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MARKUPS AND MARKDOWNS

Chad Syverson

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ABSTRACT

Interest in market power has recently surged among economists in many fields, well beyond its traditional home in industrial organization. This has focused empirical attention on markups, the ratios of price to marginal cost in product markets, and markdowns, the ratios of inputs' marginal products to their paid wage in factor markets. In this review, I offer a conceptual overview of both metrics and survey recent research examining them. I pay particular attention to the distinct interests that microeconomists and macroeconomists have had regarding these metrics, as well as topics that have bridged and are bridging these often distinct literatures.

Chad Syverson
University of Chicago
Booth School of Business
5807 S. Woodlawn Ave.
Chicago, IL 60637
and NBER
chad.syverson@chicagobooth.edu

A confluence of recent trends has heighted interest in market power among economists in many fields. Long a focus of industrial organization (IO), a growing body of theoretical and empirical research has pointed to market power's potential for explaining economic phenomena in many settings.

A natural focus of market power research is the markup, the ratio of price to marginal cost.[2] Markups are the most direct measure of the textbook definition of market power in product markets: a firm being able to influence the price at which it sells its product (e.g., Pindyck & Rubinfeld 2018, Goolsbee et al. 2024). Profit-maximizing firms use this ability to set price above marginal cost, that is, to set the markup above one. Besides indicating its presence, the how high the profit maximizing markup is above one measures the magnitude of market power.

Markdowns are the buy-side analog of markups, present primarily in factor markets. Markdowns reflect a firm's ability to hold the price it pays for an input below the input's marginal product. While factor market power analysis has traditionally taken a back seat to its product market sibling (modulo some famous exceptions, e.g., Robinson 1932), the past decade has seen burgeoning interest in monopsonistic behavior and its consequences. Analysis of monopsony-driven markdowns is a natural complement to monopoly-driven markups. As I discuss below, they share many theoretical implications and empirical patterns.

In this review, I organize and summarize economic research on markups and markdowns. It is worth prominently noting some disclaimers first. I mean the review to be an introductory overview of the related work. It is not—it cannot be, due to practical space constraints—a discussion of every result in all relevant studies. I choose the results and studies discussed here in the hopes of structuring an instructive and useful narrative which interested readers can use as a guide to dig deeper. Exclusion of particular findings, papers, or articles is not a sign that I view those works as unimportant or wrong. Further, the topical organization of the review is one I find useful, but it is far from the only one. Many potential common threads

[2] Closely related are the difference between price and marginal cost (often referred to as the *margin*) and the Lerner Index, the margin as a share of the price. The conversions among the three metrics are clear enough, but one must be careful when comparing them across different studies, as terminology is not completely standardized and sometimes even the labeling within a study slips.

tie together markup and markdown research. I weave with those I have found most fruitful, but readers may find others. For additional perspectives, Berry et al. (2019), Miller (2024), and Shapiro and Yurukoglu (2024) offer other reviews of the markups literature, primarily from an IO perspective. I also include occasional commentary notes that reflect my views but not necessarily those of other researchers.

The blossoming of market power research and its empirical manifestations in markups and markdowns has greatly enriched understanding across many fields. I am personally excited about this. I hope this review is not the end of readers' travels into this area but rather just a step (perhaps the first) along the way.

1. Some Useful Relationships with Markups and Markdowns

Reviewing the conceptual relationships between markups, markdowns, and various other economic objects (primitives and outcomes both) sheds light on the nature of market power and can help explain the variations in markups and markdowns we observe in the data. I discuss several such relationships in this section.

1.1. Markups, Costs, and Inflation

One markup relationship is simply an accounting identity yet nevertheless demonstrates how widespread changes in markups can influence other macroeconomic variables. Specifically, one can express a price, P, as the product of a markup μ and cost C:

$$P = \mu \cdot C$$

Under profit maximization, the cost C ought to equal marginal cost, and the markup μ should be a function of consumers' price sensitivity. However, the relationship is still quite useful and applicable even if prices are not set to maximize profits. One can define the markup μ as whatever multiplicative factor makes the relationship hold between any consistently measured price and cost (μ could be less than 1 if price is less than cost for some reason).

In growth rates, the relationship is:

$$Growth\ in\ P \approx Growth\ in\ \mu + Growth\ in\ C$$

That is, inflation equals the sum of markup growth and cost growth. I return to this when discussing some of the macroeconomic implications of markups below. This relationship is approximate but close to exact when growth rates are relatively modest.

1.2. Markups, Profit Shares, and Scale Elasticities

Another useful decomposition of the markup is virtually assumption free and therefore applies under general conditions. At the same time, it has realistically measurable implications in many types of data.

Its derivation begins by multiplying and dividing the markup, μ, by average costs:

$$\mu \equiv \frac{P}{MC} = \frac{P}{AC}\frac{AC}{MC}$$

Next, P/AC is multiplied and divided by the output quantity to rewrite it as the ratio of revenues to total costs. Further, by definition, the AC/MC ratio is the scale elasticity of the cost function (equivalently, the inverse of the elasticity of costs with respect to quantity).[3] When marginal costs are less than average costs, average costs are falling in quantity, and the scale elasticity is greater than one. If MC > AC, there are diseconomies of scale, and the scale elasticity is less than one.

We then have, using ν to denote the scale elasticity:

$$\mu = \frac{R}{TC}\nu$$

Defining pure profit's revenue share as $s_\pi \equiv (R - TC)/R$, we can rewrite the markup as:

$$\mu = \frac{1}{1 - s_\pi}\nu$$

The markup equals the inverse of one minus profits' share of revenue times the scale elasticity. As mentioned, the relationship applies under very general conditions; all that is required is differentiability of the function that relates output to costs. This function does not even need to be the standard cost function of production theory; i.e., the total cost expression

[3] For any differentiable cost function $C(Q)$, the elasticity of costs with respect to quantity is $C'(Q)(Q/C) = MC(1/AC)$. For homothetic production functions, the scale elasticity equals the returns to scale of the production function.

evaluated at the cost-minimizing factor demands. Whatever cost-quantity ties are implied by the observed production behavior apply.

