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Frederik P. Schlingemann
René M. Stulz

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ABSTRACT

The firms listed on the stock market in aggregate as well as the top market capitalization firm contribute less to total non-farm employment and GDP now than in the 1970s. A major reason for this development is the decline of manufacturing and the growth of the service economy as firms providing services are less likely to be listed on exchanges. We develop quantitative measures of representativeness showing how firms' market capitalizations differ from their contribution to employment and GDP. Representativeness is worst when the market is most highly valued and worsens over time for employment, but not for value added.

Frederik P. Schlingemann
Katz Graduate School of Business
University of Pittsburgh
372 Mervis Hall
Pittsburgh, PA 15260
schlinge@katz.pitt.edu

René M. Stulz
The Ohio State University
Fisher College of Business
806A Fisher Hall
Columbus, OH 43210-1144
and NBER
stulz@cob.osu.edu

1. Introduction.

In the summer of 2020, with the US economy bearing the impact of the COVID pandemic, the unemployment rate is as high as it has been any time since 1948 and the NASDAQ and the S&P 500 indices reach their highest value ever. This dramatic difference in trajectories between unemployment and the stock market raises the question of how much the stock market reflects the health of the American economy and whether in recent years it does so less than it used to. Firms listed on national exchanges as well as indices that reflect the market capitalization of these firms receive huge amounts of attention from the public at large, policymakers, and finance academics. Most academic finance research focuses on listed firms, but if these firms or their indices have become less representative of the economy, their signals may be misleading about the economy as a whole. We explore this issue from 1950 to 2019 for a subset of our data and from 1973 to 2019 for most of our data. We investigate how the direct contribution of listed firms to employment and GDP evolves. We find that listed firms contribute less to employment and GDP in the 2010s than in the 1970s.

In 1953, Charles Wilson, the president of GM, the firm with the largest market capitalization, uttered the sentence for which he is famous: “for years I thought what was good for our country was good for General Motors, and vice versa. The difference does not exist.”[1] Could it be that the firm with the largest market capitalization is more representative of the economy then than it is now? Charles Wilson added in his response to a senator that “Our company is too big. It goes with the welfare of the country. Our contribution to the Nation is quite considerable.” In this paper, we measure the extent to which a firm’s market capitalization reflects its concurrent contribution to the economy. We show a strong downward trend in the extent to which a firm’s market capitalization reflects its concurrent contribution to employment. With value added, market capitalizations are least instructive about a firms’ contemporaneous contribution to GDP around 2000, but market capitalizations appear to be as instructive about firms’ contribution to GDP in the 1970s as in the 2010s.

[1] Hearings before the Committee on Armed Services, United States Senate, Eighty-Third Congress, First Session on Nominee Designates, Government Printing Office, 1953, p. 26.

There is no compelling theoretical reason for the stock market to be highly representative of the economy and there are many reasons for why it would not be. Firms that are listed are firms for which a listing is valuable. Not all firms find it valuable to be listed and these unlisted firms differ from listed firms. Further, market capitalization reflects the value of a firm for its shareholders, but this value need not be correlated with a firm's contribution to employment or GDP. This lack of correlation can be for good reasons or bad reasons. For example, a firm might contribute little to the economy now but be expected to contribute much more in the future and hence have a high market capitalization because it reflects its future contribution. Another example is that a firm's market capitalization could increase even though its contribution to employment or to GDP does not change if it finds a way to pay its workers less without affecting their performance. Because of these considerations, how much the stock market reflects the economy is an empirical question.

Employment is a reliable benchmark for the state of the economy. Employment data for the whole economy is available for our sample period, does not depend on accounting rules, and is collected by the Federal government irrespective of whether a firm is public or not. For public corporations, employment is available for most corporations annually since the early 1970s. We find that, from 1973 to 2019, the percentage of employees working for public firms is highest at the start of the sample period and falls sharply in the 1980s. At the beginning of that period, more than 41.4 percent of non-farm workers in the private sector work for public firms, but in 2019, that percentage is 29.0 percent. In 2019, the percentage of non-farm workers in the private sector working for public firms is the lowest for our sample period for industrial firms and for all firms, including financial firms, it is the lowest except for 1989 and 1990.

We create a measure of unrepresentativeness to capture how poorly market capitalization proxies for a firm's contribution to employment over time. For each firm, we measure the absolute value of the difference between the firm's market capitalization as a share of the market capitalization of the stock market and the firm's employment share among public firms defined as the firm's employment divided by the employment of all stock market firms. The measure of unrepresentativeness is proportional to the sum of these differences. Intuitively, it is the difference between a portfolio that holds the stock market and a portfolio with weights equal to the employment weights of firms.[2] The unrepresentativeness measure increases as the two portfolios differ more. We call this measure our employment unrepresentativeness measure. This measure follows a w-shape, with its lowest values in the 1980s and 1990s and its highest values in the 1970s, around 2000, and in the recent past. The stock market is more unrepresentative at the end of our sample period with respect to employment than at any time except around the year 2000. Another way to show that market capitalizations are not instructive about firms' contribution to employment is to estimate how much of the variation in market capitalizations can be explained by variation in employment. We find that from 1973 to 2019 a firm's employment never explains as little of its market capitalization as in 2019. In most years in the 1970s and early 1980s, firm employment explains more than 50% of the variation in market capitalization. In each of the last four sample years but one, firm employment explains less than 20% of the variation in market capitalization.

Assessing a firm's contribution to GDP is more fraught with difficulties. A firm's value added depends on the total compensation it pays to its employees. However, most firms do not disclose how much they pay to their employees separately. It is therefore necessary to make approximations. We follow the existing literature in making these approximations (Donangelo, Gourio, Kehrig, and Palacios, 2019; Hartman-Glaser, Lustig, and Xiaolan, 2019; Bennett, Stulz, and Wang, 2020). With these approximations, we find that the contribution of public firms to GDP is higher in the 1970s than in the 2000s. This result is insensitive to the approximations we make. Using the same approach to measure unrepresentativeness as with employment, we construct a measure of unrepresentativeness for value added. The stock market's unrepresentativeness for value added follows a w-shape with unrepresentativeness high early in the sample period, around 2000, and late in the sample period. In contrast to employment, the unrepresentativeness at the end of the sample period is less than at the beginning of the sample period. Lastly, we examine how well cross-sectional variation in market capitalizations can be explained with our measure of firm value-added. We find that variation in value-added best explains the variation in market capitalization in the late

[2] This measure follows the approach used by Cremers and Petajisto (2009) to measure the active share of a portfolio, where they compare the active portfolio's weights to the weights of a benchmark portfolio.

1970s and early 1980s. While employment explains less of the variation in market capitalization in the 2010s than in the 1970s, the same is not the case for value added. The variation in value-added explains the variation in market capitalization less well at the end of the sample period than in a number of years, but it explains it better than in the period from 1988 (1991 for industrial firms) to 2003.

The w-shape pattern for our unrepresentativeness measures is such that the highest values of these measures occur when the market is most highly valued. We show this by regressing our unrepresentativeness measures on the Shiller CAPE ratio (Shiller, 2000) and the square of the ratio to capture a possible non-linearity in the relation. We generally find that unrepresentativeness increases with the square of the ratio, so that it is high when valuations are very high or very low. Such a result occurs because extreme market valuation levels affect some sectors more than others and hence distort valuations relative to concurrent employment or value added.

The U.S. Bureau of Labor Statistics (BLS) publishes employment data for broad industry categories, referred to as supersectors. We use these data to show that there is a straightforward explanation for the decline in the employment contribution of public firms. A stock market listing is generally more valuable for manufacturing firms than for firms that provide services. Manufacturing firms have to raise capital to finance plants and equipment. Manufacturing firms that are successful become large with many shareholders. Service firms often have small funding needs for plant and equipment. Perhaps more importantly, they typically have few employees and their most important assets, their employees, walk out of the door at the end of every business day. During no time in our sample period is the percentage of employees working for listed manufacturing firms less than 60 percent of employees working for listed and unlisted manufacturing firms combined. In 1973, manufacturing is the supersector with the most employees in the US economy, but over the period 1973-2019 its number of employees declines by more than 30 percent even though the size of the economy increases substantially. The supersector with the highest employee growth over this period is education and health services. In 1973, the workforce of this supersector is 27% of the workforce of manufacturing. In 2019, its number of employees is 2.4 times the number of employees of the manufacturing supersector. Education and health services has 3.6% of employees working for listed firms in 2019 in contrast to the manufacturing supersector, which has 79.6% of employees working for listed firms. Had manufacturing employment grown like the employment of education and health services, the share of total employment represented by listed firms would be as high in 2019 as in the 1970s.

Manufacturing is the supersector with the largest stock market capitalization. Despite the fact that the market capitalization share of the manufacturing supersector falls over time, it is the largest market capitalization supersector throughout the sample period. We examine how representative the employment distribution of listed firms across supersectors is of the distribution of non-farm payroll employment across supersectors. Using a measure of unrepresentativeness, we find that this measure increases sharply over our sample period. Such an outcome is not surprising since the fastest growing supersectors are those where listed firms contribute the smallest fraction to employment in that supersector.

Next, we investigate the contributions of the largest market capitalization firm and of the top-three market capitalization firms to the economy. The share of the stock market capitalization of the top market capitalization firm is consistently much higher before 1980. Fogel, Morck, and Yeung (2008) show that turnover among the largest firms is associated with higher economic growth. Strikingly, from 1950 to 2019, only seven distinct firms have the top market capitalization in at least one year. Only two of these firms, General Motors and AT&T, ever have the largest number of employees in the US. The percentage of US non-farm payrolls represented by the largest market capitalization firm declines steadily over time, so that it is at its lowest in the 2000s. The percentage of US GDP represented by the largest market capitalization firm is also lower in the 2000s than before 1980. The contribution of the top market capitalization firm to the economy in 2019 is a fraction of GM's contribution in 1953.

Two important caveats are in order. First, the data for public corporations is comprehensive data in that it includes both domestic and foreign activities. Consequently, the employment of a company is the company's worldwide employment. Companies sometimes disclose separately domestic and foreign employment, but they do not do that with enough consistency for us to attempt to use only domestic employment. It follows that we measure the total economic contribution of the listed firms rather than only their contribution within the US. This means that our estimates of the contribution of listed firms to the US economy are upper bounds of their actual domestic contribution to the economy. Because international activities of firms have increased, the domestic contribution of listed firms to the economy decreases more than the total contribution of listed firms. Second, we focus on the direct contribution of listed firms to the economy, which means that we focus on the employment and the value added of these firms in a given year. We do not capture indirect contributions of these firms. For instance, because these firms are public, their stock price is freely observable by everybody. The stock price may contain information that is valuable to other firms (e.g., Foucault and Frésard, 2014). Our study does not capture these indirect information spillover effects.

Our paper relates and contributes to several literatures. To start, there is an extensive literature that examines whether the stock market forecasts future economic growth. The most famous contribution to this literature is Samuelson's quip that the stock market has predicted nine of the last five recessions.[3] A recent study by Ritter (2012) using data from 1900 to 2011 for 19 countries, concludes that there is a negative cross-sectional correlation between stock market returns and economic growth. In other words, countries with greater growth experience poorer stock market performance. Levine and Zervos (1998) find evidence that stock market capitalization predicts long-run economic growth, but also find that this effect is subsumed by market turnover. Fischer and Merton (1984) argue that "the stock market is a good predictor of the business cycle" and Harvey (1987) finds that bond market data is much more useful than stock market data to predict future economic growth from 1953 to 1989. Stock and Watson (2003) review the literature on forecasting output with asset prices and produce their own evidence. They conclude that the relation between asset prices and output is unstable. We show that the stock market firms' contribution to the economy has fallen, which would suggest that the stock market may have become less valuable as a proxy for the level of economic activity. We also show that stock market valuations are particularly disconnected from firms' contributions to the economy when the stock market as a whole is particularly highly valued.

[3] "Science and stocks," by Paul A. Samuelson, Newsweek, September 19, 1966.

A second literature examines whether, instead of predicting future growth, the stock market contributes to economic growth. In particular, this literature considers the impact of non-fundamental changes in stock market valuations. Morck, Shleifer, Vishny (1990) find little evidence of an independent effect of the stock market on fundamentals. Baker, Stein, and Wurgler (2003) find evidence that non-fundamental stock price movements affect investment of firms that are equity-dependent, in that they need equity financing to finance their investments. To the extent that stock market firms have a smaller contribution to the economy, non-fundamental changes in the level of the stock market are likely to have a smaller impact on the economy as well.

A more recent literature investigates how the composition of the stock market is related to growth. In particular, Fogel, Morck, and Yeung (2009) show that countries grow less when the top market capitalization firms change less frequently. Relatedly, Bae, Bailey, and Kang (2020) examine the implications of stock market concentration. By market concentration, they mean the fraction of a stock market's capitalization accounted for by the top market capitalization firms. They find that greater concentration in a stock market predicts lower growth. Finally, Bae, Elkahmi, and Simutin (2019) show that the stock market firms are a poor vehicle to acquire exposure to developing country economies because in many developing countries listed firms correspond to a small part of the economy.

Our analysis of how firm market capitalizations relate to the contribution of firms to the economy adds to the considerable firm valuation literature. The most closely related paper from that literature is Belo, Gala, Salomao, and Vitorino (2019). That paper estimates how labor, physical capital, and intangible capital contribute to firm value over time. The authors do not relate firm value to firm value added, but they find that in their decomposition labor accounts for 14% to 22% of a firm's market value. We show that firm labor force explains much less of the cross-sectional variation of firm market value in recent years than it did earlier in our sample period.

