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MARK-UPS AND COMMON OWNERSHIP: AN IO PERSPECTIVE[‡]

Theory and Measurement of Common Ownership[†]

By Matthew Backus, Christopher Conlon, and Michael Sinkinson*

The theory of common ownership posits that diversified investors, by taking noncontrolling ownership stakes in competing firms, effect a partial merger. Azar, Schmalz, and Tecu (2018) documents empirical evidence for this claim in the US airline sector; a growing and controversial empirical literature on common ownership has emerged in the wake of that effort. Backus, Conlon, and Sinkinson (2019b) reviews that literature. Here, we focus on just one piece of the controversy: the measurement of common ownership itself.

We consider three approaches. The first is atheoretic; it describes ownership patterns and measures the extent to which investors overlap between firms. The second maps ownership into primitives of the managers' objective functions. This is the heart of the common ownership hypothesis: managers aggregate the preferences of investors who hold stakes in portfolios of firms. The third maps these primitives into equilibrium outcomes of specific strategic settings, resulting in measures such as the ubiquitous "modified Herfindahl–Hirschman index" (MHHI) of Bresnahan and Salop (1986).

I. Measuring Investor Overlap

In the United States, institutional investors with over \$100 million in assets are required to file quarterly 13(f) forms with the US Securities and Exchange Commission (SEC) listing publicly traded securities. These data are not ideal and measure ownership at the level of a legal entity, which may not correspond to the level at which decisions are made. These data suffer from additional shortcomings: short positions are not distinguished from long ones; which entity controls voting rights is often ambiguous; many firms have dual-class shares, which complicate (or sometimes obviate) investor influence; and reporting errors are common.

The commonly used Thomson Reuters database of 13(f) filings introduces a number of additional errors and coverage issues, which we document in Backus, Conlon, and Sinkinson (2019a). For the period starting in 2000, we scraped data directly from the SEC and have made our data available to the public.

Each shareholder $s \in S$ has a portfolio in which it owns a fraction of firm $f \in F$ denoted by β_{fs}. Measurement of common ownership, then, is finding ways to characterize the potentially very large matrix β. A challenge of the atheoretic approach is that one must choose among the arbitrarily many ways to reduce β, a high-dimensional object, to a reportable statistic. It is possible to correlate ownership statistics of the form $f(\beta)$ with various outcomes, but economically meaningful claims require placing additional structure on the problem.[1]

‡*Discussants:* Amit Ghandi, University of Pennsylvania; Jonathan Williams, University of North Carolina at Chapel Hill; Matthew Weinberg, Ohio State University; Daniel Ackerberg, University of Texas at Austin.

* Backus: Graduate School of Business, Columbia University; CEPR; and NBER (email: matthew.backus@columbia.edu); Conlon: Stern School of Business, New York University (email: cconlon@stern.nyu.edu); Sinkinson: School of Management, Yale University, and NBER (email: michael.sinkinson@yale.edu). Any errors are our own.

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[1] As an example of this approach, He and Huang (2017) counts the number of common blockholders that own $\beta_{fs} \geq 0.05$ and $\beta_{gs} \geq 0.05$ in both firms and correlates these measures with growth in market share.

II. Firm Objectives: Profit Weights

With two additional assumptions, the theory of common ownership maps overlapping ownership positions as measured above into primitives of a firm's objective function.

ASSUMPTION 1: *Investor returns/portfolio values are given by* $v_s \equiv \sum_s \beta_{fs} \pi_f$.

ASSUMPTION 2: *Managers maximize a* γ_{fs} *weighted average of investor returns:* $Q_f \equiv \sum_s \gamma_{fs} v_s$ (*Rotemberg* 1984).

The first assumption merely defines investor portfolios as the sum of corresponding cash-flow rights $\beta_{fs} \geq 0$, multiplied by the value of each firm π_f.

The second assumption is more controversial and states that managers maximize a weighted average of their investor payoffs. Because investors hold heterogeneous portfolios, they may disagree about their preferred objective for the firm. Managers aggregate preferences of heterogeneous investors using a set of Pareto weights γ_{fs}.

