Are US Industries Becoming More Concentrated?

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Abstract

This paper presents findings indicating a structural shift in US product markets that has weakened competition. 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, which suggests that market power is becoming an important source of value. In real terms, the average publicly-traded firm is three times larger today than it was twenty years ago. We propose that lax enforcement of antitrust regulations and increasing technological barriers to entry appear to be important factors behind this trend, resulting in weakened competition.

Introduction

A fundamental concept in economics is the role of competition in promoting the efficient allocation of resources. This idea motivated governments around the world to initiate, in the second half of the 20th century, a series of policy reforms (e.g., tariff reductions, deregulations, and aggressive antitrust enforcement) that drastically changed the industrial landscape of many markets, thereby increasing the scope of competition (e.g., Shepherd (1982); Graham, Kaplan, and Sibley (1983); Pryor (1994); Nickell (1996); and Rajan and Zingales (2001)).

This paper shows that this trend has undergone a significant reversal in the United States. We examine the evolution of product market concentration in US industries over the last forty years, and document increased concentration in US industries since the beginning of the 21st century. The Herfindahl-Hirschman Index (HHI) of market concentration has systematically increased in over 75% of US industries. Furthermore, the market share of the four largest public and private firms has significantly increased for most US industries, while US public markets have lost almost 50% of their publicly-traded firms. This decline has been so dramatic that the current number of firms is lower than in the early 1970s, when the real gross domestic product (GDP) in the United States was one-third of today's real GDP. 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 a correspondence between the large-scale consolidation of firms, and the simultaneous increase in market concentration and disappearance of public firms. In real terms, average and median firms in the US 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 other indicators of the degree of competitiveness. 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). Furthermore, Sutton (1991) shows that if firms can enhance product demand through advertising 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 should be negatively related to 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 increasingly concentrated industries could generate larger abnormal profits by exercising market power (e.g., Bain 1951, 1956).

We examine whether the changes in industry concentration levels are linked to firm profitability as measured by three factors: return on assets; market reaction to M&A announcements; and abnormal stock returns. Our results indicate that firms in industries experiencing an increase in concentration levels over the past two decades have enjoyed higher profitability, greater gains form mergers and significantly higher abnormal returns to shareholders. Specifically, 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' abilities to extract higher profit margins. A change in the *Concentration Index* in the magnitude of its interquartile range (75th minus 25th

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

percentile) increases the *Lerner Index* by 182% (relative to its median), whereas the same change increases *Asset Utilization* by only 6%, suggesting that firms in concentrated industries may be exercising market power. Further tests indicate that neither potential increase in foreign competition nor increased competition from private firms explains either the increased concentration or the higher profit margin we document.

By looking at M&A activity, we explore whether market power is the mechanism behind the greater profitability in industries with increased concentration.. 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 M&A transactions have become more profitable to shareholders in general, with even greater profitability in the industries that became more concentrated. The impact of concentration levels on M&A announcement returns is particularly strong for transactions tending to reduce competition (e.g., horizontal deals): this finding supports the view that market power is becoming an important source of value during M&A transactions.

Finally, we find evidence for an increase in returns to investors of public firms as industries become more concentrated. To examine the changes to investor welfare, we look at the performance of portfolios sorted on the change in concentration levels in their respective industries. We find that over the period of 2001–2014, unlike prior periods, 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 2000 are reflected in higher profits to shareholders. We challenge the argument that these excess returns

are a compensation for bearing extra systematic risk (Bustamante and Donangelo 2014), by finding that firms operating in markets with few rivals tend to be less sensitive to macroeconomic shocks than other firms.

The evidence quite clearly supports a positive relation between industry concentration levels and profit margins over the 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 use of Section 2 of the Sherman Act, allowing antitrust agencies to prevent increase in market power of existing dominant firms, has declined from an average of 15.7 cases per year during 1970–1999 to fewer than 3 during 2000–2014. Surprisingly, no cases were filed in 2014, even though aggregate concentration reached record levels that year. We also find evidence that completion rates for M&A transactions have been increasing over time, which is 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, 252), 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. "Given the critical role of computer-related technology and innovation in 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 and/or acquisition of innovative firms.[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 we would expect firms in concentrated industries to own stronger patent portfolios. Using the patent database created by Kogan et al. (2016), we find that while the relation between concentration levels and patents has been negative before 2000, the relation has reversed and become positive in the last fifteen years. We show that post-2000, firms in concentrated markets possess not only a larger number of patents, but also the most valuable ones. In general, this evidence suggests that technological barriers to entry may have prevented new firms from entering profitable markets.[3]

Third, we examine whether the increase in concentration levels is due to omitting private firms from our main measures of product market concentration. Using data from US Census Bureau 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 both display patterns similar to the concentration ratios based on public firms. Therefore, even though a larger number of private firms have entered the economy, their marginal contribution to the aggregate product market activity has been relatively small.[4]

Fourth, we examine whether the presence of foreign firms could provide alternative rivalry to domestic firms. To examine this possibility, we investigate how proxies for foreign

[2] Gao, Ritter, and Zhu (2013) find evidence that the main reason for the disappearance of IPOs over the past two decades is that start-ups, 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 GDP have been increasing since the late 1990s.

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 even after controlling for industry-level sales by foreign multinational enterprises in the United States, as well as the level of import penetration, the relation between concentration measures and firm profitability remains positive and significant. In addition, the finding that profit margins have significantly increased in industries that became more concentrated indicates that foreign firms' supplanting domestic firms is not highly probably. If it were, 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. To the contrary, we find that the phenomenon documented in this paper has affected the majority of US industries, and has been primarily driven by a combination of fewer IPOs and high M&A activity.

Over the last twenty years, product markets on the whole have undergone a structural change that may potentially transform the nature of competition. Markets have become more concentrated, and profit margins have increased in proportion to the increase in industry concentration. Also, perhaps due to greater market power, the increased profit margins are mainly driven by higher operating margins, rather than increases in operational efficiency. Consistent with this conclusion, we find that higher market concentration has resulted in more

profitable investment opportunities, as the market reaction to M&A announcements has become more positive, especially across horizontal deals.

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

Second, our work contributes to the literature on the evolution of 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.

Our analysis also sheds light on the factors possibly driving 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, our findings indicate that technological barriers play an important role in explaining why concentrated markets appear to be incontestable. Over the past few decades, firms in concentrated industries have been strengthening their patent portfolios, therefore increasing barriers to entry in a significant way.

The paper is organized as follows. Section I describes the sample selection procedure and documents the systematic increase in economy-wide concentration levels. In Section II we investigate the relation between profitability and proxies for industry concentration levels. Section III examines whether market power considerations are becoming an important source of value during M&A transactions, and Section IV looks at the asset pricing implications of higher concentration ratios. Section V explores several alternative explanations for the increase in concentration of US industries. Section VI concludes the paper with several policy recommendations.

I. Changes in Industry Concentration

I.A. Data

Our main sample consists of all firms on the CRSP/Compustat merged database over the period of 1972–2014. We limit our analysis to firms incorporated in the United States that trade on major stock exchanges (NYSE, AMEX, and NASDAQ), and have information on their ordinary common shares traded.[5] Otherwise, we do not apply any additional filters, and include financial firms as well as utilities.[6]

We use NAICS classification to define a firm's industry. Relying on NAICS, rather than SIC, provides several advantages.[7] First, NAICS codes are based on a consistent economic concept, and group together establishments using 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; thus the SIC system

[5] For robustness, we repeat the analysis including firms incorporated outside of the United States, as well as ADRs. The pattern of the change in the number of firms and HHI is slightly weaker but similar to the one presented here.
[6] Excluding financial firms and utilities from our analysis does not affect any of our main results.
[7] The detailed information on NAICS industry classification system can be obtained from the Bureau of Labor Statistics Web site at http://www.bls.gov/ces/cesnaics.htm.

creates inconsistent groupings across firms. Second, since all government agencies switched to NAICS classification by 2003, using the NAICS industry code system allows for an easier merge between the CRSP-Compustat data on one side, and economic indicators, provided by the US Census Bureau and Bureau of Labor Statistics, on the other. Using SIC codes where applicable does not qualitatively affect any of our results.

I.B. General Trend

We first investigate the change in industry concentration levels over time. We examine the trend in the aggregate number of publicly-traded firms over time, as well as the trend in several Herfindahl-Hirschman (HHI) concentration indices, each based on different data sets. 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. The second HHI uses census data, which contains information on both private and public industrial firms with operations in the United States. Following the approach in Irvine and Pontiff (2009), we assign the industry-level HHI to each firm, essentially weighting each industry ratio by the number of public firms, and then aggregate across firms in every year.

Figure 1-A shows the results for the Compustat-based HHI. Consistent with increased competition associated with tariff reductions deregulations, the HHI declines starting from the beginning of the 1980s until the late 1990s. From that point on, the HHI increase until the end of the sample period in 2014. The increase of almost 50% is significant both economically and statistically. As we show later, this increase in concentration is not driven by only a few industries but it is widespread. The figure also depicts the change in the number of public firms over the same time period. The number of public firms (dashed line) steadily increased during

the first part of the sample (1972–1997).[8] In the later period, however, the number of firms significantly declined from 7,064 in 1997 to 3,751 in 2014. This decline has been so substantial that the current number of publicly traded firms in the economy is similar to that of the mid-1970s, when the real gross domestic product was one third of what it is today.