This relationship should hold at the producer level—that is, the level of the entity whose choices define the cost function. It can serve as a way to measure markups or as an empirical check on markup estimates obtained using other approaches.

The right hand side of this expression is measurable in several settings. Researchers can construct reasonable approximations to profit shares from standard accounting data. Obtaining scale elasticities can be more involved, as it requires estimating the producer's production or cost function. A substantial literature serves as a guide to doing this.

If applying the relationship at more aggregate levels, one needs to recognize that the expression holds at the individual producer level, and Jensen's inequality implies the average of the producer-level markup-to-scale-elasticity ratios will not equal the analogous ratio computed in aggregate data.

Empirical implementation specifics aside, the relationship implies common ties among variations in markups and other objects of interest. For example, if producers are known to have seen substantial markup growth, either pure profit shares of income increased or the producers' scale elasticities must have risen. Likewise, one would expect observed changes in scale elasticities (or differences in the cross section) to show up in markups if profit shares were known to be constant.

The economic intuition behind what is essentially an accounting identity is as follows. Markups cause the producer's revenues to exceed its costs, at least for marginal units. This extra revenue must either lead to higher profits s_π or be used to pay off costs incurred in producing inframarginal units where average cost exceeded marginal cost. Equivalently, if the production process involves scale economies at the profit-maximizing quantity, the producer must somehow pay off the excess AC over MC (say because of fixed costs). This would not be possible if all units were sold at P = MC. A markup must be present to yield the extra revenue required to pay off those costs.

1.3. Markups and the Elasticity of Demand

One of the best-known relationships involving markups is their tie to the elasticity of demand. This arises from the price-setting problem of a profit-maximizing producer. Facing residual demand curve $q(p)$, the producer's price should conform to the following first order condition

$$q + p\frac{\partial q(p)}{\partial p} = \frac{\partial C(q)}{\partial q(p)}\frac{\partial q(p)}{\partial p}$$

where $C(q)$ is the cost function. Rearranging and recognizing that the derivative of the cost function with respect to quantity is marginal cost yields

$$\mu \equiv \frac{p}{C'(q)} = \frac{|\eta|}{|\eta| - 1}$$

where $|\eta|$ is the absolute value of the elasticity of the residual demand curve. Note that $\eta < 0$, and further, profit maximization requires the firm operate an a portion of its residual demand curve where $\eta < -1$.

This equation expresses the familiar intuition that the profit-maximizing markup falls as the residual demand curve become more elastic. Indeed, in the polar case of perfect competition where the residual demand curve is infinitely elastic, $\mu = 1$ and P = MC.

It is worth noting some points regarding this expression's generality. It assumes profit maximization, so it is not as general as the associations above. Nevertheless, given profit maximization, it applies under quite general competitive conditions. The demand curve $q(p)$ is a residual demand curve, so it embodies the demand faced by the producer conditional on the quantity choices of other firms operating in the market. It therefore applies under many potential market structures, from single-firm monopoly to monopolistic competition, to various oligopolies, to the limit case of perfect competition. It does assume the producer has only one product whose demand is affected by the chosen price, however. That is, the producer makes no substitutes or complements in the demand system. If it did, then the producer would account not just for the effect of a product's price in demand for that product, but also on demand for the producer's other products. Substitutes within the producer's portfolio would weaken the incentive to reduce price to increase quantity demanded, as some of the extra demand would be pulled from the producer's other product(s). This yields a higher markup, all else equal. Complements have the opposite effect, tending to reduce the markup on the reference good.

As discussed further below, using this relationship to measure markups requires only knowledge of the demand side of the market. In some situations, estimating producers' demand elasticities can be easier than estimating their economies of scale, as required to measure markups using the expression in the prior section. Of course, with adequate data availability, the two conditions can be used as checks on one another or combined into a single estimator.

1.4. Markups, Factor Cost Shares, and Factor Output Elasticities

Another markup relationship used recently to great empirical effect emerges from cost minimization.

For any factor X that is *flexible*—i.e., the firm can completely adjust usage to its desired level within a period, unlike fixed or quasi-fixed factors—cost minimization implies the following first order condition:

$$p_X = \lambda f_X(\cdot)$$

Here, p_X is the unit price of X, $f(\cdot)$ the production function, and $f_X(\cdot)$ the marginal product of X. The value λ is the Lagrange multiplier in the cost minimization problem, and as such is marginal cost (the derivative of the objective function with respect to the constraint). Multiplying and dividing either side by various convenient variables, recognizing that $f(\cdot)$ is output, and rearranging yields

$$\mu \equiv \frac{p}{\lambda} = \frac{\theta_X}{s_X}$$

where θ_X is the elasticity of output with respect to X, and s_X is expenditures on X expressed as a share of revenue.

One way to think about the intuition behind this relationship is that θ_X captures what output X allows the producer to make (and sell), while s_X captures what part of that revenue the firm pays to X. When revenue from sales exceeds payments to the input that yields that marginal revenue, the markup is greater than one.

Note that the above relationship is tied to the output elasticity of input X—how much output quantity increases when additional X is hired. In empirical practice, however, researchers often do not directly observe producers' output quantities, but rather revenues instead. Researchers therefore commonly replaced θ_X with the *revenue* elasticity of input X, the responsiveness of revenues to increases in X. However, Bond et al. (2021) show that this is not an innocuous proxy for the output elasticity. Indeed, profit maximization implies a pathological outcome: the ratio of X's revenue elasticity to its revenue share is always 1, regardless of the true value of the output elasticity θ_X.

To see why, denote the revenue elasticity of X as ρ_X. Then:

$$\rho_X = \frac{d}{dX}[p(q)q]\frac{X}{pq} = \frac{d}{dX}\left[p\big(f(\cdot)\big)f(\cdot)\right]\frac{X}{pf(\cdot)} = \left(\frac{|\eta|-1}{|\eta|}\right)\theta_X$$

where $|\eta|$ is the absolute value of the price elasticity of the producer's residual demand, as above. This implies the ratio of this elasticity to the revenue share of X is:

$$\frac{\rho_X}{s_X} = \left(\frac{|\eta|-1}{|\eta|}\right)\frac{\theta_X}{s_X} = \left(\frac{|\eta|-1}{|\eta|}\right)\mu$$

But by the profit-maximizing pricing condition derived above, the term in parentheses is μ^{-1}. Substituting this in, we see that $\rho_X/s_X = 1$ regardless of the output elasticity of X or for that matter the price elasticity of demand. Rather than proxying for the output-elasticity-to-cost-share ratio, the revenue-elasticity-based ratio is instead uninformative about the markup.