Under these two assumptions, one can rearrange the manager's objective such that[2]

$$Q_f \propto \pi_f + \sum_{g \neq f} \kappa_{fg} \cdot \pi_g, \quad \text{where} \quad \kappa_{fg} \equiv \frac{\sum_s \gamma_{fs} \beta_{gs}}{\sum_s \gamma_{fs} \beta_{fs}}. \tag{1}$$

This implies that managers maximize their own profits π_f plus some κ_{fg}-weighted sum of the profits of other firms π_g. These κ_{fg} terms are known as *profit weights* and have a long history in economics.[3]

The Pareto weights γ_{fs} stand in for the influence of investors on firm decisions (e.g., corporate governance). Absent an assumption on γ_{fs}, the expression in equation (1) is sufficiently general to accommodate a host of behaviors. For example, the manager m might place weight on his own private benefit π_m, with $\gamma_{fm} > 0$, and potentially ignore his investors completely: $\gamma_{fs} = 0; \forall s \neq m$. Alternatively, the manager may place equal weight $\gamma_{fs} = \gamma_{fs'} > 0$ on his largest two shareholders and ignore the rest, or place equal weight on all shareholders $\gamma_{fs} = c; \forall s$.

Nearly any model of corporate governance (with or without agency frictions) can be written using Assumptions 1 and 2.[4] In other words, the controversy arises from the specific choice of γ and not from Assumption 2 itself. Unfortunately, there is little guidance from the corporate governance literature about how to measure or specify γ.

One might be inclined to try to estimate γ from data on market outcomes. As a general problem this is somewhat futile, as there are often many more investors S (several thousand) than there are firms F (a handful) in an industry. Even if we knew the profit weights κ, we would not be able to recover the Pareto weights γ.

The empirical literature proceeds by assuming $\gamma = \beta$, sometimes called the "proportional control" assumption. In Backus, Conlon, and Sinkinson (2019a), we consider a generalization to $\gamma = \beta^\alpha$ for $\alpha \in \{1/2, 1, 2, 3\}$, a parameterization that offers some flexibility in the relative influences of large and small investors. We found that by 2017 this had little effect on average levels of κ, but it does matter for measuring the frequency of extreme values (e.g., $\kappa_{fg} > 1$).

With an assumption on γ_{fs}, the primitives of the manager's objective function are fully specified, and those primitives may vary over time with changes in the observed ownership β. This variation across time and pairs of firms (f, g) provides a way to compare different assumptions on γ.

It is still difficult to map these primitives κ_{fg} to market outcomes without making additional assumptions on the nature of interactions between (f, g) (e.g., that f and g are horizontal competitors engaged in selling substitutes). Absent these assumptions, it may be possible to develop reduced-form, correlation-based tests,

[2] This expression first appeared as such in O'Brien and Salop (2000).

[3] They date as far back as Edgeworth's "coefficients of effective sympathy."

[4] For example, the measure of common ownership and investor attention proposed in Gilje, Gormley, and Levit (forthcoming) can be shown to be mathematically equivalent to our profit weights under a formulation of $\gamma_{fs}(\beta_s)$ that places less weight on investors as they become more diversified. However, in that model, unlike in ours, the measure cannot be interpreted as a profit weight, and the authors rule out strategic interaction among firms by assumption.

even though the magnitudes of coefficients may not be interpretable. For example, Gramlich and Grundl (2017) doesn't find a strong direct relationship between prices and functions $f(\kappa)$ in the market for retail banking (a setting similar to that in Azar, Raina, and Schmalz (2016)). These reduced-form tests may not be as simple as they look, as O'Brien (2017) points out: equilibrium outcomes depend not only on κ_{fg} but on the entire $F \times F$ matrix κ; the precise relationship depends on the form of the strategic game.

III. Fully Specified Strategic Games

If one begins with the firm's objective function from equation (1) and fully specifies both the Pareto weights γ and the form of the strategic game played among all firms F, it is possible to derive relationships between common ownership and equilibrium outcomes such as prices, quantities, investment, and entry or exit.

