Do publicly-traded firms invest myopically? Evidence from U.S. tax returns*

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Abstract

It is often claimed that pressure from outside investors causes firms with publicly-traded stock to sacrifice long-term investments to improve short-term financial results. We investigate this hypothesis by comparing the investment behavior of publicly-listed and privately-held firms using data from U.S. corporate tax returns. We find that public firms invest *more* in long-term investments than their private counterparts. In particular, public firms invest more in R&D activities – a relatively risky investment. Our results suggest that public stock markets facilitate long-term investment on average, perhaps because they allow for the pooling of funds and diversification of risks. However, it is still possible that policies or shocks that elicit firms to be public generate myopic behavior on the margin. We illustrate this mechanism in a simple model.

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1 Introduction

In the United States, large and liquid stock markets play an important role in channeling capital from savers to firms. A notable benefit of this market-based financing system is that it facilitates the financing of large, risky investments by distributing risks among many smaller investors. However, the system may also have significant costs.[1] Small, dispersed shareholders may have little incentive to monitor and discipline a firm's managers when they stand to capture only a small share of the potential benefits, or prefer to free-ride on the efforts of others (Stiglitz 1985). Stock market liquidity may also discourage shareholder monitoring by making it relatively easier to simply exit by selling shares (Bhide 1993). In equilibrium, there may be too little monitoring, and managers may pursue objectives other than maximizing shareholder returns, such as consuming excessive perks (Jensen and Meckling 1976), building unnecessarily large empires (Jensen 1986), or merely living a quiet life (Bertrand and Mullainathan 2003).

Among the most prominent alleged shortcomings of public ownership is the "myopia," or short-term bias, it is said to induce. Under the myopia hypothesis, managers of public firms forego profitable long-term investment opportunities to improve short-term financial results. Theoretically, this behavior can arise even with rational managers and investors when imperfect monitoring prevents public shareholders from distinguishing between profitable investments and wasteful spending (Stein 1989). This managerial short-termism can manifest as either under-investment or over-investment in long-term projects depending on the nature of the information asymmetry between shareholders and managers (Bebchuk and Stole 1993). Nevertheless, the predominant concern that appears frequently in policy debates and the popular press regards the under-investments in long-term projects in favor of short-term profits.[2] The anecdotal examples of Michael Dell and Richard Branson taking

[1] An alternative system for financing capital investments is bank-financing, where banks play a primary role by collecting deposits from households and lending them to firms. This system is more prevalent in other developed economies, such as Germany and Japan. A large literature has debated the relative merits of bank-based and market-based financial systems, summarized in Allen and Gale (2001), Levine (2005).

[2] An August 15, 2015 article in the *The Economist* provides representative example. See

their firms private in order to invest more in long-term goals are oft-cited and loom large. In a survey of CEOs, managers of public firms report preferring short-term investments because shareholders undervalue long-term projects (Poterba and Summers 1995). As an empirical matter, several studies have examined whether managers of public firms invest myopically. This research, which we review below, generally supports the myopia hypothesis, but each analysis is limited in scope or suffers from potential biases due to data constraints. The issue remains unresolved.

In this paper, we investigate the myopia hypothesis using a previously untapped data source: administrative tax return data. We use the IRS Statistics of Income (SOI) corporate tax return files for tax years 2004 through 2014. These data provide a large, stratified sample that is representative of the universe of U.S. business tax returns, which allows us to construct a compelling comparison group of private firms to serve as a counterfactual for public firms. Because publicly-traded firms are among the largest, we focus on firms with assets between between one million and one billion dollars, and revenue between 0.5 million and 1.5 billion dollars.[3] In this range, public and private firms still differ systematically in observable characteristics, so we re-weight the sample using the method of DiNardo, Fortin, and Lemieux (1996) to generate groups with similar within-industry size distributions. In our baseline analysis, we compare the investment decisions of public firms with those of a comparison group of private firms, controlling for a number of factors. The rich information contained in tax returns allows us to not only examine total investment, but to also construct new investment measures that distinguish between short-term and long-term investment, and between physical capital expenditures and research and development (R&D). These distinctions, which are unavailable in the previous literature, are key to our conclusions on myopia.

We find that, in contrast to the myopia hypothesis, public firms undertake more long-

http://www.economist.com/news/finance-and-economics/21661027-short-termism-may-be-caused-way-investors-employ-fund-managers-new.

[3]These are the same asset and revenue cut-offs used in Yagan (2015).

term investment than private firms. Relative to physical assets, publicly-listed firms invest approximately 44 percentage points more than privately-held firms. While this elevated investment level comes from both a greater commitment to both long- and short-term assets, it is predominantly driven by long-term assets: public firms invest 36 percentage points more in long-term assets than their private firm counterparts. Moreover, it is not simply that public firms invest more relative to their size and thus out-invest private firms, but that they also direct a greater share of their investment portfolios to long-term assets. Public firms allocate 7 percentage points more of their total investment dollars to long-term assets than comparable private firms. In contrast, short-term investment as a share of total investment shows no statistically or economically important difference by public status. We obtain similar results when changing the weighting scheme, treatment of bonus depreciation allowances, and estimation sample.

We find that an important instrument for the higher investment in long-term assets by public firms is R&D expenditures. Relative to physical assets, public firms invest roughly 1 percentage points more in long-term assets excluding R&D, but 33 percentage points more in R%D expenditures. As a share of total investments, the higher propensity towards long-term investments is entirely driven by R&D expenditures. Public firms invest almost 9 percentage points more of their investment budget towards R&D than private firm; in contrast, they spend roughly 1 percentage point less in long-term physical assets. Despite the earnings pressure that public firms may face, the ability to spread risks among many small shareholders appears to facilitate heavier investments in R&D, typically the riskiest of asset classes.

Next, we focus on firms that we identify as going public during our sample period using data on initial public offerings (IPOs). We use this subset of firms to exploit within-firm variation in public and private status to examine how investment decisions change under the different ownership structures. Using an event study framework, we find that after an IPO, firms consistently invest a larger share of their investments in long-term assets. This increased commitment to long-term investment is driven by R&D expenditures: after an IPO, firms invest 4 percentage points more in R&D as a share of total investment. While this association could be due to firms going public in order to access equity financing for risky R&D investment, rather than a causal impact of access to equity markets facilitating higher R&D expenditures, both interpretations point to the attributes of going public being associated with more long-term investments. Taken together, our results make clear that public firms invest more than private firms and commit a greater share of their investment portfolios to longer-term assets, particularly R&D.

Our analysis has several policy implications. Concerns over the problems with public firm governance has translated into policy proposals. After the corporate scandals of the early 2000s, the Sarbanes-Oxley Act enhanced various governance and disclosure requirements for publicly-traded firms, but was then criticized for discouraging firms from going public on U.S. exchanges. In 2012, the Jumpstart Our Business Startups (JOBS) Act relaxed some of Sarbanes-Oxley's requirements and loosened rules surrounding small firms' abilities to raise equity, despite being criticized for weakening investor protections. Meanwhile, the costs and benefits of private equity ownership are often discussed in the debate over the tax treatment of carried interest. In France, rules grant long-term investors extra voting rights with the European Commission considering following suit. In the United States, the Delaware Supreme Court – which has an outsized role in U.S. corporate law since many firms are incorporated in the state – has endorsed the idea that a firm's owners are those who have held shares for long durations rather than those who happen to own shares at any given time.[4]

Our analysis contributes to a long literature that examines the agency problems associated with being a public company, and their resulting implications for investment decisions. The main challenge in this literature has been the lack of publicly-available data on private firms, which would serve as a natural comparison group for public firms. Earlier empirical

[4]See *Paramount Communications, Inc. v. Time, 571 A.2d 1140, 1153 (Del. 1990)*

work overcame this challenge by examining firms that went public, as these firms must report financial data from the years just prior to going public. This literature appears to be relatively consistent in finding declines in profitability or productivity post-IPO (Degeorge and Zeckhauser (1993), Jain and Kini (1994), Mikkelson, Partch, and Shah (1997), Pagano, Panetta, and Zingales (1998), Chemmanur, He, and Nandy (2010)). While this evidence supports the notion that agency problems arise when firms disperse ownership, Pastor, Taylor, and Veronesi (2009) shows that such performance declines can arise from a simple learning mechanism where firms experiencing a positive shock update their posterior belief about their long-run average profitability and decide to go public. Following the upside surprise that elevated their posteriors, these firms can naturally expect to see a decline in profitability post-IPO, even without information asymmetries or agency problems.

