

The Disappearance of Public Firms and the Changing Nature of U.S. Industries

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Abstract

There has been a systematic decline in the number of publicly-traded firms over the last two decades, and half of the U.S. industries have lost over 50% of their publicly traded peers. The decline has increased industry concentration, as the void left by public firms has not been filled by an increase in the number of private businesses or by greater presence of foreign firms. Furthermore, this phenomenon has significantly changed the nature of public firms. Firms in industries with the largest decline in the number of public firms have generated higher profit margins and abnormal stock returns, and enjoyed better investment opportunities through M&A deals. Overall, our findings suggest that the nature of US product markets has undergone a structural shift that has potentially weakened competition.

Introduction

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

Contrary to these popular beliefs, this paper shows that U.S. industries have become more concentrated since the beginning of the 21st century due to a systematic decline in the number of publicly-traded firms. This decline has been so dramatic, that the number of firms these days is lower than it has been in the early 1970s, when the real gross domestic product in the U.S. was one third of what it is today.

We show that the decline in the number of public firms has not been compensated by other mechanisms that could reduce market concentration. First, private firms did not replace public firms: The aggregate number of both public and private firms in the economy has also decreased over time, so that the growth in the number of private firms did not offset the declining trend in the number of public firms.

Second, we examine whether the intensified foreign competition could provide an alternative source of rivalry to domestic firms. We find that the share of imports out of the total revenues by U.S. public firms has remained flat since 2000. This finding indicates that public firms have been expanding at a similar rate as import growth, successfully weathering foreign competition, and maintaining their concentrated presence in the U.S. markets.

Third, we show that the decrease in the number of public firms has been a general pattern that has affected over 90% of U.S. industries. The magnitude of the changes has been dramatic, as half of the industries have lost over 50% of their publicly traded peers. Furthermore, the decrease in the number of public firms has not been driven by distressed industries, or entire business niches that have disappeared due to technological innovations or changes in consumer preferences.

We show that the decline and increased concentration have been associated with meaningful changes in the corporate share of profits, and the reduction in the number of firms has had implications to both corporate and asset pricing aspects of the remaining firms' performance. Specifically, we find strong association between the reduction in the number of public firms and the remaining firms' profitability, stock returns, and investment opportunities as captured by M&A gains.

We start by examining firm profitability, and find that the return on assets of U.S. public firms has significantly increased over the past two decades, especially in industries with a higher decline in the number of public firms. To arrive at this conclusion, we regress firm-level returns on assets (ROA) on the number of firms in the industry, including firm characteristics and firm fixed effects, and find that the number of firms in the industry is negatively correlated with profitability. When we decompose return on assets into asset utilization (or sales to assets ratio) and operating profit margins, we find that the higher return on assets are mainly driven by the firms' ability to extract higher profit margins, while there is no relation between the number of industry incumbents and asset utilization. The abnormal profits that firms are able to extract are consistent with higher market power and potential change in the nature of the U.S. industries.

We also find evidence that the returns to investors of the public firms increase with higher market concentration. To examine the changes to investor welfare, we look at the performance of portfolios sorted on the change in the number of firms in their respective industries. Specifically, we construct a trading strategy of buying firms in industries with the largest decline in the number of firms, and shorting firms in industries with the largest increase in the number of public firms. We find that over the period of 2001-2013, this strategy generates excess returns of 8.52% per year, after controlling for the standard risk factors. Thus, the higher profit margins that the firms in concentrated markets enjoy are transferred to shareholders. Although one could argue that these excess returns are a compensation for bearing extra systematic risk (Bustamante and Donangelo (2014)), we find that firms operating in concentrated markets tend to be less sensitive to macroeconomic shocks than other firms.

Finally, we show that the higher profitability of firms in more concentrated markets has important implications to their investment activity. The number of M&A deals, especially those involving private targets, has increased over time, consistent with the notion that while there are fewer public firms, they have been acquiring other firms at higher rates. Perhaps even more importantly, we find that mergers have become more profitable to shareholders in general, and even more so in concentrated industries. Specifically, cumulative abnormal returns during M&A announcements have increased from 2.3% in the 1980s to 3.3% in the 2000s, consistent with the overall trend of higher profit margins that can be extracted by firms. Further, the market reaction is higher in industries with fewer participants, suggesting that market power is becoming an important source of value during M&A transactions.

We also consider potential explanations to the changes in the number of public firms, as well as their corporate implications. Most importantly, if markets are contestable, a reduction in

the number of industry rivals should have a negligible effect on the profitability of the remaining firms as the threat from new entrants keeps markets competitive. Yet, we find evidence that profit margins increase in most industries. One possible explanation of these results is that markets are becoming more concentrated due to greater barriers to entry, driven by changes in technology. Henderson and Cockburn (1996) and Ciftci and Cready (2011) show that technological advances benefit from the economy of scale. Given the increased contribution of computer-related technology and innovative property to the growth in output in the past two decades (Corrado and Hulton (2010)), the recent technological advances could have created barriers of entry to new firms.

To summarize, the trend of increased competition across U.S. industries has reversed in the past two decades. Markets have become more concentrated, and profit margins have increased proportionally to the increase in the industry concentration. Further, our evidence suggests that the increased profit margins are not driven by increases in operational efficiency, but rather by higher operating margins, perhaps due to greater market power. Consistent with this notion, we find that higher market concentration has resulted in more profitable investment opportunities, as the market reaction to M&A announcements has become more positive, especially across horizontal deals. Taken together, these findings suggest that product markets have undergone a structural change that significantly transformed the nature of competition.

The paper is organized as follows. Section I describes the sample selection procedure and documents the systematic decline in the number of public firms and the increase in economy-wide concentration levels. Section II examines whether the disappearance of public firms over the last two decades can be explained by the increasing role of private firms and/or foreign competition. In Section III we investigate the economic consequences of the increasing

levels of concentration in U.S. industries. Section IV examines whether market power considerations are becoming an important source of value during M&A transactions. In Section V we explore several alternative explanations for the increase in concentration of U.S. industries. Section VI concludes the paper with several policy recommendations.

I. Decrease in the number of public firms and competition

I.A. Data

Our main sample consists of all firms on the CRSP-Compustat merged dataset over the period of 1972-2013. We limit our analysis to firms incorporated in the U.S. that trade on major stock exchanges (NYSE, AMEX, and NASDAQ), and have information on their ordinary common shares traded.¹ Otherwise, we do not apply any additional filters, and include financial firms as well as utilities.

Throughout the paper, we use NAICS classification to define a firm's industry. Relying on NAICS, rather than SIC, provides several advantages.² First, NAICS codes have a greater level of detail about a firm's activity than SIC, so that NAICS has twice the number of aggregate industry groupings as SIC. Second, NAICS codes are based on a consistent, economic concept, and group together establishments that use the same or similar production processes. Under the SIC system, some establishments are classified according to production processes, but others are classified using different criteria, such as class of customer, which creates inconsistent groupings across firms. Finally, since all government agencies have switched to NAICS classification by the year of 2003, using NAICS industry code system allows for an easier merge between the Compustat-CRSP data on one side, and economic indicators, provided by the US Census Bureau,

¹ For robustness, we repeat the analysis including firms incorporated outside of U.S., as well as ADRs. The pattern of the change in the number of firms and HHI is similar to the one presented here, but is of a smaller magnitude.

² The detailed information on NAICS industry classification system can be obtained on the Bureau of Labor Statistics website at <http://www.bls.gov/ces/cesnaics.htm>.

and Bureau of Labor Statistics, on the other. Using SIC codes, however, does not qualitatively affect any of our results.

1.B. General Trend

Figure 1 shows the trend in the overall number of publicly-traded firms over time, as well as the trend in the Herfindahl-Hirschman (HHI) concentration index. To construct the HHI index, within every NAICS 3-digit industry-year we sum up the squared ratios of firm sales to the total industry sales. Following the approach by 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 aggregate across firms in every year.

This figure shows that the number of public firms steadily increased during the first part of the sample (1972-1997). The concentration ratio, on the other hand, increased in the 1970s, but then declined in the 1980s, perhaps as a result of the deregulation wave (Borenstein, 1992; Winston, 1998; Strahan, 2003). More strikingly, in the later period there has been a sharp drop in the number of firms, from 6,797 in 1997 to 3,485 in 2013. The decrease in the number of firms has been so substantial that the current number of publicly traded firms in the economy is similar to its level in mid 1970s, when the real gross domestic product was one third of what it is today. The HHI increased in tandem with the drop in the number of firms, indicating higher concentration. While some of the increase in the concentration ratio is negatively associated with a higher number of firms by the nature of the index construction, the evidence from the 1970s and 1980s indicates that the number of public firms does not always proxy for industry concentration. Thus, during the 1976-1996 period the correlation between the number of firms and the HHI was only -0.25, and for a large part of the period both metrics were moving in the same direction. Yet, during the second half of the sample the correlation between these two

variables has strengthened to -0.91. The significant change in correlation between the two periods suggests that our evidence is more than a simple mechanical relation, and points to a structural change in the nature of market competition.

Next, we explore the prevalence of the decline in the number of public firms across industries. We calculate the percentage change in the number of firms and the HHI index in each industry during the 1997-2013 period, and summarize the results in Figure 2. Figure 2-A shows that the decrease in the number of firms is a general pattern, as 70 out of 75 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 half of the industries have lost over 50% of their publicly traded peers. A similar trend, pointing to a decline in competition, emerges from Figure 2-B. It shows that the change in industry concentration (measured by the HHI index) has been increasing, and the magnitude of the change is primarily concentrated in the extreme range of the spectrum.

In Figure 2-C we further examine the robustness of the trend using a different definition of industry concentration, and use the concentration index provided by the U.S. Bureau of Census. This measure includes revenues by public and private firms, but is based on the 50 largest firms in each industry, and is limited to manufacturing industries. Since Ali, Klasa, and Yeung (2009) demonstrate that Compustat and Census-based concentration ratios have low correlation and may lead to opposite conclusions, we want to ensure that the increase in concentration is not sensitive to the choice of concentration measure. We examine the changes

in concentration ratios over the period of 1997-2007, and find that trend of increased concentration remains robust to including the share of sales generated by private firms.³

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

I.C. The Sources of Change in the Number of Public Firms

After demonstrating that the number of public firms has been declining over the past two decades, we examine the potential sources of this decline. Gao, Ritter, and Zhu (2013) and Doidge, Karolyi and Stulz (2013) document a dramatic decline in the number of IPOs starting from 2000. However, it is unclear whether the decrease in IPOs can account for the entire extent of the reduction in the number of public firms. For example, a potential decline in growth opportunities could reduce the incentives of some firms to go public, but at the same time, discourage the other ones from expanding through M&As, thus keeping the overall level of firms in the economy unchanged.

