Are US Industries Becoming More Concentrated?

Gustavo Grullon, Yelena Larkin and Roni Michaely

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Abstract

More than 75% of US 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. Lax enforcement of antitrust regulations and increasing technological barriers to entry appear to be important factors behind this trend. These findings are robust to the inclusion of private firms and factors that account for foreign competition, as well as the use of alternative measures of concentration. Overall, our findings suggest that the nature of US product markets has undergone a structural shift that has weakened competition.

Grullon is from Rice University (grullon@rice.edu), Larkin is from York University (ylarkin@schulich.yorku.ca) and Michaely is from Johnson@Cornell Tech—Cornell University (rm34@cornell.edu). We thank Elizabeth Berger, Nittai Bergman, Kobi Boudoukh, Andrew Ellul, Juanita Gonzalez-Uribe, Johan Hombert, Rajkamal Iyer, Sebastien Michenaud, Sandy Klasa, Shimon Kogan, Valerie Li, Maria Marchica, Pedro Matos, Dennis Sheehan, Kelly Shue, Jared Williams, conference participants at NFA 2015, AFA 2016, UBC 2016, FIRS 2016, CICF 2016, EFA 2017, and 2017 Chicago Booth "Is there a concentration problem in America" annual meetings, and seminar participants at the University of Arizona, Baruch College, Baylor University, Cornell Tech, Hong Kong University, IDC, the University of Manchester, Michigan State University, the University of Melbourne, Moscow Higher School of Economics, University of Paris Dauphine, Penn State University, Rice University, Sun Yat-sen University, Texas A&M University, and the University of Toronto for helpful comments. We are also grateful to Yamil Kaba for his assistance on this project.

Introduction

One of the most fundamental concepts in economics is that competition promotes the efficient allocation of resources. With this idea in mind, during the second half of the 20th century governments around the world put into effect a series of policy reforms (e.g., tariff reductions, deregulations, aggressive antitrust enforcement) that drastically changed the industrial landscape of many markets, increasing the scope of competition (e.g., Shepherd (1982), Graham, Kaplan, and Sibley (1983), Pryor (1994), Nickell (1996), Rajan and Zingales (2001)).

This paper shows that this trend has drastically reversed in the US. We examine the evolution of product market concentration of US industries over the last 40 years, and document that US industries have become more concentrated since the beginning of the 21st century. The Herfindahl-Hirschman index (HHI) of market concentration has systematically increased in over 75% of US industries, and the average increase in concentration levels has reached 90%. Pointing in the same direction, the market share of the four largest firms in the industry, public and private, has significantly increased for most industries. Furthermore, US public markets have lost almost 50% of their publicly traded firms. This decline 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 US was just one third of what it is today. Importantly, the increase in concentration levels we document here is not a simple manifestation of the decline in the number of public firms. Even after controlling for the presence and impact of private firms, we still find an overall increase in concentration levels.

Our analysis also indicates that the increase in market concentration and the disappearance of public firms coincide with a large-scale consolidation of firms. In real terms, the average and median firms in the economy have become three times larger during the last two decades. Overall, our results are in line with recent comments made by the Council of Economic Advisers that "many industries may be becoming more concentrated."[1]

We also examine whether these changes in concentration are related to changes in firms profitability. This is an important question because from a theoretical standpoint the direction of relationship between concentration and profitability is not always clear. If markets are

[1] See https://www.whitehouse.gov/sites/default/files/page/files/20160414_cea_competition_issue_brief.pdf

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)). Furthermore, Sutton (1991) shows that if firms can enhance product demand through advertising and/or R&D, intense competition can lead to concentrated markets as low price-cost margins increase exit and deter entry. In this framework, profit margins are expected to be negatively related with the level of product market concentration. 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 concentrated could generate larger abnormal profits by exercising market power (see, for example, Bain (1951, 1956)).

To test these hypotheses, we examine whether the changes in industry concentration levels are linked to firm profitability, as measured by return on assets, market reaction to M&A announcements, and abnormal stock returns. Our results indicate that over the past two decades firms in industries experiencing increase in concentration levels have enjoyed higher profitability. We find that the changes in concentration levels are positively correlated with return on assets. Further, when we decompose this measure 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. A change in the *Concentration Index* in the magnitude of its interquartile range (75^{th} minus 25^{th} percentile) increases profit margins by 182% (relative to its median), whereas the same change increases *Asset Utilization* by only 6%, possibly suggesting that firms in concentrated industries might be exercising market power. Further tests indicate that neither potential increase in foreign competition nor increased competition from private firms is able to explain the increased concentration or the higher profit margin we document. Using various industry definitions (whether based on three- or four-digit NAICS), we find positive and significant association between increased in industry concentration and increased profits in those industries.

We further explore whether market power is the mechanism behind the higher profitability in industries with increased concentration by looking at M&A transactions. If industry concentration has an impact on firms' prospects, then the market should react more positively to the announcement of transactions that further erode product market competition. We find that mergers of firms in the same industry have become more profitable to shareholders in general, and even more so in industries that became more concentrated.

Finally, we find evidence that returns to shareholders increase as industries become more concentrated. To examine the changes to investors' welfare, we look at the performance of portfolios sorted on the change in concentration levels in their respective industries. Unlike in earlier periods, we find that over the period of 2001-2014, a zero-investment strategy of buying firms in industries with the largest increase in concentration levels and shorting firms in industries with the largest decrease in concentration levels, generates excess returns of approximately 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 since the turn of the century are reflected in higher returns to shareholders. Although one could still argue that these excess returns are a compensation for bearing extra systematic risk not captured by standard factors (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.

The evidence quite clearly indicates that the relations between changes in industry concentration levels and changes in profit margins and shareholders wealth have become positive over past two decades. Still, an important question remains: What are the underlying forces behind this secular trend? We explore several possible explanations. First, we examine the possibility that changes in the enforcement of antitrust laws by the Department of Justice and the Federal Trade Commission have allowed firms to significantly increase their market shares over time. Consistent with the arguments in several legal studies, we find evidence of a significant decline in antitrust enforcement during the administrations of George W. Bush and Barack Obama [(e.g., Harty, Shelanski, and Solomon (2012), Crane (2012)]. Specifically, we find that the use of Section 2 of the Sherman Act, which allows antitrust agencies to prevent increase in market power of existing dominant firms, has declined from an average of 15.7 cases per year over the period 1970-1999 to less than 3 over the period 2000-2014. Surprisingly, no cases were filed in 2014 even though aggregate concentration levels reached record levels during that year. Further, we find evidence that completion rates for M&A transactions, including mega M&A transactions, have been increasing over time, consistent with the idea that antitrust regulators are now less likely to block proposed mergers.

Second, we examine whether markets are becoming more concentrated due to greater barriers to entry. According to Bain (1968), barriers to entry are "the extent to which, in the long run, established firms can elevate their selling prices above the minimal average costs of

production and distribution… without inducing potential entrants to enter the industry" (p. 252). Given the increased contribution of computer-related technology and innovation to the growth in output in the past two decades (e.g., Corrado and Hulten (2010)), firms can create significant barriers to entry by capturing the lion's share of technological advances through internal research and development, acquisition of innovative firms, and access to unique technologies that competitors may not have.[2] To explore this possibility, we examine the relation between changes in concentration levels and patenting activity. If technological barriers are an important factor behind the recent changes in concentration, then one would expect firms in concentrated industry to own stronger patent portfolios. We find that while the relation between changes in concentration levels and changes in the number and impact of patents has been negative before 2000, it has reversed in the last fifteen years. During the post-2000 period, firms in industries that became more concentrated possess not only a larger number of patents, but also the most valuable ones. Further, the largest four firms in an industry have been capturing the lion's share of patents since 2000. In general, this evidence suggests that technological barriers to entry may have prevented new firms from entering profitable markets.[3]

Next, we examine whether the increase in concentration levels is due to the omission of private firms from our main measures of product market concentration. Using US Census data that includes both private and public firms, we find no evidence that private firms have replaced public firms. The Census-based HHI index and the share of top four firms' sales out of the total industry revenues display similar patterns as the concentration ratios based on public firms (both measures include both private and public firms).[4]

We also analyze how proxies for foreign competition affect the empirical relation between our concentration measures and firm profitability. If foreign firms are filling the gap left by disappearing domestic firms, then their presence should reduce the ability of the remaining domestic firms to exercise any market power. Contrary to this prediction, we find that

[2] Gao, Ritter and Zhu (2013) find evidence that the main reason for the disappearing of IPOs over the past two decades is that startups, which are an important driver of technological innovation, are now more likely to sell their assets to a larger firm than to go public.

[3] The idea that patent accumulation can lead to market power is an old one. For example, Machlup (1952) argues that the "accumulation of patents in the hands of large corporations may secure them an almost unlimited monopoly power."

[4] These findings are consistent with the evidence in Gabaix (2011), who shows that the total sales of the top 50 and 100 publicly-traded firms as a fraction of GPD have been increasing since the late 1990s.

even after controlling for industry-level sales by foreign multinational enterprises in the US, as well as the level of import penetration, the relation between concentration measures and firm profitability remains positive and significant. Further, the finding that profit margins have significantly increased in industries that became more concentrated also suggests that foreign firms are not completely filling the gap left by domestic firms. If they were replacing domestic firms, then we would not have observed the increase in profit margins for those industries.

Finally, we study whether the increase in concentration levels is the mechanical result of the consolidation of firms in unprofitable industries. We find no evidence that the recent increase in concentration levels has been driven by distressed industries, or by business niches that have disappeared due to technological innovations or changes in consumer preferences. The phenomenon documented in this paper has affected the vast majority of US industries.

All in all, over the last 20 years, product markets have undergone a structural change that had potentially transformed the nature of competition. Markets have become more concentrated, and profit margins and shareholders' wealth gains 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, higher market concentration has resulted in more profitable investment opportunities, as the market reaction to M&A announcements that are likely to increase market power has become more positive.

Our paper's findings are relevant and important to several strands of the literature. First, it adds to the existing research on the relation between concentration levels and profitability. Consistent with models that posit that exogenous barriers to entry increase the likelihood of market power, we find that profit margins have been economically and statistically positive related to several proxies of market concentration over the last two decades. We find no link between these two variables during the 70s and the 80s period, consistent with earlier studies (e.g., Domowitz, Hubbard, and Petersen (1986a, 1986b, 1987) and Schmalensee (1989)).

Second, our work contributes to the literature that examines the evolution of product markets, and especially product market competition, over time. While previous studies document a significant decline in market concentration levels during the last part of the 20th century (Shepherd (1982), Irvine and Pontiff (2009)), we find that 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. More broadly, our paper adds to a growing body of economic research that points to a structural change in the nature of US product market operation at the turn of the century, as reflected by weak relationship between investment and profitability (Gutiérrez and Philippon (2016)), decline in business dynamism and entrepreneurship (Decker et al. (2014, 2016)), and increase in profit share of non-financial sector (Barkai (2016)).

