1934) elasticity identity, which is stated as

$$-e_i = \sigma(1 - s_i) + s_i \tag{1}$$

In (1), σ denotes the elasticity of substitution in consumption, and s_i is the private consumption expenditure share on good *i*. On the demand side, since the available input–output data describe a single consumption vector, we assume that the elasticity of substitution is constant and corresponds to that of a single representative agent with homothetic preferences.

From (1), it is straightforward to verify that $e_i < -1$ if and only if $\sigma > 1$. Assuming $\sigma > 1$ ensures that the monopolist operates on the elastic portion of the demand curve, as required by economic theory. Profit maximization then implies that marginal revenue equals marginal cost:

$$p_i \left(1 + \frac{1}{e_i}\right) = mc_i \tag{2}$$

Using (1) and (2), the markup $\mu_i = (p_i - mc_i)/mc_i$ over marginal cost is given by:

$$\mu_i = \frac{-1}{1+e_i} = \frac{-1}{1-\sigma(1-s_i)-s_i} \tag{3}$$

The second equality can be rewritten as:

$$\mu_i = \frac{-1}{1-\sigma(1-s_i)-s_i} = \frac{-1}{(1-\sigma)\cdot(1-s_i)} \tag{4}$$

We can now calculate the markups partial derivatives and, recalling that $\sigma > 1$ and $0 < s_i < 1$ we find:

$$\frac{\partial \mu_i}{\partial \sigma} = \frac{1}{(\sigma-1)^2\cdot(s_i-1)} < 0 \quad \frac{\partial \mu_i}{\partial s_i} = \frac{1}{(\sigma-1)\cdot(s_i-1)^2} > 0 \tag{5}$$

Note that markups depend on the elasticity of substitution and decrease as this elasticity increases. This theoretical result aligns with intuition: The greater the ability to substitute one good for others, the less market power the producer has to influence its price. In the limit, when there is no ability to set prices above marginal cost, that is, under perfect competition, the markup is zero, corresponding to a situation in which the producer perceives an infinite price elasticity of demand. Any price increase, however small, would drive demand down to zero. On the other hand, the greater the market expenditure share of commodity *i*, the greater the markup, which signals that market dominance in sales yield higher market power for the producer.

Given a value $\sigma > 1$, we can calculate pure profits, b_i, conditional to the said value and the markup rule in (3), as:

$$b_i = \mu_i(c_i - b_i) \tag{6}$$

Here, c_i denotes total cost reported in the I–O data, prior to the profit deduction, which includes GOS. We must therefore subtract the portion corresponding to pure profits. Solving for b_i, we obtain:

$$b_i = \left(\frac{\mu_i}{1+\mu_i}\right) c_i \tag{7}$$

Profits depend on markups which, in turn, depend on the elasticity of substitution. Since the initial choice of σ is somewhat arbitrary, there is no reason to expect that the sum of all sectoral pure profits b_i will match the total profit volume $\bar{b}$ reported in other data sources (such as corporate tax returns).

We may therefore need to adjust the value of σ. To do this, note that from (3) and (7) we can express the dependency of b_i on σ as $b_i(\sigma)$. We then define the real-valued function *f*, which measures the discrepancy between reported aggregate profits $\bar{b}$ and calculated profits, given σ, as:

$$f(\sigma) = \sum_{i=1}^{n} b_i(\sigma) - \bar{b} \tag{8}$$

The value $f(\sigma)$ may be positive or negative, in which case we need to reduce the discrepancy, approaching it to zero. If σ^0 is the elasticity value initially assumed, we can adjust it to a new value σ^1 using the Newton approximation:

$$\sigma^1 = \sigma^0 - \frac{f(\sigma^0)}{f'(\sigma^0)} \tag{9}$$

Intuitively, if the sum of the recalculated profits is greater (less) than the reported value, the elasticity of substitution is increased (decreased) using Newton's adjustment ratio. For this to happen, the derivative in the denominator must be negative, which it is.

Using the chain rule for the derivative of each term $b_i(\sigma)$ in expression (8), we would have: $db_i(\sigma)/d\sigma = [db_i(\sigma)/d\mu_i(\sigma)] \cdot [d\mu_i(\sigma)/d\sigma]$. We observe from (7) that the derivative in the first bracket is positive, and from (3) that the second one is negative; hence, the product is negative.

