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Testing for Competitive Effects of Common Ownership

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Abstract

We propose an alternative approach for analyzing the competitive effects of common ownership: to directly analyze the weights that firms place on each others' profits rather than using measures of industry concentration (MHHI and GHHI). Analyzing weights has at least three advantages: it places fewer restrictions on the nature of competition, it requires less data to test, and it circumvents endogeneity concerns with concentration measures.

We apply our approach to data from the banking industry, and our preliminary results mixed and overall rather muted. The sign of the competitive effect is sensitive to specification, and the effects we estimate are economically quite small. Firms upon which significant weight is placed - either by themselves or competitors - move very little in price or quantity distributions.

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1 Introduction

"Common ownership" - a single investor owning shares of competing firms - can be anti-competitive if firms maximize shareholder value rather than firm profit. Common ownership creates incentives for managers to generate profit for their competitors which in turn accrues to the original firm's own shareholders. This mechanism does not require coordination or collusion - the incentives is unilateral. The mechanism has been recognized by the theoretical IO literature for some time (Reynolds and Snapp (1986); Bresnahan and Salop (1986)), though until recently there was little empirical evidence of such an effect.

Recently, however, two papers (Azar, Schmalz, and Tecu (2016) and Azar, Raina, and Schmalz (2016)) found that common ownership is associated with higher prices in the airline and banking industries.[1] These findings have sparked a number of academic papers, significant media coverage, and attention from policy makers (Council of Economic Advisors (2016); Posner, Scott Morton, and Weyl (2016)). In addition to the implications for antitrust and financial regulation, some commentators have pointed out links to issues as far-reaching as rising profit shares and income inequality.

The contribution of our paper is to propose that empirical investigations of this effect be focused directly on the weights that firms place on each others' profits, rather than on measures of industry concentration ("MHHI" and "GHHI"). The prior empirical work has focused on industry concentration, but we can think of at least three reasons to focus on weights.

First, analysis based on weights is consistent with a broader range of competitive models than analysis based on measures of market concentration. The MHHI and GHHI are generalized of the Herfindahl-Hirschman Index (HHI), and each of these HHI-based metrics only has a natural interpretation - as average industry markups - in the context of Cournot competition, in which firms compete by setting quantities. Many markets exhibit Bertrand competition, in which firms compete by setting prices. The analysis of weights that we propose is agnostic as to the form of competition, encompassing both Cournot and Bertrand, and does not require specifying a functional form for profits or firms' choice variables.

Second, analysis based on weights requires less data than analysis based on measures

[1] Antón, Ederer, Giné, and Schmalz (2016) also find that industries with more common ownership have manager compensation more closely tied to performance of competitors, though Kong (2016) finds the opposite.

of market concentration. Market concentration analysis requires three types of data - data on ownership, prices, and market shares. But the weights analysis we propose does not require shares. And, indeed, when share data are available they may be used as an additional dependent variable rather than an independent variable. This is more natural since quantities are, after all, an outcome of competitive processes rather than an input into them.

Third, analysis based on weights avoids a number of endogeneity concerns with analysis based on measures of concentration. Some of the endogeneity concerns related to placing quantities on the right hand side of a regression equation have been discussed extensively in the literature and may have been part of the reason such studies became less common over time (see Schmalensee (1988) for a discussion). Other endogeneity concerns are newly introduced by the addition of ownership data to the analysis. Analysis of weights avoids both old and new concerns. Analysis of weights does not involve putting quantities, an outcome variable, on the right hand side of a regression. Furthermore, weight metrics vary at the market-time-competitor level, not just the market-time level as do GHHI and MHHI, which avoids some (though admittedly not all) of the additional concerns related to ownership data.

We apply our approach to data from the banking industry, and our preliminary results suggest mixed and muted evidence on the competitive effects of common ownership. The sign of the effect is sensitive to the specification, and effects we estimate are economically quite small. When firms receive greater weight in profits maximization decisions - either theirs or their competitors' - it moves them very little in the price or quantity distribution.