1.5. Markdowns

The derivations above focused on product market power and markups. Analogous relationships exist for markdowns tied to factor market power.

One of the more commonly employed is the following. Suppose a producer has monopsony power in the market for input X, reflected in the fact that it faces an upward sloping residual supply curve of X. Call this inverse residual input supply curve $w(X)$, where w is the price the producer pays for a unit of X. The producer's total expenditures on the input are $w(X)X$.

Let the producer's revenue function be $R(q)$. If the producer hires X to produce output using the production function $q = f(X)$, the first order condition for profit maximization is

$$R'(q)f'(X) = w'(X)X + w(X)$$

Denoting ε_X as the elasticity of the residual factor supply curve, some manipulation shows:

$$\frac{R'(q)f'(X)}{w(X)} = \varepsilon_X^{-1} + 1$$

The ratio of the input's marginal revenue product to its price equals one plus the inverse elasticity of residual factor supply. When the producer has monopsony power, $\varepsilon_X^{-1} > 0$, so the ratio is above one. That is, the input is paid less than its marginal product. The more factor market power the producer has, the larger the wedge between the input's marginal revenue product and its price.

Note that this wedge exists even if the producer is a price taker in the product market, in which case $R'(q)$ is constant and equals the output price. In the more general case where the producer has both product and factor market power, further manipulation shows:

$$\frac{\theta_X}{s_X}\left(1 - \frac{1}{|\eta|}\right) = \varepsilon_X^{-1} + 1$$

where the output elasticity and revenue shares of X are defined as above, as is the elasticity of demand. Equivalently,

$$(\varepsilon_X^{-1} + 1)\mu = \frac{\theta_X}{s_X}$$

This clarifies that the markup expression derived in Section 1.4 is actually for the special case when the firm has only product market power. When it has market power in both the product and factor markets, the combination relates to the ratio of the firm's output elasticity with respect to X and the share of revenue paid to it. The intuition is as before, but with a new role for factor market power. Some combination of a product market markup and a factor market markdown drives a wedge between what an input is paid and its contribution to production and revenue.

I use these conceptual relationships to augment my discussion of the recent literature on markups and markdowns. I organize the discussion into two broad, familiar swaths—microeconomics and macroeconomics (though as noted below there are plenty of overlaps between them). Within each broad category, I make further distinctions to aid in describing the structure of the literature.

2. Markups and Markdowns in Microeconomic Contexts

Markups and markdowns have both positive and normative implications in microeconomic contexts.

Their positive implications are summarized by my statement in the introduction: Their presence indicates market power's existence, and their size corresponds to the magnitude of that market power. Markups and markdowns summarize in a single value much about the structure of imperfectly competitive markets.

On the normative side, one implication is the deadweight loss associated with markups and markdowns. Absent the ability to perfectly price discriminate, profit maximization causes sellers with market power to deliberately forgo opportunities to sell units of output that cost less to produce than consumers' willingness to pay. These units would yield social surplus if sold and consumed, yet firms with market power leave them unmade to avoid unprofitable reductions in the price of their inframarginal units. Generally, the amount of lost surplus increases in the markup.[4] *Buyers* with market power will choose not to hire some units of input whose marginal products are greater than their suppliers' willingness to accept. Hiring these units, while reducing profits, would otherwise yield social surplus. The lost surplus generally grows with the size of the markdown.

A second normative implication regards surplus distribution. Relative to perfectly competitive markets, imperfect competition of course allocates more surplus toward the side with greater market power. This is true regardless of the size of deadweight loss. For instance, under perfect price discrimination in output markets, even though total surplus equals that of a

[4] There can be a meta-issue in considering such welfare losses from markups in equilibrium. Producers who must pay fixed costs need to somehow recover them. If marginal costs are constant or near-constant in quantity, they will not be able to do so by selling inframarginal units at prices above marginal cost. This leaves markups for the marginal unit sold—i.e., market power—as the channel. If fixed costs are technologically immutable and more complex market-power-correction policies (subsidizing fixed costs through lump sum taxes) are not feasible, the deadweight loss of markups might be practically inescapable in some markets.

perfectly competitive market, sellers obtain all surplus. Thus market power affects total welfare under non-egalitarian social welfare functions, even aside from any deadweight loss.

Industrial organization is the field of economics most concerned with markups, a natural consequence of its focus on firms' market power and imperfect competition. Markdowns had received less attention until recent years, when an IO literature on factor market monopsony began growing (e.g., Alviarez et al. 2023, Rubens 2023). Outside IO, other micro-oriented fields (or parts of fields) seeing recent efforts to investigate markups' are markdowns' implications include, among others, labor (e.g, Azar et al. 2019, Manning 2021, Yeh et al. 2022), trade (e.g., De Loecker et al. 2016, Feenstra & Weinstein 2017, Chen & Juvenal 2022, Fitzgerald et al. 2023), finance (e.g., Wei Dou & Ji 2021, Meinen & Soares 2022) and environmental economics (e.g., Pless & van Benthem 2019, Kellogg & Reguant 2021, Hausman 2024).

2.1. Measurement of Markups and Markdowns in Microeconomic Contexts

A conceptually natural approach to measuring markups would involve direct measurement of price and marginal costs. This is rare, however. While prices are often observed, marginal costs very seldom are. Marginal costs are often complex functions of input purchases and input prices, and they typically include even harder-to-measure shadow costs. Moreover, it is also rare to separately observe purchased input quantities and their prices in standard micro-level production data. Usually only their product, expenditures on inputs, is available, exacerbating the difficulties of direct markup measurement.

Researchers instead use measurable proxies for marginal costs. These include average variable costs, which hold out greater hope of being directly observable than marginal costs. Of course, this imposes the perhaps incorrect assumption that average variable cost equals marginal cost across all quantities. Alternatively, the researcher might attempt to estimate the producer's cost curve and take the derivative at the observed quantity. In that case the difficulty is the econometric hurdle created by the simultaneity of productivity and the firm's quantity choice.