Using the adjustment from expression (9), the markups and the new profit allocation are then recalculated and compared again to the reported level of aggregate profits. This process is repeated as needed. Newton's method generates a sequence of values that rapidly converges to a value $\tilde{\sigma}$ at which the implied markups yield an aggregate profit volume equal to the reported value (within a predefined numerical tolerance):

$$f(\tilde{\sigma}) = \sum_{i=1}^{n} b_i(\tilde{\sigma}) - \bar{b} \approx 0 \tag{10}$$

Once the elasticity of substitution is adjusted to the share data, which remains constant throughout the Newton adjustment, equations (3) and (5) determine the compatible markups on costs and profit levels by branch, respectively.

2.2 Price model with market power

The Leontief price model is conceptually simple yet descriptively powerful. Essentially, under constant returns to scale, prices are determined on the basis of unit costs, which primarily comprise material costs and unit value-added, v_i. The latter can, in turn, be decomposed into distinct components, essentially comprising labor income, capital income, and possibly indirect taxes. Material costs capture the structure of productive interdependencies, which encompasses n^2 intersectoral linkages, where n denotes the number of industries. The simple structure of the price equation in the Leontief model can be represented as follows:

$$p_i = \sum_{j=1}^{n} a_{ji} \cdot p_j + v_i \tag{11}$$

In an I–O economy with market power, profit maximization entails that marginal revenue equals marginal cost which, under constant-returns-to-scale, coincides with unit cost. For each branch, *i*=1, 2, …, *n*, the Leontief price equation (11) can be written as[1]:

$$p_i = \left(\sum_{j=1}^{n} a_{ji} \cdot p_j + w \cdot \ell_i + r \cdot \tilde{k}_i\right) \cdot (1 + \mu_i) \tag{12}$$

In this equation (12), the technical coefficients a_{ji}, ℓ_i, and $\tilde{k}_i$ denote the intermediate input–output coefficients, the labor coefficient per unit of output and the adjusted capital services coefficient per unit of output, respectively, once calibrated profits $\tilde{b}_i = b_i(\tilde{\sigma})$ have been subtracted from the branch-level gross operating surplus.

The Leontief price equation (11), under competitive behavior, and with decomposed value-added, would read:

$$p_i = \sum_{j=1}^{n} a_{ji} \cdot p_j + w \cdot \ell_i + r \cdot k_i \tag{13}$$

Comparing versions (12) and (13) of the Leontief price equation, we can decompose GOS using calibrated profits $\tilde{b}_i$ to obtain capital services:

$$p_i = \sum_{j=1}^{n} a_{ji} \cdot p_j + w \cdot \ell_i + r \cdot \tilde{k}_i + \tilde{b}_i \tag{14}$$

Under CRS we can, without loss of generality, consider c_i to be accounting cost per unit of output so that $c_i = p_i$. Using equation (7), we would obtain:

$$p_i = \sum_{j=1}^{n} a_{ji} \cdot p_j + w \cdot \ell_i + r \cdot \tilde{k}_i + \left(\frac{\mu_i}{1+\mu_i}\right) \cdot p_i \tag{15}$$

Solving this expression for p_i gives us the above price equation (12).

It is important to emphasize that, within the standard competitive version of the I–O price equation, calculating the capital coefficient based on total operating surplus introduces a conceptual error: It treats profits as if they were a production cost. Although this approach is common and necessary from an I–O accounting perspective, it is incorrect for modeling purposes. Ultimately, profits represent a source of income, not a cost of production. As a result, the competitive prices derived from this method are systematically biased upward.

A properly specified competitive price model would, *ceteris paribus*, eliminate the influence of market power behavior, which is captured by the monopoly markups in equation (12). This can be achieved by setting all markups to zero. Doing so corrects the miscalibration of capital service costs and yields unbiased competitive prices. Additionally, these competitive prices are directly comparable to the monopoly power prices, since they share the same cost structure and differ only in terms of firms' behavior. This has the advantage of providing an upper-bound estimate of the impact of market power on prices.

[1] To simplify the notation, in equation (11) we represent an economy with no trade and no government intervention. The actual empirical model contains both aspects.

3. Data and results

To represent the economy, we use the most recent input–output data available for Spain, corresponding to the year 2021 (INE, 2025). This data is aggregated into 30 representative sectors (Table 1 displays the sectoral classification).