After the late 1990s, the HHI increased concurrently with the drop in the number of firms. While some of the increase in the concentration ratio is related to the decline in the number of firms by the nature of the index construction, the evidence from the 1970s and 1980s indicates that the number of public firms does not always proxy for industry concentration. Thus, during the period 1973–1990, the correlation between the number of firms and the HHI was 0.14, and for much of that 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 argues for our evidence exceeding a simple mechanical relation, and points to a structural change in the nature of product market competition.

To assess the significance of the trend from a long-term historical perspective, we use information from the beginning of the timeline used in CRSP database coverage and recalculate the number of public firms using this extended period. The results, reported in Figure 1-B, indicate that the decline in the number of public firms is substantial even when we analyze a time frame of close to a century. While there have been significant spikes in the number of firms, corresponding to the CRSP's coverage of AMEX in the 1960s and NASDAQ launch in the 1970s, we find no declines in the number of firms comparable to the decline in recent decades, even when we include the Great Depression and the 1973 oil crisis.

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

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 twenty years ago. These findings, combined with the increased HHI, provide 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 calculating the percentage change in the number of firms in each industry during the 1997–2014 period. We use 1997 as our starting period for two reasons. First, 1996 and 1997 are the years in which the HHI was at its lowest level during the sample period (and the number of public firms in our sample peaked). Second, data from the US Census Bureau 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, we calculate for every industry a percentage change in HHI 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. It is not only the HHI levels that have changed, but also the number of traded firms. Figure 2-B shows that the decrease in the number of firms is a general pattern. Sixty-six out of seventy-one industries have experienced a negative change over that time period. Moreover, the largest mass

of the distribution is concentrated in the most extreme range, indicating that 73% of the industries have lost over 40% of their publicly traded peers.[9]

One potential concern with using the Compustat-based HHI 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 provided by the US Census Bureau, which includes revenues of both public and private firms. This measure is based on the fifty 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, 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 declining over the past several decades, we look beyond the manufacturing sector to ensure that the increase in concentration is indeed prevalent across the US economy. As a census-based HHI 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 threefold. 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

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

[10] This concentration ratio is available at five-year intervals, for calendar years that end in 2 or 7 (Economic Census years), when the US Census Bureau 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.

entire industry, so that the scope of the measure is not limited to the top fifty firms (the census-based HHI index). We calculate the percentage change in the share of top four firms in each industry between 1997 and 2012, and present the distribution of changes in Figure 2-D. The distribution is heavily skewed to the right, demonstrating that there are more industries where the share of the largest firms has increased than industries where the largest four firms became diluted by smaller peers. Moreover, a large proportion of the positive changes were extreme in magnitude: in twenty-one out of sixty-five industries the increase has exceeded 40%.

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 US Census Bureau) out of the total US employment.[12] The trend shows that the share of employment by large firms in the overall economy started to escalate in the mid-90s, and has recently exceeded previous historical peaks, consistent with pattern in sales-based measures of product market concentration.

To further ensure the robustness of our findings, we calculate the change in concentration ratios using industry definitions derived from the text-based analysis of a firm's product description in 10-K reports (see Hoberg and Phillips [2010, 2016] for further details).[13] According to this classification, every firm has a unique set of peers, and the members of the set of peer firms can change over time as firms modify the variety of products or services they offer. The test-based analysis can thus account for the possibility that some industries can evolve substantially over time. In addition, this method can be more precise in classifying competitors of firms whose operations span several different industries. Using the firm-specific text-based

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

HHI ratio, we find that between 1997 and 2013 (the last year of data available) industry concentration has increased in over 60% of the industries. Lastly, as an alternative way to account for operations of multi-segment firms, we recalculate the Compustat 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 (for the sake of brevity, neither result is tabulated here).[14]

The results in subsections I.A and I.B 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 prevalent across the majority of US industries.

II. The Economic Implications of the Increase in Concentration Levels

One important question is whether the systematic increase in concentration levels has had an economic effect on the fundamentals of the remaining firms. To answer this question, we first analyze the relation between profitability and changes in proxies for industry concentration in a panel-data setting, while controlling for other factors that could influence firms' profitability levels. 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

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

because the threat of potential entrants would not affect the competitive environment.[15] Furthermore, Sutton (1991) goes a step further and shows that the presence of additional 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. 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 subsection we test these alternative hypotheses.

Using all observations in the CRSP-Compustat database 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

[15] 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." [italics original]

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.

We define the industry using a firm's three-digit NAICS code.[16] To control for potential time-series dependence in the residuals, we cluster the standard errors at the firm level. Since we include firm-fixed effects, and firms rarely switch industries, the proxies for industry concentration can be interpreted as the changes in concentration relative to the industry mean. The inclusion of firm-fixed effects also helps address a number of alternative explanations. For example, if profitable firms systematically acquire 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 intra-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 effects of economies of scale 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

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

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 firm size, providing evidence that economies of scale are an important determinant of firms' profitability.

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 relationship between industry-level price-cost margins and concentration over the 1958–1981 period, we do not find strong relationship between ROA and measures of concentration during the earlier part of our sample. It is only the later subperiod (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 this variable from the 25th to the 75th percentile leads

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

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 reveals 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, we calculate for every industry-year 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: industries experiencing a large increase in concentration (quintile 1) generate a 1.3% extra return on assets, while industries with the smallest increase (or even a decrease) in concentration show an average decrease of more than 2.5% off their return on assets (quintile 5).

II.B. The Sources of Abnormal Profits

The increase in profitability in industries that experienced increased concentration may be due to increasing barriers to entry which make markets less contestable over time. Hence, the lack of competition could allow the remaining industry incumbents to enjoy wider profit margins by setting higher prices relative to production costs. Alternatively, the consolidation of firms within an industry could increase efficiency. For example, a large firm could have more flexibility in reallocating its existing resources to extract the highest productivity from any unit of capital, consequently increasing firm profitability. To this end, we examine whether the

empirical relation between profitability and change in industry concentration levels stems from higher profit margins, higher operational efficiency, or both.

We start by decomposing return on assets into two components: the *Lerner Index* and the *Asset Utilization* ratio. The *Lerner Index* measures the extent to which prices exceed marginal costs (price-cost margins), while the *Asset Utilization* ratio measures how efficiently firms manage their assets to generate sales. Following Aghion et al. (2005), we define the *Lerner index* as operating income before depreciation (Compustat item OIBDP) minus depreciation (item DP) 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. Similar to our results using ROA, 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 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*, negatively correlated with the HHI, and positively correlated with the *Concentration Index*. In other words, no clear pattern arises.

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, we find that the relation

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

between profitability measures and proxies for industry concentration levels is stronger over the subperiod 2001–2014. In this subperiod, both the *Lerner Index* and the *Asset Utilization* ratio increase as industries become more concentrated. These results indicate that firms operating in industries becoming more concentrated are able to generate abnormal profits by increasing their profit margins and enhancing the efficiency of their existing assets. In terms of economic significance, however, 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 documented in Section II.A are mainly driven by the positive effect product market concentration on profit margins, and not because of gains in efficiency. At a conceptual level, this evidence suggests that market power could be playing an important role in many industries. One possibility is that higher barriers to entry may have increased firms' abilities to generate higher profit margins by fending off potential competitors.

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

From a theoretical perspective, mergers can create value by improving efficiency (e.g., economies of scale and scope, synergies, and elimination of duplicate functions) or by increasing market power. The latter effect should become more dominant as competition declines. Therefore, examining the relation of mergers' profitability 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. The rationale for this claim is that, all other factors remaining constant, mergers in concentrated markets are more likely than mergers in competitive markets to reduce competition. This argument is consistent with the antitrust polices of the Federal Trade Commission and the Department of Justice, both of which focus on investigating or blocking mergers in highly-concentrated markets.

We gather data from the Securities Data Corporation's (SDC) Mergers and Acquisitions database. Our sample consists of mergers and acquisitions transactions during 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; 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 examine the effect of industry concentration levels on cumulative abnormal returns, we estimate the parameters of the following model:

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

where α_t is a year-fixed effect, α_j is an industry-fixed effect, B/M_T (B/M_A) is the book-to-market ratio of the target (acquiring) firm, and *DUMCASH* (*DUMSTOCK*) is a dummy for pure cash (stock) transactions. Following the definition in Davis, Fama, and French (2000), we define the book-to-market ratio as stockholder's book equity plus balance sheet deferred taxes and investment tax credit, if available, minus the book value of preferred stock. Additionally, 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 following: market values as proxies for firm size to control for the potential economies of scales generated by the merger; year-fixed effects to control for the impact of merger waves and macroeconomic conditions on announcement returns; and industry-fixed effects to control for time-invariant industry factors. Finally, we include dummies for pure cash transactions and pure stock transactions to control for the well-documented effect of the method of payment on M&A announcement returns.

Table 3 reports the estimated coefficients of Equation 3. The first column shows the results for the specification estimated over the period 1980–2014. Consistent with the claim that M&A transactions in increasingly concentrated industries are more likely to benefit from market

power considerations, we find that the market reaction of the combined firm around M&A announcements is positively correlated with the increased industry concentration. Specifically, it is positively correlated with the changes in the Concentration Index and negatively correlated with the changes in the Number of Firms. Investors seem to expect synergies to be larger when the acquirer operates in more concentrated industries. The results for the entire sample period are only marginally significant. Column 3 shows that the relation between Combined CARs and concentration levels is stronger during the post-2000 period.