Similar difficulties exist in measuring factor market markdowns. Direct measurement is no easier; one can typically observe the factor's price but not its marginal revenue product. An alternative strategy of estimating the production function and deriving the marginal revenue product involves its own econometric complications due to simultaneity. That said, more researchers use this approach than the product-market analog of cost function estimation, perhaps due to a well-developed and active literature on production function estimation with microdata.[5]

Given these measurement difficulties, researchers often employ other estimation approaches. For markups, the modal method applied in IO is to estimate the slope of the residual demand curve facing the firm.[6] Under profit maximization, the elasticity of this residual demand implies the markup given by the expression derived in Section 1.3 above, $\mu = |\eta|/(|\eta| + 1)$. Quantifying markups this way requires a conduct assumption (profit maximization given the estimated residual demand elasticity), but it avoids having to measure or estimate marginal costs.[7] However, regardless of actual conduct, finding a residual demand curve that is not horizontal implies the firm *has* market power. A firm that fails to maximize profits while facing downward-sloping residual demand still has market power even if it does not fully exploit it. Quantifying *the amount* of market power using the expression does assume conduct, however.

Markdown measurement can proceed analogously, through estimating residual factor supply curves and inverting the factor wage using the optimal factor payment rule under cost minimization. Again, the mere fact a firm faces upward-sloping residual factor supply implies that it has market power, irrespective of whether or how it exercises it.

Despite its common use in IO, the demand approach to markup estimation can be methodologically and data intensive, requiring detailed price and quantity data, a plausible source of exogenous variation, and a demand specification either closely matched to the setting flexible enough or to capture the relevant empirical variation in the market.

[5] Production function estimation is an involved econometric exercise and, as noted, an active area of methodological work. This literature is beyond the scope of this review, however. See De Loecker and Syverson (2021) for one overview.

[6] As with production function estimation, there is a large and busy methodological literature on demand estimation with microdata that is also beyond the scope of this review.

[7] Indeed, it is common for such studies to, having estimated the residual demand elasticity, back out and use implied marginal costs from the observed price and estimated elasticity by inverting the optimal pricing condition.

Another markup estimation method —sometimes referred to as the "production approach"—employs the relationship between a flexible input's output elasticity and payment share in Section 1.4. Researchers employing this approach combine output elasticity estimates from an estimated production function with payment shares information, typically from accounting data.

As demonstrated in Section 1.5, the production approach to markup estimation is a special case of a method that obtains the combined wedge of both product and factor market power. This lends the production approach toward markdown estimation as well. However, the ratio of the factor's elasticity to its payment share s_X identifies only the product of the factor- and product-market markdown and markup. To isolate just one wedge, a researcher must either assume the other away (effectively this is done when using the production approach to measure markups as described in the prior paragraph), or additional information needs to be brought to bear that would allow separate identification.

In some ways, the production approach is more easily applied across different market settings. The data it requires is often more abundant than demand-side data. Further, many researchers hold a notion—reasonable, in my view—that accurately estimating production functions requires less modeling effort than the equivalent for estimating demand systems. This was a major motivation behind the use of the approach by De Loecker et al. (2020) in their investigation (discussed in more detail below) of economy-wide patterns of the firm-level markup distribution.

I do not view any one approach to markup or markdown estimation as strictly dominating another. Ultimately the better choice will be context specific. For one, as just noted, they use different kinds of data. Demand estimation does not even require cost information (the connection to costs comes completely through the profit-maximizing pricing structure assumption), while the production approach requires no demand-related information other than the quantity produced. Beyond this, the various approaches have different empirical modeling structures, need diverse kinds of instruments, and are vulnerable to different potential biases.

Ties to Pass Through. It is worth briefly noting the connections among markups, markdowns, and a related but distinct metric sometimes used in the market power literature: pass through.

In product markets, pass through is how much output prices change when marginal costs shift exogenously. Under perfect competition, the markup and pass through for a cost change at a particular firm are zero (that is, change in the producer's marginal cost has no effect on the market price; it serves only to change the optimal quantity produced). On the other hand, in imperfectly competitive markets where the residual demand curve has a constant elasticity η, both the markup and pass through are constant and equal to $|\eta|/(|\eta|-1)$. These examples aside, markups and pass through generally do not move in lockstep. For example, if the (fixed) residual demand curve is linear and marginal costs are constant, pass through is always one-half (i.e., half of a change in cost is passed through into the profit-maximizing price), but the markup depends on the particular quantity where the firm's marginal revenue equals its marginal cost and can vary greatly.

In factor markets, pass through describes how changes in marginal revenue products are reflected in factor prices. As with product markets, perfectly competitive factor markets have pass through of zero. Under market power, the size of pass through depends on the shape of the residual factor supply curve.

2.2. Empirical Patterns of Markups and Markdowns at the Micro Level

It is impossible to summarize in the allotted space the thousands of studies that have estimated micro-level markups. This enormous literature stretches across multiple fields and hundreds of research questions, whether motivated by interest in markups per se or their implications for various aspects of firm behavior. For parsimony's sake I simply relay some overarching patterns found in the data.

Probably the most ubiquitous result is that product-market markups are typically nonzero. That is, perfectly competitive product markets are empirically quite rare.

Additionally, research has made clear that referring to "the markup" as a singular value is wholly unwarranted. Markups' sizes vary extensively across products; some markets are much more competitive than others. Researchers have found many different institutional and behavioral features that explain markup variation, though which particular features vary notably across settings. Given the inherent differences in such features across market settings, markup variation is perhaps viewed as obvious and unsurprising among most micro researchers. As described below, however, markup variation has taken on an important role in macroeconomic views of markups.

The considerably smaller and more recent markdown estimation literature has found similar patterns of mostly nonzero and variable markdowns. Broad-based estimates of factor market power, especially in labor markets—Dube et al. (2020), Sokolova & Sorensen (2021), Azar et al. (2022), and Yeh et al. (2022), for instance—indicate firms hold broad-based market power over their current and potential employees. That said, nonzero markdowns in factor markets are perhaps not quite as ubiquitous as nonzero product markups (see, e.g., the mixed evidence on imperfect competition in academic labor markets in Goolsbee & Syverson 2023).

