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Are US Industries Becoming More Concentrated?*

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Abstract

Since the late 1990s, over 75% of US industries have experienced an increase in concentration levels. We find that firms in industries with the largest increases in product market concentration show higher profit margins and more profitable mergers and acquisitions deals. At the same time, we find no evidence for a significant increase in operational efficiency. Taken together, our results suggest that market power is becoming an important source of value. These findings are robust to the inclusion of (i) private firms; (ii) factors accounting for foreign competition; and (iii) the use of alternative measures of concentration. We also show that the higher profit margins associated with an increase in concentration are reflected in higher returns to shareholders. Overall, our results suggest that the US product markets have undergone a shift that has potentially weakened competition across the majority of industries.

JEL classification: G34, L11, L12, L13, L16

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1. Introduction

That competition promotes efficient allocation of resources is a fundamental argument of economic theory. In fact, in the late 20th century, this premise motivated governments around the world to institute a series of policy reforms, including tariff reductions, deregulations, and aggressive antitrust enforcement, whose transformation of industrial

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conditions for numerous markets facilitated increased competition (e.g., Shepherd, 1982; Graham, Kaplan, and Sibley, 1983; Pryor, 1994; Nickell, 1996; Rajan and Zingales, 2001; Irvine and Pontiff, 2009).

Around the turn of the 21st century, however, the nature of US product markets arguably began undergoing a new fundamental change. We find that over the last two decades the Herfindahl–Hirschman index (HHI) has systematically increased in more than 75% of US industries, and the average increase in concentration levels has reached 90%. Similarly, the market share of the four largest public and private firms has grown significantly for most industries, and both the average and median sizes of public firms, that is, the largest players in the economy, have tripled in real terms. This finding of increased concentration is robust to alternative measures of concentration, to the inclusion of private firms, to proxies for foreign competition, and to a variety of industry definitions.

We next examine whether increasing industry concentration has been accompanied by an increase in corporate profits.[1] If markets are contestable, that is, few barriers to entry, then even firms operating in highly concentrated industries should behave as if they have many competitors (Baumol, 1982). Alternatively, significant barriers to entry, including economies of scale, technological barriers, and large capital requirements, should cause firms operating in increasingly concentrated industries to exercise market power and generate larger abnormal profits (e.g., Bain, 1951, 1956). Barriers to entry in the form of government regulations, for example, could increase the profitability and market value of incumbent firms (Bessen, 2016). However, the possibility exists that industry consolidation can lead to improvements in operational efficiencies, thereby increasing profitability. To address this question empirically, we examine whether the changes in industry concentration levels are linked to firm profitability, profit margins, and efficiency, as well as to the value created during mergers and acquisitions (M&A).

We find that over the past two decades profitability has risen for firms in those industries sustaining increases in concentration levels. Using various industry definitions, we document a positive correlation between changes in concentration levels and return-on-assets (ROA). When we decompose this profitability measure into operating efficiency, proxied by asset utilization (i.e., sales to assets ratio), and operating profit margins (i.e., Lerner Index), we find that the higher returns on assets are driven primarily by a given firm's ability to extract higher profit margins. A change in concentration levels in the magnitude of its interquartile range, that is, 75th minus 25th percentile, increases profit margins by 142% relative to its median, whereas the same change increases Asset Utilization by

Concentration Problem in America?" annual meeting 2017, the 2017 NYU-SEC special conference on capital formation, and seminar participants at the University of Arizona, Baruch College, Baylor University, Catholic University of Chile, Cornell Tech, the Hebrew University in Jerusalem, Hong Kong University, IDC, University of Illinois at Urbana–Champaign, the University of Manchester, Michigan State University, the University of Melbourne, Moscow Higher School of Economics, University of Nevada–Las Vegas, University of Notre Dame, University of Paris Dauphine, Penn State University, University of Oklahoma, Rice University, Sun Yat-Sen University, Texas A&M University, WHU—Otto Beisheim School of Management, and the University of Toronto for helpful comments. We are also grateful to Yamil Kaba for his assistance on this project.

1 Although some of our profitability tests are limited to publicly traded firms, we have performed multiple tests to ensure that our findings are robust to the inclusion of private firms.

only 6%. These findings demonstrate that firms in concentrated industries are becoming more profitable predominantly through higher profit margins, rather than via greater efficiency.

Importantly, we also consider the possibility that accounting profits do not fully capture firms' payments for the use of capital. Since concentration levels have historically been higher in capital-intensive industries, results using ROA and profit margins may be driven by variation in cost of capital and/or in capital intensity across industries. To control for these factors, we obtain estimates of both the capital share and the cost of capital from the Bureau of Labor Statistics (BLS) to augment our analysis. While our findings for ROA and the Lerner Index remain economically and statistically significant, the positive correlation between concentration levels and Asset Utilization disappears. These results reinforce the conclusion that higher profits in concentrated markets result from the presence of markups; higher profits do not result from either increased reliance on capital or improvements in efficiency.

We also examine M&A transactions as an alternative way to test whether market power is the mechanism behind higher profitability in industries with increased concentration. If industry concentration impacts firms' prospects, then the market should react more positively to announcements of transactions that further erode product market competition. We find that mergers of firms in the same industry have generally become more profitable to shareholders, as the market reaction to merger announcements is higher in industries with higher concentration levels.

Next, we perform a series of robustness tests to investigate whether our profitability and M&A findings are robust to accounting for other mechanisms and measures of market concentration. We first examine whether intensified foreign competition can provide an alternative source of rivalry to domestic firms, and ascertain, through additional tests, that cross-sectional differences in foreign competition cannot explain our main findings. Even after controlling for industry-level sales by foreign multinational firms in the USA, as well as for the level of import penetration, the relation between concentration measures and firm profitability remains positive and significant. Our results on M&A announcements are also unaffected by the inclusion of proxies for foreign competition.

Second, we confirm that private firms have not replaced public firms. When we use census-based measures of concentration, which include both public and private firms, we find the link between product market concentration and profitability remains positive and significant. Our M&A results are also robust to the use of census-based measures of concentration. We further ensure that the positive relationship between concentration levels and profitability holds when we include information on the profitability of private firms. Specifically, we repeat the analysis of profit margins and concentration using industry-level data from the NBER-CES manufacturing database and find similar results. This analysis also reveals that total factor productivity (TFP) is uncorrelated with industry concentration levels, indicating that if the efficiency channel is at work, it would be observable through factors unrelated to capital, labor, or materials.

Third, we examine whether our results are sensitive to the role played by large multisegment firms. To a significant extent, this concern is also mitigated by using census-based measures of concentration, which break down operations of multisegment firms into operations of component divisions sharing the same industry code. To provide additional evidence, we recalculate the Compustat-based HHI after removing multisegment firms, and obtain similar results. We also find the relation between concentration and profitability, as well as

M&A returns, remains significant when we use text-based industry definitions (Hoberg and Phillips, 2010, 2016), which assign a unique set of peers to every firm.

In the final section, we examine whether changes in concentration levels are related to investors' stock returns; we find that returns to shareholders increase as industries become more concentrated. We perform this analysis by estimating alphas on portfolios sorted on the change in concentration levels. We find that, in contrast to earlier periods, during period 2001–14, a zero-investment strategy of buying firms in industries with the largest increase in concentration levels, and shorting firms in industries with the largest decrease in concentration levels, generates excess returns of approximately 8.2% per year, after controlling for standard risk factors. This evidence suggests that the higher profit margins realized by firms during this recent increase in industry concentration have been reflected in higher returns to shareholders.

Our paper makes three important contributions to understanding product markets in the USA. First, our findings demonstrate that industry concentration over the last two decades has markedly increased. Notably, this increase in concentration has not been offset by the presence of private and foreign firms. Second, those industries that sustained increased concentration subsequently exhibit increases in profitability proportionate to the relevant increase in industry concentration. We also find that increased profits are driven primarily by wider operating margins rather than by higher operational efficiency, in line with the increased market-power explanation. Additionally, and consistent with this hypothesis, we show that related mergers are more profitable when markets are more likely to become highly concentrated. Finally, our third contribution entails the finding that increase in profitability stemming from increased market power has been transferred to investors by generating higher abnormal returns.

Our paper's findings are relevant to both several strands of the academic literature and to the pragmatic interests of policymakers. First, we enhance existing research on the relation between concentration levels and profitability. Consistent with models positing that exogenous barriers to entry increase the likelihood of market power, we find that profit margins have been, both economically and statistically, positively related to several proxies of market concentration over the last two decades. To the best of our knowledge, this paper is the first in recent history to document a strong positive correlation between measures of concentration and profitability. Previous studies examining earlier periods find weak or no correlation between these variables (e.g., Domowitz, Hubbard, and Petersen, 1986a, 1986b, 1987; Schmalensee, 1989).

Second, our findings that product markets have become more concentrated in the last two decades, and that the firms affected by this secular trend generate higher profits and abnormal stock returns, augment a growing body of economic research marking a change in the nature of US product markets. This development has had a number of additional implications including: (i) higher labor market concentration and its impact on wages (Benmelech, Bergman, and Kim, 2018); (ii) a decline in business dynamism and entrepreneurship (Decker *et al.*, 2014, 2016); and (iii) a decline in capital and labor share (Barkai, 2016). In our conclusion, we briefly discuss two possible reasons for the increased concentration, the first being technological changes that have increased barriers to entry, and the second being lax antitrust enforcement; however, we leave a formal investigation of this important question to future research.

2. Changes in Industry Concentration

2.1 Data

Our main sample consists of all firms in the CRSP-Compustat merged dataset over the period of 1972–2014. The main analysis entails firms incorporated in the USA trading on NYSE, AMEX, and NASDAQ, and for which information on ordinary common shares is accessible. To account for the role of private and foreign firms, we use information from the US Census Bureau and the US BLS. The precise definitions of all variables used in the paper, as well as their data sources, are summarized in Appendix A. For the main analysis, we use NAICS classification to define a firm's industry, but consider alternative industry definitions in the Online Appendix.

2.2 General Trend

We first investigate changes in industry concentration levels over time. We examine the trend using several HHI concentration indices. The first HHI uses Compustat data, which contain information on US public firms. To construct the index, within every NAICS three-digit industry-year we sum up the squared ratios of firm sales to the total industry sales. We then aggregate the measure across industries by calculating a value-weighted average HHI, in which the weights are determined by the level of industry sales. This approach grants more weight to those industries with increasing relevance in the overall economy, and mitigates the effect of declining or disappearing industries.[2]

Figure 1 panel A shows the results for the Compustat-based HHI. Consistent with increased competition documented by prior studies (e.g., Rajan and Zingales, 2001; Irvine and Pontiff, 2009), the concentration index declines beginning in the 1980s and remains low until the late 1990s, reaching its lowest point in 1996–97. From the late 1990s, the HHI rises steadily until the end of the sample period in 2014. In aggregate, since 1997 the series has surged almost 70%. As we will demonstrate, this increase in concentration is widespread across industries.

In Figure 1 panel B we use the number of public firms as another proxy for concentration. Publicly traded firms tend to be much larger than private firms, and are therefore typically the key industry players. We use an extended period, including information from the earliest CRSP database coverage, to calculate the number of public firms. Consistent with the evidence in Gao, Ritter, and Zhu (2013); Doidge, Karolyi, and Stulz (2017); and others, the number of public firms has significantly declined since the late 1990s.[3] The significance of this decline can be measured by the fact that the current number of publicly traded firms in the economy is even lower than that of the mid-1970s, when the real gross domestic product was one-third the current GDP. Significantly, after the late 1990s, the HHI increased in tandem with the drop in the number of firms, and the correlation between the number of firms and the HHI has strengthened from −0.72 during the 1972–90 period to −0.96 during the second half of the sample.

2 For robustness, we also employ a firm-weighted aggregation approach. We assign the industry-level HHI to each firm, and then average across all firms in every year, thereby weighting each industry ratio by the number of public firms. The pattern of the firm-weighted aggregate HHI is similar to the sales-weighted one.

3 For robustness, we repeat the analysis to include firms incorporated outside of the United States, as well as ADRs. The pattern of the change in the number of firms and HHI is slightly weaker but similar to the one presented here.

Figure 1. Trends in industry concentration. This figure shows the time-series trend in measures of industry concentration. Panel **A** presents the HHI concentration index for all US publicly traded firms that appear in the CRSP-Compustat merged dataset (see Section 2.1 for details). HHI_j in industry *j* is

To analyze the link between the change in concentration and the number of firms over time, in Figure 1 panel C we examine changes in firm-size distribution over time. The chart reports the annual mean and median sizes of public firms based on total sales in constant dollars of 1970. While median firm size significantly declined from the early 1970s to the mid-1990s, it began increasing in the late 1990s. Currently the average US firm is almost three times larger in real terms than it was 20 years ago. These findings mirror the pattern of the decline in the number of public firms, and indicate that a driving force behind this systematic increase in industry concentration has been the disappearance of public firms combined with the significant increase in the scale of remaining firms.

Next, we go beyond sales-based measures to evaluate the relative importance of large US firms through labor market dynamics. Figure 1 panel D presents the results of calculating the share of employment in firms with 10,000 or more employees, which is the largest size-category classified by the Census Bureau.[4] The trend corresponds to the sales-based analysis: Employment share by large firms in the overall economy began rising in the mid-90s and has recently exceeded previous historical peaks. In addition, this trend indicates that greater concentration in product markets, as measured by concentration in sales, correlates with increased concentration in labor markets. In other words, most jobs are currently being created by large and established firms, rather than by small entrepreneurial firms, consistent with the evidence in Decker *et al.* (2014, 2016).

We also investigate the possibility that the documented dominance of large firms over the past two decades is driven by a higher prevalence of multisegment firms. If a firm's operations span multiple sectors, industry boundaries become blurred, and standard classifications such as NAICS or SIC do not identify the true set of product market competitors. We therefore recalculate the aggregate Compustat-based HHI after excluding firm-year observations in which the sales of the non-core segments, as reported in the Compustat Segment file, account for at least 30% of sales. Although the overall level of HHI is lower using the alternative definition, the pattern of a steep increase since 1997 remains unchanged.

As an alternative way to account for operations of multisegment firms across different geographic areas, we calculate the change in concentration measures using industry

Figure 1. Continued
defined based on NAICS three-digit industry classification and is constructed as described in Appendix A. To aggregate the index across industries, we use a sales-weighted approach, where the weights are determined by the level of industry sales: $\frac{1}{\sum_{j=1}^{T} \text{Sale}_j} \times \sum_{j=1}^{T} \text{Sale}_j \times \text{HHI}_j$, (where Sale_j is the total sales in industry j, and T is the total number of industries). Panel **B** shows the number of publicly traded firms in CRSP database since the beginning of its coverage in 1925. To be included in the sample, we require that the stock has share code 10 or 11, is traded on one of the three major exchanges, and has non-missing stock price information as of December of year t. Panel **C** reports the mean and median size for all US publicly traded firms in the CRSP-Compustat merged dataset (see Section 2.1 for details). Firm size is based on total sales in constant dollars of 1970. Panel **D** shows the share of employment in firms with 10,000 employees or more out of the total US employment (see Section 2.2 for details).