Finally, our analysis also sheds light on the potential factors that could have driven the recent decline in competition. We find evidence that the recent increase in industry concentration levels coincides with a significant reduction in the enforcement of antitrust regulations by government agencies. Furthermore, the findings suggest that technological barriers seem to play an important role in explaining why concentrated markets appear to be non-contestable. Over the past few decades, firms in concentrated industries have been strengthening their patent portfolios and consequently increasing barriers to entry in a significant way.

I. Changes in Industry Concentration

I.A. Data

Our main sample consists of all firms in the CRSP-Compustat merged dataset over the period of 1972-2014. The main analysis centers on firms incorporated in the US that trade on major stock exchanges (NYSE, AMEX, and NASDAQ), and have information on their ordinary common shares.[5] Otherwise, we do not apply any additional filters, and include financial firms as well as utilities.[6] To account for the role of private and foreign firms, we use information from US Bureau of Census and Bureau of Labor Statistics.

Throughout the paper, we use NAICS classification to define a firm's industry.[7] Overall, NAICS system uses a six-digit coding method to identify particular industries and their

[5] For robustness, we repeat the analysis including firms incorporated outside of US, 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.

[6] Excluding financial firms and utilities from our analysis does not affect any of our main results.

[7] Relying on NAICS, rather than SIC, provides several advantages. 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

placement in a hierarchical structure manner. The first two digits of the code designate the sector, the third designates the subsector, and the fourth digit designates the industry group. Although a 4-digit NAICS definition potentially captures industries in a more granular way, it also quite narrow, and thus, may not reflect firms' activities that span over separate markets that are closely related. Consider, for example, leather and allied product manufacturing (NAICS 316). The subsector consists of three 4-digit industries: Leather and hide tanning and finishing (NAICS 3161), footwear manufacturing (NAICS 3162), and other leather and allied products, such as luggage, handbags, and purses (NAICS 3169). While it is possible that very small businesses focus on only one type of leather products, larger companies, such as Coach Inc., Nike Inc, and Skechers USA Inc. offer a variety of products, including handbags, sport accessories, and even apparel. By using a 3-digit classification we increase the probability that large corporations are grouped together as competing firms in the same industry. Overall, our results are not affected by whether we use three- or four-digit NAICS classification. For this reason, we present our results using the three-digit code in the body of the paper. The main results using industry definitions based on a four-digit code to calculate HHI (both Census and Compustat-based) are reported in the Appendix.

I.B. General Trend

We first investigate how industry concentration levels have changed over time. We examine the trend in several Herfindahl-Hirschman (HHI) concentration indices, each based on different data sets and industry definitions. The first HHI index uses Compustat data, which contains information on US public firms. 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. The second HHI index uses Census data, which contains information on both private and public industrial firms with operations in the US. We also use the number of public firms within an industry as another proxy for concentration. Publicly-traded firms tend to be much larger than the private ones, and therefore, represent the key industry players.

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possible, does not qualitatively affect any of our results. 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.

Figure 1-A shows the results for the Compustat-based HHI. Consistent with increased competition associated with tariff reductions deregulations, the concentration index declines starting from the beginning of the 1980s until the late 1990s. From that point on, the HHI increases until the end of the sample period in 2014. As we show later, this increase in concentration is not driven by only a few industries, and is widespread.

Figure 1-B depicts the change in the number of public firms from a long-term historical perspective. We calculate the number of public firms using the extended period that includes information back to the beginning of CRSP database coverage. Similar to the previous figure, there is a structural break around 1997 and the number of public firms in the past two decades has significantly declined. 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.[8] Moreover, 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 decline in the number of firms like the one in recent decades, even when including the period of the Great Depression and the 1973 Oil Crisis.

Figure 1-C complements these findings and 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 US firm is almost three times larger (in real terms) than it was 20 years ago. These findings, combined with the increased HHI, provide additional prima facie evidence of a systematic increase in industry concentration.

I.C. Industry concentration – cross-industry evidence

Relevant to our investigation is whether the increased concentration has been widespread across industries or whether it has been a phenomenon seen only in a few industries. We start by

[8] We also find that after the late 1990s, the HHI increased in tandem with the drop in the number of firms. 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 product market competition. It is also consistent with research on strategic IPOs that shows that concentrated industries are characterized by a smaller number of public firms (Chod and Lyandres (2011)).

calculating the percentage change in the number of firms in each three-digit NAICS 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 HHI was at its lowest level during the sample period (and the number of public firms in our sample peaked). Second, data from US Census is available for 1997 (economic censuses are conducted on calendar years that end in 2 or 7), which allows for an easier comparison between Compustat and Census-based economic indicators. 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-A. 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. Specifically, the median increase in HHI is 41%, while the mean increase is 90%. As mentioned earlier, we also calculate the change in HHI using 4-digit NAICS classification system. Figures A.1.A and A.1.B, provided in the Appendix, demonstrate that the increase in concentration remains robust and is not affected by a more narrow industry definition.

Figure 2-B shows that the number of publicly-traded firms has also significantly declined in most industries. 66 out of 71 industries have experienced a negative change over the 1997-2014 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.[9]

One potential issue with using the Compustat-based HHI index or the number of publicly traded firms as the sole measures of concentration is that these measures do not include private firms. We address this issue in two ways. First, we use the HHI index provided by the US Bureau of Census, which includes revenues of both public and private firms. This measure is based on the 50 largest firms in each industry, but is limited to manufacturing industries. In Figure 2-C we examine the changes in concentration ratios using this alternative measure of the HHI over the 1997-2012 period (2012 is the most recent year for which census data is available),

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

and find that the trend of increased concentration remains robust to including the share of sales generated by private firms.[10]

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. Because the Census-based HHI index is not available for non-manufacturing industries, we perform a different type of analysis and look at the share of the top four firms (in terms of sales) in each NAICS three-digit industry. Specifically, we use the Census data to calculate the share of sales of the top four firms (private or public) relative to the industry sales. The advantages of this measure are three-folds. First, it covers almost all US industries, including manufacturing, retail, financial and service sectors.[11] 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 (the Census-based HHI index).

Figure 2-D shows the distribution of percentage changes in the share of the top four firms in each industry between 1997 and 2012. The distribution is heavily skewed to the right, demonstrating 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%. Among furniture retailers (NAICS 442), for example, the share of the four largest firms went up from 6.5% in 1997 to 19.4% in 2012, which is equivalent to an almost 200% increase. Another example is the food and beverage industry (NAICS 445). As early as 2000, the USDA Economic Research Service published a special report pointing to an unprecedented consolidation of supermarkets that has brought together regional chains and created a small group of truly nationwide food retailers.[12] Our evidence suggests that this consolidation trend has continued throughout the 21st century: while the revenues of the top four

[10] 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. See Ali, Klasa and Yeung (2009) for a detailed discussion of this measure.

[11] 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.

[12] See http://www.iatp.org/files/Consolidation_in_Food_Retailing_Prospects_for_.pdf

firms have increased from 18.3% in 1997 to 26.9% in 2012, the industry has lost over two-thirds of its publicly-traded firms, and its HHI has more than tripled.

Finally, in Figure 2-E we look at labor market dynamics, and measure the relative importance of large firms in the US economy using the share of employment in firms with 10,000 employees or more (the largest size category classified by the Bureau of Census) out of the total US employment.[13] 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 the pattern in sales-based measures of product market concentration. This is also consistent with the evidence in Decker, Haltiwanger, Jarmin, and Miranda (2014), who show that the role of small young businesses, as measured by business start-up rates, has been declining since 2000. Taken together, these results point to a structural change in the US labor market, where most jobs are being created by large and established firms, rather than by entrepreneurial activity.

Finally, 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).[14] According to this classification, every firm has a unique set of peers, so that industry definition becomes firm-specific: every firm in a given year has a unique set of peers it competes against. The set of peers can change continuously over time as firms modify the variety of products or services they offer. While far from the standard way we typically define an industry, this method can be more precise in classifying competitors of firms which operations span across several different industries. Using the text-based HHI ratio, we find that between 1997 and 2013 (the last year of data available) industry concentration has increased in over 60% of the firm-specific industries. Lastly, as an alternative way to account for operations of multi-segment firms, we re-calculate the Compustat-based HHI ratio after excluding sales of foreign divisions, as reported in the segment file. While the overall level of HHI ratio is lower using the alternative definition, the pattern of a steep increase since 1997 has remained unchanged (both results are not tabulated for the sake of brevity).[15]

[13]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).

[14] The data was obtained from Hoberg-Phillips website (http://hobergphillips.usc.edu/industryconcen.htm).

[15]Another advantage of Census-based measures of concentration compared to Compustat-based measures is the precise methodology of measuring activities of conglomerate firms. Specifically, Census constructs measures of

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

II. The Economic Implications of the Increase in Concentration Levels

In this section we examine whether the systematic increase in concentration levels has had an economic effect on the fundamentals of the remaining firms. To answer this important question, we first analyze the relation between profitability and changes in industry concentration in a panel-data setting, while controlling for other factors that could influence firms' profitability levels. We then examine the potential sources of any abnormal performance.

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)). Consequently, profitability should not be affected by changes in industry concentration levels because the threat of potential entrants would not affect the competitive environment.[16] Furthermore, Sutton (1991) goes a step further and shows that the presence of sunk costs such as advertising and R&D may result in declining industry profitability as concentration levels increase. Specifically, intense quality competition may increase the total costs of operating in a particular industry, which could lead to concentrated markets as low price-cost margins reduce the number of market participants.

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 concentrated could generate larger abnormal profits by exercising market power.

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concentration based on NAICS classification of each individual facility (rather than assigning NAICS codes at a firm level). As a result, sales of conglomerate firms are decomposed by divisions that share the same NAICS code. The sales of each division are then grouped with the sales of stand-alone firms that share the same NAICS code for construction of concentration measures.

[16] 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."

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 alternative hypotheses.

Using all observations in the Compustat-CRSP dataset over the period 1972-2014, we examine the relation between changes in profitability and changes in industry concentration levels by estimating the parameters of the following regression 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 Herfindahl-Hirschman Index at the NAICS 3-digit level using sales from Compustat (*HHI*), the total number of public firms in an industry (*Number of Firms*), 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. The results in this section are based on three-digit NAICS code. Table A.1 in the Appendix presents the results using the four-digit NAICS as the industry definition.

To control for potential time-series dependence in the residuals, we cluster the standard errors at the firm level. Since we include firm-fixed effects and firms rarely switch industries, the proxies for industry concentration can be interpreted as the changes in concentration relative to the industry mean. The inclusion of firm fixed effect 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 effects addresses this concern by focusing the analysis on the within-firm variation in profitability over time.

We use *ROA* as a proxy for profitability because this metric is not affected by changes in capital structure 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 about profitability (as firms get older, they have a better understanding of their production functions). 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. We find that *ROA* is positively related to both the *HHI* and the *Concentration Index* and negatively related to the *Number of Firms.* This result shows that firms tend to generate significantly higher profits when their industries become more concentrated. The results also reaffirm our earlier findings that the increase in concentration levels is not due to firms leaving unprofitable industries. Note that profitability is positively correlated with changes in firm size, suggesting that economies of scale are an important determinant of firms' profitability during the sample period.