2 Literature Review

The theoretical notion that common ownership of competitors may be anti-competitive is not new. Researchers noted this possibility at least as early 1980, and antitrust enforcers at least as early at the 1940s (Reynolds and Snapp (1986)). Bresnahan and Salop (1986) and O'Brien and Salop (2000) made theoretical contributions, with the latter formally developing the "MHHI" or Modified Herfindahl Hirschman Index, to account for common ownership. Both the HHI and the MHHI may be interpreted as industry average markups under Cournot competition, as we discuss further below. Other theoretical contributions include Rotemberg (1984); Gordon (1990); Gilo (2000);

O'Brien and Salop (2001); Gilo, Moshe, and Spiegel (2006); Azar (2011).

The recent empirical findings upon which our work most closely draws are Azar, Schmalz, and Tecu (2016) and Azar, Raina, and Schmalz (2016). The papers contain to our knowledge the first empirical findings that suggest common ownership reduces competition. The former paper investigates airline routes and the later banking markets. The latter paper formalizes a "GHHI" ("Generalized Herfindahl Hirschman Index") that further adapts the MHHI to account for competitors directly owning shares of each other ("cross ownership"). Our work builds on their work, both in investigating the banking market, and in proposing methods for such assessments in other industries.

Schmalensee (1988) contains a useful overview of the literature that relates outcomes variables (such as profit or price) to market structure. This literature began with the seminal study of Bain (1951). Initial studies were cross-sectional and inter-industry, but faced challenges due to factors that vary from industry to industry. Within-industry studies (e.g. Benham (1972)) became more common, though these still faced endogeneity concerns. Unobservables can provide alternative explanations for "intuitive" signs and reasonable explanations for "counter-intuitive" signs, as well. Market-specific costs can lead to both limited entry (higher concentration) and higher prices, or unobserved cost advantages can lead to market dominance (higher concentration) and higher share-weighted margins (Demsetz (1973)). Alternatively, cost advantages can lead to market dominance (higher concentration) and lower prices. These possibilities underscore that entry and market shares are generally outcomes of a competitive process rather than inputs into it. Some studies have attempted to introduce exogeneity into market structure by using regulation or mergers (Rose (1987); Prager and Hannan (1998); Miller and Weinberg (2014); Azar, Schmalz, and Tecu (2016)).

There has also been literature that has focused on reconciling the disparate outcomes predicted by Cournot and Bertrand competition (e.g. Davidson and Deneckere (1986)). The existence of this literature suggest that there is value in an analytical framework such as ours that is flexible enough to encompass both modes of competition.

Other papers with relation to ours include papers on corporate ownership, corporate governance, and potential mechanisms for a link between common ownership and decreased competition. McCahery, Sautner, and Starks (2016) find that institutional investors intervene behind the scenes in governance and exit if they are unhappy about governance. They also document that most investors use proxy advisers for voting. Rydqvist, Spizman, and Strebulaev (2014) argue that the transition from direct ownership to indirect stock ownership of stocks through institutional investors is driven by tax and

retirement policies. Adams and Ferreira (2008) survey the empirical literature relating ownership and control. As mentioned above, recent literature on the effect of common ownership on executive compensation has mixed findings. Antón, Ederer, Giné, and Schmalz (2016) and Liang (2016) find that managers are paid more for rival performance if firms are commonly owned, while Kong (2016) finds the opposite. He and Huang (2014) find that commonly owned firms experience higher market share growth, which would appear to suggest that common ownership is *pro-competitive* rather than anti-competitive. Such results underscore the need for further empirical work in this area.

3 Model

Here we discuss the theoretical framework used in the recent empirical papers (MHHI and GHHI), the "weight-based" approach we propose, and the relation between the two.

We begin with the homogenous good Cournot model, in which manager j maximizes firm j's profit by choosing j's quantity x_j:

$$\max_{x_j} \pi_j \tag{1}$$

In the equilibrium of this model, the Herfindahl-Hirschman Index (HHI) - the sum of the squared market shares - is the share-weighted sum of firms' markups (Lerner indices) scaled by the elasticity of industry demand:

$$HHI = \sum_j s_j^2 = \eta \sum_j s_j L_j = \eta \sum_j s_j \frac{p - C_j'(x_j)}{p}$$

Here s_j is the market share of firm j, η is the (absolute value) of the elasticity of demand, L_j is the Lerner index for firm j, p is the price and C_j is the cost of producing x_j.