Finally, this paper also relates to the literature on the listing gap (Doidge, Karolyi, and Stulz, 2017). This literature shows that listings on US exchanges peak in 1996 and that the US has fewer listings than predicted by cross-sectional regressions that explain the number of listings per capita across countries. This literature demonstrates that the number of listings depends on a number of factors that can change over time, including regulations and the composition of firm balance sheets (Stulz, 2020). Hence, we would expect the number of firms listed to change over time. Doidge et al. (2017) and Kahle and Stulz (2017) find that the size of listed firms increases after 1997 while the number of listed firms falls. Consequently, the listing gap by itself does not imply that the contribution of listed firms to the economy, which is the topic we focus on in this paper, falls after 1997.

The paper proceeds as follows. In Section 2, we discuss when the stock market is likely to be representative of the economy. In Section 3, we investigate how listed firms as a whole contribute to employment and GDP. In Section 4, we explain why the contribution of listed firms to employment and GDP falls like it does. Section 5 assesses how well a firm's market capitalization corresponds to its concurrent contribution to employment and GDP. We investigate how the top industry in market capitalization contributes to employment and market capitalization and how it does so relative to other industries in Section 6. In Section 7, we examine the top three firms by market capitalization over time, their importance in the market, and their contribution to the economy. We conclude in Section 8.

2. When is the stock market representative of the economy?

There are two fundamental forces that affect how representative the stock market is of the economy. First, there is a selection effect: firms are listed on an exchange when they are better off to be listed than not. Second, market capitalization by definition measures the value of a firm for its shareholders, which may differ from that firm's concurrent contribution to the economy. We address these issues in turn.

2.1. Public versus private firms.

In the US, a firm listed on an exchange has to be a public firm in that it files regular reports with the SEC. As a result, most public firms are listed firms and most unlisted firms are not public firms. In the following, we make no distinction between public and listed firms. If a firm meets an exchange's listing requirements, acquiring a listing on that exchange is a choice. By far, most firms are private. For instance, in 2016, which is the most recent year for which the finalized data on the number of firms are available from the Census Bureau, the US has 5,954,684 firms, but only 3,618 listed firms.[4] However, as shown by Doidge et al. (2017), even among firms that appear to employ as many employees as listed firms, relatively few firms are listed.

To decide whether to be listed or not, firms compare the benefits of a listing to the costs. Both the benefits and costs change over time (Stulz, 2020). Because unlisted firms are firms that do not find it advantageous to be listed, the listed firms necessarily differ from other firms. The main advantages of being listed include a greater ability to raise funds, the ability to use stock as a merger currency, the liquidity benefits for shareholders, and the information about the firm generated by public markets (see, e.g., Pagano, Panetta, and Zingales, 1998). The costs of being listed include disclosure requirements, greater attention paid to the firm and management, and fixed and variable costs of listing. The balance of benefits and costs is such that tiny firms rarely list and that larger firms are much more likely to be listed than smaller firms. If the benefits of an exchange listing decrease, everything else equal, fewer firms will be listed. As a result, differences between listed and unlisted firms increase. For example, Doidge et al. (2017) assume that the benefits of listing increase with firm size. Consequently, a decrease in the benefits of listing that leaves the costs unchanged results in an increase in the size of listed firms. Hence, following such a decrease in the benefits, the listed firms become larger relative to the population of firms. Everything else equal, we would expect a larger firm to have a larger contribution to the economy, so that it is unclear whether fewer listings implies a lower contribution to the economy of listed firms compared to unlisted firms.

Firms with large funding needs are firms that are more likely to be listed on an exchange. Typically, such firms cannot rely exclusively on debt financing and have to raise equity as well to avoid having excessively high leverage. Equity investors want to make sure that they earn a return on their investment and want the listed firm to have mechanisms in place that assure them a return (Shleifer and Vishny, 1997).

[4]The total number of firms is from the 2016 SUSB Annual Data Tables by Establishment Industry, United States Census Bureau, for total number of firms. The number of listed firms is from CRSP and follows the approach of Doidge et al. (2017).

In general, investors are more willing to fund tangible assets than intangible assets. With intangible assets, investors are concerned about potential expropriation of the assets (see, e.g., Haskel and Westlake, 2017). In particular, it can be difficult to assert property rights on intangible assets in development. Because of these considerations, firms for which tangible assets are important or firms with intangible assets that have well-defined property rights are more likely to be listed than firms with intangible assets mostly in development. Among firms with these properties are firms that engage in the production of goods. These firms need funding to scale their operations. Firms in service industries often do not have much in the way of hard assets and do not have much in the way of intangible assets with well-defined property rights. For instance, a law firm is nothing without its lawyers, but these lawyers can change firms. Law firms do not go public. Also, most firms in the service sector do not scale in such a way that it would make sense for them to be listed. Importantly, agency costs differ across industries. As a result, the agency costs of the separation of ownership and control that are intrinsic to an exchange listing may be higher in some industries than others and hence affect the propensity of firms to list in an industry (Fama and Jensen, 1983). It follows from this that the industry composition affects the economic importance of the firms listed on exchanges.

2.2. Market capitalization versus concurrent economic contribution.

A firm's market capitalization does not directly reflect its concurrent contribution to the economy. It reflects its value to its shareholders. Specifically, the market capitalization of a firm is the present value of the cash flows that the shareholders will receive from that firm:

$$V_{it} = \sum_{j=t}^{j=\infty} D_i(t,j) E_t[C_i(j)] \qquad (1)$$

where V_{it} is the value of the equity of firm i at time t and equals the discounted sum of expected future cash flows to equity. $D_i(t, j)$ is the discount factor that applies to a cash flow to equity that accrues at date j to firm i when discounted back to date t. E_t denotes the expectation formed at time t. $C_i(j)$ is the cash flow to equity at date j.

Two important properties of the relation between a firm's market capitalization and its contribution to the economy follow from the valuation formula. First, because the value of equity is the present value of all future cash flows to equity, it is possible for the value of equity to vary considerably across firms that have the same contribution to the economy in year t. For instance, compare two firms that have the same expected cash flow to equity in year t, but for firm A the cash flow is expected to grow sharply over time while for firm B the cash flow is expected to fall. Firm A will be worth much more than firm B. Second, most of the value of a firm comes from future cash flows to equity. Large changes in a firm's cash flows to equity this period have little impact on the value of the firm if they do not affect the market's expectation of future cash flows from the same firm. A simple example is the following. Suppose that a firm will live 10 years and discount rates are zero for simplicity. Its cash flow to equity is 10 each year. In this case, the value of the firm is 100. If the cash flow to equity falls by half this year but future cash flows are unaffected, the value of the firm is lower by 5%. However, if all future cash flows fall by half as well, the value of the firm falls by half.

The firm's cash flow to equity this period does not have a monotonic relation with the firm's contribution to GDP and employment. To understand how the cash flow to equity relates to a firm's contribution to the economy, consider the typical case where firm i produces output worth $Y_i(t)$ in period t using $L_i(t)$ units of labor paid $w_i(t)$ per unit, and intermediate goods $I_i(t)$ paid $q_i(t)$ per unit. With this notation, the value added of firm i in period t is:

$$\text{Value added of firm } i \text{ in period } t = Y_i(t) - q_i(t)\, I_i(t) \qquad (2)$$

This value added is produced by labor and capital and represents the contribution of firm i to GDP. If the firm is financed with equity only and equity owns the capital, then the equity-share of valued added is defined as:

$$\text{Equity share of value added by firm } i \text{ in period } t = Y_i(t) - q_i(t)\, I_i(t) - w_i(t)\, L_i(t) \quad (3)$$

If firm *i* were to distribute the equity share of value added to shareholders, the equity share of value added would be the shareholders' cash flow in period *t*. If the firm retains some of the equity share and reinvests it, it will lead to future cash flows to equity.

A well-known valuation model in finance is the Gordon growth model (Gordon, 1962). With this model, it is assumed that dividends will grow at a constant rate and are discounted at a constant discount rate. Let r_i be the required discount rate for future dividends and ρ_i the growth rate. If C_i corresponds to the cash flow to equity of firm *i* over the next period, the market capitalization of the firm with the Gordon growth model is:

$$S_i = \frac{C_i}{r_i - \rho_i} \quad (4)$$

With this model, the value of equity increases with cash flows to shareholders, falls with the discount rate and increases with the rate of growth. We can relate C_i to value added as follows. Let ω_i be the fraction of value added that accrues to shareholders at firm *i*. With this, $\omega_i\,(Y_i(t) - q_i(t)\, I_i(t))$ is the cash flow that can be used to pay dividends. Let θ_i be the fraction of the cash flow $\omega_i\,(Y_i(t) - q_i(t)\, I_i(t))$ paid out to shareholders. In this case, the market capitalization of firm *i* is:

$$S_i = \frac{\theta_i \omega_i [Y_i(t) - q_i(t) I_i(t)]}{r_i - \rho_i} \quad (5)$$

With this approach, a firm's market capitalization can increase because shareholders receive a larger fraction of value added. Two firms with identical value added can have very different market capitalizations because of differences in expected growth, in the discount rate, or in the equity share of value added. For instance, suppose that a firm has value added of 100, that 20% of the value added is received by shareholders, and that half the value added captured by shareholders is paid out. With a discount rate of 10% and an expected growth rate of 5%, the market capitalization of the firm is 200. If the equity share doubles, the market capitalization doubles assuming the growth rate is unchanged. So, two firms with identical contributions to GDP can be valued very differently. Going back to the base case, suppose that a firm has expected growth of zero. In this case, firm value becomes 100. In all these examples, the contribution of the dividend paid this year to the firm's market capitalization is small. In our base case, the dividend paid this year is 10 and the value of the firm is 200, so that the dividend paid this year makes up 5% of firm market capitalization.

As the equity share of value added for a firm increases, so does its market capitalizations. However, a firm's equity share of value added can increase while at the same time its value added falls. In other words, the shareholders can gain while the firm's contribution to the economy falls. A firm can increase equity cash flows by becoming more productive. In this case, it produces more units of goods with fewer inputs. Alternatively, a firm can increase equity cash flows by exploiting an increase in market power over its employees. In this case, the firm would pay its workers less or charge more for its products while producing less. It is therefore perfectly possible for the market capitalization to increase while the firm contributes less value added to the economy and employs fewer workers.

Two firms that have the same production function could have a very different equity share of value added because they are funded differently. Suppose that a firm has a balance sheet with a high leverage ratio and the other has no debt. Without debt, all the firm's value added in excess of employment costs accrues to equity holders either as payouts today or as future payouts. In contrast, with the highly leveraged firm, only the value added left after paying the debt holders accrues to the equity holders.

When would increases in market capitalization indicate that the economy is doing well in the sense that employment and GDP are increasing as well? Equation (5) provides a roadmap for the answer. If ω_i, θ_i, r_i, and ρ_i stay constant, then a firm's market capitalization increases with its value added. Both value added and employment increase if the firm's scale increases, if the price of inputs falls without being accompanied by substitution of inputs for labor, or if technical progress is Hicksian neutral (Hicks, 1932). With Equation

(5), firms' relative market capitalizations are proportional to their relative value added when all the parameters are the same across firms but their scale. Relative market capitalizations would then be equal to relative employment contributions if employment at the firm level is a constant fraction of value-added.

3. How important are listed firms for the economy?

In this section, we examine the evolution of the direct concurrent contribution of listed firms to the economy. We use two measures of contribution: employment and value added. With these measures, we investigate how listed firms as a whole contribute to the economy's employment level and to GDP. By direct contribution, we mean that we compute the level of employment of a firm and its value added. Firms also impact the economy through their demand for goods and the provision of goods. For instance, if a firm expands, it will likely cause its suppliers to expand. Though consideration of these indirect effects would be interesting, it goes beyond the scope of this study. In this study, we are interested in employment and value added that are directly under the control of public firms. We first consider the contribution of public firms to employment and then turn to their contribution to GDP.

Though we have data for some public corporations in the 1950s and 1960s, employment data is not available for as large a fraction of public corporations during these years as it is later. To study a period where employment data is available for most public firms, we start our analysis in this section in 1973. From 1973 onward, each year firms representing at least 93% of the market capitalization of US listed firms have employment data available on Compustat. In some cases, a firm does not have employment data in a given year but has it the year before and the year after. Such a situation can arise because of an ongoing merger. In these cases, we interpolate linearly between the two years for which data is available. To make sure that our sample firms are listed on national exchanges, we only include firms domiciled in the US for which accounting data is available from Compustat and stock price information is available from the Center for Research in Securities Prices (CRSP). We compute the percentage of non-farm payroll employment represented by employees of public firms. Non-farm payroll employment is reported by the Bureau of Labor Statistics (BLS) and includes all payroll employees from the private sector excluding farm workers, private household employees, and non-profit organization employees. We use the non-seasonally adjusted measure at the end of each year. A potential source of discrepancy between the two measures is that employment is reported yearly by listed firms, but not necessarily on a calendar-year basis. However, most firms report on a calendar year basis, so that most of our data for listed firms should be data at the end of the calendar year.

Figure 1, Panel A, shows the evolution of the percentage of total non-farm payroll employment represented by employees of listed firms. We show data for all public firms as well as for industrial firms. We see that the percentage of non-farm employment represented by public firms falls sharply to reach a low in the early 1990s. It then increases in the second half of the 1990s, before falling again with some interruptions. Employment by all public firms or all industrial public firms represents more than 40% of the non-farm payroll employment at the start of our sample period and less than 30% at the end of our sample period. Most of the decrease in that percentage takes place in the 1980s. As a percentage of the non-farm payroll employment, the employment by public industrial firms never represents a lower percentage of non-farm payrolls than at the end of our sample period. When we include financial firms, the percentage of the non-farm payroll employment corresponding to employment by public companies is lower in 1989 and 1990 than in 2019, but otherwise is always higher. The percentage of non-farm payroll employment represented by public firms falls by 12.4 percentage points from 1973 to 2019, or by 30.0%.