Markups are calibrated by solving Equation (8), using data on declared corporate income tax profits as the empirical reference (Agencia Tributaria, 2021). These reported profits are assumed to represent pure economic profits, which are subject to a distinct tax regime compared to ordinary income earned by primary factors. Capital income generated by firms that do not belong to the corporate sector is not included in the tax data. Consequently, such income is treated in the analysis as income from capital services rather than as profits.

We apply the standard unit value normalization, whereby each quantity unit in the model is assigned a value of one currency unit (Miller and Blair, 2022). In other words, the solution to equation (11) should yield unitary prices for all goods. This also serves as a consistency check: If reference prices deviate from unity, the model calibration is flawed and requires further examination.

Equation (11) is solved under two counterfactual scenarios: One with positive markups (reflecting monopoly power), and another without markups (assuming competitive behavior). In the competitive scenario, with zero markups, prices will fall below one. The difference between the two simulations estimates the impact of monopoly power relative to perfect competition, capturing all production-related economic interactions.

Let us denote the solution of Equation (11) under monopoly power as p_i^0, and under perfect competition as p_i^1. Model calibration and solution imply $p_i^0 = 1$ and $p_i^1 < 1$. From these results, we can calculate a set of economic indicators to evaluate the effects of market power on prices and welfare. For price indices, we calculate the changes in the Consumer Price index (CPI) and in the Industrial Price index (IPI):

$$\Delta\text{CPI} = \sum_j (p_j^0 - p_j^1) \cdot \alpha_j^C \qquad \Delta\text{IPI} = \sum_j (p_j^0 - p_j^1) \cdot \alpha_j^I \tag{16}$$

with consumption and output shares $\alpha_j^C \geq 0$ and $\alpha_j^I \geq 0$ obtained from the I–O database. The consumption shares correspond to the previously introduced shares s_i, and the output shares are calculated using gross sectoral output.

To approximate the private welfare effects, we use the compensating variation (CV) in the Slutsky sense. For this, we use the expenditure function defined on consumption bundles instead of on utilities:

$$e(p, f) = \sum_{j=1}^{n} p_j \cdot f_j \tag{17}$$

From here:

$$\text{CV} = e(p^0, f^0) - e(p^1, f^0) \tag{18}$$

where f^0 is the benchmark consumption bundle, and p^0 and p^1 are initial (with market power) and final (competitive) prices, respectively. Notice that Slutsky's measure relies on consumption levels observed directly in the database and does not require assuming any specific utility function. We also

approximate the loss of purchasing power using the Konüs cost-of-living index, κ, similarly redefined in terms of the observed consumption bundle rather than on utility levels:

$$\kappa = \frac{e(p^1, f^0)}{e(p^0, f^0)} \tag{19}$$

Table 1. Consumption shares, calibrated markups, and differential price effects of monopoly over perfect competition.

Branches	Consumption share (%)	Markup (%)	Competitive pricing	Difference
1. Agriculture	2.766	2.946	0.940	0.060
2. Mining	0.005	8.500	0.983	0.017
3. Foodstuffs	10.646	4.781	0.904	0.096
4. Textiles and leather	2.840	4.401	0.966	0.034
5. Wood and paper products	0.629	4.304	0.911	0.089
6. Coke and petroleum	1.826	8.662	0.914	0.086
7. Chemical products	2.605	4.391	0.938	0.062
8. Metal products	0.108	4.282	0.922	0.078
9. Electronic and precision products	1.372	4.336	0.965	0.035
10. Machinery and vehicles	2.952	4.406	0.942	0.058
11. Other manufactures	1.600	4.346	0.952	0.048
12. Repair services	0.053	7.718	0.885	0.115
13. Electricity and gas	3.508	8.818	0.869	0.131
14. Water	0.565	8.549	0.866	0.134
15. Recycling	0.489	8.542	0.874	0.126
16. Construction	0.984	4.929	0.909	0.091
17. Wholesale and retail	10.166	8.608	0.881	0.119
18. Transportation	2.386	7.907	0.861	0.139
19. Telecommunications and postal	2.188	6.928	0.904	0.096
20. Hospitality	12.266	3.455	0.924	0.076
21. Entertainment	0.648	3.060	0.943	0.057
22. Financial services	5.332	28.288	0.714	0.286
23. Real estate services and rentals	19.814	6.078	0.921	0.079
24. Professional services	0.412	3.668	0.930	0.070
25. Commercial services	1.072	3.692	0.929	0.071
26. Public services	0.129	1.393	0.963	0.037
27. Education	1.797	1.416	0.973	0.027
28. Health services	3.236	1.436	0.959	0.041
29. Recreational services	4.006	3.165	0.930	0.070
30. Personal services	3.598	3.152	0.955	0.045

Source: Own elaboration.

