Externalities of Public Firm Presence: Evidence from Private Firms' Investment Decisions

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Abstract

Public firms provide a large amount of information through their disclosures. In addition, information intermediaries publicly analyze, discuss, and disseminate these disclosures. Thus, greater public firm presence in an industry should reduce uncertainty in that industry. Following the theoretical prediction of investment under uncertainty, we hypothesize and find that private firms are more responsive to their investment opportunities when they operate in industries with greater public firm presence. Further, we find that the effect of public firm presence is greater in industries with better information quality and in industries characterized by a greater degree of investment irreversibility. Our results suggest that public firms generate positive externalities by reducing industry uncertainty and facilitating more efficient private firm investment.

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1. Introduction

Public firms disclose large amounts of information, such as their business strategy, financial performance, expected future outlook, current and future investment outlays, material contracts, and business risks. In addition, information intermediaries, such as financial analysts and the business press, analyze, discuss, and disseminate firms' disclosures. Collectively, these disclosure activities can improve the information environment for firms within the industry by reducing uncertainty about demand, supply, and cost conditions, as these factors are interrelated within an industry (Mitchell and Mulherin, 1996; Admati and Pfleiderer, 2000). In contrast, private firms are not required to publicly disclose information in the U.S. Also, analysts and the business press provide much less coverage of private firms. As a result, little is known about the operations and performance of private firms. Thus, the composition of public and private firms in an industry is likely to have a significant effect on the industry's information environment.

This paper examines whether greater public firm presence in an industry can increase the responsiveness of firms' investment to investment opportunities by enriching the industry's information environment, thereby reducing uncertainty. The intuition is that as more firms in an industry publicly disclose information and receive coverage by information intermediaries, a more complete perspective of the current economic environment and future outlook for the industry emerges. This reduction in industry uncertainty can then be used by peer firms in the industry to make more informed investment decisions. Our analysis is based on the theoretical predictions of investment under uncertainty, which indicates that when investment decisions are (even partially) irreversible, firms become cautious and hold back on investment in the face of uncertainty (e.g., Dixit and Pindyck, 1994). As a result, higher uncertainty leads to a reduction in firms' responsiveness to investment opportunities (Bloom et al., 2007; Julio and Yook, 2012).[1] If

[1] Note that our prediction relates to the responsiveness of investment to investment opportunities *rather than* the level of investment. The theoretical literature on investment under uncertainty finds that uncertainty has an ambiguous effect on the level of investment. Under some conditions, uncertainty has a positive effect on investment (e.g., Hartman, 1972; Abel, 1983; Caballero, 1991), while under other conditions, uncertainty has a negative effect (e.g., Dixit and Pindyck, 1994; Pindyck, 1993). Most empirical studies, however, find a negative relation between

greater public firm presence leads to lower uncertainty in the industry, firms operating in that industry are likely to be more responsive to investment opportunities.

Using a novel data set of private U.S. firms created by Sageworks Inc., we investigate whether private firms operating in industries with greater public firm presence are more responsive to their investment opportunities than those operating in industries with lower public firm presence.[2] Following Hubbard (1998), we interpret the responsiveness of investment to investment opportunities as a proxy for investment efficiency, where investment is measured as the change in gross fixed assets (Desai et al., 2009; Asker et al., 2012) and investment opportunities is measured using lagged sales growth (Wurgler, 2000; Whited, 2006; Bloom et al., 2007; Biddle et al., 2009; Asker et al., 2012). We proxy for public firm presence in an industry using the percentage of industry sales that are generated by public firms.

Consistent with our prediction, we find that private firm investment is more sensitive to investment opportunities in industries with a greater public firm presence. This result is robust to using alternative proxies for investment opportunities (i.e., Tobin's *Q* for private firms, industry *Q*, and state tax rate changes), an alternative measure of public firm presence, and controls for the degree of competition in an industry. Further, our findings continue to hold when we use 'firm fixed-effects' and a 'changes' specification to test our hypothesis.

Next we examine cross-sectional variation in the relation between public firm presence and private firm investment sensitivities. We begin by examining whether differences in the quality and quantity of information disclosed in the industry affect the extent to which public firm presence reduces uncertainty. If the firms and information intermediaries in an industry disclose less information or information that conceals economic performance, public firm

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investment and uncertainty (e.g., Leahy and Whited, 1996; Guiso and Parigi, 1999). Bloom et al. (2007) provide evidence using simulated data that while the effect of uncertainty on the level of investment depends on modeling assumptions, uncertainty reduces the responsiveness of investment to investment opportunities and this relation is robust to different assumptions.

[2] Although our predictions apply for both public and private firms, we focus on private firms to mitigate endogeneity concerns and facilitate empirical identification. We provide a detailed discussion in Section 2.2.

presence is less likely to reduce uncertainty and facilitate the investment decisions of peer firms in such an industry. Accordingly, we predict and find that the relation between public firm presence and private firms' investment sensitivity is stronger when the public firms have more informative earnings, provide more management forecasts, and are covered by more analysts.

