Are U.S. Industries Becoming More Concentrated?

by

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June 2016

We thank Elizabeth Berger, Kobi Boudoukh, Andrew Ellul, Juanita Gonzalez-Uribe, Johan Hombert, Rajkamal Iyer, Sebastien Michenaud, Sandy Klasa, Shimon Kogan, Pedro Matos, Dennis Sheehan, Kelly Shue, Jared Williams, conference participants at NFA 2015, AFA 2016, UBC 2016 and FIRS 2016 annual meetings, and seminar participants at Cornell Tech, IDC, Penn State University, Rice University, and the University of Melbourne for helpful comments. We are also grateful to Yamil Kaba for his assistance on this project.

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Abstract

More than three-fourths of U.S. industries have experienced an increase in concentration levels over the last two decades. Firms in industries with the largest increases in product market concentration have enjoyed higher profit margins, positive abnormal stock returns, and more profitable M&A deals, suggesting that market power is becoming an important source of value. This phenomenon has been mainly driven by the consolidation of publicly-traded firms into larger entities. The increased level of concentration due to public firms' consolidation has not been offset by a larger presence of private or foreign firms. Overall, our findings suggest that the nature of U.S. product markets has undergone a structural shift that has weakened competition.

Introduction

During the second half of the 20th century, several waves of tariff reductions and deregulations drastically changed the industrial landscape of many markets (e.g., Andrade, Mitchell, and Stafford (2001), Irvine and Pontiff (2009), and Fresard and Valta (2014)). While these changes significantly reduced concentration levels in most industries, there is a common perception among market participants and regulators that this phenomenon has continued up to this day.

Contrary to these popular beliefs, this paper shows that U.S. industries have become more concentrated since the beginning of the 21st century. Common measures of industry concentration such as the number of industry incumbents and the Herfindahl-Hirschman index (HHI) indicate that concentration levels have been systematically increasing in over three-fourths of U.S. industries. This surprising economic phenomenon has been mainly driven by the large-scale consolidation of publicly-traded firms. In the past twenty years, the U.S. has lost almost 50% of its publicly traded firms. This decline in the number of firms has been so dramatic that the number of firms these days is lower than it was in the early 1970s, when the real gross domestic product in the U.S. was one third of what it is today.

We show that firms operating in industries with the largest increases in product market concentration have significantly outperformed other firms in less concentrated markets in several dimensions. Specifically, we find that proxies for industry concentration levels are positively correlated with the incumbent firms' profit margins, long-run abnormal stock returns, and investment opportunities as captured by M&A gains.

We begin our analysis by examining whether the firms affected by this secular increase in product market concentration have experienced abnormal changes in profitability. To test this

hypothesis, we regress firm-level returns on assets (ROA) on several proxies for industry concentration, controlling for firm characteristics and firm fixed effects, and find that the changes in concentration levels are positively correlated with profitability levels. When we decompose return on assets into asset utilization (i.e., sales to assets ratio) and operating profit margins (i.e., Lerner index), we find that the higher return on assets are mainly driven by firms' ability to extract higher profit margins. This evidence is consistent with higher market power and potential changes in the nature of U.S. industries.

We also examine how investors react to announcements of M&A transactions. If industry concentration levels have an impact on firms' prospects, then the market should react more positively to the announcement of transactions that further erode product market competition. Consistent with this hypothesis, we find that M&A transactions have become more profitable to shareholders in general, and even more so in concentrated industries. More importantly, the more positive market reaction to the mergers of firms in concentrated industries is especially high around the announcement of horizontal merger deals, suggesting that market power is becoming an important source of value during M&A transactions.

Finally, we find evidence that the returns to investors of the public firms increase with higher market concentration. To examine the changes to investor welfare, we look at the performance of portfolios sorted on the change in concentration levels in their respective industries. Specifically, we construct a trading strategy of buying firms in industries with the largest decline in concentration levels, and shorting firms in industries with the largest increase in concentration levels. We find that over the period of 2001-2014, this strategy generates excess returns of approximately 9% per year, after controlling for standard risk factors. Thus, the higher profit margins that firms enjoy as a consequence of the change in concentration are

reflected in higher profits to shareholders. Although one could argue that these excess returns are a compensation for bearing extra systematic risk (Bustamante and Donangelo (2014)), we find that firms operating in markets with few rivals tend to be less sensitive to macroeconomic shocks than other firms.

Taken together, our results suggest that the systematic increase in industry concentration levels has potentially weakened competition in the U.S. To further investigate this issue, we examine whether the disappearance of such a large portion of public firms has been offset by other mechanisms that could maintain high levels of product market competition. Using U.S. Census data, we show that private firms did not replace public firms. The concentration ratios measured by Census-based HHI index and the share of top four firms' sales out of the total industry revenues have experienced an increase similar to the increase in concentration ratios based on publicly-traded firms data. Therefore, even though more private firms have entered the economy, their marginal contribution to the aggregate product market activity has been relatively small.

Second, we examine whether the intensified foreign competition could provide an alternative source of rivalry to domestic firms. We find that the relationship between industry concentration and firm profitability remains positive and significant after controlling for industry-level foreign direct investment in the U.S., as well as the level of import penetration. This finding indicates that public firms have been successfully weathering foreign competition, and maintaining their concentrated presence in the U.S. markets.

Finally, we show that the increase in concentration levels has affected the vast majority of U.S. industries. Moreover, the decrease in the number of public firms has not been driven by distressed industries, or entire business niches that have disappeared due to technological

innovations or changes in consumer preferences. Instead, it has been driven by a combination of fewer IPOs, as well as high M&A activity.

We also examine what could explain the link between increase in concentration levels and firm profitability. If markets are contestable, a reduction in the number of industry rivals should have a negligible effect on the profitability of the remaining firms as the threat from new entrants keeps markets competitive. Yet, we find evidence that profit margins are positively correlated with proxies for industry concentration levels. One possible explanation for these results is that markets are becoming more concentrated due to greater barriers to entry, mainly driven by changes in technology. Given the increased contribution of computer-related technology and innovative property to the growth in output in the past two decades (Corrado and Hulten (2010)), it is possible that recent technological advances could have prevented new firms from entering certain markets. To test this hypothesis, we examine the relation between the change in concentration levels and the number of patents that firms generate. We find that while the association has been positive in earlier periods, it has reversed in the last decade. Hence, innovation seems to play a role in the recent spike in concentration levels. Further, we show that recent changes in U.S. antitrust policies might have contributed to the increase in concentration levels in most industries.

Overall, our evidence indicates that the trend of increased competition across U.S. industries has reversed in the past two decades. Markets have become more concentrated, and profit margins have increased proportionally to the increase in industry concentration. Further, the increased profit margins are mainly driven by higher operating margins, rather than increases in operational efficiency, perhaps due to greater market power. Consistent with this notion, we find that higher market concentration has resulted in more profitable investment opportunities, as

the market reaction to M&A announcements has become more positive, especially across horizontal deals. Product markets have undergone a structural change that had potentially transformed the nature of competition.

Our paper findings are relevant and important to several strands of the literature. First, it adds to the existing research on the evolution of product market competition (Irvine and Pontiff (2009), Hoberg, Phillips and Prabhala (2014)), as well as to the recent research on the implications of product market competition to firms' financial and investment policy (see, among others, Grullon and Michaely (2007), Valta (2012), Fresard and Valta (2014)). We contribute to this literature by demonstrating that, surprisingly, product markets have become more concentrated in the past two decades, and that the firms affected by this secular trend are generating higher profits and abnormal stock returns.

Second, our paper is related to the literature on the institutional aspects of listings and de-listings. For example, Gao et al. (2013) and Doidge et al. (2013) show that the number of IPOs has decreased dramatically in the early 2000s. In a contemporaneous paper, Doidge et al. (2015) examine the disappearance of U.S. firms from international and regulatory perspectives. Our study complements and extends their results by exploring the economic and product-market implications of the decrease in the number of public firms.

Finally, our results help understand the motives behind the phenomenal surge in M&A deals over the past few years, widely discussed in the financial press. For example, a recent article by the WSJ (June 27, 2015) shows that in 2015 firms have been merging "at an unseen pace", and argues that "there is a competitive and strategic pressure to act." Our results offer a potential explanation for this phenomenon by demonstrating that mergers have become more

profitable over time. We show that the excess profits may be driven by higher market power, thus emphasizing the importance of industry consolidation.

The paper is organized as follows. Section I describes the sample selection procedure and documents the systematic decline in the number of public firms and the increase in economy-wide concentration levels. In Section II we investigate the relation between profitability and proxies for industry concentration levels. Section III examines whether market power considerations are becoming an important source of value during M&A transactions, and Section IV looks at the asset pricing implications of higher concentration ratios. Section V examines whether the increase in industry concentration levels over the last two decades can be explained by the increasing role of private firms, foreign competition, and/or distressed industries. In Section VI we explore several alternative explanations for the increase in concentration of U.S. industries. Section VII concludes the paper with several policy recommendations.

I. Changes in Industry Concentration

I.A. Data

Our main sample consists of all firms on the CRSP-Compustat merged dataset over the period of 1972-2014. We limit our analysis to firms incorporated in the U.S. that trade on major stock exchanges (NYSE, AMEX, and NASDAQ), and have information on their ordinary common shares traded.[1] Otherwise, we do not apply any additional filters, and include financial firms as well as utilities.[2]

[1] For robustness, we repeat the analysis including firms incorporated outside of U.S., 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.
[2] Excluding financial firms and utilities from our analysis does not affect any of our main results.

Throughout the paper, we use NAICS classification to define a firm's industry. Relying on NAICS, rather than SIC, provides several advantages.[3] First, NAICS codes are based on a consistent, economic concept, and group together establishments that use the same or similar production processes. Under the SIC system, some establishments are classified according to production processes, but others are classified using different criteria, such as class of customer, which creates inconsistent groupings across firms. Second, since all government agencies have switched to NAICS classification by the year of 2003, using NAICS industry code system allows for an easier merge between the Compustat-CRSP data on one side, and economic indicators, provided by the US Census Bureau and Bureau of Labor Statistics, on the other. Using SIC codes, whenever possible, does not qualitatively affect any of our results.

I.B. General Trend

In this sub-section we examine how industry concentration levels have changed over time. To investigate this issue, we examine the trend in the aggregate number of publicly-traded firms over time, as well as the trend in the Herfindahl-Hirschman (HHI) concentration index. To construct the HHI, within every NAICS 3-digit industry-year, we sum up the squared ratios of firm sales to the total industry sales. Following the approach in Irvine and Pontiff (2009), we assign the industry-level HHI to each firm, essentially weighting each industry ratio by the number of public firms, and then aggregate across firms in every year.

Figure 1-A shows the results from this analysis. Note that the number of public firms (dashed line) steadily increased during the first part of the sample (1972-1997).[4] In the later period, however, the number of firms significantly declined from 7,064 in 1997 to 3,751 in 2014.

[3] The detailed information on NAICS industry classification system can be obtained on the Bureau of Labor Statistics website at http://www.bls.gov/ces/cesnaics.htm.

[4] For the purpose of the analysis, every calendar year we count all the firms that have released their annual reports in that year.

This decline has been so substantial that the current number of publicly traded firms in the economy is similar to the one in mid 1970s, when the real gross domestic product was one third of what it is today. This figure also shows that after the late 1990s, the HHI increased in tandem with the drop in the number of firms, indicating higher concentration. While some of the increase in the concentration ratio is negatively associated with a higher number of firms by the nature of the index construction, the evidence from the 1970s and 1980s indicates that the number of public firms does not always proxy for industry concentration. Thus, during the 1973-1990 period, the correlation between the number of firms and the HHI was 0.14, and for a large part of the period both metrics were moving in the same direction. Yet, during the second half of the sample the correlation between these two variables dropped to -0.94. The significant change in correlation between the two periods suggests that our evidence is more than a simple mechanical relation, and points to a structural change in the nature of market competition.

To assess the significance of the trend from a long-term historical perspective, we re-calculate the number of publicly firm using the extended period that includes information back to the beginning of CRSP database coverage. The results, reported in Figure 1-B, indicate that the decline in the number of public firms is substantial even when we analyze a time frame that is almost century long. While there have been significant spikes in the number of firms, corresponding to the CRSP's coverage of AMEX in the 60s and NASDAQ launch in the 70s, there has been no comparable declines in the number of firms, even when including the period of the Great Depression and the 1973 Oil Crisis.

Finally, to further investigate whether U.S. industries have undergone a structural change, we examine the time-series trend in the size of publicly traded firms. Figure 1-C reports the annual mean and median size of public firms (based on total sales in constant dollars of 1970).

Note that while average firm size significantly declined from the early 1970s to the mid-1990s, it started to increase in the late 1990s. The average U.S. firm is almost three times larger (in real terms) than it was 20 years ago. These findings, combined with a decrease in the number of firms, provide additional evidence of a systematic increase in industry concentration.

I.C. Industry concentration – cross-industry analysis

In this subsection we examine the prevalence of the decline in the number of public firms across industries. We start by calculating the percentage change in the number of firms in each industry during the 1997-2014 period. We use 1997 as our starting period for two reasons. First, 1996 and 1997 are the years in which the number of public firms in our sample peaks. Second, 1997 is the year of Economic Census (Census conducts more comprehensive data collection for calendar years that end in 2 or 7), which allows for an easier comparison of Compustat versus Census- based economic indicators. Figure 2-A shows that the decrease in the number of firms is a general pattern. 66 out of 71 industries have experienced a negative change over that time period. Moreover, the largest mass of the distribution is concentrated in the most extreme range, indicating that 73% of the industries have lost over 40% of their publicly traded peers.[5] Next, we examine the industry-level changes in HHI index. To be able to compare the changes across industries with different levels of concentration ratio, for every industry we calculate a percentage change in HHI index over the 1997-2014 period, and report the distribution of all the changes in Figure 2-B. The results point to a similar trend. The concentration ratio has been increasing across most industries, and the magnitude of the change is primarily concentrated in the extreme range of the spectrum.