To understand which component of entry and exit is responsible for the overall decline, we examine firms' entries and exits, as reported in CRSP. Since most additions in the 1970-1974 period were driven by the introduction of NASDAQ, we perform the analysis of this subsection starting from 1975. 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

³ This concentration ratio is available at a 5-year intervals, for calendar years that end in 2 or 7 (Economic Census years), when Census conducts more comprehensive data collection. The Bureau of Census has not yet released information for the year 2012.

process, or a spin-off from another firm.⁴ 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, when a firm is unable to sustain its publicly traded status due to a poor financial performance.

Figure 3 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. However, the decline in IPOs is not the only mechanism behind the disappearance of public firms. The level of M&A activity starting from 2000 has also remained stable. In fact, this source of firm exits is sufficiently high on its own to offset all the entries into the public market during the same period. This contrasts with the trend during the 1980s and most of the 1990s, in which the rate of firm entries into the market was almost twice as high as the rate of mergers.

To further analyze the time-series changes in M&A activity, Figure 4 shows all the deals completed by U.S. public firms over the period of 1980-2013. Notably, the last two decades

⁴ Additional cases of a new firm entry include cross-listings of domestic firms, listings by foreign firms, and mergers. We exclude cross-listing events from our sample, as we are interested in the first time the company becomes public, rather than the number of exchanges it trades on. We also limit our sample to US-based firms, so that foreign listings are also excluded. Another reason for a firm appearance in CRSP is as a result of a merger deal, when the newly consolidated firm receives a new PERMNO, and both the bidder and the target exit the sample. Although this recording method reduces the precision of a firm entry classification, it does not bear a systematic effect on the differences between entries and exits, as it increases the level of both. In addition, in unreported results we find that our time-series of CRSP-based entries has a 0.63 correlation with the time-series IPO activity (as reported on Jay Ritter's website at <http://bear.warrington.ufl.edu/ritter/ipodata.htm>), suggesting that it captures the time-series trend fairly well.

have been characterized by much higher rates of mergers than the 1980s and early 1990s, with the change being especially pronounced across private target deals. This trend offers two interesting insights. First of all, it suggests that many private firms choose to become a subsidiary of a public firm, rather than continue operating as an independent and potentially publicly- traded entity. Second, it suggests that the overall reduction in the number of public firms does not seem to be an outcome of the lack of growth opportunities in the market, as firms' growth through acquisition has remained relatively high. This further supports the idea that the reduction in the number of public firms is driven by structural changes in the nature of product markets, rather than a temporary decline in economic conditions.

To summarize, a number of mechanisms are responsible for the decline in the number of public firms. Specifically, the trend has been driven not just by declining IPOs, but also by a relatively stable level of M&As. Finally, it is important to note that firms do not exit the public markets due to liquidation or involuntary delisting. Figure 3 illustrates that the number of exits due to liquidation, as well as involuntary delisting (other exists) has remained low, even after accounting for the 2007-2009 recession. As will be elaborated in the next section, this finding suggests that the decline in the number of firms is not driven by higher rates of bankruptcy and/or financial distress.

II. Alternative Explanations

The evidence summarized in previous section reveals a significant decrease in the number of public firms and a corresponding increase in the HHI index, indicating that product markets have become more concentrated. In this section we explore alternative explanations to this phenomenon, and ask whether other mechanisms have helped sustain low levels of market concentration despite a decline in the number of public firms.

II.A. Substitution by Private Firms

It is possible that decline in the number of public firms is driven by the increasing importance of private firms, especially after the approval of Sarbanes-Oxley in 2002, which significantly increased the cost of being a public entity. To explore this idea, we obtain data from the Statistics of U.S. Business database, which is managed by the U.S. Census Bureau. This database provides information on the total number of firms in each industry (including public and private), the number of establishments (which are the operating units that firms own), and information on labor characteristics, such as employment and total annual pay. From the same source we obtain data on total revenues of firms, which, similarly to the concentration ratio, is only available at five-year intervals.

Before 1998 all indicators have been reported by Census using SIC classification, and after that using NAICS classification, which has also undergone revisions in 2002 and 2007. To combine these data into one time-series, we map the SIC industries into the corresponding NAICS codes. We also map across different definitions of NAICS, as those changed over time.⁵ While in many cases the mapping is one-to-one, there are some instances in which one NAICS industry corresponds to several SIC codes, and vice versa. We deal with those cases in the following way. When one NAICS correspond to several SIC codes, we aggregate the data across all the SIC codes that correspond to the NAICS industry. If one SIC code corresponds to several NAICS codes, we divide the SIC-level information by the number of NAICS that belong to this SIC, and assign the resulting number to each NAICS code. We apply a similar approach when mapping across different NAICS classifications. To ensure that our findings are not driven by the assumptions made throughout the mapping process, we exclude all the industries where the

⁵ The historical data of US businesses are obtained at https://www.census.gov/econ/susb/historical_data.html, and the tables of industry concordances at <https://www.census.gov/eos/www/naics/concordances/concordances.html>.

absolute change in the number of firms compared to the previous year has exceeded 30% in years of industry reclassification (that is, 1998, 2002, and 2007), attributing those changes to imperfect mapping. Finally, we restrict our analysis to industries that have existed throughout the entire period of 1992-2011.⁶

Panel A of Table 1 shows the 5-year changes (4-year change in the case of the 2007-2011 period) in the overall number of firms over time. As evident from both the mean and the median, there has been an overall decrease in the number of firms starting from 1997. The magnitude of this change is smaller than the change in the number of public firms, but is still negative, indicating that the increase in the number of private firms has not been sufficiently large to compensate for the decrease in the number of public firms. While the largest drop of 8.1% corresponds to the recession period, the change in the number of firms has been negative throughout the earlier period as well, when the economy was expanding. The last column shows that the negative change has been a widespread pattern, so our results are not driven by few industries.

II.B. Distressed Industries

In this sub-section we examine whether the change in the number of public firms is driven by distressed industries. Changes in consumer tastes along with technological changes (e.g., advances in computers and telecommunications) have made some industries obsolete. Therefore, the reduction in the number of firms could be driven by industries that are shrinking due to a declining demand for their products.

To test this hypothesis, we examine the performance indicators of all public and private firms, as reported by the Bureau of Census, and calculate the growth rates of sales, number of

⁶ The Census Bureau has not yet released information for years 2012 and 2013.

units under a firm's ownership (establishments), as well as employment, over the past two decades. Panels B through E of Table 1 show that the mean and median growth rates of all indicators have been positive. Thus, while there are fewer firms in the economy, they have become larger, as indicated by higher sales, expanding labor force, and a larger number of operating units. The only exception to this trend is the last period, which captures the recession of 2007-2009.⁷

The decomposition of exit reasons by public firms (Figure 3) further confirms that liquidation and involuntary listings are not the reason behind the decline in the number of public firms. In fact, the level of delisting cases due to those reasons has decreased over time. Taken together, our results are the opposite of what we would expect to find if the decline in the number of public firms were driven by distressed or declining industries. In contrast, they suggest that the remaining firms are doing well and expanding at a persistent and positive rate.

II.C. Substitution by Foreign Firms

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

We investigate this issue by analyzing U.S. imports over time. While the share of aggregate import volume out of the overall GDP has been steadily increasing, it does not necessarily point to lower concentration of U.S. public firms in product markets. First, the increase in imports could be pronounced in sectors with historically low presence of public firms

⁷ In an untabulated analysis, we find that asset and sales growth among publicly-traded firms has been higher in concentrated industries.

(such as agriculture, for example), so that the overall increase in imports could be irrelevant for many public firms. Second, the level of GDP is a poor proxy for the revenues of public firms, as it includes production by all types of business enterprises, as well as the public sector.

To directly evaluate the impact of foreign competition on U.S. publicly-traded firms, we examine imports at the industry level, and look at the proportion of sales by foreign firms to sales by domestic public corporations. Specifically, we scale the overall import volume by the total revenues of publicly traded firms, and examine the change in this ratio over time. We obtain the information on U.S. International Trade Data from the public releases of the U.S. Census Bureau.⁸ We sum up the revenues of public firms for every NAICS 3-digit level industry, and calculate the ratio of imports to the total revenue of public firms (industries with no exports data as well as industries with no presence of public firms are excluded from the analysis).

Figure 5 summarizes the results. In Panel A we use equal weights to aggregate the import ratio across industries, and in Panel B we weigh each industry ratio by the number of public firms, consistent with the analysis in Section I. Both figures show that there has been no significant change in the share of imports out of the total revenues by public firms. While the median import-to-sales ratio slightly increases, the mean ratio does not exhibit any consistent pattern. Similar results are obtained using the firm-weighted methodology, as the pattern remained flat throughout the decade. Overall, these findings indicate that even though the overall share of imports in the U.S. economy has been increasing, public firms have been able to successfully weather the competition.

III. The Economic Implications of the Decline in the Number of Public Firms

⁸ 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.

In this section we test whether the systematic decline in the number of publicly-traded has economic implications, and explore whether it has an effecting on the fundamentals of the remaining firms. To answer this question, we first analyze the relation between profitability and the number of industry incumbents in a panel-data setting, while controlling for other factors that could influence firms' profitability levels. Next, we perform asset-pricing tests to examine whether there is a link between stock returns and the decline in the number of firms.

III.A. Number of Firms and Profitability

If markets are contestable (e.g., no barriers to entry), then even firms operating in highly concentrated industries should behave as if they had many competitors (Baumol (1982)). This implies that profitability should not be affected by the number firms in an industry because the threat of potential entrants would keep markets competitive and drive abnormal profits toward zero.⁹ Alternatively, if there are significant barriers to entry (e.g., economies of scale, technological barriers, large capital requirements, etc.), then firms operating in highly concentrated industries could generate abnormal profits by exercising market power. Under this scenario, one would expect firms' profitability levels to increase as the number of industry participants declines as firms compete against fewer competitors without facing the threat of entry by potential rivals. In this sub-section we test these two hypotheses.