To further 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 the effect of related mergers, we augment Equation 3 by including a dummy variable (*Related*) that is equal to one if the target and the acquiring firm are in the same industry, and an interaction variable equal to the product of *Related* and *Concentration Level*:

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

If 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 4 reports the estimated coefficients from this regression. The first

column provides evidence that the empirical relation between *Combined CARs* and the proxies for changes in concentration levels results largely from related mergers, thus reinforcing support for the predictions of the market power hypothesis. Once again, 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 credibility to the possibility that the increased market power indeed affects 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 abnormal stock returns. To investigate this issue, we calculate the relative change in the concentration levels in each industry (defined using a firm's three-digit NAICS code) over the period 1972–2014:

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

We then sort industries based on the magnitude of the change, and form three portfolios. The high *RelChg* portfolio contains the top ten industries, the low *RelChg* portfolio contains the bottom ten industries, and the middle portfolio the rest of the industries.[19] To calculate returns on year *t*, we first calculate equally-weighted and value-weighted returns by industry. After these industries are assigned to one of the three portfolios based on the relative change in the number of firms, we calculate equally-weighted industry returns for each portfolio. For value-

[19] Because the relative change may have many ties, we use a dense ranking system; therefore, we may have more than ten industries in the top and bottom portfolios depending on the number of ties.

weighted returns, we aggregate the market value of equity of all firms within an industry and calculate value-weighted industry returns for each of the three portfolios. Using this portfolio formation, we calculate monthly equally-weighted and value-weighted returns from July of year *t* to June of year *t*+1.

To control for differences in systematic risk across portfolios, we use three different asset-pricing models: CAPM, Fama and French (1993) three-factor model, and Fama and French (2015) five-factor model plus momentum. Table 5 reports the difference in abnormal returns (alphas) between high- and low-concentration portfolios for all our proxies for concentration. Panel A shows that most alphas are not statistically different from zero over the period 1972–2014. When we isolate the period of the significant decline in the number of firms, the results change dramatically. Panels B, C, and D report alphas estimated over three different sub-periods. While there is no evidence of abnormal performance over the periods 1972–1986 and 1987–2000, we find that the alphas are positive and statistically significant over the period 2001–2014. Even after controlling for Fama-French (2015) five factors plus the momentum factor, an investment strategy consisting of buying the high-concentration portfolio and shorting the low-concentration portfolio generates abnormal returns that range from 5.6% to 8.8% per year. These abnormal returns are much larger in magnitude 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 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 outperforms the low concentration portfolio over the crisis period (untabulated). These findings indicate that the alphas documented in this paper are not related to a risk premium; they also point to a possible market anomaly in which investors underestimate the effect of industry concentration on stock returns.

V. Potential Explanations for the Increasing Trend in Concentration Levels

In this section we investigate the potential economic forces that may have contributed to the wide-spread increase in concentration and the corresponding increase in profitability in the United States since around 2000. We identify two potential contenders: one, lax enforcement of antitrust laws, and, two, technological innovation. Our evidence posits that each contender in its unique way may have contributed to the increased concentration and barriers to entry. Three additional, more mechanical, explanations to the increased concentration, which we address in detail later in this section, are that our concentration measures do not properly account for the growing presence of private firms, the growing presence of foreign firms, or for distressed industries. We show that these reasons cannot explain our 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; and 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, 1).

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.[20] 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 beginning in the early 1980s, the aggregate HHI has been negatively

[20] 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" (https://www.ourdocuments.gov/)

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 case 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 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.

Clearly, we must be careful not to draw causal inferences from this analysis: Yet, the significant negative correlation between changes in concentration levels and antitrust enforcement over the past two decades offers valid support for the argument that fewer regulatory barriers can have direct implications on product market competition. 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 the late 1990s, as well as the popularization of personal computers around the same time, has had a large impact on productivity and growth. Corrado and Hulten (2010) quantify the sources of growth in output and demonstrate that during the period 1995–2007, the contribution on intangible capital, and its components, such as computerized information, innovative property, and economic competencies has doubled. Thus, the innovation-related intangible inputs have been increasingly important to US economic 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 an economy of scale. Ciftci and Cready (2011) derive R&D value based on its association with future earnings realizations, and show strong evidence in favor of the economy of scale hypothesis across the CRSP-Compustat universe of firms. If technology is better developed and implemented among large firms, the recent technological advances could essentially create barriers of entry to new firms. 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. Specifically, we examine whether firms in markets that become more concentrated markets have come to possess stronger patent portfolios after 2000. Table 6, Panel A 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.[21] Panel A shows that while the relationship between industry concentration and number of patents granted has been negative in the period 1986–2000, 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 creating entry barriers to new firms, and encouraging new firms 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, a higher volume of M&A activity, and potentially higher profit margins,.

While the changes in antitrust policy may be unique to the United States, 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. (2015) report that other countries of comparable level of economic development and quality of financial intermediary system have not experienced a decline in the number of public firms. The uniqueness of the pattern in the United States suggests that additional factors must have played a

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

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 the United States 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 competition systems have similar objectives, the differences in laws, policy, and rules lead to different enforcement outcomes. For example, Fox (1997) shows that even the definition of a dominant firm differs across the two jurisdictions: the United States treats a firm as holding significant market power only if it control two-thirds or more of a relevant market, while according to the EU 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" (*The New York Times*, April 2, 2015). Thus, the combined evidence indicates 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 antitrust 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, the decline in the number of public firms may be 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 remains 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, 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 (Figure 2-C) is similar to the pattern we observe based on Compustat-based HHI (Figure 2-B). Thus, private firms did not become large enough to dilute the higher levels of product market concentration driven by the disappearance of public firms. A similar conclusion is obtained when we look beyond the manufacturing sector and calculate the change in the share of top four 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 increased in most industries. Figure 2-E provides similar results based on labor market measures of concentration. In sum, this analysis suggests 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 to various concentration measures and to the inclusion of private firms.

To further examine whether the findings are driven by private firms simply substituting public firms, rather than a result of increased concentration, we ask whether the role of public firms in the overall economy has remained high despite their dwindling 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

(similar to the concentration ratio, census figures are only available at five-year intervals).[22] 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 the US Census Bureau. Similarly, we calculate the ratio of the number of public firms to the total number of firms in the US economy.

Figure 6-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 more private firms have entered the economy, their contribution to the aggregate product market activity was negligible.

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 the Census Bureau's Statistics of US Businesses report). The results, presented in Figure 6-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 private firms has dropped, public firms have continued to dominate the US economy. Thus, even within the subsample of large firms, any substitution of public firms by private ones has been economically small.

For robustness, we also calculate the aggregate revenues of publicly-traded firms as a percentage of the 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 dwindling number of public firms in the overall economy has been relatively small.

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

V.B. Substitution by Foreign Firms

Since the 1970s, the globalization process has significantly increased the volume of international trade across countries. Consequently, if foreign firms have been filling the gap left by the disappearing 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.

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 United States, 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 help 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, and has been used in a number of studies (see, e.g., Borjas and

Ramey 1995; Cuñat and Guadalupe 2009; and Irvine and Pontiff 2009). 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.[23]

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

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 can be shipped (apparel, food, rubber, metal, machinery, as well as commodities and crops). As a result, industries outside of manufacturing, mining, and agricultural sectors are not affected by foreign competition in the form of import penetration. Another problem of import penetration data is that many foreign companies operate directly out of the United States. In this case, if foreign firms manufacture and sell their products in the United States, their revenues will not be accounted in imports data, biasing the actual scope of foreign competition downwards. To address this issue, we perform a different type of analysis and look at activities of US affiliates of foreign multinational enterprises. These statistics, managed by the Bureau of Economic Analysis (BEA), are based on mandatory surveys of virtually all US business enterprises that are affiliates of a foreign person

[23] 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.

or a foreign parent company.[24] 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.[25] To assess the importance of foreign firms' operations in the United States, 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 it is possible that operations by foreign firms have grown primarily in the industries that have experienced the largest increase in concentration, substituting for domestic competition. A correlation analysis indicates that this is not the case. The correlation between the percentage increase in Compustat-based HHI ratio and the percentage change in the ratio of sales by foreign multi-national to US public firms is −0.19. The negative sign indicates that foreign multinationals seem to be more active in industries that have become more competitive over time, contradicting the substitution hypothesis. We perform a similar exercise by replacing the change in concentration with the percentage change in the number of public firms, and find that the correlation coefficient is −0.05 and statistically insignificant. To examine the substitution hypothesis more formally, we repeat the main estimation of firm profitability as a function of concentration, while adding the log of sales by foreign multinational enterprises at the industry level. We find that our main results are unaffected.

To summarize, the results on activities of foreign multinational firms and the scope of import penetration show that although the overall volume of foreign activity in the United States has been increasing, a large portion of US industries have expanded at a similar pace, balancing off the foreign competition. Moreover, an increase in the activity of foreign firms did not occur

[24] 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.

[25] 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.

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 increased domestic concentration, as we find. Ultimately, the notion that foreign firms have been filling the gap left by US public firms is not supported by the data.