We now turn to value added. Unlike employment, public corporations do not report value added. As discussed in Section 2, value added is a firm's revenue minus the cost of intermediate goods used in production. An approximation frequently used in the literature is operating income before depreciation (OIBDP) plus labor costs. We use this approximation as well but, unfortunately, less than 15% of Compustat firms disclose labor costs. Therefore, we have to approximate labor costs at the firm level.

The literature proposes different approaches to approximate labor costs. For example, Bennett, Stulz, and Wang (2020) use the average labor cost per employee within an industry and then multiply employment by that average cost per employee using the Fama-French classification with 12 industries (FF 12 industries). Donangelo, Gourio, Kehrig, and Placios (2019) add the inventory change to OIDP and compute the average wage using the Fama-French classification with 17 industries (FF 17) when available and otherwise use the average ratio from the 2-digit SIC industry. Lastly, Hartman-Glaser, Lustig, and Xiaolan (2019) implement the approach of Donangelo et al. (2019) with two differences. First, they do not include the inventory change. Second, they sort the firms within the FF 17 industries into 20 size groups based on total assets. They then compute the average labor cost per employee for each size group within each industry.

We estimate value added using all three approaches. With each of these approaches, the authors winsorize variables in various ways. With our study, we are interested in the total value added of listed firms. With our dataset, winsorization has the effect of severely reducing the value added of the largest firms. We therefore focus on results without winsorization to make sure we do not understate the economic significance of listed firms. We also estimate value added with winsorization. Doing so has the effect of reducing the contribution of public firms. Each of the three cited studies excludes the financial industry from the sample. We report results for industrial firms, but also compute value added for the whole sample of public firms. In total, we implement fourteen different approaches of computing a firm's value-added that differ in whether and how we winsorize and in how employment compensation is derived when it is not reported on Compustat for a firm. Among all these approaches, we highlight the results using the Donangelo et al. (2019) approach without winsorization, but we compute labor costs using the industry median instead of the mean. This measure, Value Added, is highly correlated with the measures using the alternative approaches. Specifically, the correlation between that approach and any of the other approaches is at least 92% when we do not use winsorization.

For the economy as a whole, the sum of the value added by all firms is GDP. We therefore compute the percentage of GDP represented by industrial public firms. We show that percentage in Figure 1, Panel B. The time-series pattern for Value Added is similar to the one we document for employment in the early years but differs in the second half of the sample period. The contribution of industrial public firms to GDP is highest in the 1970s and then falls. It reaches a low of 20.1% in 1993. The average following that low is 20.8% to the end of the sample period. The contribution of industrial public firms to GDP in the last year of the sample period is the same as the average.

We also estimate the contribution to GDP of all listed firms including financial firms. As expected, the sample that includes all public firms contributes more to GDP in every year. The contribution of all public firms to GDP evolves similarly to the contribution of industrial firms except that the gap between the two contributions increases over time and especially during the late 1990s. In the 1970s, the contribution to GDP of listed financial firms is always less than 10% of the contribution of industrial firms. After 1995, there is only one year where the contribution of listed financial firms to GDP is less than 20% of the contribution of industrial firms, 2008. The largest contribution of listed financial firms to GDP is 39.2% of the contribution of industrial firms in 2006.

We implement approaches more similar to the one proposed in Hartman-Glaser et al. (2019) using a variety of iterations of size portfolios and winsorization. We report the results for Value Added (HLX), which employs no winsorization and five instead of twenty size bins. Value Added (HLX) has the highest share for industrial listed firms among all the iterations of measures in the spirit of Hartman-Glaser et al. (2019) we consider. We see that the contribution of public firms to GDP is slightly higher with Value Added (HLX) than with Value Added, but the two measures evolve similarly. Appendix A provides a detailed definition of Value Added and Value Added (HLX).

Whether we consider employment or value added, we find that the public firms contribute directly to the economy much more in the 1970s than in recent years. Since then, their contribution falls. For employment, it reaches a low at the end of our sample period. For value added, it reaches a low in the early 1990s, but the contribution of public firms to GDP is only slightly higher at the end of our sample period than in the early 1990s. In percentage terms, the contribution of industrial (all) listed firms to employment falls by 30.0% (35.3%) from 1970 to 2019. Using the same approach, the contribution to GDP of industrial (all) listed firms drops by 28.6% (14.5%). Similar to employment, the bulk of the drop in the contribution of value added to the economy of listed firms takes place in the 1980s.

The analysis so far in this section does not distinguish between purely domestic firms and multinationals. Multinationals are firms with foreign affiliates and hence firms that employ workers both in the US and abroad. The employment and operating income data we use are consolidated data at the firm level. This means that for a multinational company the employment data includes workers employed abroad and the operating income data includes income earned abroad.[5] Ideally, we would separate domestic from foreign employment. As reported by Beatty and Liao (2012), disclosure of foreign employment by a company is voluntary and most firms do not report foreign employment. Without foreign employment, we cannot compute a firm's value added from foreign affiliates. It follows from this that our measures of the contribution of listed firms to domestic employment and GDP are upper bounds. If foreign activities of listed firms have become more important over time, the domestic contribution to economic activity of listed firms falls more than we show.

We take two approaches that help understand the importance of international activities. First, the Bureau of Economic Analysis (BEA) reports yearly data on the activities of US multinational companies. The first release of the data is in 1982 and the most recent is in 2018. Unfortunately, the data is for all US multinational companies and it does not distinguish between listed and unlisted firms. The 2019 BEA release shows that roughly 75% of the employees of US multinationals work in the US in 1999. For 2018, it is 66.5% with US multinationals employing 28.6 million workers domestically and 14.4 million abroad. The workers employed abroad by US multinationals correspond to 9.1% of the total domestic non-farm employment. In 1982, workers employed abroad represent 6.8% of US non-farm employment and 65% of them are employed by firms in the manufacturing supersector. The percentage employed in the manufacturing sector falls to 38% in 2018. Yet, during that time, while domestic employment in manufacturing falls sharply, foreign employment in manufacturing by US firms increases by 22%. Though the 1982 release of the BEA does not report value added data, the more recent ones do. In 2018, for example, US multinationals have worldwide value added of $5.7 trillion. Of that amount, value added by foreign affiliates is $1.5 trillion or 23% of worldwide value added.

With the BEA data, we cannot adjust the employment of listed firms to exclude workers employed abroad by these firms. Instead, we adjust the total non-farm employment to include employment by US

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[5] Note that multinationals during our sample period have incentives to not repatriate foreign income for tax reasons. However, the foreign income is still included in consolidated accounts.

multinationals abroad to obtain worldwide employment by US firms. We can then measure the fraction of worldwide employment by US firms accounted for by listed firms for the period for which the BEA data is available. As can be seen in Figure 1A, with this adjustment, the fraction of worldwide employment by US firms accounted for by listed firms falls over time and is at its lowest at the end of 2019. We proceed in the same way for Figure 1B. Taking into account foreign value added of multinationals does not change our inferences in a significant way.

Second, we use Compustat to measure the share of pre-tax income attributable to foreign operations. Figure 2 shows the evolution of the share of foreign pre-tax income to all pre-tax income. The graph plots the percentage for industrial firms (excluding utilities). Note that widespread coverage of foreign and domestic income on Compustat starts in 1984. We find that the share of foreign pre-tax income increases sharply from 2000 to 2010. The takeaway from both approaches is that the contribution of listed firms to domestic employment and GDP, if anything, falls more than we can show directly with the data available to us.

As discussed in Kahle and Stulz (2017), investments in intangible capital have become more important for listed firms. These investments are often expensed under GAAP. As a result, they decrease operating income before depreciation (OIBDP) that we use to estimate value added, which leads to an understatement of value added. At the same time, however, the employment expenses used in the computation of value added should be employment expenses for workers used in production. Some employees work on investment projects rather than production. For instance, R&D typically requires the work of researchers. To compute value added, we would like to remove from our measure the expenses of workers engaged in investment projects. Doing so would decrease value added. While it is possible to adjust OIBDP for investment in intangibles, firms do not disclose the number of employees used in investment projects as opposed to production, which means we cannot adjust the number of employees. Consequently, an adjustment to OIBDP without an adjustment to the number of employees would overstate value added. Nevertheless, to assess whether our conclusions depend on the accounting treatment of intangible investments, we adjust OIBDP following the approach and variable definitions of Peters and Taylor (2017).

This approach adds R&D expenditures and 30% of SG&A back to OIBDP. In unreported analyses, we find that the adjusted relative to the unadjusted aggregate value added increases throughout the period from 1973 to 2019, with a difference of approximately 12% until 1980, which then increases and levels off at 23% in 2000. Hence, the importance of intangible investments increases mostly from 1980 to 2000. However, our main conclusion about the evolution of the contribution of listed firms to GDP, as shown in Figure 1B, does not change when we use the adjusted value added. To conserve space we do not reproduce this figure, but the contribution of listed firms to GDP continues to be much lower in the 2000s than in the 1970s.

4. Why has the contribution of listed firms to the economy fallen?

In Section 2, we explain why some industries are better suited for firms to list on exchanges compared to others. In this section, we show that over our sample period the industries that are well represented in the stock market shrink while the sectors that are poorly represented grow sharply. To show this, we have to use what BLS refers to as NAICS supersectors as this is the data for the whole economy available over the period 1973-2019. These supersectors are not granular. The ten supersectors correspond roughly to SIC one-digit codes.[6] Compustat has NAICS codes for the majority of firms that exist after 1985. For firms that delist before 1985, NAICS codes are frequently missing. For these firms, we follow the procedure outlined in Covarrubias, Gutiérrez, and Philippon (2019). This procedure maps these firms to the most common NAICS-4 industry among firms with same SIC and non-missing NAICS. As discussed in Section 3, the employment data for listed firms is their worldwide employment. In contrast, the BLS supersector data is domestic employment. As a result of this discrepancy, it is possible for a supersector to have more than 100% of BLS employment by listed firms. We find that to be the case in some years for the information sector.

[6] We exclude the Government supersector. A detailed description of supersectors is available at https://www.bls.gov/sae/additional-resources/naics-supersectors-for-ces-program.htm.

The percentage of the employment in a supersector represented by the employment of listed firms differs considerably across supersectors. Figure 3 shows for each supersector the percentage of employees in that industry employed by listed firms. The supersectors that have on average across the sample years the highest fraction of total employment by listed firms are Mining and Logging, Information, and Manufacturing. In 2019, these industries together employ 16.4 million employees, corresponding to 10% of non-farm payrolls. Listed firms employ 84.6% of employees in those industries. In no other industry do listed firms employ more than 50% of the employees. In Education and Health Services, the percentage of employees that work for listed firms is a minuscule 3.6% in 2019. The industries that have less than 20% employees working for public firms in 2019 employ 46% of the private nonfarm employment. Manufacturing is the industry with the highest level of employment among listed firms every sample year until 2008 and since then it is the industry with the highest level of employment among listed firms six years. Over the last four sample years, the Trade, Transportation, and Utilities industry has more employment by listed firms than Manufacturing.

Figure 3 also shows the percentage of non-farm payroll employment accounted for by each supersector. Employment across NAICS super sectors changes considerably during our sample period. In 1973, Manufacturing is the industry that employs the most people in the economy (30%). In 1982, Trade, Transportation, and Utilities becomes the sector with the largest employment (25%), followed by Manufacturing (24%), and remains the industry with the most employment for the remainder of the sample period. At the end of our sample period, four industries have more employment than Manufacturing: Trade, Transportation and Utilities, Education and Health Services, Professional Business Services, and Leisure and Hospitality. From 1973 to 2019, employment in Manufacturing falls by 30.9%. In contrast, employment in Education and Health Services, Professional Business Services, and Leisure and Hospitality increases by 374.8%, 267.8%, and 210.5%, respectively.

Our analysis shows that the largest industries in terms of employment in 2019 are poorly represented on the stock market. For example, the largest industry in 2019, Trade, Transportation, and Utilities, has 27.7 million employees. Listed firms in that industry have 11.3 million employees or 41.1% of all the employees in the industry. The next largest industry, Education and Health services, employs 24.1 million employees in 2019, but listed firms in that industry employ only 862,000 employees or 3.6% of all the employees in that industry. The third largest industry is Business Services with 21.3 million employees. Only 11.6% of these employees work for public firms.

To see how much the decline of manufacturing and the growth of service industries contribute to the decrease in the economic importance of stock market firms, it is useful to note that Manufacturing employment by stock market firms declines from 1973 to 2019 by 2.2 million employees. Though employment in Education and Health Services increases from 1973 to 2019 by 19 million employees, the increase in employment in that industry by stock market firms is only 813,840 employees. If Education and Health Services had the same percentage of employees from listed firms as Manufacturing in 2019, listed firms would have 19.3 million more employees in 2019. Instead of listed firms representing 29% of non-farm payrolls in 2019, they would represent 42.9% under this hypothetical scenario.