To examine the relation between profitability and the number of firms in an industry, we estimate the parameters of the following model:

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

⁹ 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."

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 $Number\ of\ Firms_{jt}$ is the total number of public firms in industry j at time t . We define industry using a firm's three-digit NAICS code.¹⁰ To control for potential time-series dependence in the residuals, we cluster the standard errors at the firm level. As discussed in Section I, our sample consists of all observations in the Compustat-CRSP dataset over the period 1972-2013.

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. In addition to these advantages, there is evidence from simulation analysis that ROA is superior to other measures of profitability in detecting abnormal operating performance (Barber and Lyon (1996)). Following Bertrand and Mullainathan (2003) and Giroud and Mueller (2010), we include firm size and age in all our regressions to control for the effect of economies of scales and learning on profitability. We also include firm-fixed effects to control for unobserved time-invariant firm-specific characteristics and year-fixed effects to control for unobserved time-specific shocks affecting all firms. To mitigate the effect of outliers, we winsorize ROA at the 1% and the 99% of its empirical distribution.

The first column of Table 2 reports the coefficients of Equation 1 estimated over the period 1972-2013. Consistent with the idea that industries with fewer firms tend to be more profitable, we find that the relation between ROA and the number of industry participants is negative and statistically significant at the 1% level. As for the economic significance, the magnitude of the effect is large; a decline of 10% in the number of firms from the sample median

¹⁰ 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.

leads to an increase in *ROA* of about 16% relative to its median. This result shows that firms tend to generate significantly higher profits when they compete against fewer firms, which is inconsistent with the theory of contestable markets. This table also shows that profitability is positively correlated with firm size, suggesting that economies of scale are an important determinant of firms' profitability.

Section I documents that most of the decline in the number of public firms occurs in the latter part of our sample. Therefore, we test whether the empirical relation between profitability and number of firms has changed over that particular time period. To perform this analysis, we estimate the regression parameters of Equation 1 over three different sub-periods (1972-1986, 1987-2000 and 2001-2013). Columns 2, 3 and 4 of Table 2 report the results from this analysis. Interestingly, we find that the negative relation between *ROA* and the number of firms is only statistically significant over the period 2001-2013. The coefficient of *Number of Firms* in the last column of Table 2 indicates that a decline of 10% in the number of firms from the sample median leads to an increase in *ROA* of about 39% relative to its median. Thus, our analysis indicates that firms operating in industries with few rivals tend to earn significantly higher profits, and points to a significant structural shift over the past decade in the economic relation between industry structure and firm's profitability.

III.B. The Sources of Abnormal Profits

In this sub-section we investigate the sources of abnormal profits in industries with a decreasing number of competitors. One potential explanation for this phenomenon is that increasing barriers to entry are making markets less contestable over time. Thus, the decline in the number of firms could be allowing the remaining firms to enjoy wider profit margins by setting higher prices. Alternatively, the consolidation of firms within an industry could increase

efficiency. For example, a large firm could have more flexibility in reallocating its existing resources in a way that extracts the highest productivity from any unit of capital, consequently increasing firm profitability. To test the validity of these two explanations, we examine whether the negative correlation between profitability and number of firms in an industry stems from higher profits margins, higher operational efficiency, or both.

We start by decomposing return on assets into two components: the *Lerner index* and the *asset utilization* ratio. The *Lerner index* measures the extent to which prices exceed marginal costs (price-cost margins), while the *asset utilization* ratio measures how efficiently firms manage their assets to generate sales. Following Aghion et al. (2005), we define the *Lerner index* as operating income before depreciation (Compustat item OIBDP) minus depreciation (item DP) scaled by total sales (item SALE). We exclude depreciation from operating income to take into account the cost of physical capital (Hall and Jorgenson (1967)).¹¹ *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 3. Panel A shows that over the period 1972-2013 the *Lerner index* is negative correlated with the number of firms in an industry. This empirical relation is not only statistically significant, but also economically significant. The magnitude of the coefficient suggests that a decline of 10% in the number of industry incumbents from the sample median leads to an increase in the *Lerner index* of about 82% relative to its median. Consistent with the findings in the previous sub-section, the last three columns of Table 3 show that the

¹¹ Our main results are qualitatively similar if we use a version of the Lerner index that does not exclude depreciation from operating income.

negative relation between the *Lerner index* and number of industry incumbents is only statistically significant over the period 2001-2013, and the coefficient of the *Number of Firms* estimated over this period is significantly larger than the one estimated over the entire sample.

In Panel B of Table 3 we examine the effect of the number of firms in an industry on operational efficiency. The first column of this table shows that the relation between asset utilization and number and firms is statistically insignificant over the period 1972-2013. In addition to this, the positive sign of the coefficient of the *Number of Firms* cannot explain the negative relation between *ROA* and number of industry incumbents. Although there is some evidence that firms become more efficient as the number of firms declines over the period 2001-2013, the coefficient is economically small.

Overall, our findings in this sub-section indicate that the empirical relation between profitability and number of firms appears to be mainly driven by the negative effect of the number of industry rivals on profit margins. In contrast, there is weak evidence that this empirical relation is driven by improvements in operational efficiency. These results are consistent with the idea that the systematic decline in the number of public firms allows firms to generate abnormal profits by increasing market power, rather than by creating an incentive across firms to enhance the efficiency of their existing assets.

III.C. Number of Firms and the Cross-Section of Stock Returns

Several theoretical models predict that industry concentration could affect the cross-section of stock returns through its impact on systematic risk. Hou and Robinson (2006) argue that because barriers to entry protect firms operating in concentrated industries from non-diversifiable distress risk, these firms should have lower expected returns. More recently, Bustamante and Donangelo (2014) develop a theoretical model in which industry concentration

levels can have two opposing effects on expected returns. On the one hand, low levels of industry concentration can lead to higher expected returns by reducing profit margins, and consequently, exposing firms in these markets to systematic risk. On the other hand, because the investment opportunity set of firms operating in concentrated industries is more sensitive to systematic shocks (most of their value comes from growth opportunities), these firms command higher returns. In this sub-section we test these competing theories by examining the effect of the decline in the number of public firms on expected stock returns.

To investigate this issue, we calculate the relative change in the number of firms in each industry (defined using a firm's three-digit NAICS code) over the period 1972-2012:

$$RelChg_{t-1} = (Number\ of\ Firms_{t-1} / Number\ of\ Firms_{t-2}) - 1 \quad (2)$$

We then sort industries based on the magnitude of the change, and form the three portfolios. The high *RelChg* portfolio contains the top 10 industries, the low *RelChg* portfolio contains the bottom 10 industries, and the middle portfolio the rest of the industries.¹² To calculate returns on year t , we first calculate equally-weighted and value-weighted returns by industry. After these industries are assigned to one of the three portfolios based on the relative change in the number of firms, we calculate equally-weighted industry returns for each portfolio. For value-weighted returns, we aggregate the market value of equity of all firms within an industry and calculate value-weighted industry returns for each of the three portfolios. Using this portfolio formation, we calculate monthly equally-weighted and value-weighted returns from July of year t to June of year $t+1$.

To control for differences in systematic risk across portfolios, we use three different asset-pricing models: CAPM, Fama and French (1993) three-factor model, and Carhart (1997)

¹² Because the relative change may have many ties, we use a dense ranking system, which means that we may have more than 10 industries in the top and bottom portfolios depending on the number of ties.

four-factor model. Table 4 reports the alphas for the three portfolios sorted on the relative change in the number of firms. Panel A shows that the differences in alphas between the high and low *RelChg* portfolios are not statistically different from zero over the period 1972-2013. To investigate whether the relation between changes in competition and stock returns has changed over time, we report in Panels B, C, and D 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 differences in alphas between the high and low *RelChg* portfolios are negative and statistically significant over the period 2001-2013. Even after controlling for Fama-French (1993) three factors and the momentum factor, an investment strategy consisting of buying the low *RelChg* portfolio and shorting the high *RelChg* portfolio generates abnormal returns of about 8.64% per year. These abnormal returns are much larger in magnitude to the ones generated by other important investment strategies. For example, the momentum strategy generated a negative alpha over the period 2001-2013.

One potential explanation for these empirical results is that firms in more concentrated industries command higher expected returns because their investment opportunity set is extremely sensitive to macroeconomic shocks (Bustamante and Donangelo (2014)). To test this hypothesis, 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. Contrary to the predictions of the risky investment opportunities hypothesis, untabulated results show that the low *RelChg* portfolio outperforms the high *RelChg* portfolio over the crisis period. These findings suggest that the alphas documented in this paper are not related to a risk premium, and point to a possible market anomaly in which investors underestimate the effect of industry concentration on stock returns.

IV. The Effect of Competition on the Market Reaction around M&A Announcements

In this section we test whether industry concentration, proxied by the number of firms, affects investors' reaction to mergers and acquisitions announcements. From a theoretical perspective, mergers can create value by improving efficiency (e.g., economies of scale and scope, synergies, elimination of duplicate functions) or by increasing market power. In this section 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 with few rivals. The rationale for this is that, keeping everything else constant, mergers in concentrated markets are more likely to further reduce competition than mergers in competitive markets. This assumption is consistent with the antitrust policies of the Federal Trade Commission and the Department of Justice of mainly investigating mergers in highly-concentrated markets.

To examine this issue, we gather data from the Securities Data Corporation's (SDC) Mergers and Acquisition database. Our sample consists of mergers and acquisitions transactions over the period 1980-2013 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; (iv) acquirer and target firm have different identifiers; (v) the transaction is completed; (vi) return data around the announcement date is available on CRSP; and (vii) offer price is available on SDC.