Second, we examine whether variation in the degree of investment irreversibility across industries affects the relation between public firm presence and private firms' investment sensitivity. Corporate investment decisions are characterized by some degree of irreversibility, i.e., investment expenditures are at least partially sunk, and thus cannot be costlessly undone once incurred (Pindyck, 1991). When investment decisions are irreversible, uncertainty makes firms more cautious and leads firms to take a 'wait and see' strategy, thereby reducing the sensitivity of investment to investment opportunities (Bloom et al., 2007; Julio and Yook, 2012). Accordingly, we predict and find that the effect of public firm presence on the responsiveness of investment to investment opportunities is greater in industries characterized by higher degrees of investment irreversibility. These cross-sectional results provide additional support for our hypothesis that public firms' disclosures reduce industry uncertainty, which helps peer firms in the industry identify and exploit investment opportunities.

Like other research that examines corporate investment, our empirical tests are subject to potential endogeneity concerns. A standard concern in the investment literature is that investment opportunities are measured with error (e.g., Erickson and Whited, 2000). Further, public firm presence in an industry might be correlated with industry-wide growth opportunities that are not captured by our firm-specific proxies for growth opportunities.[3] We conduct three tests to mitigate these concerns. First, we identify two instruments for public firm presence, verify the strength of these instruments (Staiger and Stock, 1997) and their joint validity using an overidentification test (Sargan, 1958), and show that our inferences are robust to using both

[3] However, as we note earlier, our predictions concern the *sensitivity* of investment to investment opportunities rather than the *level* of investment, which is more likely to be affected by changes in growth opportunities.

instruments. Second, we conduct our analyses in a setting where private firms are subject to similar disclosure requirements as public firms—i.e., the United Kingdom (Ball and Shivakumar, 2005). Since private firms publicly disclose financial information in the U.K., greater public firm presence is unlikely to have an effect on industry uncertainty. Accordingly, we predict that public firm presence will not affect investment sensitivities in the U.K. However, if investment sensitivities are instead driven by industry growth opportunities or measurement error, we should continue to find that public firm presence impacts private firms' investment sensitivities in the U.K. Consistent with our prediction, we find no evidence that public firm presence affects investment sensitivities of private firms in the U.K., which further validates our inferences. Third, following Asker et al. (2012), we use changes in state corporate income tax rates as an exogenous shock to investment opportunities, thereby eliminating the need to measure investment opportunities. Again, we find that our inferences are unchanged.

This paper makes several contributions. First, investment project selection is one of the most fundamental and important tasks undertaken by a firm (Hubbard, 1998). Our evidence provides insights into the process through which managers obtain industry-relevant information, which is central to effective investment decision making. Specifically, we find that the presence of public firms in an industry fosters disclosures by not only the public firms themselves, but also information intermediaries that analyze, summarize, and disseminate firm news. Collectively, these disclosures help to provide a more comprehensive view of the industry, thereby reducing uncertainty and facilitating more efficient investment.

Second, our paper adds to the emerging literature on information transfers and its effect on peer firm investment (Durnev and Mangen, 2009; Beatty et al., 2013; Shroff et al., 2013). For example, Shroff et al. (2013) show that the external information environment facilitates the investment decisions of multinational firms by allowing parent firms to better monitor their foreign subsidiaries. Durnev and Mangen (2009) show that accounting restatements are associated with lower abnormal returns and reduced investment by non-restating firms in the

industry. The authors suggest a 'learning' effect in that restatements convey information about investment projects to the managers of restating firms' competitors. However, Gleason et al. (2008) argue that restatements cause investors to reassess the content and credibility of financial statements issued by other firms in the same industry—i.e., a transparency or 'accounting quality' effect. Therefore, changes in firms' investment decisions following restatements by competitors could be due to changes in the industry cost of capital. We add to this literature by using a broader setting unrelated to restatements to document positive externalities from public firm presence. Our setting and the mechanisms we study allow us to further understand the information spillovers from public firms.

Third, although private firms comprise the vast majority of firms in the U.S., little is known about private firms' investment. Asker et al. (2012) compare the investment behavior of public and private firms and show that private firm investment is more efficient than that of a matched sample of public firms. They attribute the difference in investment efficiency to agency issues in public firms. Rather than compare public and private firm investment, this paper examines whether differences in investment efficiency within the set of U.S. private firms can be partially explained by variation in the presence of public firms in the industry.

Finally, despite its pervasiveness, disclosure regulation is often quite challenging to justify because of market-based incentives to disclose information (Admati and Pfleiderer, 2000; Leuz and Wysocki, 2008; Berger, 2011). That is, since the costs of obfuscating information are ultimately borne by the firm, the firm has incentives to disclose information to reduce such costs (see, e.g., Admati and Pfleiderer, 2000). One justification put forward in favor of mandatory disclosure is the presence of positive externalities to such disclosure. This paper provides initial evidence consistent with positive externalities of corporate disclosures, namely, improving the average investment efficiency of private firms in the industry.

The rest of the paper proceeds as follows. In Section 2, we develop our hypotheses. Section 3 describes our sample and variables. Section 4 presents our empirical design and results. Section 5 addresses endogeneity. Section 6 presents sensitivity tests. Section 7 concludes.

2. Motivation

2.1. Public firms and the information environment

Mandatory corporate disclosures, such as 10-K and 10-Q filings, contain enormous amounts of information about firms and their operating environments (Palepu et al., 2000; Beyer et al., 2010). These disclosures are an important source of information about firms' future sales, earnings, supplier/customer contracts, investment outlays, strategic directions, and capital structure, which can provide valuable insights into the firms' prospects. Supporting this contention, Li (2010a) shows that forward-looking statements in the Management Discussion and Analysis (MD&A) section in 10-Ks contain information about firms' future earnings. Lundholm et al. (2010) show that store growth rate information in retail firms' 10-Ks can be used to generate reasonably accurate sales forecasts. Most recently, Li et al. (2013) find that 10-K disclosures of firms' competitive environment are related to the firms' future profitability. These studies suggest that the information disclosed by public firms in regulatory filings is informative about firms' future performance and to some extent, the overall industry outlook.