Perhaps the most common example in the literature is to assume that the firms engage in symmetric Cournot competition (simultaneous Nash in quantities) so that $Q_f(q_f, q_{-f}) = \pi_f(q_f, q_{-f}) + \sum_{g \neq f} \kappa_{fg} \cdot \pi_g(q_f, q_{-f})$. When one solves for the first-order conditions of the resulting game, it is possible to derive a relationship between share-weighted average markups and the (modified) concentration measure:[5]

$$(2) \qquad \sum_f s_f \frac{p_f - c_f}{p_f} = \frac{1}{\epsilon}\left[MHHI(\kappa)\right],$$

$$(3) \qquad MHHI(\kappa) = \underbrace{\sum_f s_f^2}_{HHI} + \underbrace{\sum_f \sum_{g \neq f} \kappa_{fg} s_f s_g}_{\Delta MHHI}.$$

Note that $MHHI(\kappa)$ is not a measure of common ownership; it is a modified concentration index and an equilibrium outcome itself. Scholars sometimes portray $MHHI(\kappa)$ and the profit weights κ as different ways to measure common ownership, although they are not. The profit weights κ are a primitive object in the manager's objective function, while $MHHI(\kappa)$ and $MHHID(\kappa)$ are equilibrium outcomes of a Cournot game where the market shares depend on κ.

Perhaps the most important point is that if the strategic game is something other than symmetric Cournot, there need not be any relationship between $MHHI(\kappa)$ and equilibrium outcomes. For example, if the strategic game is Bertrand in differentiated products, $Q_f(p_f, p_{-f}) = \pi_f(p_f, p_{-f}) + \sum_{g \neq f} \kappa_{fg} \cdot \pi_g(p_f, p_{-f})$. This gives a different first-order condition, where the bracketed expression is known as $PPI(\kappa)$:

$$(4) \qquad p_f = \frac{\epsilon_f}{\epsilon_f - 1}\left[c_f + \sum_{f \neq g} \kappa_{fg} D_{fg}(p_g - c_g)\right].$$

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This relates prices to the own elasticity of demand ϵ_f, and the substitution to the rival's products as measured by the diversion ratio D_{fg} (O'Brien and Salop 2000).

Backus, Conlon, and Sinkinson (2018) shows that misspecifying the form of the game can lead to spurious results. For example, regressions of prices on $MHHI(\kappa)$ can yield spurious positive or negative results when the strategic game is actually Bertrand and there is no effect of common ownership.

Attempting to test for common ownership by regressing prices on $MHHI(\kappa)$ leads to additional challenges. First, the implied relationship in equation (2) is between share-weighted average markup and $MHHI(\kappa)$, not prices. Second, because it requires the researcher to compute market shares in addition to κ, it suffers the difficulties of proper market definition.[6] The $PPI(\kappa)$ is hardly better, as it requires estimates of the diversion ratios D_{fg}. Finally, because $MHHI(\kappa)$ is a market-level measure, it is unable to exploit variation across firms.

IV. The Role of Measurement

Differing approaches to measurement drive controversy in the growing common ownership literature, as researchers describe historical patterns, attempt to test the predictions of the model, and use it to generate counterfactual predictions.

[5] The MHHI was originally developed in Bresnahan and Salop (1986) to study joint ventures.

[6] This is further complicated when researchers construct market shares from publicly available databases, such as Compustat, that are limited to publicly traded US firms. The $MHHI(\kappa)$ measure implicitly requires the appropriate geographic and product market, as all products must be equally good substitutes within the relevant market.

As we have seen, descriptive approaches are perilous, both due to data limitations and in the need for interpretation. For this latter reason, Backus, Conlon, and Sinkinson (2019a), which measures common ownership in the United States from 1980 to 2017, advocates for a focus on κ, the objective function of the firm. Because it is generic to the formulation of firms' interaction, there is no need for compromises on market definition.

In Backus, Conlon, and Sinkinson (2019a), we also show that the key to testing the theory of common ownership hypothesis is really the profit weights κ. While one might learn about κ through equilibrium outcomes like $MHHI(\kappa)$ or $PPI(\kappa)$, or through other outcomes such as entry, R&D, or investment, testing common ownership—like testing collusion—is about the profit weights firms put on each other.

These reflections on measurement are critical to structural testing, but they can also guide reduced-form work. For example, seemingly innocuous financial market transactions could have potentially large impacts on product markets through κ. Boller and Scott Morton (2019) provides some encouraging evidence here. The authors find that when firms join stock indices, there are pricing anomalies for the stock of rival firms. These pricing anomalies are correlated with the theoretically motivated κ—consistent also with asymmetries of κ between firms—but not other, purely descriptive overlap measures.

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