In our tests, we focus on the change in the combined value of the target and the acquiring firm to gauge the magnitude of the total wealth creation around the merger announcement. For this analysis, we use standard event study methodology to determine the total value created

during these corporate events. Specifically, we calculate the cumulative abnormal return (CAR) of the combined firm over a three-day event window $[-1, 1]$ around the merger announcement:

$$\text{Combined CAR}_{i,t} = \frac{MV_{A,t+1} + MV_{T,t+1}}{MV_{A,t-1} + MV_{T,t-1}} - r_{CRSP,t-1,t+1} \quad (3)$$

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

To examine the effect of the number of firms on cumulative abnormal returns, we estimate the parameters of the following model:

$$\begin{aligned} \text{CAR}_{ijt} = & \alpha_t + \alpha_j + \beta_1 B/M_{T,i,t-1} + \beta_2 B/M_{A,i,t-1} + \beta_3 \log(MV_{T,i,t-1}) + \beta_4 \log(MV_{A,i,t-1}) \\ & + \beta_5 \log(\text{Number of Firms}_{jt-1}) + \varepsilon_{ijt} \end{aligned} \quad (4)$$

where α_t is a year-fixed effect, α_j is an industry-fixed effect, and B/M_T (B/M_A) is the book-to-market ratio of the target (acquiring) firm. Following the definition in Davis, Fama, and French (2000), we define the book-to-market ratio as stockholder's book equity, plus balance sheet deferred taxes and investment tax credit, if available, minus the book value of preferred stock. Further, we cluster the standard errors at the industry level and winsorize the book-to-market ratios at the 1% and the 99% of their empirical distributions.

We include the book-to-market ratios of the target and the acquiring firm as control variables to capture the effect of investment opportunities (Jovanovich and Rousseau (2002)) and/or potential misvaluation (Shleifer and Vishny (2003)) on the wealth effects of mergers. We also include the market values as proxies for firm size to control for the potential economies

of scales generated by the merger, year-fixed effects to control for the impact of merger waves and macroeconomic conditions on announcement returns, and industry-fixed effects to control for time-invariant industry factors.

Table 5 reports the estimated coefficients of Equation 4. Panel A shows the results for the specification using the cumulative abnormal return of the combined firm as dependent variable. Consistent with the idea that M&A transactions in concentrated industries are more likely to benefit from market power considerations, we find that the market reaction of the combined firm around M&A announcements is negatively correlated with the number of firms in the acquirer's industry. That is, our evidence indicates that investors expect synergies to be larger when the acquirer operates in an industry with fewer rivals. As in the case of profitability, the second and third columns show that the relation between *Combined CARs* and the *Number of Firms* is stronger during the post-2000 period.

In Panels B and C of Table 5 we examine the effect of the *Number of Firms* on the cumulative abnormal returns of the target and acquiring firm to determine how the intensity of competition in an industry affects the allocation of synergies between the firms involved in the M&A transaction. The evidence indicates that the number of industry incumbents have a negative effect on acquiring firms and a weak but positive effect on targets. These findings suggest that acquiring firms have stronger negotiating power when they face fewer rivals in their product markets.

The previous results indicate that market power considerations are likely to be an important source of value during M&A transactions. To further investigate this issue, we test whether the effect of the number of firms on announcement returns is stronger when the target and the acquirer are in the same industry (related mergers) than when the target and the acquirer

are in different industries (unrelated mergers). The rationale for this test is that if the impact of the number of firms on expected synergies is mainly driven by the effect of the merger on the competitive landscape of the industry, then the effect should be stronger during related mergers.

To test this hypothesis, we augment Equation 4 by including a dummy variable (*Related*) that is equal to one if the target and the acquiring firm are in the same industry, and an interaction variable equal to the product of *Related* and *Number of Firms*. If market power considerations are driving our results, we should observe a negative coefficient on the interaction variable. Table 6 reports the estimated coefficients from this regression. Further supporting the predictions of the market power hypothesis, our results indicate that the negative relation between *Combined CARs* and the *Number of Firms* comes largely from related mergers. Note that the coefficient on the *Number of Firms* is now statistically insignificant while the coefficient on the interaction variable is negative and statistically significant. Once again, we find that this effect is much stronger over the post-2000 period. Overall, the findings in this section suggest that market power considerations appear to be important source of value during M&A transactions.

V. Forces behind the Consolidation of Industries

After demonstrating that the change in the number of public firms has implications to firm profitability, M&A activity, and asset prices, we turn our discussion to the potential mechanisms behind the consolidation of U.S. industries over the past 20 years. While gauging the channel at work in a causal way is a challenging task, in this section we introduce several potential explanations, which are not mutually exclusive, and provide some supporting evidence.

V.A. Regulatory Changes

Several studies document the importance of regulatory changes in explaining the volume of M&A activity of US firms (Mitchell and Mulherin (1996), Kaplan (2000)). While no new M&A reforms were implemented in the past two decades, the majority of this period overlapped with the presidency of George W. Bush. His view on antitrust laws was that they need “to be applied where there are clear cases of price fixing”, and there should be no other roles for antitrust enforcement (Harty, Shelanski, and Solomon (2012)). Bush’s administration was consistent with his statement, which led to a surge in large unrestrained merger deals.

To evaluate the overall impact of George W. Bush’s administration on merger antitrust enforcement, Table 7 summarizes horizontal merger investigations conducted by the Federal Trade Commission over the period of 1996-2011. First, this table shows the number of Hart-Scott-Rodino (HSR) second requests, which are requests that are usually triggered during transactions that could potentially affect competition. Note that the number of requests has dropped from 281 over the 1996-2003 period to 183 over the 2004-2011 period. The change is even more dramatic when evaluated at a per year basis. Interestingly, the later period includes the first presidency term by Barack Obama, who joined the office in 2009, and emphasized aggressive antitrust enforcement as part of his presidential campaign. Yet, while merger challenge rates increased under President Obama, their rate was only 1.5%, compared to the rates of 0.75% and 0.9% under President Bush.¹³ Moreover, the average number of transactions reported under HSR act during the 2009-2010 period was 941, compared to 1,672 during Bush administration of 2001-2008 (the number are obtained from Figure 3 of Harty, Shelanski, and Solomon (2012)), suggesting that Obama’s presidency did not have as dramatic effect on antitrust policy, as it was anticipated.

¹³ “How antitrust authorities view mergers and acquisitions”, InsideCounsel, March 26, 2013.

Fewer regulatory barriers could have direct implications on the product market competition and the level of industry concentration. First, it increases the overall M&A activity, especially deals between large public firms, which further reduces the number of public firms. Second, low antitrust enforcement allows for mergers with more market power potential, leading to a higher market reaction and wider profit margins.

V.B. Technological Changes

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

Could technological advances, as well as innovation, benefit from economies of scale and firm consolidation? Studies in industrial organization examine this issue by estimating the effects of economies of scale on R&D. Although Schumpeter (1942) proposes that larger firms are better positioned than smaller firms to implement and successfully exploit R&D efforts, the empirical evidence has arrived at mixed conclusions. Yet, several recent papers have presented evidence in favor of the economy of scale hypothesis. Henderson and Cockburn (1996) examine the search productivity in drug discovery and show that larger research efforts in the

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

The benefits of economies of scale could also lead to consolidation of large firms, and exit of the small ones. To examine the validity of this claim, we report in Table 8 results from regressions relating the number of patents granted to publicly traded firms to firm characteristics and the number of firms in the industry. We find that while the relationship between the number of firms in the industry and number of patents granted has been positive in the early period, it has reversed in the last decade, so that now firms in concentrated markets patent more. This result is consistent with the idea that advances in technology have made innovation more resource-consuming, thus essentially creating entry barriers to new firms, and encouraging them to sell their inventions to larger corporations at early stages of development. Overall, this explanation is consistent with the reduction in the number of firms, higher volume of M&A activity, and potentially higher profit margins, if more complex technology also facilitates synergy potential.

VI. Conclusion

Over the last 15 years U.S. stock exchanges have lost almost half of the publicly traded firms. This paper investigates the implications that this sharp decline had on product markets, and finds that it has dramatically increased the level of product market concentration across most industries. We also find that the void left by the disappearing public firms has not been filled by other market participants. Thus, while there has been some increase in the number of private

firm, it was insufficient to offset the decline in the number of public firms. In addition, the remaining firms have been successfully withstanding competition from abroad, as the share of imports out of total sales by publicly traded firms remained flat. Finally, the industries with declining number of public firms do not exhibit any signs of financial or economic distress, and our findings cannot be attributed to changes in consumer tastes or industries that rely on technology that became obsolete.

We show that the decline in the number of firms has implications to firm performance, as it affects profitability, investment, and return to investors. First, the decline in the number of industry incumbents is associated with remaining firms generating higher profits through higher profit margins. Second, firms in industries with a declining number of firms experience significant abnormal stock returns. Finally, mergers in industries with a decreasing number of firms enjoy more positive market reactions, consistent with the idea that market power considerations are becoming a key source of value during these corporate events. Overall, our findings suggest that despite popular beliefs, competition could have been fading over time.

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

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Figure 1
Number of Public Firms and HHI

This chart shows the number of publicly-traded firms, as well as the Herfindahl-Hirschman concentration index (HHI) for all US publicly-traded firms that appear in CRSP and Compustat over the period 1972-2013. 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 overall number of firms in the industry.

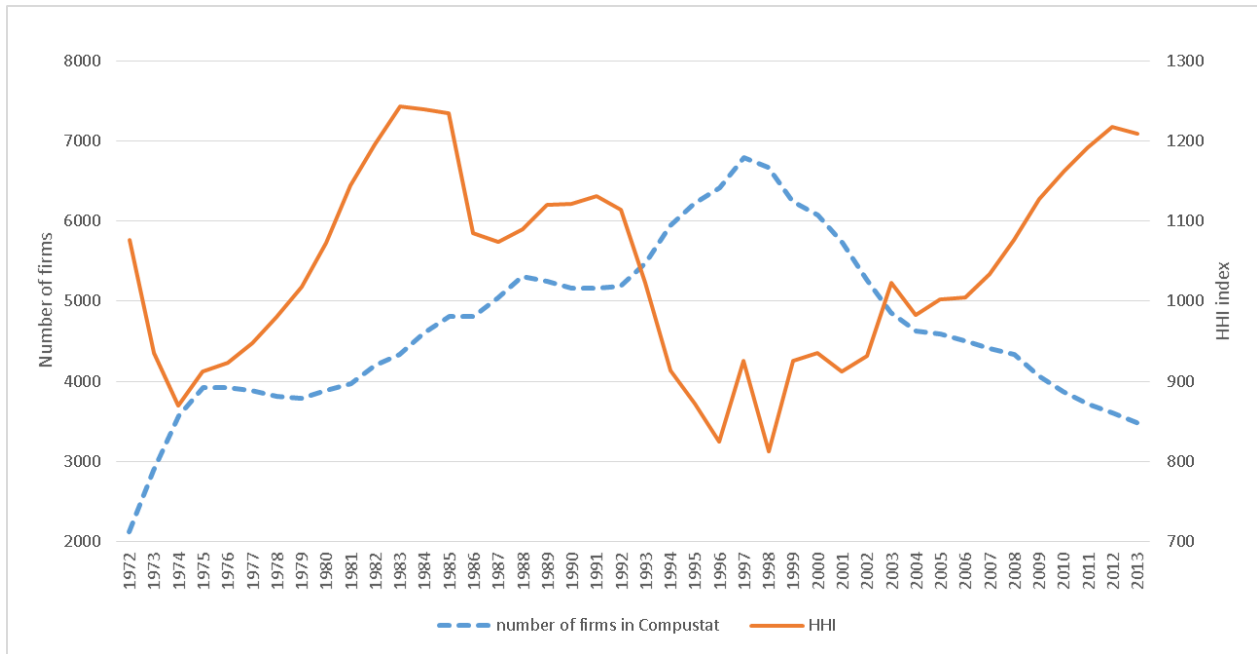


Figure 2
Change in the Number of Firms and HHI Index across Industries

The histogram summarizes industry frequency in a specific range of the percentage change in the number of public firms (Figure A) and HHI Compustat-based index (Figure B). The changes are calculated over the 1997 – 2013 period. Figure C shows the change in Census-based HHI index, calculated over the 1997 – 2007 period. The industries are defined based on NAICS 3-digit classification.