In addition to providing important information in mandatory financial reports, public firms often voluntarily disclose valuable information to the market. For example, firms often disclose value-relevant information about future prospects, such as earnings and cash flows forecasts (Beyer et al., 2010; Goodman et al., 2013) as well as important corporate actions or events, such as product launches (Gu and Li, 2003), capital expenditures (Li, 2010b; Brown et al., 2006), and management turnovers (Weisbach, 1995; Murphy and Zimmerman, 1993). Bonsall et al. (2013) provide evidence that management forecasts of firms with greater exposure to macroeconomic risks contain significant and timely information about the macro-economy. These studies suggest that firms' voluntary disclosures, especially earnings and capital

expenditure forecasts, are likely to be informative about the economic environment of the industry.

Besides firm-initiated disclosures, information intermediaries, such as financial analysts and the business press, analyze, summarize, and disseminate information about individual public firms as well as the overall industry and macro-economy (e.g., Asquith et al., 2005; Frankel et al., 2006). Recently, Hutton et al. (2012) show that analyst earnings forecasts are more accurate than management forecasts when the firms' earnings move in concert with macroeconomic factors, suggesting that analyst forecasts contain valuable information about the macro-economy. Similarly, Kadan et al. (2012) find that analysts often issue industry-level recommendations, which are associated with the future performance of the industries. These studies indicate that analyst reports contain important and relevant information about future industry prospects.

In contrast to public firms, private firms are generally not required to disclose information to the public. Further, the lack of demand for information about private firms by shareholders and potential investors reduces the likelihood that private firms receive analyst coverage. As a result, much less is known about the operations and performance of private firms. In fact, as Farre-Mensa (2011) suggests, one of the primary reasons firms stay private is to avoid having to disclose proprietary information to competitors and potential entrants.[4]

Given the significant differences between public and private firms with respect to public information generation, the composition of public and private firms in an industry is likely to have a significant effect on the information environment of the industry as a whole. That is, to the extent a more comprehensive set of firms in an industry publicly disclose information and are

[4] When asked about the public information provided by Groupon in its pre-initial public offering (IPO) filings, Tim O'Shaughnessy (chief executive officer (CEO) of LivingSocial) indicated, "When…there's some opacity in how people are operating, you make guesses, and some of those guesses are right and some of them are wrong. I'm a data-oriented guy, and fundamentally it's interesting to see, OK, what do your numbers actually look like? What do your growth rates actually look like? …you're actually able to match up and see how good were our guesses… One of the things that—and many people have talked about this—is just that they [Groupon] have become much more increasingly international and I think that went from a very small piece of their business to the majority of their business in a very short period of time. A lot of people have said, boy, that's interesting." (*The Wall Street Journal*, August 29, 2011).

covered by information intermediaries, a more complete view of the current economic environment and future outlook for the industry emerges. Consequently, we predict that private firms operating in industries with greater public firm presence can better identify and exploit investment opportunities, thereby increasing their responsiveness to investment opportunities.

Our prediction is based on the theoretical analyses of investment under uncertainty where corporate investments are viewed as 'options' and are characterized by some degree of irreversibility (McDonald and Siegel, 1986; Pindyck, 1991; Dixit and Pindyck, 1994). This literature suggests that firms face a trade-off between (1) postponing investment to wait for additional information, which lowers the risk of an ex post suboptimal decision, but increases the risk of potentially missing a valuable opportunity, and (2) investing now, which lowers the risk of missing a profitable opportunity, but increases the chance of making an ex post suboptimal decision. The primary result from this literature is that capital investments have option value and the value of waiting for additional information before investing/disinvesting (i.e., not exercising the option) is greater when there is greater uncertainty.

An alternative view initiated by Hartman (1972) and followed by Abel (1983) argues that greater uncertainty *increases* the investment of a risk-neutral firm in a competitive environment. They show that given constant returns to scale, the marginal product of capital is a convex function of the uncertain price faced by the firm, so that by Jensen's inequality, greater uncertainty raises the marginal value of one additional unit of capital, leading to higher investment. Caballero (1991) and Abel and Eberly (1994, 1996) generalize this result.

While the theoretical literature finds that the relation between uncertainty and investment is ambiguous, most empirical studies find a negative relation between uncertainty and investment (see, e.g., Leahy and Whited, 1996; Guiso and Parigi, 1999). More relevant to our paper, Bloom et al. (2007) show that uncertainty reduces the responsiveness of investment to investment opportunities. They also show (using simulated data) that while the effect of uncertainty on investment levels is sensitive to the different modeling assumption [such as in Hartman (1972)

and Abel (1983)], its effect on the responsiveness of investment to investment opportunities is robust to a variety of assumptions about adjustment costs, convex marginal product of capital, and time-varying uncertainty (see Bloom et al., 2007, Table 3, pp. 401–402). Our prediction builds on the analyses in Bloom et al. (2007). Specifically, we predict that reduced industry uncertainty (through greater public firm presence) increases peer firms' investment sensitivities. In the Appendix, we develop a two-period model that shows that uncertainty reduces the sensitivity of investment to investment opportunities, but has an ambiguous effect on the level of investment.