These results might seem surprising given all the attention paid to tech stocks. One might think that the growth of the tech industry leads to an increase in the economic importance of listed firms. However, this is not the case. Unfortunately, the tech industry is not a supersector, which prevents us from making a direct comparison between the employment of tech listed firms and all tech firms in the economy. Tech firms belong in some manufacturing industries, such as Computer Hardware and Electronics, telecommunication industries, such as Communication Services, and in the service industries, such as Software.[7] Listed manufacturing tech firms have become a more important contributor to manufacturing employment and to manufacturing value added. In contrast, listed non-manufacturing tech firms have become a less important

[7] The finance literature typically follows Loughran and Ritter (2004) and classifies as tech industries the industries with the following SIC codes: SIC codes 3571, 3572, 3575, 3577, 3578 (computer hardware), 3661, 3663, 3669 (communications equipment), 3671, 3672, 3674, 3675, 3677, 3678, 3679 (electronics), 3812 (navigation equipment), 3823, 3825, 3826, 3827, 3829 (measuring and controlling devices), 3841, 3845 (medical instruments), 4812, 4813 (telephone equipment), 4899 (communications services), and 7371, 7372, 7373, 7374, 7375, 7378, and 7379 (software). We modify the classification by including SIC 7370, which includes both Alphabet (Google) and Facebook. SIC 7370 includes computer programming and data processing. When we also include Amazon and Netflix in our tech industry classification, the employment, value added, and market capitalization percentages for 2019 are 18.6%, 23.0%, and 36.3%, respectively.

contributor to non-manufacturing employment and value added. The employment of all listed tech firms, whether in manufacturing or not, as a percentage of the employment of all listed firms increases over our sample period. In 1973, tech firms account for 10.7% of the employment of listed firms. By the end of our sample period, that percentage is 16.3%. The percentage of value added of listed firms accounted for by the tech industry increases from 12.0% to 22.1% over our sample period. Tech firms' share of the market capitalization of the stock market almost doubles from 16.7% in 1973 to 32.8% in 2019. Consequently, the share of the market capitalization of tech firms in the total market capitalization of listed firms increases much more than their share of the contribution to the economy of listed firms.

Doidge et al. (2017) show that there is a large decrease in the propensity to list after 1996. A decrease in the propensity to list could decrease the economic contribution of stock market firms if the remaining listed firms do not change. However, as Doidge et al. (2017) show, a major reason the number of listed firms falls is that public firms merge. If two public firms merge, the resulting firm is larger and contributes more to the economy. With a merger that creates synergies, one would expect that the merged firm contributes more to the economy than the two merged firms did before they were combined. It is therefore important to assess how much of the decrease in the contribution of listed firms to the economy can be attributed to the decrease in the percentage of non-farm payroll employment represented by manufacturing versus how much can be attributed by a change in the percentage of manufacturing employment represented by public firms. In Table 1, Panel A, we decompose the change in the percentage of employment of listed firms represented by each supersector in a share effect (the change in the industry's share of employment) and a shift effect (the change in the percentage of the industry's employment represented by listed firms).[8] The decomposition shows that the percentage of non-farm payroll employees working for listed firms falls by 12.81 percentage points from 1973 to 2019. This decrease is due to a negative share effect of 16.51 percentage points and a positive shift effect of 3.70 percentage points. The biggest shift effect is a 2.30 percentage point increase for the industry composed of Trade, Transportation, and Utilities. The biggest

[8] Our implementation of the shift-share decomposition follows Elsby, Hoijn, and Sahin (2013).

share effect is a negative effect of 16.04 percentage points for Manufacturing. Manufacturing explains almost all of the share effect. Without manufacturing, the story of the shift-share analysis would be that employment by listed firms relative to their industry increases.

Panel B of Table 1 conducts the same shift-share analysis for the number of listed firms. As Doidge et al. (2017), we eliminate firms with fewer than 20 employees, so that we consider only firms that are large enough in terms of employment that they could plausibly be listed. Note that the data for this analysis is available only from 1977 to 2014 and the industry classifications are based on SIC codes. We see that the number of manufacturing firms as a percentage of all firms falls from 1977 to 2014 and the number of service firms increases. All industries experience a decrease in the percentage of firms listed. The share effect is the part of the decrease in the percentage of firms from an industry listed that is due to a change in the percentage of firms from that industry in the economy. The shift effect is the part of the decrease in the percentage of firms from an industry that is due to a decrease in the listing propensity. We find that the share effect (–0.27 percentage points) explains half of the decrease in the percent of firms (–0.55 percentage points) listed since 1977. The share effect for the Manufacturing supersector is actually slightly larger than the total effect. The shift effect for Manufacturing is the largest in absolute value among all industries. The interpretation of the shift effect is that, had the fraction of manufacturing firms in the economy stayed the same, the percentage of listed manufacturing firms would have decreased by 0.07 percentage points because of the decrease in the listing propensity. It follows that the shrinkage of the manufacturing industry plays an important role in the decrease in the percentage of listed firms that are from manufacturing from 1977 to 2014.

5. How well does a firm's market capitalization measure a firm's contribution to the economy?

In this section, we investigate how closely market capitalizations are related to firms' contribution to the economy. For that purpose, we construct a yearly unrepresentativeness measure (*U*). The measure is inspired by the active share measure used in the investment literature (Cremers and Petajisto, 2009**)**. The active share measure assesses how much a portfolio departs from a benchmark by comparing portfolio weights to the weights of the index. Another way to put this is that the active share measure compares differences in portfolio weights of two portfolios. The measure is computed yearly, but we omit the time subscript in the following for simplicity. Here, we compare how firms' market capitalization weights differ from their direct economic contribution weights in the universe of listed firms. This is equivalent to comparing two sets of portfolio weights as is done with the active share measure since both the market capitalization weights and the direct economic contribution weights have to sum to one.

Specifically, consider firm *i*. Firm *i* has a market capitalization weight w_i measured as the ratio of the market capitalization of firm *i* to the sum of the market capitalizations of all listed firms. Similarly, we can compute firm *i*'s relative contribution to employment (*E*) of all listed firms. Let L_i be the contribution to employment of listed firms of firm *i*, which is the ratio of employment of firm *i* divided by the total employment of listed firms. For our purpose, however, the sign of the difference in the weights is irrelevant. We are concerned about the magnitude of the departure of the employment weights of firms from their capitalization weights. Consequently, we use the absolute value of the percentage absolute differences. Our measure *U*(*E*) is therefore the employment unrepresentativeness of listed firms, measured as the equally weighted average percentage absolute difference across all *n* listed firms:

$$U(E) = \frac{1}{2}\sum_{i=1}^{n}|w_i - L_i| \times 100\% \tag{6}$$

U(*E*) increases linearly with the average of the absolute value of the percentage differences. With this approach, the market is perfectly representative for employment if U(E) is zero. It is 0% if every firm's percentage of total market capitalization is the same as its percentage of total employment of listed firms. The highest value U(E) can take is 100%. We construct a similar measure for value added, which we denote as *U*(*VA*).

Figure 4 shows the evolution of the unrepresentativeness measures for employment. Panel A shows the employment unrepresentativeness for industrial firms and for all firms. Panel B shows value added measures. Both unrepresentativeness measures have their lowest value in the early 1980s and their highest value in 1999. The lowest values for *U*(*E*) is 36.3% for industrial firms and 34.9% for all listed firms in 1984 and the highest values are 57.2% and 53.8%, respectively, in 1999. This measure shows how disconnected firm valuations are from their employment contributions at the peak of the so-called internet bubble. The U(*E*) at the end of our sample period is the highest except for the years surrounding 2000. For both measures, the level of the unrepresentativeness is higher when we exclude financial firms.

We estimate the linear trend line for the unrepresentativeness measures for industrial firms only and for all public firms, including financials. We show the results in Panel A of Table 2. We find that the trend line is significantly positive for the employment unrepresentativeness measures. Since the values for 1999-2000 are so large, we also estimate the trend line without 1999 and 2000. When we do that, the trend has more explanatory power. We also estimate a non-parametric Kendall's τ_b correlation coefficient between the year and the unrepresentativeness measure. This non-parametric correlation is significant every year and corroborates the positive trend.

We then turn to the evolution of the unrepresentativeness measures for value added. In Figure 4, Panel B, we show results for Value Added, but results for Value Added (HLX) are similar. We find a w-shape pattern similar to the one we find for employment, with unrepresentativeness being the lowest in the early 1980s and highest in 2000. However, whereas employment unrepresentativeness is higher in 2019 than in the 1970s, this is not the case with the measures for value added even though the unrepresentativeness measure in 2019 is elevated. With value added, unrepresentativeness is lower in 2019 than the highest value in the 1970s by 3.8 percentage points for industrial firms and 7.3 percentage points for all public firms. We also estimate trends for the unrepresentativeness measures for value added. There are no significant trends in the parametric estimation for either industrial firms or for all listed firm, but the non-parametric correlations are positive and significant for industrial firms. These results are reported in Panel B of Table 2.

It is striking that unrepresentativeness is high when valuations are especially high, namely around 2000 and at the end of the sample period. Such an outcome is not possible if all valuations increase proportionately, but it is the expected outcome of an increase in valuations that favors a subset of firms. Shiller (2000) introduces the cyclically adjusted price/earnings ratio (CAPE) as a measure of valuation. Specifically, it measures the price-earnings ratio where, for the S&P 500, the price is the index and the earnings component is the ten-year moving average of inflation-adjusted earnings. With this measure, stocks are most expensive during the sample period in 2000 and 2019 and least expensive in 1981. On his website, Professor Shiller has two updated versions of CAPE.[9] One version is the original version. The second version accounts for the increased prevalence of repurchases over dividends in more recent times. We denote the former measure by $CAPE_1$ and the latter by $CAPE_2$. Note that $CAPE_2$ has data available only until 2018 instead of 2019 for $CAPE_1$.

We use the CAPE ratio as a measure of valuation and estimate robust regressions of the employment unrepresentativeness indices on a constant, CAPE, and CAPE squared. We report the results in Table 3 in Panel A. Models (1) to (4) show results for $U(E)$ for the sample of industrial firms and models (5) to (8) show results for the whole sample. In the regressions, whether we use $CAPE_1$ or $CAPE_2$, the coefficient is always positive and significant. The coefficients on the squared values of $CAPE_1$ and $CAPE_2$ are never significant. To assess economic significance, note that an increase of one standard deviation in $CAPE_1$ in model (1) of Table 2, Panel A, corresponding to an increase of CAPE of 11.32% relative to its mean of 19.72, is associated with an increase in employment unrepresentativeness of 2.58% relative to its mean of 48.83%.

In Table 3, Panel B, we present the results for the same regressions as reported in Panel A using the measures of unrepresentativeness for value added, $U(VA)$, as the dependent variable. When CAPE enters the regression only linearly, it has a positive significant coefficient. When CAPE enters linearly and quadratically, the linear term has a significant negative coefficient and the quadratic term has a positive

[9] http://www.econ.yale.edu/~shiller/data.htm

significant coefficient. An increase of one standard deviation in $CAPE_1$ in model (1) of Panel B of Table 3 is associated with an increase in unrepresentativeness of 0.77%.

An alternative approach to understand how market capitalizations relate to employment and value added is to assess how useful employment and value added are to explain the cross-sectional variation in market capitalizations. For example, if firm capitalizations were a constant times employment for all firms, then we would know a firm's market capitalization if we knew its employment. In this case, a regression of firm capitalization on firm employment would have an R^2 statistic of 1. In contrast to our unrepresentativeness measure, such a regression will be much more affected by the largest firms. Each year, we estimate a cross-sectional regression of firm market capitalization on employment and, similarly, a regression of market capitalization on value added. Figure 5, Panel A, plots the time-series of the R^2 statistics from the employment regressions. We see a dramatic decrease in how well the cross-sectional variation in employment explains the variation in firm market capitalization. The ability of employment to predict market capitalization is at its lowest at the end of the sample period and at its highest in the 1970s and 1980s. The R^2 of the regression exceeds 50% a number of years in the 1970s and during the first half of the 1980s, so that employment variation across firms could explain more than half of the variation in market capitalization across firms. At the end of the sample period, the R^2 statistics have declined to just 15%.

In Panel B of Figure 5, we plot the R^2 statistics for regressions of market capitalization on value added. The time-series plot of the R^2 statistics for regressions of market capitalization on value added looks quite different from the plot of the R^2 statistics for regressions of market capitalization on employment. With employment, the R^2 statistics mostly fall throughout the sample period. With value added, the R^2 statistics follow an inverted w pattern, where they increase initially, then fall to reach their lowest value shortly before 2000. From there they increase again to reach values as high as their highest values before 2000, and then, finally, fall sharply in the 2010s. However, from Figure 5 it is obvious that variation in value added explains much more of the variation in market capitalization than variation in employment does. In some years, value added explains more than 70% of the variation in market capitalization. The lowest R^2

coefficient for Value Added is slightly more than 38%. Our conclusions remain largely unchanged again when we replace Value Added with our alternative measure of value added, Value Added (SP).

It follows from the results presented in this section that unrepresentativeness is worse in 2019 than in the 1970s and increases over time. In contrast, though unrepresentativeness is high in 2019 for value added, it is lower than in the 1970s and it does not increase over time. We also find that the ability of employment to explain market capitalization worsens dramatically during our sample period, but the same is not true for value added.

6. Is the stock market representative of the contribution of industries to the economy?

As discussed earlier, the data we use to compare employment by listed firms in an industry to total employment of that industry is the data for NAICS supersectors made available by the BLS over our whole sample period. For data for listed firms only, we can use much more granular industry definitions. One widely used classification is the Fama and French (1997) classification that divides US firms into 48 industries (FF 48 industries).

When we consider supersectors, the Manufacturing NAICS supersector is the most highly capitalized supersector in the stock market every year from 1973 to 2019. This is the case despite the fact that the manufacturing sector has shrunk during our sample period, as discussed in Section 4. Specifically, the market capitalization of the Manufacturing supersector is almost 40% of the market capitalization of the whole stock market in 1973 and falls to about 26% in 2019. We compute a measure of unrepresentativeness of the stock market firms for the supersectors as follows. We sum the absolute difference between an industry’s share of total employment by stock market firms and that industry’s share of payroll non-farm employment. With this measure (not tabulated), the stock market becomes much less representative over time. This result is consistent with our evidence of Section 4 that the industries that expanded the most are the industries where firms are the least suited for stock market listing.

We know turn to the FF 48 classification. In Table 4, we show data for the most capitalized industry each year. During our sample period, there is considerable persistence in the most highly capitalized industry. In 2019, the most highly capitalized FF 48 industry is Business Services. That industry is the most highly capitalized consistently since 2012 and also in 2009 and 2001 for a total of ten sample years. The industry that is most often the most highly capitalized industry is the Oil industry, which has the top rank 16 years during the sample period. Banks have the top rank 10 years, followed by the Telecommunication industry, which has the top rank 7 years. The top industry generally has a higher share of stock market capitalization than either of labor employment or value added. However, the business services industry is the one with shares of labor employment and value added that are closest to its share of market capitalization. In contrast, the oil industry and banks have low shares of employment compared to their market capitalization shares.