A positive CV indicates the welfare gain that would result if monopoly power were eliminated. For a relative reference point, we measure it against the initial Gross Domestic Product (GDP)

derived from the I–O database. Similarly, a Konüs index value below 1 reflects the loss in purchasing power caused by market power.

In Table 1, we also present the price indices for the 30 I–O branches under the assumption that all markups are removed and perfect competition prevails. For simplicity, we omit the unit-calibrated prices under monopoly. The differences can be interpreted as the percentage decreases in prices that would occur if monopoly power were dismantled.

Some sectors show substantial differences between the two pricing scenarios. For instance, Financial services (22) has a competitive price, which is about 71 percent of the monopoly price, representing an almost 29 percent reduction. At the other extreme, Mining (2) shows a competitive price of about 98 percent of the monopoly level; barely 2 percent lower than under monopolistic pricing.

When grouping sectors into broader categories, three distinct patterns emerge:

1 Sectors with prices very close to the monopoly level (≥95 percent) include Mining (2), Textiles and leather (4), Electronic and precision products (9), Other manufactures (11), Public services (26), Education (27), Health services (28), and Personal services (30). These, predominantly industrial or public services, appear less sensitive to competition**,** with minimal price reductions, which may reflect differences in sector-specific cost structures or market conditions that are not explicitly identified within the model. This indicates that economic policy interventions might target market structures by fostering greater competition or implementing regulatory measures aimed at addressing market concentration, enhancing efficiency, and lowering prices, particularly in public services where social welfare considerations are essential.

2 Sectors with moderate price reductions (90–94 percent) include Agriculture (1), Foodstuffs (3), Wood and paper products (5), Coke and petroleum (6), Chemical products (7), Metal products (8), Machinery and vehicles (10), Construction (16), Telecommunications and postal (19), Hospitality (20), Entertainment (21), Real estate services and rentals (23), Professional services (24), Commercial services (25), and Recreational services (29). These sectors experience reductions that indicate partial competitiveness, likely due to some market power or entry barriers.

3 Sectors with substantial price reductions (<90 percent) include Repair services (12), Electricity and gas (13), Water (14), Recycling (15), Wholesale and retail (17), Transportation (18), and especially, Financial services (22). These sectors experience reductions ranging from 12 percent to 29 percent**,** showing that competition significantly lowers prices, particularly in financial and certain utility markets when compared with a monopolistic scenario.

The effect of competition on prices is summarized by the mean and median of competitive prices relative to the monopoly benchmark. The mean reflects the overall magnitude of price reductions across sectors, capturing the aggregate impact of competition relative to monopoly. The median, by contrast, represents the typical sector and reduces the influence of extreme observations.

In our dataset, the average competitive price is 91.72 percent of the monopoly price, indicating an overall reduction of roughly 8.28 percent, while the median competitive price is 92.64 percent, or 7.36 percent lower than under monopoly. Reporting both measures provides a balanced perspective: The mean highlights the aggregate effect of competition, whereas the median offers insight into the sector most representative of the general trend. Figure 1 presents the ranked price index results, highlighting sectoral heterogeneity under alternative market structures.