Another strand of literature tests the myopia hypothesis by estimating the discount rates applied to earnings at various horizons that are implied by market valuations of firms. Results from these attempts are mixed. Where Miles (1993) finds larger discount rates applied to earnings at longer horizons in data from the UK, Satchell and Damant (1995) provide an alternative explanation for his results that does not rely on myopia. Abarbanell and Bernard (2000) do not find evidence of such myopia in more recent U.S. data. The accounting literature has also documented a variety of examples where managers sacrifice cash flows or alter real decisions in order to improve their accounting earnings or short-run stock prices. For example, Erickson, Hanlon, and Maydew (2004) report that their sample of 27 firms paid a total of $320 million in real cash taxes on earnings that were later alleged to be fraudulent. Firms may also reduce their real spending on activities like R&D to avoid reporting a loss for accounting purposes, in an example of what is known as "real earnings management" (e.g., Baber, Fairfield, and Haggard (1991), and Dechow and Sloan (1991)).

More recent papers have taken various new and clever approaches to assemble data that allows a comparison between public and private firm behavior. Sheen (2009) uses data from chemical industry trade reports to compare investment across public and private chemical producers, finding that private firms better time their investments to take advantage of demand shocks. Lerner, Sorensen, and Stromberg (2011) use patent data to document that firms undergoing leveraged buyouts (LBOs) register more important patents after going private, while Bernstein (2012) uses similar data to document declines in patent quality post-IPO. Edgerton (2012) uses data from corporate jet registrations to compare the fleets of public and private firms. He finds that jet fleets decline in size when firms are taken private in LBOs, consistent with agency problems among public firms that facilitate managerial overconsumption of perks. In the paper perhaps most similar to this one, Asker, Farre-Mensa, and Ljungqvist (2015) combine Compustat data with data from Sageworks, which collects accounting data for a large sample of private firms from many accounting firms. They find that public firms invest less overall than a matched sample of private firms, and that public firms also exhibit less sensitivity of investment to measures of investment opportunities like sales growth or Tobin's q. They conclude that their results are consistent with the hypothesis of greater managerial myopia in public firms.

Overall, we read the balance of the existing evidence comparing public and private firms as consistent with the notion that private firms invest "better" in various ways—in more profitable projects, in more innovative patents, in fewer managerial perks, and less myopically. There are exceptions to this pattern, however. For example, Bharath, Dittmar, and Sivadasan (2010) use Census data on manufacturers and find no evidence that establishments increase their productivity after going private. Gilje and Taillard (2013) use data from natural gas producers and actually find that public firms invest "better" by responding more quickly to changes in gas prices and investment opportunities.

Our paper brings new data to shed light on the question of whether public firms invest myopically. Tax return data provide a number of advantages over data used in the prior literature. Our data provide a large sample of public and private firms that is truly representative of all U.S. firms. Thus, we are able to examine myopia at an aggregate level, rather than focusing on a particular industry or subset of firms. In addition, the Sageworks data describe a set of private firms that were not chosen randomly and may suffer from selection bias of various kinds. Tax return data for public and private firms are reported on a consistent basis, eliminating the concern that apparent differences in behavior might actually reflect differences in data collection. Finally, and most importantly, tax returns allow us to distinguish short-term from long-term investment. These advantages allow us to investigate the myopia hypothesis far more comprehensively than prior researchers. In particular, our analysis focuses on the proportion of investment that is concentrated in longer-term projects, rather than on total investment.

2 Model

Our empirical work assesses whether public and private firm differ in terms of key investment characteristics like the average life of their capital and the R&D intensity of their investment. This section presents a simple, illustrative model that will aid in interpreting these results and comparing them to others in the literature.

Firm i has a fixed set of activities that it can perform, and the value of the firm under private ownership is V_i^{Priv}. Its value under public ownership is,

$$V_i^{Pub} = V_i^{Priv} + b_i - c(h_i),$$

where h_i measures the "horizon" of the firm's activities, and c measures the cost being publicly traded in terms of firm value as a function of the firm's activity horizon. A version of the myopia hypothesis would hold that $c' > 0$, that is, that the longer a firm's investment horizon, the more costly are the myopic decisions required to please public investors and thus the more costly it is to be publicly traded. b_i above captures all other benefits or costs to firm i of being publicly traded. For example, if firm i's activities require a large scale of investment, it might command a larger value in the public market, where many investors can hold the firm as a small piece of a diversified portfolio, than as a private firm, where a smaller number of investors would need to expose themselves to large idiosyncratic risks to hold the firm. In a market with no other frictions, firm i will maximize its value and choose to be publicly-traded if $V_i^{Pub} > V_i^{Priv}$, or, equivalently, if $b_i > c(h_i)$.

Suppose b and h are jointly distributed across firms in the economy with joint density function $f(b_i, h_i)$, with $\int_{\underline{h}}^{\bar{h}} \int_{\underline{b}}^{\bar{b}} f(b_i, h_i) db_i dh_i = 1$. Taking some notational liberties, for a given level of h, the fraction of firms that are publicly traded among all firms with $h_i = h$ is,

$$s_h = \frac{\int_{c(h)}^{\bar{b}} f(b_i, h) db_i}{N_h},$$

where N_h is the number of firms with investment projects at horizon h.

We will be interested in understanding public status relates to investment horizon. We find,

$$\frac{ds_h}{dh} = \frac{-c'(h) f(c(h), h)}{N_h} + \frac{\int_{c(h)}^{\bar{b}} f_h(b_i, h) db_i - s_h \int_{\underline{b}}^{\bar{b}} f_h(b_i, h) db_i}{N_h},$$

where f_h is the partial derivative of the density function with respect to h. The first term on the right-hand-side is the baseline myopia effect. If myopia imposes costs on publicly traded firms that are increasing in investment horizon ($c' > 0$), this term is negative and we should expect to see a lower fraction of publicly-traded firms among long-horizon firms, all else equal.

If the second term on the right-hand-side is positive and large enough, however, we could still see the share of publicly traded firms increasing with investment horizon. This will be the case when the density function increases relatively more among the higher-b firms as h increases—essentially, when b and h are appropriately positively correlated. This could be the case, for example, if longer-horizon investment projects also require a larger scale that tends to benefit from the kind of large equity investments that are facilitated by the public markets. In a world like this, we would still say that the public equity markets *facilitate* long-horizon investments on average, even though they do induce myopic behavior on the margin, in the sense that private firms induced to become public by a change in b_i would indeed see an increase in myopic behavior.

Like prior papers that examine how investment behavior differs between public and private firms, we cannot test directly for the myopia effect in isolation. Instead what we can assess is whether *on net* the myopia pressures of public status lead to less investment despite the potential benefits of financing investment through equity capital markets.

3 Data

We use the IRS Statistics of Income (SOI) corporate tax return files for tax years 2004 through 2014. For each year, the SOI corporate sample includes a stratified random sample of roughly 100,000 firms. The samples include C corporations, S corporations, Real Estate Investment Trusts (REITS) and Regulated Investment Companies (RICs).[5] Sampling weights are provided so that the corporate sample is representative of the population of corporate firms.[6] The sampling weights vary by corporation type, and are a decreasing function of total assets and gross receipts. Larger firms are sampled at higher rates, and sampling weights equal one for all firms with at least $50 million in assets. That is, all large corporations will be included in the sample with probability one.

Tax return data offer several advantages over data that have previously been used to test the myopia hypothesis. First, because the SOI sample contains both public and private firms, we are able to construct investment measures that are reported consistently across firm types. Thus, we eliminate the concern that observed differences in behavior may reflect differences in reporting requirements. In addition, the private firms contained in Sageworks data were not randomly chosen, and so may introduce sample selection bias. Second, the SOI data provides a large sample that allows us to construct a compelling comparison group of private firms to serve as a counterfactual for public firms. Third, because the SOI sample is representative

[5]S Corporations, REITs and RICs are pass-through entities.

[6]The target population is active corporations that are organized for profit.

of all U.S. firms, we are able to examine whether public and private firms behave differently in aggregate, rather than focusing on a particular industry or subset of firms. Finally, and most importantly, the rich detail in tax returns allow us to distinguish short-term from long-term investments. This distinction is unavailable in many other datasets, and allow us to investigate the myopia hypothesis in much greater detail than has been previously possible.