4 The historical data on employment by firm size are obtained from Business Dynamics Statistics (BDS) annual report, managed by the US Census (http://www.census.gov/ces/dataproducts/bds/data.html).

definitions derived from the text-based analysis of a firm's product description in 10-K reports (see Hoberg and Phillips, 2010, 2016, for further details).[5] According to this classification, each firm has a distinct group of competitors, thereby rendering industry definition firm-specific: Every firm in a given year has a distinct set of competing peers. In contrast to the standard approach for defining an industry, this method yields additional insight by classifying competitors of firms whose operations spread across different industries, and firms that change the mix of products offered. Using the text-based HHI, we find that between 1997 and 2014 industry concentration has increased in over 60% of the firm-specific industries (untabulated).

2.3 Industry Concentration—Cross-Industry Evidence

The previous subsection documents that over the past two decades, product market concentration levels have significantly increased. In this subsection, we examine whether the increased concentration has been widespread across industries, or whether the phenomenon has been limited to a few markets.

Our first test examines changes in concentration measures in each three-digit NAICS industry between 1997 and 2014. We use 1997 as our starting period because 1996 and 1997 are the years in which, during our sample period, the HHI was at its lowest level, and the number of public firms in our sample peaked.[6] For every industry we use all public firms' data from the merged CRSP-Compustat universe and calculate a percentage change in HHI from its 1997 level to its 2014 level. Figure 2 panel A reports the distribution of all changes. The concentration index has increased in 80% of the industries, and the magnitude of the change is concentrated in the extreme range of the spectrum. Specifically, the median increase in HHI is 41%, while the mean increase is 90%.

The absence of private firms in this measure is a potential weakness of the Compustat-based HHI. While private firms are on average very small ($1.3 million according to Asker, Farre-Mensa, and Ljungqvist, 2011), the possibility exists for a fraction of these firms to grow large enough to replace public firms. In this case, the measures of concentration based on only public firms would seem to point to an increase in concentration, despite the actual concentration having changed only slightly. We address this potential concern in three ways. First, we use the HHI provided by the US Census Bureau, which includes revenues of both public and private firms in the manufacturing sector. In addition to including private firms, another advantage of the census measure is its superior ability to account for the activities of conglomerates. Specifically, rather than assigning NAICS codes at a firm level, the census constructs measures of concentration based on NAICS classification of each individual facility. Consequently, sales of conglomerate firms are decomposed by divisions sharing the same NAICS code, and then grouped with the sales of stand-alone firms sharing the same NAICS code. Figure 2 panel B reports the changes in concentration measures using this alternative census-based measure of the HHI during the period 1997–2012 (2012 being the most recent year for which census data are available). We find an HHI increase in

5 The data were obtained from Hoberg-Phillips website (http://hobergphillips.usc.edu/industrycon cen.htm).

6 We choose 1997 as opposed to 1996 due to availability of US Census data, which we introduce in this subsection. Since data from the US Census are available for calendar years ending in 2 or 7, using 1997 as our starting point allows for a more effective comparison between Compustat and census-based economic indicators.

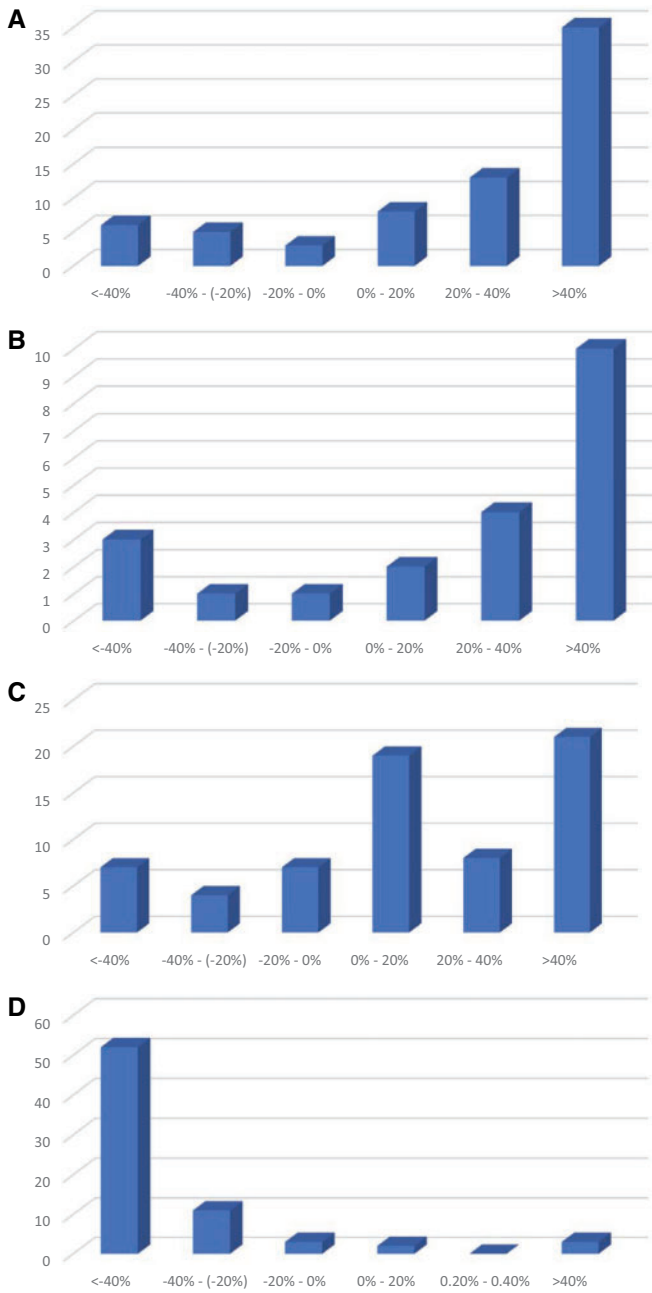

Figure 2. Change in measures of concentration across industries. Panel **A** (Panel **B**) depicts the distribution of percentage changes in the HHI Compustat-based index (HHI census-based index) across industries. Panel **C** shows the change in the share of the largest four firms in the industry (using census data), and Panel **D** shows the percentage change in the number of publicly traded firms across industries. Compustat-based HHI and the number of publicly traded firms are calculated for all US publicly traded firms that appear in the CRSP-Compustat merged dataset. The changes are calculated over the 1997–2014 period in the Compustat-based sample (i.e., for every industry we calculate the percentage change in concentration measure from its level in 1997 to its level in 2014), and over the 1997–2012 period in the census-based sample. The industries are defined based on NAICS three-digit classification.

76% of the manufacturing industries. Thus, the trend of increased concentration remains robust to including the share of sales generated by private firms.

Because the census-based HHI is not available for non-manufacturing industries, we also look at the share of the top four firms in terms of sales in each NAICS three-digit industry, which is also census based. The advantage of this measure is three-fold. First, it covers almost all US industries, including manufacturing, retail, financial, and service sectors.[7] Second, it is based on both public and private firms' information, thus extending beyond the Compustat universe. Third, the share of top four firms can be calculated out of total sales of the entire industry; therefore, the scope of the measure is not limited to the top 50 firms, as occurs with the census-based HHI.

Figure 2 panel C shows the distribution of percentage changes in the share of the top four firms in each industry between 1997 and 2012. The distribution is heavily skewed to the right, demonstrating a greater number of industries in which the share of the largest firms has increased compared with industries in which the largest four firms became diluted by smaller peers. Moreover, a large proportion of the positive changes were extreme in magnitude: In twenty-one out of sixty-five industries the increase has exceeded 40%. Among Furniture and Home Furnishings retailers (NAICS 442), for example, the share of the four largest firms went up from 6.5% in 1997 to 19.4% in 2012, which is equivalent to an almost 200% increase. Another example is Food and Beverage retail (NAICS 445). As early as 2000, the USDA Economic Research Service published a special report pointing to an unprecedented consolidation of supermarkets that created a small group of *de facto* nationwide food retailers by bringing together regional chains.[8] Together, the evidence indicates that the consolidation trend has continued over the last 20 years: While the revenues of the top four firms have increased from 18.3% in 1997 to 26.9% in 2012, the industry has lost over two-thirds of its publicly traded firms, and its HHI has more than tripled.

Finally, to examine whether public firms have remained dominant in the overall economy despite their dwindling numbers, we calculate the share of sales by public firms out of the total sales by public and private firms (see Online Appendix, Figure O-A.2).[9] We find that the share of public sales in the total revenues of US business enterprises has remained stable. To focus on the potential role of large firms, we repeat our analysis for the subsample of firms with sales over $100 million, which is the largest firm-size category classified in Statistics of US Businesses report, and find a similar trend.[10] Therefore, even though the number of private firms increased and the number of public firms decreased, the share of private firms' sales relative to those of public firms did not increase.

Our final measure of concentration examines the change in the number of publicly traded firms across industries. Figure 2 panel D shows that the number of publicly traded

7 The data are available at http://www.census.gov/econ/census/help/sector/data_topics/concentration_ratios.html. There are no data for Mining (NAICS 21), Construction (NAICS 23), and Management of Companies and Enterprises (NAICS 55). The information is available for economic census years only.

8 See http://www.iatp.org/files/Consolidation_in_Food_Retailing_Prospects_for_.pdf

9 The data is obtained from Statistics of US Businesses (SUSB) Annual Data Tables, managed by the US Census Bureau. See https://www.census.gov/programs-surveys/susb.html

10 For robustness, we also calculate the aggregate revenues of publicly traded firms as a percentage of the US gross domestic product. Consistent with the evidence in Gabaix (2011), we find that despite their shrinking numbers, public firms still represent a large fraction of the US economy.

firms has significantly declined in most industries. Out of seventy-one industries, sixty-six have experienced a negative change between 1997 and 2014. Moreover, the largest portion of the distribution is concentrated in the extreme range, indicating that 73% of the industries have lost over 40% of their publicly traded peers.[11]

We also decompose the changes in the number of public firms by sources of entry and exit to address the possibility that the increase in industry concentration could be driven by industries shrinking due to declining demand, which, in turn, leads to fewer participants in the market. We find that a decrease in the number of IPOs and an increase in M&A activity are two key mechanisms responsible for the decline in the number of public firms (Online Appendix, Figure O-A.3). Firms do not usually exit public markets due to liquidation or involuntary delisting. Instead, our results show that the remaining firms are not only thriving but also expanding at a positive and persistent rate.

Overall, the results consistently point to an increase in product market concentration over the past two decades. The pattern is economically large, robust to different measures of product market concentration and different industry classifications, and prevalent across the majority of US industries.

3. The Economic Implications of the Increase in Concentration Levels

Although existing literature in economics has devoted much attention to the question whether concentration is associated with profitability, researchers have not yet been able to detect a significant relationship between these two variables (Domowitz, Hubbard, and Petersen, 1986a, 1986b, 1987; Schmalensee, 1989). Given the change in the nature of product markets over the past two decades, we reexamine this important question by analyzing the relation between profitability and changes in industry concentration in a panel-data setting, while controlling for other factors that can influence firms' profitability levels.

3.1 Industry Concentration Levels and Profitability

If markets are contestable, that is, few barriers to entry, then even firms operating in highly concentrated industries should behave as if they had many competitors (Baumol, 1982). Consequently, profitability should not be affected by changes in industry concentration levels because the threat of potential entrants would keep markets competitive.[12] Furthermore, Sutton (1991) goes a step further to show that the presence of sunk costs such as advertising and R&D may result in declining industry profitability as concentration levels increase. More recently, Autor *et al.* (2017) present a model in which a higher degree of competition helps the most productive "superstar firms" capture market share, thus increasing industry concentration. Taken together, this strand of economic literature posits that intense quality competition may increase the total costs of operating in a particular industry, which, in turn, will lead to concentrated markets, as low price-cost margins reduce the number of market participants.

11 We also find that over 50% of the industries in the United States have lost at least half of their peers.

12 Baumol (1982, p.2) argues that "in the limiting case of perfect contestability, oligopolistic structure and behavior are freed entirely from their previous dependence on the conjectural variations of *incumbents* and, instead, these are generally determined uniquely and, in a manner that is tractable analytically, by the pressures of *potential* competition."

Alternatively, if barriers to entry, including economies of scale, technological barriers, and large capital requirements, become more salient, then firms operating in increasingly concentrated industries may generate larger profits by exercising market power, and/or becoming more efficient. Note that under both scenarios, firms' profitability levels should be positively correlated with industry concentration levels. Nevertheless, the market power hypothesis predicts that this positive relation will be driven primarily by increasing profit margins. The efficiency hypothesis predicts that the increased profitability will be driven primarily by improvements in operational efficiency, and in the absence of competition, at least part of this surplus will result in increased profitability. We test these predictions in Section 3.2.

We start by examining the relation between changes in profitability and changes in industry concentration levels. Specifically, we estimate the parameters of the following regression model:

$$\begin{aligned} \text{ROA}_{ijt} &= \alpha_i + \alpha_t + \beta_1 \log(\text{Assets}_{it}) + \beta_2 \log(\text{Age}_{it}) \\ &\quad + \beta_3 \log(\text{Concentration Level}_{jt}) + \epsilon_{ijt}, \end{aligned} \tag{1}$$

where ROA is the operating income before depreciation (Compustat item OIBDP) scaled by the book value of assets (item AT), α_i is a firm-fixed effect, α_t is a year-fixed effect, Assets is the book value of total assets, Age is the time in years from the firm's CRSP listing date, and Concentration Level$_{jt}$ is a proxy for the level of product market concentration in industry j at time t. Our main proxies for concentration are: (i) the HHI at the NAICS three-digit level using sales from Compustat (HHI); (ii) the total number of public firms in an industry (Number of firms); and (iii) a cross-sectional ranking of the previous two measures that is equal to the sum of the annual rank of the HHI combined with the annual inverse rank of the total number of industry incumbents (Concentration Index). Note that by construction this index increases as the level of industry concentration increases.

To control for potential time-series dependence in the residuals, we cluster the standard errors at the firm level. Since we include firm-fixed effects, and firms rarely switch industries, the proxies for industry concentration can be interpreted as the changes in concentration relative to the industry mean. The inclusion of firm-fixed effects addresses several alternative explanations, in addition to several potential endogeneity concerns. For example, if profitable firms systematically acquire the nonprofitable ones, this matching can lead to a mechanical relation between concentration levels and profitability. The inclusion of firm-fixed effects addresses this concern by focusing the analysis on the within-firm variation in profitability over time.