[5] We also find that over 50% of the industries in the U.S. have lost at least half of their peers.

One potential issue with using the Compustat-based HHI index is that this measure does not include private firms. We address this issue in several ways. First, we use the HHI index provided by the U.S. Bureau of Census, which includes revenues by both public and private firms. This measure is based on the 50 largest firms in each industry, and is limited to manufacturing industries. Since Ali, Klasa, and Yeung (2009) demonstrate that Compustat and Census-based concentration ratios have low correlation and may lead to opposite conclusions, we want to ensure that the increase in concentration is not sensitive to the choice of concentration measure. In Figure 2-C we examine the changes in concentration ratios using this alternative measure of the HHI, and find that the trend of increased concentration remains robust to including the share of sales generated by private firms.[6]

Since the importance of manufacturing industries in the overall economy has been also declining over the past several decades, we ensure that the increase in concentration is prevalent across the US economy when we look beyond the manufacturing sector. As Census-based HHI index is not available for non-manufacturing industries, we perform a different type of analysis and look at the share of top four firms in each NAICS three-digit industry. The advantage of this measure is three-folds. First, it covers almost all US industries, including manufacturing, retail, financial and services sectors.[7] Second, it is based on public and private firms' information, and therefore, is not limited to the Compustat universe. Lastly, the share of top four firms can be calculated out of total sales of the entire industry, so that the scope of the measure is not limited to the top 50 firms (which is another drawback of the Census-based HHI index). We calculate

[6] This concentration ratio is available at a 5-year intervals, for calendar years that end in 2 or 7 (Economic Census years), when Census conducts more comprehensive data collection.

[7] The data is 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.

the percentage change in the share of top four firms in each industry between 1997 and 2012, and present the distribution of changes in Figure 2-D. The distribution is heavily skewed to the right, demonstrating that there are more industries where the share of the largest firms has increased than industries where the largest four firms became diluted by smaller peers. Moreover, a large proportion of the positive changes were extreme in magnitude: in 21 out of 65 industries the increase has exceeded 40%.

Finally, in Figure 2-E we look at the evolution of U.S. labor market and measure the relative importance of large firms in the economy using the share of employment in firms with 10,000 employees and more (the largest size category classified by the Bureau of Census) out of the total U.S. employment.[8] The trend shows that the share of employment by large firms in the overall economy started to escalate in the mid-90s, and has recently exceeded previous historical peaks, consistent with pattern in sales-based measures of product market concentration.

To further ensure the robustness of our findings, we calculate the change in concentration ratios using industry 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).[9] According to this classification, every firm has a unique set of peers, which can change continuously over time as firms modify the variety of products or services they offer. The test-based analysis can thus account for the possibility that some industries can evolve substantially over time. In addition, this method can be more precise in classifying competitors of firms which operations span across several different industries. Using the firm-specific text-based HHI ratio,

[8] The historical data on employment by firm size is obtained from Business Dynamics Statistics (BDS) annual report, managed by the US Census http://www.census.gov/ces/dataproducts/bds/data.html.
[9] The data was obtained from Hoberg-Phillips Industry-Level Data website at http://hobergphillips.usc.edu/industryconcen.htm

we find that between 1997 and 2013 (the last year of data available) industry concentration has increased in over 60% of the firms (unreported for the sake of brevity).

The results in subsections I.A and I.B consistently point to an increase in product market concentration over the past two decades. There are fewer public firms in the U.S., which have become bigger and more prominent in their particular markets. The pattern is economically large, robust to different measures of product market concentration, and prevalent across the vast majority of U.S. industries.

II. The Economic Implications of the Increase in Concentration Levels

In this section we test whether the systematic increase in concentration levels has economic implications, and explore whether it has an effect on the fundamentals of the remaining firms. We first analyze the relation between profitability and changes in proxies for industry concentration in a panel-data setting, while controlling for other factors that could influence firms' profitability levels. Next, we examine the potential sources of abnormal profitability.

II.A. Industry Concentration Levels and Profitability

If markets are contestable (e.g., few barriers to entry), then even firms operating in highly concentrated industries should behave as if they had many competitors (Baumol (1982)). This implies that profitability should not be affected by changes in industry concentration levels because the threat of potential entrants would not affect the competitive environment.[10] Alternatively, if there are significant barriers to entry (e.g., economies of scale, technological barriers, large capital requirements, etc.), then firms operating in industries that become more

[10] Baumol (1982) 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."

concentrated could generate larger abnormal profits by exercising market power. Under this scenario, one would expect firms' profitability levels to be positively correlated with industry concentration levels as firms compete against fewer competitors without facing the threat of entry by potential rivals. In this sub-section we test these two alternative hypotheses.

Using a sample consists of all observations in the Compustat-CRSP dataset over the period 1972-2014, we examine the relation between profitability and proxies for industry concentration levels by estimating the parameters of the following model:

$$ROA_{ijt} = \alpha_i + \alpha_t + \beta_1 \log(Assets_{it}) + \beta_2 \log(Age_{it}) + \beta_3 \log(Concentration\ Level_{jt}) + \varepsilon_{ijt} \quad (1)$$

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 proxies for concentration are: the total number of public firms in an industry (*Number of Firms*), the Herfindahl-Hirschman Index at the NAICS 3-digit level using sales from Compustat (*HHI*), and a cross-sectional ranking of the previous two measures that is equal to the sum of the annual rank of the HHI and 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.

We define industry using a firm's three-digit NAICS code.[11] 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.

[11] As a robustness check, we also define industry using three-digit SIC codes and Fama and French 48 industries grouping system. Our results are unaffected by these alternative definitions.

The inclusion of firm fixed effects also helps address a number of alternative explanations. For example, if profitable firms systematically acquire the non-profitable ones, this matching could lead to a mechanical relation between concentration levels and profitability. The inclusion of firm fixed effect 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 or by the presence of unusual and nonrecurring items. Further, simulation evidence (Barber and Lyon (1996)) suggests that *ROA* is superior to other measures of profitability in detecting abnormal operating performance. Following Bertrand and Mullainathan (2003) and Giroud and Mueller (2010), we include firm size and age in all our regressions to control for the effect of economies of scales and learning on profitability. In addition to firm fixed effects we also include year-fixed effects to control for unobserved time-specific shocks affecting all firms. To mitigate the effect of outliers, we winsorize *ROA* at the 1% and the 99% of its empirical distribution.

Panel A of Table 1 reports the coefficients of Equation 1 estimated over the period 1972-2014. Consistent with the idea that concentrated industries tend to be more profitable, we find that *ROA* is negatively related to the *Number of Firms* and positively related to both the *HHI* and the *Concentration Index*. This result shows that firms tend to generate significantly higher profits when their industries become more concentrated. More importantly, it further suggests that the increase in concentration levels is not due to firms leaving unprofitable industries. This table also shows that profitability is positively correlated with firm size, suggesting that economies of scale are an important determinant of firms' profitability.

Our findings in Section I indicate that most of the increase in industry concentration levels occurs in the latter part of our sample. Therefore, we test whether the empirical relation between profitability and concentration levels has changed over that particular time period. To perform this analysis, we estimate the regression parameters of Equation 1 over three different sub-periods (1972-1986, 1987-2000 and 2001-2014).[12] Panel B of Table 1 reports the results from this analysis. Note that 2001-2014 is the only sub-period in which the relation between *ROA* and our proxies for industry concentration levels is statistically significant across all measures. In terms of economic significance, the coefficient of *Concentration Index* estimated over this period indicates that a change in this variable from the 25th to the 75th percentile leads to an increase in *ROA* of about 44.5% relative to the its median. We find similar magnitudes when we use HHI and the number of firms as alternative measures of concentration. Thus, our analysis indicates that firms operating in more concentrated industries tend to earn significantly higher profits, and points to a significant structural shift over the past fifteen years in the economic relation between industry structure and firm's profitability.

To further highlight the economic significance of our results, Figure 3 illustrates our regression results for the 2001-2014 period by depicting ROA across quintiles of change in the number of firms. To construct the quintiles, for every industry-year we calculate the deviation of the number of firms in that industry from the long-term industry mean. Next, for every firm-year we calculate net ROA by subtracting the firm-level mean ROA, and average the results within every quintile. The figure shows that the link between the number of firms and profitability is economically significant: A large drop in the number of firms in the industry (quintile 1)

[12] Splitting the sample into alternative sub-periods does not qualitatively affect any of our main results.

generates a 1.3% extra return, while an entry of public firms into an industry shaves more than 2.5% off the profit margins for all the incumbents (quintile 5).

II.B. The Sources of Abnormal Profits

In this sub-section we investigate the sources of abnormal profits in highly concentrated industries. One potential explanation for the increase in profitability in these industries is that increasing barriers to entry are making markets less contestable over time. Thus, the lack of competition could allow the remaining industry incumbents to enjoy wider profit margins by setting higher prices relative to production costs. Alternatively, the consolidation of firms within an industry could increase efficiency. For example, a large firm could have more flexibility in reallocating its existing resources in a way that extracts the highest productivity from any unit of capital, consequently increasing firm profitability. To test the validity of these two explanations, we examine whether the empirical relation between profitability and change in industry concentration levels stems from higher profits 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) scaled by total sales (item SALE). We exclude depreciation from operating income to take into account the cost of physical capital (Hall and Jorgenson (1967)).[13] *Asset Utilization* is simply defined as total sales scaled by total assets. As in the case of *ROA*, we winsorize the

[13] Our main results are qualitatively similar if we use a version of the Lerner index that does not exclude depreciation from operating income.

Lerner Index and the *Asset Utilization* ratio at the 1% and the 99% of their empirical distributions.

Using the same specification as in Equation 1, we estimate the coefficients of the model using the *Lerner index* and the *Asset Utilization* ratio as dependent variables. The results from this analysis are reported in Table 2. While Panel A shows that over the period 1972-2014 the *Lerner Index* is negatively correlated with the *Number of Firms* but uncorrelated with the *HHI* and the *Concentration Index*, Panel B shows that over the same time period *Asset Utilization* is uncorrelated with the *Number of Firm*, negative correlated with the HHI, and positively correlated with *Concentration Index*. These mixed results could be driven by that fact that the relation between ROA and industry concentration levels has been changing over time. To investigate this possibility, Panels C and D reports the regression parameters estimated over the sub-periods 1972-1986, 1987-2000, and 2001-2014. Consistent with our previous findings, we find that the relation between our profitability measures and proxies for industry concentration levels is stronger over the sub-period 2001-2014. In this sub-period, both the *Lerner Index* and the *Asset Utilization* ratio increase as industries become more concentrated. These results suggest that firms operating in concentrated markets have been able to generate abnormal profits by increasing their market power and enhancing the efficiency of their existing assets. In terms of economic significance, however, the former effect is much stronger than the latter. While a change in the *Concentration Index* from the 25th to the 75th percentile leads to an increase in the *Lerner Index* of about 182% 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 suggest that the relation between profitability and the changes in concentration levels documented in Section II.A is mainly driven by the positive effect product market concentration

on profit margins. At a conceptual level, these findings indicate the appearance of barriers to entry, and, potentially, point to a decrease in competition.

III. The Effect of Changes in Industry Concentration Levels on the Market Reaction around M&A Announcements

To further investigate the source of higher profits in more concentrated industries, we next turn to examining the following question: Do changes in industry concentration levels affect investors' reaction to mergers and acquisitions announcements? From a theoretical perspective, mergers can create value by improving efficiency (e.g., economies of scale and scope, synergies, elimination of duplicate functions) or by increasing market power. The latter effect should become more dominant as competition declines. We disentangle these two effects by examining how a firm's product market environment affects the market reaction around mergers and acquisitions announcements. If investors perceive that the wealth effects in mergers are partially due to increases in market power, then the market reaction to these corporate events should be stronger in concentrated industries. The rationale for this is that, keeping everything else constant, mergers in concentrated markets are more likely to further reduce competition than mergers in competitive markets. This assumption is consistent with the antitrust polices of the Federal Trade Commission and the Department of Justice of mainly investigating or blocking mergers in highly-concentrated markets.

To examine this issue, we gather data from the Securities Data Corporation's (SDC) Mergers and Acquisition database. Our sample consists of mergers and acquisitions transactions over the period 1980-2014 that meet all of the following conditions: (i) percent of ownership by acquirer prior to event is less than 50%; (ii) percent of ownership by acquirer after event is more than 50%; (iii) both acquirer and target are identified as public firms (since we are interested in total market reaction, to both public and target firms); (iv) acquirer and target firm have different

identifiers; (v) the transaction is completed; (vi) return data around the announcement date is available on CRSP; and (vii) offer price is available on SDC.

In our tests, we focus on the change in the combined value of the target and the acquiring firm to gauge the magnitude of the total wealth creation around the merger announcement. To this end, we calculate the cumulative abnormal return (CAR) of the combined firm over a three-day event window [-1, 1] around the merger announcement:

$$Combined\ CAR_{i,t} = \frac{MV_{A,t+1}+MV_{T,t+1}}{MV_{A,t-1}+MV_{T,t-1}} - 1 - r_{CRSP,t-1,t+1} \quad (2)$$

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 $r_{CRSP,t-1,t+1}$ is the cumulative return on the CRSP value-weighted market portfolio from t-1 to t+1. Using a similar approach, we also calculate the cumulative abnormal returns for the target firm (*Target CAR*) and the acquirer (*Acquirer CAR*). We compute these returns to examine how the number of firms in an industry affects the ability of the target and the acquiring firm to capture the economic gains from a merger.