To determine whether a firm is publicly traded, we rely on two sources. First, we utilize Form M-3, which was introduced in 2004 and must be filed by all firms with over $10 million in assets.[7] Form M-3 requires that firms answer two questions: (1) whether they file a form 10-K with the Securities and Exchange Commission (SEC), and (2) whether any of the firm's voting stock is publicly traded. We deem a firm publicly traded if it answers affirmatively to either of these questions. Second, we utilize the Compustat-CRSP merged files, which contain accounting information for all publicly traded firms. This supplemental data source is particularly important because Form M-3 is unavailable for firms that fall below the $10 million filing threshold. Therefore, we also deem a firm to be publicly traded in year t if we match it to a record in Compustat-CRSP by its employer identification number (EIN).[8]

We collect several income and tax variables from each firm's basic tax return, Form 1120 or Form 1120S, along with several balance sheet items, that are reported on the tax return. A detailed description of the tax form line items that correspond to each of our variables is provided in the Data Appendix. From the front page of the 1120, we collect total assets, gross receipts, cost of goods sold, total income, salaries and wages (including executive compensation), depreciation, total deductions. For C corporations, we collect net income, taxable income and taxable receipts, and for S Corporations we collect ordinary business income. Balance sheet items from Schedule L are total assets, depreciable assets (less accumulated depreciation), and intangible assets (less accumulated amortization). All

[7] Some firms that fall below the $10 million asset threshold opt to file this form. The majority of these are firms that are historically over $10 million in assets but then fall below this threshold in a particular year. [IS THIS TRUE?]

[8] We account for IPO year as Compustat-CRSP often contains firm information in the years leading up to an IPO. Thus, if the corporate sample firm matches to Compustat-CRSP in the years prior to its IPO, we count this firm as private.

income variables are converted to real 2004 dollars using the CPI, and all annual measures are consistent with the SOI year concept, which accounts for the fact that roughly 40% of C corporations have a tax year that does not correspond with a calendar year. Details on tax-derived variables can be found in the Data Appendix.

To provide a baseline for the firms included in SOI data, the top panel of Table 1 reports summary statistics for the sample in 2005, 2009 and at the end of the sample period in 2014. Firms age somewhat over the sample period with the average age climbing from 12.0 years in 2004 to 14.4 years ten years down the line in 2014. Profit margins remain steady over the sample period declining slightly from 21% in 2004 to 20%. Many financial measures decline in 2009 relative to 2004, reflecting the impacts of Great Recession, before recovering by 2014. Average total assets fell by nearly 7% from \$1.8 billion to \$1.7 billion between 2004 and 2009 and then increased to \$1.9 billion by 2014. Total income and total deductions declined and recovered similarly. Net income fell more precipitously, plummeting by nearly 75% before recovering once again to \$94 million in 2014. Taxes paid saw far less volatility than net income, declining by 10.5% from 2004 to 209 and then increasing by 19.3% by the end of the sample period. The bottom panel of Table 1 shows the highlights the raw differences between public and private firms. Not surprisingly, public firms are on average older and larger than private firms.

We construct our measures of investment from expenditures on qualified research activities and depreciation allowances. Expenditures on qualified R&D come from Form 6765 (Credit for Increasing Research Activities). Over our time period, there are several alternative methods among which firms can choose to compute expenditures that are eligible for the R&D tax credit. We take the maximum value of qualified research spending across these computations. Total property investments are obtained using depreciation allowances reported on Form 4562, summing over property placed in service during the tax year using the general depreciation system or special depreciation allowances.[9] Because property under

[9]General depreciation allowances are reported in line 19 of Form 4562, which includes property that depreciates at 3, 5, 7, 10, 15, 20 and 25 years, residential and nonresidential investment. Special depreciation

the general depreciation system is reported by asset life, we are able to differentiate short-term from long-term investments. We consider short-term investment to include any physical property with 3, 5, and 7 year lives; long-term investment includes any physical investment category with at least a 10 year depreciation allowance, residential and non-residential property, and R&D expenditures. We compute total investment as the sum of total property investments and R&D expenditures.

Because bonus depreciation is not reported by asset life, we allocate these investments based on a firm's average distribution of general depreciation allowances between 2005 and 2007, years in which bonus depreciation has temporarily expired.[10] For example, if a firm invests 40% of its total investment in short term assets between 2005 and 2007, then we allocate 40% of its bonus depreciation line to short term assets in all other years. We test the sensitivity of our results to this assumption in two ways: (1) by running our analysis on 2005-2007 only, and (2) by adjusting our definition of short term to include all asset lives up to 20 years–the maximum allowed by the bonus depreciation rules–and long term to be all investment in longer-lived assets. In this latter scenario, all bonus depreciation is allocated to the short-term investment category.

Using these variables, we construct several measures of investment behavior. To examine whether public firms invest more than private firms overall, we use the ratio of total investment to lagged total tangible capital assets, where tangible assets is defined as depreciable assets minus accumulated depreciation (Sch. L line 10a less Sch. L line 10b). This variable is comparable to that used in Asker, Farre-Mensa, and Ljungqvist (2015). We similarly compute these measures for short-term investments and long-term investments. To examine whether public firms commit a higher share of their investment portfolios to long-term assets, we compute the fraction of total investment that is considered long-term. Because decisions

allowances are reported on line 14 of Form 4562.

[10] A natural question is whether public and private firms responded differentially to the statutory changes in the treatment of bonus depreciation. However, because bonus depreciation allowances are reported lump-sum, we are unable to differentiate between the short-term and long-term investments to which bonus depreciation applied.

over R&D and physical property may be different, we also examine the intensity of R&D expenditures and non-R&D long-term asset expenditures as a share of total investment or of lagged depreciable assets separately.

For our baseline analysis, we make several adjustments to our sample of firms. First, we restrict our analysis to non-financial C and S corporations, excluding RICs and REITs, as is standard in the finance literature.[11] Second, we exclude observations with negative tangible capital assets. Lastly, we focus on firms with assets between one million and one billion dollars, and revenues between 0.5 million and 1.5 billion dollars. Because publicly traded firms are among the largest, this restriction narrows our set of firms so that we construct a compelling comparison group of private firms. These income cutoffs are the same as those used in Yagan (2015), but we exclude a firm if it is ever observed too fall outside of these ranges over our sample period. We show that our results are robust to this restriction. Our final estimation sample comprises roughly 2.7 million firm-years, representing a population of about 1.5 million S corporation and 1.1 million C corporation firm-years. Of those firm-years, approximately 5% (or 0.8% of the SOI-weighted sample) are defined to be public – roughly 2,400 in 2004 and declining to just under 1,700 by 2014. These figures are consistent with external counts of public firms listed on stock exchanges.

To obtain comparable distributions of public and private firms, we use the re-weighting methodology of DiNardo, Fortin, and Lemieux (1996) (DFL).[12] When there are two distinct groups, the goal of DFL is to re-weight the data so that the distribution of observable characteristics for the target group is the same as the distribution of observable characteristics for the base group. This re-weighting will ultimately hold fixed these observables across the two groups considered. We use DFL re-weighting to control for industry and size differences across public and private firms, where we compute "size" as the the average of one and two

[11]This restriction is standard in the literature because of the special organizational and tax status of these firms.

[12]The DFL procedure that we utilize is similar to Yagan (2015), which re-weights S corporations so that their within-industry size distributions are comparable to C corporations in order to test whether these groups of firms responded differentially to the 2003 dividend tax cuts. In contrast, Asker, Farre-Mensa, and Ljungqvist (2015) use nearest-neighbor matching to estimate an average "treatment effect" of being public.

year lagged business receipts.[13] To implement DFL, we first bin our sample of firms by their SOI industry code, and we use public corporations as our base group in each year.[14] We then construct weights so that the distribution of firm size for the target group (e.g., private firms in year t) more closely matches the distribution of firm size in the base group (i.e., public firms in year t). The re-weighted data yields year-specific size distributions of public and private firms within the same industry group. Our final weights are computed as the product of the resulting DFL weight and firm size, as measured by the two-year average of lagged business receipts, so that the estimates are representative of the size of economic activity.

Figure 1 illustrates the effect of using DFL weights. Panel (a) presents the unweighted distributions of average gross receipts for public and private firms. This figure highlights the differences underlying public and private firms: unlike public firms, there is a large mass of small, private firms. In panel (b), we apply DFL weights to private firms. Panel (b) shows the effect of employing DFL weights: small private firms are down-weighted so that the distribution of private firms more closely mimics that of public firms. Note that by definition, DFL weights are equal to one for public firms. In panel (c), we additionally weight both public and private firms by firm size. The two distributions are virtually identical. We use this DFL-size weights for our baseline analysis, which yields distributions of public and private firms are arguably comparable. We show, however, that our main results are robust to alternative weighting schemes.

We present means and standard deviations of our key investment measures for public and private firms included in our estimation sample in Table 2. The first four columns present summary statistics for the DFL-size weighted sample. Comparing the average investment behavior of public and private firms reveals a clear pattern that previews our regression results. Public firms invest more than private firms in terms of total dollars, and as a share

[13]When business receipts from two years prior is not available the one-year lagged value is used.