We use ROA as a proxy for profitability because this metric is not affected by changes in capital structure nor by the presence of unusual and nonrecurring items. Additionally, simulation evidence (Barber and Lyon, 1996) indicates that ROA is superior to other measures of profitability in detecting abnormal operating performance. Finally, ROA is calculated net of organizational capital expenses (SG&A), including R&D and advertising, therefore ROA mitigates concerns that the relationship between concentration and profitability is driven by those industries in which the role of intangible capital has increased over time (Bessen, 2016).[13] Following Bertrand and Mullainathan (2003) and Giroud and

13 Using the methodological approach in Peters and Taylor (2017), we also calculate a measure of ROA that incorporates intangible assets into the denominator. Our results are robust to this alternative definition.

Mueller (2010), we include firm size and age in all our regressions. In addition to firm-fixed effects, we also include year-fixed effects to control for unobserved time-specific shocks affecting all firms. Finally, to mitigate the impact of extreme ratio values, we exclude firms with assets or sales less than $5 million, that is, microcaps.[14]

Figure 3 plots the dynamics of aggregate ROA over time. Aggregate ROA is calculated as the aggregate operating income before depreciation scaled by the aggregate book value of assets. Panel A shows that aggregate ROA has declined over approximately the past four decades from 11% in 1972 to almost 5% in 2014. Although this evidence implies that aggregate profitability and aggregate concentration levels are moving in the opposite direction, additional analysis reveals that this is not the case. When we split the sample into nonfinancial and financial firms (NAICS two-digit sector code 52), in Figure 3 panels B and C, respectively, both groups exhibit reasonably stable trends in profitability, thus enabling us to posit that the negative aggregate trend in ROA is driven primarily by the increasing importance to the economy of financial firms, which tend to have lower ROA.[15] These findings highlight the importance of controlling for other factors when examining the relation between profitability and concentration levels. To ensure that our results are not driven by the change in the mix of financial versus nonfinancial firms, we exclude financial firms from the main analysis. We also exclude utilities (NAICS two-digit sector code 22) because these firms were highly regulated during part of our sample period.[16]

Table I panel A reports the coefficients of Equation (1) estimated over the period 1972–2014. We find that ROA is positively related to both the HHI and the Concentration Index, and negatively related to the Number of Firms. This result shows that firms tend to generate significantly higher profits when their industries become more concentrated. The results also reaffirm our earlier findings that the increase in concentration levels is not due to firms' leaving unprofitable industries. Note that profitability is positively correlated with changes in firm size, indicating that economies of scale are an important determinant of firms' profitability during the sample period.

Since most of the increase in industry concentration levels occurs in the latter part of our sample, we test for change in the empirical relation between profitability and concentration levels over that time period. To perform this analysis, we estimate the regression parameters of Equation (1) over three different subperiods: 1972–86; 1987–2000; and 2001–14. The rationale behind our choice of subperiods is as follows: Our univariate analysis collectively indicates that the recent increase in concentration levels started between 1996 and 2001. To determine the split accurately, we divide the overall sample into subsamples of equal length, that is, 1972–86 covers 15 years of data; 1987–2000 covers 14 years of data; and 2001–14 covers 14 years of data. We also conduct a Wald test of a structural break at an unknown break date in the time-series of the aggregate HHI and find

14 Including microcaps in our regressions does not affect our main results.

15 Greenwood and Scharfstein (2013) document that the financial sector share of GDP has significantly increased over the past three decades.

16 Including the financial and utilities sectors does not materially affect the results of our main regressions.

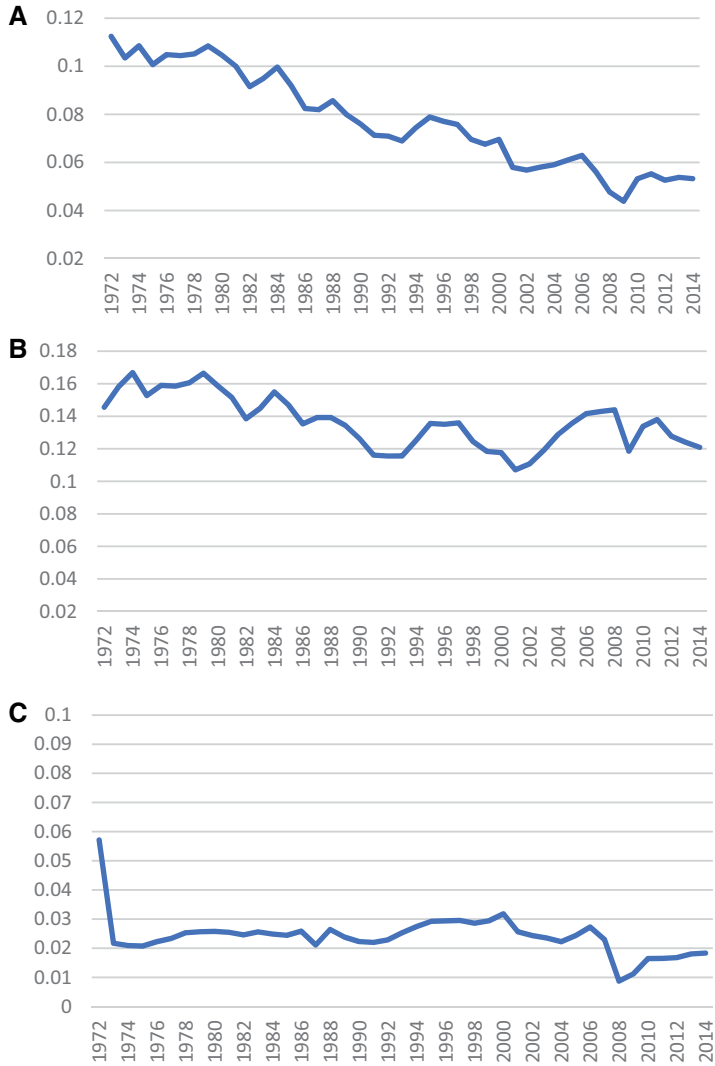

Figure 3. Trends in aggregate ROA. Panel **A** depicts the aggregate ROA for all the firms that appear in the CRSP-Compustat merged dataset (see Sections 2.1 and 3.1 for details) over the period 1972–2014. Aggregate ROA is equal to the aggregate operating income before depreciation scaled by the aggregate book value of assets. Panels **B** and **C** depict aggregate ROA for nonfinancial and financial firms (NAICS two-digit sector code 52), respectively.

a statistically significant structural break in the trend coefficient around the year 2000.[17] Separating the sample into alternative subperiods does not qualitatively affect any of our main results.

17 This result is consistent with the findings by Doidge, Karolyi, and Stulz (2017) who estimate the listing gap of the US publicly traded firms and find that the structural break, where the listing gap started to arise, occurred in 2000–2001.

Table I. Change in the level of product market concentration and profitability

This table reports coefficients from regressions of firm profitability on several proxies for the level of product market concentration and other control variables. ROA is the operating income before depreciation scaled by the book value of assets. Assets is the book value of total assets. Age is the time (in years) from the firm's CRSP listing date. HHI is the Herfindahl–Hirschman index based on sales data from Compustat. Number of Firms is the total number of public firms in an industry. Concentration Index is the sum of the annual rank of the HHI and the annual inverse rank of the total number of industry incumbents. See Sections 2.1 and 3.1 for dataset description, and Appendix A for details of variables construction. Industry is defined using a firm's three-digit NAICS code. Standard errors (reported in parentheses) are clustered at the firm level. Symbols [a], [b], and [c] indicate significance at 1%, 5%, and 10%, respectively.

Panel A: Entire sample

	Dependent variable: ROA		
Variable	1972–2014		
Constant	0.0696[a]	0.1092[a]	0.0854[a]
	(0.0107)	(0.0067)	(0.0044)
Log(Assets)	0.0169[a]	0.0171[a]	0.0169[a]
	(0.0012)	(0.0012)	(0.0012)
Log(Age)	–0.0178[a]	–0.0177[a]	–0.0178[a]
	(0.0013)	(0.0013)	(0.0013)
Log(HHI)	0.0027[c]		
	(0.0014)		
Log(Number of Firms)		–0.0056[a]	
		(0.0014)	
Concentration Index			0.0014[b]
			(0.0007)
N	143,602	143,602	143,602
Adjusted R^2	57.21%	57.22%	57.21%
Year-fixed effects	Yes	Yes	Yes
Firm-fixed effects	Yes	Yes	Yes
Clustering at firm level	Yes	Yes	Yes

Panel B: Subperiods

	Dependent variable: ROA								
Variable	1972–86			1987–2000			2001–14		
Constant	0.1914[a]	0.1644[a]	0.1708[a]	0.0743[a]	0.0751[a]	0.0770[a]	–0.2444[a]	–0.0665[a]	–0.1740[a]
	(0.0175)	(0.0107)	(0.0079)	(0.0191)	(0.0148)	(0.0092)	(0.0320)	(0.0243)	(0.0202)
Log(Assets)	0.0011	0.0011	0.0009	0.0198[a]	0.0198[a]	0.0198[a]	0.0349[a]	0.0351[a]	0.0353[a]
	(0.0021)	(0.0021)	(0.0021)	(0.0021)	(0.0021)	(0.0021)	(0.0030)	(0.0030)	(0.0030)
Log(Age)	–0.0200[a]	–0.0199[a]	–0.0199[a]	–0.0327[a]	–0.0327[a]	–0.0326[a]	0.0097[a]	0.0100[a]	0.0090[a]
	(0.0020)	(0.0020)	(0.0020)	(0.0024)	(0.0024)	(0.0024)	(0.0036)	(0.0036)	(0.0036)
Log(HHI)	–0.0038[c]			0.0007			0.0168[a]		
	(0.0023)			(0.0024)			(0.0040)		
Log(Number of Firms)		0.0002			0.0008			–0.0140[a]	
		(0.0022)			(0.0027)			(0.0037)	
Concentration Index			–0.0026[b]			0.0006			0.0095[a]
			(0.0012)			(0.0010)			(0.0019)
N	44,622	44,622	44,622	54,883	54,833	54,833	44,147	44,147	44,147
Adjusted R^2	53.06%	53.05%	53.06%	59.29%	59.29%	59.29%	67.08%	67.08%	67.11%
Year-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clustering at firm level	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table I panel B reports the results from this analysis. Similar to Domowitz, Hubbard, and Petersen (1986a, 1986b, 1987) and Schmalensee (1989), who have studied the intra-industry relation between industry-level price-cost margins and concentration levels over the 1958–81 period, we do not find a strong relation between ROA and measures of concentration during the earlier part of our sample. In fact, evidence exists for the correlation between these two variables being negative over the period 1972–86. The relation between ROA and our proxies for industry concentration levels is only positive and statistically significant across all measures during the later subperiod, 2001–14. In terms of economic significance, the coefficient of Concentration Index estimated over this period indicates that a change in concentration from the 25th to the 75th percentile leads to an increase in ROA of about 32.3% relative to its median. We find similar magnitudes when we use HHI and the number of firms as alternative measures of concentration. Consequently, this analysis points to a significant structural shift, beginning at the turn of the 21st century, in the economic relation between industry structure and firms' profitability.

3.2 The Sources of Abnormal Profits

A potential explanation for the increase in profitability in more concentrated industries is the decrease in contestability over time resulting from increasing barriers to entry. Thus, lack of competition may allow remaining industry incumbents to gain wider profit margins by setting higher prices relative to production costs. Consistent with this explanation, Barkai (2016) uses a general equilibrium model to demonstrate that increase in markups is the only factor able to explain the increase in profit share in the US nonfinancial sector in the past 30 years. Alternatively, some analysts argue that given the changing nature of US industries, the consolidation of firms within an industry may increase operational efficiency. For example, a large firm may enhance flexibility by reallocating its existing resources to extract the highest productivity from any unit of capital, consequently increasing firm profitability. To this end, we examine whether the empirical relation between profitability and change in industry concentration levels stems from higher profit margins, higher operational efficiency, or both.

We start by decomposing return on assets into two components: the Lerner Index and the Asset Utilization ratio. The Lerner Index measures the extent to which prices exceed marginal costs (price-cost margins), while the Asset Utilization ratio measures how efficiently firms manage their assets to generate sales. Following Aghion *et al.* (2005), we define the Lerner Index as operating income before depreciation (Compustat item OIBDP) minus depreciation (item DP), all scaled by total sales (item SALE). We subtract depreciation from operating income to take into account the cost of physical capital (Hall and Jorgenson, 1967). Asset Utilization is defined as total sales scaled by total assets.

Figure 4 plots the dynamics of the aggregate Lerner Index and the aggregate Asset Utilization over the period 1972–2014. This figure demonstrates that while the aggregate Lerner Index experienced a positive shift in the early 2000s, aggregate Asset Utilization has declined over time. This pattern suggests that the positive link between concentration and ROA is potentially driven by higher profit margins rather than by higher operational efficiency.