V.C. Distressed Industries

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

To understand which component of entry and exit is responsible for the systematic decline in the number of public firms, we examine firms' entries and exits, as reported in CRSP. Since most additions in the 1970–1973 period were driven by the introduction of NASDAQ, we perform the analysis of this subsection starting in 1974. To identify an entry, we record the first

year that a firm appears in the sample as its entry year. A new firm enters public markets primarily through an IPO process, or a spin-off from another firm.[26] To identify the source of a firm exit, we rely on the delisting information on CRSP, and classify the delisting codes into three categories: mergers, bankruptcy and liquidations, and other exits. Other exits primarily include delisting by current exchanges due to insufficient capital; not meeting financial guidelines for continued listing due to share price falling below an acceptable level; or insufficient flow of assets. This category can be broadly viewed as another type of bankruptcy, in which a firm is unable to sustain its publicly-traded status due to a poor financial performance.

Figure 7 presents the decomposition of the change in the number of public firms into entries and exits, with exits further decomposed into mergers, liquidations, and other exits. The rate of firm entries increases through the earlier period, but reverses in the late 1990s, consistent with previous studies that document the disappearing of IPOs (e.g., Gao, Ritter, and Zhu 2013). However, the decline in IPOs is not the only mechanism behind the disappearance of public firms. The level of M&A activity starting from early 2000 has also remained stable. In fact, the exit of public firms as a result of M&A deals is sufficiently high to offset all the entries into the public market during most years of that period. This contrasts with the trend during the 1980s and most of the 1990s, in which the rate of firm entries into the market was almost twice as high as the rate of mergers.

[26] Additional cases of a new firm entry include cross-listings of domestic firms, listings by foreign firms, and mergers. We exclude cross-listing events from our sample, as we are interested in the first time the company becomes public. We also limit our sample to US-based firms, so that foreign listings are also excluded. Another reason for a firm appearance in CRSP is as a result of a merger deal, when the newly consolidated firm receives a new PERMNO, and both the bidder and the target exit the sample. Although this recording method reduces the precision of a firm entry classification, it does not bear a systematic effect on the differences between entries and exits, as it increases the level of both. In addition, in unreported results we find that our time-series of CRSP-based entries has a 0.62 correlation with the time-series IPO activity (as reported on Jay Ritter's website at http://bear.warrington.ufl.edu/ritter/ipodata.htm), suggesting that CRSP-based entries capture the time-series trend fairly well.

To summarize, there are primarily two mechanisms that are responsible for the decline in the number of public firms. The first is a decline in the number of IPOs, and the second is the higher rate of M&As relatively to the number of remaining public firms. Firms do not exit the public markets due to liquidation or involuntary delisting. Figure 7 illustrates that the number of exits due to liquidation, as well as involuntary delisting (other exits) has remained low, even after accounting for the 2007–2009 recession. In sum, our results indicate that the remaining firms are doing well and expanding at a persistent and positive rate.

VI. Conclusion

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

We show that the increase in concentration levels has implications for firm performance, as concentration levels affect 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 results indicate that the increase in profit margin is due to increased market power, rather than simply an increased efficiency because of changes in economies of scale. Second, 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 may be weakening 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 Wall Street Journal* (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.

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 some of these gains appear to be transferred to the firms' shareholders, whether the higher market concentration benefits consumers or other stakeholders is not conclusive. The increase in profit margins without a corresponding economically significant decline in production costs may imply the opposite. Although it is possible that the case of more concentrated 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 further examine the impact of the increased concentration.

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Figure 1
Trends in Industry Concentration

This figure shows the time-series trend in measures of industry concentration. Panel A reports the number of publicly-traded firms, as well as the Herfindahl-Hirschman (HHI) concentration index, for all 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: Number of Public Firms and HHI

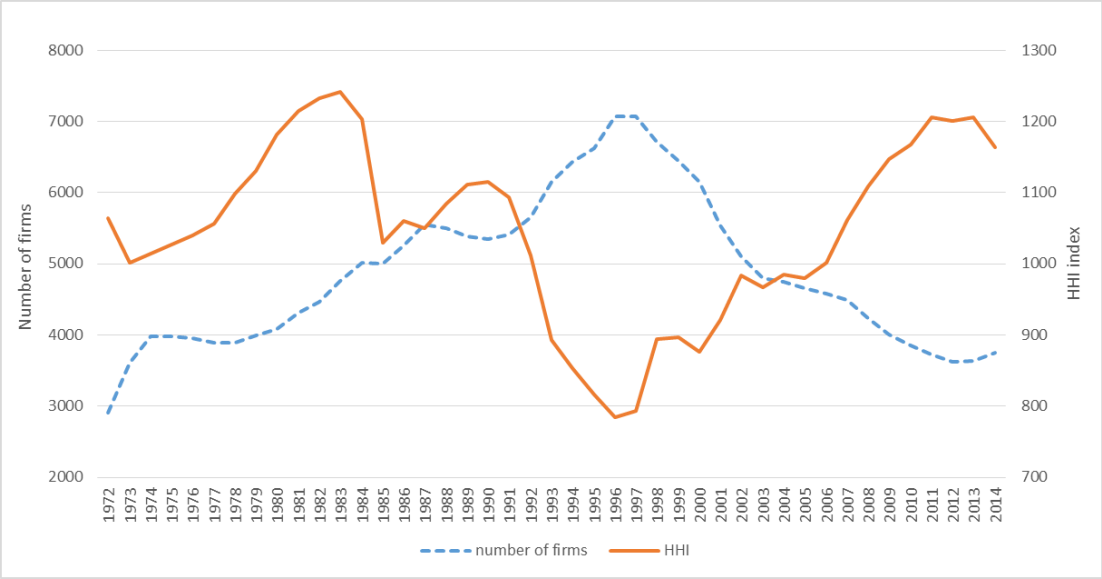


Figure 1-B: Number of Public Firms – Historical CRSP Coverage

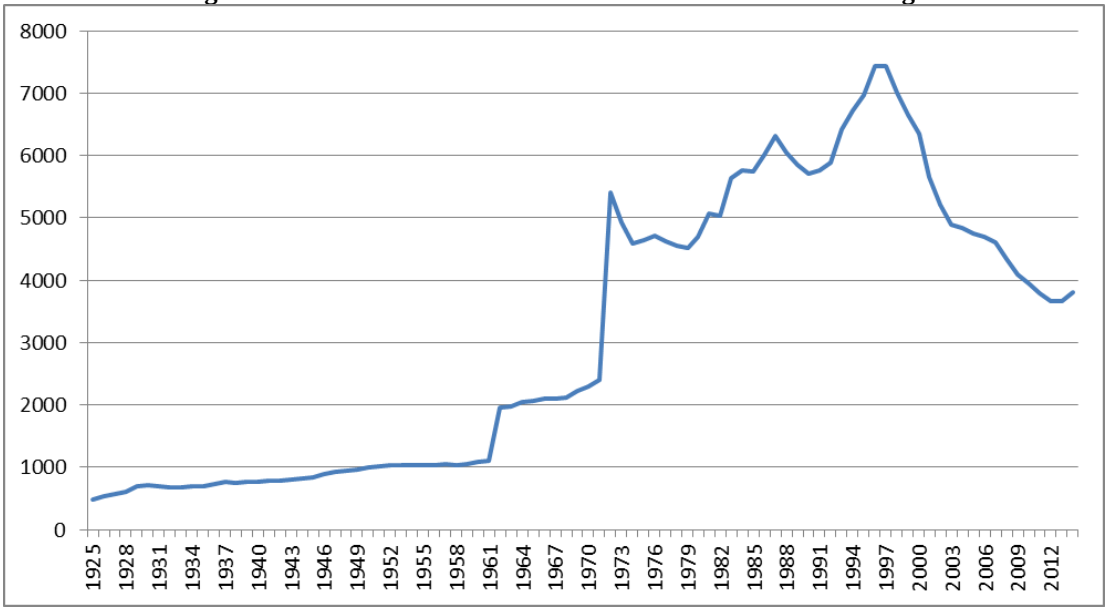


Figure 1-C: Average and Median Size of Public Firms

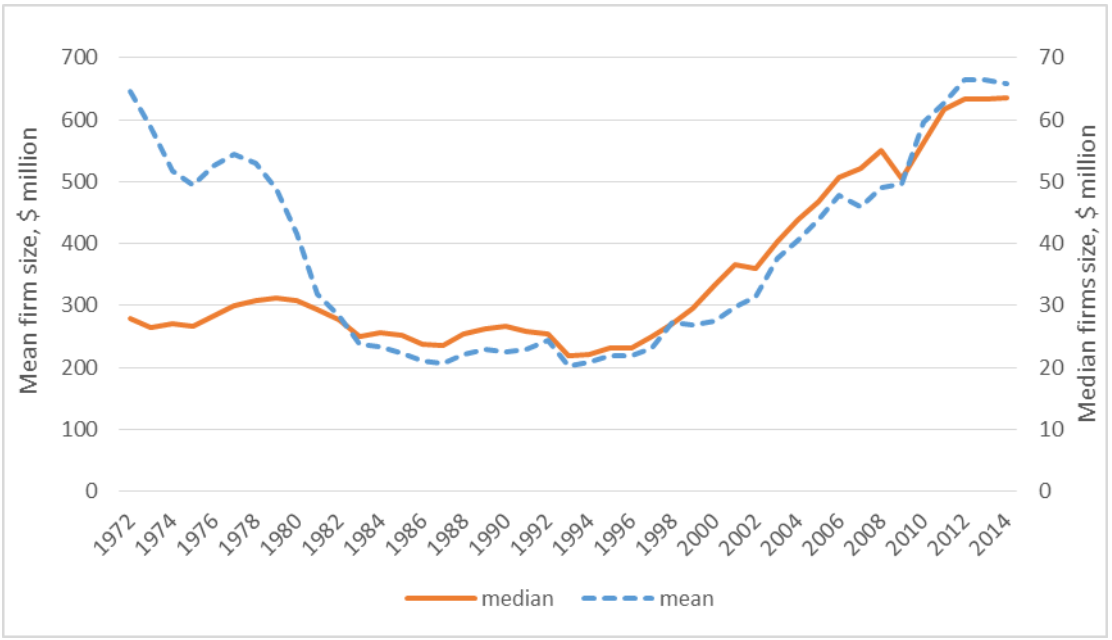


Figure 2
Change in Measures of Concentration across Industries

This figure depicts the distribution of percentage changes in the Compustat-based HHI (Figure A) and the number of publicly-traded firms (Figure B) and across industries. The changes are calculated over the 1997-2014 period. Figure C shows the change in census-based HHI, 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 and more out of the total US employment.