Table 4 also shows for each year the industry concentration for market capitalization, employees, and value added. As our measure of concentration, we use the Herfindahl index. With this index, the highest value of 10,000 would occur if there is just one firm in an industry. Starting with market capitalization, we see that concentration is highest in 2019 since the early 1980s. However, the highest value for concentration in the sample period is almost twice the concentration in 2019. Though employment concentration is never as high as at the end of the sample period, valued added concentration is higher than at the end of the sample period for five years in the early 2000s and in 1980. There does not seem to be a pattern of secular increase in these concentration measures. Such a result may not be surprising as concentration varies across industries as well as over time.

Next, we compute the unrepresentativeness measures for the FF48 industries but do not tabulate the results. For these unrepresentativeness measures, we use industry data instead of firm data, so that we use an industry's market capitalization share of the stock market and either its employment share or its value added share. We find that the unrepresentativeness measures for the FF 48 industries have the same w-shape pattern that we see with the measures for individual stocks. There is a significant upward trend in the unrepresentativeness measure for employment but not in the measure for value added. We can compare the levels of the measures of unrepresentativeness for firms and for industries. The stock market is more representative for industries than it is for firms. For instance, the unrepresentativeness for employment for industrial firms does not fall below 35%; in contrast, the unrepresentativeness for employment for industries falls below 25%.

7. How representative of the economy are the firms with the largest market capitalization?

In this section, we evaluate how the largest (top-1) and top-3 capitalization firms in a given year contribute to the economy and whether that contribution has changed over time. As discussed earlier, there are issues with the data before 1973. In particular, a much larger proportion of listed firms is missing employment data. Nevertheless, for some analyses, the data available for the years before 1973 can be used and we do so. In particular, we can identify each year the firms with top market capitalization since 1950. With our data, we can identify the top market capitalization firm using CRSP data or Compustat data. These two sources always agree on the most highly capitalized firm. In five years, one firm within the top three firms differs between Compustat and CRSP. We report the results based on CRSP, but arrive at similar overall conclusions based on market capitalization based on year-end prices from Compustat.

Using data starting in 1950, it is striking how few distinct firms have been the most highly capitalized firms in the stock market. Figure 6 shows the top three most highly capitalized firms since 1950 for every year. From 1950 to 2019, only seven distinct firms are the most highly capitalized firms. Starting with 1950, AT&T is the top firm for sixteen years. In the 1950s, GM is the top capitalized firm for three years and AT&T is the top firm for the other years. AT&T is the top firm every year from 1957 to 1966. IBM is then the top firm from 1967 to 1990 with three one-year interruptions – twice AT&T is the top firm and once Exxon Mobil Corp. is the top firm. GE is then the top firm for a total of ten years, but during the GE period Microsoft is the top firm for three years. The GE period is followed by Exxon Mobil being the top firm for seven consecutive years. During most recent years in our sample period, Apple is the firm with the highest market capitalization, but in one year it is replaced at the top by Microsoft.

Figure 7 plots the market capitalization of the largest market capitalization firm for each year since 1950, where the market capitalization is calculated in 2019 constant dollars from the year-end price times the number of shares outstanding on CRSP. Since the 1950s, the market capitalization of the firm with the top market capitalization in 2019 dollars has increased dramatically. The market capitalization of the top firm is fairly stable from the 1960s to the middle of the 1990s. However, as can be seen in Figure 7, it explodes in the second half of the 1990s. After the collapse of the internet bubble, the market capitalization of the top firm does not fall back to its pre-bubble level. Instead, after having increased by roughly a factor of five from 1995, it stays between two and three times its 1995 value until the mid-2010s when it explodes again. As a result, the market capitalization of the largest market capitalization firm in 2019, Apple, is more than six times in constant dollars the market capitalization of the largest market capitalization firm in 1995. In contrast, the market capitalization of the largest firm in 1995 is roughly at the average of the market capitalization from 1960 to 1995. From 1960 to 1995, the market capitalization of the largest firm never exceeds the market capitalization of the largest market capitalization firm in 1995 by more than 50% and is never noticeably lower.

It would be reasonable to infer from our discussion of the level of the market capitalization of the largest market capitalization firm that the firm with the largest market capitalization represents a much higher fraction of the market after 1995 than before. In Figure 8, we plot the market value of the top-1 and top-3 firms as a percentage of the stock market capitalization each year. It is clear that in the 2000s the top-1 or top-3 firms together represent a relatively low, but recently increasing proportion of the total stock market capitalization, when compared to the earlier years in the sample. This can be explained through the sharp increase in the market capitalization of the overall market in the second half of the 1990s. Table 5 shows that the fraction of the market represented by the largest firm reaches a peak of 12.6% in 1960 and drops after that, though not monotonically, to reach a minimum in 1992 of 1.9%. After 1992, the market share of the firm with the largest market capitalization is always higher. In 2019, however, that market share is higher than any time since 1984, but is only slightly higher than in 2000.

How does the contribution of the top market capitalization firm to employment evolve? For 1953, GM is the top firm in market capitalization. It employs 1.39% of non-farm employees. In 2019, Apple's employment contribution is 0.11% (or less than one twelfth GM's employment contribution in 1953). There are even fewer firms that are top employers from 1973 to 2019 than there are firms that have the highest market capitalization. Only three firms have the largest number of employees from 1950 to 2019: AT&T, General Motors, and Walmart Inc. As discussed earlier, AT&T and GM are the only firms with the highest market capitalization from 1950 until the late 1960s. This means that the firms that are the most highly capitalized in those years are also the firms with the highest employment. In the 2000s, none of the firms that are among the top three market capitalization firms are among the top three employers except for Walmart Inc., which is among the top three market capitalization firms for five years, and Amazon Inc., which is among the top three market capitalization firms for three years. Amazon Inc. is the second firm in terms of employment in the last three years of our sample period. Not surprisingly, when a large employer enters or exits the top three market capitalization firms it leads to large changes in the employment of the top three firms. However, the number of employees of the firm with the top stock market share or of the top three stock market share firms was much higher before the 1980s than recently. The last time the top employer is also the most highly capitalized firm is in the 1960s. This obviously would change if Amazon Inc. becomes the top market capitalization firm.

We also compute the share of non-farm payroll employment represented by the largest market capitalization firm. That share is never as consistently low as it is after the Global Financial Crisis. The share of employment of the top three market capitalization firms has never been as low as it is in the 2010s before Amazon Inc. becomes one of the top three firms in market capitalization. However, even with Amazon Inc., the top three firms in market capitalization employ a smaller fraction of the non-farm payroll employment than at any time before the late 1980s.

In 1953, GM's value added is 1.2% of GDP. In contrast, Apple's contribution is 0.42% in 2019. We also estimate the value added of the top market capitalization firm and of the top three market capitalization firms since 1973. For the top three firms as well as for the top firm, the contribution to GDP is much lower since the 1980s than before, but the contribution in 2019 is not abnormally low. The contribution to GDP of the top firm and of the top three firms reaches a minimum in the second half of the 1990s. Table 5 also reports the rank of the top market capitalization firm in employment and value added since 1973. It is notable that the top market capitalization firm is always in the top ten value-added firms except for three years, where Microsoft is ranked 42^{nd}, 32^{nd}, and 27^{th} in 1998, 1999, and 2002, respectively. In 2018 Microsoft has again the largest market capitalization with the 9^{th} highest value added. In contrast, the top market capitalization firm is always in the top ten employment firms until 1988, but is almost never in the top ten since then. The last time the top market capitalization firm is in the top ten firms in terms of employment is in 2005 with GE. Apple is the firm with the 40^{th} highest employment level in 2019. In contrast, GM in 1953 has the second highest employment level. AT&T which is the firm most frequently the top market capitalized firm in the 1950s is always the top employer.

8. Conclusion.

In this paper, we examine how listed firms contribute to the economy over time and how their market capitalization is related to their contribution to the economy. We find that stock market firms as a group contribute less to employment and to GDP than in the 1970s. Since 1973, industrial stock market firms never contribute as little to employment as they do in 2019 and all firms on the stock market contribute less than in 2019 only two years. Though the contribution to GDP of stock market firms is less in recent years than in the 1970s, the decline in contribution to GDP is less than the decline in contribution to employment.

Our estimates for the contribution of listed firms to GDP come with some important caveats. Listed firms generally do not disclose their employment expenses, so that we have to approximate them using approaches developed in the recent literature. Further, though listed firms disclose employment, they do not generally disclose separately domestic and foreign employment. As a result, our estimates of employment and value added for listed firms are estimates for worldwide employment and worldwide value added of these firms. To the extent that foreign activities of firms increase over time, our estimates likely understate the decrease in the contribution of listed firms to the US economy. It is well-known that the relative importance of investments in intangible capital has increased over time. These investments are mostly expensed under GAAP. Though we can adjust firm income for investment in intangible capital, we cannot adjust employment for employees who work on projects that increase invested capital. If we adjust income for investment in intangible capital, our conclusions about the evolution of the contribution of value added of listed firms to GDP are unchanged.

We measure how representative the market capitalization of firms is of their contribution to the economy. We find that our measure of unrepresentativeness follows a w shape for both employment and value added: the measure is high in the 1970s, around 2000, and at the end of the sample period. For labor, unrepresentativeness increases over time, but not for value added. We also find that the relation between firm market capitalization and firm employment collapses during our sample period. In the 1970s, employment explains 50.7% on average of the variation in market capitalization across firms. In the 2010s, it explains 21.8% on average. A firm's value added explains much more its market capitalization than its employment. This is true throughout our sample period. Strikingly, there is no consistent degradation in the ability of value added to explain the variation in market capitalization across firms. In the 1970s, value-added explains 68.2% of the variation in market capitalization in average. In the 2010s, it explains 67.7%.

Perhaps not surprisingly, the top market capitalization firm evolves in the same way as the market as a whole. In the 1950s, the top market capitalization firm was the top employer in the country. In the 2010s, it is the 40^{th}. However, the top market capitalization firm is in the top ten of firms by value added in the 2010s as in the 1970s.

The evolution we document is largely the result of the decline of manufacturing in the US. Not all firms are equally suited to be public firms. Small firms and service firms are much less likely to be listed on stock exchanges. Over our sample period, employment by the manufacturing industry falls sharply in importance while employment by the service industries grows dramatically in importance. A large fraction of the employees of manufacturing firms work for public firms. A small fraction of employees of service firms work for public firms. As a result, the fraction of employees working for public firms falls.

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Appendix: Methodology for Value Added measures

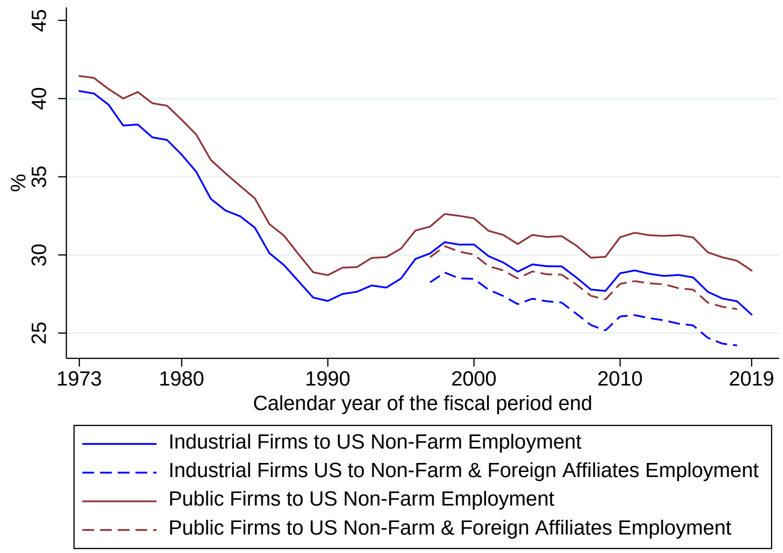
Our two main measures for value added follow the methodologies of Donangelo et al. (2019) and Hartman-Glaser et al. (2019). We make several adjustments dictated by our research question. For both Value Added and Value Added (HLX) we define value added as the sum of operating income before depreciation (OIBDP) and labor expenses, referred to as staff expenses in Compustat (XLR).

Since the data item labor expenses is frequently missing in Compustat, we apply different replacement strategies, that are similar to the methods applied in the literature, but feature some important distinctions. First, we follow the literature and substitute missing observations for XLR with the imputed value based on the industry median of the ratio of XLR/Employees. We multiply this ratio with the number of employees listed for the firm in a given year in order to derive the extended XLR measure as a replacement for the missing firm-level XLR in Compustat.

Following the literature, we define industries initially as the Fama-French 17 industries. However, we require a minimum of 20 observations to exist in a year in order to calculate the median of the XLR/Employees ratio to calculate the extended XLR. When this condition is not met, we repeat the process using the Fama-French 12 industry classification, and, if needed, the two-digit based industry code classification. Given the prevalent situation of missing observations for XLR in Compustat, this still leaves 6.8% of observations where we have fewer than 20 industry peer observations within the 2-digit SIC code classification. For these cases, we rely on the median of the ratio from the supersector.

For Value Added (HLX) we sort firms in five size portfolios within their industry classifications instead of the 20 portfolios used in Hartman-Glaser et al. (2019). We also do not apply any additional winsorization given that we rely on medians as opposed to means and sort into larger benchmark bins. In unreported analyses, we vary these sorting, matching and winsorization conditions and end up with 14 different measures, where we both include and exclude financial firms. The correlations among these measures are very high with a minimum of 92%, but these conditions have large impacts for the largest market capitalization firms on which we focus in this study. The approaches we use lead to a higher contribution to the economy of listed firms than approaches that use extensive winsorization.