Since most of the increase in industry concentration levels occurs in the latter part of our sample, we test whether the empirical relation between profitability and concentration levels might have 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).[17]

Panel B of Table 1 reports the results from this analysis. Similar to Domowitz, Hubbard, and Petersen (1986a, 1986b, 1987) and Schmalensee (1989), who have studied the intra-industry relation between industry-level price-cost margins and concentration levels over the 1958-1981 period, we do not find a strong relation between ROA and measures of concentration during the earlier part of our sample. It is only the later sub-period (2001-2014) 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 concentration from the 25th to the 75th

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

percentile leads to an increase in *ROA* of about 44.5% relative to its median. We find similar magnitudes when we use HHI and the number of firms as alternative measures of concentration. Thus, this analysis points out to a significant structural shift starting at the turn of the 21st century in the economic relation between industry structure and firms' 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 concentration. 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 change in the number of firms and profitability is economically significant: the difference in mean net ROA between firms in industries experiencing a large increase in concentration (quintile 1) and firms in industries with the smallest increase (or even a decrease) in concentration (quintile 5) is approximately 3.8 percentage points.

II.B. The Sources of Abnormal Profits

One potential explanation for the increase in profitability in industries that experienced increased concentration 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. Along these lines, Barkai (2016) uses a general equilibrium model to demonstrate that increase in markups is the only factor that can explain increase in the profit share in the US non-financial sector in the past 30 years. Alternatively, some argue that in the face of the changing nature of US industries, the consolidation of firms within an industry could increase operational 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 this end, 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)).[18] *Asset Utilization* is simply defined as total sales scaled by total assets. As in the case of *ROA*, we winsorize the *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. There is no clear relation between Lerner index (or asset utilization) and concentration measures during the whole sample period (1972-2014): the *Lerner Index* is uncorrelated with both the *HHI* and the *Concentration Index*, and negatively correlated with the *Number of Firms*. Similarly, Panel B shows that over the same time period *Asset Utilization* is uncorrelated with the *Number of Firms*, and negative correlated with the HHI and the *Concentration Index*. In other words, we find no clear pattern over the overall period.

More importantly, the results reported for the sub-periods (Panels C and D) show a very steady pattern starting in 2000. Consistent with our previous findings, the relation between 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 industries that become more concentrated are able to generate abnormal profits by increasing their profit margins and enhancing the efficiency of their existing assets. The economic significance of the profit margin impact is much stronger than the efficiency effect. While a change in the *Concentration Index* from the 25th to the 75th percentile leads to an increase in the *Lerner Index* of about 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 relations between profitability (ROA) and the changes in concentration levels (Table 1) are mainly driven by the positive effect product market concentration on profit margins, and not by efficiency gains. At a conceptual level, this evidence suggests that market

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

power could be playing an important role in many industries. One possibility is that higher barriers to entry may have increased firms' ability to generate higher profit margins by fending off potential competitors.

III. Changes in Industry Concentration and the Value of Mergers

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. Thus, examining how mergers' profitability is related to changes in concentration may allow us to gain further insight into the mechanism behind the increased profitability we have documented. To this end, 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 industries that become more concentrated, especially in related mergers. 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 argument 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.

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 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.

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 capture this effect, 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.

To investigate the effect of market power considerations on M&A transactions, we test whether the effect of the changes in concentration levels on announcement returns is stronger when the target and the acquirer 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 impact of the merger on the competitive landscape of the industry, then the effect should be stronger for related mergers. To test this hypothesis, we estimate the parameters of the following model:

$$\begin{aligned} CAR_{ijt} &= \alpha_t + \alpha_j + \beta_1 B/M_{T,i,t-1} + \beta_2 B/M_{A,i,t-1} + \beta_3 \log(MV_{T,i,t-1}) + \beta_4 \log(MV_{A,i,t-1}) \\ &+ \beta_5 DUMCASH + \beta_6 DUMSTOCK + \beta_7 \log(Concentration\ Level_{jt-1}) \\ &+ \beta_8 Related_i + \beta_9 Related_i \times \log(Concentration\ Level_{jt-1}) + \varepsilon_{ijt} \end{aligned} \quad (3)$$

The main variable of interest is the effect of the increased concentration on related mergers. Therefore we include 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 *Concentration Level*. We also include several other relevant variables: 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 (Jovanovic 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.

If investors believe that market power considerations are an important part of the expected synergies from the merger, then we should observe a positive coefficient on the interaction variable. Table 3 reports the estimated coefficients from this regression. Supporting the predictions of the market power hypothesis, the first column provides evidence that the empirical relation between *Combined CARs* and the proxies for concentration levels comes largely from related mergers. Consistent with our profitability results, we find that this effect is much stronger during the post-2000 period. While the second column (period 1980-2000) shows that the interaction variable is insignificant for all measures of concentration, the third column (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. They also lend further credence to the possibility that the increased market power indeed affect profit margins for firms in industries that become more concentrated.

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

Our analysis so far indicates that firms in more concentrated markets tend to earn higher profits. In this section we examine whether these higher profits also lead to abnormal stock returns.[19] To investigate this issue, we calculate the annual change in the concentration levels in each industry (defined using a firm's three-digit NAICS code) over the period 1972-2014:

[19] There is a debate in the literature on how stock returns are related to concentration levels. While Hou and Robinson (2006) find that firms in more competitive markets tend to earn higher stock returns, Bustamante and Donangelo (2014) find that these firms earn lower returns. Our contribution to this debate is that we focus on the

$$Chg_{t-1} = (Concentration\ Level_{t-1} - Concentration\ Level_{t-2}) \quad (4)$$

We then sort industries based on the magnitude of the change, and form three portfolios. The high *Chg* portfolio contains the top 10 industries, the low *Chg* portfolio contains the bottom 10 industries, and the middle portfolio the rest of the industries.[20] To calculate returns in 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 change in concentration levels, 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 4 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 increase in concentration levels, the results change quite 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 8.9% per year. These abnormal returns are much larger in magnitude compared to the ones generated by other important investment strategies. For example, the momentum strategy generated a negative alpha over the same time period. Interestingly, most of the abnormal returns from this

changes in concentration rather than on the levels of concentration to capture the part of concentration that was unexpected by investors.

[20] Because the 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 strategy come from the firms in industries experiencing an increase in concentration (long portfolio).

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 test 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 significantly 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 and the corresponding increase in profit margins on stock returns.

V. Potential Explanations for the Increasing Trend in Concentration Levels

In this section we investigate economic forces that may have contributed to the wide-spread increase in concentration and the corresponding increase in profitability in the US since the turn of the century. We identify two potential contenders: lax enforcement of antitrust laws and technological innovation. Our evidence suggests that both in their own unique way may have contributed to the increased concentration and barriers to entry. We also examine more mechanical explanations to the increased concentration, and find that these reasons cannot explain our main findings.

V.A. Enforcement of Antitrust Laws

The US government has approved a series of laws since the late 1800s (e.g., the Sherman Act and the Clayton Act) to promote competition by outlawing monopolistic practices. However, many legal scholars believe that the enforcement of these laws has been strongly influenced by political factors. While some authors argue that the Clinton administration significantly intensified the enforcement of antitrust laws in the 1990s (Litan and Shapiro (2001)), others argue that during the two recent administrations antitrust enforcement has declined ((e.g., Harty, Shelanski, and Solomon (2012), Spitzer (2011), Crane (2012)). In particular, legal scholars consider the presidency of George W. Bush as the turning point in the

enforcement of antitrust laws. His view on these 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)).

Using enforcement data from both the Department of Justice (DoJ) and the Federal Trade Commission (FTC), we investigate whether the increase in industry concentration levels coincides with a decline in the number of antitrust cases. We begin our analysis by examining the number of cases filed by the Department of Justice under Section 2 of the Sherman Act over time. We focus on these cases because they deal with situations in which the government believes that firms have gained, or are attempting to gain, excessive market power.[21] We find that the number of Section 2 cases has significantly declined over time from an average of 15.7 cases over the period 1970-1999 to 2.8 cases over the period 2000-2014. More surprisingly, the antitrust agencies did not file a single case in 2014 despite the recent increases in industry concentration levels.

To examine the time-series relation between concentration levels and antitrust enforcement, we plot in Figure 4 the aggregate HHI and the number of Section 2 cases over time. This figure shows that since the early 1980s, the aggregate HHI has been negatively correlated with the number of Section 2 cases. It also shows the spike in antitrust enforcement in the 1990s during the Clinton administration. More importantly, supporting the idea that during both the Bush and Obama administrations antitrust agencies have been more lenient, this figure shows that the number of Section 2 cases has been declining over the recent period of increasing concentration levels. The correlation between the HHI and the number of Section 2 cases over this time period is -0.49.

We also investigate whether the probability of completing an M&A transaction has changed over time. If firms are facing lower thresholds during the regulatory approval of M&A transactions, then one would expect the success rate for deal closures to be higher in the past few decades. Figure 5 depicts the proportion of completed M&A deals as a fraction of total deals for all transactions involving public firms on the Securities Data Corporation's (SDC) Mergers and

[21] Section 2 of the Sherman Act establishes that "every person who shall monopolize, or attempt to monopolize, or combine or conspire with any other person or persons, to monopolize any part of the trade or commerce among the several States, or with foreign nations, shall be deemed guilty of a felony, and, on conviction thereof, shall be punished by fine not exceeding $100,000,000 if a corporation, or, if any other person, $1,000,000, or by imprisonment not exceeding 10 years, or by both said punishments, in the discretion of the court."

Acquisitions database. This figure shows that completion rates have been increasing over time from approximately 70% in the early 1980s to approximately 90% in the last few years. The difference in means between the pre- and the post-2000 periods is positive (10.8%) and statistically significant at the 1% significance level. Our results are consistent with Mehta, Srinivasan, and Zhao (2017) who use cross-sectional analysis to demonstrate that firms that are linked to antitrust regulators receive more favorable antitrust outcomes.

Clearly, we should be very careful with drawing causal inferences from this analysis. Yet, given the significant negative correlation between concentration levels and antitrust enforcement over the past two decades, it is possible that fewer regulatory barriers could have direct implications on product market competition. Consistent with this notion, we also find that the resources available to regulators, compared to the size of the market they have to monitor and regulate, have shrunk over the same time period. Specifically, the DoJ budget, relative to S&P500 market cap, has declined substantially over the past 20 years (the results are unreported for the sake of brevity). Thus, low antitrust enforcement can incentivize firms to engage in M&A activity, which further reduces competition. Moreover, it allows for mergers with more market power potential, leading to a higher market reaction and higher profit margins.

V.B. Barriers to Entry

Another potential explanation for the recent increase in industry concentration levels is technological changes. Over the past several decades, the investment in tangible capital as a proportion of the total output has remained flat, while the investment in intangible assets has doubled (Corrado and Hulten (2010)). Public adoption of the Internet in 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 of 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 US 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. Decker et al. (2014) examine the labor market shift from young to mature firms, and argue that information technology has provided advantage for large multinational firms by allowing for better coordination of supply and chain network across multiple locations. If technology is better developed and implemented among large firms, the recent technological advances could essentially create barriers of entry to new firms. These new technological-barriers to entry have the potential to change the industry landscape.