Using the same specification we employed in Equation (1), in Table II we estimate the coefficients of the model using the Lerner Index and the Asset Utilization ratio as dependent variables. Table II panel A shows a strong relation between the Lerner Index and

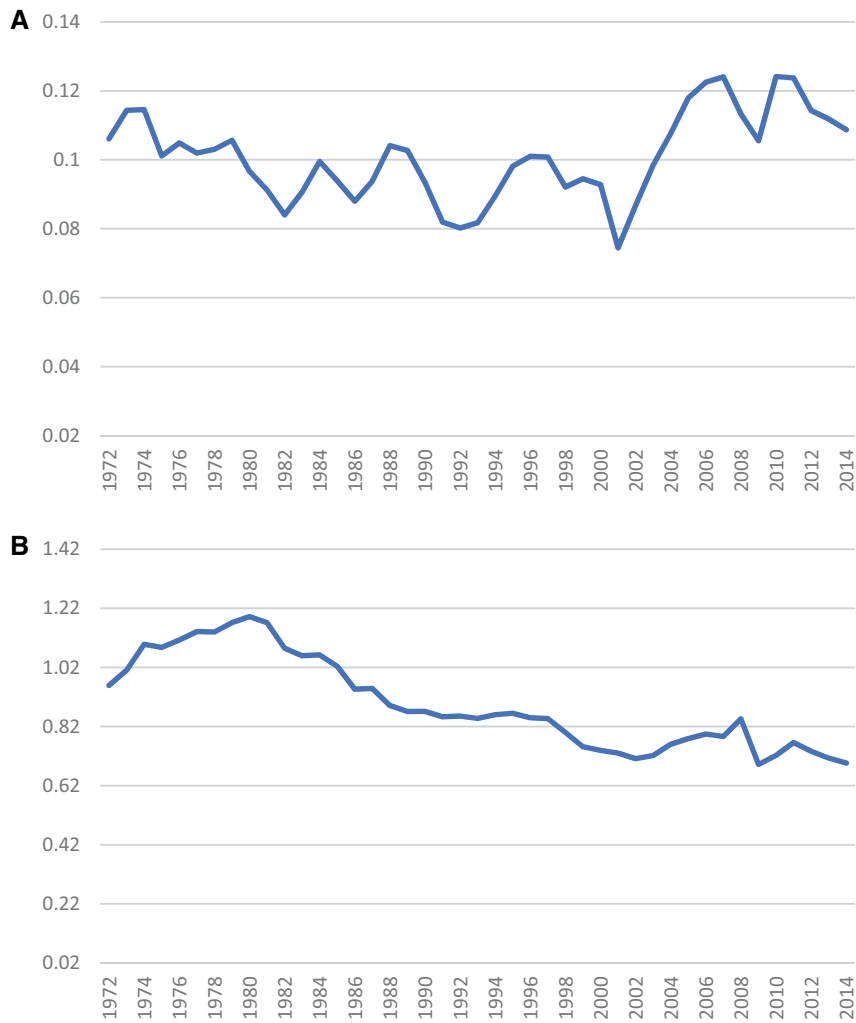

Figure 4. Trends in the aggregate Lerner index and the aggregate asset utilization: non-financial firms. Panel **A** depicts the aggregate Lerner Index and Panel **B** depicts Asset Utilization for all non-financial firms (excluding firms with the NAICS two-digit sector code 52) that appear in the CRSP-Compustat merged dataset (see Sections 2.1 and 3.1 for details) over the period 1972–2014. The aggregate Lerner Index is defined as the aggregate operating income after depreciation scaled by aggregate sales, while the aggregate Asset Utilization is defined as aggregate sales scaled by the aggregate book value of assets.

concentration measures during the whole sample period (1972–2014): the Lerner Index is positively correlated with both the HHI and the Concentration Index, and negatively correlated with the Number of Firms. On the other hand, Table II panel B shows a negative correlation between Asset Utilization and concentration measures over the same time period.

Consistent with our previous findings, the average within-firm relation between profitability measures and proxies for industry concentration levels is stronger over the subperiod

Table II. Change in the level of product market concentration, profit margins, and efficiency

This table reports coefficients from regressions of profit margins and efficiency measures on several proxies for the level of product market concentration and other control variables. Lerner Index is the operating income before depreciation minus depreciation, all scaled by total sales. Asset Utilization is defined as total sales scaled by total assets. Assets is the book value of total assets. Age is the time (in years) from the firm's CRSP listing date. HHI is the Herfindahl–Hirschman index based on sales data from Compustat. Number of Firms is the total number of public firms in an industry. Concentration Index is the sum of the annual rank of the HHI and the annual inverse rank of the total number of industry incumbents. See Sections 2.1 and 3.1 for dataset description, and Appendix A for details of variable construction. Industry is defined using a firm's three-digit NAICS code. Standard errors (reported in parentheses) are clustered at the firm level. Symbols [a], [b], and [c] indicate significance at 1%, 5%, and 10%, respectively.

Panel A: Concentration and Lerner index—entire sample

	Dependent variable: Lerner Index		
Variable	1972–2014		
Constant	–0.1251[a]	0.0287[c]	–0.0369[a]
	(0.0255)	(0.0173)	(0.0118)
Log(Assets)	0.0155[a]	0.0159[a]	0.0157[a]
	(0.0037)	(0.0037)	(0.0037)
Log(Age)	–0.0012	–0.0011	–0.0013
	(0.0039)	(0.0039)	(0.0039)
Log(HHI)	0.0147[a]		
	(0.0036)		
Log(Number of Firms)		–0.0142[a]	
		(0.0033)	
Concentration Index			0.0066[a]
			(0.0017)
N	143,230	143,230	143,230
Adjusted R^2	57.31%	57.31%	57.31%
Year-fixed effects	Yes	Yes	Yes
Firm-fixed effects	Yes	Yes	Yes
Clustering at firm level	Yes	Yes	Yes

Panel B: Concentration and asset utilization—entire sample

	Dependent variable: Asset Utilization		
Variable	1972–2014		
Constant	2.0301[a]	1.8617[a]	1.8961[a]
	(0.0521)	(0.0377)	(0.0226)
Log(Assets)	–0.1991[a]	–0.1990[a]	–0.1993[a]
	(0.0061)	(0.0061)	(0.0061)
Log(Age)	0.1051[a]	0.1051[a]	0.1053[a]
	(0.0066)	(0.0067)	(0.0067)
Log(HHI)	–0.0222[a]		
	(0.0070)		
Log(Number of Firms)		0.0041	
		(0.0080)	

(continued)

Table II. Continued

Panel B: Concentration and asset utilization—entire sample

	Dependent variable: Asset Utilization		
Variable	1972–2014		
Concentration Index			–0.0098[a]
			(0.0033)
N	143,807	143,807	143,807
Adjusted R^2	83.47%	83.46%	83.47%
Year-fixed effects	Yes	Yes	Yes
Firm-fixed effects	Yes	Yes	Yes
Clustering at firm level	Yes	Yes	Yes

Panel C: Concentration and Lerner index—subperiods

	Dependent variable: Lerner Index								
Variable	1972–1986			1987–2000			2001–14		
Constant	0.1088[a]	0.0715[a]	0.0689[a]	–0.0592	–0.0272	–0.0343	–0.8904[a]	–0.1008	–0.5419[a]
	(0.0198)	(0.0120)	(0.0083)	(0.0361)	(0.0327)	(0.0217)	(0.1348)	(0.1065)	(0.0833)
Log(Assets)	0.0150[a]	0.0153[a]	0.0149[a]	0.0241[a]	0.0241[a]	0.0241[a]	–0.0109	–0.0103	–0.0089
	(0.0023)	(0.0023)	(0.0023)	(0.0056)	(0.0056)	(0.0056)	(0.0148)	(0.0149)	(0.0147)
Log(Age)	–0.0208[a]	–0.0205[a]	–0.0207[a]	–0.0346[a]	–0.0347[a]	–0.0347[a]	0.1268[a]	0.1290[a]	0.1233[a]
	(0.0023)	(0.0023)	(0.0023)	(0.0048)	(0.0048)	(0.0048)	(0.0191)	(0.0192)	(0.0191)
Log(HHI)	–0.0068[b]			0.0040			0.0835[a]		
	(0.0027)			(0.0044)			(0.0188)		
Log(Number of Firms)		–0.0029			–0.0010			–0.0503[a]	
		(0.0024)			(0.0052)			(0.0146)	
Concentration Index			–0.0034[a]			0.0008			0.0471[a]
			(0.0013)			(0.0017)			(0.0085)
N	44,260	44,260	44,260	54,832	54,832	54,832	44,138	44,138	44,138
Adjusted R^2	56.58%	56.56%	56.57%	68.30%	68.30%	68.30%	58.65%	58.62%	58.69%
Year-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clustering at firm level	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Panel D: Concentration and asset utilization—subperiods

	Dependent variable: Asset Utilization								
Variable	1972–86			1987–2000			2001–14		
Constant	2.1227[a]	2.0700[a]	2.1095[a]	2.0253[a]	2.227[a]	2.1137[a]	2.3305[a]	2.5846[a]	2.4732[a]
	(0.0814)	(0.0553)	(0.0439)	(0.0808)	(0.0691)	(0.0408)	(0.1016)	(0.0833)	(0.0619)
Log(Assets)	–0.2056[a]	–0.2062[a]	–0.2057[a]	–0.2393[a]	–0.2387[a]	–0.2393[a]	–0.2831[a]	–0.2830[a]	–0.2826[a]
	(0.0113)	(0.0114)	(0.0113)	(0.0093)	(0.0093)	(0.0093)	(0.0094)	(0.0095)	(0.0094)

(continued)

Table II. Continued

Panel D: Concentration and asset utilization—subperiods

	Dependent variable: Asset Utilization								
Variable	1972–86			1987–2000			2001–14		
Log(Age)	0.0262[b]	0.0256[b]	0.0262[b]	0.1211[a]	0.1224[a]	0.1214[a]	0.0926[a]	0.0936[a]	0.0921[a]
	(0.0114)	(0.0114)	(0.0114)	(0.0097)	(0.0096)	(0.0097)	(0.0113)	(0.0113)	(0.0113)
Log(HHI)	–0.0027			–0.0213[b]			0.0294[b]		
	(0.0101)			(0.0104)			(0.0131)		
Log(Number of Firms)		0.0099			–0.0267[b]			–0.0126	
		(0.0118)			(0.0137)			(0.0124)	
Concentration Index			–0.0025			–0.0023			0.0120[b]
			(0.0057)			(0.0043)			(0.0058)
N	44,683	44,683	44,683	54,931	54,931	54,931	44,193	44,193	44,193
Adjusted R^2	89.95%	89.95%	89.95%	85.81%	85.81%	85.80%	87.96%	87.95%	87.95%
Year-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clustering at firm level	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

2001–14. In this subperiod, both the Lerner Index and the Asset Utilization ratio increase as industries become more concentrated (Table II panels C and D, respectively). These results indicate that firms operating in increasingly concentrated industries are able to generate abnormal profits by boosting their profit margins and, to a lesser extent, by enhancing the efficiency of their existing assets. The economic significance of the profit-margin impact is in fact considerably greater than the efficiency effect. While a change in the Concentration Index from the 25th to the 75th percentile leads to an increase in the Lerner Index of about 142% relative to its median, a similar change in the Concentration Index only leads to an increase in Asset Utilization of about 6% relative to its median. These results indicate relations between profitability (ROA) and the changes in concentration levels (Table I) are driven primarily by the positive effect of product market concentration on profit margins, and not by efficiency gains.

After establishing the main results, we perform a battery of robustness tests to ensure that our findings are not sensitive to the choice of industry definition. Section 1.A of the Online Appendix discusses the differences in industry definitions based on three versus four-digit NAICS code, and shows that the profitability results are robust to the use of four-digit NAICS as a more granular industry definition. In Section 1.B of the Online Appendix, we consider the changing landscape of industry structure, as well as potential role of multisegment firms, and re-estimate the results using text-based industry classification, described in Section 2.2 of the paper. Our main results are robust to these alternative specifications.

The accumulated evidence demonstrates that market power is likely playing an important role in explaining the increased profitability in many industries. One possible

explanation is that higher barriers to entry have increased firms' abilities to generate higher profit margins by fending off potential competitors. Alternatively, the possibility exists that firms have become more efficient due to declines in their marginal cost of production. However, our measure of efficiency, widely used in the literature (see, e.g., Nohel and Tarhan, 1998; Ang, Cole, and Lin, 2000; Patatoukas, 2012; Irvine, Park, and Yildizhan, 2016), is not significantly higher in more concentrated markets. This evidence, combined with the documented decline in capital and labor share (Barkai, 2016; Gutiérrez and Philippon, 2017), indicates that neither capital nor labor is the source of the efficiency gains that can explain the increased profitability. However, we cannot rule out other possible gains in efficiency that might have contributed to the gains in profitability.

Finally, since we do not have data on consumer prices, we cannot determine whether there is also a positive relation between concentration and consumer prices, which would substantially determine the need for antitrust intervention. However, our analysis effectively rules out the explanation that, in competitive markets, changes in the optimal distribution of firm size can lead to increases in concentration levels without affecting profit margins. Furthermore, our analysis rules out the possibility that improvements in efficiency are derived from better asset utilization or improvements in TFP (as will be described in Section 6.2).

3.3 Accounting Profits versus Economic Profits

Our previous analysis used accounting profits to measure firms' profitability. However, because no market transactions are recorded for capital services, the profits we measure from the accounting statements can differ from the true economic profits as a result of industry variations in the price and the use of capital. In Section 3 of the Online Appendix, we show that the wedge between accounting and economic profits is driven by the two determinants of capital payments: the price of capital and the capital share. Therefore, if the payment for capital is higher in concentrated industries, ignoring these two factors can lead to a spurious correlation between accounting profits and concentration levels.

To address this econometric concern, we gather data on the price of capital and the capital share at the three-digit NAICS industry level from the KLEMS Multifactor Productivity Tables produced by the BLS. Price of Capital is defined as the capital payments scaled by the stock of assets, while Capital Share is defined as the capital payments scaled by the total value of production. Capital payments are equal to the flow of services from the stock of assets, which include equipment, structures, intellectual property products, inventories, and land. The BLS aggregates the stock of assets using weights based on the implicit prices these assets would generate in a rental market.[18] These variables have been available on an annual basis from 1987.

Table III reports the results from regressions of ROA, Lerner Index, and Asset Utilization on the Concentration Index controlling for the Price of Capital and the Capital Share. Consistent with our previous findings, the results show that the ROA and the Lerner Index are positively related to concentration levels over the period 2001–13. The results further indicate that the industry cross-sectional variation in the use and cost of capital does not drive our main findings. Moreover, Table III shows that Asset Utilization is negatively correlated with the Capital Share and positively correlated with the Price of Capital. This evidence implies that the marginal productivity of capital declines as the capital share

18 See https://www.bls.gov/mfp/mprdload.htm for a detailed discussion of these variables.

Table III. Change in the level of product market concentration and profitability—controlling for the use and cost of capital

This table reports coefficients from regressions of ROA, profit margins, and efficiency measures on the industry concentration index (defined as the sum of the annual rank of the HHI and the annual inverse rank of the total number of industry incumbents), controlling for the use and cost of capital and other variables. ROA is the operating income before depreciation scaled by the book value of assets. Lerner index is the operating income before depreciation minus depreciation, all scaled by total sales. Asset Utilization is defined as total sales scaled by total assets. Price of Capital is equal to the industry-level capital payments scaled by the stock of assets. Capital Share is equal to the industry-level capital payments scaled by the total value of production. See Sections 2.1 and 3.1 for dataset description, and Appendix A for details of variables construction. Industry is defined using a firm's three-digit NAICS code. Standard errors (reported in parentheses) are clustered at the firm level. Symbols [a], [b], and [c] indicate significance at 1%, 5%, and 10%, respectively.