To examine the effect of industry concentration levels on cumulative abnormal returns, we estimate the parameters of the following model:

$$CAR_{ijt} = \alpha_t + \alpha_j + \beta_1 B/M_{T,i,t-1} + \beta_2 B/M_{A,i,t-1} + \beta_3 \log(MV_{T,i,t-1}) + \beta_4 \log(MV_{A,i,t-1}) \quad (3)$$
$$+ \beta_5 DUMCASH + \beta_6 DUMSTOCK + \beta_7 \log(Concentration\ Level_{jt-1}) + \varepsilon_{ijt}$$

where α_t is a year-fixed effect, α_j is an industry-fixed effect, B/M_T (B/M_A) is the book-to-market ratio of the target (acquiring) firm, and *DUMCASH* (*DUMSTOCK*) is a dummy for pure cash (stock) transactions. 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. Further, we cluster

the standard errors at the industry level and winsorize the book-to-market ratios at the 1% and the 99% of their empirical distributions.

We include the book-to-market ratios of the target and the acquiring firm as control variables to capture the effect of investment opportunities (Jovanovich and Rousseau (2002)) and/or potential misvaluation (Shleifer and Vishny (2003)) on the wealth effects of mergers. We also include the market values as proxies for firm size to control for the potential economies of scales generated by the merger, year-fixed effects to control for the impact of merger waves and macroeconomic conditions on announcement returns, and industry-fixed effects to control for time-invariant industry factors. Finally, we include dummies for pure cash transactions and pure stock transactions to control for the well-documented effect of the method of payment on M&A announcement returns.

Table 3 reports the estimated coefficients of Equation 3. Panel A shows the results for the specification estimated over the period 1972-2014. Consistent with the idea that M&A transactions in concentrated industries are more likely to benefit from market power considerations, we find that the market reaction of the combined firm around M&A announcements is negatively correlated with the changes in the *Number of Firms* and positively correlated with the changes in the *Concentration Index*. That is, our results indicate that investors expect synergies to be larger when the acquirer operates in a concentrated industry.

In Panel A we also examine the effect of the changes in concentration levels on the cumulative abnormal returns of the target and acquiring firm to determine how the intensity of the change in competition in an industry affects the allocation of synergies between the firms involved in the M&A transaction. While there is evidence that acquiring firms' returns are higher in more concentrated industries, and we do not find such effect on targets. This evidence

suggests that acquiring firms in more concentrated markets generate more wealth during M&A deals than those in less concentrated markets. As in the case of profitability, Panels B and C show that the relation between *Combined CARs* and concentration levels is stronger during the post-2000 period.

To further investigate the effect market power considerations value creation during 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 are in the same industry (related mergers) than when they are in different industries (unrelated mergers). The rationale for this test is that if the impact of the change in concentration levels on expected synergies is mainly driven by the effect of the merger on the competitive landscape of the industry, then the effect should be stronger during related mergers.

To test this hypothesis, we augment Equation 3 by including a dummy variable (*Related*) that is equal to one if the target and the acquiring firm are in the same industry, and an interaction variable equal to the product of *Related* and *Number of Firms*:

$$CAR_{ijt} = \alpha_t + \alpha_j + \beta_1 B/M_{T,i,t-1} + \beta_2 B/M_{A,i,t-1} + \beta_3 \log(MV_{T,i,t-1}) + \beta_4 \log(MV_{A,i,t-1}) \quad (4)$$
$$+ \beta_5 DUMCASH + \beta_6 DUMSTOCK + \beta_7 \log(Concentration\ Level_{jt-1})$$
$$+ \beta_8 Related_i + \beta_9 Related_i \times \log(Concentration\ Level_{jt-1}) + \varepsilon_{ijt}$$

If market power considerations are driving our results, we should observe a positive coefficient on the interaction variable. Table 4 reports the estimated coefficients from this regression. Further supporting the predictions of the market power hypothesis, Panel A provides evidence that the empirical relation between *Combined CARs* and the proxies for concentration levels comes largely from related mergers. Once again, we find that this effect is much stronger during the post-2000 period. While Panel B (period 1980-2000) shows that the interaction

variable is insignificant for all measures of concentration, Panel C (period 2001-2014) shows that the effect of concentration levels on *Combined CARs* tends to be much stronger during related mergers. Overall, the findings in this section suggest that market power considerations appear to be important source of value during M&A transactions.

IV. Change in the Number of Firms and the Cross-Section of Stock Returns

Several theoretical models predict that industry concentration could affect the cross-section of stock returns through its impact on systematic risk. Hou and Robinson (2006) argue that because barriers to entry protect firms operating in concentrated industries from non-diversifiable distress risk, these firms should have lower expected returns. More recently, Bustamante and Donangelo (2014) develop a theoretical model in which industry concentration levels can have two opposing effects on expected returns. On the one hand, low levels of industry concentration can lead to higher expected returns by reducing profit margins, and consequently, exposing firms in these markets to systematic risk. On the other hand, because the investment opportunity set of firms operating in concentrated industries is more sensitive to systematic shocks (most of their value comes from growth opportunities), these firms command higher returns. In this sub-section we test these competing theories by examining the effect of the decline in the number of public firms on expected stock returns.

We calculate the relative change in the concentration levels in each industry (defined using a firm's three-digit NAICS code) over the period 1972-2014:

$$RelChg_{t-1} = (Concentration\ Level_{t-1}/Concentration\ Level_{t-2}) - 1 \qquad (5)$$

We then sort industries based on the magnitude of the change, and form the three portfolios. The high *RelChg* portfolio contains the top 10 industries, the low *RelChg* portfolio

contains the bottom 10 industries, and the middle portfolio the rest of the industries.[14] To calculate returns on year *t*, we first calculate equally-weighted and value-weighted returns by industry. After these industries are assigned to one of the three portfolios based on the relative change in the number of firms, we calculate equally-weighted industry returns for each portfolio. For value-weighted returns, we aggregate the market value of equity of all firms within an industry and calculate value-weighted industry returns for each of the three portfolios. Using this portfolio formation, we calculate monthly equally-weighted and value-weighted returns from July of year *t* to June of year *t*+1.

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 5 reports the difference in abnormal returns (alphas) between high and low concentration portfolios for all our proxies for concentration. 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 decline in the number of firms the results change quiet dramatically. Panels B, C, and D report alphas estimated over three different sub-periods. While there is no evidence of abnormal performance over the periods 1972-1986 and 1987-2000, we find that the alphas are positive and statistically significant over the period 2001-2014. Even after controlling for Fama-French (2015) five factors plus the momentum factor, an investment strategy consisting of buying the high concentration portfolio and shorting the low concentration portfolio generates abnormal returns that range from 5.6% to 8.8% per year. These abnormal returns are much larger in magnitude to the ones generated by other important

[14] Because the relative change may have many ties, we use a dense ranking system, which means that we may have more than 10 industries in the top and bottom portfolios depending on the number of ties.

investment strategies. For example, the momentum strategy generated a negative alpha over the same time period.

One potential explanation for these empirical results is that firms in industries with fewer rivals command higher expected returns because their investment opportunity set is extremely sensitive to macroeconomic shocks (Bustamante and Donangelo (2014)). To examine this possibility, we examine the returns of our investment strategy during one of the largest negative systematic shocks in recent history: the global financial crisis of 2007-2008. We find that the high concentration portfolio outperforms the low concentration portfolio over the crisis period (untabulated). These findings suggest that the alphas documented in this paper are not related to a risk premium, and point to a possible market anomaly in which investors underestimate the effect of industry concentration on stock returns.

V. Market Concentration and the Number of Public Firms: Potential Explanations

The evidence in previous sections suggests that the decrease in the number of public firms has affected the competitive landscape of U.S. industries. In this section we ask whether other mechanisms have helped sustain low levels of market concentration despite a decline in the number of public firms. We examine whether the decline is the number of public firms was offset by an increasing presence of private firms, whether foreign firms' activity filled the gap left by public firms and finally, whether the decline was particularly pronounced in distressed industries.

V.A. Substitution by Private Firms

It is possible that the decline in the number of public firms is driven by the increasing importance of private firms, especially after the approval of Sarbanes-Oxley in 2002, which significantly increased the cost of being a public entity. Consistent with this line of thinking,

Doidge et al. (2015) demonstrate that the total number of public and private firms in U.S. has increased from 4.75 million in 1997 to about 5.03 million in 2012.

However, a simple back-of-the envelope calculation illustrates that private firms are far too small to fill in the void left by public firms. According to Akser, Farre-Mensa and Ljungqvist (2011), the assets size of a median private firm over the period of 2000-2007 was $1.3M, while the size of a publicly-traded firm was $246.2M (all in dollars of 2000).[15] As a result, it takes almost 200 private firms to replace one public firm.[16] Therefore, on its own, the increase in the number of private firms could not have filled the void left by the decline in the number of public firms.

It is still possible that the distribution of sales within the private firms' universe has changed over time. While private firm are on average very small, a fraction of them could become large enough to take over the product market space, previously occupied by public firms. To account for the size of private firms, we start by referring back to the Census-based HHI index, which is based on sales of both public and private firms. If some private firms were to become more dominant, we would expect to find a smaller or no increase in the Census-based industry concentration measure. Yet, the increase in Census-based HHI index (Figure 2-C) is similar to the pattern we observe based on Compustat-based HHI index (Figure 2-B). Thus, private firms did not become large enough to dilute the higher levels of product market concentration driven by the disappearance of public firms. A similar conclusion is obtained when we look beyond the manufacturing sector and calculate the change in the share of top four

[15] The study by Askel et al. (2011) is based on a database obtained from Sageworks Inc, which collects information from large and mid-size accounting firms. As a result, the private firms in their sample are larger than the actual universe of private firms, creating an upward bias in the importance of private firms compared to the public ones.

[16] To arrive at this number, we obtain total revenues and the number of private and public firms from the U.S. Bureau of Census Statistics of U.S. Businesses report. We subtract the sales of all public firms (based on Compustat data) from the total revenues, and divide it by the total number of firms net of the number of public firms.

firms in the industry. Figure 2-D demonstrates that the importance of the largest firms in the industry has grown across all sectors of the economy, and Figure 2-E provides similar results based on labor market measures of concentration. Taken together, this analysis demonstrates that the trend of increased concentration and higher importance of large firms in the overall U.S. economy remains robust to including private firms.

To further test the private-firm substitution hypothesis, we ask whether the role of public firms in the overall economy has remained high despite their disappearing numbers. To address this question, we examine the economic importance of publicly-traded firms by looking at the share of sales by public firms out of the total sales by public and private firms. If public firms were displaced by private firms, then one would expect the public-to-total sales ratio to decline over time. We obtain data on total revenues of public and private firms from the U.S. Census Bureau (similarly to the concentration ratio, it is only available at five-year intervals).[17] To construct our measure of interest, we sum up the sales of all public firms based on Compustat data, and divide that sum by total sales of public and private firms, as reported by Census. Similarly, we calculate the ratio of the number of public firms to the total number of firms in the U.S. economy.

Figure 4-A shows that the share of public sales in the total revenues of U.S. business enterprises has remained stable, and if anything, has increased over time. Therefore, even though more private firms have entered the economy, their contribution to the aggregate product market activity was negligible. Taken together, our analysis demonstrates that the importance of private firm in substituting for the share of the disappearing public firms in the overall economy has been relatively small.

[17] The historical data on U.S. businesses are obtained from U.S. Businesses (SUSB) report, managed by the U.S. Census https://www.census.gov/econ/susb/historical_data.html.

To zoom in on a potential role of large private firms, we repeat our analysis for the subsample of firms with sales over $100M (the largest size category classified in U.S. Businesses report). The results, presented in Figure 4-B, depict a similar picture. The share of public firms in the total revenues of large corporations has remained flat, demonstrating that although the number of public relative to the private firms has dropped, public firms have continued to dominate the U.S. economy. Thus, even within the subsample of large firms any substitution of public firms by private ones has been economically small.

For robustness, we also calculate the aggregate revenues of publicly-traded firms as a percentage of the U.S. 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 U.S. economy, as the contribution of their sales to the total GDP has remained stable over time (unreported).

V.B. Substitution by Foreign Firms

Since the 1970s, the globalization process has significantly increased the volume of international trade across countries. Consequently, if foreign firms have been filling the gap left by the disappearing U.S. public firms, then it is possible that the level of product market competition in U.S. industries may not have been adversely affected by the systematic decline in the number of public firms over the last two decades.

To address this question, we start by once again referring to the Census-based indicators of industry concentration. In addition to including sales of both public and private firms, the Economic Census tabulates the data of business establishments physically located in the U.S., regardless of their ownership. Thus, the Census-based measures include the revenues of U.S.-located establishments of foreign-owned firms.

In addition, the Census-based measures exclude the activity of foreign subsidiaries of U.S. firms. This point is also important, as over the last several years large conglomerates, such as Walmart and Apple, have generated over 50% of the total revenues in the overseas markets. Census-based measures of concentration helps mitigate the concern that the portion of foreign sales, incorporated in Compustat-based revenues, generate an upward bias in the measurement of product market concentration.

To evaluate the impact of foreign competition on profitability of U.S. publicly-traded firms in a direct manner, we perform two types of analyses. First, we incorporate import penetration in our main analysis. Second, we examine foreign direct investments as another way to measure international competition.

We start the analysis by looking at import penetration. This is one of the most common measures of foreign competition, which has been used in a number of studies (see, among, others, Borjas and Ramey (1995); Cuñat and Guadalupe (2009); Irvine and Pontiff (2009)). We obtain the information on U.S. International Trade Data, which reports the dollar values of import and export activity, from the public releases of the U.S. Census Bureau.[18] To ensure that our conclusions regarding increased concentration in U.S. are not driven by substitution of U.S.-manufactured goods by foreign imports, we re-estimate the regression of profitability as function of industry concentration after removing all the NAICS three-digit industries that could be potentially affected by import penetration (33 industries total). We find that the significance of the concentration impact on firm profitability remains unaffected.