[14]Unlike Yagan (2015), we do not hold fixed the base year as we are not testing the impact of any particular time-related event like the 2003 dividend tax cut.

of total assets. In addition, public firms invest more in all asset classes: short-term, long-term physical capital and especially R&D. Public firms and private firms also display markedly different investment priorities. Private firms dedicate 71% of their investment dollars to short-term assets, whereas public firms dedicate nearly 61% of their investment dollars to short-term assets. Public firms direct 25% of their investment budgets to R&D, compared to just 7% among private firms. Non-R&D long-term assets comprise roughly similar investment shares for public and private firms. For comparison, the rightmost panel shows summary statistics for the SOI-weighted private firm sample. Without re-weighting the data, the summary statistics would reveal much larger difference in investment propensities across public and private firms.

These means, of course, mask underlying differences between public and private firms such as the industries in which they operate, profitability or debt levels that may also affect investment choices. To better control for these sources of heterogeneity, we next compare the investment choices of public and private firms in a regression framework.

4 Baseline Analysis and Results

To evaluate whether earnings pressure leads public firms to myopically under-invest, on net, we estimate the following regression equation:

$$Y_{it} = \alpha_0 + \beta PUBLIC_{it} + X'\gamma_{it} + \delta_i + \mu_t + \epsilon_{it}, \quad (1)$$

where Y is an investment measure of interest, $PUBLIC$ is a binary indicator for being a public firm, and X contains a number of firm characteristics such as a quadratic in firm age, asset deciles, profit margin[15] and a binary indicator for S-corporations.[16] The vector δ_i

[15] Profit margin is defined as the ratio of operating profit to revenue.

[16] Exactly balanced data means that controlling further for X is unnecessary because it is unrelated to the treatment variable, and so a simple difference in means on the matched data can estimate the causal effect; approximately balanced data require controlling for X with a model (such as the same model that would have been used without matching), but the only inferences necessary are those relatively close to the data,

contains industry fixed effects, constructed using two-digit NAICS industry codes, and the vector μ_t contains year fixed effects. Thus, our framework yields within-industry comparisons, controlling non-parametrically for the evolution of average investment rates across all firms. Observations are weighted by the product of the SOI sample weight and DFL weight described in Section 3. Standard errors are clustered at the firm level.

In this analysis, re-weighted private firms serve as a counterfactual for the investment choices of public firms, absent the potential agency problems associated with public ownership. The coefficient of interest is β, which measures the relative investment propensity of public firms compared to private firms. Under they myopia hypothesis, public firms will invest less than comparable private firms and we should expect that $\beta < 0$.

Table 3 presents estimates of β from equation (1). In Panel A, our investment measures are scaled by the lag of physical assets. Column (1) examines the the difference between public and private firms in their overall investment rate. The estimate implies that public firms show a greater commitment to overall investment relative to physical assets: a publicly-listed company will invest roughly 44 percentage points more than a privately-held firm of similar size. Relative to the average total investment to physical assets of private firms (Table 1), this represents 46% more total investment of public firms than private firms. In columns (2) and (3), we split total investment into short-term and long-term investments. Although public firms invest more in both types of assets, we find this advantage is much more pronounced in long-term investments. On average, public firms out-invest private firms by more than 125% (36 percentage points) in long-term assets, but only 17% (10 percentage points) in short-term assets.

Because R&D investments and long-lived physical assets differ substantially in risk profiles, the ability to diversity risk among many small shareholders may yield differential benefits across these types of assets. We assess this hypothesis in columns (4) and (5). The results imply that although public firms invest more in all types of long-term assets than

leading to less model dependence and reduced statistical bias than without matching.

private firms, they especially dedicate more dollars to R&D. Public firms invest about 1 percentage point more than similarly-sized private firms in long-term assets outside R&D and this effect is only marginally statistically significant. However, public firms out invest private firms by more than 334% (33 percentage points) when it comes to R&D. Despite the earnings pressures that public firms may face, access to capital markets appears to make public firms particularly successful at financing riskier R&D investments.

It is possible that our results on long-term investment reflect that public firms simply invest more than private firms, and thus out-invest private firms when it comes to long-term capital. In Panel B, we show that this is not the case: public firms also commit a greater share of their total investments to long-term assets, and particularly to R&D investments. In column (3), the dependent variable is the share of total investment in long-term investment. The estimate shows that public firms dedicate 29% (7 percentage points) more of their investment budgets to long-term assets, on average, than private firms. As columns (4) and (5) detail, this higher share of long-term investment is driven entirely by a greater R&D share of investment among public firms. In fact, public firms spend a smaller share of their investment dollars on long-term physical assets. The long-term investment priority of public firms is fully attributable to their particularly strong commitment to R&D, where they spend almost 124% (9 percentage points) more of their investment budget than private firms.

4.1 Robustness to Alternative Weighting Schemes

Interpreting our results as evidence of the differences in investment choices between public and private firms turns crucially on our ability to construct a compelling comparison group of private firms. The DFL weighting scheme we use is well-known and used extensively in the labor economics literature and other fields.[17] Alternative weighting schemes, however, could be employed. In this subsection, we examine the robustness of our main results to

[17] For example, Yagan (2015), which examines the impact of the 2003 dividend tax cut on corporate investment and employment, uses the DFL weighting method to construct a comparison sample of S corporations that matches the size distribution of the C corporations that are the subject of the analysis.

two alternative matching methods that aim to re-weight the samples of public and private firms so that the two groups are similar on average. As with our baseline specification, final weights are computed as the product of the new methodology's weight and firm size.

The first alternative weighting scheme that we use is nearest-neighbor matching with replacement. Under this weighting scheme, each public firm is matched to a single private firm with the same five-digit NAICS code based upon tangible capital assets in a base year, here 2005. We maintain the same public-private firm match throughout our analysis. If the private firm leaves the sample (perhaps due to sampling or change in private firm status), the public firm is rematched to a new private firm. Analysis using nearest-neighbor matching naturally uses a smaller sample because public firms, which comprise less than half of the full sample of firms, are matched to exactly one private firm in each year, and public firms may be matched to the same private firm. This is similar to the weighting scheme used in Asker, Farre-Mensa, and Ljungqvist (2015).

The second weighting scheme is entropy balancing weights. This methodology re-weights the data to match the covariate distributions of the target group based on a set of specified moment conditions. We balance the data based on the first moments of the firm size, income, receipts, salaries, and age distributions within each tax year. Thus, rather than re-weighting private firms to match the within-industry size distribution of public firms, we re-weight private firms to match the within-year means of several attributes of public firms. This weighting scheme retains all of the observations used in our baseline DFL-weighted estimates.

Table 4 reports results using these alternative weighting schemes. Panels A and B present results for our dependent variables scaled by lagged physical capital, and panels C and D present results for dependent variables measured as a share of total investment. Across the board, the point estimates are consistent with our baseline analysis.

Focusing first on investment relative to physical capital assets, we again find public firms invest more than private firms in total, and both short- and long-term assets. Point estimates obtained using nearest-neighbor matching are somewhat smaller, and because they use a much smaller sample, we lose statistical power. When we split long-term assets into physical long-lived assets and R&D, the smaller sample yields point estimates that are positive and similar to the baseline estimates, but are not statistically significant. Estimates obtained using entropy balancing weights are generally larger than those using DFL and nearest-neighbor matching. These estimates suggest that public firms invest 23.8 percentage points more in short-lived assets, and more than twice as much in long-term investments. This large estimated boost in long-term investments stems from R&D.

Turning to results using the share of total investments in long-term assets as the dependent variable, we again consistently find that public firms invest more in long-term assets, and that this result is driven by investments in R&D. Nearest-neighbor matching again yields point estimates that are somewhat smaller than baseline. Entropy balancing weights obtain estimates that are somewhat larger than baseline, suggesting that public firms invest 13.5 percentage points more of their investment budgets in R&D offsetting a 2.8 percentage point smaller investment share in physical long-term assets to, on net, invest 10.7 percentage points more in long-term assets.

Regardless of which weights are used, we consistently find that public firms out-pace private firms in investing in long-term assets, particularly R&D expenditures. Our preferred method, which generates a comparison group of private firms that matches the size distribution of public firms, leads to generally smaller point estimates that are in line with those generated using other weights.

4.2 Robustness to Treatment of Bonus Depreciation

As described in Section 3, we may mismeasure short-term and long-term investments in years with bonus deprecation because these allowances are not reported by asset life. In Table 5, we investigate whether our results are sensitive to our allocation of bonus depreciation allowances in two ways.

In Panels A and C, we estimate our baseline specifications using data from 2005 through 2007 only — the tax years in our sample period when there was no bonus depreciation. Panel A reports estimates where our investment measures are scaled by assets while Panel C assesses the sensitivity of our results examining the share of investment dedicated to long-term assets. Both sets of results are quite similar to the baseline results (Table 3) in economic and statistical significance. For example, the baseline estimate suggests that public firm invest 36.3 percentage points more than similarly-sized private firms, just slightly more than the 32.0 percentage point advantage to public firms estimates reported in column 3 of Panel A here suggest. Column 5 of Panel reports that in 2005 through 2007 public firms invested 8.2 percentage points more of their investment budgets in R&D relative to private firms, very similar to the baseline estimate of 8.7 percentage points using all years of data.