Empirically measured factor market power has tended to covary with influences that limit substitutability between buyers. These include switching costs, differentiated buyers, and search and other information frictions, analogously to the many influences limiting output substitutability and creating product market power.

2.3. Bridges between Micro and Macro

At least three lines of research that use micro data for markup estimation nevertheless speak strongly toward macro-related issues. I describe those here to segue into a discussion of markups in a macroeconomic context.

Markup Distribution across Firms. Much of the work on the firm-level markup distribution was spurred by De Loecker et al. (2020). They employ the production approach to estimate the moments of the markup distribution going back several decades. Their results indicate the average markup among US firms increased from 1.21 to 1.61 between 1980 and 2016. This mean growth primarily reflects increases in the upper portions of the distribution. The median markup was essentially flat over the period, but the 75th percentile rose from about 1.25 to 1.5, and the 90th percentile shot up from 1.5 to 2.5. De Loecker & Eeckhout (2021) find echoes of these results in other economies. These results have generated copious discussion and much follow-on work, some each both supporting and controverting these results. I discuss this more in the following section.

Miller (2024) explores the micro-macro bridge explicitly in light of the De Loecker et al. (2020) results. After discussing some of the methodological concerns raised in the literature about the production approach (I summarize some of these below as well), he works systematically through the industrial organization literature for case studies that, combined, can shed light on patterns in average markups. He notes researchers have found considerable variation in markup trends across markets, and based on this infers it is hard to interpret a general tendency towards increasing markups from the totality of case studies alone. He does suggest one common theme to the various results, however, and that is the observed trends in costs, markups, and prices across the very different settings nonetheless have a common underlying driving factor sourced in technological change. The particular way technological change manifests itself in these markets differs, however.

Trajectories of Product-Level Markups. A second set of micro-to-macro markup-related research involves trajectories of product-specific markups over time. There has in general been increasing interest in the literature to the roles that product growth and expansion has in firm expansion, and product-level markup dynamics are one component of this work.

For example, Fitzgerald et al. (2023) demonstrate in customs data for Irish exporters that successful new export market entry leads to growth in quantities sold but not markups. Estimates from an empirical model of market entry and growth imply expansion of the firm's customer base is sensitive to marketing expenditures but not past sales in the market. This gives little incentive for firms to grow by initially pricing low to build future sales and increase the markup later to harvest profits from the larger base (as embodied in the structure of Foster et al. 2016 for instance). Instead, the properties of demand incentivize firms to conduct marketing efforts that ultimately shift out the demand curve without steepening it. Argente et al. (2024) find a similar qualitative pattern in the different setting of the consumer food sector. Instead of trying to manipulate markups to grow, successful entrants engage in constant-markup expansion by raising product availability along the extensive margin, both across geographic markets and across stores within those markets. These expansions are sometimes supported by marketing efforts that, again, appear to shift out demand without steepening it.

Markups, Markdowns, and Misallocation. A large literature has explored how misallocations at the micro level reduce aggregate (industry- or economy-level) productivity.[8] Misallocations are across-producer variations in inputs' marginal revenue products that result from various market distortions and frictions. Misallocations imply that producers whose inputs have relatively low marginal products are too large relative to their social optimum, while at the same time those having inputs with relatively high marginal products are too small. Under such conditions, total output could be increased without any growth in aggregate inputs, if one were to reallocate inputs from low-marginal-product to high-marginal-product producers. In short, misallocations hurt productivity.

A more precise way to define misallocations is that they are variations in the wedges between inputs' marginal revenues and marginal costs. Stated this way, it is clear how across-producer variations in markups or markdowns, which by definition are wedges between marginal revenues and marginal costs, reflect misallocations. This highlights a welfare cost of market power distinct from the deadweight loss of markups and markdowns noted above. If all producers had the *same* markup or markdown, this would create deadweight loss, but there would be no misallocation because the wedge is the same for all producers. The presence of *different* markups and markdowns across producers is what leads to productivity and welfare losses from misallocation.[9]

[8] This includes foundational work like Restuccia & Rogerson (2008) and Hsieh & Klenow (2009), the overview of Hopenhayn (2014), and more recent studies such as Asker et al. (2019); Baqaee & Farhi (2020); Gollin & Udry (2021); and Bloom et al. (2022).

[9] An example of how this can play out is in Boar & Midrigan (2024). Their structure implies markup-based misallocation actually makes the social planner want to make industries more concentrated. In their model, market shares under misallocation are too diffuse, because markups (and hence marginal-revenue-to-marginal-cost gaps) increase with size. This leads the social planner to want to make large firms still bigger, allowing diminishing marginal revenue and/or increasing marginal cost to shrink their wedge. Smaller, lower-wedge firms lose share, increasing their wedges, but reducing the overall wedge variance and hence welfare losses from misallocation.

Given the empirical ubiquity of varying markups and markdowns across and within markets, it is fair to surmise that they are a source of welfare losses due to misallocation, not just the traditional deadweight loss. In contrast to many microeconomists' views that markup and markdown dispersion is a remarkable but perhaps innocuous empirical fact, the misallocation literature highlights that they reflect lost productivity and welfare.

Empirical research into misallocations has largely avoided quantifying the role of markup variation, however. The literature has not yet developed a consensus as to the quantitative effect of markup/markdown-based misallocation. One reason for this gap is that the empirical workhorse of the literature, the model laid out by Hsieh & Klenow (2009), abstracts away from markup variation by assuming all producers face residual demand curves with a common elasticity. Some recent work has moved away from this assumption. See, for example, Haltiwanger et al. (2018); David & Venkateswaran (2019); Weinberger (2020); Brooks et al. (2021); and Liang (2023).

3. Markups and Markdowns in a Macro Context

Macroeconomists' interests in markups and markdowns might be separated into two categories. I discuss both in this section.

One involves their cyclical patterns. These are important because time-varying price-cost wedges can act as a shock transmission mechanism and thereby influence the qualitative and quantitative nature of business cycles. This issue has seen active inquiry for over three decades.