[18] The data is available at http://censtats.census.gov/naic3_6/naics3_6.shtml. Unfortunately, the information on foreign trade at a NAICS level is available starting from year 2000 only, so we limit our analysis to the period of 2000-2013.

While import penetration data is widely used in economics studies, it has several shortcomings. First, import penetration is a valid source of competition only in a subsample of industries, specifically in those that produce tangible goods that could be shipped (apparel, food, rubber, metal, machinery, as well as commodities and crops). As a result, industries outside of manufacturing, mining, and agricultural sectors are not affected by foreign competition in the form of import penetration. Another problem of import penetration data is that many foreign companies operate directly out of U.S. In this case, if foreign firms manufacture and sell their products in U.S., their revenues will not be accounted in imports data, biasing the actual scope of foreign competition downwards. To address this issue, we perform a different type of analysis and look at activities of U.S. affiliates of foreign multinational enterprises. These statistics, managed by the Bureau of Economic Analysis (BEA), a division of U.S. Census, are based on mandatory surveys of virtually all U.S. business enterprises that are affiliates of a foreign person or a foreign parent company.[19] For the purpose of our analysis, we obtain information on total sales of majority-owned foreign affiliates by industry of sales for the period of 2002-2013.[20]

To assess the importance of foreign firms' operations in the U.S., for every industry-year we scale the total sales of foreign-owned U.S. firms by total sales of publicly-traded firms. We then ask whether it is possible that operations by foreign firms have grown primarily in the industries that have experienced the largest increase in concentration, substituting for domestic competition. A correlation analysis indicates that this is not the case. The correlation between the percentage increase in Compustat-based HHI ratio and the percentage change in the ratio of sales

[19] The benchmark surveys, conducted for Census years, cover the vast majority of US affiliates of a foreign person. In the surveys of other years (sample surveys) reports are not required for small affiliates. Instead, BEA estimates the data by extrapolating forward their data from the most recent benchmark surveys.

[20] BEA provides data starting from 1997. However, the industry classification system for the period of 1997-2001 is too crude, so that the data is available for about one-third of NAICS 3-digit industries only.

by foreign multi-national to US public firms is -0.19. The negative sign indicates that foreign multinational seem to be more active in industries that have become more competitive over time, contradicting the substitution hypothesis. 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 -0.05 and statistically insignificant. To examine the substitution hypothesis more formally, we repeat the main estimation of firm profitability as a function of concentration, while adding the log of sales by foreign multinationals at an industry level. We find that our main results are unaffected.

To summarize, the results on activities of foreign multinational firms and the scope of import penetration show that although the overall volume of foreign activity in US has been increasing, a large portion of U.S. industries have expanded at a similar pace, balancing off the foreign competition. Moreover, the increase in activity of foreign firms did not happen in industries with the largest increase in concentration of domestic firms, contradicting the foreign substitution hypothesis. Finally, the positive impact of the measures of product market concentration (based on the activity of US-based firms) on productivity is not driven by import-sensitive sectors, and is robust to inclusion of foreign operations in the regression analysis. Taken together, the idea that foreign firms have been filling the gap left by US public firms is not supported by the data.

V.B. Distressed Industries

In this subsection we address the possibility that the increase in industry concentration could be driven by distressed industries. Changes in consumer tastes along with technological changes (e.g., advances in computers and telecommunications) have made some industries obsolete, potentially leaving few large publicly-traded players, but eliminating the majority of

smaller private incumbents. Therefore, the increase in concentration levels could be driven by industries that are shrinking due to a declining demand that leads to fewer participants in the market.

To address this concern, we decompose the changes in the number of public firms to investigate potential drivers of the recent decline. Generally speaking, there are three possible mechanisms: a change in the number of IPOs, a change in the number of firms delisting due to bankruptcy, and a change in the pace of M&A activity.

To understand which component of entry and exit is responsible for the systematic decline in the number of public firms, we examine firms' entries and exists, as reported in CRSP. Since most additions in the 1970-1973 period were driven by the introduction of NASDAQ, we perform the analysis of this subsection starting in 1974. To identify an entry, we record the first year that a firm appears in the sample as its entry year. A new firm enters public markets primarily through an IPO process, or a spin-off from another firm.[21] To identify the source of a firm exit, we rely on the delisting information on CRSP, and classify the delisting codes into three categories: mergers, bankruptcy and liquidations, and other exits. Other exits primarily include delisting by current exchanges due to insufficient capital; not meeting financial guidelines for continued listing due to share price falling below an acceptable level; or

[21] Additional cases of a new firm entry include cross-listings of domestic firms, listings by foreign firms, and mergers. We exclude cross-listing events from our sample, as we are interested in the first time the company becomes public, rather than the number of exchanges it trades on. We also limit our sample to US-based firms, so that foreign listings are also excluded. Another reason for a firm appearance in CRSP is as a result of a merger deal, when the newly consolidated firm receives a new PERMNO, and both the bidder and the target exit the sample. Although this recording method reduces the precision of a firm entry classification, it does not bear a systematic effect on the differences between entries and exits, as it increases the level of both. In addition, in unreported results we find that our time-series of CRSP-based entries has a 0.63 correlation with the time-series IPO activity (as reported on Jay Ritter's website at http://bear.warrington.ufl.edu/ritter/ipodata.htm), suggesting that it captures the time-series trend fairly well.

insufficient flow of assets. This category can be broadly viewed as another type of bankruptcy, when a firm is unable to sustain its publicly traded status due to a poor financial performance.

Figure 5 presents the decomposition of the change in the number of public firms into entries and exits, with exits further decomposed into mergers, liquidations, and other exits. The rate of firm entries increases through the earlier period, but reverses in the late 1990s, consistent with previous studies that document the disappearing of IPOs (e.g., Gao, Ritter, and Zhu (2013)). However, the decline in IPOs is not the only mechanism behind the disappearance of public firms. The level of M&A activity starting from early 2000 has also remained stable. In fact, the exit of public firms as a result of M&A deals is sufficiently high to offset all the entries into the public market during most years of that period. This contrasts with the trend during the 1980s and most of the 1990s, in which the rate of firm entries into the market was almost twice as high as the rate of mergers.

To summarize, there are primarily two mechanisms that are responsible for the decline in the number of public firms. The first is a decline in the number of IPOs, and the second is the higher rate of M&As relatively to the number of remaining public firms. The number of exits due to liquidation, as well as involuntary delisting (other exists) has remained low, even after accounting for the 2007-2009 recession. Taken together, our results suggest that the remaining firms are doing well and expanding at a persistent and positive rate.

VI. Discussion

So far we have shown that the decline in the number of firms has a real effect on the corporate landscape: remaining firms become more profitable, profit margins increase primarily due to in increased profit margins (and not due to increased efficiency), and M&A transactions,

especially those done within an industry, generate greater wealth gains to acquiring firms' shareholders increase. What are the causes for this change in the competitive landscape? While gauging the channel at work in a causal way is a challenging task, we can think of a few possible factors that contribute to the decline in the number of firms and competition.

The first factor we consider is the change in monitoring over M&A transactions in the past 15 years. Several studies document the importance of regulatory changes in explaining the volume of M&A activity of U.S. firms (Mitchell and Mulherin (1996), Kaplan (2000)). While no new M&A reforms were implemented in the past two decades, the majority of this period overlapped with the presidency of George W. Bush. His view on antitrust laws was that they need "to be applied where there are clear cases of price fixing", and there should be no other roles for antitrust enforcement (Harty, Shelanski, and Solomon (2012)).

To evaluate the impact of George W. Bush's administration on merger antitrust enforcement, Table 6 summarizes horizontal merger investigations conducted by the Federal Trade Commission over the periods 1996-2003 and 2004-2011. This table shows the number of FTC requests (formally known as Hart-Scott-Rodino (HSR) second requests), which are usually triggered during transactions that could potentially affect competition over time. The number of requests has dropped from 281 over the 1996-2003 period to 183 over the 2004-2011 period. The change is even more dramatic when evaluated at a per year basis. Interestingly, the later period includes the first presidency term by Barack Obama, who joined the office in 2009, and emphasized aggressive antitrust enforcement as part of his presidential campaign. Yet, while merger challenge rates increased under President Obama, their rate was only 1.5%, compared to the rates of 0.75% and 0.9% under President Bush.[22] In addition, Crane (2012) shows that from

[22] "How antitrust authorities view mergers and acquisitions", InsideCousel, March 26, 2013.

2007 to 2008, the Bush administration made 52 second requests, while from 2010 to 2011, the Obama administration made 53 requests.

Clearly we should be very careful with drawing causal inferences from this analysis. Yet, given the positive correlation between the more relaxed compliance requirements and the increase in concentration levels, it is possible that fewer regulatory barriers could have direct implications on the product market competition. Low antitrust enforcement increases the aggregate M&A activity, especially deals between large public firms, which further increase competition. Moreover, it allows for mergers with more market power potential, leading to a higher market reaction and higher profit margins.

Another potential source of industry consolidation is technological changes. Over the past 60 years, 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 late-1990s, as well as the popularization of personal computers around the same time, has had a large impact on productivity and growth. Corrado and Hulten (2010) quantify the sources of growth in output and demonstrate that during the period 1995-2007, the contribution on intangible capital, and its components, such as computerized information, innovative property, and economic competencies has doubled. Thus, the innovation-related intangible inputs have been increasingly important to the U.S. economy growth.

Could technological advances, as well as innovation, benefit from economies of scale and firm consolidation? Studies in industrial organization examine this issue by estimating the effects of economies of scale on R&D. Although Schumpeter (1942) proposes that larger firms are better positioned than smaller firms to implement and successfully exploit R&D efforts, the empirical evidence has arrived at mixed conclusions. Yet, several recent papers have presented

evidence in favor of the economy of scale hypothesis. Henderson and Cockburn (1996) examine the search productivity in drug discovery and show that larger research efforts in the pharmaceutical industry benefit from economy of scale. Ciftci and Cready (2011) derive R&D value based on its association with future earnings realizations, and show strong evidence in favor of the economy of scale hypothesis across the CRSP-Compustat universe of firms. If technology is better developed and implemented among large firms, the recent technological advances could essentially create barriers of entry to new firms, increasing the incentives of technological start-ups to exit through M&As rather than organic growth.

The benefits of economies of scale could also lead to consolidation of large firms, and exit of the small ones. To test this claim, we report in Table 7 results from regressions relating the change in the number of patents granted (to publicly traded firms), to firm characteristics and proxies for industry concentration levels. We find that while the relationship between the number of firms in the industry and number of patents granted has been positive in the period 1986-2000, it has reversed in the last decade, so that now firms in concentrated markets patent more. This result is consistent with the idea that advances in technology have made innovation more resource-consuming, thus essentially creating entry barriers to new firms, and encouraging them to sell their inventions to larger corporations at early stages of development. Overall, this explanation is consistent with the reduction in the number of firms, higher volume of M&A activity, and potentially higher profit margins, if more complex technology also facilitates synergy potentials.

Lastly, it is possible that the increase in market concentration is driven by a combination of factors. Doidge et al. (2015) find that other countries of comparable level of economic development and quality of financial intermediary system have not experienced a decline in the

number of public firms. The uniqueness of the pattern in U.S. suggests that additional factors must have played a role along with technological advances, allowing U.S. to exploit the consolidation benefits to a greater extent than other countries. Regulatory differences regarding antitrust laws in U.S. and other developed countries could be an additional contributing factor.

Consistent with this argument, existing research in law and economics suggests that although U.S. and European competition systems have similar objectives, the differences in laws, policy, and rules lead to different enforcement outcomes. For example, Fox (1997) shows that even the definition of a dominant firm differs across the two jurisdictions: leading U.S. cases treat a firm as holding monopoly power only if it control two-thirds or more of a relevant market, while according to the E.U. law even a 40% market share can constitute dominance. The recent European antitrust investigation into Google, Apple, Facebook and potentially other technological giants highlight those differences, and provide an example of Europe's increasing willingness to police powerful companies, in contrast to a "relatively hands-off approach, favored by U.S. authorities" (New York Times, April 2, 2015). Thus, the combined evidence suggests that while many countries could also benefit from the economy of scale due to technological innovations, U.S. firms were able to act on those changes due to lenient anti-trust regulations.

VII. Conclusion

This paper documents that over the last 15 years the level of product market concentration in the U.S. has increased across most industries. This phenomenon has been fueled by consolidation of public firms into mega firms.

We show that the increase in concentration levels has implications to firm performance, as it affects profitability, investment, and returns to investors. First, the increase in industry

concentration levels is associated with remaining firms generating higher profits through higher profit margins. The results suggest that the increase in profit margin cannot be attributed to increased efficiency but rather to increased market power. Second, mergers in concentrated industries enjoy more positive market reactions, consistent with the idea that market power considerations are becoming a key source of value during these corporate events. Finally, firms in concentrated industries experience significant abnormal stock returns, suggesting that considerable portion of the gains accrues to shareholders. In general, our findings suggest that despite popular beliefs, competition could have been fading over time.

The findings that firms in industries that have become more concentrated generate higher profit margins, and enjoy better investment opportunities through M&A deals should be of interest to policy makers. While those gains appear to be transferred to the firms' shareholders, it is not clear whether the higher market concentration benefits consumers or other stakeholders. The increase in profit margins without a corresponding significant decline in production costs may suggest the opposite. Although it is possible that a more concentrated nature of product markets improves the quality or variety of products offered, it is unclear whether those changes are sufficient to compensate customers for the higher profit margins that firms enjoy. Our findings may motivate policy makers to examine this issue further.

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Figure 1
Trends in Industry Concentration

This figure shows the time-series trend in measures of industry concentration. Panel A reports the number of publicly-traded firms, as well as the Herfindahl-Hirschman (HHI) concentration index, for all U.S. publicly-traded firms that appear in CRSP and Compustat. To construct the HHI index, every year we sum up the squared total sales of each firm in a given NAICS 3-digit industry divided by the aggregate number of firms in the industry. 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 average and median size for all U.S. publicly-traded firms that appear in CRSP and Compustat. Firm size is based on total sales in constant dollars of 1970.