	1987–2013			1987–2000			2001–13		
Variable	ROA	Lerner Index	Asset Utilization	ROA	Lerner Index	Asset Utilization	ROA	Lerner Index	Asset Utilization
Constant	–0.0743[a]	–0.2082[a]	0.9870[a]	0.0487	–0.2458[a]	1.4727[a]	–0.1735[a]	–0.2041	1.3002[a]
	(0.0242)	(0.0550)	(0.1172)	(0.035)	(0.0781)	(0.1704)	(0.0423)	(0.1314)	(0.1370)
Log(Assets)	0.0274[a]	0.0277[a]	–0.2212[a]	0.0224[a]	0.0361[a]	–0.2444[a]	0.0387[a]	0.0065	–0.2797[a]
	(0.0019)	(0.0065)	(0.0069)	(0.0026)	(0.0056)	(0.0098)	(0.0034)	(0.0167)	(0.0097)
Log(Age)	–0.0204[a]	–0.0042	0.1137[a]	–0.0371[a]	–0.0482[a]	0.1138[a]	0.0051	0.1099[a]	0.0913[a]
	(0.0020)	(0.0066)	(0.0078)	(0.0027)	(0.0049)	(0.0101)	(0.0044)	(0.0217)	(0.0117)
Concentration Index	0.0037[a]	0.0055[c]	–0.0105[b]	0.0011	–0.0004	–0.0064	0.0144[a]	0.0420[a]	0.0053
	(0.0013)	(0.0034)	(0.0054)	(0.0015)	(0.0023)	(0.0060)	(0.0030)	(0.0131)	(0.0093)
Log(Price of Capital)	0.0190[a]	0.0218[a]	0.1932[a]	0.0087	0.0384[a]	0.0787[a]	–0.0020	–0.0454[a]	0.1768[a]
	(0.0037)	(0.0075)	(0.0192)	(0.0055)	(0.0124)	(0.0263)	(0.0065)	(0.0175)	(0.0215)
Log(Capital Share)	–0.0023	0.0186	–0.1414[a]	0.0063	–0.0146	–0.1271[a]	0.0001	0.0539[b]	–0.1650[a]
	(0.0050)	(0.0117)	(0.0209)	(0.0072)	(0.0157)	(0.0316)	(0.0069)	(0.0224)	(0.0231)
N	74,586	74,586	74,682	41,645	41,645	41,702	32,941	32,941	32,980
Adjusted R^2	59.01%	56.13%	80.20%	58.95%	62.03%	82.45%	67.59%	59.38%	85.97%
Year-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clustering at firm level	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

increases, which is consistent with diminishing returns on capital. Further, this evidence posits that the productivity of capital is reflected in the price of capital. Table III also shows that the positive within-firm correlation between Asset Utilization and concentration levels documented in Section 3.2 disappears after controlling for these two factors. Overall, these results strengthen the claim that the higher profits earned by firms in increasingly concentrated industries result from markups, and not from the use of more capital or from better utilization of the given firms' assets.

4. Changes in Industry Concentration and the Value of Mergers

From a theoretical perspective, mergers can create value by improving efficiency, including economies of scale and scope, synergies, and elimination of duplicate functions; mergers also create value through increasing market power. The latter effect should become more dominant as competition declines. Therefore, examining the relation between M&A announcement returns and concentration levels should enable further insight into what drives the relationship between increased concentration and profitability. If investors perceive the wealth effects in mergers as partially due to increases in market power, then the market reaction to these corporate events should be stronger in industries with increased concentration, especially in related mergers. The rationale for this conclusion is that, with all else constant, mergers in concentrated markets are more likely than mergers in competitive markets to further reduce competition. This argument is consistent with the antitrust polices of the Federal Trade Commission and the Department of Justice, in which horizontal mergers in highly concentrated markets are predominantly investigated and/or blocked.

We gather data from the Securities Data Company's (SDC) M&A database. Our sample consists of M&A transactions over the period 1980–2014 that meet the following conditions: (i) percent of ownership by acquirer prior to event is lower than 50%; (ii) percent of ownership by acquirer after event is higher than 50%; (iii) both acquirer and target are identified as public firms; (iv) acquirer and target firm have different identifiers; (v) the transaction is friendly; (vi) return data around the announcement date are available on CRSP; and (vii) the method of payment is known. We also exclude financials and utilities from our sample because these firms face more regulatory uncertainty during the merger process.

We focus on the change in the combined value of the target and the acquiring firms to gauge the magnitude of the total wealth creation around the merger announcement. To capture this effect, we calculate the cumulative abnormal return (CAR) of the combined firm over a 3-day event window $[-1, 1]$ around the announcement of merger d:

$$\text{Combined CAR}_d = \frac{\text{MV}_{A,t+1} + \text{MV}_{T,t+1}}{\text{MV}_{A,t-1} + \text{MV}_{T,t-1}} - 1 - r_{\text{CRSP},t-1,t+1}, \tag{2}$$

where t is the announcement date of the transaction, MV_A (MV_T) is the market value of equity of the acquiring (target) firm, and $r_{\text{CRSP},t-1,t+1}$ is the cumulative return on the CRSP value-weighted market portfolio from $t-1$ to $t+1$. Deals in our sample generate an average combined CAR of 1.15%. The aggregate dollar value of the estimated combined CAR across all transactions is approximately \$245.4 billion.

To investigate the effect of market power considerations on M&A transactions, we test whether the effect of the changes in concentration levels on announcement returns is stronger when the target and the acquirer belong to the same industry (related mergers) than the

effect is when they belong to different industries (unrelated mergers). If the impact of the change in concentration levels on expected synergies is primarily driven by the impact of the merger on the competitive landscape of the given industry, then the effect should be stronger for related mergers. To test this hypothesis, we estimate the parameters of the following model:

$$\begin{aligned} \mathrm{CAR}_d &= \alpha_t + \alpha_j + \beta_1 B/M_{\mathrm{T},t-1} + \beta_2 B/M_{A,t-1} + \beta_3 \log(\mathrm{MV}_{T,t-1}) \\ &+ \beta_4 \log(\mathrm{MV}_{A,t-1}) + \beta_5 \mathrm{DumCash}_d + \beta_6 \mathrm{DumStock}_d \\ &+ \beta_7 \log(\text{Concentration Level}_{j,t-1}) + \beta_8 \mathrm{Related}_d + \beta_9 \mathrm{Related}_d \\ &\times \log(\text{Concentration Level}_{j,t-1}) + \epsilon_d. \end{aligned} \tag{3}$$

where T and A denote target and acquirer, respectively; t is the year of the merger; j is the NAICS three-digit code industry of the acquiring firm; and d is the deal indicator.

The main variable of interest is the effect of concentration levels on related mergers. Therefore, we include a dummy variable (Related) equal to 1 if the target and the acquiring firm are in the same NAICS three-digit code industry, and an interaction variable equal to the product of Related and Concentration Level. We also include year-fixed effects (α_t) to control for the impact of merger waves and macroeconomic conditions on announcement returns and an industry-fixed effects based on the acquirer's industry (α_j) to control for time-invariant industry factors. To control for deal characteristics, we include the book-to-market ratios of the target ($\mathrm{B/M}_T$) and the acquiring firm ($\mathrm{B/M}_A$) as control variables to capture the effect of investment opportunities (Jovanovic and Rousseau, 2002) and/or potential misvaluation (Shleifer and Vishny, 2003) on the wealth effects of mergers.[19] We also include the market values of the target (MV_T) and the acquirer (MV_A) as proxies for firm size to control for the potential economies of scales generated by the merger (see, e.g., Asquith, Bruner, and Mullins, 1983). Further, we include dummies for both pure cash transactions ($\mathrm{DumCash}_d$) and pure stock transactions ($\mathrm{DumStock}_d$) to control for the established empirical fact that stock-financed transactions generate lower CARs than cash-financed transactions (see, e.g., Andrade, Mitchell, and Stafford, 2001).

If investors expect market power considerations to be an important part of the anticipated synergies from a merger, then we should observe a positive coefficient on the interaction variable. Table IV reports the estimated coefficients from this regression. The regression results show that the market reaction around M&A announcements is stronger for related mergers occurring in highly concentrated industries.[20] Consistent with our profitability results, we find that this effect is much stronger during the post-2000 period. While the middle panel (1980–2000) shows that the interaction variable is insignificant for all measures of concentration, the right panel (2001–2014) shows the effect of concentration levels on Combined CARs tending to be much stronger during related mergers. The relationship is also economically significant. A one-standard-deviation increase in the Concentration Index increases the CAR of a related merger by approximately 104 basis points. This effect is large, considering that the average CAR in our sample is 114 basis points. Moreover, if the merger results are driven by efficiencies of horizontal mergers,

19 Following the definition in Davis, Fama, and French (2000), we define the book-to-market ratio as stockholder's book equity, plus balance-sheet deferred taxes and investment tax credit (if available), minus the book value of preferred stock.

20 These findings are insensitive to the exclusion of controls for deal characteristics.

Table IV. Change in the level of product market concentration and M&A returns

The table presents results of regressing CARs around merger announcements on several proxies for the level of product market concentration and other control variables. The sample consists of M&A transactions over the period 1980–2014. CAR is the cumulative abnormal return of the combined firm (acquirer plus target) over a 3-day event window [−1, 1] around the merger announcement (see Equation (2)). Related is a dummy variable that takes on a value of 1 if the acquirer and the target belong to the same NAICS three-digit industry, and zero otherwise. Industry is defined using the acquirer's three-digit NAICS code. We control for deal characteristics by including the market values and book-to-market ratios of the target and acquiring firms, and dummies for pure cash transactions and pure stock transactions. See Section 4 for dataset description and full specification, and Appendix A for details of variable construction. Symbols [a], [b], and [c] indicate significance at 1%, 5%, and 10%, respectively.

Variable	1980–2014			1980–2000			2001–14		
Constant	0.0514[c]	0.0477[a]	0.0400[a]	0.0671[c]	0.0577[b]	0.0439[a]	0.0022	0.0621	0.0301[b]
	(0.0279)	(0.0189)	(0.0154)	(0.0371)	(0.0295)	(0.0147)	(0.0424)	(0.0431)	(0.0142)
Log(HHI)	–0.0012			–0.0034			0.0044		
	(0.0034)			(0.0050)			(0.0054)		
Log(Number of Firm)		–0.0011			–0.0029			–0.0059	
		(0.0027)			(0.0051)			(0.0077)	
Concentration Index			0.0057			0.0159			–0.0079
			(0.0164)			(0.0196)			(0.0288)
Related	–0.0296	0.0271[a]	0.0066[c]	–0.0059	0.0073	0.0003	–0.0566	0.0549[a]	0.0176[a]
	(0.0261)	(0.0075)	(0.0035)	(0.0308)	(0.0086)	(0.0045)	(0.0371)	(0.0117)	(0.0060)
Proxy for Concentration×	0.0046	–0.0053[a]	0.0206[a]	0.0005	–0.0019	0.0085	0.0094[c]	–0.0098[a]	0.0531[a]
Related	(0.0039)	(0.0014)	(0.0081)	(0.0047)	(0.0016)	(0.0107)	(0.0054)	(0.0023)	(0.0198)
N	5,281	5,281	5,281	3,340	3,340	3,340	1,941	1,941	1,941
Adjusted R^2	3.88%	4.04%	3.97%	3.42%	3.44%	3.50%	6.33%	6.82%	6.39%
Year-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Acquirer's industry-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Deal characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clustering at industry level	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

rather than by market power, our size controls should capture some of this effect (see, e.g., Asquith, Bruner, and Mullins, 1983).

Similar to the analysis of profitability, we verify the robustness of our M&A results to alternative industry definitions, and find that our conclusions remain unaffected (the results based on NAICS four-digit industry definition, as well as industry classification based on text-based analysis, are tabulated in the Online Appendix). Overall, we conclude that market power considerations appear to be an important source of value during M&A transactions. These findings strengthen the claim that increased market power affects profit margins for firms in industries with increased concentration.

5. Substitution by Foreign Firms

So far, we have used industry measures to capture the overall product market environment. Industries and product markets are not, however, identical concepts. While domestic production is crucial in supplying final goods to consumers in the USA, imports remain a significant component of overall product market activity. If foreign firms have been filling the gap left by the disappearing US public firms, then the level of product market competition in US industries may not have been adversely affected by the increased concentration of domestic firms over the last two decades.

Foreign competition takes two main forms. Foreign firms can ship their products into the USA in the form of imports, or operate and sell directly out of the USA. The latter, despite being a different form of competition, is considered part of US domestic production. Operations of foreign firms in the USA are not captured by Compustat, but the census-based calculation of industry concentration does account for these operations. In addition to including sales of both public and private firms, the economic census tabulates the data of business establishments physically located in the USA regardless of their ownership, domestic, or foreign, and thus captures the operations of foreign competitors. Moreover, the census-based measures exclude the activity of foreign subsidiaries of US firms, which is also significant.

To ensure that our results using Compustat-based measures of concentration are also robust to the presence of foreign competition, thereby successfully describing the product market space rather than the portion of domestic production, we augment our main regressions of profitability and efficiency, as well as the regression of M&A announcement returns, with two proxies for foreign competition. Each proxy corresponds to a different form of foreign competition, as outlined above.

We first control for import penetration, which is one of the most common measures of foreign competition (e.g., Katics and Petersen, 1994; Borjas and Ramey, 1995; Cuñat and Guadalupe, 2009; Irvine and Pontiff, 2009; Autor, Dorn, and Hanson, 2013; Acemoglu *et al.*, 2016). We use the total value of import activity at the NAICS three-digit industry level (Import), obtained from the US Census Bureau, as a proxy for international competition.[21]

To control for international competition in the form of foreign operations on US territory, we also include the scope of operations by foreign multinationals. Adding a control variable for sales by foreign multinationals captures the degree of foreign competition in industries not significantly affected by imports, such as transportation, accommodation

21 Unfortunately, the information on foreign trade at a NAICS level is only available from 2000, so we limit our analysis to the period 2000–2013.

services, or entertainment. To construct the proxy, we consider the activities of US affiliates of foreign multinational enterprises. We obtain information on total sales of majority-owned foreign affiliates by industry for the period of 2002–13 from the Bureau of Economic Analysis (BEA), and include the total sales figures in the USA (variable Intersales), converted into logs, in the main regressions of profitability and M&A returns.

Table V reports the results from the profitability regressions controlling for log(1 + Import) and log(1 + Intersales). We find that the positive and significant relation between concentration levels and firm profitability remains unaffected. For example, the middle panel of Table V indicates that the coefficient of log(HHI) in the estimation of the Lerner Index is 0.093, compared with the coefficient of 0.084 in the main analysis of Table II panel C, and both coefficients are significant at a 1% level. The coefficients on the number of firms and the concentration index are also close in magnitude to their values in the original specification, tabulated in Table II panel C. The coefficients of log(1+Import) and log(1+Intersales) are in general mixed, and have a positive sign when significant. We also repeat the analysis of M&A combined abnormal returns and report the results in Table VI. Consistent with the main results, we find that controlling for the role of foreign multinational firms does not materially change our conclusions, and horizontal mergers lead to higher announcement returns in more concentrated industries.[22]

Our results ultimately indicate that, although the overall volume of foreign activity in the USA has been increasing (see e.g., Feenstra and Weinstein, 2017), the positive relation between profitability measures and concentration levels is not driven by import-sensitive sectors, and is robust to the inclusion of foreign operations in the regression analysis.