2.2. Private firm setting

Although our logic for the impact of public firm presence readily extends to the investment behavior of both public and private firms, we focus on the investment behavior of private firms for three reasons. First, using a private firm setting allows us to better isolate the mechanism through which public firm externalities manifest. As Bushman and Smith (2001) argue, financial information can affect firms' investment decisions by (1) helping firms identify and exploit investment opportunities (i.e., reducing uncertainty), and (2) reducing agency issues through enhanced monitoring, which can lead to improved managerial behavior as well as reductions in the firm's cost of capital due to lower information asymmetry. Since agency issues are arguably much less prevalent among private firms,[5] the role of accounting information in disciplining managers and reducing information asymmetry due to better disclosure (i.e., channel 2) are less likely.[6]

[5] For example, Ang et al. (2000, p. 83) observe that "[w]hen compared to publicly traded firms, [private firms] come closest to the type of [zero-agency-cost] firms depicted in the stylized theoretical model of agency costs developed by Jensen and Meckling (1976)."

[6] While it is conceivable that an increase in public firm presence reduces industry uncertainty for both private firms and their creditors, public firm presence is unlikely to reduce information asymmetry between the two parties because the information disclosed by public firms doesn't directly concern the private firms' borrowing capacity. Rather, public firm disclosures are relevant for private firms' creditors only to the extent these disclosures provide information that reduces industry uncertainty. However, creditors have much more information about the industry than an individual private firm because creditors lend money to many firms, and hence obtain detailed information

Second, examining the externalities of public firm presence on the investment decisions of other *public* firms can introduce an endogeneity bias because public firm presence in an industry is likely to increase when private firms have initial public offerings (IPOs). To the extent private firms choose to have their IPOs and become public when they are rapidly growing, our results might be affected by such unobservable increases in firm growth, which is correlated with public firm presence. By focusing on private firms, we effectively remove firms that choose to have IPOs from our sample, thus reducing the likelihood of such an endogeneity bias.

Lastly, we focus on private firms because they are an economically important group of firms, and little is known about their investment behavior (Asker et al., 2012; Chen et al., 2011). Asker et al. (2012) estimate that in 2007, private U.S. firms accounted for 54.5% of aggregate nonresidential fixed investment, 67.1% of private sector employment, 57.6% of sales, and 20.6% of aggregate pre-tax profits. Further, they document that private firms accounted for 85.6% of all firms with 500 or more employees and more than 98% of all firms in 2007. Despite their importance in the U.S. economy, little is known about their investment decisions.

Regardless of the above arguments for focusing on private firms, we recognize that our prediction is valid for public firms as well. Therefore, we examine whether our results hold for public firms in Section 6.3.

3. Data and variable measurement

3.1. Sample selection

We obtain confidential access to private firm data from Sageworks Inc., a company that collects private firm data from a large number of accounting firms and develops financial analysis tools, primarily for accounting firms and banks. Sageworks cooperates with most of the largest national accounting firms as well as many of the regional firms. Like Compustat,

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from all firms they have relationships with. More importantly, while the cost of debt and supply of funds has a direct relation with the *level* of investment, its effect on the *sensitivity* of investment to investment opportunities is unclear.

Sageworks contains data from income statements and balance sheets along with basic demographic information, such as the North American Industry Classification System (NAICS) industry codes and geographic location, except that Sageworks exclusively covers private firms. Although firms are anonymous, each firm in the Sageworks database has a unique identifier allowing us to construct a panel. The main drawback of anonymity for our purpose is that we cannot identify a closer group of peer firms that produce public financial statements.

Sageworks started in 2000 with fiscal year 2001 as the first panel year. We have data through fiscal year 2010 giving us a ten-year panel data set. To construct our sample of private companies, we follow Minnis (2011) and exclude all observations with data quality issues as well as non-U.S. based companies. Specifically, we delete all firm-years that fail to satisfy basic accounting identities as well as those with net income (NI), cash flow from operations (CFO), accruals (ACC), or property, plant, and equipment (PPE) that are greater than total assets at year-end. We also require firm-years to have assets and sales greater than $100,000 (Minnis, 2011). We remove financial firms (NAICS 52) and regulated utilities (NAICS 22) because typical investment models are not suited for financial firms and the investment decisions of utilities are often regulated. Finally, we drop firm-year observations with missing values for gross fixed assets, total assets, sales, and net income. Applying the above sampling restrictions results in a sample of 70,235 firm-years (34,064 firms).

3.2. Variable measurement

3.2.1. Investment and investment opportunities

Most prior research on investment focuses on capital expenditures (CapEx), mergers and acquisitions (M&A), and/or research and development (R&D) expenditure. However, Sageworks' data do not allow us to distinguish between these forms of investment. Therefore, we measure investment as annual increases in fixed assets (Asker et al., 2012). Specifically, we follow Asker et al. (2012) and measure investment as gross investment (*INV*), which is the

annual increase in gross fixed assets scaled by total assets at the beginning of the year. We also use net investment as an alternative proxy for investment, where net investment is the annual increase in net fixed assets scaled by total assets at the beginning of the year. While CapEx and M&A lead to an increase in fixed assets (i.e., *INV*), R&D does not affect fixed assets, and hence is not captured by *INV*. We acknowledge this data limitation and provide evidence suggesting that our inferences are unlikely to be driven by it. Specifically, we find that our inferences are unaffected when we drop industries with the highest R&D intensity as observed for public firms.