Now consider a more general objective function for a firm:

$$\max \Pi_j = \sum_i \gamma_{ij}(\beta_{ij}) \sum_k \beta_{ik}\pi_k \tag{2}$$

$$= \pi_j \sum_i \gamma_{ij}(\beta_{ij})\beta_{ij} + \sum_i \sum_{k \neq j} \gamma_{ij}(\beta_{ij})\beta_{ik}\pi_k \tag{3}$$

This objective function is more general than the objective function in equation 1 in two ways. First, a choice variable (price or quantity) has not been specified, nor has any functional form for π_k. Second, firm j maximizes its **owners'** payoffs rather than its own profits. This may coincide with own-profit maximization - in the case of a single undiversified owner - but it need not. β_{ik} represents owner i's "ownership share" of firm k, the percentage of firm k's returns to which owner i is entitled.[2] $\gamma_{ij}(\beta_{ij})$ represents owner i's "control share" of firm j, the weight that manager j assigns to owner i in manager j's objective function.[3] γ_{ij} is a non-decreasing function of β_{ij}, a special case of which is $\gamma_{ij} = \beta_{ij}$, "proportional control". We use proportional control throughout this paper

Note that firm j's objective function may place weight on any firm's profit (π_k) because firm j's shareholders may own profit rights that accrue to j's competitors, $k \neq j$. Equation 3 emphasizes this by isolating the own-profit term terms with others' profit. Firm j places weight on firms in whom its own (controlling) shareholders have ownership. The more "control" those shareholders have in j , the more heavily firm j will weight those outside interests.

With data on ownership and a competitive outcome (such as price), the foundations for an empirical test are already present. Despite this, past research has proceeded to, at this point, impose Cournot competition. O'Brien and Salop (2000) show that doing so leads to a Modified Herfindahl-Hirschman Index (MHHI):

$$\begin{aligned} MHHI &= \sum_j \sum_k s_j s_k \frac{\sum_i \gamma_{ij}(\beta_{ik})\beta_{ik}}{\sum_i \gamma_{ij}(\beta_{ik})\beta_{ij}} \\ &= HHI + \sum_j \sum_{k \neq j} s_j s_k \frac{\sum_i \gamma_{ij}(\beta_{ik})\beta_{ik}}{\sum_i \gamma_{ij}(\beta_{ik})\beta_{ij}} \\ &= HHI + MHHI\Delta \end{aligned} \tag{4}$$

Azar, Raina, and Schmalz (2016) additionally allow for competitors to directly own each other, and yield a variant of this equation they call the GHHI. Both the MHHI and the GHHI have the useful interpretation that the HHI has - as average industry markups. But the cost of imposing Cournot is that the interpretation of this metric is unclear since quantities - endogenously determined variables - end up being included

[2] This is a share of i in k, so holding k constant and summing over i yields 1.
[3] This is also a share of i in j, so holding j constant and summing over i yields 1.

as independent variables in estimation equations. Furthermore, the interpretation of HHI-based metrics is not clear if firms compete in prices.

The main insight of our paper is that equation 1 already forms the basis for analysis of effects of ownership on outcome variables. Whether competition is Bertrand or Cournot (assuming at least some differentiation), firms whose profits receive more weight (either from themselves, meaning they compete, or from others who acquiesce) should have *relatively* more attractive prices and *relatively* higher quantities as compared to when less weight is placed on their profits (either by themselves or by others).[4] This result does not depend on the functional form of profits or even the specification of a choice variable.

The above relationship may be expressed in matrix form. $HHI = s's$, $MHHI = s'Ws$ and $GHHI = s'Ws$, where s is a vector of market shares and W is a matrix with weights w_{jk} that the manager of firm j places on the profits of firm k.[5] If there is no common ownership or cross-ownership, then managers place no weight on the profits of their rivals and HHI=MHHI=GHHI. To the extent that firm j's shareholders (with non-zero control) hold shares (β_{ik}) of other firms, k , in the market, then the matrix will have non-zero off-diagonal elements. Previous papers developed the very object we propose to use in analysis - the W matrix. But they combined it with share vectors in a way that can confuse the interpretation of results.