Panel A: Employees as a percentage total non-farm payroll employment (1973-2019)



Panel B. Value-added as a percentage of US nominal GDP (1973-2019)

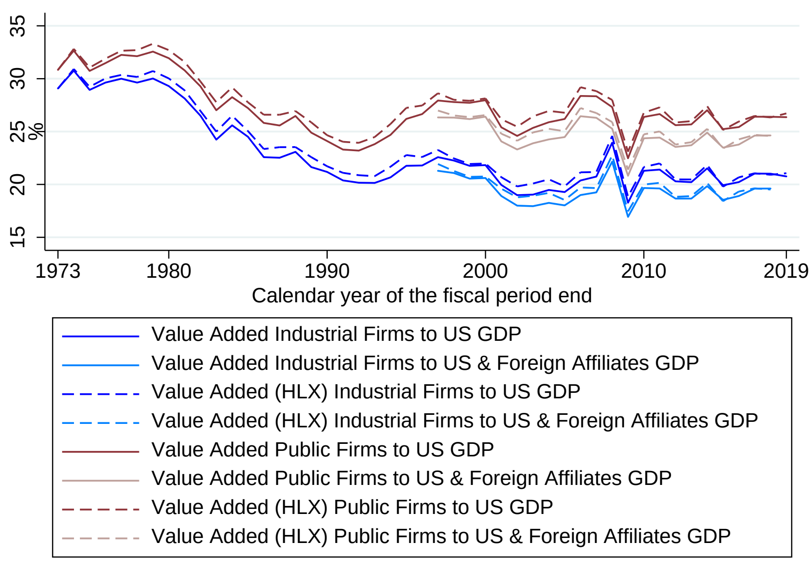


Figure 1.
In Panel A, the graph plots the evolution of the percentage of total non-farm payroll employment represented by employees of listed firms for 1973-2019. Firm-level employment data is from Compustat and US non-farm payroll employment is from the US Bureau of Labor Statistics (BLS). In Panel B, the graph plots the evolution of the percentage contribution of the aggregate value added measures, Value Added and Value Added (HLX) for industrial and listed firms to the US Gross Domestic Product for 1973-2019. Value added and Valued add (HLX) are defined in the data appendix. Public firms are industrial firms plus financial firms. Employment and GDP for foreign affiliates of US multinational enterprises are from the Bureau of Economic Analysis (BEA) and available for years 1997–2018.

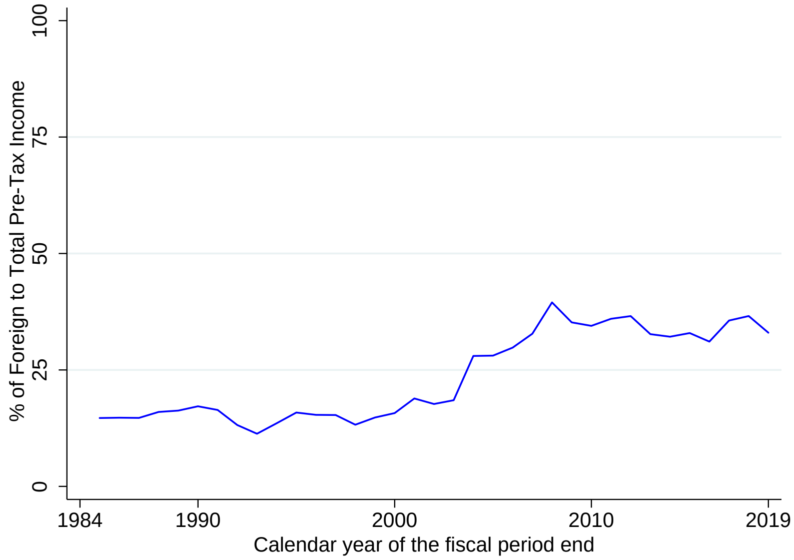


Figure 2.
The graph plots the evolution of the percentage of foreign pre-tax income to the total of domestic and foreign pre-tax income. The pre-tax income data is from Compustat items PIFO and PIDOM, which exclude financial firms and utilities. Widespread data coverage on Compustat starts in 1984.

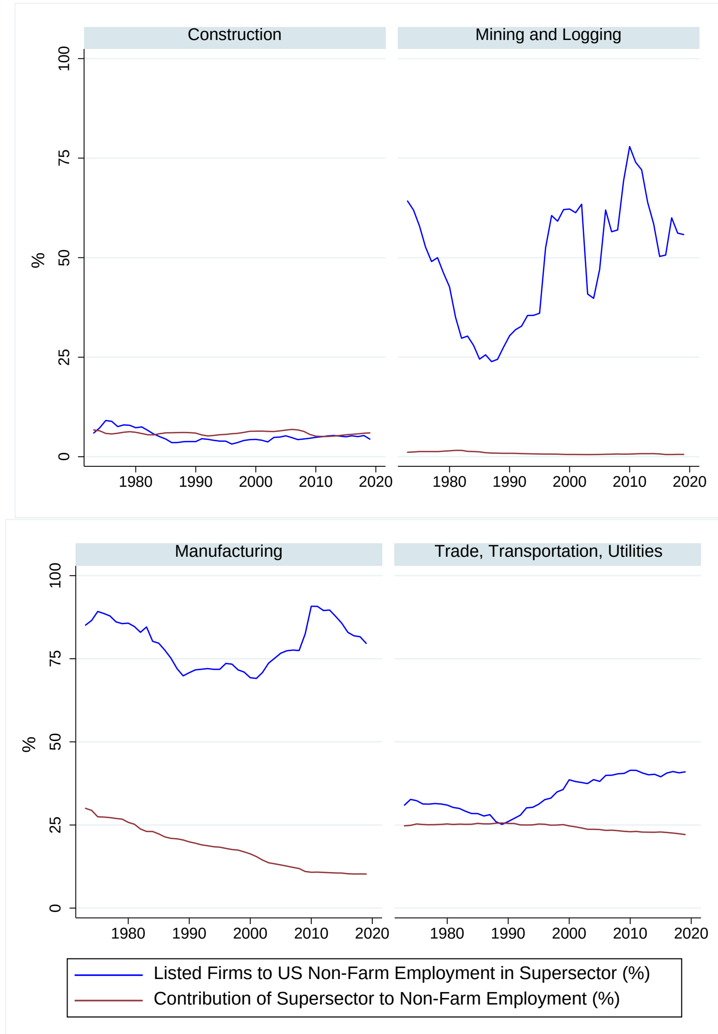
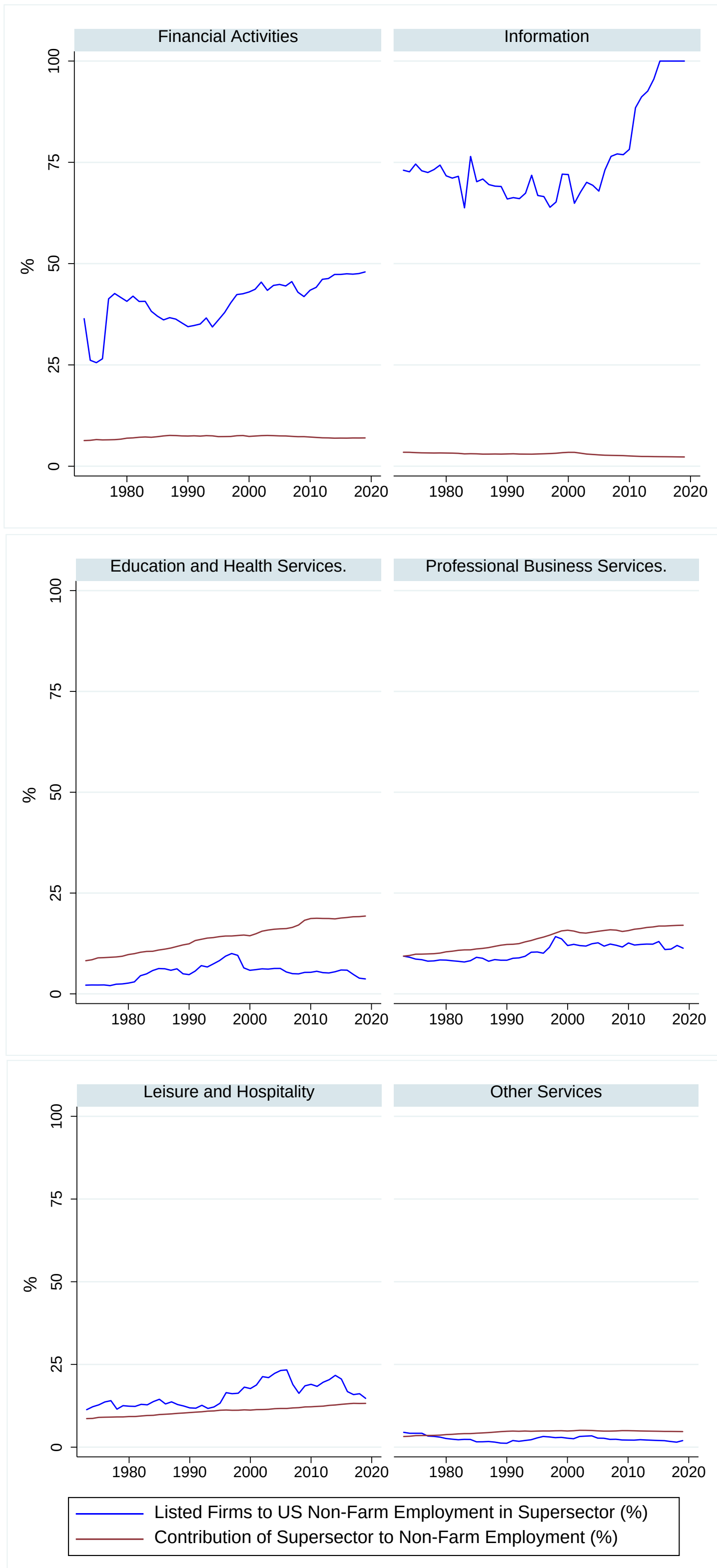
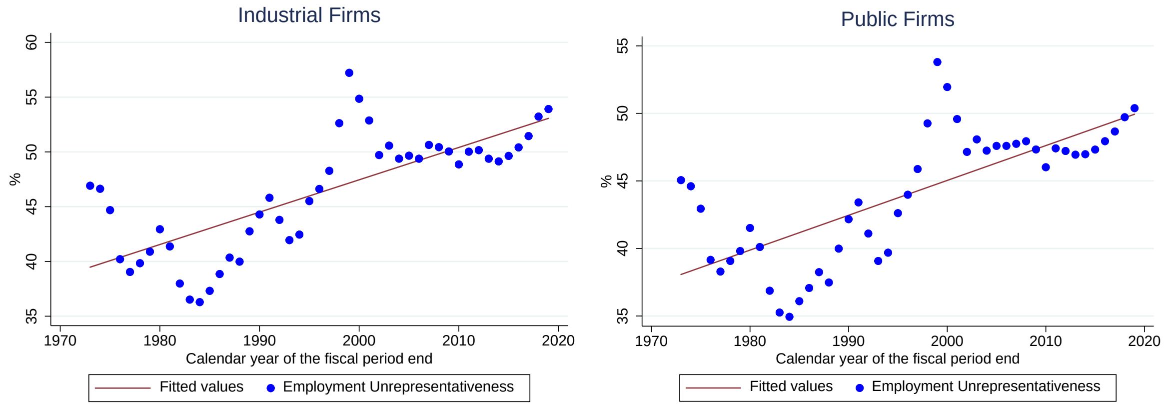


Figure 3.
Each graph plots (in blue) the contribution of total employment of public firms in a supersector as a percentage of US non-farm employment in the same supersector. Each graph plots (in red) the contribution of total employment in a supersector as a percentage of total US non-farm employment. Each plot runs from 1973-2019. Firm-level employment is from Compustat and US non-farm employment and supersector definitions are from the Bureau of Labor Statistics.