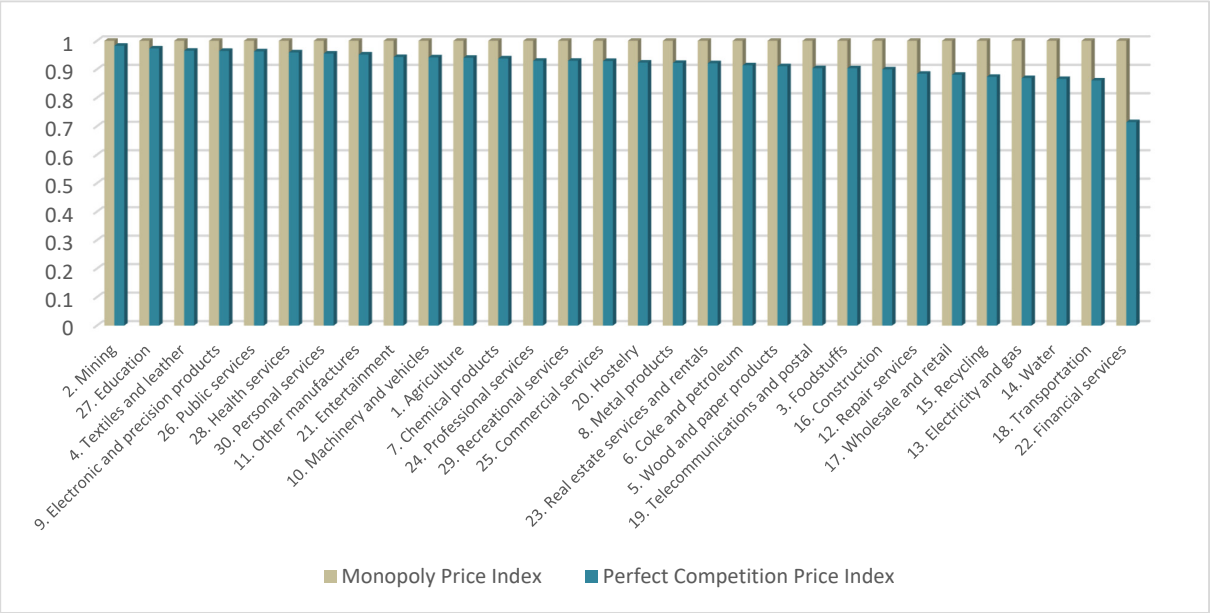


Figure 1. Sectoral price indices ranked under monopoly power versus perfect competition. Source: Own elaboration.

Table 2. Price and welfare effects of monopoly market power.

Indicators	Monopoly	Perfect competition	Differential effect
CPI	1.000	0.921	0.079
IPI	1.000	0.899	0.101
Compensating variation	-	-	0.050
Konüs index	-	-	0.908

Source: Own elaboration.

Table 2 reports on the aggregate price and welfare effects. The CPI measures the cost of a representative basket of final goods and services under monopoly and perfect competition. In this setting, the CPI under perfect competition equals 0.921 relative to the monopolistic benchmark of 1, implying that consumer prices would be almost 8 percent lower in a fully competitive economy. This result indicates that market power directly raises consumer costs, reducing real purchasing power across the economy.

The IPI measures the weighted average prices of intermediate and, where relevant, capital goods used in production. It captures direct price changes and their propagation through production chains, thereby reflecting the cost-side burden of monopoly pricing. Under perfect competition, the IPI equals 0.899; around 10 percent below the monopolistic level. This larger gap suggests that monopoly power distorts production inputs even more than final consumption goods, undermining cost competitiveness and amplifying downstream inflationary pressures.

Welfare effects are assessed through the compensating variation, expressed as a share of GDP. The CV value of 0.050 implies that eliminating market power would yield welfare gains equivalent

to roughly 5 percent of GDP. This quantifies the macroeconomic efficiency losses embedded in current price distortions and provides a practical benchmark for evaluating the potential benefits of pro-competitive policies.

The Konüs cost-of-living index, the ratio of the cost of achieving the same consumption bundle under monopoly and perfect competition, records a value of 0.908. This corresponds to a loss of purchasing power of approximately 9.20 percent due to monopoly-induced price increases. In other words, under competitive conditions, consumers could attain the same level of consumption with about 9 percent less expenditure.

These indicators highlight the potential macroeconomic significance of market power, revealing consistent price and welfare penalties on the production and consumption sides of the economy. They show that the input–output price model can effectively trace how distortions propagate across interdependent sectors and estimate their aggregate economic impact, providing a useful tool for analyzing the relevant effects of monopoly behavior.

Beyond static price comparison, this model offers a diagnostic framework for understanding how market structure shapes pricing behavior. By quantifying deviations from the monopolistic benchmark, it identifies where competition exerts downward pressure on prices and where structural rigidities sustain monopoly-like outcomes.

Minimal sectoral price differentials may be associated with intrinsic characteristics that are not fully captured by the model and may therefore benefit more from efficiency and innovation-oriented policies than from conventional competition enforcement. Conversely, sectors where competitive prices diverge sharply from monopolistic ones, such as finance, utilities, and transport, present opportunities for regulatory modernization and pro-competitive reform, with potentially substantial welfare gains.

More broadly, the model provides a framework for identifying where market power generates the greatest social costs and where policy interventions may be most effective. By linking sectoral market structures with measurable pricing outcomes, it bridges theoretical competition models and practical policy analysis, supporting a more evidence-based approach to market regulation and reform.