Figure 1-A: Number of Public Firms and HHI

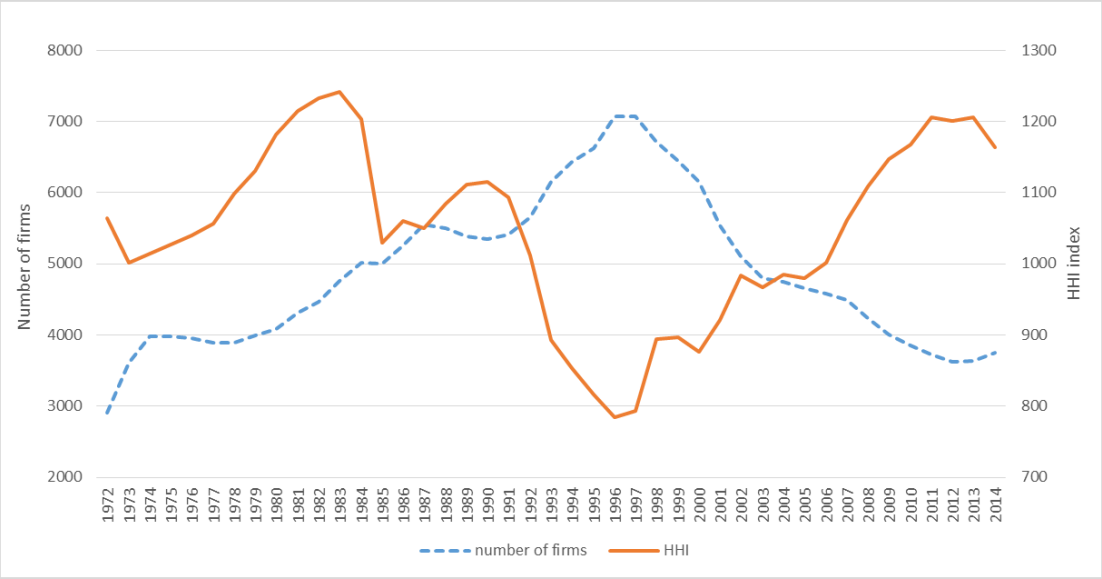


Figure 1-B: Number of Public Firms – Historical CRSP Coverage

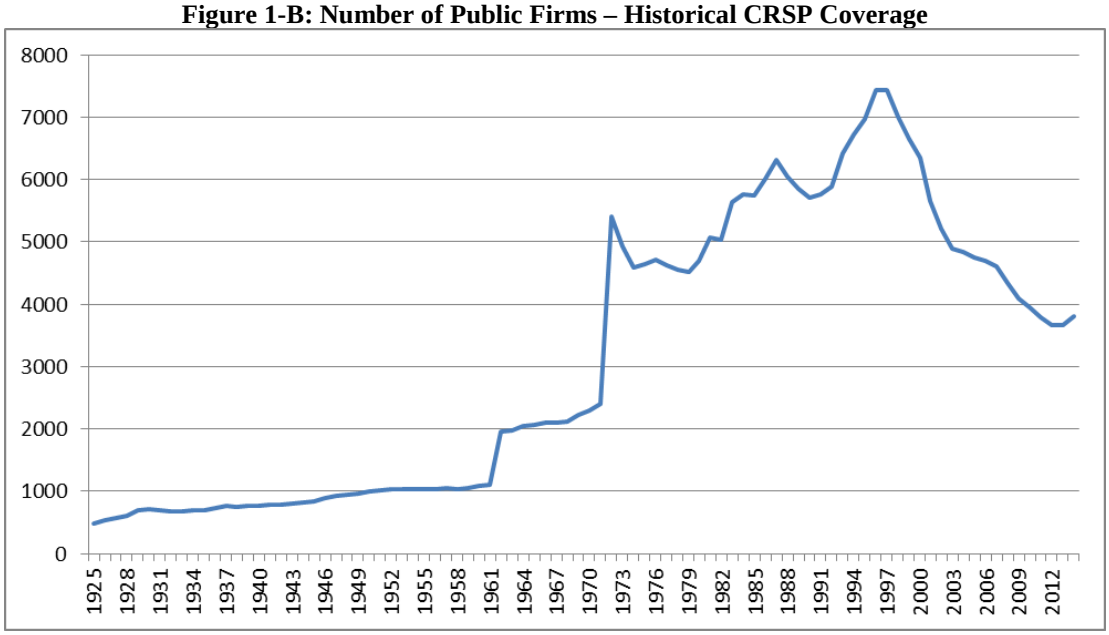


Figure 1-C: Average and Median Size of Public Firms

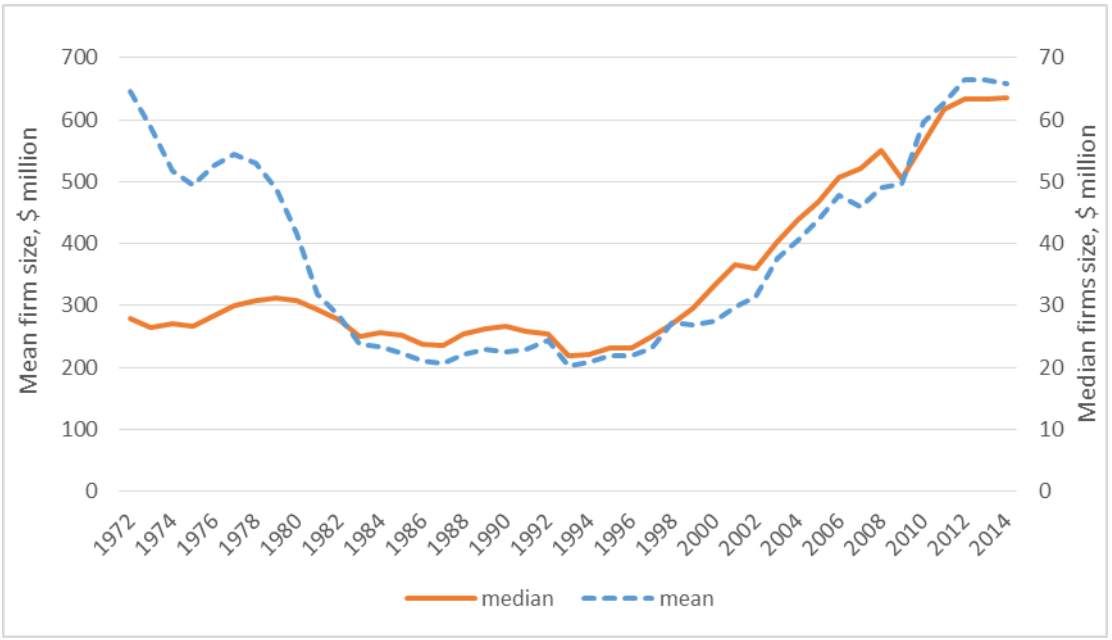


Figure 2
Change in Measures of Concentration across Industries

This figure depicts the distribution of percentage changes in the number of publicly-traded firms (Figure A) and the HHI Compustat-based index (Figure B) across industries. The changes are calculated over the 1997-2014 period. Figure C shows the change in Census-based HHI index, and Figure D shows the change in the share of the largest four firms in the industry, both calculated over the 1997-2014 period. The industries are defined based on NAICS 3-digit classification. Figure 2-E shows the share of employment in firms with 10,000 employees and more out of the total U.S. employment.

Figure 2-A: Change in the Number of Public Firms

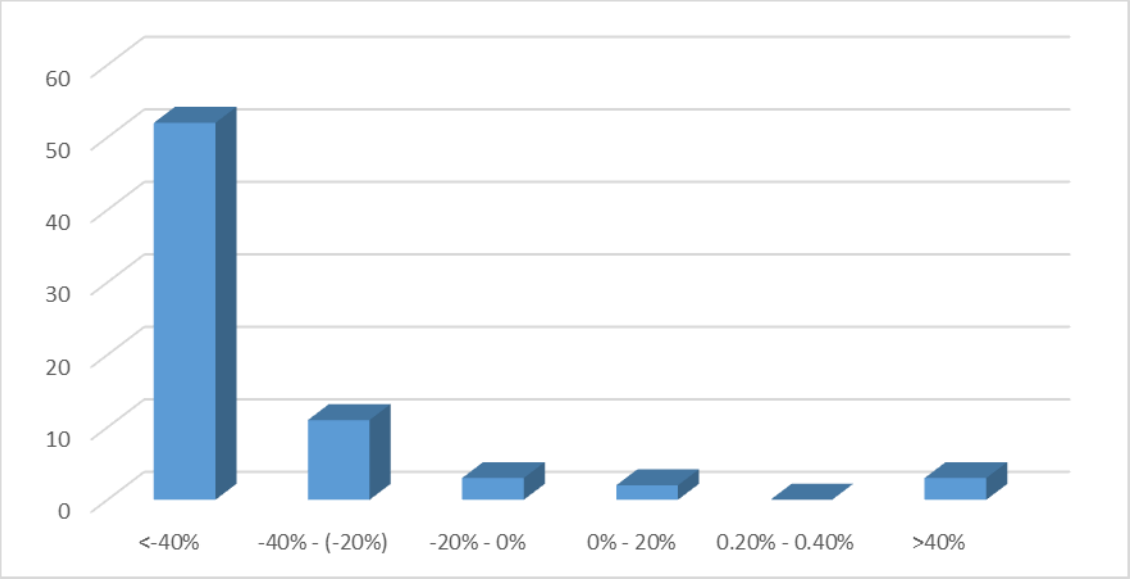


Figure 2-B: Change in the HHI (Compustat-based)

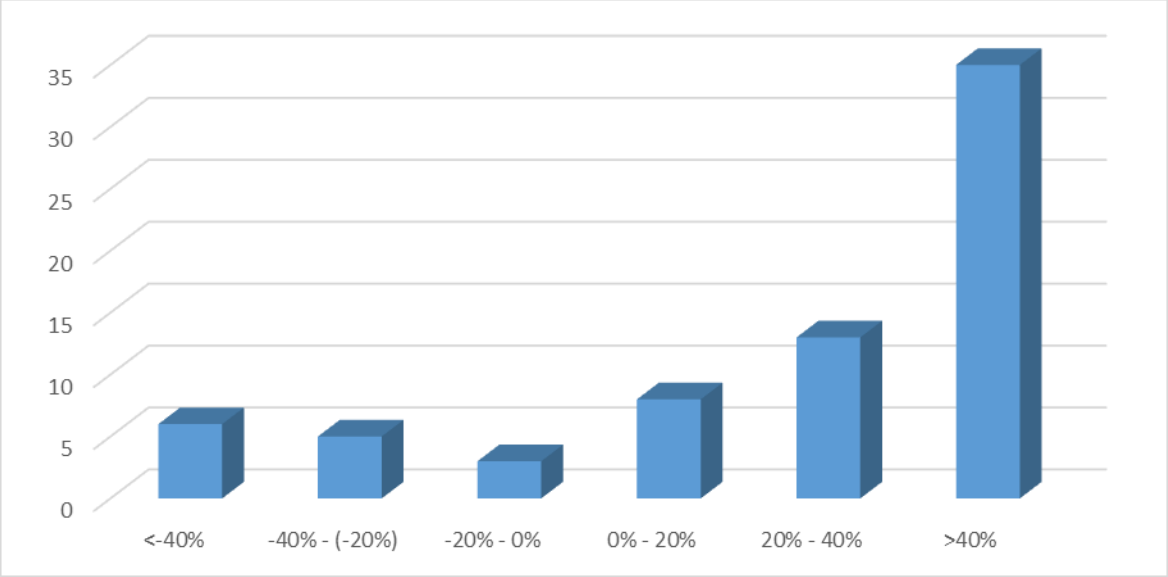


Figure 2-C: Change in the HHI (Census-based)