Figure 3 – *Continued*



Panel A: Employment unrepresentativeness (1973-2019)



Panel B: Value added unrepresentativeness (1973-2019)

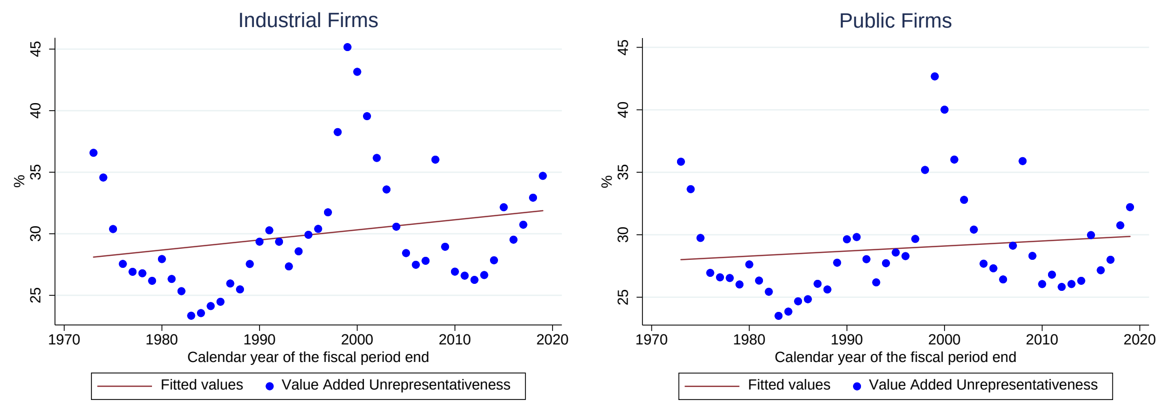
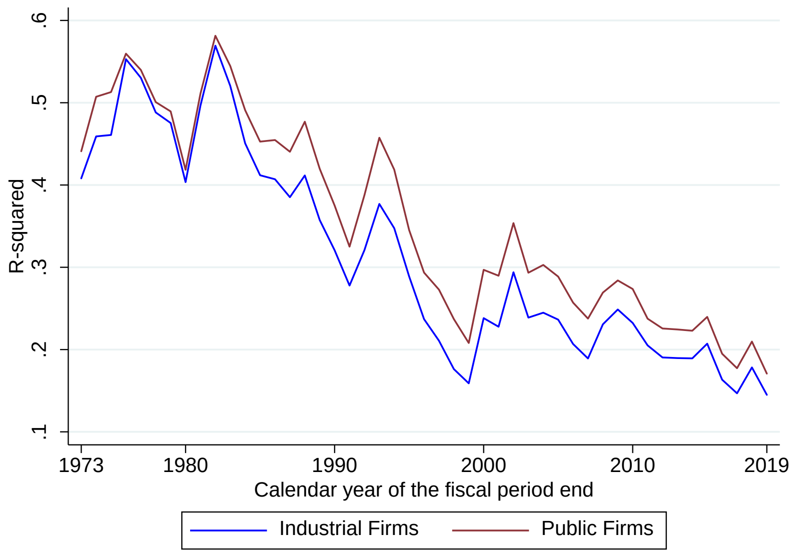


Figure 4.
The dots in Panel A plot the evolution of the employment unrepresentativeness, *U*(*E*), measure for industrial firms (left) and public firms (right) for 1973-2019. The dots in Panel B plot the evolution of the value added unrepresentativeness, *U*(*VA*), measure for industrial firms (left) and all public firms (right) for 1973-2019. *U*(*E*) and *U*(*VA*) are defined as the average percentage absolute difference between a firm's market capitalization weight and its, respectively, employment and value added weight across of all listed firms as formulated in Equation (6). The straight line represents the fitted linear time trend. Public firms are industrial firms plus financial firms.

Panel A: R-squared statistics from cross-sectional regressions of Market Capitalization on Employment



Panel B: R-squared statistics from cross-sectional regressions of Market Capitalization on Value Added

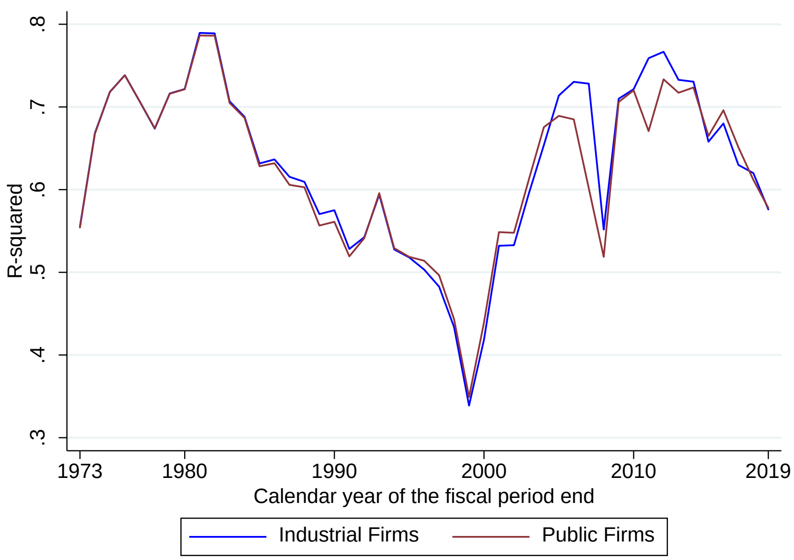


Figure 5.
The graph plots R-square statistics from yearly cross-sectional regressions, where the dependent variable is the firm's market capitalization regressed on a constant and a single independent variable for 1973-2019. In Panel A the independent variable is the firm's employment. In Panel B, the dependent variable is Value Added for the firm. Public firms are industrial firms plus financial firms.

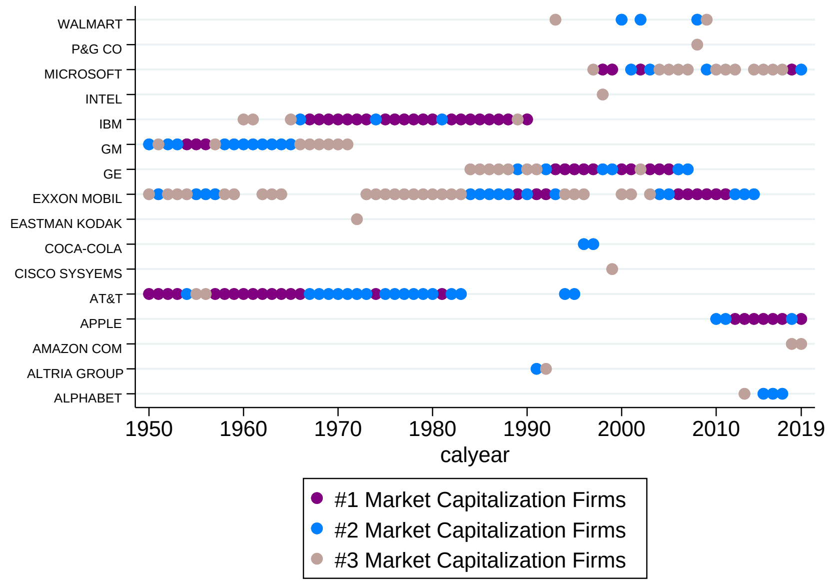


Figure 6.
The graph plots the firms with the largest (#1), second largest (#2), and third largest (#3) market for each of the sample years (1950-2019). The market capitalization of a firm is measured by the number of shares times the year-end stock price from CRSP.

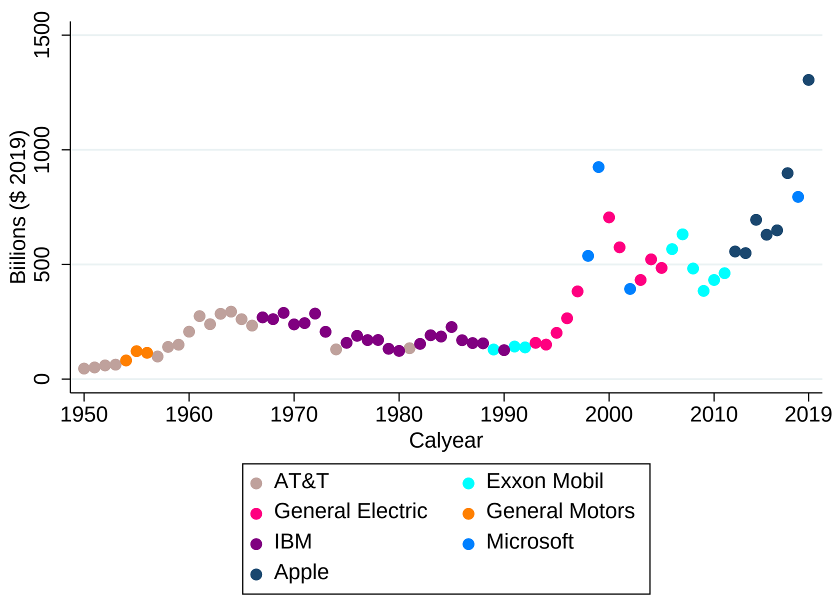


Figure 7.
The graph plots the market capitalization for the largest market capitalization firms each year in billions of dollars (2019 CPI adjusted). The market capitalization is measured as the number of shares times the year-end stock price from CRSP for the sample period 1950-2019.

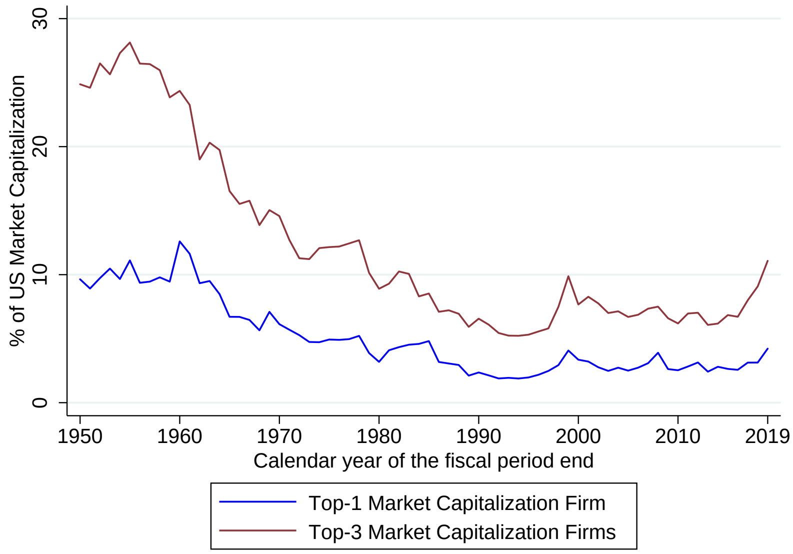


Figure 8.
The graph plots the market capitalization of Top-1 and Top-3 firms as a percentage of the market capitalization of all listed firms (1950-2019). The market capitalization of a firm is measured by the number of shares times the year-end stock price from CRSP.

Table 1.
Industry shift-share analysis 1973 – 2019

Columns 1, 2, and 3 in Panel A tabulate the proportion of employment of all firms (private and public) for each supersectors for 1973, 2019, and the change from 1973 to 2019, respectively. Columns 4, 5, and 6 tabulate these proportions for public firms. Columns 7 and 8 tabulate the change in the percentage of the industry's employment represented by public firms (Shift) and the change in the industry's share of employment (Share) for each supersector for 1973 and 2019. Panel B tabulates the same columns as in Panel A, but based on the relative number of firms for each industry, where industries are organized in ten major industries based on 2-digit SIC code ranges, following the Bureau of Economic Analysis (BEA).

Panel A: *Change in the percentage of employment of listed firms represented by inudstry supersectors (NAICS)*

	All Firms			Public Firms			Shift-share analysis	
Industries (NAICS Supersectors)	1973	2019	Change	1973	2019	Change	Shift	Share
Nonfarm business sector	100	100	0	40.59	27.79	-12.81	3.70	-16.51
Mining and Logging	1.10	0.57	-0.53	64.23	55.80	-8.43	-0.07	-0.32
Construction	6.61	5.84	-0.77	5.96	4.42	-1.54	-0.10	-0.04
Manufacturing	29.48	10.00	-19.48	85.12	79.63	-5.49	-1.08	-16.04
Trade, Transportation, and Utilities	24.31	21.59	-2.72	30.97	40.98	10.01	2.30	-0.98
Information	3.39	2.23	-1.16	73.06	114.64	41.58	1.17	-1.09
Financial Activities	6.22	6.81	0.60	36.41	47.96	11.54	0.75	0.25
Professional Business Services	9.19	16.61	7.41	9.36	11.32	1.96	0.25	0.77
Education and Health Services	8.08	18.84	10.76	2.16	3.71	1.55	0.21	0.32
Leisure and Hospitality	8.47	12.92	4.45	11.32	14.75	3.43	0.37	0.58
Other Services	3.16	4.59	1.44	4.48	1.97	-2.50	-0.10	0.05

Panel B: *Change in the Percentage of number of listed firms represented by major industry sectors (SIC)*

	All Firms			Public Firms			Shift-share analysis	
Major Industries (SIC-based)	1977	2014	Change	1977	2014	Change	Shift	Share
Nonfarm business sector	100	100	0	1.11	0.56	-0.55	-0.27	-0.27
Agriculture, Forestry, Fishing	0.44	1.51	1.07	1.13	0.08	-1.05	-0.01	0.01
Mining	1.08	0.66	-0.42	4.63	3.66	-0.96	-0.01	-0.02
Construction	7.58	6.40	-1.18	0.22	0.13	-0.09	-0.01	0.00
Manufacturing	20.74	9.89	-10.85	2.79	2.32	-0.47	-0.07	-0.28
Transportation and Public Utilities	4.50	4.21	-0.29	2.17	1.01	-1.16	-0.05	0.00
Wholesale Trade	11.58	7.53	-4.04	0.39	0.21	-0.18	-0.02	-0.01
Retail Trade	22.92	23.19	0.27	0.39	0.15	-0.24	-0.06	0.00
Finance, Insurance, Real Estate	6.11	5.38	-0.73	2.31	2.03	-0.28	-0.02	-0.02
Services	25.06	41.23	16.17	0.35	0.23	-0.11	-0.04	0.05

Table 2.
Trend analysis for unrepresentativeness measures (1973-2019)

In Panel A, Columns 4, 5, and 6 tabulate the slope coefficients, p-values, and adjusted R-squares for a linear fit estimation of the time trend of the employment unrepresentativeness over the sample period (1973-2019). Columns 7 and 8 tabulate the non-parametric Kendall Tau correlation coefficient and its p-value. Panel B repeats the same columns for value added unrepresentativeness. Unrepresentativeness is defined in Equation (6). *, **, *** denote statistical significance at the 1, 5, and 10% level. Public firms are industrial firms plus financial firms.

Panel A: *Employment unrepresentativeness*

		Parametric			Non-parametric	
Sample	Exclude 1999-2001	Slope Coefficient	*p* -value	Adj-R^2	Kendall Tau Correlation	*p* -value
Industrial Firms	No	0.295***	*< 0.001*	0.555	0.532***	*< 0.001*
Industrial Firms	Yes	0.285***	*< 0.001*	0.634	0.581***	*< 0.001*
Public Firms	No	0.258***	*< 0.001*	0.522	0.506***	*< 0.001*
Public Firms	Yes	0.248***	*< 0.001*	0.594	0.552***	*< 0.001*

Panel B: *Value added unrepresentativeness*

		Parametric			Non-parametric	
Sample	Exclude 1999-2001	Slope Coefficient	*p* -value	Adj-R^2	Kendall Tau Correlation	*p* -value
Industrial Firms	No	0.082	*0.121*	0.032	0.204**	*0.043*
Industrial Firms	Yes	0.064	*0.104*	0.039	0.211**	*0.043*
Public Firms	No	0.040	*0.365*	-0.004	0.138	*0.172*
Public Firms	Yes	0.026	*0.436*	-0.009	0.135	*0.195*

Table 3.