The estimation equations we use are:

$$p_j = \theta_1 w_{jj} + \theta_2 \bar{w}_{kj} + \Theta_p X_j + \varepsilon_j \quad (5)$$

$$q_j = \theta_3 w_{jj} + \theta_4 \bar{w}_{kj} + \Theta_q X_j + \varepsilon_j \quad (6)$$

w_{jj} is the weight that firm j places on itself. $\bar{w}_{kj}$ represents the average weight that one's market competitors place on firm j. One could include other functions of weight that competitors place on firm j, though we only use the average in our current specifications. The weight matrix is row normalized, so that each firm places a total weight of 1 distributed over themselves and their competitors.[6] X_j includes fixed effects, including

[4]With no differentiation, both Bertrand and Cournot yield somewhat degenerate results regarding prices and quantities.

[5]For $GHHI$, calculation of W involves an additional step to take into account cross-ownership between firms.

[6]The elements of the weight matrix as calculated in the MHHI and GHHI papers can sum to more than one. We simply row-normalize the resulting matrix.

bank-time and and market-time. All subscripts j and k are implicitly sub-scripted with mt (market and time), but this notation is suppressed. The null hypothesis, that common ownership does not affect competition, is that $\theta_1, \theta_2, \theta_3, \theta_4 = 0$. If common ownership does affect competition, we should expect that $\theta_1, \theta_2 > 0$, and $\theta_3, \theta_4 > 0$. Prices are actually "reverse prices" because firms pay consumers, so higher prices are more attractive to consumers.

Note that HHI, $MHHI$ and $GHHI$ vary only at the market-time level, but W varies at the market-time-firm level, allowing us to test firm-level predictions. For example, suppose there is a market with three firms. In the first year, firms A and B have common shareholders but none in common with C. In the second year the ownership structure changes such that B and C have common owners but none in common with A. This scenario could leave the $MHHI$ unchanged in the two market-time periods, but our formulation allows us to test whether this change affects market outcomes at the firm-time level. In other words, we remove some concerns about the endogeneity of common ownership. Common ownership has increased most over time in urban banking markets (because these contain more publicly-traded competitors), so if urban markets have experienced greater cost increases over time, leading to less attractive prices to consumers, then regressions based on $MHHI$ and $GHHI$ may incorrectly attribute the less attractive prices to common ownership. Our tests can avoid this concern.

Of course, there can still be endogeneity concerns with our measure, as well. If publicly-traded banks (the only banks at which common ownership can meaningfully grown, given available data) have adopted different business models over time - such as monetizing their larger footprint by offering less competitive prices to consumers - then we could also incorrectly attribute an apparent decrease in competition to common ownership. Of course we do not eliminate all endogeneity concerns, but we do eliminate some. To eliminate others we have begun an analysis of mergers which affect common ownership.

4 Data

Data we use to estimate our empirical specification come from a number of sources. Ownership data comes from SEC 13f filings, pricing data come from RateWatch, and quantity data come from the Summary of Deposits (SOD). We briefly describe these

data sets here, and include an appendix for more discussion of construction of the ownership data.

Ownership data come from SEC 13f investment filings. The SEC requires any institutional investor with over $100 million in assets under management to file a schedule 13f form every quarter. Filers include banks, insurance companies, parents of mutual funds, pension funds, and university endowments. Filers report the dollar value of holdings in all publicly traded companies. Shares outstanding and market cap data are available from the 13f filings and from CRSP,[7] allowing us to calculate percentage ownership. Because 13f filers submit holdings of all publicly traded companies, these data exist for many industries researchers may want to investigate. We focus on holdings of banks.

As seen in Table 1, The number of publicly traded banks has decreased somewhat following consolidations in the wake of the financial crisis. The market capitalization of publicly traded banks grew steadily until the crisis, fell in the wake of the crisis, and then rebounded. The percentage of market cap of publicly traded banks that is held by large, institutional investors (meaning any 13f filer) peaked in the crisis and has dropped somewhat since. The percentage of market cap help by a number of large, individual investors such as Vanguard, State Street, BlackRock (which purchased Barclays' Asset Manager in 2009) has increased, though the percentage of market cap held by other banks has fallen over time, and that held by Fidelity has fallen since the crisis.