We estimate technological innovation using several patent-related proxies. Using the patent database created by Kogan et al. (2016), we examine whether the relationship between technological innovation and industry concentration had changed around the turn of the century. First, we start with a univariate analysis and calculate patent concentration by looking at the share of top four patent-generating firms in the industry. Specifically, for every NAICS 3-digit industry, we identify four firms that have generated the largest number of patents in a given year, and scale the total number of patents these four firms generated by the number of patents generated by all public firms in the same industry and year. Figure 6 shows that similar to revenue-based measures of concentration, the patent-based concentration has exhibited a structural break around 2000 and has increased substantially in the 21st century.

Next, we turn to a multivariate analysis and examine whether firms in concentrated markets possess stronger patent portfolios after 2000 (controlling for firm's assets, age, and both year and firm fixed effects). Table 5 reports results from regressions relating the change in the number of patents granted, as well as their value, to firm characteristics and proxies for changes in industry concentration levels.[22] Panel A shows that while the relationship between changes in industry concentration and number of patents granted has been negative in the period 1986-2000,

[22] Kogan et al. (2016) use the stock market reaction to news about patents as a proxy for their value.

it has reversed in the last decade, so that now firms in concentrated markets possess more patents. We find similar results when we examine the relation between concentration levels and the market value of the patents (see Panel B). These results are 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.

While the changes in anti-trust policy may be unique to the US, technological changes are more universal. With the exception of the number of publicly traded firms, detailed international data on most concentration measures is not readily available. Doidge et al. (2013, 2017) report that other countries of comparable level of economic and financial development as the US have not experienced such a decline in the number of public firms. The uniqueness of the pattern in US suggests that additional factors must have played a role along with technological advances, allowing US firms to exploit the consolidation benefits to a greater extent than other countries. Regulatory differences regarding antitrust laws in US and other developed countries could be an additional contributing factor.

Consistent with this argument, existing research in law and economics suggests that although US and European antitrust agencies 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: the US treats a firm as holding significant market 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 investigations of 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 US 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, US firms were able to act on those changes, perhaps due to lenient anti-trust regulations.

V.C. Substitution by Private Firms

While the positive association between changes in industry concentration and increasing ROA cannot be explained by the presence of 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.

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 ($1.3 million according to Asker, Farre-Mensa and Ljungqvist (2011)), 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 when we use the Compustat-based HHI index (Figure 2-A). 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 firms in the industry (accounting for both private and public firms). Figure 2-D demonstrates that the importance of the largest firms in the industry has grown across all sectors of the economy, indicating again that concentration has increase in most industries. Figure 2-E provides similar results based on labor market measures of concentration. Taken together, this analysis suggest that the trend of increased concentration across most industries as well as the higher importance of large firms in the overall US economy remains robust various concentration measures and to the inclusion of private firms.

To further examine the possibility that our findings are driven by private firms simply substituting public firms, 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 US Census Bureau (similarly to the concentration

ratio, it is only available at five-year intervals).[23] 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 US economy.

Figure 7-A shows that the share of public sales in the total revenues of US business enterprises has remained stable, and if anything, has increased over time. Therefore, even though the number of private firms increase and the number of public firms decreased, the aggregate contribution of private firms relative to public firms did not increase.

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 US Businesses report). The results, presented in Figure 7-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 US economy. Thus, even within the subsample of large firms, the effect of any substitution of public firms by private ones on concentration levels has been economically small.

For robustness, we also calculate the aggregate revenues of publicly-traded firms as a percentage of the US gross domestic product. Consistent with the evidence in Gabaix (2011), we find that despite their shrinking numbers, public firms still represent a large fraction of the US economy, as the contribution of their sales to the total GDP has remained stable over time (unreported). Taken together, the importance of private firms in substituting for the share of the disappearing public firms in the overall economy has been relatively small.

V.D. 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 US public firms, then it is possible that the level of product market competition in US industries may not have been adversely affected by the systematic decline in the number of public firms over the last two decades.

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

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 US, regardless of their ownership. Thus, the Census-based measures include the revenues of US-located establishments of foreign-owned firms, capturing operations of foreign competitors.

Moreover, the Census-based measures exclude the activity of foreign subsidiaries of US 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 Compustat-based sales include foreign sales by US corporations, and therefore, generate an upward bias in the measurement of product market concentration.

We perform two types of tests to further evaluate the impact of foreign competition on the profitability of US publicly-traded firms. First, we incorporate import penetration in our main analysis. Second, we examine operations of foreign multinationals 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, Katics and Petersen (1994), Borjas and Ramey (1995), Cuñat and Guadalupe (2009), Irvine and Pontiff (2009), Autor, Dorn, and Hanson (2013), Acemoglu, Autor, Dorn, Hanson and Price (2016)). We obtain the information on US International Trade Data, which reports the dollar values of import and export activity at the industry level, from the public releases of the US Census Bureau.[24]

To ensure that our conclusions regarding increased concentration in US are not driven by substitution of US-manufactured goods by foreign imports, we re-estimate the regression of profitability as a function of industry concentration including a dummy variable equal to one if the firm belongs to one of NAICS three-digit industries that could be potentially affected by import penetration (33 industries total). We find that the significance of the effect of concentration levels on firm profitability remains unaffected.

[24]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. Second, many foreign companies operate directly out of the US and import penetration data does not capture this activity. If foreign firms manufacture and sell their products in the US, their revenues will not be accounted in imports data, biasing the actual scope of foreign competition downwards. Although both aspects are actually captured by the census-based measures of concentration, which include operations of all domestic and foreign-owned facilities on the US territory, we perform a different type of analysis and look at activities of US affiliates of foreign multinational enterprises. These statistics, managed by the Bureau of Economic Analysis (BEA), a division of US Census, are based on mandatory surveys of virtually all US business enterprises that are affiliates of a foreign person or a foreign parent company.[25] 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.[26] To assess the importance of foreign firms' operations in the US, for every industry-year we scale the total sales of foreign-owned US firms by total sales of publicly-traded firms.

We then ask whether the operations by foreign firms have grown primarily in the industries that have experienced the largest increase in concentration, substituting for domestic competition. Our 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 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

[25] The data is available at http://www.bea.gov/itable/. The benchmark surveys, conducted for Census years, cover the vast majority of US affiliates of a foreign person or parent company. 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.

[26] 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.

hypothesis more formally, we repeat the main estimation of firm profitability as a function of concentration, while adding the log of sales by foreign multinational enterprises at the industry level. We find that our main results are unaffected.

To summarize, our results indicate that although the overall volume of foreign activity in US has been increasing, a large portion of US industries have expanded at a similar pace, balancing off 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. Further, the substitution effect of foreign firms should not have resulted in increased ROAs for the industries with increase domestic concentration, as we find. Altogether, the idea that foreign firms have been filling the gap left by US public firms is not supported by the data.

V.E. Distressed Industries

In this subsection we address the possibility that the increase in industry concentration could be driven by industries that are shrinking due to declining demand, which, in turn, leads to fewer participants in the market.

To address this concern, we decompose the changes in the number of public firms to investigate the 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.

Figure 8 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. This figure shows that 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. Firms do not usually exit the public markets due to liquidation or involuntary delisting. Further, 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. Conclusion

This paper documents that over the last 20 years the level of product market concentration in the US has increased across most industries. We show that the increase in concentration levels has implications to firm performance, as it affects profitability, innovation, and returns to investors. First, the increase in industry concentration levels is associated with remaining firms generating higher profits through higher profit margins. The increase in profit margins appears to be related to increased market power, rather than to an increase in efficiency. Second, horizontal mergers in industries that become more concentrated 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 industries that become more concentrated 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.

Our results also 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.

Finally, we offer two possible explanations to the trend in product market consolidation. The unique combination of lax enforcement of antitrust laws and technological innovation could have contributed to the increased concentration and barriers to entry. Using enforcement data from both the Department of Justice and the Federal Trade Commission, we find that antitrust enforcement, as measured by the number of cases filed by the Department of Justice under Section 2 of the Sherman Act, has weakened since early 2000, whereas the probability of M&A deal completion has increased.

Another potential explanation for the recent increase in industry concentration levels is technological changes, which have created advantages to the economies of scale, and had the

potential to change the industry landscape. Consistent with this idea, we find that patent concentration has increased in the past two decades, and the relationship between changes in industry concentration and number of patents granted has reversed since 2000, so that now firms in concentrated markets possess more patents. These results suggest that complex technology also facilitates synergy potentials and increase barriers to entry.

More broadly, 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 at least parts of these 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 economically significant increase in efficiency 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 the impact of the increased concentration 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 present the Herfindahl-Hirschman (HHI) concentration index for all US 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 US publicly-traded firms that appear in CRSP and Compustat. Firm size is based on total sales in constant dollars of 1970.