Figure 2-A: Change in the number of firms

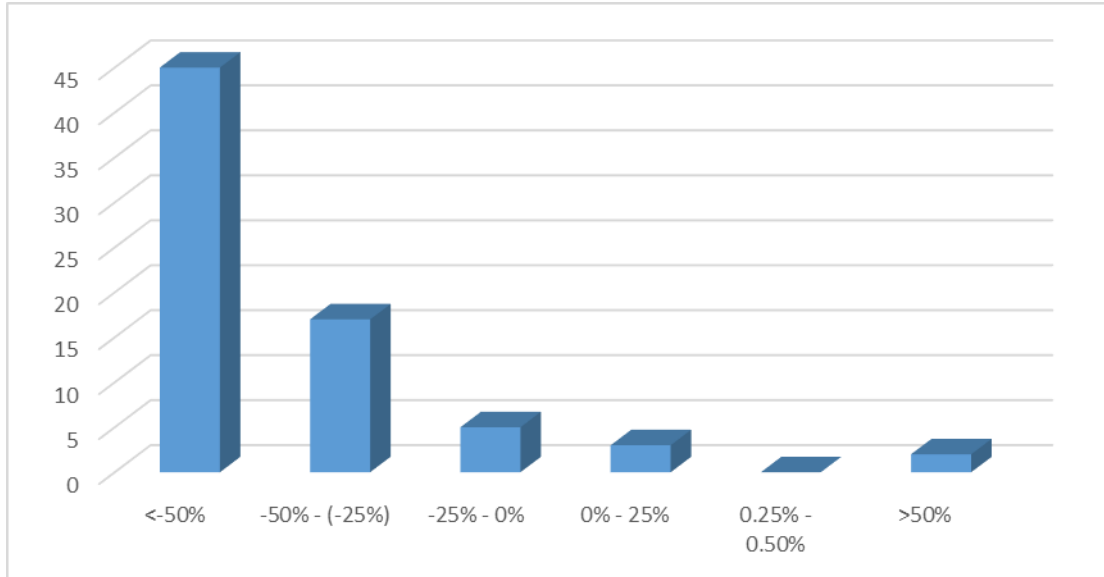


Figure 2-B: Change in the HHI index (Compustat-based)

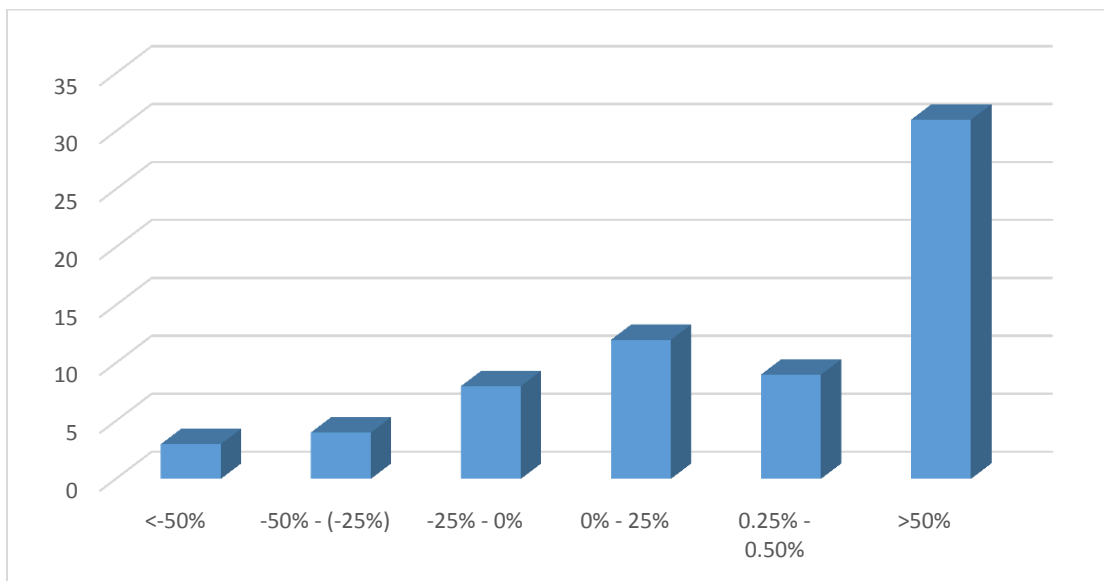


Figure 2-C: Change in the HHI index (Census-based)

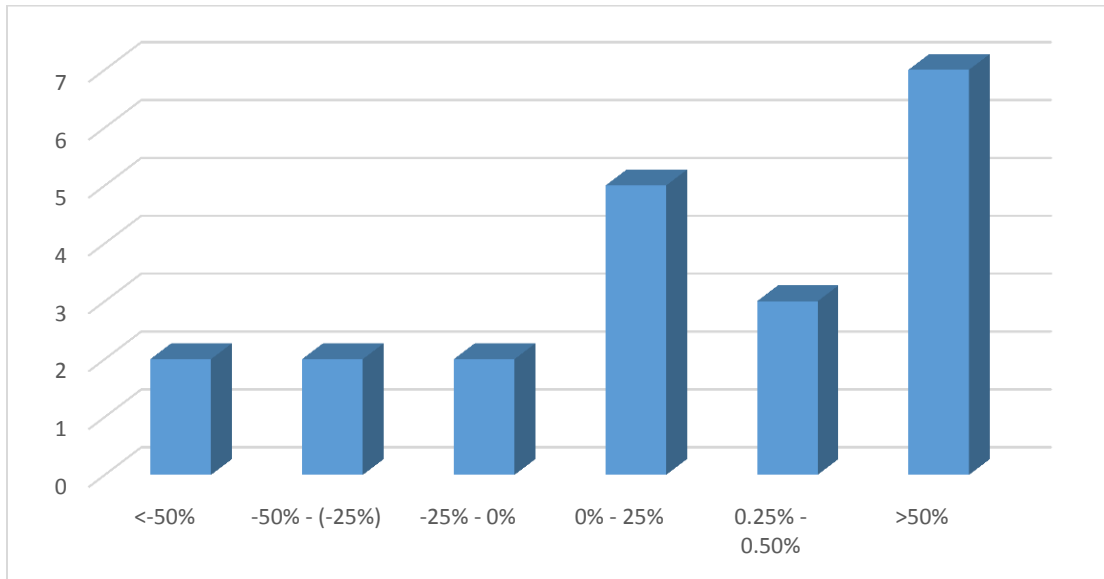


Figure 3
Entries and Exits in Public Markets

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).

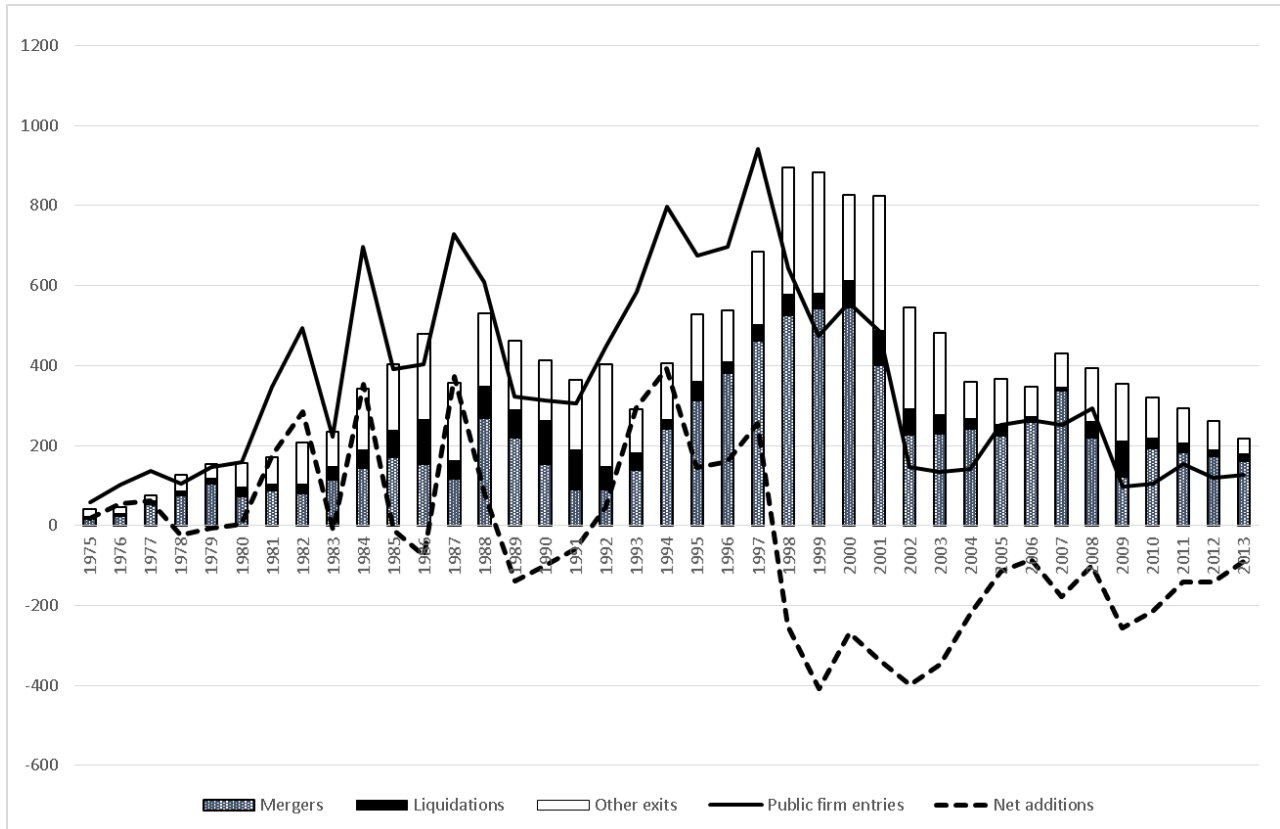


Figure 4
Mergers and Acquisitions by Public Firms

Figure 4 presents all the M&A deals over the period of 1980-2013 where the bidder is a publicly traded U.S. firm, and the target is public or private U.S. firm. The sample includes all completed deals with transaction value of at least \$1 million. We further require that the bidder acquire at least 50% of the target shares, and that the deal is completed within 1,000 days of the announcement.