Table 1: Investment Data

	Banks	Market Cap ($T)	Filers	By 13f Filer	By Banks	By Vanguard	By State Street	By BlackRock	By Barclays	By Fidelity
2000	525	1.4	1423	49.5 %	7.6 %	1.2 %	1.9 %	0.1 %	2.8 %	2.8 %
2001	514	1.6	1520	52.6 %	8.5 %	1.4 %	2.8 %	0.0 %	3.1 %	3.2 %
2002	527	1.5	1523	55.1 %	8.5 %	1.6 %	2.9 %	0.0 %	3.4 %	3.3 %
2003	530	1.5	1612	57.5 %	8.4 %	1.7 %	3.2 %	0.0 %	3.8 %	3.5 %
2004	541	1.8	1721	58.1 %	8.1 %	1.9 %	3.3 %	0.0 %	3.9 %	3.1 %
2005	543	1.8	1844	57.4 %	7.4 %	2.1 %	3.1 %	0.1 %	4.3 %	2.6 %
2006	532	1.9	1909	58.9 %	7.0 %	2.4 %	3.0 %	0.1 %	4.1 %	2.5 %
2007	538	2.1	2062	61.2 %	6.6 %	2.7 %	3.1 %	0.9 %	4.3 %	2.4 %
2008	530	1.2	2161	65.8 %	6.9 %	3.0 %	3.8 %	0.8 %	4.2 %	2.7 %
2009	514	0.9	2078	67.3 %	6.0 %	3.3 %	3.9 %	0.9 %	4.3 %	3.6 %
2010	508	1.2	2131	60.5 %	5.1 %	3.4 %	3.6 %	1.1 %	0.0 %	2.9 %
2011	485	1.4	2227	65.3 %	5.2 %	3.5 %	3.8 %	4.9 %	0.0 %	2.3 %
2012	470	1.3	2245	63.9 %	5.7 %	3.9 %	3.7 %	4.9 %	0.1 %	2.2 %
2013	464	1.8	2422	66.7 %	5.8 %	4.3 %	4.0 %	5.5 %	0.1 %	2.5 %
2014	470	2.2	2588	56.5 %	2.2 %	4.5 %	3.9 %	1.4 %	0.1 %	2.4 %
2015	444	2.3	2543	58.0 %	4.7 %	5.0 %	3.9 %	1.7 %	0.1 %	2.5 %

[7] Center for Research in Security Prices (CRSP), CRSP1925 US Stock Database.

The pricing data come from RateWatch.[8] RateWatch has done weekly surveys of branches for rates and fees for various financial products since 2003. We use certificates of deposit (CD) rates because they are the most homogenous and comparable products from bank to bank. We have rates on CDs with maturities of 3, 6, 12, and 24 months.

RateWatch does not survey every branch in the country; they have identified what we call rate-setter and rate-taker branches. Rate-setters are branches which set the rates for all branches in some region (which in some instances can be as large as country-wide). RateWatch also provides a mapping of rate-takers to rate-setters, so one can impute rates for takers. In our main specifications we only use rate-setters, but we also run specifications including rate-takers - clustering standard errors at the rate-setter level - with little difference to the results.

RateWatch surveys branches weekly. Within a quarter, the level at which the ownership data vary, we choose the median price from each branch.

Quantity data come from the SOD. The SOD is an annual census of insured banking institutions that is taken as of June 30 of each year, and tracks deposit information (among other information) at the branch level. There are currently just under 100,000 branches in the country, divided into roughly 2,000 banking markets (usually approximately the size of counties).[9]

In the pricing regressions, the unit of observation is the bank-county-quarter. Quarters are the frequency at which the 13f ownership data varies. Within a quarter, banks may have multiple branches with multiple weeks of reported prices: we use the first reported week for each branch, and take the median branch price. Summary statistics of our regression data set are in Table 2.