Figure 1-A: Compustat-based HHI

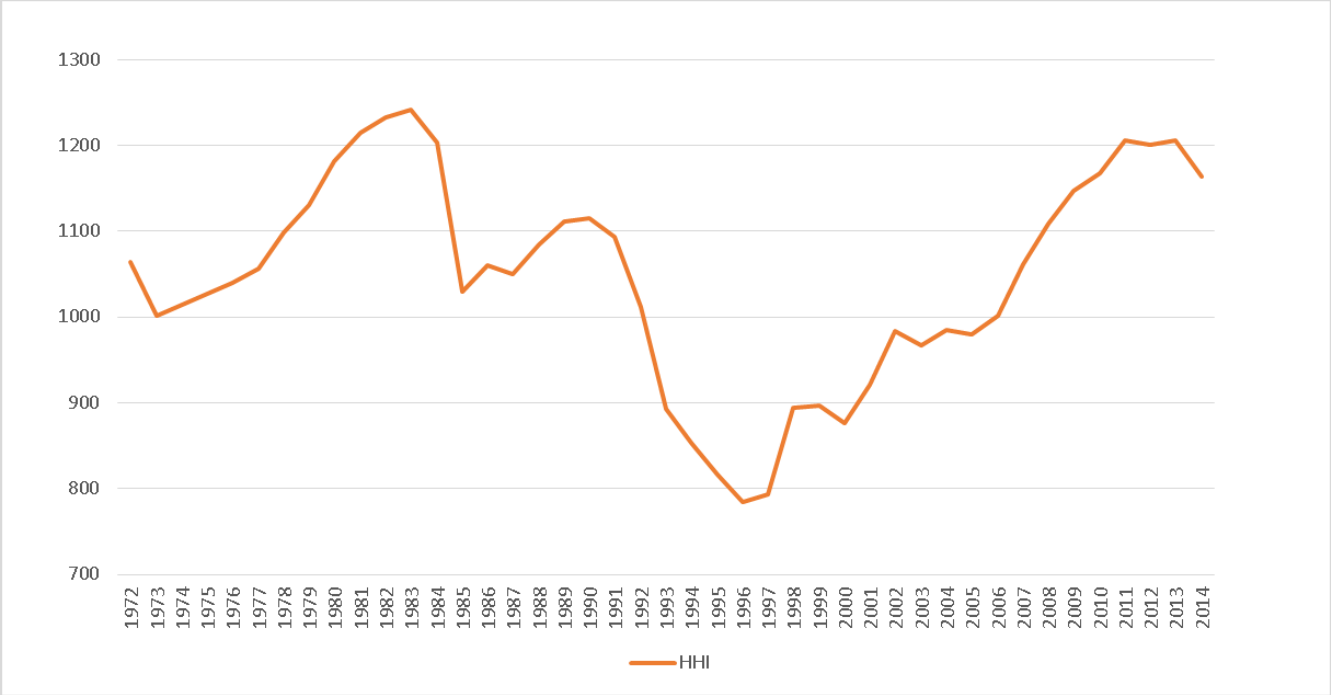


Figure 1-B: Number of Public Firms – Historical CRSP Coverage

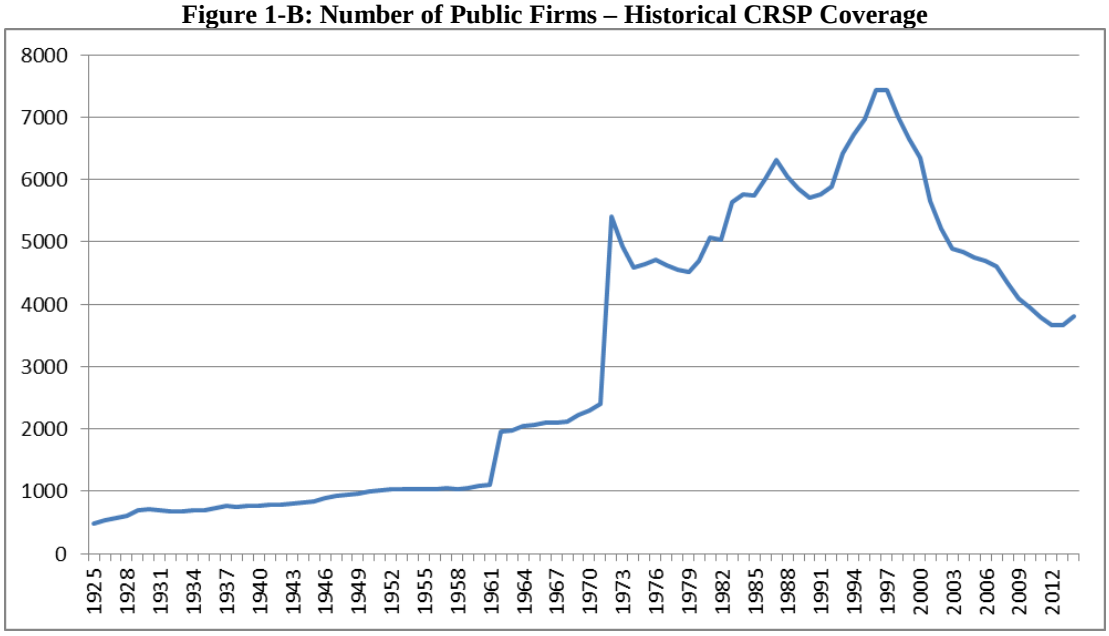


Figure 1-C: Average and Median Size of Public Firms

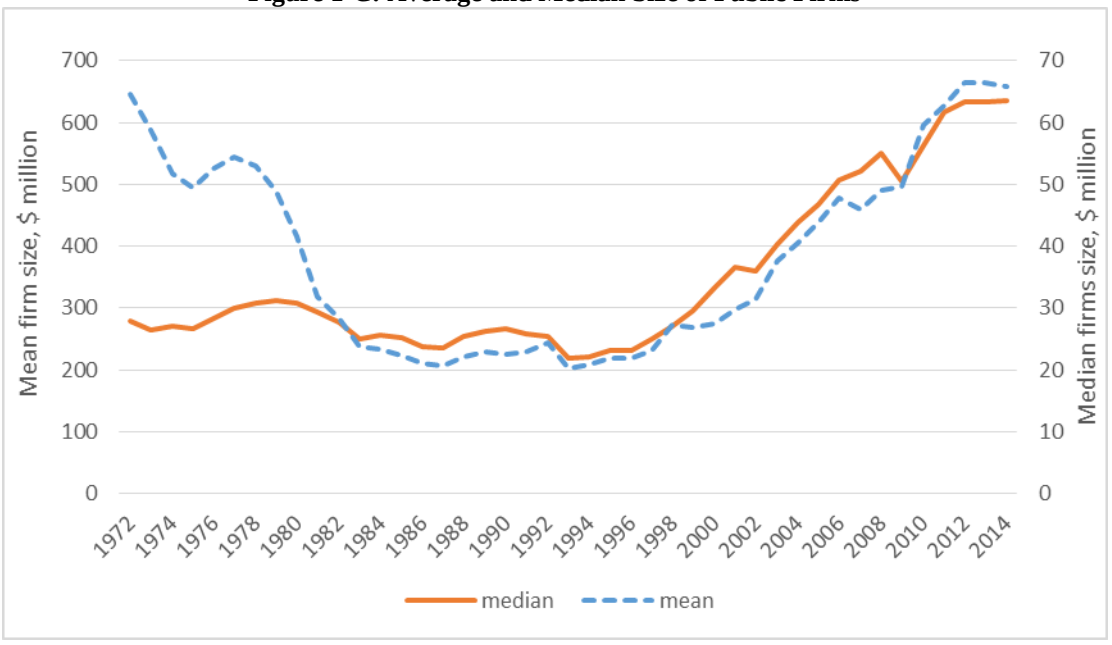


Figure 2
Change in Measures of Concentration across Industries

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 1997-2012 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 or more out of the total US employment.

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

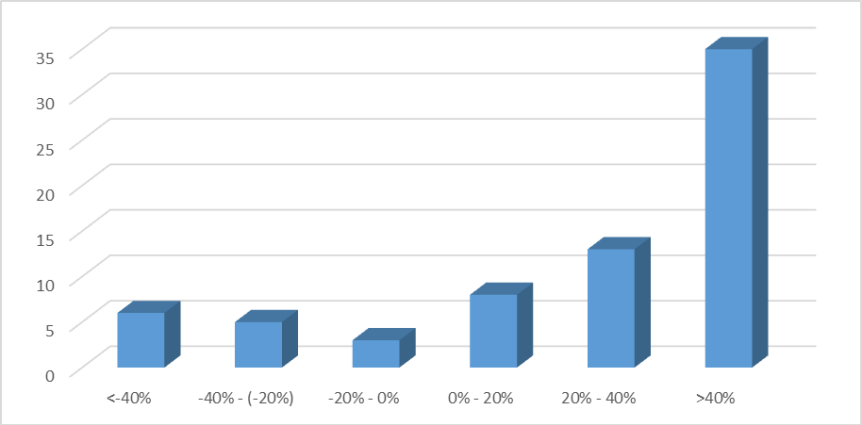


Figure 2-B: Change in the Number of Firms

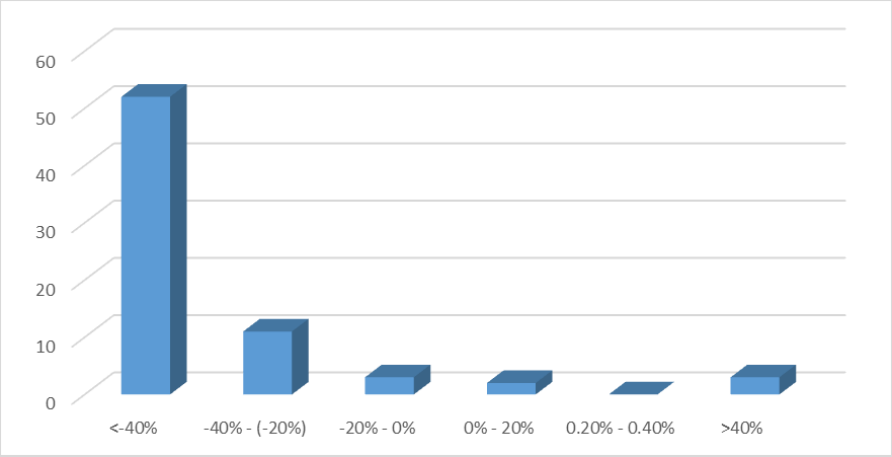


Figure 2-C: Change in the HHI (Census-based)

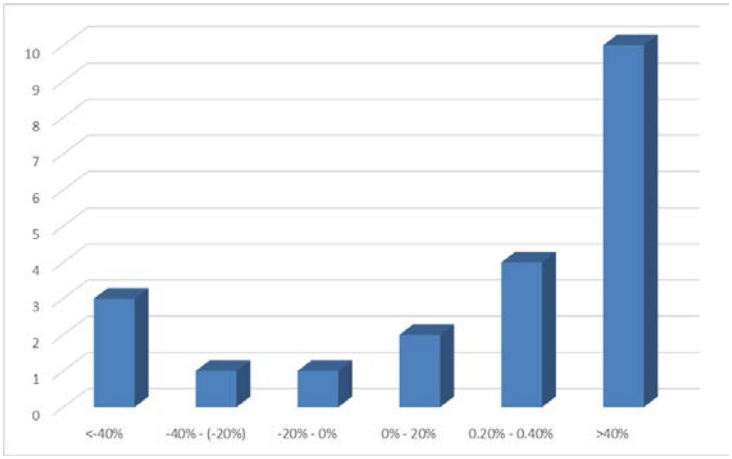


Figure 2-D: Change in the Share of the Largest Four Firms in the Industry

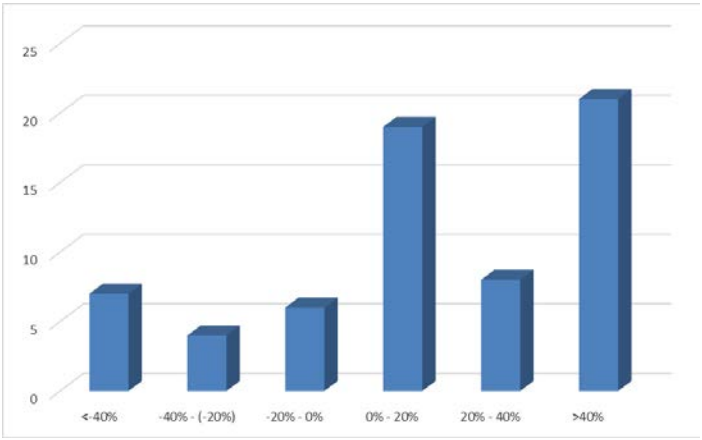


Figure 2-E: Share of Employment in Firms with 10,000+ Employees

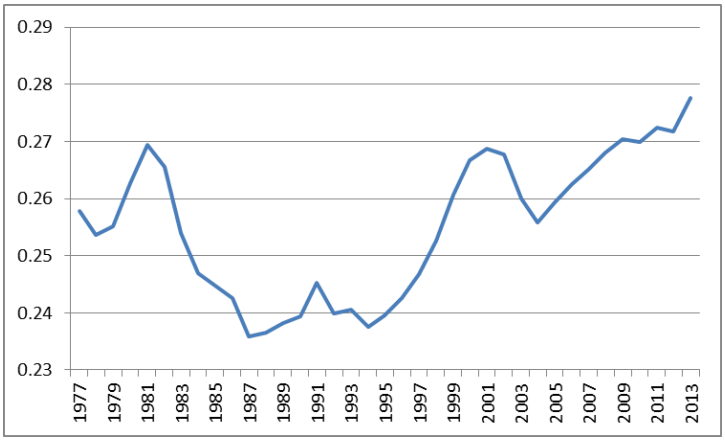


Figure 3
ROA and Change in the Number of Firms

This figure 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.