Time-series regression of employment unrepresentativeness on Shiller (CAPE) index

The table reports coefficients and *p*-vales in parentheses for robust OLS regressions. In Panel A, the dependent variable is the measure for employment unrepresentativeness, *U*(*E*). Models (1) – (4) are estimated on industrial firms and models (5) – (8) for all listed firms. In Panel B, the dependent variable is the measure for value added unrepresentativeness, *U*(*VA*). The independent variables are the Shiller (2000) cyclically adjusted price/earnings ratio ($CAPE_1$) and an updated version ($CAPE_2$) from 2018. The data for both indices are available from http://www.econ.yale.edu/~shiller/data.htm. Each even-numbered specification includes squared terms of the relevant index. *, **, and *** denotes statistical significance at the 1, 5, and 10% level. Public firms are industrial firms plus financial firms.

Panel A: *Unemployment unrepresentativeness U(E)*

	Industrial Firms				Public Firms			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$CAPE_1$	0.495***	0.650***			0.431***	0.504***		
	(0.000)	(0.001)			(0.000)	(0.006)		
$(CAPE_1)^2$		-0.003				-0.002		
		(0.338)				(0.641)		
$CAPE_2$			0.450***	0.543***			0.391***	0.407**
			(0.000)	(0.009)			(0.000)	(0.037)
$(CAPE_2)^2$				-0.002				-0.000
				(0.603)				(0.923)
Intercept	36.034***	34.592***	35.629***	34.633***	35.079***	34.407***	34.782***	34.605***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
n	47	47	46	46	47	47	46	46
Adjusted-R^2	0.703	0.707	0.654	0.655	0.661	0.662	0.604	0.604

Panel B: *Value added unrepresentativeness U(VA)*

	Industrial Firms				Public Firms			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$CAPE_1$	0.344***	-0.465**			0.243***	-0.537***		
	(0.000)	(0.019)			(0.002)	(0.003)		
$(CAPE_1)^2$		0.018***				0.017***		
		(0.000)				(0.000)		
$CAPE_2$			0.316***	-0.530**			0.223***	-0.590***
			(0.000)	(0.010)			(0.005)	(0.002)
$(CAPE_2)^2$				0.017***				0.016***
				(0.000)				(0.000)
Intercept	22.867***	30.378***	22.535***	31.677***	23.900***	31.147***	23.688***	32.466***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
n	47	47	46	46	47	47	46	46
Adjusted-R^2	0.413	0.537	0.381	0.515	0.295	0.459	0.268	0.444

Table 4.

Market capitalization, employment, and value added for top-1 Fama-French 48 industries by market capitalization (1973-2019)

The table tabulates for each sample year in columns 2 to 4 the Herfindahl index based on the market capitalization, employees, and value added, respectively, for the top-1 Fama-French 48 industry by market capitalization. Columns 5 and 6 list the name of the top-1 industry and its percentage market capitalization relative to the overall market capitalization. Columns 7 and 8 list percentage of employees for the top-1 industry and its employee-based rank relative to the whole market. Columns 9 and 10 list the percentage of value added and its rank relative to the whole market.

			Herfindahl Index			Employees		Value-added	
Year	Top-1 Industry Mkt Cap	Market Capitalization (%)	Market Capitalization	Employees	Value-added	Industry (%)	Industry (Rank)	Industry (%)	Industry (Rank)
1973	Oil	14.58	212.58	19.78	103.30	4.45	5	10.16	2
1974	Oil	15.02	225.54	21.02	168.93	4.58	4	13.00	1
1975	Oil	14.04	197.08	23.20	146.44	4.82	4	12.10	1
1976	Oil	14.63	213.89	27.14	135.89	5.21	4	11.66	1
1977	Oil	14.60	213.29	26.22	127.21	5.12	4	11.28	1
1978	Oil	14.34	205.59	26.54	122.80	5.15	4	11.08	1
1979	Oil	18.66	348.27	27.68	166.78	5.26	4	12.91	1
1980	Oil	23.94	572.89	30.04	207.34	5.48	3	14.40	1
1981	Oil	18.71	350.14	31.65	166.49	5.63	3	12.90	1
1982	Oil	12.44	154.67	27.45	148.37	5.24	4	12.18	1
1983	Oil	11.69	136.73	22.65	147.58	4.76	5	12.15	1
1984	Oil	10.48	109.83	17.34	98.66	4.16	7	9.93	1
1985	Util	9.16	83.84	9.76	59.37	3.12	11	7.70	4
1986	Util	9.30	80.27	41.57	77.43	3.18	10	7.95	3
1987	Telcm	9.35	87.33	42.16	71.11	6.49	3	8.43	2
1988	Telcm	9.86	97.32	46.71	71.03	6.83	3	8.43	2
1989	Telcm	12.48	155.71	48.40	74.91	6.96	3	8.66	2
1990	Telcm	10.70	114.47	45.75	72.92	6.76	3	8.54	1
1991	Drugs	10.11	102.16	5.37	9.90	2.32	17	3.15	12
1992	Telcm	9.55	91.11	39.62	69.99	6.29	3	8.37	2
1993	Telcm	10.32	106.54	36.75	67.90	6.06	3	8.24	2
1994	Telcm	10.05	100.93	35.95	65.89	6.00	3	8.12	3
1995	Banks	10.13	102.61	26.35	102.31	5.13	5	10.11	1
1996	Banks	11.51	132.40	25.18	114.62	5.02	4	10.71	1
1997	Banks	13.18	173.61	23.90	118.21	4.89	4	10.87	1
1998	Banks	11.92	142.07	23.22	124.60	4.82	5	11.16	1
1999	BusSv	14.91	222.18	60.55	69.31	7.78	2	8.33	2

Table 4 – *Continued*

Year	Top-1 Industry Mkt Cap	Market Capitalization (%)	Herfindahl Index: Market Capitalization	Herfindahl Index: Employees	Herfindahl Index: Value-added	Employees: Industry (%)	Employees: Industry (Rank)	Value-added: Industry (%)	Value-added: Industry (Rank)
2000	Drugs	11.5993	106.40	52.79	61.88	2.03	18	3.00	13
2001	BusSv	11.5983	134.52	51.70	64.08	7.19	2	8.01	2
2002	Banks	12.2928	151.11	33.86	208.71	5.82	4	14.45	1
2003	Banks	13.7466	188.97	36.26	273.87	6.02	4	16.55	2
2004	Banks	13.3787	178.99	35.04	235.77	5.92	4	15.35	2
2005	Banks	11.5672	133.80	33.15	237.71	5.76	4	15.42	2
2006	Banks	11.9461	142.71	34.34	226.89	5.86	4	15.06	2
2007	Oil	10.198	104.00	2.84	61.15	1.68	18	7.82	5
2008	Oil	10.5687	111.70	3.29	59.70	1.81	18	7.73	4
2009	BusSv	9.7917	95.88	62.05	110.40	7.88	2	10.51	3
2010	Oil	9.8529	97.08	3.08	53.02	1.76	18	7.28	4
2011	Oil	10.1064	97.77	67.17	97.07	1.74	18	8.59	4
2012	BusSv	9.9002	98.01	73.53	116.71	8.57	2	10.80	3
2013	BusSv	10.7261	115.05	79.78	113.54	8.93	2	10.66	3
2014	BusSv	10.7393	115.33	86.81	118.67	9.32	2	10.89	2
2015	BusSv	12.6255	159.40	93.34	141.06	9.66	2	11.88	2
2016	BusSv	12.3613	152.80	94.53	140.91	9.72	2	11.87	2
2017	BusSv	13.7438	188.89	110.17	155.87	10.50	2	12.48	1
2018	BusSv	15.9583	254.67	116.69	177.26	10.80	2	13.31	1
2019	BusSv	17.4156	303.30	115.71	156.24	10.76	2	12.50	1

Table 5.

Top-1 market capitalization firms, employment ranks, and value added ranks

Columns 1 and 2 list the sample year and name of the largest (top-1) market capitalization firms in the sample. Columns 3 and 4 tabulate for each year the market capitalization in millions of 2019 CPI-adjusted dollars and as a percentage of the overall market capitalization. Columns 5 and 6 tabulate employment and value added ranking relative to the overall market. Value-added data has been collected back to 1973.

		Market Capitalization		Employment	Value added
Year	Name	$ (million 2019)	%	Rank	Rank
1950	AT&T CORP	45,844.20	9.639	1	.
1951	AT&T CORP	50,975.58	8.915	1	.
1952	AT&T CORP	59,717.28	9.734	1	.
1953	AT&T CORP	62,983.08	10.475	1	.
1954	GENERAL MOTORS CO	81,400.77	9.661	2	.
1955	GENERAL MOTORS CO	121,817.03	11.115	2	.
1956	GENERAL MOTORS CO	114,749.06	9.366	2	.
1957	AT&T CORP	98,535.86	9.456	1	.
1958	AT&T CORP	140,437.03	9.791	1	.
1959	AT&T CORP	149,888.73	9.457	1	.
1960	AT&T CORP	206,843.73	12.598	2	.
1961	AT&T CORP	274,649.47	11.628	1	.
1962	AT&T CORP	239,514.46	9.332	2	.
1963	AT&T CORP	284,767.18	9.504	2	.
1964	AT&T CORP	294,081.84	8.478	2	.
1965	AT&T CORP	261,285.00	6.709	2	.
1966	AT&T CORP	233,419.05	6.702	2	.
1967	INTL BUSINESS MACHINES	269,353.75	6.463	7	.
1968	INTL BUSINESS MACHINES	261,467.36	5.653	7	.
1969	INTL BUSINESS MACHINES	288,796.16	7.093	7	.
1970	INTL BUSINESS MACHINES	238,686.83	6.133	7	.
1971	INTL BUSINESS MACHINES	244,311.27	5.699	7	.
1972	INTL BUSINESS MACHINES	285,678.94	5.275	7	.
1973	INTL BUSINESS MACHINES	206,354.25	4.742	7	5
1974	AT&T CORP	129,557.21	4.724	1	1
1975	INTL BUSINESS MACHINES	158,216.70	4.933	6	4
1976	INTL BUSINESS MACHINES	188,737.61	4.908	6	5
1977	INTL BUSINESS MACHINES	170,185.31	4.966	7	5
1978	INTL BUSINESS MACHINES	170,692.63	5.22	7	5
1979	INTL BUSINESS MACHINES	132,319.21	3.876	7	5
1980	INTL BUSINESS MACHINES	122,965.32	3.189	6	4
1981	AT&T CORP	134,706.91	4.095	1	1
1982	INTL BUSINESS MACHINES	153,636.16	4.338	6	3
1983	INTL BUSINESS MACHINES	191,283.24	4.53	5	2
1984	INTL BUSINESS MACHINES	185,651.89	4.591	3	2
1985	INTL BUSINESS MACHINES	227,200.27	4.813	3	2
1986	INTL BUSINESS MACHINES	169,636.33	3.181	3	3
1987	INTL BUSINESS MACHINES	157,146.02	3.061	3	3
1988	INTL BUSINESS MACHINES	155,982.36	2.946	3	3
1989	EXXON MOBIL CORP	129,049.32	2.114	34.5	5

Table 5 – *Continued*

Year	Name	Market Capitalization $ million	Market Capitalization %	Employment Rank	Value added Rank
1990	INTL BUSINESS MACHINES	126,243.78	2.361	3	4
1991	EXXON MOBIL CORP	142,029.93	2.136	38	6
1992	EXXON MOBIL CORP	138,301.12	1.893	40.5	7
1993	GENERAL ELECTRIC CO	158,289.02	1.941	9	3
1994	GENERAL ELECTRIC CO	150,439.70	1.889	9	3
1995	GENERAL ELECTRIC CO	201,774.48	1.971	10	3
1996	GENERAL ELECTRIC CO	265,298.73	2.179	9	3
1997	GENERAL ELECTRIC CO	382,572.24	2.483	6	3
1998	MICROSOFT CORP	537,374.92	2.934	250	42
1999	MICROSOFT CORP	924,622.43	4.075	219	32
2000	GENERAL ELECTRIC CO	705,332.85	3.357	8	3
2001	GENERAL ELECTRIC CO	574,790.44	3.214	8.5	2
2002	MICROSOFT CORP	393,187.90	2.768	139	27
2003	GENERAL ELECTRIC CO	432,280.08	2.483	8	1
2004	GENERAL ELECTRIC CO	522,341.16	2.734	8	1
2005	GENERAL ELECTRIC CO	484,879.66	2.505	7	2
2006	EXXON MOBIL CORP	566,882.26	2.735	71	2
2007	EXXON MOBIL CORP	631,401.54	3.085	71	5
2008	EXXON MOBIL CORP	482,263.74	3.901	69	1
2009	EXXON MOBIL CORP	384,644.49	2.624	65	10
2010	EXXON MOBIL CORP	432,276.95	2.534	71	4
2011	EXXON MOBIL CORP	461,911.22	2.826	74	3
2012	APPLE INC	556,499.42	3.14	79	6
2013	APPLE INC	549,459.39	2.422	73	7
2014	APPLE INC	694,743.61	2.806	69	4
2015	APPLE INC	629,661.48	2.64	60.5	1
2016	APPLE INC	648,796.40	2.567	52	2
2017	APPLE INC	898,113.61	3.13	51	2
2018	MICROSOFT CORP	794,658.07	3.135	47	9
2019	APPLE INC	1,304,764.74	4.223	40	3