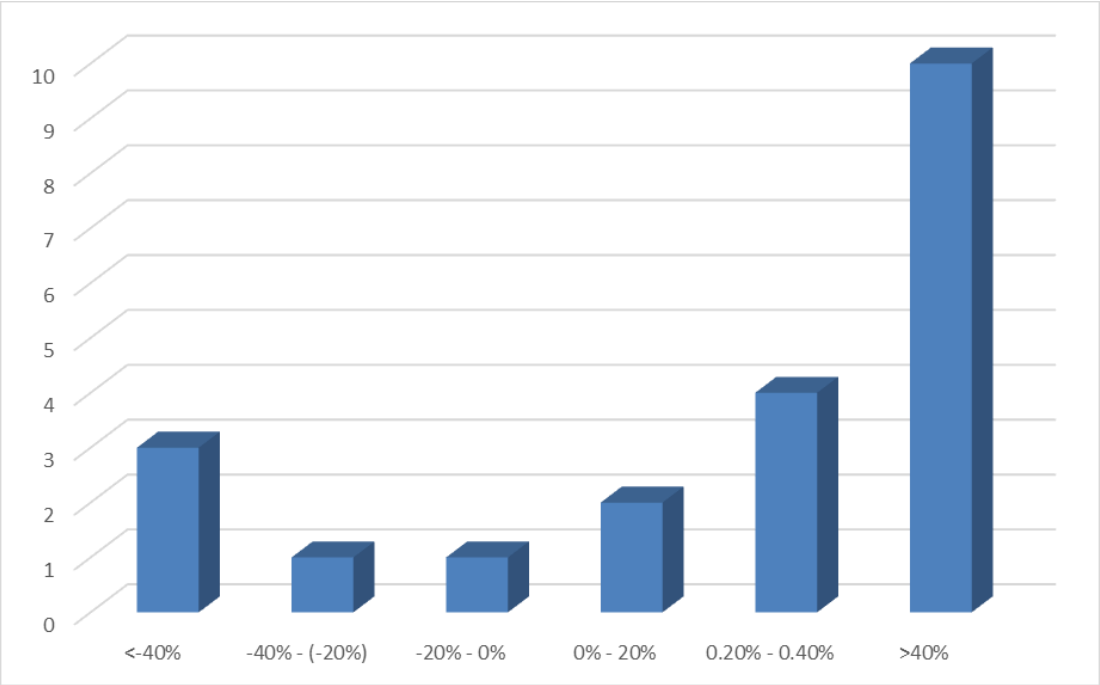


Figure 2-D: Change in the Share of the Largest Four Firms in the Industry

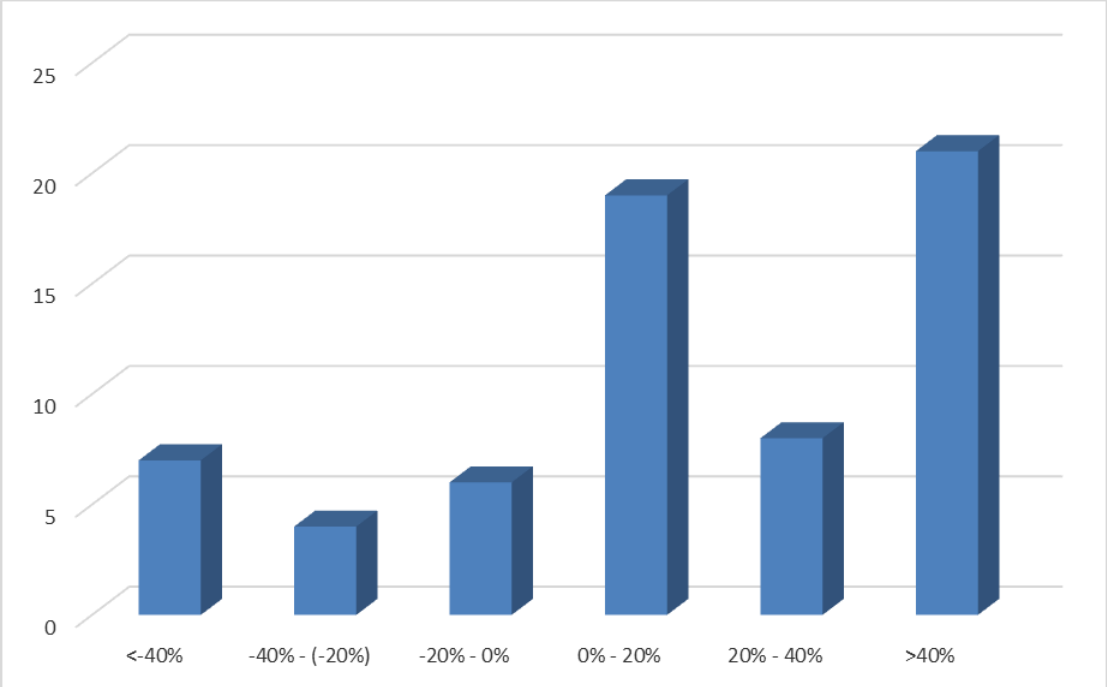


Figure 2-E: Share of Employment in Firms with 10,000+ Employees

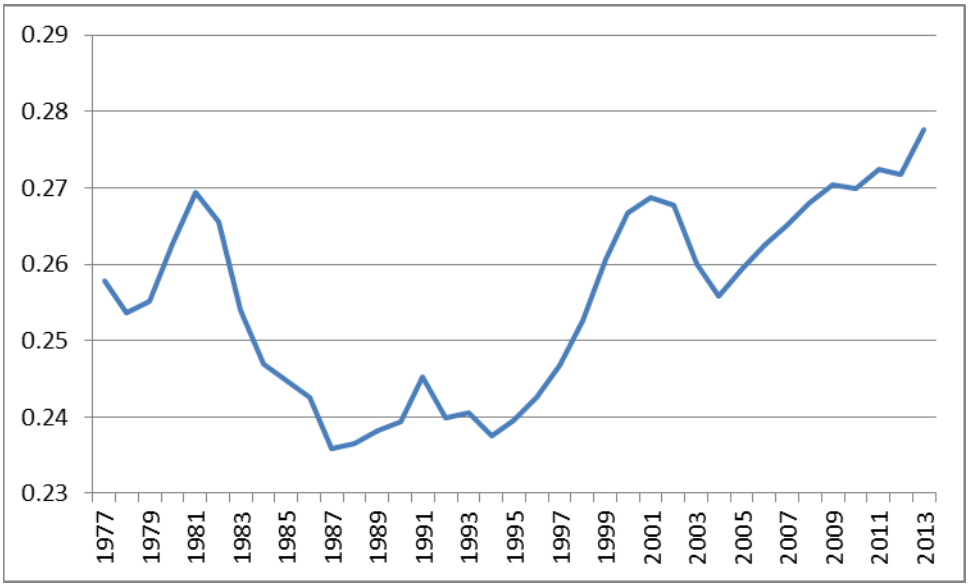


Figure 3
ROA and Change in the Number of Firms

Figure 5 shows net ROA across quintiles of change in the number of firms. The sample period is 2001-2014. To construct the quintiles, for every industry-year we calculate the deviation of the number of firms from the industry mean (over the entire sample period), and assign the resulting difference to each firm in that industry. Next, we allocate all the firms in the sample into quintiles based on the deviation in the number of firms from industry mean. Finally, we subtract the long-term firm mean ROA (also calculated over the entire sample period) from every firm-year ROA, and average the resulting net ROA within every quintile of change in the number of firms.

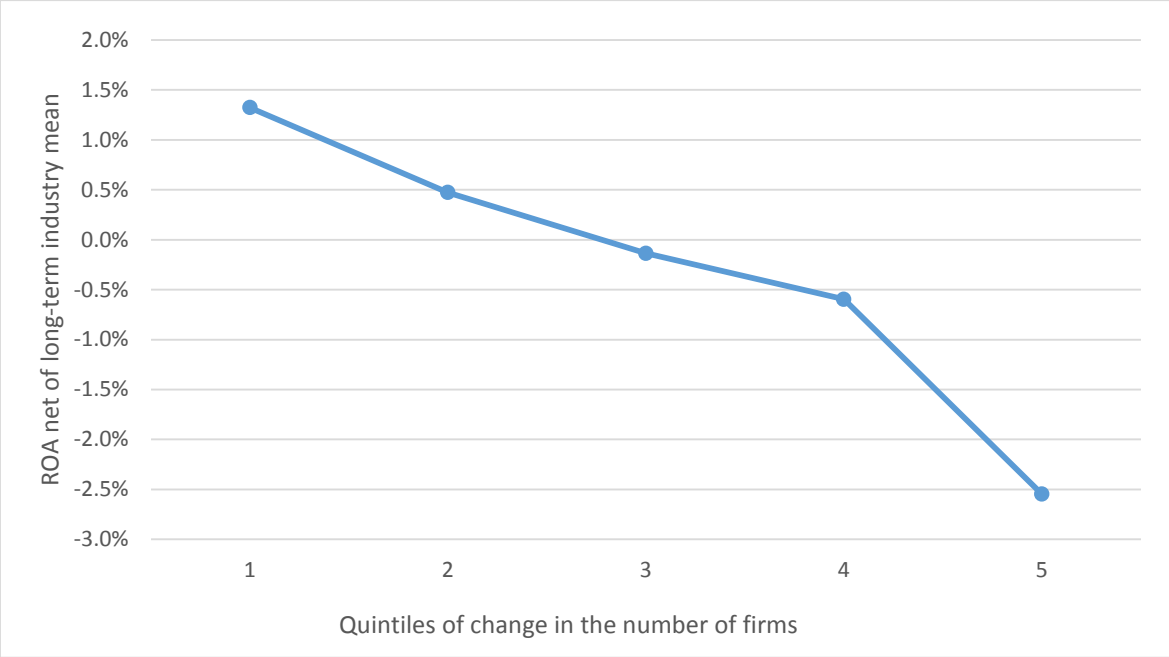
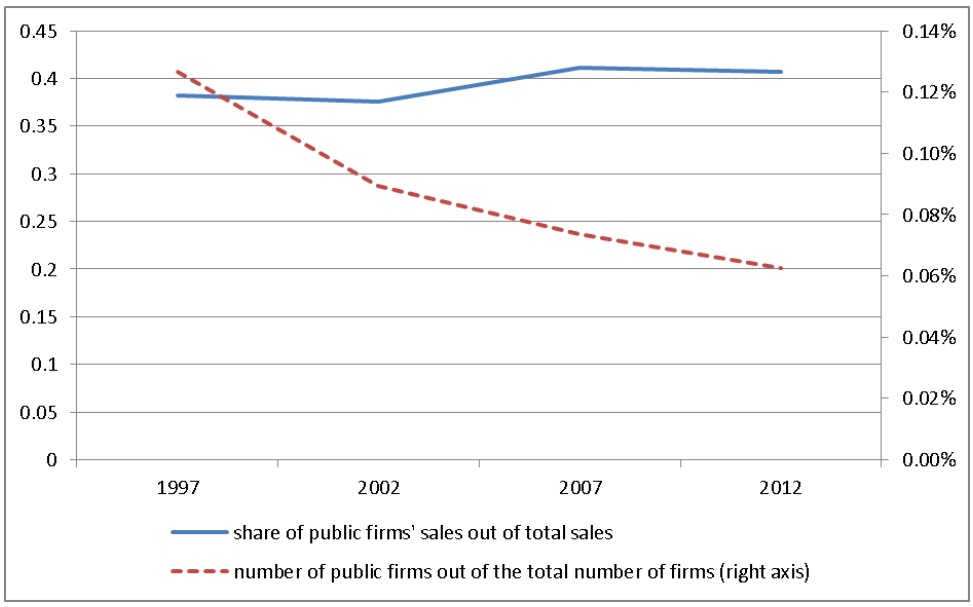


Figure 4
Total Public Firms' Revenues as a Fraction of Public and Private Firms' Revenues

This figure shows total revenues [number] of public firms as a fraction of total revenues [number of firms] of public and private firms for the period 1997-2012. The information on public firms is obtained from Compustat, and the information on public and private firms are from Statistics of U.S. Businesses (SUSB) report, managed by the U.S. Census. Panel A is based on the overall sample, while Panel B is based on the subsample of firms with sales over $100M.

Panel A: All firms



Panel B: Firms with sales over $100M

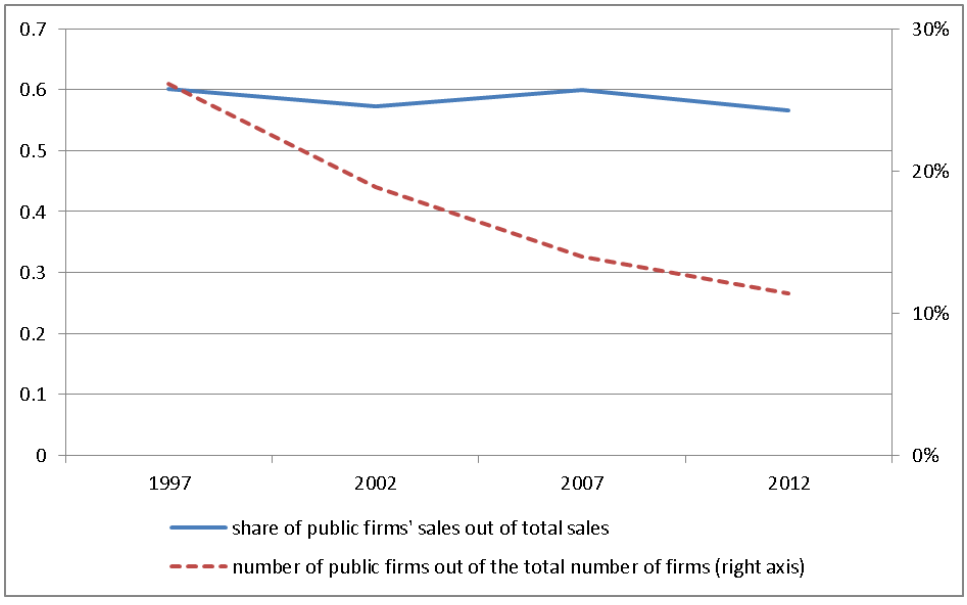


Figure 5
Entries and Exits in Public Markets

This figure decomposes the changes in the number of public firms into entries and exits, as reported in the CRSP database. Firm exits are further split into mergers (delisting codes 200 through 299); liquidations (delisting codes 400 through 499, 574, and 580); and other exits (all the other delisting codes).