A large empirical investment literature uses either Tobin's *Q* or sales growth as a proxy for investment opportunities. Tobin's *Q* is usually constructed as the ratio of the market value of firms' total assets to its book value. However, since private firms are not traded on a stock exchange, their market value is not observed. We therefore favor sales growth (*SALES_GR*) as our proxy for investment opportunities. Sales growth is widely used as a measure of investment opportunities in prior research on investment (see, e.g., Lehn and Poulsen, 1989; Shin and Stulz, 1998; Whited, 2006; Whited and Wu, 2006; Bloom et al., 2007; Asker et al., 2012).

For robustness purposes, we use two additional measures of investment opportunities. First, following Campello and Graham (2013) and Asker et al. (2012), we construct a measure of Tobin's *Q* for private firms. Campello and Graham (2013) suggest regressing Tobin's *Q* for public firms on four variables thought to be informative about a firm's marginal product of capital. The four variables include: sales growth, return on assets (*ROA*), net income, and leverage. The resulting regression coefficients are then used to generate a 'predicted *Q*' (*TOBIN'S_Q*) for each private firm in our sample. Second, we use industry *Q* (*INDUSTRY_Q*) as a proxy for the investment opportunities available to each firm in the industry. *INDUSTRY_Q* is measured as the size-weighted average *Q* of all public firms in each four-digit NAICS industry.

A standard concern in the investment literature is that investment opportunities are measured with error (Kaplan and Zingales, 1997; Almeida et al., 2010; Erickson and Whited, 2000, 2012). To address this concern, we use an approach that circumvents the need to directly

measure investment opportunities. Following Asker et al. (2012), we use a change in state corporate income tax rates as an exogenous shock to firms' investment opportunities. Tax changes directly affect the after-tax cash flows from investments, thereby providing a relatively clean measure of changes in investment opportunities. While changes in the federal tax rates are rare, there is considerable variation in state taxes across time. We obtain data for 21 tax cuts and 15 tax increases over our sample period in a total of 20 states from the Tax Foundation, which we verify using state legislature and state department of revenue Web sites (following Asker et al. 2012). We code a firm as being affected by a tax change if the firm is headquartered in a state that changed tax rates.[7] We code tax changes using an indicator variable set to 1 (-1) for firms affected by a tax decrease (tax increase), and zero otherwise (*TAX_CHANGE*).[8] We also separate tax changes into tax increases (*TAX_INCREASE*) and tax decreases (*TAX_DECREASE*) to examine whether they differentially affect investment.

3.2.2. Public firm presence

To capture the presence of public firms in an industry, we obtain data on the total number of firms operating in each four-digit NAICS industry from the Census Bureau, and we proxy for the total number of public firms in the industry using Compustat. We use two measures of public firm presence in an industry: (1) total sales by public firms scaled by total sales by all firms in the industry (*PUBLIC_PROP_S*), and (2) the number of public firms scaled by the total number of firms in the industry (*PUBLIC_PROP_F*). The first measure can be thought of as a value-

[7] A drawback of using state tax changes is that states levy taxes on all corporate activities within their jurisdiction, irrespective of where a firm is headquartered. Therefore, if a firm operates in multiple states, their firm-level investment decisions will be less sensitive to a tax change in the headquartered state. To mitigate the concern that state tax rate changes do not affect firms' taxes and hence, their decisions, in untabulated analyses we verify that our tax change proxies are significantly correlated with changes in firms' effective tax rates.

[8] We use an indicator variable instead of changes in tax rates because some of the tax changes (e.g., the introduction of a state Alternative Minimum Tax or a tax surcharge) affect a firm's overall tax burden, but not marginal tax rates.

weighted proportion of public to total firms in an industry, whereas the second measure is an equal-weighted proportion.

During our sample period, the Census Bureau data are only available in 2002 and 2007. To obtain the total number of firms (industry sales) for years other than 2002 and 2007, we calculate the growth in the number of firms (industry sales) between 2002 and 2007 and apply that rate to the base year of 2002. This allows us to approximate the number of firms and industry sales for all years in our sample period. In untabulated results, we verify the robustness of our inferences to using data from years 2002 and 2007 only. We also find that our inferences are unchanged when we proxy for industry sales and number of firms using Sageworks and Compustat data in place of Census data.

4. Research design and empirical results

4.1. Descriptive statistics

Table 1, Panel A presents summary statistics for our variables of interest. Our primary proxy for investment is the change in gross fixed assets (*INV*), which is 4.2% of total assets during our sample period. Average sales growth (*SALES_GR*) is 14%, average predicted Tobin's *Q* (*TOBIN'S_Q*) is 1.32, and the average industry *Q* (*INDUSTRY_Q*) is 1.39. These values are similar to those reported in Asker et al. (2012). Table 1, Panel A also shows that the private firms in our sample are fairly profitable with an average *ROA* of 13.5%, have large cash balances (*CASH*) equal to 14.1% of total assets, and finance 53% of their assets by debt (*LEVERAGE*). The reliance on leverage is not surprising given that private firms have little access to equity markets (Berger and Udell, 1998). Also, the average firm in our sample has $6 million in assets. Finally, we find that the proportion of public firms' sales to total industry sales is 28.1% and the ratio of public firms to all firms in the industry is 0.4%.