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

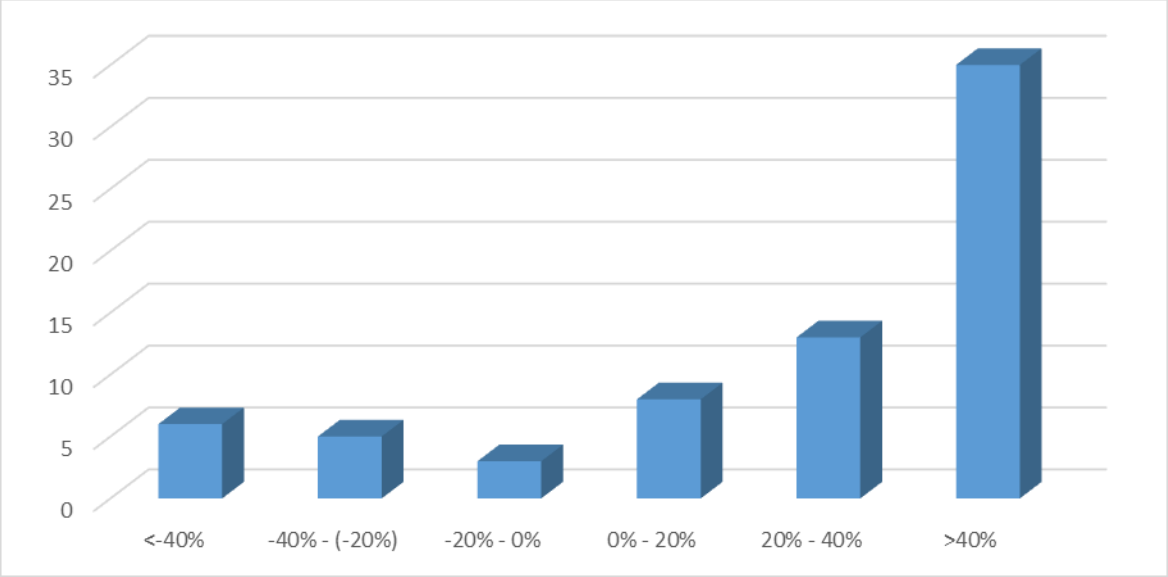


Figure 2-B: Change in the Number of Firms

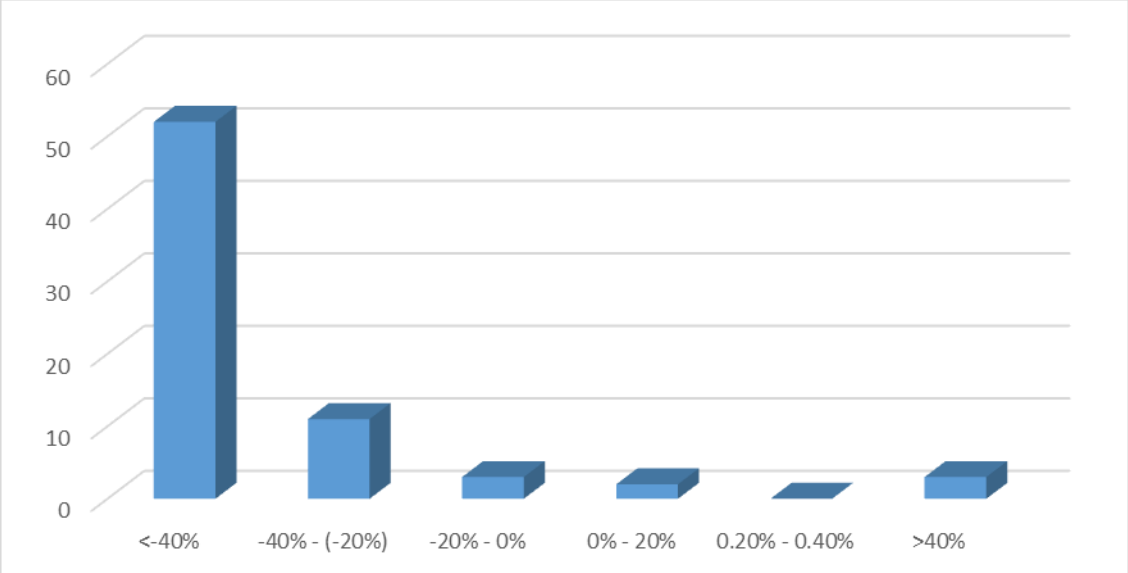


Figure 2-C: Change in the HHI (census-based)