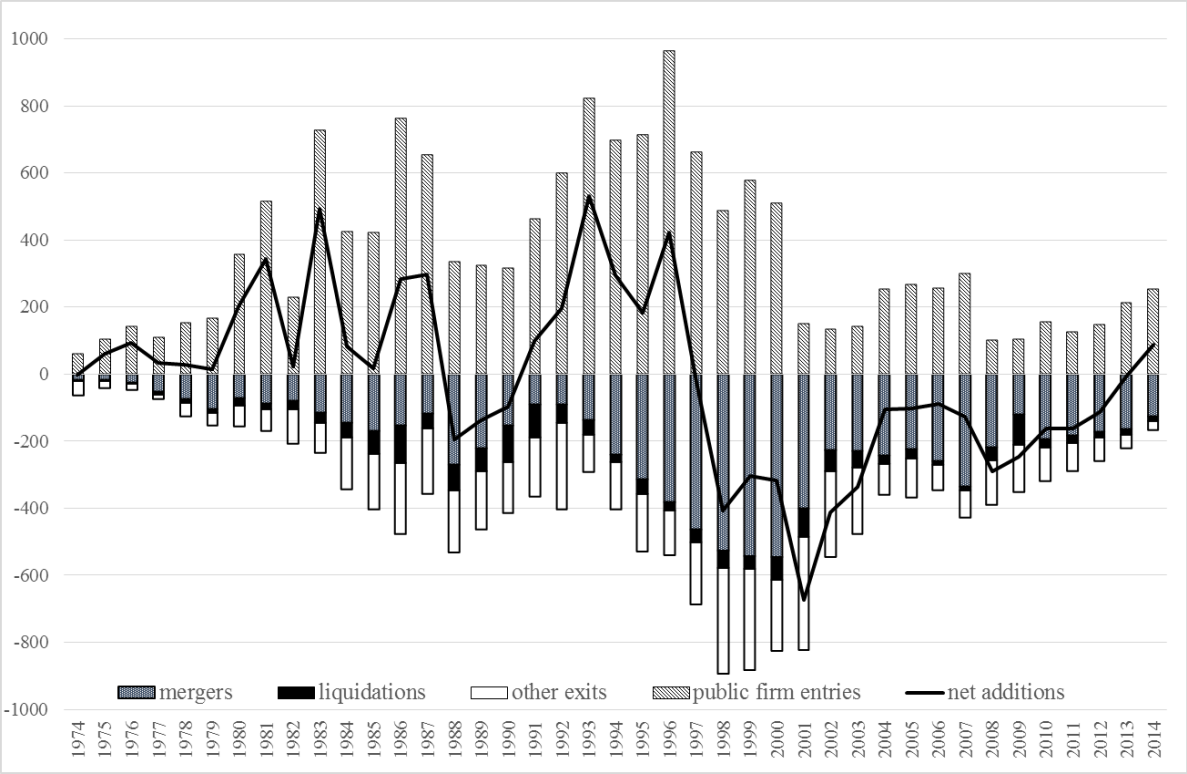


Table 1
Change in the Level of Product Market Concentration and Profitability

This table reports coefficients from regressions of firm profitability on several proxies for the level of product market competition in an industry 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. *Number of Firms* is the total number of public firms in an industry. *HHI* is the Herfindahl-Hirschman Index at the NAICS 3-digit level using sales data from Compustat. *Concentration Index* is the sum of the annual rank of the HHI and the annual inverse rank of the total number of industry incumbents. 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*		
	1972-2014		
Constant	-0.0097	-0.0490[a]	-0.0294[a]
	(0.0072)	(0.0112)	(0.0050)
Log(*Assets*)	0.0390[a]	0.0388[a]	0.0389[a]
	(0.0014)	(0.0014)	(0.0014)
Log(*Age*)	-0.0146[a]	-0.0148[a]	-0.0149[a]
	(0.0013)	(0.0013)	(0.0012)
Log(*Number of Firms*)	-0.0059[a]		
	(0.0015)		
Log(*HHI*)		0.0024[c]	
		(0.0014)	
Concentration Index			0.0013[a]
			(0.0005)
N	194,604	194,572	194,572
Adjusted R^2	66.79%	66.78%	66.78%
Year Fixed Effects	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes
Clustering at Firm Level	Yes	Yes	Yes

Panel B: Sub-Periods

	Dependent Variable: *ROA*								
	1972-1986			1987-2000			2001-2014		
Constant	0.0506[a]	0.0738[a]	0.0493[a]	-0.1251[a]	-0.1425[a]	-0.1216[a]	-0.2011[a]	-0.3850[a]	-0.2424[a]
	(0.0127)	(0.0100)	(0.0100)	(0.0170)	(0.0213)	(0.0111)	(0.0251)	(0.304)	(0.0205)
Log(*Assets*)	0.0242[a]	0.0242[a]	0.0241[a]	0.0532[a]	0.0532[a]	0.0532[a]	0.0569[a]	0.0566[a]	0.0570[a]
	(0.0029)	(0.0029)	(0.0029)	(0.0025)	(0.0025)	(0.0025)	(0.0032)	(0.0032)	(0.0032)
Log(*Age*)	-0.0224[a]	-0.0225[a]	-0.0225[a]	-0.0309[a]	-0.0309[a]	-0.0309[a]	0.0036	0.0033	0.0025
	(0.0020)	(0.0020)	(0.0020)	(0.0024)	(0.0024)	(0.0024)	(0.0030)	(0.0030)	(0.0030)
Log(*Number of Firms*)	0.0004			-0.0008			-0.0169[a]		
	(0.0022)			(0.0030)			(0.0034)		
Log(*HHI*)		-0.0032			0.0020			0.0151[a]	
		(0.0024)			(0.0027)			(0.0036)	
Concentration Index			-0.0017[b]			0.0015[c]			0.0077[a]
			(0.0009)			(0.0009)			(0.0013)
N	57,567	57,566	57,566	76,785	76,754	76,754	60,252	60,252	60,252
Adjusted R^2	67.02%	67.02%	67.03%	69.35%	69.36%	69.36%	75.47%	75.45%	75.48%
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 2
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 competition in an industry and other control variables. *Lerner index* is the operating income before depreciation minus depreciation 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. *Number of Firms* is the total number of public firms in an industry. *HHI* is the Herfindahl-Hirschman Index at the NAICS 3-digit level using sales data from Compustat. *Concentration Index* is the sum of the annual rank of the HHI and the annual inverse rank of the total number of industry incumbents. 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: Lerner Index - Entire Sample

	Dependent Variable: *Lerner Index*		
	1972-2014		
Constant	-0.5456[a]	-0.6525[a]	-0.644[a]
	(0.0655)	(0.1090)	(0.0347)
Log(*Assets*)	0.1266[a]	0.1256[a]	0.1258[a]
	(0.0110)	(0.0109)	(0.0109)
Log(*Age*)	0.0878[a]	0.0870[a]	0.0869[a]
	(0.0114)	(0.0114)	(0.0114)
Log(*Number of Firms*)	-0.0266[c]		
	(0.0156)		
Log(*HHI*)		0.0003	
		(0.0149)	
Concentration Index			0.0025
			(0.0049)
N	187,339	187,339	187,339
Adjusted R^2	63.38%	63.37%	63.37%
Year Fixed Effects	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes
Clustering at Firm Level	Yes	Yes	Yes

Panel B: Asset Utilization - Entire Sample

	Dependent Variable: *Asset Utilization*		
	1972-2014		
Constant	1.4451[a]	1.5768[a]	1.4489[a]
	(0.0328)	(0.0464)	(0.0195)
Log(*Assets*)	-0.1467[a]	-0.1476[a]	-0.1467[a]
	(0.0052)	(0.0052)	(0.0053)
Log(*Age*)	0.1093[a]	0.1095[a]	0.1097[a]
	(0.0056)	(0.0056)	(0.0056)
Log(*Number of Firms*)	0.0025		
	(0.0071)		
Log(*HHI*)		-0.0176[a]	
		(0.0063)	
Concentration Index			-0.0037[c]
			(0.0023)
N	195,677	195,645	195,645
Adjusted R^2	84.64%	84.67%	84.66%
Year Fixed Effects	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes
Clustering at Firm Level	Yes	Yes	Yes

Panel C: Lerner Index - Sub-Periods

	Dependent Variable: *Lerner Index*								
	1972-1986			1987-2000			2001-2014		
Constant	-0.3670[a]	-0.4923[a]	-0.4190[a]	-1.1215[a]	-0.7963[a]	-1.1067[a]	-0.8089[a]	-1.7983[a]	-1.1263[a]
	(0.0680)	(0.1220)	(0.0586)	(0.1591)	(0.1892)	(0.0942)	(0.2432)	(0.3393)	(0.1765)
Log(*Assets*)	0.1073[a]	0.1064[a]	0.1066[a]	0.1401[a]	0.1400[a]	0.1340[a]	0.1005[a]	0.0978[a]	0.1008[a]
	(0.0177)	(0.0176)	(0.0176)	(0.0192)	(0.0192)	(0.0192)	(0.0289)	(0.0289)	(0.0289)
Log(*Age*)	0.0253[c]	0.0245[c]	0.0244[c]	0.0875[a]	0.0872[a]	0.0870[a]	0.2267[a]	0.2276[a]	0.2204[a]
	(0.0139)	(0.0139)	(0.0139)	(0.0213)	(0.0213)	(0.0213)	(0.0304)	(0.0305)	(0.0303)
Log(*Number of Firms*)	-0.0165			0.0173			-0.1179[a]		
	(0.0121)			(0.0275)			(0.0385)		
Log(*HHI*)		0.0098			-0.0358			0.0608	
		(0.0135)			(0.0263)			(0.0436)	
Concentration Index			0.0036			-0.0138[c]			0.0485[a]
			(0.0050)			(0.0083)			(0.0141)
N	54,320	54,320	54,320	74,181	74,181	74,181	58,838	58,838	58,838
Adjusted R^2	70.12%	70.12%	70.12%	66.36%	66.37%	66.37%	71.52%	71.49%	71.52%
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: Asset Utilization - Sub-Periods

	Dependent Variable: *Asset Utilization*								
	1972-1986			1987-2000			2001-2014		
Constant	1.7212[a]	1.7065[a]	1.7308[a]	1.5571[a]	1.7005[a]	1.5286[a]	2.0648[a]	1.8511[a]	2.0302[a]
	(0.0506)	(0.0710)	(0.0381)	(0.0685)	(0.0757)	(0.0376)	(0.0736)	(0.0890)	(0.0551)
Log(*Assets*)	-0.1668[a]	-0.1665[a]	-0.1668[a]	-0.1632[a]	-0.1668[a]	-0.1661[a]	-0.2181[a]	-0.2184[a]	-0.2179[a]
	(0.0109)	(0.0109)	(0.0109)	(0.0081)	(0.0080)	(0.0080)	(0.0084)	(0.0084)	(0.0084)
Log(*Age*)	0.0356[a]	0.0359[a]	0.0357[a]	0.1287[a]	0.1290[a]	0.1298[a]	0.0837[a]	0.0832[a]	0.0824[a]
	(0.0094)	(0.0094)	(0.0094)	(0.0081)	(0.0081)	(0.0081)	(0.0087)	(0.0087)	(0.0087)
Log(*Number of Firms*)	0.0037			-0.0104			-0.0169		
	(0.0100)			(0.0127)			(0.0108)		
Log(*HHI*)		0.0041			-0.0270[a]			0.0197[c]	
		(0.0088)			(0.0104)			(0.0117)	
Concentration Index			-0.0021			0.0023			0.0089[a]
			(0.0035)			(0.0034)			(0.0040)
N	57,689	57,688	57,688	77,529	77,498	77,498	60,459	60,459	60,459
Adjusted R^2	90.22%	90.22%	90.22%	86.15%	86.22%	86.22%	89.66%	89.66%	89.66%
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 3
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 competition in an industry and other control variables. The sample consists of mergers and acquisitions transactions over the period 1980-2014. The cumulative abnormal return (CAR) of the combined firm over a three-day event window [-1, 1] around the merger announcement as calculated as follows:

$$Combined\ CAR_{i,t} = \frac{MV_{A,t+1} + MV_{T,t+1}}{MV_{A,t-1} + MV_{T,t-1}} - 1 - r_{CRSP,t-1,t+1}$$

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 $r_{CRSP,t-1,t+1}$ is the cumulative return on the CRSP value-weighted market portfolio from t-1 to t+1. The cumulative abnormal returns for the target firm (*Target CAR*) and the acquirer (*Acquirer CAR*) are calculated in a similar way. *Number of Firms* is the total number of public firms in an industry. *HHI* is the Herfindahl-Hirschman Index at the NAICS 3-digit level using sales data from Compustat. *Concentration Index* is the sum of the annual rank of the HHI and the annual inverse rank of the total number of industry incumbents. Industry is defined using a firm'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. Symbols [a], [b], and [c] indicate significance at 1%, 5%, and 10%, respectively.

Panel A: Period 1980-2014

	Combined CARs			Acquirer CARs			Target CARs		
Constant	0.1375[a]	0.0107	0.0711[a]	0.0548	-0.0657	-0.0021	0.2005	0.2741[a]	0.3249[a]
	(0.0431)	(0.0479)	(0.0160)	(0.0375)	(0.0459)	(0.0162)	(0.1578)	(0.1041)	(0.0753)
Log(*Number of Firms*)	-0.0137[c]			-0.0116[c]			0.0235		
	(0.0077)			(0.0065)			(0.0222)		
Log(*HHI*)		0.0083			0.0090[c]			0.0066	
		(0.0071)			(0.0053)			(0.0145)	
Concentration Index			0.0477[c]			0.0281			0.0904
			(0.0277)			(0.0023)			(0.1128)
N	3,100	3,100	3,100	3,100	3,100	3,100	3,100	3,100	3,100
Adjusted R^2	7.34%	7.32%	7.30%	8.28%	8.31%	8.20%	13.32%	13.29%	13.31%
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
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

Panel B: Period 1980-2000

	Combined CARs			Acquirer CARs			Target CARs		
Constant	0.1416[a]	0.0572	0.0429[c]	0.0575	0.0187	0.0021	0.3823[b]	0.1525	0.2112[c]
	(0.0482)	(0.0654)	(0.0229)	(0.0481)	(0.0495)	(0.0138)	(0.1868)	(0.1852)	(0.1192)
Log(*Number of Firms*)	-0.0215[b]			-0.0120			-0.0351		
	(0.0088)			(0.0093)			(0.0312)		
Log(*HHI*)		-0.0025			-0.0026			0.0091	
		(0.0083)			(0.0063)			(0.0199)	
Concentration Index			0.0399			0.0197			-0.0535
			(0.0325)			(0.0291)			(0.1124)
N	1,811	1,811	1,811	1,811	1,811	1,811	1,811	1,811	1,811
Adjusted R^2	11.24%	10.88%	10.95%	8.84%	8.73%	8.74%	10.02%	9.93%	9.93%
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
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

Panel C: Period 2001-2014

	Combined CARs			Acquirer CARs			Target CARs		
Constant	0.2229[b]	-0.0981	0.0458[b]	0.1074	-0.1188	-0.0621[b]	-0.0272	0.5588[c]	0.3968[a]
	(0.0873)	(0.0717)	(0.0216)	(0.1500)	(0.1245)	(0.0256)	(0.3817)	(0.3046)	(0.1050)
Log(*Number of Firms*)	-0.0314[b]			-0.0272			0.0585		
	(0.0150)			(0.0280)			(0.0645)		
Log(*HHI*)		0.0231[b]			0.0118			-0.0411	
		(0.0119)			(0.0189)			(0.0479)	
Concentration Index			-0.0143			-0.0802			0.4237
			(0.0609)			(0.0853)			(0.2911)
N	1,289	1,289	1,289	1,289	1,289	1,289	1,289	1,289	1,289
Adjusted R^2	4.36%	4.38%	4.23%	9.84%	9.72%	9.73%	14.12%	14.13%	14.24%
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
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

Table 4
Change in the Level of Product Market Concentration and M&A Returns – Related vs. Unrelated Mergers

The table presents results of regressing CARs around merger announcements on several proxies for the level of product market competition in an industry as well as bidder-target relatedness, and other control variables. *Related* is a dummy variable that takes on a value of 1 if the bidder and the target belong to the same NAICS 3-digit industry, and zero otherwise. See Table 4 for the description of the sample and variables construction. Symbols [a], [b], and [c] indicate significance at 1%, 5%, and 10%, respectively.