6. The Role of Private Firms

The evidence in the previous sections suggests that the increase in product market concentration is associated with changes in the competitive landscape of US industries, as measured by profitability (ROA), profit margins, and merger value creation. In this section, we ask whether the positive and significant relationship between increased concentration and the various measures of profitability holds when we account for the presence of private firms.

6.1 Census-Based Measures of Concentration

Heretofore, our analysis concerning the association between concentration and profitability has focused on Compustat-based measures of concentration. While we find that the relative importance of public firms has not declined despite the decrease in the number of public firms (see Figure O-A.2 in the Online Appendix), our analysis might neglect a relevant dimension by investigating only publicly traded firms.

22 We also find that the activity of foreign firms did not increase in industries whose domestic firms experienced the largest increase in concentration. For example, we find that the correlation between the percentage increase in Compustat-based HHI index and the percentage change in the ratio of sales by foreign multinational to US public firms is −0.20. The negative sign indicates that foreign multinationals seem to be more active in industries that have become more competitive over time, and this claim is inconsistent with the notion of substitution. We perform a similar exercise by replacing the change in concentration with the percentage change in the number of public firms and find that the correlation coefficient is close to zero and statistically insignificant.

Table V. Change in the level of product market concentration and profitability—controlling for international competition

This table reports coefficients from regressions of ROA, profit margins, and efficiency measures on several proxies for the level of product market concentration controlling for proxies for international competition. The sample covers the period 2001–13. HHI is the Herfindahl–Hirschman index based on sales data from Compustat. Number of Firms is the total number of public firms in an industry. Concentration Index is the sum of the annual rank of the HHI and the annual inverse rank of the total number of industry incumbents. ROA is the operating income before depreciation scaled by the book value of assets. Lerner Index is the operating income before depreciation minus depreciation, all scaled by total sales. Asset Utilization is defined as total sales scaled by total assets. Import is equal to the total value of import activity at the NAICS three-digit industry level. Intersales is equal to the total domestic sales of majority-owned foreign affiliates operating in the USA. See Sections 2.1 and 3.1 for dataset description, and Appendix A for details of variable construction. Industry is defined using a firm's three-digit NAICS code. Standard errors (reported in parentheses) are clustered at the firm level. Symbols [a], [b], and [c] indicate significance at 1%, 5%, and 10%, respectively.

Variable	ROA			Lerner Index			Asset Utilization		
Constant	–0.3268[a]	–0.0788[a]	–0.2397[a]	–1.0271[a]	–0.1114	–0.6756[a]	2.4143[a]	2.5983[a]	2.5255[a]
	(0.0339)	(0.0251)	(0.0230)	(0.1301)	(0.1114)	(0.0863)	(0.1070)	(0.0862)	(0.0674)
Log(Assets)	0.0358[a]	0.0362[a]	0.0364[a]	–0.0169	–0.0160	–0.0144	–0.2853[a]	–0.2854[a]	–0.2850[a]
	(0.0030)	(0.0031)	(0.0031)	(0.0153)	(0.0154)	(0.0153)	(0.0096)	(0.0096)	(0.0096)
Log(Age)	0.0105[a]	0.0107[a]	0.0093[a]	0.1405[a]	0.1424[a]	0.1354[a]	0.0914[a]	0.0924[a]	0.0912[a]
	(0.0039)	(0.0039)	(0.0038)	(0.0205)	(0.0206)	(0.0204)	(0.0117)	(0.0117)	(0.0117)
Log(HHI)	0.0228[a]			0.0934[a]			0.0226[c]		
	(0.0039)			(0.0188)			(0.0133)		
Log(Number of Firms)		–0.0213[a]			–0.0636[a]			–0.0066	
		(0.0039)			(0.0144)			(0.0127)	
Concentration Index			0.0137[a]			0.0571[a]			0.0085
			(0.0019)			(0.0083)			(0.0058)
Log(1 + Import)	0.0021[a]	0.0024[a]	0.0023[a]	0.0028	0.0032	0.0039	–0.0030	–0.0032[c]	–0.0030
	(0.0007)	(0.0007)	(0.0007)	(0.0034)	(0.0036)	(0.0034)	(0.0019)	(0.0020)	(0.0019)
Log(1+ Intersales)	0.0023[a]	0.0024[a]	0.0027[a]	0.0074[a]	0.0074[a]	0.0090[a]	0.0003	0.0001	0.0004
	(0.0004)	(0.0004)	(0.0004)	(0.0019)	(0.0019)	(0.0019)	(0.0015)	(0.0015)	(0.0015)
N	41,609	41,609	41,609	41,601	41,601	41,601	41,655	41,655	41,655
Adjusted R^2	67.27%	67.28%	67.33%	59.43%	59.39%	59.48%	88.14%	88.14%	88.14%
Year-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clustering at firm level	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table VI. Change in the level of product market concentration and M&A returns—controlling for international competition

The table presents results of regressing CARs around merger announcements on several proxies for the level of product market concentration controlling for international competition. The sample consists of M&A transactions over the period 2001–13. CAR is the cumulative abnormal return of the combined firm (acquirer plus target) over a 3-day event window [−1, 1] around the merger announcement (see Equation (2)). HHI is the Herfindahl–Hirschman index based on sales data from Compustat. Number of Firms is the total number of public firms in an industry. Concentration Index is the sum of the annual rank of the HHI and the annual inverse rank of the total number of industry incumbents. Related is a dummy variable that takes on a value of 1 if the acquirer and the target belong to the same NAICS three-digit industry, and zero otherwise. Import is equal to the total value of import activity at the NAICS three-digit industry level. Intersales is equal to the total domestic sales of majority-owned foreign affiliates operating in the US industry is defined using the acquirer's three-digit NAICS code. We control for deal characteristics by including the market values and book-to-market ratios of the target and acquiring firms, and dummies for pure cash transactions and pure stock transactions. See Section 4 for dataset description and full specification, and Appendix A for details of variable construction. Symbols [a], [b], and [c] indicate significance at 1%, 5%, and 10%, respectively.

Variable	(1)	(2)	(3)
Constant	–0.0222	0.0562	0.0041
	(0.0418)	(0.0495)	(0.0208)
Log(HHI)	0.0049		
	(0.0054)		
Log(Number of Firm)		–0.0092	
		(0.0082)	
Concentration Index			–0.0127
			(0.0263)
Related	–0.0639[c]	0.0557[a]	0.0187[a]
	(0.0336)	(0.0108)	(0.0052)
Proxy for Concentration×Related	0.0106[b]	–0.0099[a]	0.0560[a]
	(0.0049)	(0.0020)	(0.0178)
Log(1+ Import)	0.0014	0.0015	0.0010[b]
	(0.0010)	(0.0010)	(0.0004)
Log(1+ Intersales)	0.0006	0.0007	0.0013
	(0.0005)	(0.0005)	(0.0010)
N	1,856	1,856	1,856
Adjusted R^2	5.40%	5.90%	5.44%
Year-fixed effects	Yes	Yes	Yes
Acquirer's industry-fixed effects	Yes	Yes	Yes
Deal characteristics	Yes	Yes	Yes
Clustering at industry level	Yes	Yes	Yes

To address this issue, we re-estimate our main regressions of profitability and M&A announcements for the last subperiod (2001–14) using the share of top four firms and top eight firms in each NAICS three-digit industry.[23] The advantages of using the share of top

23 Since data for the top four [top eight] firms are available only for a limited number of industries prior to 1997, we cannot repeat census-based analysis for earlier subperiods.

four (eight) firms is that first this method covers both private and public firms, and second unlike the census HHI, this method covers almost all US industries. One limitation of the census-based measures of concentration is that they are only reported every 5 years. To construct annual measures of concentration, we therefore assume that the indices remain constant until the results from a new survey are available. For example, we use the share of the top four firms reported in 1997 for the observations in years 1997, 1998, 1999, 2000, and 2001.

The findings, presented in Table VII, indicate that the use of concentration measures based on both private and public firms does not affect our main conclusions. Similar to the analysis reported in Tables I and II, we find that industry concentration has a positive and statistically significant impact on ROA. For example, the coefficient on CensusTop4 is 0.0009, and is statistically significant. From an economic standpoint, a one-standard-deviation change in the share of top four firms leads to an increase in ROA of about 16% relative to its mean. Consistent with our previous results, the ROA effect is driven primarily by widening profit margins and not by improvements in efficiency. While the Lerner Index is positively correlated with concentration levels, Asset Utilization is not.

Table VIII repeats the analysis of merger announcement returns after including private firms in the calculations of concentration. Once again, our findings remain consistent to the inclusion of private firms in our empirical investigation, and the interaction term between the share of top four (top eight) firms and dummy variable for horizontal mergers remains positive and statistically significant. The robustness of our profitability and M&A findings to census-based measures is particularly important given the work by Ali, Klasa, and Yeung (2009), who show that the significant relations of Compustat-based industry concentration measures with the dependent variables are not always obtained when US census measures are used.

6.2 Census-Based Measures of Concentration and Profitability

Our previous analysis shows that the main findings hold when we rely on either census or Compustat information to calculate concentration. However, until this point the presence of private firms has been reflected only in the concentration measures and not in the profitability measures. Therefore, this subsection ensures the robustness of our profitability results to including information on private firms in the construction of profit margins and return on capital.

Since firm-level financial information on private firms is not publicly available, we incorporate industry-level information from the NBER-CES database, which contains annual industry-level data (available at NAICS six-digit level) for manufacturing industries over the period of 1958–2011.[24] NBER-CES-based analysis provides us with two advantages. First, it allows us to include the profitability and productivity of private firms. Second, industry-level analysis reinforces our main argument: If individual firms are becoming more profitable in more concentrated industries, we should also find that concentrated industries as a whole are becoming more profitable. One limitation of this dataset is its narrow focus on the manufacturing sector.

We use NBER-CES information to construct measures which mirror both independent and dependent variables in our main firm-level analysis. We construct an equivalent ROA profitability measure (NBER ROA) by subtracting total payroll, as well as the cost of

24 The data were obtained from http://www.nber.org/nberces/.

Table VII. Change in the level of product market concentration and profitability—controlling for private firms

This table reports coefficients from regressions of ROA, profit margins, and efficiency measures on proxies for the level of product market concentration that include sales by private firms. The sample covers the period 2001–14. ROA is the operating income before depreciation scaled by the book value of assets. Lerner Index is the operating income before depreciation minus depreciation, all scaled by total sales. Asset Utilization is defined as total sales scaled by total assets. CensusTop4 is the share of sales of the top four firms (public or private) relative to the industry sales. CensusTop8 is the share of sales of the top eight firms (public or private) relative to the industry sales. The other control variables are defined in Table I. See Sections 2.1 and 3.1 for dataset description, and Appendix A for details of variable construction. Industry is defined using a firm's three-digit NAICS code. Standard errors (reported in parentheses) are clustered at the firm level. Symbols [a], [b], and [c] indicate significance at 1%, 5%, and 10%, respectively.

Variable	ROA	Lerner Index	Asset Utilization	ROA	Lerner Index	Asset Utilization
Constant	–0.1541[a]	–0.4199[a]	2.6377[a]	–0.1566[a]	–0.4233[a]	2.6390[a]
	(0.0199)	(0.0820)	(0.0623)	(0.0205)	(0.0833)	(0.0639)
Log(Assets)	0.0368[a]	–0.0008	–0.3027[a]	0.0368[a]	–0.0008	–0.3027[a]
	(0.0032)	(0.0153)	(0.0099)	(0.0032)	(0.0153)	(0.0099)
Log(Age)	0.0088[b]	0.1238[a]	0.0944[a]	0.0088[b]	0.1241[a]	0.0946[a]
	(0.0037)	(0.0198)	(0.0119)	(0.0037)	(0.0198)	(0.0119)
CensusTop4	0.0009[a]	0.0023[b]	0.0008			
	(0.0003)	(0.0010)	(0.0010)			
CensusTop8				0.0007[a]	0.0017[c]	0.0005
				(0.0003)	(0.0009)	(0.0008)
N	40,289	40,289	40,329	40,289	40,289	40,329
Adjusted R^2	68.88%	59.74%	88.06%	68.88%	59.74%	88.05%
Year-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Clustering at firm level	Yes	Yes	Yes	Yes	Yes	Yes

Table VIII. Change in the level of product market concentration and M&A returns—controlling for private firms

The table presents results of regressing CARs around merger announcements on proxies for the level of product market concentration that include sales by private firms. The sample consists of M&A transactions over the period 2001–14. CAR is the cumulative abnormal return of the combined firm (acquirer plus target) over a 3-day event window [−1, 1] around the merger announcement (see Equation (2)). Related is a dummy variable that takes on a value of 1 if the acquirer and the target belong to the same NAICS three-digit industry, and zero otherwise. CensusTop4 is the share of sales of the top four firms (public or private) relative to the industry sales. CensusTop8 is the share of sales of the top eight firms (public or private) relative to the industry sales. Industry is defined using the acquirer's three-digit NAICS code. We control for deal characteristics by including the market values and book-to-market ratios of the target and acquiring firms, and dummies for pure cash transactions and pure stock transactions. See Section 4 for dataset description and full specification, and Appendix A for details of variable construction. Symbols [a], [b], and [c] indicate significance at 1%, 5%, and 10%, respectively.

Variable	(1)	(2)
Constant	0.0559[a]	0.0630[a]
	(0.0157)	(0.0177)
CensusTop4	–0.0010[b]	
	(0.0004)	
CensusTop8		–0.0010[b]
		(0.0004)
Related	–0.0066	–0.0094
	(0.0062)	(0.0067)
Proxy for Concentration×Related	0.0006[a]	0.0005[a]
	(0.0002)	(0.0002)
N	1,660	1,660
Adjusted R^2	7.43%	7.51%
Year-fixed effects	Yes	Yes
Acquirer's industry-fixed effects	Yes	Yes
Deal characteristics	Yes	Yes
Clustering at industry level	Yes	Yes

materials and energy, from the total value of shipment, and scale by the total real capital stock. The NBER Lerner Index is constructed in a similar manner, but we scale the profits by the total value of shipment. Finally, we use TFP measure as the measure corresponding to asset utilization. To control for size, in our baseline analysis, we include total value of industry shipment and total capital stock, and convert these variables into natural logs. To account for time-varying industry characteristics in an alternative set of regression results, we follow Gutiérrez and Philippon, (2017) and augment our estimation with additional controls (see Appendix A for definitions). Finally, we estimate the regressions of profitability and efficiency as a function of the share of top four (eight) largest firms.[25] All specifications include NAICS six-digit and year-fixed effects, as well as clustering at NAICS six-digit level. Since NBER-CES data stop in 2011, our sample period is 2001–11.