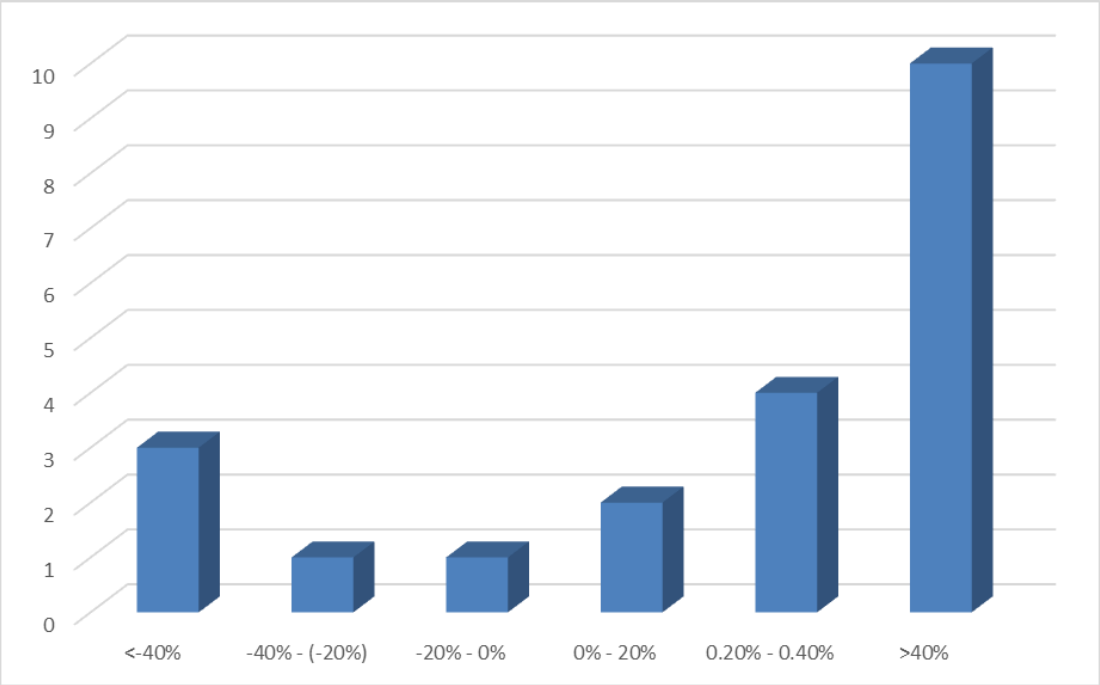


Figure 2-D: Change in the Share of the Largest Four Firms in the Industry

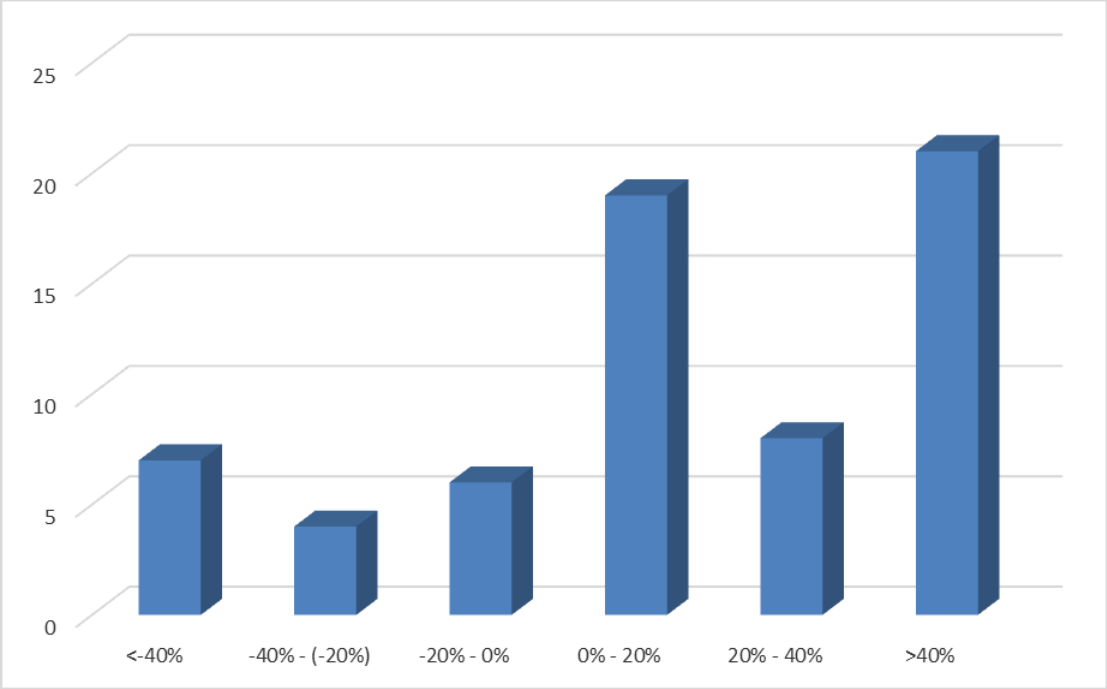


Figure 2-E: Share of Employment in Firms with 10,000+ Employees

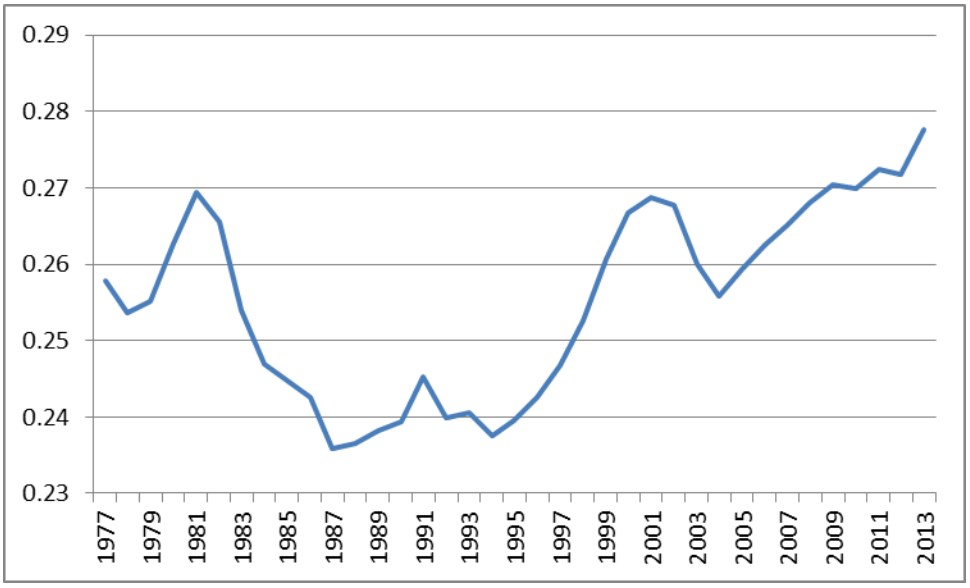


Figure 3
ROA and Change in the Number of Firms

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

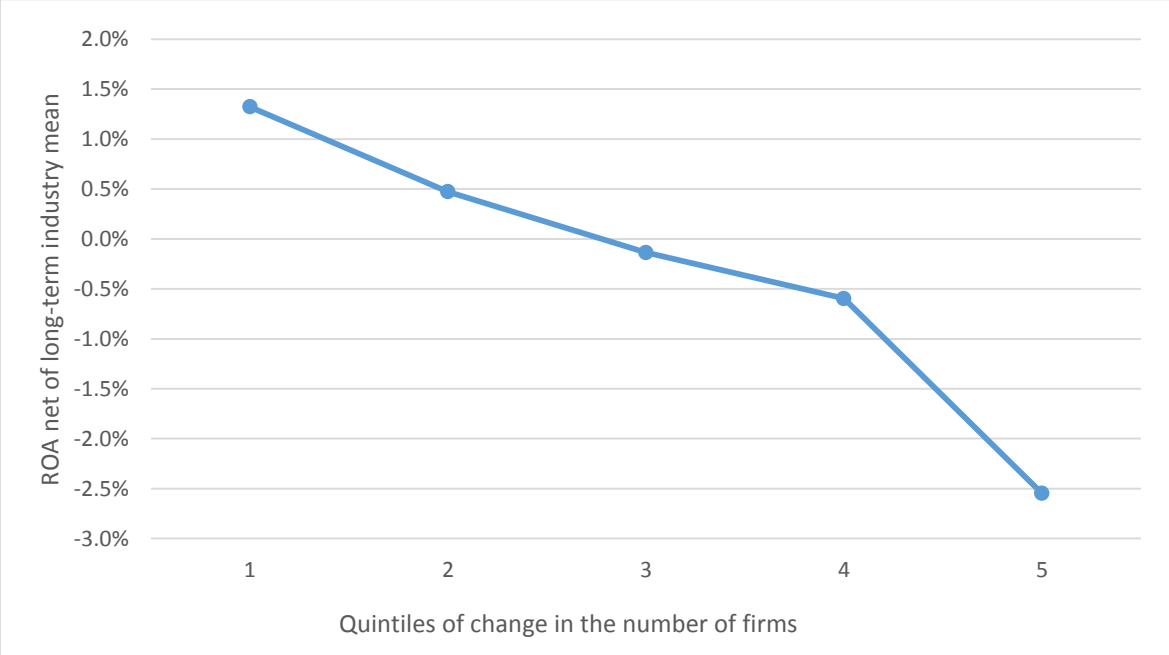


Figure 4
Relation between Concentration Levels and Antitrust Enforcement

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.

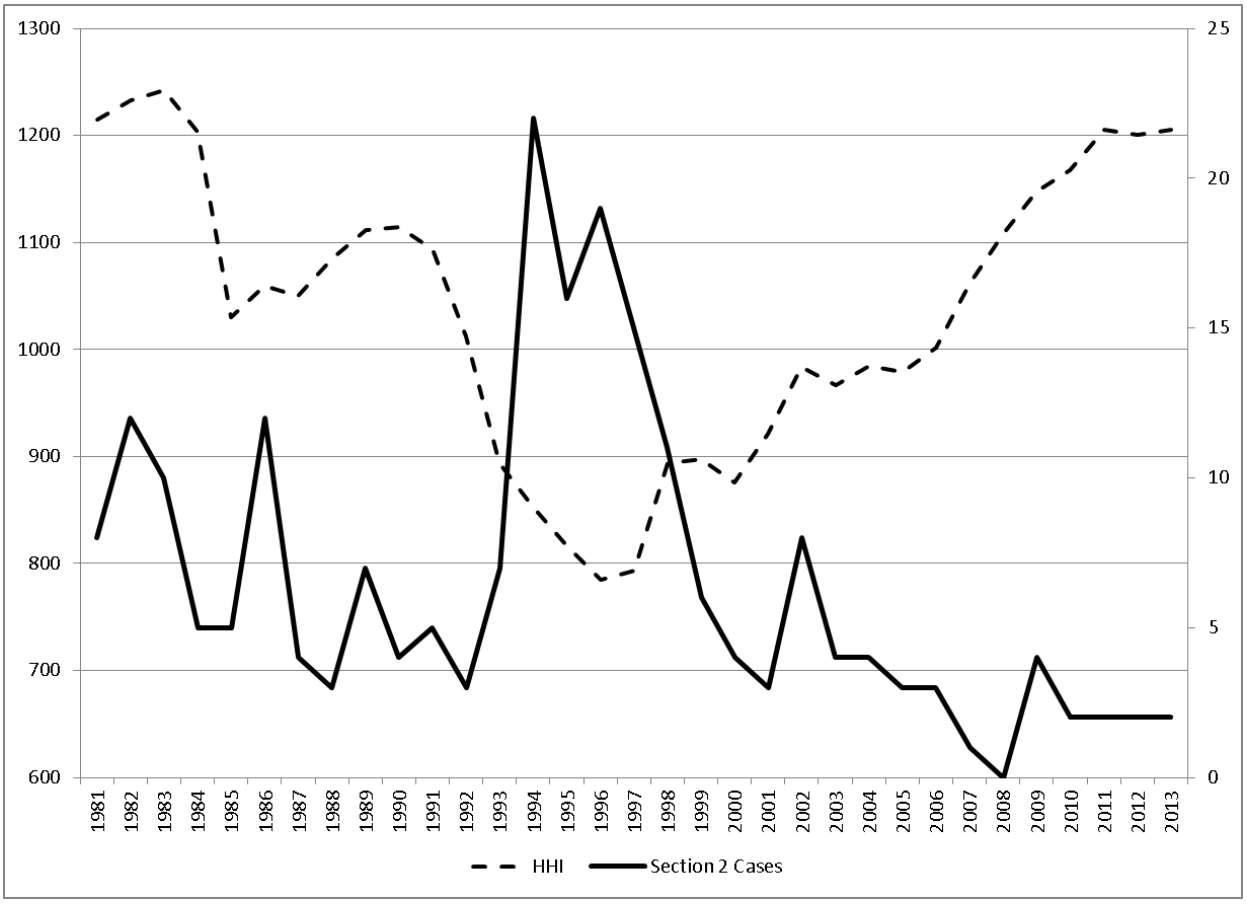


Figure 5
Proportion of Completed M&A Deals

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.