In Panels B and D, we redefine short-term assets to include all assets with lives up to 20 years – the maximum asset life allowed under bonus depreciation rules. This definition effectively treats all assets that could qualify for bonus depreciation as short-term assets. To the extent that public firms utilize bonus depreciation allowances on assets with lives between 10 to 20 years, this specification biases us against detecting a higher rate of long-term investment among public firms. The estimates under this alternative treatment of bonus depreciation allowances are even more similar to the baseline estimates.

4.3 Robustness to Sample Selection

In this subsection, we test the robustness of our results to two different sample definitions. First, we restrict our sample to firms that report some R&D expenditures in at least one year, dropping the vast number of firms that never report R&D. In tax return data, firms report R&D expenditures on Form 6765 (Credit for Increasing Research Activities), which calculates a firm's R&D tax credit as a percentage of eligible research expenditures above some base amount. As such, firms are most likely to report their research spending in years when they qualify for the tax credit. Qualifying firms may also fail to report their eligible expenditures because they either are unaware that they qualify for the R&D tax credit, or because the costs of learning the accounting rules related to the credit are too high. This type of selection may affect smaller firms more, which would upward bias our estimates of the public firm effect on R&D. The sample of firms that ever report some R&D restricts attention to firms with the requisite expertise to fill out Form 6765. Results for the " ever R&D" sample are presented in Panels A and B of Table 6. Generally, we find estimates that are largely in line with our baseline results. As a share of total investment, the estimated public effect of R&D expenditures is nearly identical to those found in our main sample.

Second, we re-estimate our baseline results using the full size distribution of firms.[18] Our baseline analysis focuses on firms with assets between one million and one billion dollars, and revenues between 0.5 and 1.5 billion dollars. This restriction is meant to narrow in on a firm size range that yields greater overlap in public and private firms than the full sample. In panels C and D of Table 6, we show that our results remain in the full sample. We again find that public firms invest more in long-term assets, particularly in R&D. While the results in Panel C, which examine investment levels relative to assets, are somewhat muted relative to the baseline, with public firms investing 19.7 percentage points more than private firms in R&D, all of the estimates are consistent with the baseline findings. Interestingly, the estimates in Panel D suggest that public firms lean even more heavily toward R&D when allocating their investments across asset classes, investing 20.3 percentage points more of their investments in R&D.

5 Analysis of Newly Public Firms

Our analyses thus far assess whether the benefits of public status, namely the ability to finance investment through small equity shares, outweigh the potential costs of a short-term focus on financial performance due to myopic views of equity holders. This analysis is fundamentally observational. When comparing firms that are public to those that are

[18]We still exclude financial firms, and drop observations with negative physical capital assets.

private—by their own strategic choosing—we are possibly comparing firms that differ along myriad dimensions. Despite the DFL matching and employing a number of controls, it may be true that our previous estimates are attributable, at least in part, to unobservable characteristics.

We can, however, isolate the impact of public status for the smaller set of firms that switch from private to public status during our sample period — the set of firms that issue an initial public offering (IPO) between 2004 and 2012. These firms inform how becoming a public firm affects investment decisions relative to the *same* firm's behavior when it was private. Identification here rests on no factor correlated with the horizon of investment other than public status changing when a firm goes public.

We determine that a firm in our data has gone public through a multi-step procedure. First, we use data the Center for Research in Security Prices (CRSP) database, which provides information on IPO dates. Second, we then turn to the Thomson-Reuters SDC database which tracks equity capital market new issues. Finally, we use the IRS data to verify that a firm is indeed public in each year after its IPO. This verification will catch any firms that are taken private again in the years after their IPOs. This procedure yields over 2,800 IPO events in our data.

To test whether firms invest differently before and after an IPO, we perform an event-study analysis. We run regressions of the following form:

$$Y_{it} = \alpha_0 + \sum_{\tau=-8}^{10} \beta_\tau (IPO_i) + X'\gamma_{it} + \delta_i + \mu_t + \epsilon_{it} \tag{2}$$

where i indexes firms, t indicates tax year, and τ denotes years relative to the IPO year. Year fixed effects, μ_t, and industry fixed effects, δ_i, control for the overall evolution of long-term investment shares and differences in long-term investment across industries, as defined by two-digit NAICS codes.[19] The vector X' includes a fourth degree polynomial in firm age, an

[19]Note that we can separately identify the β_τs and the year fixed effects because firms go public in different years.

S-Corporation indicator, asset decile dummies and profitability. The vector β_τ contains the parameters of interest. Coefficients where $\tau < 0$ correspond to years prior to a firm's IPO, and $\tau > 0$ correspond to years after the IPO year. These coefficients measure the period-specific means of the dependent variable in public and not yet public firms, conditional on the fixed effects and other controls. The regression is weighted by firm size.

Because our SOI data span 2004 through 2014, we are able to examine behavior up to 10 years before the most recent IPOs in our sample.[20] In our data, we also observe firms as many as 45 years after their IPO. We restrict our observations to those just 10 years following an IPO because firms that have long been public may differ systematically from those that have more recently gone public.

Figure 2 plots the β_τ estimates of equation 2. The plotted coefficients and their 90% confidence intervals show that although many point estimates are not statistically significant, collectively they reveal a striking pattern. In the years after IPO, long-term investments are consistently a larger share of total investment than prior to IPO, and an F-test comparing the aggregated pre-IPO and post-IPO coefficients rejects their equality at the one-percent level. When we replace $\sum_{\tau=-8}^{10} \beta_\tau (IPO_i)$ with $PostIPO_{it}$, an indicator variable that equals one in the year of the firm's IPO and after, in Equation 2, we find that firms allocate 5.0 percentage points more of their total investment to long-term assets, and this effect is statistically significant at the 1 percent level. In short, not only do public firms invest more in long-term assets than private firms, firms invest more in long-term assets *after* going public.

Comparisons of the investment behavior of newly public firms to their investment patterns while private show that the boost to long-term investment that occurs upon IPO is driven by R&D investments. Figure 3 plots the β_τ coefficients from a regression of equation 2 where there dependent variable is the ratio of R&D expenditures to total investment. Although the 90% confidence intervals largely include zero in the years after going public and thus

[20]Note, we lump 9 and 10 years prior to an IPO into the same category as 8 years prior due to the very small number of observations. Thus, we assume that years 8–10 prior to an IPO are equivalent, on average.

are statistically insignificant, the pattern of point estimates suggests that after going public firms invest more in R&D; their magnitude suggests that they account for the lion's share of the increase in long-term investment undertake following their IPO. The coefficient on a $PostIPO_{it}$ dummy denoting all years following a firm's IPO, is 0.04 (0.02), which is statistically significant at the 5% level.

Consistent with our baseline results comparing all public and private firms, we find that upon going public, firms invest more in long-term assets – specifically, they increase their expenditures on highly uncertain R&D expenditures. The ability to access equity capital boosts investment in intangible assets, but not the types of physical assets that could be used as collateral in bank- or other debt-financing. While this association could be attributed to firms going public when they want to equity-finance risky R&D investments, rather than a causal impact of the availability of equity financing, either story substantiates that the attributes of going public facilitates the undertaking of the types of risky investments that can hold the greatest potential for growth for both firms and the broader economy.

6 Conclusions

To the debate over whether public ownership encourages short-termism, we bring new evidence using a new data source for comparing the investment decisions of public and private firms. Tax returns provide a large sample of firms that are representative of U.S. businesses, along with investment data that allows us to distinguish short-term from longer-term investments. In contrast to the myopia hypothesis, we find robust evidence that public firms invest more than private firms in long-term assets.

Public firms in particular commit a larger share of their investment dollars to R&D activities than private firms. Whether or not R&D investments pan out into new innovations with commercial applications is highly uncertain and the fact that public firms especially emphasize these investments may suggest that diversified public ownership makes these risks easier to bear. R&D spending is thought to have the added benefit of positive spillovers that increase the productivity of other firms (Griliches 1998) —and as such are generally subject to under-investment (Arrow 1962). As such the heightened R&D spending of public firms is an important source of much needed investment in innovation.

These findings shed light on the the trade-offs between the costs and benefits of public ownership, which is central to a number of current policy debates. In particular, they can help inform recently proposed policy changes aimed at curbing short-termism that have appeared on both sides of the Atlantic. Our results suggest that public ownership does not result in a degree of myopia that forgoes long-run productivity and profits for short-term earnings. Policies that effectively discourage public ownership could in fact reduce investment in long-term assets, particularly investments in innovation. Our estimates also suggest that efforts to cast private equity ownership as a route to more long-minded investment may be misguided.