25 To keep the level of industry granularity consistent across all variables in the analysis, we use concentration measures based on 6-digit level NAICS.

Table IX. Change in the level of product market concentration and profitability—industry level analysis

This table reports coefficients from regressions of ROA, profit margins, and efficiency measures on proxies for product market concentration using NBER-CES industry-level data over the period 2001–11. The dependent and control variables are constructed at the industry level and are defined in Section 6.2 and Appendix A. Industry is defined using six-digit NAICS code. Standard errors (reported in parentheses) are clustered at the industry level. Symbols [a], [b], and [c] indicate significance at 1%, 5%, and 10%, respectively.

Panel A: Share of top four firms

Variable	NBER ROA	NBER Lerner	TFP	NBER ROA	NBER Lerner	TFP
Constant	–0.224	0.203[c]	1.310[a]	–0.373	0.153	1.278[a]
	(0.422)	(0.107)	(0.371)	(0.431)	(0.114)	(0.395)
CensusTop4	0.003[a]	0.001[a]	0.001	0.003[a]	0.001[a]	0.000
	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)
Log(VShip)	0.796[a]	0.043[a]	0.231[a]	0.907[a]	0.068[a]	0.271[a]
	(0.044)	(0.008)	(0.019)	(0.046)	(0.009)	(0.022)
Log(CapStock)	–0.770[a]	–0.042[b]	–0.309[a]	–0.846[a]	–0.058[a]	–0.338[a]
	(0.064)	(0.016)	(0.052)	(0.066)	(0.016)	(0.053)
% Product. Workers				–0.188	–0.018	–0.104
				(0.165)	(0.042)	(0.095)
K/L				0.001[a]	0.000[a]	0.000[a]
				(0.000)	(0.000)	(0.000)
Mean Wage				–0.004[b]	–0.001	0.001
				(0.002)	(0.001)	(0.002)
Mean Wage Product.				–0.001	0.000	–0.003
				(0.003)	(0.001)	(0.002)
N	5,161	5,161	5,161	5,161	5,161	5,161
Adjusted R^2	90.3%	83.7%	77.2%	90.9%	84.5%	77.8%
Year-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Clustering at industry level	Yes	Yes	Yes	Yes	Yes	Yes

Panel B: Share of top eight firms

Variable	NBER ROA	NBER Lerner	TFP	NBER ROA	NBER Lerner	TFP
Constant	–0.234	0.166	1.348[a]	–0.356	0.118	1.309[a]
	(0.425)	(0.111)	(0.380)	(0.433)	(0.117)	(0.403)
CensusTop8	0.004[a]	0.001[a]	0.000	0.003[a]	0.001[a]	0.000
	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)
Log(VShip)	0.791[a]	0.041[a]	0.225[a]	0.911[a]	0.066[a]	0.264[a]
	(0.044)	(0.008)	(0.019)	(0.047)	(0.009)	(0.023)
Log(CapStock)	–0.773[a]	–0.037[b]	–0.306[a]	–0.859[a]	–0.055[a]	–0.335[a]
	(0.063)	(0.017)	(0.053)	(0.064)	(0.016)	(0.053)
% Product. Workers				–0.202	–0.011	–0.076
				(0.170)	(0.041)	(0.090)
K/L				0.001[a]	0.000[a]	0.000[a]
				(0.000)	(0.000)	(0.000)

(continued)

Table IX. Continued

Panel B: Share of top eight firms

Variable	NBER ROA	NBER Lerner	TFP	NBER ROA	NBER Lerner	TFP
Mean Wage				–0.005[b]	–0.001	0.001
				(0.002)	(0.001)	(0.002)
Mean Wage Product.				–0.001	–0.000	–0.003
				(0.003)	(0.001)	(0.002)
N	5,179	5,179	5,179	5,179	5,179	5,179
Adjusted R^2	90.5%	84.2%	77.4%	91.1%	84.9%	77.9%
Year-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Clustering at industry level	Yes	Yes	Yes	Yes	Yes	Yes

The results are presented in Table IX. Panel A shows the relationship between concentration and profitability to be positive and statistically significant. The effect of CensusTop4 is pronounced for NBER ROA and NBER Lerner Index but is insignificant for TFP. Expanding the list of control variables with additional proxies of industry performance in Table IX Columns 4–6 does not materially change the magnitude or the statistical significance of the concentration coefficients. Table IX panel B further shows that if we use CensusTop8, all our findings remain essentially the same. Taken together, these results demonstrate that more concentrated industries are able to derive wider profit margins without necessarily becoming more efficient. Therefore, these findings indicate that our conclusions do not change when we perform industry- rather than firm-level analysis, and they account for the potential contribution of private firms to the overall industry profitability, as well as to overall industry concentration.

7. Change in Concentration and the Cross-Section of Stock Returns

Consistent with a market-power explanation, our analysis heretofore indicates that firms operating in increasingly concentrated industries earn higher profits. In addition, relative to other industries, mergers' gains in highly concentrated product markets are also higher for horizontal deals. An important and still unanswered question is whether market participants have recognized the higher profitability of firms associated with more concentrated industries. In particular, we examine whether the higher ROA and market reaction to merger announcements are also associated with abnormal stock returns. Past empirical evidence regarding the association between market power and abnormal returns has been mixed. Although Hou and Robinson (2006) find that firms in more competitive markets tend to earn higher stock returns, Bustamante and Donangelo (2017) find that these firms earn lower returns. Our contribution to this debate is two-fold. First, we focus on the changes in, rather than levels of, concentration to capture the aspect of concentration unanticipated by investors. Second, we examine whether the positive association we uncovered between concentration and profit margins is also reflected in stock prices.

To investigate this issue, we calculate the annual change in the concentration levels in each industry (defined using a firm's three-digit NAICS code) over the period 1972–2014:

$$\text{Chg}_{t-1} = (\text{Concentration Level}_{t-1} - \text{Concentration Level}_{t-2}). \quad (4)$$

We then sort industries based on the magnitude of the change, and form two portfolios. The high Chg portfolio contains the top ten industries (i.e., industries with the largest increase in concentration), while the low Chg portfolio contains the bottom ten industries. Using this portfolio formation, we calculate monthly equally weighted and value-weighted returns from July of year t to June of year $t+1$. Specifically, we first calculate equally weighted and value-weighted stock returns within each industry (the weights in the value-weighted approach are based on the market cap of each stock as of June of year t). We then use the industries included in one of the two portfolios (based on the change in concentration levels) to calculate equally and value-weighted returns at a portfolio level. For equally weighted portfolio returns, we average across industries in each portfolio. For value-weighted returns, we sum up the market value of equity of all firms within an industry to obtain total industry weight, and calculate value-weighted returns for each of the two portfolios.

To control for differences in systematic risk across portfolios, we use three different asset-pricing models: CAPM, Fama and French (1993) three-factor model, and Fama and French (2015) five-factor model plus momentum. Table X reports the difference in abnormal returns (alphas) between high and low concentration portfolios for all our proxies for concentration. Table X panel A shows that most alphas are not statistically different from zero over the period 1972–2014. When we isolate the period of the significant increase in concentration levels, the results change dramatically. Table X panels B–D report monthly alphas estimated over three different subperiods. While there is no evidence of abnormal performance over the periods 1972–86 and 1987–2000, we find that the alphas are positive and statistically significant over the period 2001–14. For example, according to the CAPM model, an investment strategy consisting of buying the high concentration equally weighted portfolio and shorting the low concentration equally weighted portfolio generates abnormal returns ranging from 6.6% to 8.2% per year. These abnormal returns greatly exceed those generated by other important investment strategies. For example, the momentum strategy generated a negative alpha over the same time period. Interestingly, most of the abnormal returns from this investment strategy come from the firms in industries experiencing increased concentration (long portfolio). The abnormal alpha remains significant after controlling for other factors.

A possible explanation for these empirical results is the higher expected returns commanded by firms in industries with fewer rivals, since their investment opportunity set is extremely sensitive to macroeconomic shocks (Bustamante and Donangelo, 2017). To test this possibility, we examine the returns of our investment strategy during the global financial crisis of 2007–08, which is one of the largest negative systematic shocks in recent history. We find that the high concentration portfolio significantly outperforms the low concentration portfolio during the crisis period (untabulated). These findings suggest that the alphas documented in this paper are unlikely to be related to a risk premium, and they point to a possible market anomaly in which investors underestimate the effect of industry concentration and the corresponding increase in profit margins on stock returns.

While the positive alphas during the period 2011–14 are robust to a multitude of benchmark portfolios, we recognize that using the evidence based on Compustat measures of concentration might not rule out certain alternative explanations for this set of results. For example, if the greater presence of private firms in some industries is not captured by Compustat-based HHI, then this hypothetical omission could affect the relationship between changes in concentration and returns. Unlike our prior results, we are not able to use

Table X. Change in the level of product market concentration and the cross-section of stock returns

This table reports alphas (top number in each cell) and *t*-statistics (bottom number in each cell) of a long-short strategy that buys stocks in the 10 industries with the largest change (i.e., largest increase) in concentration levels and shorts stocks in the ten industries with the smallest change in concentration levels. Changes in concentration levels are calculated from year $t-2$ to year $t-1$. See Section 7 for the description of portfolio formation and returns calculations. Symbols [a], [b], and [c] indicate significant differences between the high and low portfolios at 1%, 5%, and 10%, respectively.

Panel A: 1972–2014

	Difference in returns between high and low concentration portfolios		
Model	HHI	Number of Firms	Concentration Index
CAPM			
Equally weighted portfolios	0.0033[b]	0.0034[b]	0.0026[c]
	2.1833	2.2454	1.8583
Value-weighted portfolios	0.0042[b]	0.0045[b]	0.0042[b]
	2.2541	2.1356	2.1924
Fama–French three factors			
Equally weighted portfolios	0.0036[a]	0.0029[c]	0.0022
	2.3441	1.8964	1.5687
Value-weighted portfolios	0.0036[c]	0.0018	0.0028
	1.9001	0.8776	1.4643
Fama–French six factors			
Equally weighted portfolios	0.0038[a]	0.0013	0.0017
	2.3535	0.8014	1.1283
Value-weighted portfolios	0.0014	0.0001	–0.0004
	0.7469	0.0661	–0.1844

Panel B: 1972–86

	Difference in returns between high and low concentration portfolios		
Model	HHI	Number of Firms	Concentration Index
CAPM			
Equally weighted portfolios	–0.0011	0.0007	0.0017
	–0.4708	0.2755	0.6563
Value-weighted portfolios	0.0085[a]	0.0048	0.0069[b]
	2.4329	1.2896	2.1413
Fama–French three factors			
Equally weighted portfolios	–0.0022	0.0008	0.0008
	–0.8693	0.3147	0.2982
Value-weighted portfolios	0.0071[c]	0.0010	0.0054[c]
	1.9528	0.2583	1.6841
Fama–French six factors			
Equally weighted portfolios	–0.0038	–0.0009	–0.0011
	–1.3564	–0.3216	–0.3881

(continued)

Table X. Continued

Panel B: 1972–86

	Difference in returns between high and low concentration portfolios		
Model	HHI	Number of Firms	Concentration Index
Value-weighted portfolios	0.0030	–0.0025	0.0010
	0.8048	–0.6104	0.2952

Panel C: 1987–2000

	Difference in returns between high and low concentration portfolios		
Model	HHI	Number of Firms	Concentration Index
CAPM			
Equally weighted portfolios	0.0044	0.0034	0.0009
	1.4246	1.1210	0.3441
Value-weighted portfolios	–0.0022	0.0020	0.0011
	–0.6774	0.4771	0.2718
Fama–French three Factors			
Equally weighted portfolios	0.0050	0.0027	0.0007
	1.6176	0.8610	0.2639
Value-weighted portfolios	–0.0044	–0.0016	–0.0013
	–1.3668	–0.4065	–0.3617
Fama–French six factors			
Equally weighted portfolios	0.0052	–0.0010	0.0010
	1.5214	–0.3064	0.3435
Value-weighted portfolios	–0.0031	–0.0029	–0.0040
	–0.9027	–0.6927	–1.0250

Panel D: 2001–14

	Difference in returns between high and low concentration portfolios		
Model	HHI	Number of Firms	Concentration Index
CAPM			
Equally weighted portfolios	0.0068[a]	0.0064[a]	0.0055[a]
	2.9964	2.8709	2.4810
Value-weighted portfolios	0.0058[b]	0.0075[a]	0.0048[c]
	2.0844	2.5629	1.7988
Fama–French three factors			
Equally weighted portfolios	0.0075[a]	0.0064[a]	0.0056[a]
	3.2926	2.8828	2.5214
Value-weighted portfolios	0.0063[b]	0.0061[b]	0.0042
	2.2212	2.1422	1.5610
Fama–French six factors			
Equally weighted portfolios	0.0059[a]	0.0055[a]	0.0045[c]
	2.5016	2.3725	1.9347
Value-weighted portfolios	0.0038	0.0051[c]	0.0018
	1.3145	1.7624	0.6832

census-based concentration measures here. Since census-based measures are updated only once in 5 years, the declining relevance of the concentration indicators does not allow for a proper rebalancing of portfolios on an annual basis. However, the robustness of our main results in Sections 3 and 4 to various measures of concentration accounting for private firms, foreign firms, as well as different definitions of industries, remains a strong indicator that these are not the driving factors behind our findings.

8. Discussion and Conclusion

This paper documents the increase over the last 20 years in the level of product market concentration across most industries in the USA. We demonstrate that this increase in concentration levels has significant implications for firm performance, namely profitability, merger gains, and returns to investors. First, while the increase in industry concentration levels correlates with remaining firms' generating higher profit margins, we observe no link between asset utilization, a proxy for efficient use of capital, and concentration. Our findings conjointly posit that the increase in profit margins is related to increased mark-ups.

Second, horizontal mergers in more concentrated industries elicit stronger market reactions, which supports the claim for market-power considerations' becoming a key source of value during these corporate events. These findings not only point to an increase in profits associated with increased concentration and markups, but further indicate that the surge in M&A deals over the past few years is in fact motivated by gains associated with increased market power.

Third, we find that firms in more concentrated industries experience significant abnormal stock returns, which indicates that a considerable portion of the gains accrues to shareholders. *Prima facie*, the positive and significant alphas connote a simple and profitable trading strategy, which is interesting in its own right. This finding also raises the question, why does the market not "get it" in the first place. Unlike many other apparent and long-standing anomalies, such as book-to-market effect, the anomaly we document here is recent and perhaps unknown to most market participants. For example, MacLean and Pontiff (2016) find that most anomalies tend to disappear over time. Importantly, our results are consistent with Barkai's (2016) findings that increase in profitability did not result in increased investment in capital or labor, which in turn imply that those gains are going to shareholders. Our evidence is therefore not only consistent with this conclusion, but strengthens it with direct evidence.