Table 1, Panel B reports the Pearson (Spearman) correlations above (below) the diagonal for our main variables of interest. Consistent with our expectations, we see strong positive correlations between investment (*INV*), investment opportunities (*SALES_GR*; *TOBIN'S Q*;

INDUSTRY Q), and past performance (*ROA*). We also find that both our proxies for public firm presence are positively correlated. Specifically, the Pearson (Spearman) correlation between *PUBLIC_PROP_S* and *PUBLIC_PROP_F* is 0.37 (0.72).

Table 1, Panel C (and Fig. 1) shows cross-sectional (time-series) variation in public firm presence, *PUBLIC_PROP_S*. Our data reveal that there is significant variation in public firm presence both across industries and over time, but perhaps not surprisingly, cross-sectional variation appears to be greater than the time-series variation. In the cross-section, we find that the mining, information, and manufacturing industries have the highest public firm presence and the wholesale trade, other services, and agriculture industries have the lowest public firm presence. In the time-series, we find that the average public firm presence across all industries fluctuates over time with its peak in 2001 at 32% and its lowest value in 2005 at 26%.

4.2. Baseline regressions: Public firm presence and investment sensitivities

Our main prediction is that private firms operating in industries with a greater public firm presence are more responsive to their investment opportunities than those operating in industries with lesser public firm presence. We estimate the following regression to test our prediction:

$$INV_{i,t} = \beta_1 SALES\_GR_{i,t\text{-}1} + \beta_2 PUBLIC\_PROP_{j,t\text{-}1} + \beta_3 \mathbf{SALES\_GR}_{i,t\text{-}1} \mathbf{x}\ \mathbf{PUBLIC\_PROP}_{j,t\text{-}1} + \beta_4 HI_{j,t} + \beta_5 HI_{j,t} \text{ x } SALES\_GR_{i,t\text{-}1} + \beta_6 ROA_{i,t\text{-}1} + \beta_7 CASH_{i,t\text{-}1} + \beta_8 LEVERAGE_{i,t\text{-}1} + \beta_9 ASSETS_{i,t\text{-}1} + \varepsilon_{i,t,} \quad (1)$$

where $INV_{i,t}$ is the change in gross fixed assets scaled by total assets for firm i in year t, $SALES\_GR_{i,t\text{-}1}$ is the percentage change in sales for firm i in year t-1, $PUBLIC\_PROP_{j,t\text{-}1}$ is the ratio of public firms' sales to total industry sales or the ratio of the number of public firms to total firms in industry j and year t-1, $HI_{j,t\text{-}1}$ is a Herfindahl index for competition, measured as the square of firm sales scaled by aggregate industry sales summed over all firms in the industry. We use both private and public firms' data to compute aggregate industry sales, thereby reducing measurement error in *HI* (see Ali et al., 2009). $ROA_{i,t\text{-}1}$ is net income scaled by beginning-of-year assets for firm i in year t-1, $LEVERAGE_{i,t\text{-}1}$ is the beginning-of-year long-term and short-term debt

scaled by assets for firm *i* in year *t*-1, and $ASSETS_{i,t-1}$ is the total assets for firm *i* in year *t*-1. We include indicator variables for each year and four-digit NAICS industry to capture systematic changes in investment across years and industries. We cluster standard errors at the firm-level to allow for residual correlation in firms' investment over time.

The coefficient of interest in the above equation is β_3, which captures the incremental sensitivity of investment to investment opportunities related to the proportion of public firms in an industry. We control for *HI* and *HI* x *SALES_GR* to allow for the possibility that industry competition affects firms' investment efficiency. The remaining control variables are based on Asker et al. (2012). Specifically, we control for *CASH* and *LEVERAGE* because firms with greater cash holdings or lower leverage might more easily take advantage of improvements in investment opportunities. Finally, we control for *ROA* and *ASSETS* because profitable firms and large firms have fewer financing constraints.[9]

The results from this regression are presented in Table 2, Panel A. The table shows that the coefficient for *SALES_GR* x *PUBLIC_PROP_S* is positive and statistically significant at the 1% level, indicating private firm investment is more responsive to investment opportunities in industries with a larger proportion of public firms.[10] In economic terms, we find that a 1% increase in the proportion of public firms increases investment sensitivities by 0.65% from the

[9] A potential concern induced by controlling for variables such as *ROA* and *ASSETS* is that they are likely to be correlated with growth opportunities. Since our interest lies in the estimating the sensitivity of investment to growth opportunities, these control variables may affect the interpretation of our results. In untabulated analyses, we verify that our inferences are unchanged when we remove these controls.

[10] While sales growth is widely used as a measure of investment opportunities in prior research, it is most applicable for production technologies for which the profitability of current and future projects are highly correlated (e.g., the neoclassical model). However, when the profitability of new projects is different than the profitability of existing projects [e.g., production technologies, such as putty-clay; see Gilchrist and Williams (2000) and Gomes et al. (2003)], sales growth is harder to interpret. In untabulated analyses, we verify that our results hold for the subsample of industries that show high persistence in profitability (i.e., the profitability of new projects is similar to that of existing projects). This analysis helps mitigate concerns that the results are driven by industries that have production technologies such as putty-clay, where measurement error from using sales growth to proxy for investment opportunities is likely to be high.

mean level.[11] Table 2, Panel A also shows that this result is robust to using the alternative measure of public firm presence, *PUBLIC_PROP_F*. In Table 2, Panels B and C, we re-estimate our results using two alternative measures of investment opportunities based on the predicted Tobin's *Q* (*TOBIN'S_Q*) from Campello and Graham (2013) and industry *Q* (*INDUSTRY_Q)*. We find that our inferences remain unchanged using these alternative proxies.