There is certainly more to be understood regarding the role of public ownership in investment decisions. The results presented here take public and private ownership as a given state and though evidence from IPOs buttresses our primary findings, our results do not arise from an experiment, natural or otherwise. We have not observed the random assignment of public and private status to otherwise identical firms and measured the resulting investment behavior. Using variation in policies that enabled or thwarted firms from going public may allow future researchers to provide new evidence on this key question.

References

Abarbanell, J., and V. Bernard (2000): "Is the U.S. Stock Market Myopic?," *Journal of Accounting Research*, 38(2), 221 – 242.

Allen, F., and D. Gale (2001): *Comparing Financial Systems*. The MIT-Press.

Arrow, K. (1962): *The Rate and Direction of Inventive Activity*chap. Economic Welfare and the Allocation of Resources for Invention, pp. 609–625. Princeton University Press, Princeton, NJ.

Asker, J., J. Farre-Mensa, and A. Ljungqvist (2015): "Corporate Investment and Stock Market Listing: A Puzzle?," *Review of Financial Studies*, 28(2), 342 – 390.

Baber, W. R., P. M. Fairfield, and J. A. Haggard (1991): "The Effect of Concern about Reported Income on Discretionary Spending Decisions: The Case of Research and Development.," *Accounting Review*, 66(4), 818 – 829.

Bebchuk, L., and L. Stole (1993): "Do Short-Term Objectives Lead to Under-or Overinvestment in Long-Term Projects?," *The Journal of Finance*, 48(2), 719–730.

Bernstein, S. (2012): "Does Going Public Affect Innovation?," Unpublished working paper, Stanford University, Graduate School of Business.

Bertrand, M., and S. Mullainathan (2003): "Enjoying the Quiet Life? Corporate Governance and Managerial Preferences," *Journal of Political Economy*, 111(5), 1043–1075.

Bharath, S. T., A. K. Dittmar, and J. Sivadasan (2010): "Does Capital Market Myopia Affect Plant Productivity? Evidence from Going Private Transactions," Unpublished working paper.

Bhide, A. (1993): "The hidden costs of stock market liquidity," *Journal of Financial Economics*, 34(1), 31 – 51.

Chemmanur, T. J., S. He, and D. K. Nandy (2010): "The Going-Public Decision and the Product Market," *Review of Financial Studies*, 23(5), 1855–1908.

Dechow, P. M., and R. G. Sloan (1991): "Executive incentives and the horizon problem: An empirical investigation," *Journal of Accounting and Economics*, 14(1), 51 – 89.

Degeorge, F., and R. Zeckhauser (1993): "The Reverse LBO Decision and Firm Performance: Theory and Evidence," *The Journal of Finance*, 48(4), 1323–1348.

DiNardo, J., N. Fortin, and T. Lemieux (1996): "Labor Market Institutions and the Distribution of Wages: 1973–1993: A Semi-Parametric Approach," *Econometrics*, 64(5), 1001–1045.

Edgerton, J. (2012): "Agency Problems in Public Firms: Evidence from Corporate Jets in Leveraged Buyouts," *The Journal of Finance*, 67(6), 2187–2213.

Erickson, M., M. Hanlon, and E. L. Maydew (2004): "How much will firms pay for earnings that do not exist? Evidence of taxes paid on allegedly fraudulent earnings," *The Accounting Review*, 79(2), 387–408.

Gilje, E., and J. Taillard (2013): "Do Public Firms Invest Differently than Private Firms? Taking Cues from the Natural Gas Industry," Unpublished working paper.

Griliches, Z. (1998): *R&D and Productivity: The Econometric Evidence*chap. The Search for R&D Spillovers, pp. 251 – 268. University of Chicago Press.

Jain, B. A., and O. Kini (1994): "The Post-Issue Operating Performance of IPO Firms," *The Journal of Finance*, 49(5), 1699–1726.

Jensen, M. C. (1986): "Agency Costs of Free Cash Flow, Corporate Finance, and Takeovers," *American Economic Review*, 76(2), 323–29.

Jensen, M. C., and W. H. Meckling (1976): "Theory of the firm: Managerial behavior, agency costs and ownership structure," *Journal of Financial Economics*, 3(4), 305 – 360.

Lerner, J., M. Sorensen, and P. Stromberg (2011): "Private Equity and Long-Run Investment: The Case of Innovation," *The Journal of Finance*, 66(2), 445–477.

Levine, R. (2005): "Chapter 12 Finance and Growth: Theory and Evidence," vol. 1, Part A of *Handbook of Economic Growth*, pp. 865 – 934. Elsevier.

Mikkelson, W. H., M. M. Partch, and K. Shah (1997): "Ownership and operating performance of companies that go public," *Journal of Financial Economics*, 44(3), 281 – 307.

Miles, D. (1993): "Testing for Short Termisn in the UK Stock Market," *Economic Journal*, 103(421), 1379–96.

Pagano, M., F. Panetta, and L. Zingales (1998): "Why Do Companies Go Public? An Empirical Analysis," *The Journal of Finance*, 53(1), 27–64.

Pastor, L., L. A. Taylor, and P. Veronesi (2009): "Entrepreneurial Learning, the IPO Decision, and the Post-IPO Drop in Firm Profitability," *Review of Financial Studies*, 22(8), 3005–3046.

Poterba, J. M., and L. Summers (1995): "A CEO Survey of U.S. Companies' Time Horizons and Hudle Rates," *Sloan Management Review*, 37, 43–53.

Satchell, S. E., and D. C. Damant (1995): "Testing for Short Termism in the UK Stock Market: A Comment," *Economic Journal*, 105(432), 1218–23.

Sheen, A. (2009): "Do Public and Private Firms Behave Differently? An Examination of Investment in the Chemical Industry," Unpublished Working Paper.

Stein, J. C. (1989): "Efficient Capital Markets, Inefficient Firms: A Model of Myopic Corporate Behavior," *The Quarterly Journal of Economics*, 104(4), pp. 655–669.

Stiglitz, J. E. (1985): "Credit Markets and the Control of Capital," *Journal of Money, Credit and Banking*, 17(2), 133–52.

Yagan, D. (2015): "Capital Tax Reform and the Real Economy: The Effects of the 2003 Dividend Tax Cut," *American Economic Review*, 105(12), 3531–3563.

Table 1: Summary Statistics

Panel A: Cross-Sectional

	2005		2009		2014	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Firm Age	12.0	11.7	13.1	12.2	14.4	12.9
Profit Margin	0.21	0.30	0.20	0.31	0.20	0.27
Total Assets ($)	1,807	127,132	1,684	131,459	1,876	159,067
Total Income ($)	990	41,077	903	39,965	1,076	49,072
Total Deductions ($)	873	34,133	840	35,157	946	40,289
Net Income ($)	94	10,013	24	7,871	94	11,009
Taxes Paid ($)	3,239	121,823	2,898	120,435	3,458	142,804
N	71,398		65,126		68,503	
Weighted N	4,152,990		4,414,829		4,561,554	
Fraction S Corp	0.68		0.72		0.75	

Panel B: Firm Year

	All Years		Public		Private	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Firm Age	13.1	12.3	25.2	22.8	13.1	12.3
Profit Margin	0.03	357.65	-0.93	86.93	0.03	357.77
Total Assets ($)	1,902	189,829	1,736,726	5,472,231	644	110,240
Total Income ($)	1,018	46,484	596,684	1,569,430	586	10,858
Total Deductions ($)	919	40,001	523,615	1,344,722	540	9,544
Net Income ($)	71	10,178	69,642	350,362	21	3,332
Taxes Paid ($)	3,345	148,666	1,823,851	4,737,600	2,024	58,561
N	760,340		31,249		729,091	
Weighted N	47,908,759		34,730		47,874,029	
Fraction S Corp	0.71		0.00		0.71	

Note: The upper panel of the table reports cross-sectional SOI-weighted means and standard deviations of key financial measures for all firms in 2005, 2009 and 2014. The lower panel reports the same means and standard deviations for the pooled sample and for public and private firms separately. Financial measures converted to thousands of 2004 dollars based on CPI.