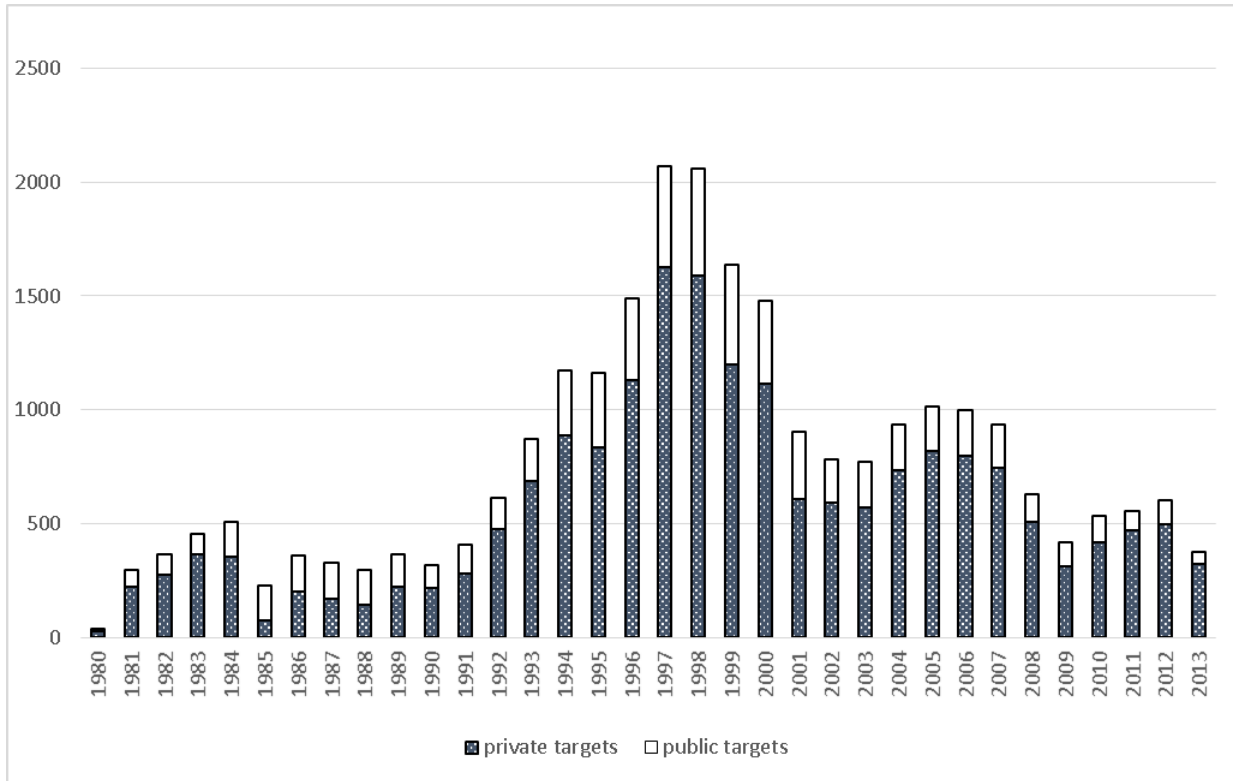


Figure 5 The Share of Imports Out of Total Public Firms' Revenues

This figure shows the ratio of U.S. imports at a NAICS 3-digit industry level to the total sales by public traded firms in that industry. Information on U.S. imports is obtained from the U.S. Census Bureau website. In Figure A we use equal weights to aggregate the ratio across industries in a given year; and Figure B we weigh the industry ratio by the number of public firms in that industry

Figure 5-A: Equally weighted

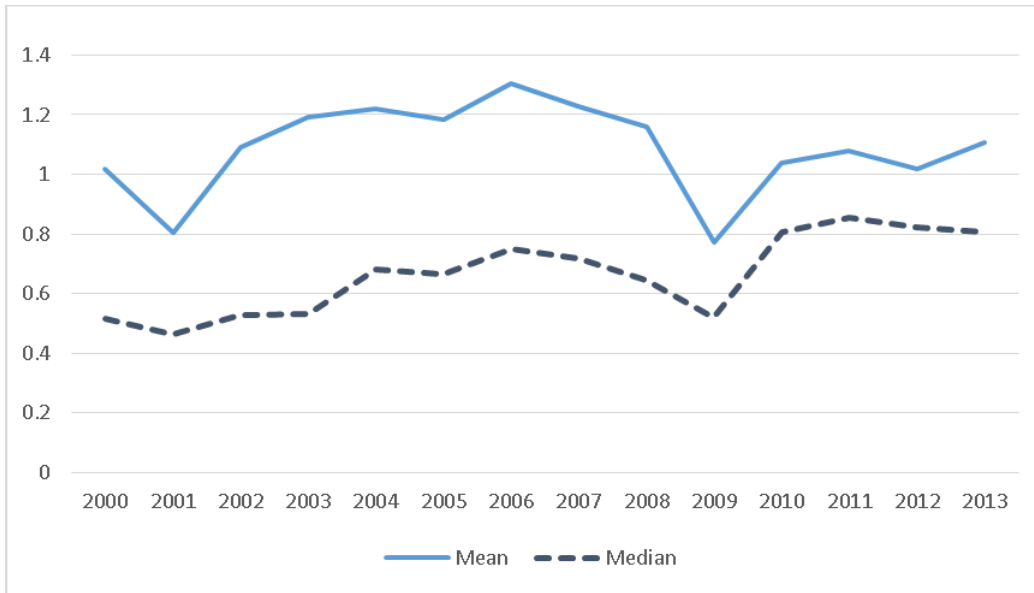


Figure 5-B: Value weighted

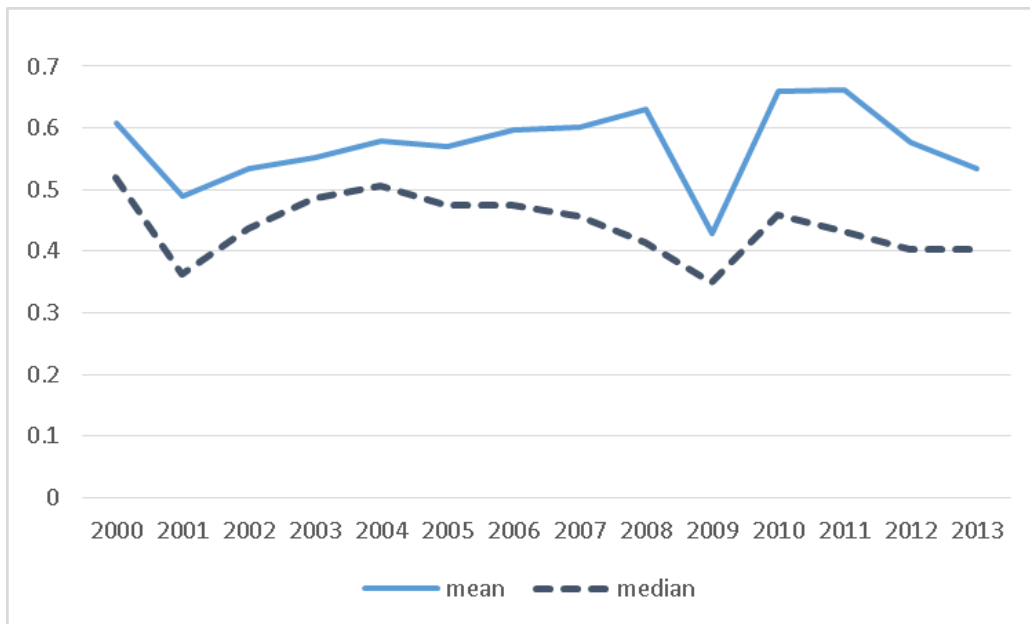


Table 1
Number and performance of U.S. public and private firms

The table shows the summary statistics of the 5-year changes (4-year change in the case of the 2007-2011 period) in economic indicators of U.S. businesses, as reported by the U.S. Census Bureau, across NAICS 3-digit industries. Panel A reports the overall number of public and private firms. Panel B shows the number of establishments, or firm units (defined as a single physical location where business is conducted); and Panel C shows the changes in employment (which consists of full and part-time employees). Panel D presents the annual pay, which includes all forms of direct compensation (salaries, wages, bonuses, etc.), and Panel E shows the total revenues.