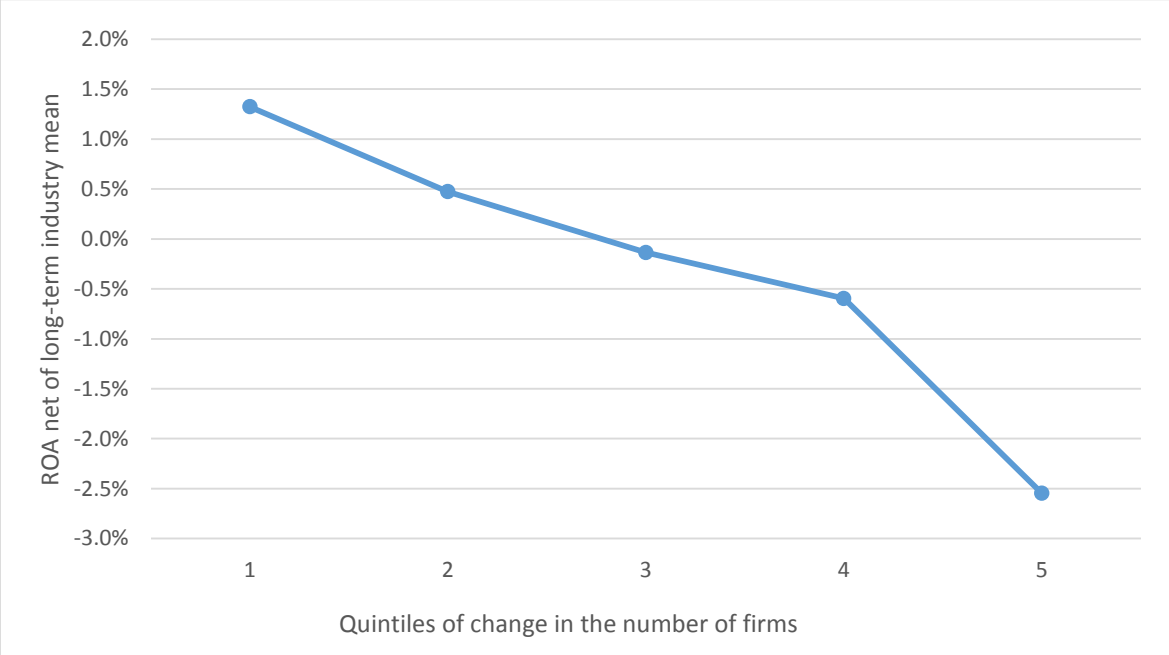


Figure 4
Relation between Concentration Levels and Antitrust Enforcement

This figure depicts the relation between the aggregate HHI and the number of cases filed by the Department of Justice under Section 2 of the Sherman Act of 1890. The HHI is Herfindahl-Hirschman concentration index for all US 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.

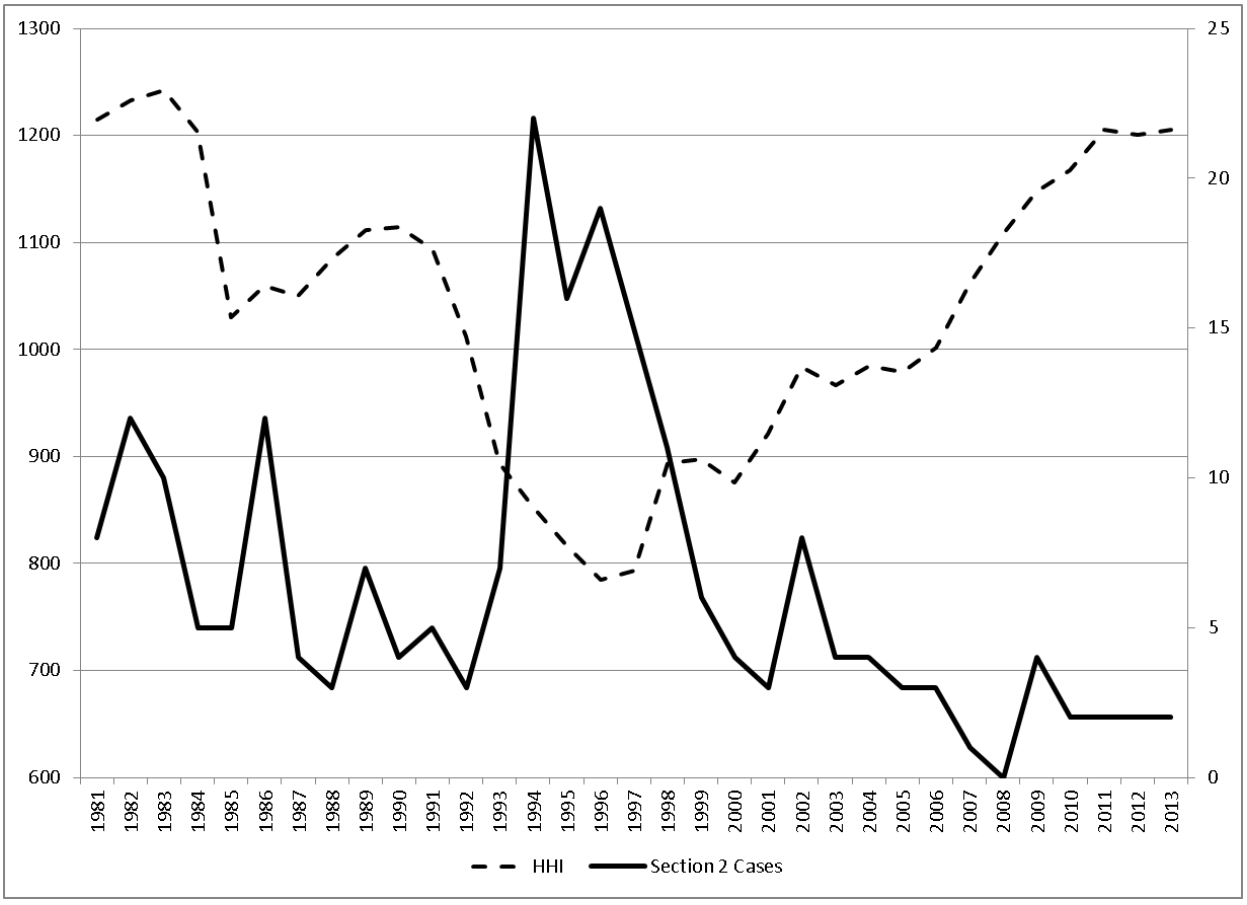


Figure 5
Proportion of Completed M&A Deals

This figure depicts the proportion of completed M&A deals as a fraction of total deals for the period 1979-2014. The sample consists of all transactions on the Securities Data Corporation's (SDC) Mergers and Acquisition database 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.

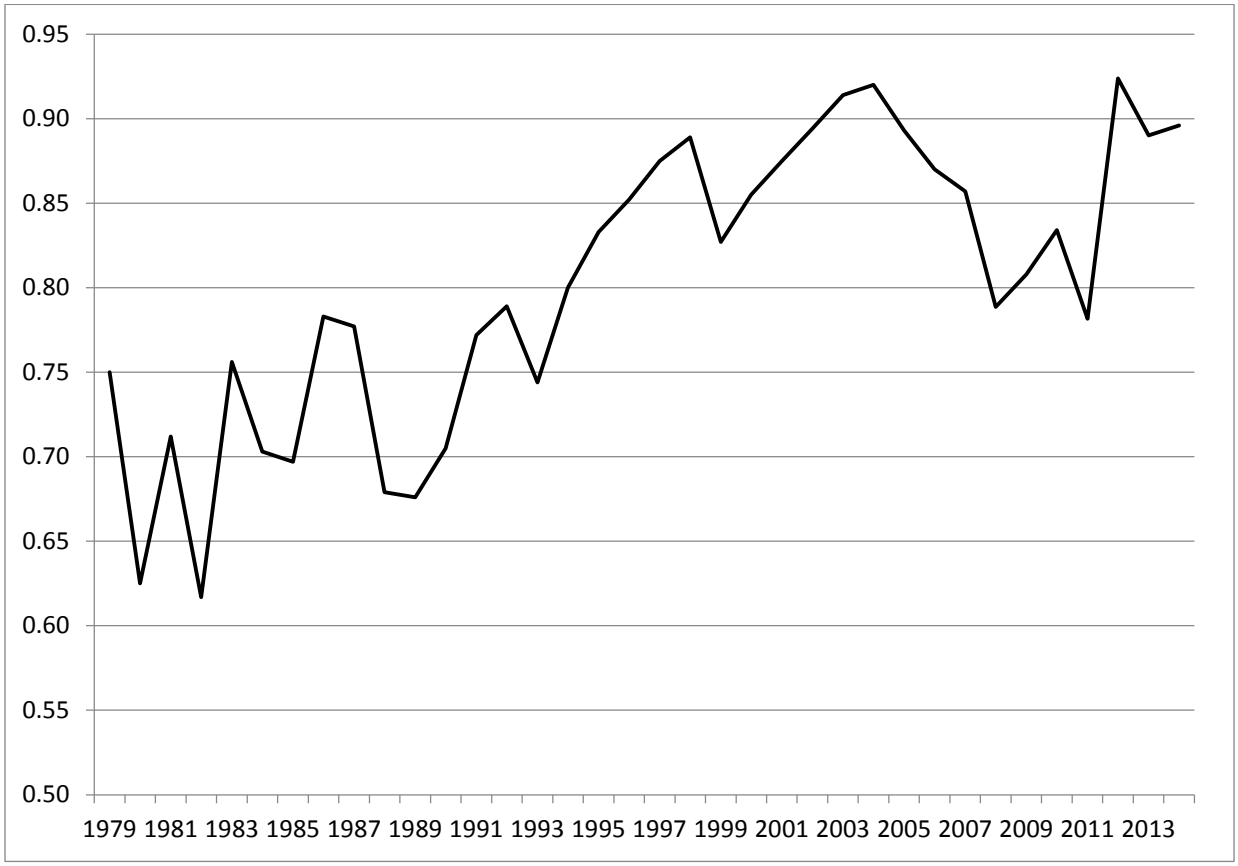


Figure 6
Patent-Based Industry Concentration over Time

This figure shows the change in the share of the largest four firms, measured by patent generation activity, over the 1972-2010 period. We use the patent database created by Kogan et al. (2016). The sample includes all the industries where at least one firm is granted a patent in a given year. For every industry and year we identify four firms that have generated the largest number of patents, and scale the total number of patents these four firms generated by the number of patents generated by all public firms in the same industry and year. The figure shows the average of the obtained ratios across industries.