Table 2: Summary Statistics of Regression Data set

	Mean	Std	Min	Max	Obs
CD Rate Paid - 3 mo	1.10	1.17	0.00	6.78	911217
CD Rate Paid - 6 mo	1.37	1.35	0.00	7.29	982646
CD Rate Paid - 12 mo	1.61	1.43	0.00	7.52	977128
CD Rate Paid - 24 mo	2.51	1.39	0.00	7.51	850673
Deposit Share	0.11	0.15	0.00	1.00	1656807
Weight on Own Profits	0.80	0.32	0.00	1.00	1658615
Average Weight Received From Rivals	0.20	0.35	0.00	2.69	1658615

[8]RateWatch Deposit, Loan, and Fee Data. https://www.rate-watch.com .

[9]We cap the deposits of urban branches at $1 billion and rural branches at $500 million to avoid attributing centrally-booked, geographically-disperse deposits to local competition.

5 Results

We include 3 tables with price regressions (of Equation 5) and 3 tables with deposit regressions (of Equation 6). All specifications include county-quarter and bank-quarter fixed effects. Recall that if common ownership reduces competition, we should expect that $\theta_1, \theta_2 > 0$, and $\theta_3, \theta_4 > 0$. Prices are actually "reverse prices" (firms pay consumers), so higher prices are more attractive to consumers.

The overarching conclusions are that signs and significance levels are mixed, and magnitudes are small. We will make specific comments on each table one by one.

In Table 3 , we see that *various CD maturities suggest mixed conclusions regarding effects of common ownership on competition.* The dependent variable is price percentile within the nation for a particular quarter. For three month CDs, $\theta_1, \theta_2 > 0$, suggesting that common ownership may be reducing competition. But for the other maturity CDs at least one of θ_1, θ_2 is less than 0. The magnitude of the coefficients is small: they suggests that if firm j goes from placing no weight on itself to full weight on itself, it will only move 2 percentage points in the national price distribution for the quarter.

In Table 4 , we see that *alternative ways of calculating the weight matrix provide even more muted conclusions.* Again, the dependent variable in all specifications is price percentile. We focus on the 3-month CD since that is the maturity in Table 3 that is most consistent with the anti-competitive hypothesis. Here we calculate weight matrices as they enter GHHI ((1), (2), (5), (6), following Azar, Schmalz, and Tecu (2016)) and as they enter MHHI ((3), (4), (7), (8), following O'Brien and Salop (2000)).[10] We also include no self-ownership ((1)-(4)) and 1% self-ownership ((5)-(8)) to buffer some extreme weights that can drive MHHI and GHHI over 10,000.[11] Specifications (1) and (2) were carried over from the previous Table, and we see that the new specifications, (3)-(8), have even less statistical significance and smaller coefficients.

In Table 5 , we see that *alternative transformations of the rate variable also provide mixed inference on whether or not common ownership affects competition.* Specifications (5) and (6) are carried over from specifications (1) and (2) in the previous tables. Specifications (3) and (4) - with a logged price as the dependent variable - suggest larger anti-competitive effects. Going from no weight to full weight on one's self could move a firm by 23 percentage points in the price distribution. However, in specifications (1)

[10] In Table 3, we have calculation all specifications consistent with GHHI.

[11] In Table 3, we had not included a self-ownership share. In a companion paper we are investigating these properties of the control function, γ_{ij} (β_{ij}) .

and (2) - with a linear price as the dependent variable - the opposite is true; large and statistically significant *pro-competitive* effects of common ownership appear.

In Tables 6 - 8, the dependent variables are functions of deposits (quantities). Results here are also mixed. Table 8, using *shares* of market deposits, shows a more consistently anti-competitive effect than with linear (Table 6) or logged (Table 7) deposit variables. But even focusing on Table 8, we again see that the economic magnitudes of the coefficients are small. Going from placing no weight to full weight on yourself increases your deposit market share by less than 1%, and having all competitors similarly shift their entire weight toward you increases your market share by only 4-6%.

6 Conclusion and Extensions

We propose an alternative method for analyzing the effects of common ownership on competition. Relative to previous approaches, this approach requires less data, encompasses a broader range of competitive models, and avoids endogeneity concerns with HHI regressions and new data on common ownership that only vary at the market-time level.