Table 2: Summary Statistics: SOI and DFL weights

	DFL Weighted				SOI Weighted	
	Public		Private		Private Firms	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Total Investment	11,323	14,963	2,555	2,888	403	1,048
Short-Term Investment ($)	3,702	6,675	1,132	1,533	165	555
Long-Term Investment	5,493	9,545	739	1,174	110	436
Long-Term Investment (ex. R&D) ($)	1,488	3,864	366	623	58	240
R&D ($)	3,816	8,051	195	517	34	204
Total Assets$_{t-1}$ ($)	27,630	44,993	9,662	9,875	1,320	3,481
Total Investment/Total Assets$_{t-1}$	1.98	5.26	0.96	3.51	1.13	4.55
Short-Term/Total Assets$_{t-1}$	0.60	1.22	0.59	2.01	0.76	2.93
Long-Term/Total Assets$_{t-1}$	1.30	4.08	0.29	1.19	0.25	1.22
Long-Term (ex. R&D)/Total Assets$_{t-1}$	0.10	0.29	0.10	0.38	0.12	0.53
R&D/Total Assets$_{t-1}$	1.17	3.96	0.10	0.50	0.05	0.38
Long-Term/Total Investment	0.39	0.35	0.24	0.29	0.17	0.28
Long-Term/Total Investment (ex. R&D)	0.14	0.22	0.16	0.24	0.14	0.26
R&D/Total Investment	0.25	0.35	0.07	0.21	0.03	0.14
Observations	14,620		273,307		273,307	

Note: The table contains means and standard deviations for DFL-weighted public and private firms and SOI-weighted private firms in our estimation sample for tax years 2004 – 2014. The estimation sample includes firms that report total assets between $1 million and $1 billion, and report gross receipts between $0.5 million and $1.5 billion in each year that they file a tax return between 2004–2014. Financial measures converted to thousands of 2004 dollars based on CPI. DFL weights were generated within 2 digit industry by year to match public and private firms based on firm size as measured by average gross receipts. Note that the share variables do not sum to one because roughly 10% of firms do not have measurable investment in any given year. Total Assets are equal to Total Physical Assets or Plant, Property and Equipment (PPE).

Table 3: The Effect of Public Status on Investment

	(1) Total Investment	(2) Short-term Investment	(3) Long-term Investment	(4) Long-term ex. R&D	(5) R&D only
Panel A: Investment/Total Physical Assets					
PUBLIC	0.443***	0.100***	0.363***	0.008*	0.334***
	(0.053)	(0.020)	(0.038)	(0.004)	(0.050)
Observations	287,927	287,927	287,927	287,927	287,927
R-squared	0.089	0.089	0.068	0.033	0.018
Panel B: Long-Term Investment/Total Investment					
PUBLIC			0.070***	-0.016***	0.087***
			(0.008)	(0.006)	(0.008)
Observations			287,927	287,927	287,927
R-squared			0.106	0.121	0.145

Note: In panel A, the dependent variable is equal to investment divided by lagged tangible capital assets. In panel B, the dependent variable is long-term investment divided by total investment. Total investment is equal to the sum of total property investments and R& D expenditures, short-term investment is equal to investment in assets with less than 10-year lives, and long-term investment is equal to the sum of investments in assets with 10, 20 or 25-year lives, investments in residential and non-residential properties, and R&D expenditures. All specifications control for a quadratic in firm age, profit margin, tangible capital asset deciles and S Corp dummy. All models include year and 2-digit NAICS code fixed effects and an unreported constant and are weighted by Size-DFL weights where size is equal to the average of business receipts over the previous two lagged years. Standard errors clustered by EIN.
*** $p<0.01$, ** $p<0.05$,* $p<0.1$.

Table 4: Robustness to Alternative Weights

	(1) Total Investment	(2) Short-term Investment	(3) Long-term Investment	(4) Long-term ex. R&D	(5) R&D only
Panel A: Nearest-Neighbor Matching, Investment/Physical Assets					
PUBLIC	0.183*	0.052**	0.204***	0.007	0.128
	(0.106)	(0.024)	(0.074)	(0.006)	(0.100)
Observations	26,668	26,668	26,668	26,668	26,668
R-squared	0.217	0.226	0.161	0.061	0.117
Panel B: Entropy Balancing Weights, Investment/Physical Assets					
PUBLIC	0.276***	0.238***	1.077***	0.031***	1.023***
	(0.023)	(0.020)	(0.070)	(0.004)	(0.087)
Observations	288,803	288,803	288,803	288,803	288,803
R-squared	0.106	0.110	0.132	0.035	0.069
Panel C: Nearest-Neighbor Matching, LT Investment/Total Investment					
PUBLIC			0.035**	-0.007	0.044***
			(0.014)	(0.008)	(0.014)
Observations			26,668	26,668	26,668
R-squared			0.111	0.168	0.186
Panel D: Entropy Balancing Weights, LT Investment/Total Investment					
PUBLIC			0.107***	-0.028***	0.135***
			(0.007)	(0.004)	(0.006)
Observations			288,803	288,803	288,803
R-squared			0.172	0.147	0.243

Note: The dependent variable in Panels A and B is investment divided by lagged tangible capital assets. The dependent variable in Panels C and D is long term investment divided by total investment. Total investment is equal to the sum of total property investments and R& D expenditures, short-term investment is equal to investment in assets with less than 10-year lives, and long-term investment is equal to the sum of investments in assets with 10, 20 or 25-year lives, investments in residential and non-residential properties, and R&D expenditures. In Panels A and C private firms are weighted according to the nearest-neighbor matching method while in Panels B and D private firms are weighted using entropy balancing weights which are weighted on the first moments of firm size, total income, lagged total business receipts, salaries and firm age. All specifications are also weighted by size where size is the average of business receipts over the previous two lagged years. All specifications control for a quadratic in firm age, profit margin, tangible capital asset deciles and S Corp dummy. All models include year and two-digit NAICS code fixed effects and an unreported constant. Standard errors clustered by EIN. *** p<0.01, ** p<0.05,* p<0.1.

Table 5: Robustness to Treatment of Bonus Depreciation

	(1) Total Investment	(2) Short-term Investment	(3) Long-term Investment	(4) Long-term ex. R&D	(5) R&D only
Panel A: Investment/Total Physical Assets, 2005–2007 Only					
PUBLIC	0.371***	0.069***	0.320***	0.010*	0.303***
	(0.046)	(0.021)	(0.034)	(0.005)	(0.040)
Observations	86,114	86,114	86,114	86,114	86,114
R-squared	0.097	0.089	0.066	0.032	0.028
Panel B: Investment/Total Physical Assets, Alternative ST/LT Definitions					
PUBLIC	0.443***	0.104***	0.387***	0.006**	0.334***
	(0.053)	(0.021)	(0.036)	(0.002)	(0.050)
Observations	287,927	287,927	287,927	287,927	287,927
R-squared	0.089	0.088	0.067	0.012	0.018
Panel C: Long-Term Investment/Total Investment, 2005–2007 Only					
PUBLIC			0.069***	-0.011	0.082***
			(0.010)	(0.008)	(0.009)
Observations			86,114	86,114	86,114
R-squared			0.121	0.127	0.146
Panel D: Long-Term Investment/Total Investment, Alternative ST/LT Definitions					
PUBLIC			0.077***	-0.009**	0.087***
			(0.008)	(0.004)	(0.008)
Observations			287,927	287,927	287,927
R-squared			0.102	0.072	0.145

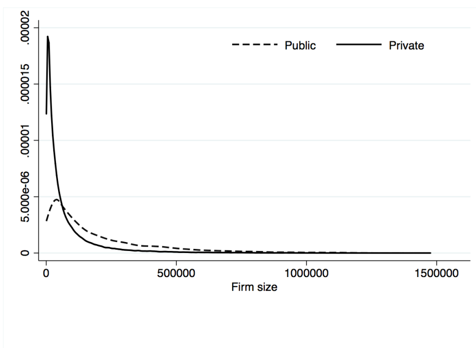
Note: In Panels A and B, the dependent variable is investment divided by lagged tangible capital assets. In Panels C and D, the dependent variable is long-term investment divided by total investment. Total investment is equal to the sum of total property investments and R& D expenditures, short-term investment is equal to investment in assets with less than 10-year lives, and long-term investment is equal to the sum of investments in assets with 10, 20 or 25-year lives, investments in residential and non-residential properties, and R&D expenditures. Panels A and B only use data from 2005 through 2007 when no bonus depreciation was allowed. Panels C and D classify all bonus depreciation as short-term investment. All specifications also included an unreported constant and are weighted by Size-DFL weights where size is equal to the average of business receipts over the previous two lagged years. All specifications control for a quadratic in firm age, profit margin, tangible capital asset deciles and S Corp dummy. All models include year and two-digit NAICS code fixed effects and an unreported constant. Standard errors clustered by EIN.
*** p<0.01, ** p<0.05,* p<0.1.