Panel A: Number of firms						
period over which the change is calculated	N	Mean	Median	25th Pctl	75th Pctl	% of industries with negative change
1997 vs. 1992	48	12.6%	7.9%	-0.4%	23.0%	27.1%
2002 vs. 1997	48	-2.0%	0.3%	-14.1%	9.7%	51.0%
2007 vs. 2002	49	-0.7%	-1.2%	-6.6%	5.0%	53.1%
2011 vs. 2007	49	-8.1%	-8.6%	-13.7%	-2.0%	83.7%

Panel B: Number of establishments						
period over which the change is calculated	N	Mean	Median	25th Pctl	75th Pctl	% of industries with negative change
1997 vs. 1992	48	12.1%	9.2%	0.2%	18.3%	22.9%
2002 vs. 1997	48	3.0%	6.1%	-11.1%	12.7%	40.8%
2007 vs. 2002	49	0.8%	1.4%	-3.0%	5.6%	40.8%
2011 vs. 2007	49	-5.2%	-5.3%	-11.8%	0.3%	73.5%

Panel C: Employment						
period over which the change is calculated	N	Mean	Median	25th Pctl	75th Pctl	% of industries with negative change
1997 vs. 1992	48	11.4%	11.3%	2.0%	20.2%	22.9%
2002 vs. 1997	48	2.1%	3.4%	-9.3%	14.2%	40.8%
2007 vs. 2002	49	2.1%	2.4%	-2.5%	8.2%	46.9%
2011 vs. 2007	49	-9.4%	-8.1%	-15.4%	-3.1%	79.6%

Panel D: Annual pay						
period over which the change is calculated	N	Mean	Median	25th Pctl	75th Pctl	% of industries with negative change
1997 vs. 1992	48	30.6%	32.6%	17.7%	42.8%	6.3%
2002 vs. 1997	48	22.8%	22.0%	5.3%	38.7%	20.4%
2007 vs. 2002	49	20.6%	21.3%	10.0%	31.8%	10.2%
2011 vs. 2007	49	0.2%	2.0%	-7.3%	7.7%	46.9%

Panel E: Revenues						
period over which the change is calculated	N	Mean	Median	25th Pctl	75th Pctl	% of industries with negative change
1997 vs. 1992	48	33.9%	34.2%	21.0%	45.3%	2.1%
2002 vs. 1997	48	20.7%	18.7%	-2.6%	40.3%	30.6%
2007 vs. 2002	49	35.0%	30.3%	18.5%	44.9%	4.1%
2011 vs. 2007				N/A		

Table 2
Change in the Number of Firms in an Industry and Profitability

This table reports coefficients from regressions relating firm profitability to the number of firms 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. 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.

	Dependent Variable: <i>ROA</i>			
	<u>1972-2013</u>	<u>1972-1986</u>	<u>1987-2000</u>	<u>2001-2013</u>
Constant	0.0254 ^a (0.0065)	0.0965 ^a (0.0122)	-0.0692 ^a (0.0141)	-0.1339 ^a (0.0235)
Log(<i>Assets</i>)	0.0307 ^a (0.0013)	0.0137 ^a (0.0024)	0.0427 ^a (0.0022)	0.0455 ^a (0.0029)
Log(<i>Age</i>)	-0.0129 ^a (0.0012)	-0.0195 ^a (0.0019)	-0.0274 ^a (0.0023)	0.0052 ^c (0.0030)
Log(<i>Number of Firms</i>)	-0.0065 ^a (0.0013)	-0.0006 (0.0021)	-0.0020 (0.0025)	-0.0160 ^a (0.0032)
N	180,956	54,030	72,285	54,641
Adjusted R ²	66.57%	66.08%	69.81%	75.26%
Year Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Clustering at Firm Level	Yes	Yes	Yes	Yes

Table 3
Change in the Number of Firms in an Industry, Profit Margins and Efficiency

This table reports coefficients from regressions relating profit margins and efficiency measures to the number of firms 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. 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				
	Dependent Variable: <i>Lerner Index</i>			
	<u>1972-2013</u>	<u>1972-1986</u>	<u>1987-2000</u>	<u>2001-2013</u>
Constant	-0.4111 ^a (0.0517)	0.1866 ^a (0.0508)	-0.9252 ^a (0.1320)	-0.5326 ^a (0.2077)
Log(<i>Assets</i>)	0.1033 ^a (0.0095)	0.0766 ^a (0.0113)	0.1147 ^a (0.0162)	0.0868 ^a (0.0256)
Log(<i>Age</i>)	0.0639 ^a (0.0100)	-0.0192 ^b (0.0090)	0.0702 ^a (0.0191)	0.1912 ^a (0.0283)
Log(<i>Number of Firms</i>)	-0.0239 ^b (0.0124)	-0.0067 (0.0092)	0.0182 (0.0223)	-0.1258 ^a (0.0348)
N	174,308	51,006	69,892	53,410
Adjusted R ²	65.19%	72.38%	68.89%	72.90%
Year Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Clustering at Firm Level	Yes	Yes	Yes	Yes
Panel B				
	Dependent Variable: <i>Asset Utilization</i>			
	<u>1972-2013</u>	<u>1972-1986</u>	<u>1987-2000</u>	<u>2001-2013</u>
Constant	1.4716 ^a (0.0319)	1.8097 ^a (0.0512)	1.5672 ^a (0.0629)	2.0622 ^a (0.0763)
Log(<i>Assets</i>)	-0.1451 ^a (0.0054)	-0.1774 ^a (0.0113)	-0.1665 ^a (0.0079)	-0.2115 ^a (0.0086)
Log(<i>Age</i>)	0.1021 ^a (0.0058)	0.0214 ^b (0.0102)	0.1240 ^a (0.0088)	0.0804 ^a (0.0091)
Log(<i>Number of Firms</i>)	0.0002 (0.0070)	0.0039 (0.0092)	-0.0036 (0.0118)	-0.0217 ^c (0.0113)
N	180,956	54,030	72,285	54,641
Adjusted R ²	85.57%	91.01%	86.98%	90.55%
Year Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Clustering at Firm Level	Yes	Yes	Yes	Yes

Table 4
Number of Firms in an Industry 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 contains the 10 industries with the smallest relative change in the number of firms, Portfolio 3 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 significance at 1%, 5%, and 10%, respectively.

Panel A: 1972-2013

	<u>Portfolio 1 (Low)</u>	<u>Portfolio 2</u>	<u>Portfolio 3 (High)</u>	<u>Diff (High-Low)</u>
CAPM				
Equally-Weighted Portfolios	0.0021 1.1125	0.0018 1.3042	-0.0003 -0.0900	-0.0023 -0.8816
Value-Weighted Portfolios	0.0015 1.2412	-0.0004 -1.3451	-0.0010 -0.7085	-0.0025 -1.2656
Fama-French 3 Factors				
Equally-Weighted Portfolios	-0.0007 -0.4710	-0.0012 -1.3785	-0.0024 -0.9194	-0.0018 -0.6554
Value-Weighted Portfolios	0.0008 0.7172	-0.0005 -1.7771	0.0002 0.1663	-0.0006 -0.3069
Fama-French 3 Factors + Momentum				
Equally-Weighted Portfolios	0.0014 0.9925	0.0005 0.5789	-0.0002 -0.0679	-0.0015 -0.5620
Value-Weighted Portfolios	0.0018 1.5092	-0.0007 -2.5293	0.0012 0.7997	-0.0006 -0.3028

Panel B: 1972-1986

	<u>Portfolio 1 (Low)</u>	<u>Portfolio 2</u>	<u>Portfolio 3 (High)</u>	<u>Diff (High-Low)</u>
CAPM				
Equally-Weighted Portfolios	0.0021 0.8114	0.0033 1.3454	0.0041 0.6086	0.0020 0.3073
Value-Weighted Portfolios	0.0010 0.8130	-0.0025 -4.1236	-0.0008 -0.3224	-0.0018 -0.6477
Fama-French 3 Factors				
Equally-Weighted Portfolios	-0.0013 -0.9677	-0.0006 -0.6366	0.0009 0.1423	0.0023 0.3348
Value-Weighted Portfolios	0.0002 0.1561	-0.0017 -2.9181	0.0003 0.1301	0.0001 0.0430
Fama-French 3 Factors + Momentum				
Equally-Weighted Portfolios	-0.0015 -1.0548	-0.0001 -0.1007	0.0012 0.1658	0.0027 0.3753
Value-Weighted Portfolios	0.0006 0.4767	-0.0020 -3.1421	0.0009 0.3650	0.0003 0.1034

Panel C: 1987-2000

	<u>Portfolio 1 (Low)</u>	<u>Portfolio 2</u>	<u>Portfolio 3 (High)</u>	<u>Diff (High-Low)</u>
CAPM				
Equally-Weighted Portfolios	-0.0039 -1.0689	-0.0031 -1.3169	-0.0065 -1.8752	-0.0027 -0.8629
Value-Weighted Portfolios	-0.0022 -0.8725	0.0010 2.7432	-0.0006 -0.1931	0.0016 0.3775
Fama-French 3 Factors				
Equally-Weighted Portfolios	-0.0043 -1.4663	-0.0037 -2.4016	-0.0063 -2.1894	-0.0020 -0.6395
Value-Weighted Portfolios	-0.0030 -1.2144	0.0005 1.9229	0.0013 0.4334	0.0044 1.0825
Fama-French 3 Factors + Momentum				
Equally-Weighted Portfolios	-0.0011 -0.3775	-0.0007 -0.4673	-0.0021 -0.7208	-0.0009 -0.2803
Value-Weighted Portfolios	-0.0008 -0.3186	0.0006 2.0240	0.0025 0.7837	0.0033 0.7883

Panel D: 2001-2013

	<u>Portfolio 1 (Low)</u>	<u>Portfolio 2</u>	<u>Portfolio 3 (High)</u>	<u>Diff (High-Low)</u>
CAPM				
Equally-Weighted Portfolios	0.0093 2.9100	0.0067 2.8153	0.0018 0.5661	-0.0075 ^a -3.3469
Value-Weighted Portfolios	0.0057 2.5548	0.0004 1.0278	-0.0028 -1.2508	-0.0086 ^a -2.6344
Fama-French 3 Factors				
Equally-Weighted Portfolios	0.0052 1.9793	0.0024 1.5413	-0.0019 -0.7220	-0.0072 ^a -3.1782
Value-Weighted Portfolios	0.0050 2.2583	0.0003 0.8097	-0.0025 -1.1081	-0.0075 ^a -2.2729
Fama-French 3 Factors + Momentum				
Equally-Weighted Portfolios	0.0060 2.4712	0.0029 2.1763	-0.0011 -0.4632	-0.0071 ^a -3.1332
Value-Weighted Portfolios	0.0051 2.3080	0.0002 0.5895	-0.0020 -0.9409	-0.0072 ^b -2.1829

Table 5**Change in the Number of Firms in an Industry and M&A Returns**

The table presents results of regressions relating CARs around merger announcements to the number of public firms in the industry and firm characteristics. The sample consists of mergers and acquisitions transactions over the period 1980-2013 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% or unknown; (iii) both acquirer and target are identified as public 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. 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:

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

where t is the announcement date of the transaction, MV_A (MV_T) is the market value of equity of the acquiring (target) firm, and $r_{CRSP,t-1,t+1}$ is the cumulative return on the CRSP value-weighted market portfolio from $t-1$ to $t+1$. The cumulative abnormal returns for the target firm (*Target CAR*) and the acquirer (*Acquirer CAR*) are calculated in a similar way. B/M_T (B/M_A) is the book-to-market ratio of the target (acquiring) firm, defined as in Davis, Fama, and French (2000), and winsorized at the 1% and the 99% level. Symbols ^a, ^b, and ^c indicate significance at 1%, 5%, and 10%, respectively.