We apply our method to an industry that has previously been analyzed - the banking industry - and find more muted effects that the previous study did. We see some results that are consistent with the anti-competitive effect that Azar, Schmalz, and Tecu (2016) find, but the sign of the effect is not robust, and implied magnitudes of the effects that are found are small.

We are pursuing a number of extensions. First, we intend to explore functional forms for $\gamma_{ij}(\beta_{ij})$ inspired by the corporate control literature. We have followed the recent empirical literature in assuming "proportional control," $\gamma_{ij}(\beta_{ij}) = \beta_{ij}$, but the weight matrix (and thus the MHHI and GHHI) is sensitive to the specification of this function. We are investigating whether and by how this may be influencing either set of results. We believe this needs more attention before conclusions about the effect of common ownership on competition in any industry may be drawn.

Second, we intend to experiment with mergers to address potential endogeneity of W. Mergers are likely to introduce variation in common ownership that avoid some of the potential endogeneity in the growth of W elements over time.

Third, we believe investigations of other industries would be a valuable exercise for researchers and policy makers. The ownership data are readily available from the SEC's

13f filings, and our proposed method demonstrates that either price or quantity data are sufficient to test hypotheses - one need not obtain both.

Table 3: Different CDs, Rate Percentile, W1

	3 Months		6 Months		12 Months		24 Months	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Weight on Own Profits (1)	0.00737*	0.00837**	-0.00646*	-0.00569*	-0.0160***	-0.0148***	0.00588	0.00508
	(0.00304)	(0.00304)	(0.00275)	(0.00275)	(0.00271)	(0.00271)	(0.00320)	(0.00320)
Average Weight Received From Rivals (1)		0.215***		0.156***		0.234***		-0.178***
		(0.0201)		(0.0182)		(0.0181)		(0.0213)
Quarter Fixed Effects	No	No	No	No	No	No	No	No
Bank-County Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County-Quarter Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	819543	819543	876543	876543	871658	871658	750660	750660

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4: 3 Month CDs, Rate Percentile, Different W

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Weight on Own Profits (1)	0.00737*	0.00837**						
	(0.00304)	(0.00304)						
Average Weight Received From Rivals (1)		0.215***						
		(0.0201)						
Weight on Own Profits (2)			0.00423	0.00530				
			(0.00307)	(0.00307)				
Average Weight Received From Rivals (2)				0.173***				
				(0.0206)				
Weight on Own Profits (3)					0.000747	0.00393		
					(0.00315)	(0.00317)		
Average Weight Received From Rivals (3)						0.199***		
						(0.0220)		
Weight on Own Profits (4)							-0.00151	0.00109
							(0.00317)	(0.00319)
Average Weight Received From Rivals (4)								0.154***
								(0.0225)
Quarter Fixed Effects	No	No	No	No	No	No	No	No
Bank-County Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County-Quarter Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	819543	819543	819543	819543	819543	819543	819543	819543

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5: 3 Month CDs, Different transformations of rate, W1

	3 Month CD Rate		log(3 Month CD Rate)		3 Month CD Rate Percentile	
	(1)	(2)	(3)	(4)	(5)	(6)
Weight on Own Profits (1)	-0.0757***	-0.0757***	0.222***	0.228***	0.00737*	0.00837**
	(0.00542)	(0.00542)	(0.00754)	(0.00754)	(0.00304)	(0.00304)
Average Weight Received From Rivals (1)		0.00714		1.323***		0.215***
		(0.0359)		(0.0500)		(0.0201)
Quarter Fixed Effects	No	No	No	No	No	No
Bank-County Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
County-Quarter Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
N	819543	819543	819151	819151	819543	819543

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 6: Deposits, Different W

	Deposits							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Weight on Own Profits (1)	-115683.4***	-121634.8***						
	(12794.8)	(12840.3)						
Average Weight Received From Rivals (1)		-452448.7***						
		(82202.6)						
Weight on Own Profits (2)			-120397.4***	-127636.2***				
			(12986.2)	(13050.7)				
Average Weight Received From Rivals (2)				-478627.5***				
				(85776.3)				
Weight on Own Profits (3)					-176026.4***	-196286.2***		
					(13322.2)	(13574.7)		
Average Weight Received From Rivals (3)						-720387.4***		
						(92720.8)		
Weight on Own Profits (4)							-177015.8***	-197523.8***
							(13436.5)	(13702.0)
Average Weight Received From Rivals (4)								-724186.5***
								(94832.6)
Quarter Fixed Effects	No	No	No	No	No	No	No	No
Bank-County Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County-Quarter Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	1566442	1566442	1566442	1566442	1566442	1566442	1566442	1566442