Finally, in Table 2, Panel D, we re-estimate our results using changes in state tax rates to proxy for changes in investment opportunities. A decrease (increase) in a state's corporate income tax rate increases (decreases) project net present values (NPV) for firms operating in that state, which should increase (decrease) firms' after-tax returns on investment, and thus their investment opportunities. This test provides insight into whether private firms are more sensitive to changes in state corporate income tax rates when they operate in industries with a greater public firm presence. To conduct this test, we augment Eq. (1) by including two additional covariates: *TAX_CHANGE* and *PUBLIC_PROP* x *TAX_CHANGE*. Since changes in investment opportunities due to tax changes are unlikely to be captured by *SALES_GR*, we continue to include *SALES_GR* and *SALES_GR* x *PUBLIC_PROP* in the regression (Asker et al., 2012).

Table 2, Panel D shows that the coefficient for *TAX_CHANGE* is positive and statistically significant at the 5% level, indicating that private firms' investment is responsive to changes in state tax rates. Further, the coefficient for *PUBLIC_PROP_S* x *TAX_CHANGE* is also positive and statistically significant at the 5% level. This result suggests that the investment of private firms operating in industries with greater public firm presence is more responsive to state tax rate changes than that of private firms operating in industries with lower public firm presence.

We recognize, however, that tax rate changes could reflect political economy factors, such as firms lobbying the state legislature, which could be endogenous to firms' investment opportunities. To address this concern, we construct two indicator variables to capture a tax rate

[11] The average responsiveness of investment to investment opportunities is 0.0197 (i.e., 0.0161 + 0.0127 x 0.281) and the incremental effect of a 1% change in public firm presence is 0.0127 x 1%.

increase, *TAX_INCREASE,* and decrease, *TAX_DECREASE*. While it is possible that tax cuts are in part due to firms' lobbying efforts, it is less clear why firms would lobby for a tax increase. Table 2, Panel D shows that *TAX_INCREASE* (*TAX_DECREASE*) is negatively (positively) associated with *INV*, which is consistent with expectations. Further, the change in investment spending following tax rate decreases (tax rate increases) is more positive (negative) when the industry is comprised of a greater proportion of public firms. This result supports our hypothesis and mitigates the concern that our inferences are driven by the potential endogeneity between tax rate changes and firms' investment opportunity sets.

Finally, in another validation of our tax rate-change identification strategy, we re-estimate our results for private firms that are *not* incorporated under Internal Revenue Service (IRS) Subchapter C (C-Corps). Given that only C-Corps are subject to state corporate income taxes, tax rate changes should have little effect on the investment behavior of private non-C-Corps. Table 2, Panel D confirms this prediction. Specifically, we find that the coefficients for *TAX_CHANGE* and *PUBLIC_PROP_S* x *TAX_CHANGE* are statistically insignificant. In untabulated results, we also find that the coefficient for *PUBLIC_PROP_S* x *TAX_CHANGE* is statistically different for C-Corps and *non* C-Corps (p-value = 0.09).

Aside from our main variable of interest, we find that the coefficients for our control variables are consistent with prior research and our expectations. Specifically, we find that *ROA* and *CASH* are positively related to investment, and *LEVERAGE* and *ASSETS* are negatively related to investment. Finally, we note that the coefficient for *PUBLIC_PROP* is generally positive and significant, suggesting that firms operating in industries with higher public firm presence invest more. To the extent higher public firm presence reduces uncertainty, this result is consistent with Panousi and Papanikolaou (2012) who find that when managers own a large fraction of the firm (such as in private firms), managerial risk aversion induces a negative relation between uncertainty and investment.

For the remainder of the analyses, we report results using *PUBLIC_PROP_S* as our measure of public firm presence and *SALES_GR* as our proxy for investment opportunities for the sake of brevity. However, we obtain similar results when we use *PUBLIC_PROP_F*, *TOBIN'S_Q*, *INDUSTRY_Q*, and *TAX_CHANGE* instead.

4.3. Cross-sectional tests

4.3.1. Industry information quality and quantity

The information environment in the industry is determined not only by a greater public firm presence, but also by the quality and quantity of information disclosed by these public firms. While the Securities and Exchange Commission's (SEC) mandatory disclosure requirements provide a basic framework and minimum standard for many financial disclosures, considerable latitude remains in determining what information is actually provided. For example, Kothari (2001) surveys a large body of accounting research that finds there is significant cross-sectional variation in the information content of earnings. Beyer et al. (2010) and Healy and Palepu (2001) survey research on voluntary disclosure and discuss the time-series and cross-sectional patterns in the number of firms providing management guidance of future performance. In addition to variation in the quality and quantity of disclosures provided by firms, there are differences in the amount of information provided by information intermediaries (see Asquith et al., 2005).