Table 6: Robustness to Sample Restrictions

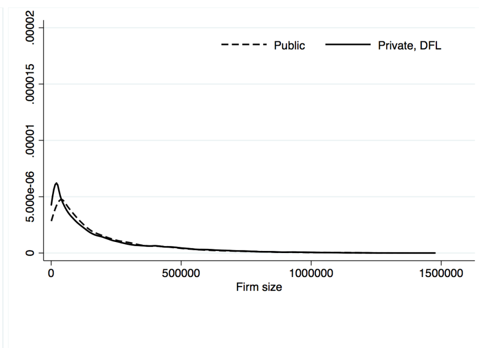
	(1) Total Investment	(2) Short-term Investment	(3) Long-term Investment	(4) Long-term ex. R&D	(5) R&D only
Panel A: Investment/Total Physical Assets, Ever R&D Sample					
PUBLIC	0.383***	0.058**	0.444***	0.011**	0.266**
	(0.085)	(0.023)	(0.065)	(0.005)	(0.104)
Observations	57,474	57,474	57,474	57,474	57,474
R-squared	0.290	0.196	0.243	0.056	0.171
Panel B: Long-Term Investment/Total Investment, Ever R&D Sample					
PUBLIC			0.080***	-0.003	0.086***
			(0.013)	(0.008)	(0.014)
Observations			57,474	57,474	57,474
R-squared			0.089	0.077	0.114
Panel C: Investment/Total Physical Assets, Full Sample					
PUBLIC	0.177***	0.020	0.160***	-0.006	0.197***
	(0.048)	(0.025)	(0.032)	(0.009)	(0.045)
Observations	498,452	498,452	498,452	498,452	498,452
R-squared	0.069	0.067	0.041	0.043	0.008
Panel D: Long-Term Investment/Total Investment, Full Sample					
PUBLIC			0.062***	-0.017	0.203***
			(0.016)	(0.021)	(0.016)
Observations			498,452	498,452	498,452
R-squared			0.121	0.127	0.146

Note: In Panels A and C, the dependent variable is investment divided by lagged tangible capital assets. In Panels B and D, the dependent variable is long-term investment divided by total investment. Total investment is equal to the sum of total property investments and R& D expenditures, short-term investment is equal to investment in assets with less than 10-year lives, and long-term investment is equal to the sum of investments in assets with 10, 20 or 25-year lives, investments in residential and non-residential properties, and R&D expenditures. The coefficients in both panels are estimated using a broader sample that includes firms with less than one million or more than one billion dollars in assets, or less than 0.5 million or 1.5 billion dollars in revenues, which are excluded in the prior analysis. All specifications also included an unreported constant and are weighted by Size-DFL weights where size is equal to the average of business receipts over the previous two lagged years. All specifications control for a quadratic in firm age, profit margin, tangible capital asset deciles and S Corp dummy. All models include year and two-digit NAICS code fixed effects and an unreported constant. Standard errors clustered by EIN.
*** p<0.01, ** p<0.05,* p<0.1.

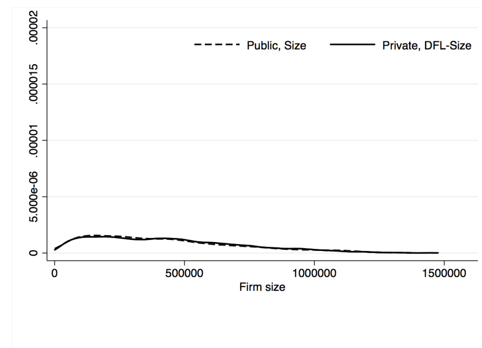
Figure 1: Distribution of Public and Private Firms by Size



(a) Unweighted



(b) Public: Unweighted; Private: DFL-Wgt.



(c) Public: Size Wgt.; Private: DFLxSize Wgt.

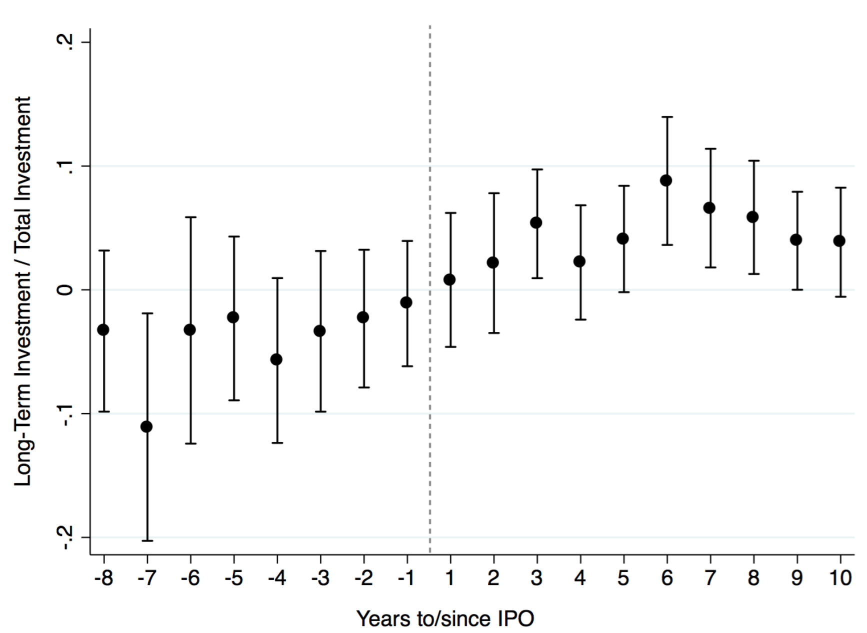


Figure 2: Long-Term Investment Share Advantage of Public Firms, by Years Since IPO

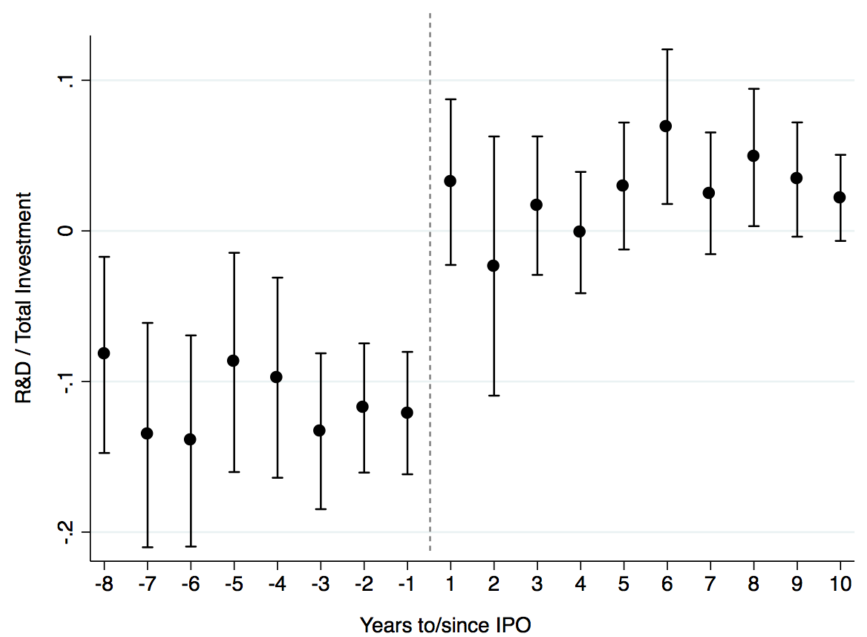


Figure 3: R&D Share Advantage of Public Firms, by Years Since IPO

Data Appendix

Table 1: Description of tax variables

Variable	Description
Form 1120 or 1120S, Front page	
Tangible capital assets	Line 10b
Revenue	Line 1c
Cost of goods sold	Line 2 (also line 8 on Schedule A)
Total income	Line 11
Salaries paid	Line 12 + Line 13
Depreciation	Line 20
Total deductions	Line 27
Net income	Line 28
Taxable income	Line 30
Total receipts	Line 1 + Line 11
Operating Profit	
C-corporations	Line 1c+ Line 12 + Line 18 + Line 19 + Line 20+
Line 25 - Line 2 - Line 27	
S-corporations	Line 1c + Line 7 + Line 13 + Line 14 - Line 2 - Line 20
Schedule L: Balance Sheet Items	
Total balance sheet assets	Line 15
Depreciable assets less accumulated depreciation	Line 10a - Line 10b
Intangible assets less accumulated amortization	Line 13a - Line 13b
Form 6765: Credit for Increasing Research Activities	
Qualified research expenses under regular credit method	Line 9
Qualified research expenses under ASC method	Line 53
Qualified research expenses under AIC method	Line 28
Form 4562: Depreciation and Amortization	
Property basis amount, 3 years	Line 19a
Property basis amount, 5 years	Line 19b
Property basis amount, 7 years	Line 19c
Property basis amount, 10 years	Line 19d
Property basis amount, 15 years	Line 19e
Property basis amount, 20 years	Line 19f
Property basis amount, 25 years	Line 19g
Residential rental property basis amount	Line 19h
Nonresidential rental property basis amount	Line 19i
Basis for depreciation, class life	Line 20a
Basis for depreciation, 12-year	Line 20b
Basis for depreciation, 40-year	Line 20c