The incorporation of aggregate price and welfare indicators, such as the CPI, IPI, CV, and Konüs index, further enhances the model's analytical scope. These measures extend the analysis beyond relative price comparisons, offering first insights into the macroeconomic and welfare consequences of imperfect competition. By quantifying effects on consumer purchasing power, production costs, and aggregate efficiency, the framework provides an integrated perspective on how market power permeates the economy.

4. Concluding remarks

Monopoly and perfect competition are counterfactual assumptions frequently used in input–output analysis as alternative benchmarks for modeling price formation[2]. Ultimately, any modeling approach requires assumptions that both approximate the nature of the phenomenon under study and enable the model to be tractable. The results are therefore conditional on the modeling choices and the supporting data.

[2] Using an older terminology, we may say they represent "ideal hypotheses" (Friedman, 1953).

These two benchmark scenarios are used in this paper to characterize the range of outcomes associated with alternative market structures. The main contribution of this work is the estimation of the pure profit markups consistent with monopoly theory and at the same time aligned with available empirical data on reported corporate profits. We then compare and quantify the implications of using perfect competition as the standard framework for price and welfare analysis in I–O modeling.

It is essential to stress, once again, that the observed differences stem from two highly hypothetical scenarios and should not be interpreted as fully descriptive of actual economic behavior. The real-world functioning of an economy will necessarily lie somewhere between these two extremes. Recognizing this is crucial to avoid drawing conclusions that are not sufficiently justified.

Our numerical results indicate, for example, that the welfare difference between a competitive market and one dominated by monopoly power is approximately 5 percent of GDP. A nuanced interpretation of this figure is that eliminating all market power would improve welfare by, at most, these 5 points, thus establishing an upper bound. Similarly, the benefit for households in purchasing power under competitive conditions can reach 9.20 percent compared to the market power scenario. This estimate also represents an upper bound, as measured by the Konüs cost-of-living index. The order of magnitude of these differences is substantial, highlighting the potential harm caused by market power and supporting the case for policy-relevant interventions and regulatory reforms.

As noted, these results depend on the structure of the economy and the dataset used to calibrate the model, with 2021 serving as the reference year in our case study. However, the data ideally required for the modeling are not always available, which imposes certain limitations on the numerical results. One example is that we consider only the business profits of the corporate sector; the remaining capital income comprises an amalgam of earnings from diverse sources that are difficult to trace and categorize.

Another limitation of the analysis is behavioral, as second-order reactions in price formation are not considered. This follows from the very nature of the input–output model, in which all technical coefficients are assumed to be fixed and do not respond to price signals. For this reason, such prices are commonly referred to as accounting prices, as they indicate only the constraints imposed by the economic structure in the short run.

Even with these limitations, the version of the input–output price model proposed herein offers significant potential as a diagnostic and policy tool. It enables policymakers and researchers to evaluate welfare losses from market concentration, identify priority sectors for reform, and estimate potential gains from greater competition. Grounded in observable data, the model bridges economic theory and practice, fostering a more coherent and evidence-based approach to market regulation that balances efficiency, equity, and welfare objectives.

In summary, the model results confirm that market power generates economic distortions in prices and welfare while being able to approximate their magnitude within an input–output tool that encompasses the cost structure of the economy. By integrating alternative market structures into a unified quantitative framework, this approach contributes to the analysis of interdependent production systems and supports empirical assessments of socioeconomic outcomes for policy analysis.

Author contributions

M. Alejandro Cardenete: Conceptualization, data curation, resources, and funding acquisition.

M. Carmen Lima: Conceptualization, formal analysis, writing–original draft, visualization, validation, writing–review & editing, and funding acquisition.

Ferran Sancho: Conceptualization, methodology, formal analysis, writing–original draft, validation, writing–review & editing, and funding acquisition.

Use of AI tools declaration

The authors did not use generative AI or AI-assisted technologies in the preparation of this manuscript.

Acknowledgments

The first and second authors thank the support of the Climamodel-SEJ511 research project-Universidad Pablo de Olavide, Spain. The third author thanks the support of grants PID2023-147183NB-I00 from the Ministry of Science and Innovation of Spain; SGR2021-00194 from the Department of Universities and Research of Catalonia; and CEX2024-001476-S under the Severo Ochoa Program for Centers of Excellence in R&D awarded to the Barcelona School of Economics.

Conflict of interest

The authors declare no conflict of interest.

Data availability statement

All data is publicly available from government repositories cited in the text and methods are also referenced in the text.

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