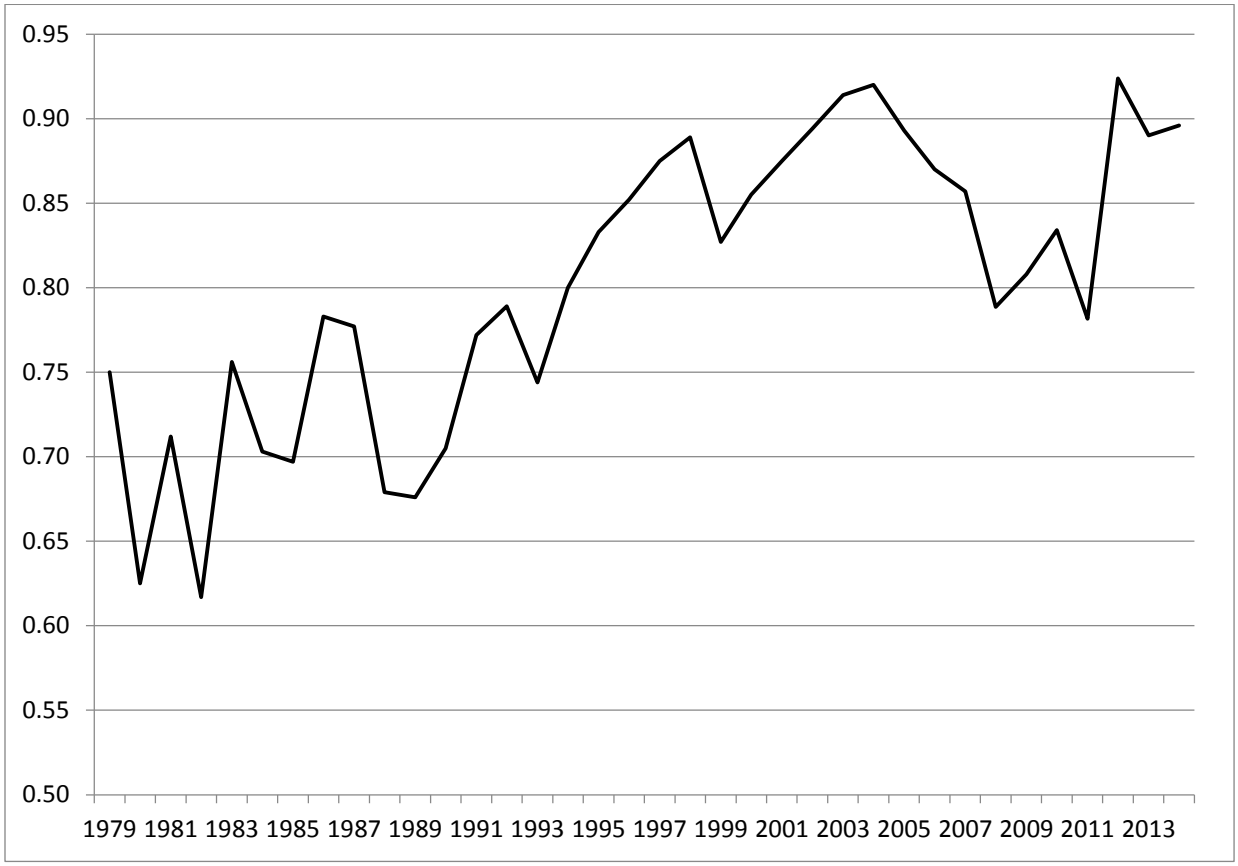
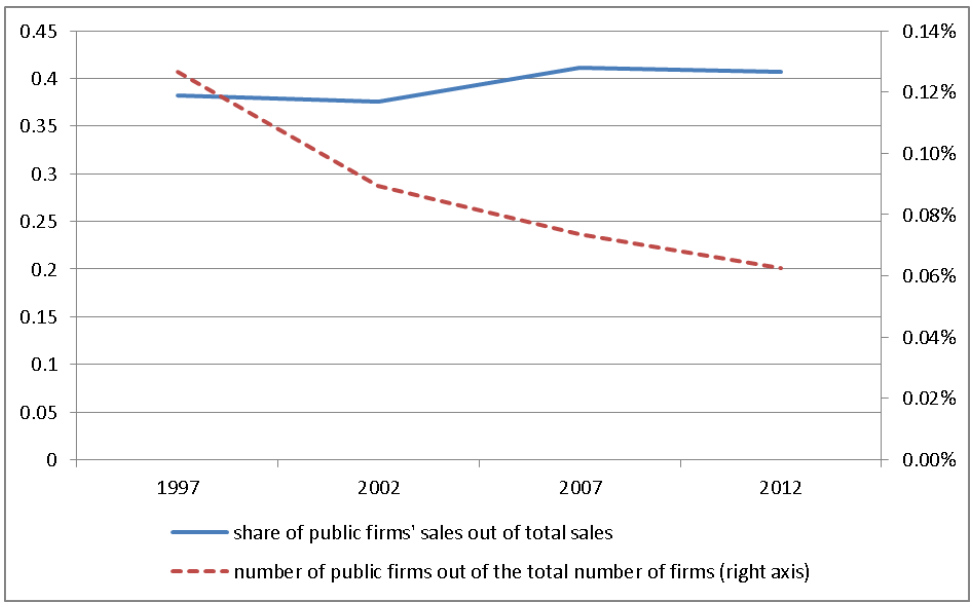


Figure 6
Total Public Firms' Revenues as a Fraction of Public and Private Firms' Revenues

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 Bureau. 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