The second category involves attention to trends in the average level of markups. While there was some historical interest in the potential macroeconomic influence of the average amount of market power in the economy, some influential estimates indicated it was not very large.[10] However, recent empirical work using much more and better data has rekindled the

[10] Harberger (1954) was particularly important along these lines, estimating miniscule average markups within US industries. He also found very little dispersion in markups across industries, suggesting few misallocation losses as well. This view appears to have become the norm for decades, with perhaps the most serious pushback until recently coming from Hall (1988).

interest in this issue. This work has found indications of widespread markups and markdowns (and upward trends in the former).

3.1. Cyclical Patterns

A longstanding macroeconomic interest in markups has been as a shock transmission mechanism.[11] For instance, sticky-price New Keynesian structures naturally predict cyclical markups, as prices do not fully and instantaneously adjust to cost changes, and this influences the response of many aggregate outcomes to shocks. Markups' cyclical patterns have drawn research attention in this light.

In an influential piece, Rotemberg & Saloner (1986) proposed a mechanism that would create countercyclical markups. Suppose firms engaged in tacit dynamic collusion where future gains from continued cooperation relative to the current value from defecting sustained markups above the static Nash Equilibrium level. The relative value of these future gains would be countercyclical, because during temporary downturns, current values from defecting would be relatively small compared to the (post-downturn) future cooperation values. As a result, high markups would be easier to sustain in downturns. During a boom, on the other hand, current defection values would grow relative to future gains, reducing the equilibrium markup.

Despite this theoretical prediction, empirical efforts to measure markup cyclicality have yielded mixed results. Nekarda & Ramey (2021) acknowledge this inconsistency, stating "…estimating the cyclicality of the markup is one of the more challenging tasks in macroeconomics" (p. 320). They discover in their own investigation that the estimated cyclicality depends on how markups are measured. When they focus specifically on sticky-price New Keynesian models, which actually predict different cyclicalities depending on the type of shock forcing the markup changes, they find that as predicted, markups are procyclical in response to TFP shocks and countercyclical in response to investment-specific technology shocks. However, in contrast to theory, measured markups are procyclical in response to positive monetary policy shocks and government spending shocks. They suggest that sticky-

[11] This literature has focused primarily on product-market markups, but some of the effects of sticky wages in theories that posit them might be interpreted as reflecting the influence of varying labor markdowns.

wage frameworks rather than sticky-price frameworks may yield predictions more consistent with the cyclical patterns they measure.

Burstein et al. (2023) argue contradictory results on markup cyclicality may reflect compositional and aggregation effects. Imposing a nested CES demand system to allow straightforward aggregation, they show their model implies large firms have procyclical markups, while small firms have countercyclical ones. Therefore the aggregate markup's cyclicality depends on distribution of firm-level markups and expenditure shares. They find support for the model's predictions in French administrative firm-level data. Firm-level markups for smaller firms are counter-cyclical but are procyclical for the largest firms. Moreover, markups measured at a more aggregate level vary in their cyclicality depending on the level of aggregation. Thus even within a given market setting, measured markup cyclicality appears to be quite dependent on a number of factors.

3.2. Trends in the Markup and Markdown Distributions

The recent burst of attention to trends in average markups comes from two directions. One is sourced in the coincident, decades-long trends in important real macro variables such as falling productivity growth, lagging investment rates, drops in labor's share of income, and growing profit shares. The other is more contemporaneous: the post-Covid inflation acceleration. While the inflationary pattern has a shorter history than the long-running trends, they are connected in that growth in market power might explain them. I discuss the relevant research for each here.

Edmond et al. (2023) usefully summarize the three macroeconomic distortionary implications of markups.[12] First, the average markup acts as a tax on output. The wedge between marginal costs and prices creates the same type of distortion that an output tax does. This is in essence a reframing of the deadweight loss described above. Second, also as explained above, markup variance across individual producers implies productivity losses due to input misallocation. Third, markups lead to inefficient entry decisions because they create a

[12] While they focus on markups, these implications apply to markdowns as well.

misalignment between the private and social values of entry, affecting the former but not the latter.

3.2.1. Average Markups and Long-Run Trends

Some researchers had suggested that increasing market power might be a driving force behind the decades-long trends described above (e.g., Furman & Orszag 2015, Covarrubias et al. 2019, Barkai 2020, Eggertsson et al. 2021). The conversation was turbocharged by the broad-based establishment- and firm-level markup estimates of the aforementioned De Loecker et al. (2020) study (hereafter DEU). DEU offered the most direct evidence that average markups had been rising for a long time, driven primarily by increases at the highest quantiles of the distribution.

The study has been incredibly influential and spurred considerable follow-up work and policy discussions. Some researchers have critiqued the DEU empirical approach and interpretation of the results, while others have found evidence consistent with it in different settings. I summarize both of these strands of responses here.

Recall that DEU employed the method described in Section 1.4 to obtain their markup estimates. One issue raised in the responding work involves the measured variable input X. Production micro data are not collected with the objective of measuring economic markups in mind, so measurement compromises and imperfections are inevitable. DEU's core specification uses Cost of Goods Sold (COGS) in Compustat as the measure of variable input use. Traina (2018) shows the estimated markup trends are attenuated if, rather than just COGS, the *sum* of reported COGS and Sales, General, and Administrative (SG&A) costs are used instead to measure variable inputs. The revenue-weighted mean of these alternate markup estimates rise from 1980 to 2014, but considerably less. Of course, the fact that the results change is not definitive evidence that DEU's estimates are wrong. Whatever shortcomings COGS might have as a measure of variable input use, SG&A likely has its own, perhaps substantial, imperfections.

Bond et al. (2021) forwarded the derivation described in Section 1.4 as a note of general concern about using the production-based approach to markup estimation. This is because in most settings with production microdata, only revenues are available as output measures and expenditures as input measures, confounding prices and quantities. The DEU paper addresses this issue by applying additional structure to infer prices from the cross-sectional correlation between revenues and input expenditures within industries. It is also useful to remember that any bias of markup measures toward one would presumably tend to make it more difficult to find the result that markups were steadily increasing over time, unless for some reason the bias gradually weakened with the same trajectory. Further still, De Ridder et al. (2024) find that in their sample, while the level of revenue-based markup estimates is biased, they correlate highly with true markups. Moreover, their correlations with profitability and market share are similar to output-based markup estimates. In other words, not all of the markup “signal” is lost in their case, even when using estimates that are conceptually problematic.