Although a formal investigation of the driving forces behind the increase in concentration is beyond the scope of this study, we offer two possible explanations for the trend in product market consolidation and the associated increase in profits. The unique combination of lax enforcement of antitrust laws in the USA and technological innovation may have contributed to increased concentration and barriers to entry. During recent administrations, antitrust enforcement has weakened. Legal scholars argue that, beginning with George W. Bush's first administration, antitrust enforcement has declined (e.g., Spitzer, 2011; Harty, Shelanski, and Solomon, 2012; Crane, 2012), despite the Clinton administration's having significantly intensified the enforcement of antitrust laws in the 1990s (Litan and Shapiro, 2001). Consistent with this claim, we find in untabulated results that the number of cases filed by the Department of Justice under Section 2 of the Sherman Act has weakened since early 2000. These findings strengthen claims that antitrust agencies were more lenient during both the Bush and Obama administrations. Limited antitrust

enforcement can incentivize firms to engage in M&A activity, which further reduces competition. Moreover, weak enforcement can allow for mergers with greater market-power potential, leading to a higher market reaction and higher profit margins.

Technological changes provide another plausible explanation for the recent increase in industry concentration levels. Developments in technology have created advantages for economies of scale, and have arguably changed the industry landscape. Over the past several decades, the investment in tangible capital as a proportion of the total output has remained flat, while the investment in intangible assets has doubled (Corrado and Hulten, 2010). Public adoption of the Internet in the late 1990s, as well as the concomitant popularization of personal computers, has had an extensive impact on productivity and growth. If large firms are better able to develop and implement technology, then recent technological advances may create barriers of entry to new firms. In support of this argument, we calculate the evolution of patent-based industry concentration by looking at the share of total patent activity by the largest four firms in the industry using the patent database by Kogan *et al.* (2017), and find that it follows a pattern almost identical to that of the sales-based HHI (unreported). These results suggest that complex technology also facilitates synergy potentials and increases barriers to entry.

Finally, whether the higher market concentration benefits consumers or other stakeholders such as employees is questionable; the increase in profit margins without a corresponding economically significant increase in efficiency suggests the opposite. Although a greater concentration of product markets can improve the quality, or increase the variety, of products offered, whether those changes are sufficient to compensate customers for firms' higher profit margins remains an open question. As pointed out by Lopez, Azzam, and Lirón-España (2002), "whether or not concentration is in the public interest depends critically on whether or not the cost-efficiency gains through concentration offset the welfare losses from greater market power." While the evidence points to firms in concentrated markets exercising market power by keeping prices over marginal costs, future research should focus on the welfare implications of our empirical findings. The $5 billion fine filed against Google in June 2018 signals that the European Commission views global dominance by a given firm to be detrimental to consumers. Our findings can encourage policymakers around the world to pursue different avenues of investigation into the impact of increased concentration.

Supplementary Material

Supplementary data are available at *Review of Finance* online.

Appendix A

This appendix defines each of the variables used throughout the paper. Firm/industry characteristics variables are measured at either the firm-year or industry-year level. Merger characteristics variables are at deal, acquirer, and target levels. For clarification, we use the

Variable	Definition	Source
%Product. Workers$_{jt}$	Production workers (PRODE) divided by total employment (EMP). Winsorized at 1% and 99% of the annual distribution.	NBER-CES
Age$_{it}$	Number of years since the CRSP listing date.	CRSP
Aggregate ROA$_t$	Aggregate operating income before depreciation (OIBDP) (summed across all firms), scaled by the aggregate book value of assets (also summed across all firms), for a given year t.	Compustat
Assets$_{it}$	Book value of assets (AT).	Compustat
Asset Utilization$_{it}$	Total sales (SALE) divided by total assets (AT). Winsorized at 1% and 99% of the distribution.	Compustat
B/M$_{it}$	Book-to-market ratio calculated as book equity divided by market equity. Book equity is defined as stockholders' book equity, plus balance sheet deferred taxes and investment tax credit (TXDITC) if available, minus the book value of preferred stock. Depending on the data's availability we use SEQ as stockholders' equity, the book value of common equity (CEQ) plus the par value of preferred stock (PSTK), or the book value of assets (item AT) minus total liabilities (LT), in that order. Book value of preferred stock is defined depending on data availability as redemption (PSTKRV), liquidation (PSTKL), or par value (PSTK) of preferred stock. Market equity is equal to the CRSP's shares outstanding (SHROUT) times the absolute value of price (PRC) in June of year t. B/M$_A$ is the market ratio of the acquiring firm; B/M$_T$ is the market ratio of the target firm, as of the most recent fiscal year-end prior to the merger announcement date. We winsorize the book-to-market ratios at the 1% and the 99% of their empirical distributions.	Compustat
Capital Share$_{jt}$	Capital payments variable, scaled by the total value of production, both variables reported in KLEMS Multifactor Productivity Tables, available at https://www.bls.gov/mfp/mprdload.htm.	BLS
CapStock$_{jt}$	Total real capital stock (CAP).	NBER-CES
CensusTop4$_{jt}$	Sum of value of shipments of the four largest companies divided by the total value of shipments in the industry (in %). The measure is computed by the Census Bureau and is available every 5 years for calendar years ending in 2 and 7. To construct an annual measure, we assume that the measure stays constant until the results from a new survey are available. For example, we use the share of the top four firms reported in 1997 for the observations in years 1997,	Census Bureau

(continued)

Continued

Variable	Definition	Source
	1998, 1999, 2000, and 2001. The data are obtained from the Census Bureau's website at https://www.census.gov/econ/concentration.html.	
CensusTop8_{jt}	Sum of value of shipments of the eight largest companies divided by the total value of shipments in the industry (in percentage). The measure is computed by the Census Bureau and is available every 5 years for calendar years ending in 2 and 7. To construct an annual measure, we assume that the measure stays constant until the results from a new survey are available. For example, we use the share of the top four firms reported in 1997 for the observations in years 1997, 1998, 1999, 2000, and 2001. The data are obtained from the Census Bureau's website at https://www.census.gov/econ/concentration.html.	Census Bureau
$\text{Chg}_{j,t-1}$	Difference between $\text{HHI}_{j,t-1}$ and $\text{HHI}_{j,t-2}$	Compustat
Combined CAR_d	CAR of newly combined (as the sum of the acquirer and target) firm over a 3-day event window $[-1, 1]$ around merger d announcement, defined as: $$\text{Combined CAR}_d = \frac{\text{MV}_{A,t+1} + \text{MV}_{T,t+1}}{\text{MV}_{A,t-1} + \text{MV}_{T,t-1}} - 1 - r_{\text{CRSP},t-1,t+1}$$ where MV_A (MV_T) is the market value of equity of the acquiring (target) firm, and $r_{\text{CRSP},t-1,t+1}$ is the cumulative return on the CRSP value-weighted market portfolio from t−1 to t+1, where t is the merger announcement day.	CRSP, SDC
$\text{Concentration Index}_{jt(it)}$	An index calculated based on combination of two concentration measures. Every year we separately rank all firms based on each measure of concentration. The index is the sum of the two annual ranks for each firm. If a measure is an inverse proxy of concentration, then descending ranking is used, so that by construction, the index increases as the level of concentration increases.	See description of each concentration measure
$\text{Concentration Measure}_{jt(it)}$	Proxy for the level of product market concentration in industry j at year t. Depending on specification, the proxies are: HHI, Number of firms, CensusTop4, CensusTop8, Text-Based HHI, and Total Similarity. For Text-Based HHI, and Total Similarity the measure is defined for every firm i at year t.	See description of each concentration measure
DumCash_d	A dummy variable that takes on a value of 1 if the merger transaction was a pure cash transaction, and zero otherwise.	SDC
DumStock_d	A dummy variable that takes on a value of 1 if the merger transaction was a pure stock transaction, and zero otherwise.	SDC

(continued)

Continued

Variable	Definition	Source
HHI_{jt}	The HHI of market concentration, calculated by squaring the market share (in percentage) of each firm in an industry, and then summing the resulting numbers across all firms in the industry.	
	HHI_{jt} (Compustat-based) is computed by (i) calculating the ratio of firm sales (variable SALE) to the total industry sales for every firm in a given industry-year; (ii) squaring the obtained ratios, and then (iii) summing up the squared market shares (in percentage) across all firms in a given industry-year. In most analyses throughout the paper industry is defined based on NAICS classification. The process we use for filling in missing NAICS values is as follows: (1) First, we use the Compustat historical NAICS (NAICSH), whenever available. (2) If (1) is not available, then we use the CRSP historical value (NAICS from the msenames table). (3) If neither (1) or (2) is available, then we use NAICS from Compustat's names table. (4) If none of the previous (i.e., (1)–(3)) NAICS sources are available, then we convert SIC codes to NAICS using the US Census Bureau conversion tables. SIC codes are populated in a similar way.	Compustat
	HHI_{jt} (Census-based) is calculated by summing the squares of the individual company percentages (market share) for the 50 largest companies. If the industry has fewer than 50 firms, then the US Census uses the overall industry universe. The measure is computed by the Census Bureau and is available every 5 years for calendar years ending in 2 and 7. To construct an annual measure, we assume that the index stays constant until the results from a new survey are available. For example, we use the share of the top four firms reported in 1997 for the observations in years 1997, 1998, 1999, 2000, and 2001. The measure is available for industries within the manufacturing sector only. The data are obtained from the Census Bureau's website at https://www.census.gov/econ/concentration.html.	Census Bureau
$Import_{jt}$	Total value of import activity (based on CIF import value) at the NAICS three-digit industry level, obtained from the US International Trade Data (since the time of data collection, the website was removed and most of the data have become part of the US Trade Online data tool. Data for years 2000–2001 are now reported separately and are available at https://census.gov/foreign-trade/statistics/country/naics/index.html). Value of zero is assigned to industries where import data are unreported.	Census Bureau
$Intersales_{jt}$	Total sales of majority-owned non-bank foreign affiliates by industry of sales, defined at NAICS three-digit level. The statistics is managed by the BEA, a division of the US Census Bureau, and is available at https://www.bea.gov/iTable/index_MNC.cfm. BEA provides data starting from 1997, and at the time of data collection was available through	Census Bureau

(continued)

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Variable	Definition	Source
	2013. However, the industry classification system for the period of 1997–2001 is too crude, so that the data are available for about one-third of NAICS three-digit industries only.	
K/L_{jt}	Total real capital stock (CAP) divided by total employment (EMP). Winsorized at 1% and 99% of the annual distribution.	NBER-CES
$Lerner_{it}$	Operating income before depreciation (OIBDP) minus depreciation (DP), all divided by total sales (SALE). Winsorized at 1% and 99% of the distribution.	Compustat
$Lerner_{jt}$ (NBER)	Total value of shipments (VSHIP) minus the sum of (total payroll (PAY); total cost of materials (MATCOST); and cost of electric and fuels (ENERGY)), all divided by the total value of shipments. Winsorized at 1% and 99% of the annual distribution.	NBER-CES
$MV_{A,t-1}$	The market value of equity of the acquiring firm, as of the most recent fiscal year-end prior to the merger announcement date.	CRSP
$MV_{T,t-1}$	The market value of equity of the target firm, as of the most recent fiscal year-end prior to the merger announcement date.	CRSP
Mean Product. $Wage_{jt}$	Production worker wages (PRODW) divided by total employment (EMP). Winsorized at 1% and 99% of the annual distribution.	NBER-CES
Mean $Wage_{jt}$	Total payroll (PAY) divided by total employment (EMP). Winsorized at 1% and 99% of the annual distribution.	NBER-CES
Number of $Firms_{jt}$	The number of publicly traded firms in industry j in year t.	CRSP-Compustat
$Related_d$	A dummy variable that takes on a value of 1 if the acquiring and target firms are in the same NAICS three-digit industry, and zero otherwise.	Compustat
ROA_{it}	Operating income before depreciation (OIBDP), all divided by book value of assets (AT). Winsorized at 1% and 99% of the distribution.	Compustat
ROA_{jt} (NBER)	Total value of shipment (VSHIP) minus the sum of (total payroll (PAY); cost of materials (MATCOST); and cost of electric and fuels (ENERGY)), all divided by total real capital stock (CAP). Winsorized at 1% and 99% of the annual distribution.	NBER-CES
$Sales_{it}$	Total net sales (SALE).	Compustat

(continued)

Continued

Variable	Definition	Source
Share of Employment$_{jt}$	Employment in firms with 10,000 or more employees divided by total employment in the sector. The data are obtained from BLS, and are available for each of the following sectors: Agriculture; Forestry and Fishing; Mining; Construction; Manufacturing; Transportation, Communication, and Public Utilities; Wholesale Trade; Retail Trade; Finance, Insurance, and Real Estate; and Services. The data are obtained from Business Dynamics Statistics (BDS) annual report, a division of the US Census Bureau, at http://www.census.gov/ces/dataproducts/bds/data.html.	Census Bureau
Price of Capital$_{jt}$	Capital payments variable, scaled by the stock of assets, both variables reported in KLEMS Multifactor Productivity Tables, available at https://www.bls.gov/mfp/mprdload.htm.	BLS
TFP$_{jt}$	Five-factor TFP index; 1997=1.0. See http://www.nber.org/nberces/nberces5811/nberces_5811_technical_notes.pdf for more details. Winsorized at 1% and 99% of the annual distribution.	NBER-CES
Text-based HHI$_{it}$	The text-based HHI of market concentration for firm *i* is calculated by squaring the market shares of firms that are considered firm *i*'s peer firms in year *t*. Peer firms are defined based on similarity score, derived from product description in 10-K reports. All HHIs are based on firm sales data from Compustat. See http://hobergphillips.usc.edu/industrycon cen.htm for data on HHI values and further methodology details.	Hoberg–Phillips data library
Total Similarity$_{it}$	The sum of the pairwise similarities between the given firm *i* and all other public firms in a given year. Firm-by-firm pairwise similarity scores are obtained by parsing the product descriptions from the firm 10-Ks and forming word vectors for each firm to compute continuous measures of product similarity between the firm and all the other firms in the sample in each year. See http://hobergphillips.usc.edu/industryconcen.htm for data on similarity scores and further methodology details.	Hoberg–Phillips data library
VShip$_{jt}$	Total value of shipment (VSHIP).	NBER-CES

following subscripts: *i* for firms, *j* for industries, *t* for year (unless specified otherwise), *A* for acquiring firm, *T* for target firm, and *d* for merger deal.

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