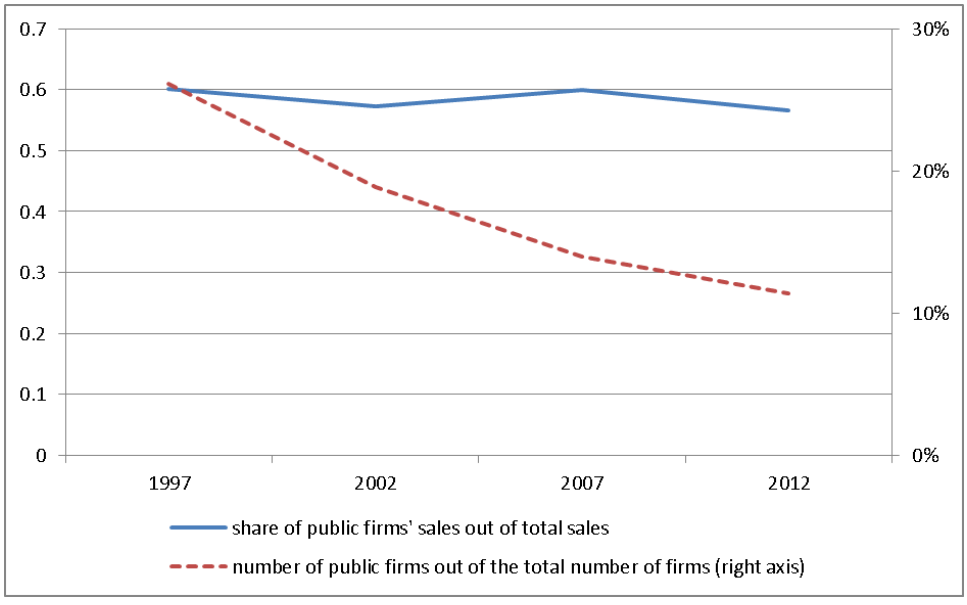


Figure 7
Entries and Exits in Public Markets

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

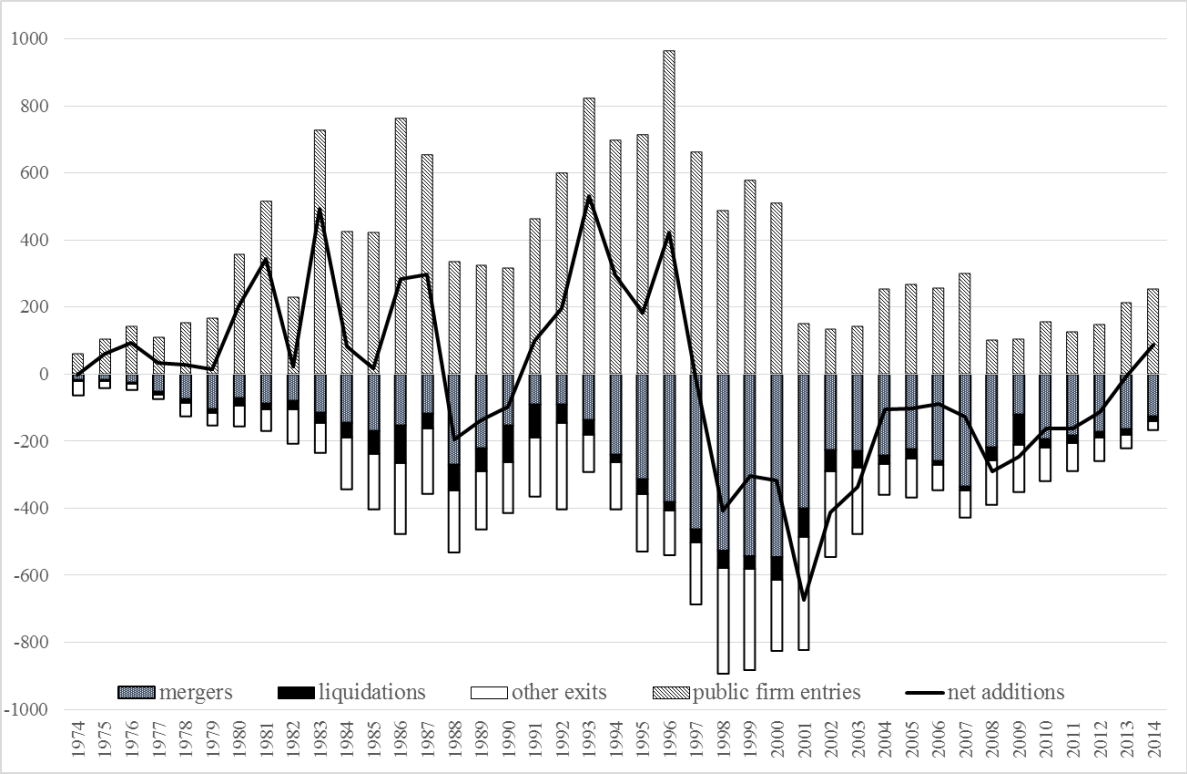


Table 1
Change in the Level of Product Market Concentration and Profitability

This table reports coefficients from regressions of firm profitability on several proxies for the level of product market competition in an industry and other control variables. *ROA* is the operating income before depreciation scaled by the book value of assets. *Assets* is the book value of total assets. *Age* is the time (in years) from the firm's CRSP listing date. *Number of Firms* is the total number of public firms in an industry. *HHI* is the Herfindahl-Hirschman Index at the NAICS 3-digit level using sales data from Compustat. *Concentration Index* is the sum of the annual rank of the HHI and the annual inverse rank of the total number of industry incumbents. Industry is defined using a firm's three-digit NAICS code. Standard errors (reported in parentheses) are clustered at the firm level. Symbols [a], [b], and [c] indicate significance at 1%, 5%, and 10%, respectively.

Panel A: Entire Sample

	Dependent Variable: *ROA*		
	1972-2014		
Constant	-0.0097	-0.0490[a]	-0.0294[a]
	(0.0072)	(0.0112)	(0.0050)
Log(*Assets*)	0.0390[a]	0.0388[a]	0.0389[a]
	(0.0014)	(0.0014)	(0.0014)
Log(*Age*)	-0.0146[a]	-0.0148[a]	-0.0149[a]
	(0.0013)	(0.0013)	(0.0012)
Log(*Number of Firms*)	-0.0059[a]		
	(0.0015)		
Log(*HHI*)		0.0024[c]	
		(0.0014)	
Concentration Index			0.0013[a]
			(0.0005)
N	194,604	194,572	194,572
Adjusted R^2	66.79%	66.78%	66.78%
Year Fixed Effects	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes
Clustering at Firm Level	Yes	Yes	Yes

Panel B: Sub-Periods

	Dependent Variable: *ROA*								
	1972-1986			1987-2000			2001-2014		
Constant	0.0506[a]	0.0738[a]	0.0493[a]	-0.1251[a]	-0.1425[a]	-0.1216[a]	-0.2011[a]	-0.3850[a]	-0.2424[a]
	(0.0127)	(0.0100)	(0.0100)	(0.0170)	(0.0213)	(0.0111)	(0.0251)	(0.304)	(0.0205)
Log(*Assets*)	0.0242[a]	0.0242[a]	0.0241[a]	0.0532[a]	0.0532[a]	0.0532[a]	0.0569[a]	0.0566[a]	0.0570[a]
	(0.0029)	(0.0029)	(0.0029)	(0.0025)	(0.0025)	(0.0025)	(0.0032)	(0.0032)	(0.0032)
Log(*Age*)	-0.0224[a]	-0.0225[a]	-0.0225[a]	-0.0309[a]	-0.0309[a]	-0.0309[a]	0.0036	0.0033	0.0025
	(0.0020)	(0.0020)	(0.0020)	(0.0024)	(0.0024)	(0.0024)	(0.0030)	(0.0030)	(0.0030)
Log(*Number of Firms*)	0.0004			-0.0008			-0.0169[a]		
	(0.0022)			(0.0030)			(0.0034)		
Log(*HHI*)		-0.0032			0.0020			0.0151[a]	
		(0.0024)			(0.0027)			(0.0036)	
Concentration Index			-0.0017[b]			0.0015[c]			0.0077[a]
			(0.0009)			(0.0009)			(0.0013)
N	57,567	57,566	57,566	76,785	76,754	76,754	60,252	60,252	60,252
Adjusted R^2	67.02%	67.02%	67.03%	69.35%	69.36%	69.36%	75.47%	75.45%	75.48%
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clustering at Firm Level	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 2
Change in the Level of Product Market Concentration, Profit Margins and Efficiency

This table reports coefficients from regressions of profit margins and efficiency measures on several proxies for the level of product market competition in an industry and other control variables. *Lerner index* is the operating income before depreciation minus depreciation scaled by total sales. *Asset utilization* is defined as total sales scaled by total assets. *Assets* is the book value of total assets. *Age* is the time (in years) from the firm's CRSP listing date. *Number of Firms* is the total number of public firms in an industry. *HHI* is the Herfindahl-Hirschman Index at the NAICS 3-digit level using sales data from Compustat. *Concentration Index* is the sum of the annual rank of the HHI and the annual inverse rank of the total number of industry incumbents. Industry is defined using a firm's three-digit NAICS code. Standard errors (reported in parentheses) are clustered at the firm level. Symbols [a], [b], and [c] indicate significance at 1%, 5%, and 10%, respectively.

Panel A: 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

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. 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	0.1375[a]	0.0107	0.0711[a]	0.1416[a]	0.0572	0.0429[c]	0.2229[b]	-0.0981	0.0458[b]
	(0.0431)	(0.0479)	(0.0160)	(0.0482)	(0.0654)	(0.0229)	(0.0873)	(0.0717)	(0.0216)
Log(*Number of Firms*)	-0.0137[c]			-0.0215[b]			-0.0314[b]		
	(0.0077)			(0.0088)			(0.0150)		
Log(*HHI*)		0.0083			-0.0025			0.0231[b]	
		(0.0071)			(0.0083)			(0.0119)	
Concentration Index			0.0477[c]			0.0399			-0.0143
			(0.0277)			(0.0325)			(0.0609)
N	3,100	3,100	3,100	1,811	1,811	1,811	1,289	1,289	1,289
Adjusted R^2	7.34%	7.32%	7.30%	11.24%	10.88%	10.95%	4.36%	4.38%	4.23%
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Deal Characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clustering at Industry Level	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

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

The table presents results of regressing CARs around merger announcements on several proxies for the level of product market competition in an industry as well as bidder-target relatedness, and other control variables. *Related* is a dummy variable that takes on a value of 1 if the bidder and the target belong to the same NAICS 3-digit industry, and zero otherwise. See Table 3 for the description of the sample and variables construction. 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 5
Change in the Level of Product Market Concentration and the Cross-Section of Stock Returns

This table reports alphas for portfolios sorted by the relative change in the number of firms in an industry from year t-2 to year t-1. Portfolio 1 (Low) contains the 10 industries with the smallest relative change in the number of firms, Portfolio 3 (High) contains the 10 industries with the largest relative change in the number of firms, and Portfolio 2 contains the rest of the industries. To calculate returns on year t, we first calculate equally-weighted and value-weighted returns by industry. After these industries are assigned to one of the three portfolios based on the relative change in the number of firms, we calculate equally-weighted industry returns for each portfolio. For value-weighted returns, we aggregate the market value of equity of all firms within an industry and calculate value-weighted industry returns for each of the three portfolios. Using this portfolio formation, we calculate monthly equally-weighted and value-weighted returns from July of year t to June of year t+1. Symbols [a], [b], and [c] indicate significant differences between the high and low portfolios at 1%, 5%, and 10%, respectively.

Panel A: 1972-2014

	Difference in Returns between High and Low Concentration Portfolios		
	Number of Firms	HHI	Concentration Index
CAPM			
Equally-Weighted Portfolios	0.0033	0.0028	0.0011
	1.3356	0.9746	0.5348
Value-Weighted Portfolios	0.0038[c]	0.0038[c]	-0.0003
	1.8235	1.9309	-0.1901
Fama-French 3 Factors			
Equally-Weighted Portfolios	0.0027	0.0034	0.0011
	1.0730	1.1655	0.5120
Value-Weighted Portfolios	0.0018	0.0035[c]	-0.0016
	0.8992	1.7150	-0.8960
Fama-French 6 Factors			
Equally-Weighted Portfolios	0.0012	0.0035	0.0002
	0.4734	1.1445	0.0898
Value-Weighted Portfolios	-0.0014	0.0013	-0.0039[b]
	-0.6832	0.6312	-2.1964

Panel B: 1972-1986

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

Panel C: 1987-2000

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

Panel D: 2001-2014

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

Table 6
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