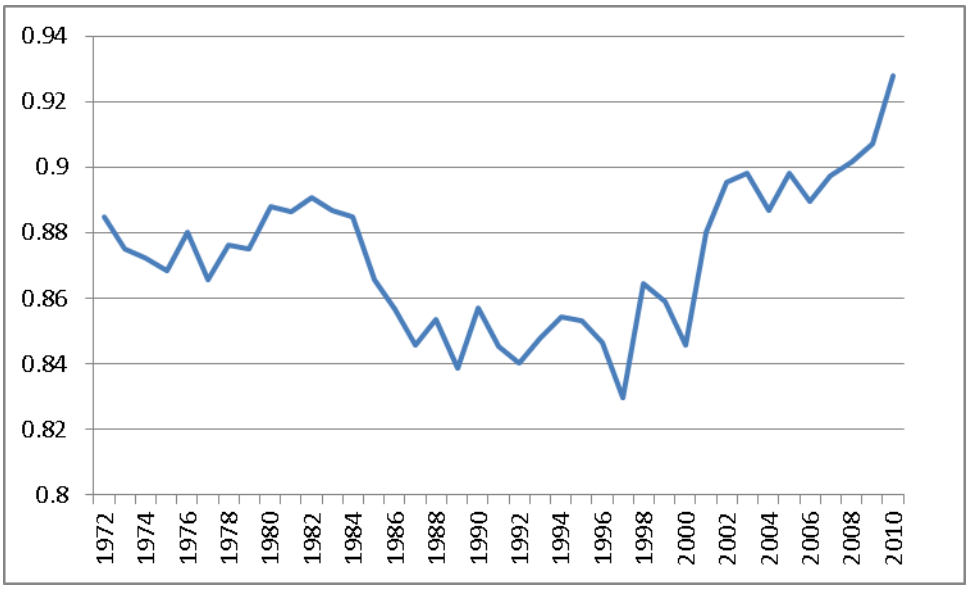
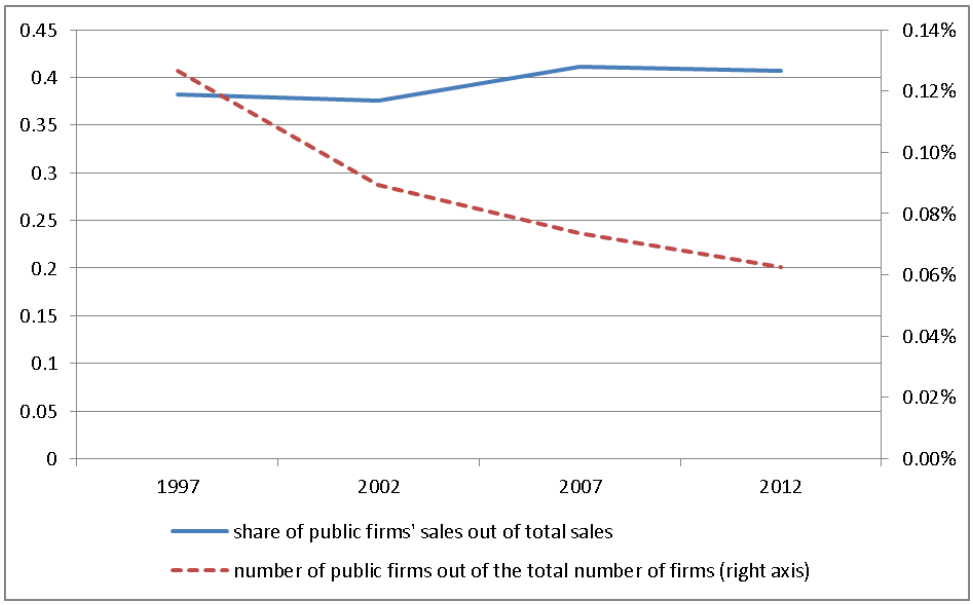


Figure 7
Total Public Firms' Revenues as a Fraction of Public and Private Firms' Revenues

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 US Businesses (SUSB) report, managed by the US 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

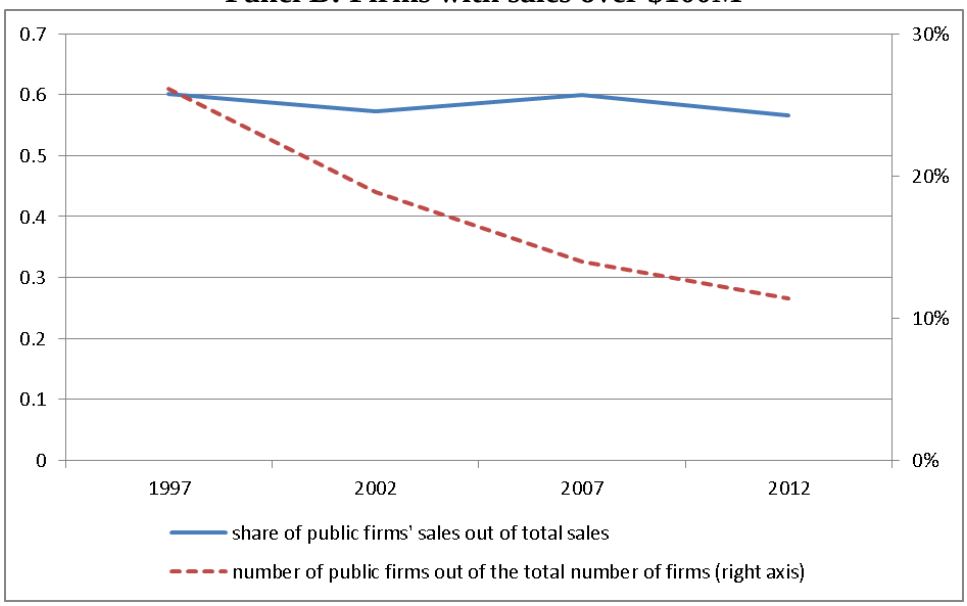


Figure 8
Entries and Exits in Public Markets

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).

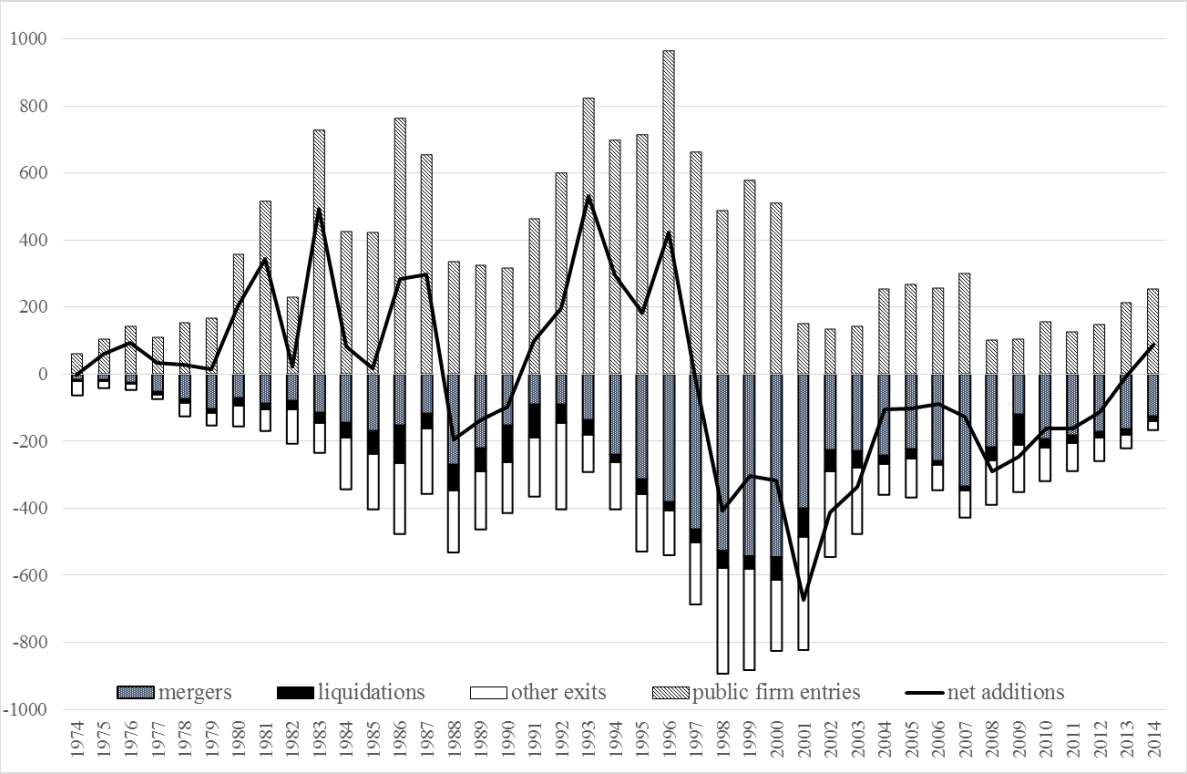


Table 1
Change in the Level of Product Market Concentration and Profitability

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)	(0.0304)	(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: 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: 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: 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: 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 – 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 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. *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. 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. 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.

	1980-2014			1980-2000			2001-2014		
Constant	0.1239[a]	0.0405	0.0716[a]	0.1326[a]	0.0557	0.0461[b]	0.1713[c]	-0.0275	0.0248
	(0.0444)	(0.0476)	(0.0168)	(0.0483)	(0.0647)	(0.0233)	(0.0937)	(0.0701)	(0.0236)
Log(*Number of Firms*)	-0.0096			-0.0186[b]			-0.0211		
	(0.0081)			(0.0087)			(0.0164)		
Log(*HHI*)		0.0043			-0.0018			0.0120	
		(0.0068)			(0.0085)			(0.0104)	
Concentration Index			-0.0085			0.0129			-0.1358
			(0.0351)			(0.0378)			(0.0812)
Related	0.0305[b]	-0.0460	0.0061	0.0076	0.0042	-0.0030	0.0828[b]	-0.1183[c]	0.0208[b]
	(0.0128)	(0.0338)	(0.0048)	(0.0176)	(0.0303)	(0.0081)	(0.0244)	(0.0636)	(0.0105)
Proxy for Concentration x *Related*	-0.0066[a]	0.0066	0.0644[a]	-0.0029	-0.0018	0.0285	-0.0154[a]	0.0186[b]	0.1367[b]
	(0.0022)	(0.0052)	(0.0248)	(0.0032)	(0.0048)	(0.0313)	(0.0046)	(0.0094)	(0.0585)
N	3,100	3,100	3,100	1,811	1,811	1,811	1,289	1,289	1,289
Adjusted R^2	7.41%	7.33%	7.38%	11.34%	10.98%	11.08%	4.57%	4.43%	4.29%
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 the Cross-Section of Stock Returns

This table reports alphas for portfolios sorted by the change in the proxies for concentration from year t-2 to year t-1. Portfolio 1 (Low) contains the 10 industries with the smallest change in concentration levels, Portfolio 3 (High) contains the 10 industries with the largest change in concentration levels, 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 change in concentration levels, 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 5
Changes in the Levels of Product Market Concentration and Patent Generation

This table reports coefficients from regressing the number and the market value of patents granted to a firm as a function of industry concentration levels and other control variables. We use the patent database created by Kogan et al. (2016). The sample includes all the industries where at least one firm is granted a patent in a given year. In Panel A the dependent variable is the log of 1 plus the number of patents that a firm was granted in a given year. In Panel B the dependent variable is the log of 1 plus the proxy for patent value developed by Kogan et al. (2016). 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.