Panel A: Period 1980-2014

	Combined CARs			Acquirer CARs			Target CARs		
Constant	0.1239[a]	0.0405	0.0716[a]	0.0429	-0.0327	-0.0016	0.2154	0.2041[c]	0.3179[a]
	(0.0444)	(0.0476)	(0.0168)	(0.0378)	(0.0494)	(0.0154)	(0.1535)	(0.1182)	(0.0762)
Log(*Number of Firms*)	-0.0096			-0.0080			0.0180		
	(0.0081)			(0.0068)			(0.0218)		
Log(*HHI*)		0.0043			0.0044			0.0156	
		(0.0068)			(0.0059)			(0.0147)	
Concentration Index			-0.0085			-0.0088			0.0706
			(0.0351)			(0.0032)			(0.1194)
Related	0.0305[b]	-0.0460	0.0061	0.0270[c]	-0.0508[c]	0.0037	-0.0253	0.1089	0.0167
	(0.0128)	(0.0338)	(0.0048)	(0.0198)	(0.0301)	(0.0041)	(0.0562)	(0.1218)	(0.0163)
Proxy for Concentration x *Related*	-0.0066[a]	0.0066	0.0644[a]	-0.0058[b]	0.0074[c]	0.0423[c]	0.0076	-0.0146	0.0246
	(0.0022)	(0.0052)	(0.0248)	(0.0027)	(0.0045)	(0.0023)	(0.0111)	(0.0182)	(0.0733)
N	3,100	3,100	3,100	3,100	3,100	3,100	3,100	3,100	3,100
Adjusted R^2	7.41%	7.33%	7.38%	8.37%	8.36%	8.23%	13.32%	13.31%	13.30%
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
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

Panel B: Period 1980-2000

	Combined CARs			Acquirer CARs			Target CARs		
Constant	0.1326[a]	0.0557	0.0461[b]	0.0546	0.0189	0.0039	0.4373[b]	0.0398	0.2127[c]
	(0.0483)	(0.0647)	(0.0233)	(0.0488)	(0.0529)	(0.0136)	(0.1904)	(0.2025)	(0.1188)
Log(*Number of Firms*)	-0.0186[b]			-0.0109			-0.0488		
	(0.0087)			(0.0096)			(0.0336)		
Log(*HHI*)		-0.0018			-0.0024			0.0254	
		(0.0085)			(0.0069)			(0.0222)	
Concentration Index			0.0129			0.0136			-0.0235
			(0.0378)			(0.0315)			(0.1349)
Related	0.0076	0.0042	-0.0030	-0.0002	0.0005	-0.0037	-0.1083[c]	0.2029[c]	-0.0112
	(0.0176)	(0.0303)	(0.0081)	(0.0188)	(0.0323)	(0.0063)	(0.0634)	(0.1072)	(0.0214)
Proxy for Concentration x *Related*	-0.0029	-0.0018	0.0285	-0.0008	-0.0008	0.0046	0.0207[c]	-0.0320[c]	-0.0406
	(0.0032)	(0.0048)	(0.0313)	(0.0033)	(0.0050)	(0.0266)	(0.0113)	(0.0164)	(0.0628)
N	1,811	1,811	1,811	1,811	1,811	1,811	1,811	1,811	1,811
Adjusted R^2	11.34%	10.98%	11.08%	8.80%	8.70%	8.71%	10.09%	10.03%	9.85%
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
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

Panel C: Period 2001-2014

	Combined CARs			Acquirer CARs			Target CARs		
Constant	0.1713[c]	-0.0275	0.0248	0.0631	-0.0518	-0.0803[a]	-0.1066	0.5125[c]	0.3590[a]
	(0.0937)	(0.0701)	(0.0236)	(0.1547)	(0.1408)	(0.0264)	(0.3600)	(0.2819)	(0.1149)
Log(*Number of Firms*)	-0.0211			-0.0180			0.0687		
	(0.0164)			(0.0291)			(0.0587)		
Log(*HHI*)		0.0120			0.017			-0.0384	
		(0.0104)			(0.0211)			(0.0417)	
Concentration Index			-0.1358			-0.1977[c]			0.3656
			(0.0812)			(0.0995)			(0.2952)
Related	0.0828[b]	-0.1183[c]	0.0208[b]	0.0738[a]	-0.1113[b]	0.0185[b]	0.0901	0.0640	0.0330
	(0.0244)	(0.0636)	(0.0105)	(0.0272)	(0.0541)	(0.0080)	(0.1273)	(0.3160)	(0.0273)
Proxy for Concentration x *Related*	-0.0154[a]	0.0186[b]	0.1367[b]	-0.0142[a]	0.0171[b]	0.1354[a]	-0.0110	-0.0047	0.0230
	(0.0046)	(0.0094)	(0.0585)	(0.0049)	(0.0082)	(0.0523)	(0.0275)	(0.0455)	(0.2551)
N	1,289	1,289	1,289	1,289	1,289	1,289	1,289	1,289	1,289
Adjusted R^2	4.57%	4.43%	4.29%	10.29%	9.90%	9.97%	14.21%	14.19%	14.26%
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
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

Table 5
Change in the Level of Product Market Concentration and the Cross-Section of Stock Returns

This table reports alphas for portfolios sorted by the relative change in the number of firms in an industry from year t-2 to year t-1. Portfolio 1 (Low) contains the 10 industries with the smallest relative change in the number of firms, Portfolio 3 (High) contains the 10 industries with the largest relative change in the number of firms, and Portfolio 2 contains the rest of the industries. To calculate returns on year t, we first calculate equally-weighted and value-weighted returns by industry. After these industries are assigned to one of the three portfolios based on the relative change in the number of firms, we calculate equally-weighted industry returns for each portfolio. For value-weighted returns, we aggregate the market value of equity of all firms within an industry and calculate value-weighted industry returns for each of the three portfolios. Using this portfolio formation, we calculate monthly equally-weighted and value-weighted returns from July of year t to June of year t+1. 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		
	Number of Firms	HHI	Concentration Index
CAPM			
Equally-Weighted Portfolios	0.0033	0.0028	0.0011
	1.3356	0.9746	0.5348
Value-Weighted Portfolios	0.0038[c]	0.0038[c]	-0.0003
	1.8235	1.9309	-0.1901
Fama-French 3 Factors			
Equally-Weighted Portfolios	0.0027	0.0034	0.0011
	1.0730	1.1655	0.5120
Value-Weighted Portfolios	0.0018	0.0035[c]	-0.0016
	0.8992	1.7150	-0.8960
Fama-French 6 Factors			
Equally-Weighted Portfolios	0.0012	0.0035	0.0002
	0.4734	1.1445	0.0898
Value-Weighted Portfolios	-0.0014	0.0013	-0.0039[b]
	-0.6832	0.6312	-2.1964

Panel B: 1972-1986

	Difference in Returns between High and Low Concentration Portfolios		
	Number of Firms	HHI	Concentration Index
CAPM			
Equally-Weighted Portfolios	-0.0004	-0.0039	-0.0022
	-0.0716	-0.5317	-0.4371
Value-Weighted Portfolios	0.0048	0.0037	-0.0015
	1.3701	1.1867	-0.5154
Fama-French 3 Factors			
Equally-Weighted Portfolios	-0.0009	-0.0045	-0.0018
	-0.1394	-0.5875	-0.3551
Value-Weighted Portfolios	0.0028	0.0029	-0.0013
	0.7823	0.8876	-0.4503
Fama-French 6 Factors			
Equally-Weighted Portfolios	-0.0021	-0.0039	-0.0032
	-0.2923	-0.4619	-0.5582
Value-Weighted Portfolios	-0.0023	0.0033	-0.0066[b]
	-0.6670	0.0951	-2.1013

Panel C: 1987-2000

	Difference in Returns between High and Low Concentration Portfolios		
	Number of Firms	HHI	Concentration Index
CAPM			
Equally-Weighted Portfolios	0.0028	0.0049	0.0003
	0.8814	1.4311	0.1313
Value-Weighted Portfolios	-0.0010	0.0030	-0.0024
	-0.2318	0.6861	-0.6912
Fama-French 3 Factors			
Equally-Weighted Portfolios	0.0020	0.0060[c]	0.0001
	0.6331	1.7346	0.0572
Value-Weighted Portfolios	-0.0038	0.0023	-0.0052
	-0.9585	0.5169	-1.6163
Fama-French 6 Factors			
Equally-Weighted Portfolios	-0.0010	0.0063	-0.0002
	-0.2836	1.6443	-0.0719
Value-Weighted Portfolios	-0.0072[c]	-0.0096	-0.0053
	-1.7057	-0.1986	-1.6255

Panel D: 2001-2014

	Difference in Returns between High and Low Concentration Portfolios		
	Number of Firms	HHI	Concentration Index
CAPM			
Equally-Weighted Portfolios	0.0076[a]	0.0076[a]	0.0053[a]
	3.5580	3.1830	2.4261
Value-Weighted Portfolios	0.0076[a]	0.0050[c]	0.0033
	2.5208	1.8801	1.1491
Fama-French 3 Factors			
Equally-Weighted Portfolios	0.0074[a]	0.0085[a]	0.0054[a]
	3.4532	3.5713	2.4517
Value-Weighted Portfolios	0.0066[b]	0.0053[b]	0.0024
	2.1972	1.9679	0.8381
Fama-French 6 Factors			
Equally-Weighted Portfolios	0.0060[a]	0.0074[a]	0.0047[b]
	2.7075	2.9065	2.0370
Value-Weighted Portfolios	0.0054[c]	0.0049[c]	0.0007
	1.8449	1.7268	0.2310

Table 6
Horizontal Merger Investigations

This table reports horizontal mergers investigations conducted by the Federal Trade Commission over the period 1996-2011. HSR second requests are requests in which firms involved in a transaction have to provide additional information to the Federal Trade Commission under the Hart-Scott Rodino Act. Data on total announcements and mega deals comes from Mergerstat. Mega deals are transactions with values of more than $1 billion.

	1996-2003	2004-2011
HSR Second Requests	281	183
HSR Second Requests per Year	35.1	22.9
% of Total Announcements	0.44%	0.24%
% of Mega Deals	26.66%	14.51%

Table 7
Changes in the Levels of Product Market Concentration and Patent Generation

This table reports coefficients from regressing the number of patents granted to a firm as a function of industry concentration levels and other control variables. Patents are obtained from NBER website. The sample includes all the industries where at least one firm is granted a patent in a given year. The dependent variable is the log of 1 plus the number of patents that a firm was granted in a given year. The other variables are defined in Table 1. Industry is defined using a firm's three-digit NAICS code. Standard errors are clustered at the firm level. Symbols [a], [b], and [c] indicate significance at 1%, 5%, and 10%, respectively, and p-values are reported in the parentheses.

	Dependent Variable: log(1 + Number of Patents)								
	1972-1986			1987-2000			2001-2006		
Constant	0.0932[c]	0.0750	0.1392[a]	-0.2165[a]	0.1104[c]	-0.0376	0.1566	-0.2812[b]	-0.0793
	(0.0567)	(0.0636)	(0.0374)	(0.0621)	(0.0593)	(0.0392)	(0.1266)	(0.1292)	(0.0955)
Log(*Assets*)	0.0625[a]	0.0636[a]	0.0635[a]	0.0876[a]	0.0873[a]	0.0869[a]	0.0499[a]	0.0512[a]	0.0523[a]
	(0.0079)	(0.0080)	(0.0080)	(0.0090)	(0.0090)	(0.0090)	(0.0109)	(0.0109)	(0.0109)
Log(*Age*)	0.0305[b]	0.0315[b]	0.0315[b]	0.0412[a]	0.0409[a]	0.0405[a]	0.0855[b]	0.0843[b]	0.0808[b]
	(0.0125)	(0.0125)	(0.0124)	(0.0103)	(0.0103)	(0.0103)	(0.0339)	(0.0337)	(0.0338)
Log(*Number of Firms*)	0.0121			0.0185[b]			-0.0218[c]		
	(0.0101)			(0.0085)			(0.0121)		
Log(*HHI*)		0.0102			-0.0353[a]			0.0491[a]	
		(0.0077)			(0.0081)			(0.0151)	
Concentration Index			0.0007			-0.0186[a]			0.0227[a]
			(0.0034)			(0.0029)			(0.0062)
N	40,920	40,920	40,920	69,562	69,535	69,535	27,161	27,161	27,161
Adjusted R^2	90.30%	90.30%	90.30%	85.62%	85.63%	85.65%	89.97%	89.98%	89.98%
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