Panel A

	Dependent Variable: Combined CARs		
	<u>1980-2013</u>	<u>1980-2000</u>	<u>2001-2013</u>
Constant	0.1279 ^a (0.0306)	0.1511 ^a (0.0377)	0.1758 ^b (0.0856)
B/M _T	0.0056 (0.0036)	0.0068 (0.0047)	0.0031 (0.0054)
B/M _A	0.0146 ^a (0.0057)	0.0112 ^c (0.0064)	0.0181 (0.0131)
Log(MV _T)	0.0018 (0.0014)	0.0020 (0.0016)	0.0014 (0.0019)
Log(MV _A)	-0.0058 ^a (0.0016)	-0.0067 ^a (0.0017)	-0.0046 ^a (0.0018)
Log(Number of Firms)	-0.0133 ^b (0.0055)	-0.0185 ^b (0.0076)	-0.0303 ^c (0.0165)
N	2,367	1,492	875
Adjusted R ²	5.28%	4.99%	4.52%
Year Fixed Effects	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes
Clustering at Industry Level	Yes	Yes	Yes

Panel B

	Dependent Variable: Acquirer CARs		
	<u>1980-2013</u>	<u>1980-2000</u>	<u>2001-2013</u>
Constant	0.0636 ^c (0.0342)	0.0807 ^c (0.0477)	0.0748 (0.1069)
B/M _T	0.0027 (0.0034)	0.0068 (0.0045)	-0.0029 (0.0048)
B/M _A	0.0181 ^a (0.0060)	0.0099 ^c (0.0056)	0.0320 ^a (0.0123)
Log(MV _T)	-0.0080 ^a (0.0018)	-0.0065 ^a (0.0017)	-0.0098 ^a (0.0025)
Log(MV _A)	0.0036 ^b (0.0017)	0.0021 (0.0016)	0.0056 ^b (0.0021)
Log(Number of Firms)	-0.0121 ^b (0.0062)	-0.0130 (0.0111)	-0.0230 (0.0214)
N	2,369	1,494	875
Adjusted R ²	6.51%	7.09%	6.29%
Year Fixed Effects	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes
Clustering at Industry Level	Yes	Yes	Yes

Panel C

	Dependent Variable: Target CARs		
	<u>1980-2013</u>	<u>1980-2000</u>	<u>2001-2013</u>
Constant	0.2286 (0.1619)	0.3398 ^c (0.1728)	0.0184 (0.4777)
B/M _T	0.0224 (0.0148)	0.0249 (0.0213)	0.0092 (0.0275)
B/M _A	0.0120 (0.0129)	0.0080 (0.0177)	0.0001 (0.0271)
Log(MV _T)	-0.0384 ^a (0.0041)	-0.0309 ^a (0.0059)	-0.0517 ^a (0.0097)
Log(MV _A)	0.0340 ^a (0.0031)	0.0331 ^a (0.0039)	0.03195 ^a (0.0059)
Log(Number of Firms)	0.0217 (0.0304)	-0.0218 (0.0357)	0.0510 (0.0903)
N	2,369	1,494	875
Adjusted R ²	12.92%	9.75%	10.92%
Year Fixed Effects	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes
Clustering at Industry Level	Yes	Yes	Yes

Table 6
Change in the Number of Firms in an Industry and M&A Returns – Related vs. Unrelated Mergers

The table presents the results of estimating CAR around merger announcements as a function of the number of public firms in the industry, as well as bidder-target relatedness, and firm characteristics. 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 5 for the description of the sample and variable construction. Symbols ^a, ^b, and ^c indicate significance at 1%, 5%, and 10%, respectively.

	Panel A		
	Dependent Variable: Combined Announcement Returns		
	1980-2013	1980-2000	2001-2013
Constant	0.1217 ^a (0.0316)	0.1464 ^a (0.0368)	0.1360 (0.0918)
B/M _T	0.0058 ^c (0.0035)	0.0080 ^c (0.0046)	0.0026 (0.0054)
B/M _A	0.0147 ^a (0.0057)	0.0113 ^c (0.0064)	0.0184 (0.0131)
Log(MV _T)	0.0022 (0.0014)	0.0030 ^c (0.0017)	0.0010 (0.0017)
Log(MV _A)	-0.0062 ^a (0.0016)	-0.0077 ^a (0.0018)	-0.0045 ^a (0.0017)
Log(Number of Firms)	-0.0108 ^c (0.0058)	-0.0162 ^b (0.0077)	-0.0226 (0.0177)
Related	0.0155 (0.0124)	-0.0005 (0.0160)	0.0613 ^b (0.0282)
Log(Number of Firms) x Related	-0.0046 ^b (0.0022)	-0.0027 (0.0031)	-0.0114 ^b (0.0052)
N	2,367	1,492	875
Adjusted R ²	5.45%	5.48%	4.80%
Year Fixed Effects	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes
Clustering at Industry Level	Yes	Yes	Yes

Panel B

	Dependent Variable: Acquirer Announcement Returns		
	<u>1980-2013</u>	<u>1980-2000</u>	<u>2001-2013</u>
Constant	0.0533 (0.0347)	0.0742 (0.0477)	0.0282 (0.1082)
B/M _T	0.0024 (0.0033)	0.0070 (0.0046)	-0.0035 (0.0049)
B/M _A	0.0181 ^a (0.0060)	0.0099 ^c (0.0059)	0.0324 ^a (0.0124)
Log(MV _T)	-0.0080 ^a (0.0018)	-0.0064 ^a (0.0018)	-0.0101 ^a (0.0022)
Log(MV _A)	0.0035 ^b (0.0016)	0.0020 (0.0017)	0.0057 ^a (0.0018)
Log(Number of Firms)	-0.0087 (0.0063)	-0.0109 (0.0111)	-0.0136 (0.0218)
Horizontal	0.0321 ^b (0.0144)	0.0129 (0.0178)	0.0758 ^b (0.0314)
Log(Number of Firms) x Horizontal	-0.0068 ^a (0.0026)	-0.0033 (0.032)	-0.0146 ^a (0.0057)
N	2,369	1,494	875
Adjusted R ²	6.63%	7.03%	6.71%
Year Fixed Effects	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes
Clustering at Industry Level	Yes	Yes	Yes

Panel C

	Dependent Variable: Target Announcement Returns		
	<u>1980-2013</u>	<u>1980-2000</u>	<u>2001-2013</u>
Constant	0.2529 (0.1571)	0.3889 ^b (0.1706)	-0.0478 (0.4928)
B/M _T	0.0237 (0.0148)	0.0291 (0.0205)	0.0085 (0.0279)
B/M _A	0.0120 (0.0130)	0.0082 (0.0176)	-0.0001 (0.0280)
Log(MV _T)	-0.0374 ^a (0.0044)	-0.0272 ^a (0.0057)	-0.0536 ^a (0.0093)
Log(MV _A)	0.0335 ^a (0.0035)	0.0305 ^a (0.0041)	0.0336 ^a (0.0066)
Log(Number of Firms)	0.0147 (0.0288)	-0.0337 (0.0362)	0.0596 (0.0925)
Horizontal	-0.0817 (0.0602)	-0.1494 ^b (0.0688)	0.0590 (0.1617)
Log(Number of Firms) x Horizontal	0.0151 (0.0128)	0.0236 ^c (0.0132)	-0.0054 (0.0362)
N	2,369	1,494	875
Adjusted R ²	12.94%	10.30%	10.92%
Year Fixed Effects	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes
Clustering at Industry Level	Yes	Yes	Yes

Table 7
Horizontal Merger Investigations

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

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

Table 8
Change in the Number of Firms in an Industry and Patent Generation

This table reports coefficients from regressions of patents as a function of the number of firms in an industry and other control variables. Patents are obtained from NBER website. The sample include 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 we scale each patent by the number of citation it received (adjusted for truncation) before converting the number onto logs. *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. 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.

	Dependent variable: Number of patents			
	1972 - 2006	1972 - 1986	1987 - 2000	2001 - 2006
Constant	-0.507 ^a 0.00	-0.245 ^a (0.00)	-0.224 ^a (0.00)	-0.071 (0.52)
Log(<i>Assets</i>)	0.131 ^a 0.00	0.068 ^a 0.00	0.102 ^a 0.00	0.064 ^a 0.00
Log(<i>Age</i>)	0.041 ^a 0.00	0.041 ^a (0.01)	0.035 ^a 0.00	0.110 ^a 0.00
Log(<i>Number of Firms</i>)	0.015 ^b (0.04)	0.044 ^a 0.00	0.007 (0.44)	-0.027 ^a (0.04)
N	131,687	39,459	69,553	26,680
adj. R-sq	82.0%	89.0%	83.9%	88.7%
Year Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Clustering at Firm Level	Yes	Yes	Yes	Yes

	Dependent variable: Scaled number of patents			
	<u>1972 - 2006</u>	<u>1972 - 1986</u>	<u>1987 - 2000</u>	<u>2001 - 2006</u>
Constant	-1.732 ^a 0.00	-0.368 ^b (0.03)	-0.531 ^a (0.00)	-0.843 ^a (0.01)
Log(<i>Assets</i>)	0.220 ^a 0.00	0.132 ^a 0.00	0.203 ^a 0.00	0.161 ^a 0.00
Log(<i>Age</i>)	0.102 ^a 0.00	0.027 (0.38)	0.090 ^a 0.00	0.126 ^a (0.02)
Log(<i>Number of Firms</i>)	0.037 ^a (0.01)	0.107 ^a 0.00	0.03 (0.15)	-0.06 (0.18)
N	131,687	39,459	69,553	26,680
adj. R-sq	72.9%	81.0%	75.5%	73.0%
Year Fixed Effects	Yes	Yes	Yes	Yes
Firm Fixed Effects	Yes	Yes	Yes	Yes
Clustering at Firm Level	Yes	Yes	Yes	Yes