Panel A

	Dependent Variable: log(1 + Number of Patents)								
	1972-1986			1987-2000			2001-2010		
Constant	0.1530[a]	0.1457[b]	0.1975[a]	-0.1959[a]	0.1314[c]	-0.0124	0.2050[b]	-0.4814[a]	-0.1991[b]
	(0.0510)	(0.0710)	(0.0363)	(0.0691)	(0.0675)	(0.0410)	(0.1010)	(0.1377)	(0.0813)
Log(*Assets*)	0.0814[a]	0.0824[a]	0.0825[a]	0.0873[a]	0.0871[a]	0.0866[a]	0.0763[a]	0.759[a]	0.0775[a]
	(0.0087)	(0.0086)	(0.0087)	(0.0090)	(0.0090)	(0.0090)	(0.0010)	(0.0099)	(0.0099)
Log(*Age*)	0.0340[b]	0.0351[b]	0.0351[b]	0.0530[a]	0.0525[a]	0.0522[a]	0.0734[a]	0.0708[a]	0.0690[a]
	(0.0159)	(0.0159)	(0.0159)	(0.0125)	(0.0125)	(0.0125)	(0.0229)	(0.0229)	(0.0228)
Log(*Number of Firms*)	0.035			0.0189[c]			-0.0491[a]		
	(0.0104)			(0.0104)			(0.0136)		
Log(*HHI*)		0.0083			-0.0350[a]			0.0670[a]	
		(0.0088)			(0.0094)			(0.0173)	
Concentration Index			0.0017			-0.0195[a]			0.0292[a]
			(0.0039)			(0.0035)			(0.0064)
N	51,664	51,664	51,664	67,028	67,007	67,007	41,012	41,012	41,012
Adjusted R^2	89.50%	89.50%	89.50%	85.11%	85.12%	85.14%	89.32%	89.33%	89.33%
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 B

	Dependent Variable: log(1 + Market Value of Patents)								
	1972-1986			1987-2000			2001-2010		
Constant	0.0063	-0.2000[a]	0.0103	-0.5306[a]	0.0975	-0.1944	-0.0322	-0.8033[a]	-0.4317[a]
	(0.0032)	(0.0747)	(0.0429)	(0.1134)	(0.1117)	(0.0689)	(0.1570)	(0.1930)	(0.1257)
Log(*Assets*)	0.1177[a]	0.1183[a]	0.1184[a]	0.1713[a]	0.1710[a]	0.1702[a]	0.1892[a]	0.1887[a]	0.1896[a]
	(0.0110)	(0.0110)	(0.0110)	(0.0156)	(0.0156)	(0.0154)	(0.0160)	(0.0160)	(0.0160)
Log(*Age*)	-0.0889[a]	-0.0878 [a]	-0.0883[a]	-0.0210	-0.0223	-0.0227	0.0310	0.0280	0.0281
	(0.0203)	(0.0203)	(0.0203)	(0.0217)	(0.0217)	(0.0217)	(0.0358)	(0.0358)	(0.0358)
Log(*Number of Firms*)	0.0039			0.0341[b]			-0.0548[a]		
	(0.0116)			(0.0161)			(0.0183)		
Log(*HHI*)		0.0326[a]			-0.0689[a]			0.0756[a]	
		(0.0089)			(0.0156)			(0.0233)	
Concentration Index			0.0039			-0.0364[a]			0.0225[a]
			(0.0041)			(0.0056)			(0.0088)
N	51,664	51,664	51,664	67,028	67,007	67,007	41,012	41,012	41,012
Adjusted R^2	91.91%	91.91%	91.91%	83.45%	83.47%	83.50%	88.72%	88.72%	88.72%
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

Appendix
Figure A.1
Change in Measures of Concentration across Industries – 4-digit NAICS

This figure depicts the distribution of percentage changes in the HHI Compustat-based index over 1997 – 2014 period (Figure A) and the change in Census-based HHI index over 1997 – 2012 period (Figure B). The industries are defined based on NAICS 4-digit classification.

Figure A.1.A: Change in the HHI (Compustat-based)

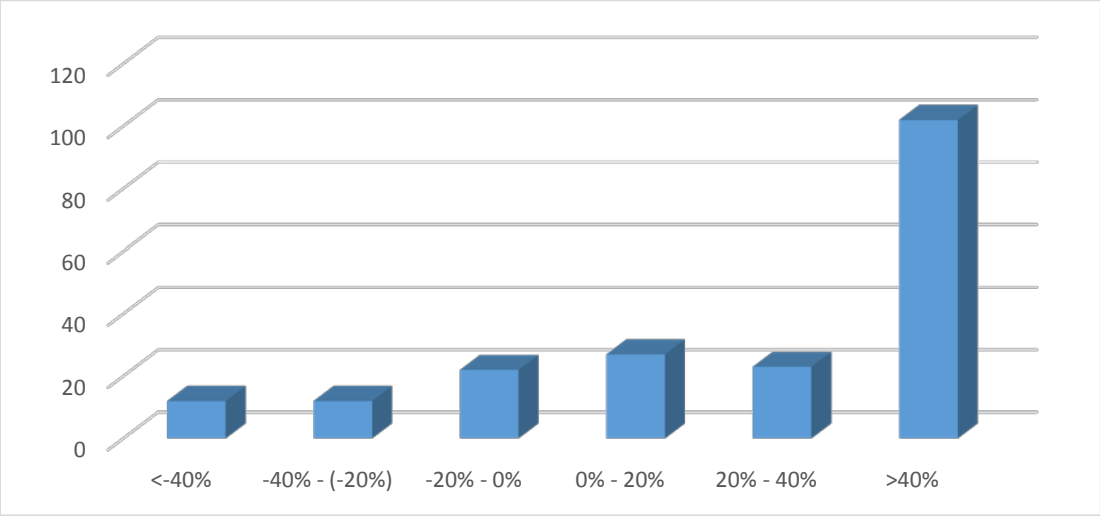


Figure A.1.B: Change in the HHI (census-based)

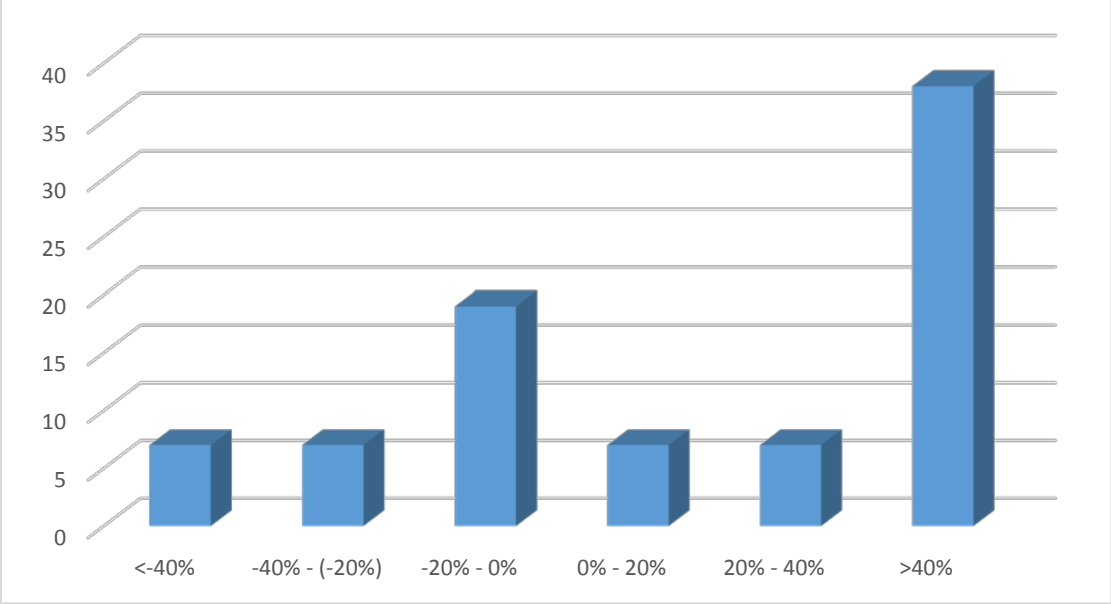


Table A.1
Change in the Level of Product Market Concentration and Profitability– 4-digit NAICS

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 4-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 four-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	-0.0361[a]	-0.0587[a]	-0.0520[a]
	(0.0063)	(0.0121)	(0.0051)
Log(*Assets*)	0.0473[a]	0.0469[a]	0.0471[a]
	(0.0013)	(0.0015)	(0.0015)
Log(*Age*)	-0.0201[a]	-0.0206[a]	-0.0206[a]
	(0.0013)	(0.0013)	(0.0013)
Log(*Number of Firms*)	-0.0067[a]		
	(0.0014)		
Log(*HHI*)		0.0004	
		(0.0014)	
Concentration Index			0.0015[a]
			(0.0005)
N	202,356	202,276	202,276
Adjusted R^2	66.85%	66.84%	66.84%
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	0.0313[a]	0.0639[a]	0.0279[a]	-0.1595[a]	-0.1453[a]	-0.1651[a]	-0.2555[a]	-0.4045[a]	-0.2928[a]
	(0.0112)	(0.0206)	(0.0104)	(0.0145)	(0.0230)	(0.0114)	(0.0239)	(0.0279)	(0.0212)
Log(*Assets*)	0.0319[a]	0.0317[a]	0.0316[a]	0.0649[a]	0.0647[a]	0.0648[a]	0.0665[a]	0.0660[a]	0.0661[a]
	(0.0031)	(0.0030)	(0.0031)	(0.0026)	(0.0020)	(0.0026)	(0.0034)	(0.0034)	(0.0034)
Log(*Age*)	-0.0268[a]	-0.0266[a]	-0.0267[a]	-0.0384[a]	-0.0387[a]	-0.0385[a]	0.0004	0.0005	-0.0009
	(0.0021)	(0.0021)	(0.0021)	(0.0025)	(0.0025)	(0.0025)	(0.0030)	(0.0031)	(0.0030)
Log(*Number of Firms*)	-0.0007			-0.0020			-0.0193[a]		
	(0.0019)			(0.0027)			(0.0033)		
Log(*HHI*)		-0.0045[b]			-0.0029			0.0100[a]	
		(0.0023)			(0.0027)			(0.0028)	
Concentration Index			-0.0012			0.0031			0.0067[a]
			(0.0009)			(0.0009)			(0.0011)
N	59,012	59,007	59,007	80,433	80,374	80,374	62,911	62,895	62,895
Adjusted R^2	66.89%	66.87%	66.87%	69.37%	69.40%	69.39%	75.88%	75.82%	75.86%
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