Edmond et al. (2023) point to an aggregation issue. They demonstrate that proper aggregation of micro-level markups to an economy-wide mean involves weighting by producers’ costs rather than their revenues. They also show the difference between the two weighted averages increases with the cross-sectional dispersion in markups. DEU’s results on increasing skewness implies a growing gap between the weighted means, and indeed both Edmond et al. (2023) and DEU’s own robustness checks find this, which the cost-weighted average markup rising less than the revenue-weighted average.

Raval (2023) points out that the cost minimization assumption at the heart of the production approach implies that the output-elasticity-to-payment-share ratio in Section 1.4 should equal the markup for *any* flexible input. As there is only one product-market markup per output but many inputs, this implies a test: the ratios constructed for all flexible inputs should equal each other. Raval (2023) rejects equality in production microdata from multiple countries, finding markups estimated using labor as a flexible input are negatively correlated with those that use intermediate materials. Even restricting attention to markups computed using energy intermediates and raw material intermediates typically yields inequality. Raval posits that non-neutral productivity differences across firms may explain the results. More generally, his findings suggest caution about underlying market realities and care in interpreting ratio-based markup estimates.

Demirer (2022) picks up this thread and shows that allowing for factor-augmenting rather than factor-neutral productivity explains why two factors might have different output-elasticity-to-payment-share ratios even if there is only one markup. He constructs a method to estimate markups in a factor-augmenting-productivity environment and shows that this adjustment affects both the level and growth rates of estimated markups. In particular, he too finds that his measure of markups grow more slowly than do the DEU measures.

Hashemi et al. (2022) do not revisit the DEU results directly, but they make the point laid out in Section 1.5. Specifically, the production-based approach to markup estimation uses a relationship between an input's output elasticity, its share of revenue, and the markup that is actually a special case of a more general relationship that admits the possibility not just in the product market but in the factor market as well. This implies DEU-style markup estimates might not be solely product market markups but also incorporate factor market markdowns. A factor market wedge would still be a distortion, of course, and one related to market power at that, but both its interpretation (e.g., the implied decades-long trend in increasing market power might be in factor markets rather than labor markets), and potential policy remedies could be different.

Foster et al. (2022) show that allowing greater flexibility in the production technology, especially across subindustries, also reduces the implied upward trend in markups. Mechanically, this result would hold if elasticities θ_X tended to be lower when payment shares s_X were. If one were to incorrectly impose that θ_X were fixed across producers, say among those in a sector/industry that truly was composed by subindustries with different technologies, then subindustries with lower s_X would have a correspondingly smaller θ_X. If these subindustries with overstated markups in turn grew in relative importance within the broader industries they resided in, this would lead to a spurious upward trend in measured markups.

Albrecht & Decker (2024) note a puzzle present in two trends many researchers thought to be associated: markups and business dynamism (such as job reallocation and business formation rates). The notion was that overall market power growth may have driven the observed downward trend in dynamism. However, when they correlate markups and dynamism measures across industries, they do not find the negative correlation observed in the aggregates. Rather, industry-level markups and dynamism are positively correlated.

These critiques noted, there has also been follow-on work that found similar results to DEU in different data or through different approaches. Both Atalay et al. (2023) and Döpper et al. (2024) propose and apply a structure that allows the demand-based approach to markup estimation across a wider variety of products than typical demand-based studies do (though not as wide as the broadest production-approach-based projects). The studies use versions of Nielsen's household panel data on consumer package goods and estimate discrete choice demand systems that allow demand elasticity and hence markup estimation across an array of products. Despite the quite different approach, both studies find broadly consistent patterns with DEU. Their average revenue-weighted markups trended upward through their samples (though they are considerably shorter than DEU's). They also found substantial variation in markups for specific products both within and across markets. Interestingly, both also found an important role for reductions in marginal costs (in the face of more stable prices) in accounting for the increased markups, perhaps pointing to factor market monopsony as in Section 1.5. Atalay et al. (2023) estimate about half of the markup growth comes from decreasing marginal costs, where Döpper et al. (2024) find marginal costs' share is closer to one.

Hasenzagl & Pérez (2023) use a network production structure and Compustat data to obtain markup estimates. As with DEU, they find markups rose over the past several decades. Their measured change is smaller, with the aggregate markup rising from 1.1 to 1.23 between 1970 and 2020. Notably, they estimate that aggregate returns to scale rose from 1.00 to 1.13 over the same period. Interpreting these results in light of the expression derived in Section 1.2, greater markups should show up either as increased profits, greater returns to scale, or some combination thereof. They derive a similar condition under the more general case of fixed costs and factor market power. Working with this condition in aggregate data, they find that profit share has been a constant fraction of GDP despite the higher markups, implying the additional monopoly rents were eaten up by rising fixed costs as reflected in the greater scale elasticity.

My own view on this active literature at this writing is as follows. The methodological critiques of DEU are conceptually solid and appear to have some empirical bite. The researchers argue for corrections that have valid conceptual and theoretical bases, and when they apply them, the estimated upward trend in markups are typically attenuated from DEU's measured levels. Clearly, when applying the production method, one must be circumspect about multiple measurement specifics (e.g., revenues vs. quantities, which input is variable, aggregation weights) and interpretation (product-market markups vs. factor-market markdowns) when applying the production approach. When the data is available, the relationships between markups and other measureable elements discussed in Section 1 may offer helpful additional empirical discipline.

All that said, I am not aware of credible estimates indicating markups (or wedges more broadly) actually *declined* in the decades following 1980. Hence my view is that a quasi-Bayesian meta-interpretation of the literature is that the wedge between price and cost likely did trend upwards over the period, though probably less than the amount implied by the largest estimates. And, given the findings of recent work on monopsony, some of this wedge might be in factor markets.