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 7: log(Deposits), Different W

	log(Deposits)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Weight on Own Profits (1)	-0.0347***	-0.0246***						
	(0.00477)	(0.00478)						
Average Weight Received From Rivals (1)		0.770***						
		(0.0306)						
Weight on Own Profits (2)			-0.0170***	-0.00641				
			(0.00484)	(0.00486)				
Average Weight Received From Rivals (2)				0.698***				
				(0.0320)				
Weight on Own Profits (3)					-0.0566***	-0.0355***		
					(0.00497)	(0.00506)		
Average Weight Received From Rivals (3)						0.751***		
						(0.0345)		
Weight on Own Profits (4)							-0.0360***	-0.0172***
							(0.00501)	(0.00511)
Average Weight Received From Rivals (4)								0.665***
								(0.0353)
Quarter Fixed Effects	No	No	No	No	No	No	No	No
Bank-County Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County-Quarter Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	1559168	1559168	1559168	1559168	1559168	1559168	1559168	1559168

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 8: Deposit Share, Different W

	Deposit Share							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Weight on Own Profits (1)	0.00284***	0.00364***						
	(0.000336)	(0.000337)						
Average Weight Received From Rivals (1)		0.0608***						
		(0.00216)						
Weight on Own Profits (2)			0.00418***	0.00490***				
			(0.000341)	(0.000343)				
Average Weight Received From Rivals (2)				0.0471***				
				(0.00225)				
Weight on Own Profits (3)					0.000901*	0.00257***		
					(0.000350)	(0.000356)		
Average Weight Received From Rivals (3)						0.0595***		
						(0.00243)		
Weight on Own Profits (4)							0.00257***	0.00388***
							(0.000353)	(0.000360)
Average Weight Received From Rivals (4)								0.0461***
								(0.00249)
Quarter Fixed Effects	No	No	No	No	No	No	No	No
Bank-County Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County-Quarter Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	1566442	1566442	1566442	1566442	1566442	1566442	1566442	1566442

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

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Appendix - Ownership Data

Ownership data come from SEC 13f investment filings. The SEC requires any institutional investor with over $100 million in assets under management to file a schedule 13f form every quarter. Filers include the following: banks, insurance companies, parents of mutual funds, pension funds, and university endowments. Filers report the dollar value of holdings in all publicly traded companies, so the data exist for many industries researchers may want to investigate.

The 13f data set is provided by the Wharton Research Data Services (WRDS) using data collected from Thomson Reuters mutual fund and investment company common stock holding database. The level of the data set is at the stock CUSIP number, filing date of the asset manager and asset manager. Security prices and shares outstanding are provided by the asset managers.. Amendments to the 13f data are possible within a reporting period, resulting in multiple observations per reporting period. In such instances we keep the last report date of each asset manager within a reporting period.

An institution may issue multiple securities. This does not occur often, however it does occur in large banks such as Bank of America, Citigroup, and Wells Fargo. In institutions with multiple CUSIPs we sum the shares outstanding across securities. If there is a single CUSIP to an institution, percentage shares owned are calculated using shares outstanding. If there are multiple CUSIPs to an institution, percentage shares owned are calculated using the market capitalization.

We adjust percentage shares owned if an asset manager's value is greater than 25% for a single quarter, replacing the value with the subsequent quarter. We do not adjust the percentage share owned if the asset managers' ownership share was 25% over multiple reporting periods. Indeed, if shares owned by all 13f filers in any given bank in a single quarter is greater than 100%, we normalized the percentage shares with values from the previous quarter.

The PERMCO variable links to a Federal Reserve Bank of New York crosswalk that also contains the regulatory identification numbers (ID_RSSD) from the National Information Center. The ID_RSSD variables subsequently link to price and quantity data.