It is less clear to me if the increase in average market power causally drove most or all of the macro trends of interest (falling productivity growth, lagging investment rates, etc.). Autor et al. (2020), Bessen (2020), and Crouzet & Eberly (2018) have argued in different ways, and with some evidence behind their various assertions, that these trends are not so clearly reflections of market power. More generally, the potential equilibrium connection between markups and changes in the production technology (for instance, if increases in fixed costs required higher markups to pay them, as noted above) raises the possibility that the macro trends might not be a direct consequence of market power growth, but rather, market power might be yet another trend driven by an underlying change in production technologies. Elements of the Berry et al. (2019), Miller (2024), and Shapiro and Yurukoglu (2024) surveys draw out this argument as well.

Regardless, the issue is not yet settled, and more work remains in refining and further testing the varying hypotheses. De Loecker et al. (2022) take one step toward resolution. They construct a model that allows both technology and competition to affect equilibrium market power and then show how data on business dynamism can be used to quantify the separate influence of each channel. Estimating the model using their 1980-2016 sample, they find a role for both. Technology and market structure changes over the sample raised welfare through their influences on reallocation toward higher-productivity producers (both among incumbents an entrants), but they also had countervailing welfare effects due to greater deadweight loss from market power and replication of overhead costs.

I also note that pressing further into characterizing the mechanisms that drove the observed changes seems well suited to IO's analytical tools, especially regarding its eye for institutional and market details that can influence how changes in fundamentals translate into observed outcomes.

3.2.2. Average Markups and Inflation

The spate of inflation beginning in mid-2021 introduced a separate discussion about the influence of average markups on macroeconomic outcomes. How inflation could heighten further interest in markups is apparent in the accounting decomposition in Section 1.1, which shows that inflation must reflect some combination of markup growth and cost growth. If a sufficiently large mass of firms raised markups around the same time, this could certainly explain increased inflationary pressure.

However, the same decomposition presents cost growth as an alternative source of inflation growth. Of course, it is also possible that fundamentals could drive simultaneous increases in both markups and costs. Empirical work on the topic faces the difficult task of separating inflation into markup and cost components.

A natural question raised by a markup-driven explanation for overall inflation is why a large number of firms would increase their markups with such similar timing. The basic pricing theory in Section 1.3 implies optimal markups depend on the elasticity of residual demand curves. If demand conditions do not change suddenly, and in a way that makes residual demand less elastic on average, the theory would imply no increase in the average profit-maximizing markup.

Perhaps there *was* a sudden, broad-based shift in demand conditions at the time of the inflation acceleration. Certainly, there was substantial fiscal stimulus at that time, and monetary authorities were not initially aggressive about counteracting it. But while a fiscal shock might be expected to shift out demand, it is not immediately clear that it would also make it less elastic. A fiscal-stimulus-drives-markups explanation needs an added element of elasticity change. Furthermore, if firms have upward-sloping marginal cost curves, a shift out in demand would increase marginal costs, aside from any change in the demand elasticity. This would pose an alternative, (at least partially) cost-based story for inflation.

If one considers the supply chain constraints prevalent at the time as a key driving force, a markup-based inflation story needs to explain how supply shocks would systematically shift firms to less elastic portions of their residual demand curves. Supply chain constraints of course lend themselves very directly to a cost-based explanation, making it hard to discern the relative responsibility for price inflation.

Still another possible explanation for the inflation episode is that the changes in firms' residual demand curves came about not because of shifts in market demand or supply but instead because of shifts in firms' strategic behaviors. The notion is that inflationary environments can weaken the intensity of competition and raise optimal markups. The notion here has some flavor of Rotemberg & Saloner (1986), in that firms across multiple markets are engaged in strategic pricing interactions (perhaps market-specific but synchronized across markets) that influence average markups. Weber and Wasner (2023) exposit such a mechanism. In their framework, the business-cycle element of Rotemberg & Saloner (1986) is absent, but other elements that propagate markup and price growth such as production chains and labor market bargaining are present.

Strategic-behavior-based explanations for markup-induced inflation might be considered formalizations of the so-called "greedflation" hypothesis. While there seem to be multiple, loose definitions of the term, greedflation is generally understood to mean increases in prices in excess of changes in costs (i.e., increases in markups) undertaken in an inflationary environment. Indeed, greedflation appears to posit that the inflationary environment both induced and was induced by broad-based price changes. While the hypothesis has seen considerable discussion outside traditional academic fora, there has been less formal empirical research into it. Two important exceptions are Conlon et al. (2023) and Leduc et al. (2024).

Conlon et al. (2023) measure firm-level markups using the production approach in Compustat data. They pair these with industry PPI series from the US Bureau of Labor Statistics. They measure the covariance in their growth rates over multiple decades and specifically at the start of the recent inflation acceleration. In some ways, this is a decomposition of inflation into markup and cost components; if industry PPI growth is closely tied to markup changes among industry firms, this points to markup growth as the source of industry inflation. Any difference is attributable to cost changes.

The results are striking. They find no correlation between measured markup and price growth, statistically or economically. Firms in industries with larger average price increases were not measured to have larger markup growth than firms in lower-inflation industries. Presuming their markup estimates (obtained using the production approach) accurately reflect true markups, the results point to higher costs having the primary role in driving price growth.

Leduc et al. (2024) find echoes of this result in their industry-level analysis over a longer portion of the inflationary period. Applying the production approach to U.S. BEA industry-level data, they find considerable variation industry markup growth rates during the inflationary period. However, this variation is essentially symmetric around zero; the average markup for the entire economy did not trend upwards over the same time. Moreover, they show this zero-markup-trend is typical during periods of recovery from recessions.

While more work is warranted given the importance of the research question, these results are more consistent with the recent inflation being cost-driven than markup-driven.

4. Conclusion

Once primarily the concern of industrial organization researchers, product market markups and factor market markdowns have gained considerable attention from fields across economics in recent years. And no wonder: a growing body of empirical research has found that markups and markdowns are substantial in magnitude, vary considerably across producers and market settings, and influence many microeconomic and macroeconomic outcomes of interest.

Considerable portions of the markup and markdown literatures are still in their early stages, though we have already learned much. Nevertheless much remains to be discovered. I hope this review will serve as a guide to interested readers and researchers about in which directions such potential discoveries might lie.

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