Differences in information quality and quantity affect the extent to which public firm presence reduces uncertainty. Therefore, we predict that the relation between public firm presence and private firms' investment sensitivity is stronger in industries with better public firm information. We estimate the following regression to test our prediction:

$$\begin{aligned} INV_{i,t} = {} & \beta_1 SALES\_GR_{i,t\text{-}1} + \beta_2 PUBLIC\_PROR_{j,t\text{-}1} + \beta_3 SALES\_GR_{i,t\text{-}1} \text{ x } PUBLIC\_PROP_{j,t\text{-}1} + \\ & \beta_4 INFO\_QTY_{j,t\text{-}1} + \beta_5 SALES\_GR_{i,t\text{-}1} \text{ x } INFO\_QTY_{j,t\text{-}1} + \beta_6 PUBLIC\_PROP_{j,t\text{-}1} \text{ x } \\ & INFO\_QTY_{j,t\text{-}1} + \beta_7 \mathbf{SALES\_GR}_{i,t\text{-}1} \mathbf{\text{ x }} \mathbf{PUBLIC\_PROP}_{j,t\text{-}1} \mathbf{\text{ x }} \mathbf{INFO\_QTY}_{j,t\text{-}1} + \\ & CONTROLS + \varepsilon_{i,t,} \end{aligned} \quad (2)$$

where $INFO\_QTY_{j,t\text{-}1}$ is our proxy for the information quality in industry j and year t-1. *CONTROLS* is a vector of control variables that includes *CASH*, *LEVERAGE*, *ROA*, and *ASSETS*, defined previously. The coefficients of interest are β_3 and β_7, where the former captures the effect of public firm presence on the responsiveness of private firm investment to their investment opportunities and the latter captures the *incremental effect* of public firm presence on private firms' investment responsiveness as information quality in the industry changes.

We use three proxies to capture information quality in an industry. Our first proxy is earnings informativeness. Holthausen and Verrecchia (1988) and Kothari (2001) discuss a simple model of the effect of noise in a signal on the price reaction to the signal. Their basic result is that noise in a signal reduces the price reaction to the signal. For example, noise in earnings reduces the earnings response coefficient (ERC)—our measure of earnings informativeness. Following this intuition, we use ERCs as a proxy for information quality. We measure ERCs as the association between annual stock returns and changes in annual earnings (Hanlon et al. 2008). We measure annual stock returns as the raw buy-and-hold 12-month return beginning the fourth month after the fiscal year-end of t-1 and ending three months after the fiscal year-end of year t, and we measure changes in earnings as the change in earnings before extraordinary items from year t-1 to year t, scaled by the market value of equity at the end of year t-1 (see Hanlon et al., 2008). Our proxy for earnings informativeness is the average ERC for all public firms in an industry-year (*ERC*).

A number of firms provide investors with guidance about their expectations of future earnings, capital expenditures, revenues, etc. Prior research finds that the forward-looking nature of such disclosures can (individually and in aggregate) help reduce uncertainty about the future prospects of the industry and macro-economy (Anilowski et al., 2007; Bonsall et al., 2013). Therefore, we use the total number of firms providing at least one management forecast in each industry-year as our second proxy for industry information quality.

Our final proxy for industry information quality is the average number of financial analysts covering firms in an industry-year. Prior research finds that financial analysts play a significant role in analyzing firms' disclosures and providing additional insights about the firm and the industry (Asquith et al., 2005; Hutton et al., 2012; Kadan et al., 2012). For example, Kadan et al. (2012) find that sell-side analysts provide detailed reports about each industry and that analyst industry rankings are significantly associated with the future industry performance.

Table 3 presents the results from estimating Eq. (2). The table shows that the coefficient for *SALES_GR* x *PUBLIC_PROP_S* continues to be positive and statistically significant at the 5% level or better in all three regressions. Consistent with our earlier inference, these results indicate that public firm presence is positively associated with the responsiveness of investment to investment opportunities for private firms in that industry. Further, we find that the coefficient for *SALES_GR* x *PUBLIC_PROP_S* x *INFO_QTY* is also positive and statistically significant at the 5% level or better for all three measures of industry information quality. These coefficients indicate that public firm presence has a greater effect on the investment responsiveness of private firms when public firm earnings are more informative, when a larger number of public firms provide guidance, and when there are more analysts covering the firms in the industry. In other words, the externality generated from public firm presence is greater when public firms are associated with better quality disclosures.[12]

4.3.2. Degree of investment irreversibility

Thus far, we argue and provide evidence that public firm presence reduces industry uncertainty, which leads to an increase in the sensitivity of investment to investment opportunities. The intuition is that corporate investment decisions are characterized by some

[12] In untabulated analyses, we use the enactment of the Sarbanes-Oxley (SOX) Act as an exogenous shock to public firm disclosure quality. However, since we have limited data for private firms in the years prior to SOX, we examine the effect of public firm presence on the investment behavior of public firms. Consistent with our expectations, we find that public firm presence has a greater effect on investment sensitivities following the enactment of SOX.

degree of irreversibility; that is, investment expenditures are at least partially sunk, and thus cannot be costlessly undone. When investment decisions are even partially irreversible, uncertainty makes firms more cautious and leads firms to take a 'wait and see' strategy, which reduces the sensitivity of investment to investment opportunities (Bloom et al., 2007).

In this section, we examine whether cross-sectional differences in the degree of investment irreversibility in an industry affects the public firm presence externality. In particular, when there is a greater degree of investment irreversibility in an industry, we predict that public firm presence has a larger effect on investment sensitivities. In other words, if firms can more easily liquidate installed capital (i.e., sunk costs are lower), firms should be relatively less likely to take a 'wait and see' strategy when facing uncertainty.

We use three proxies for industry investment irreversibility. Our first proxy is industry "comovement" following Guiso and Parigi (1999) and Panousi and Papanikolaou (2012). This proxy relies on the intuition in Shleifer and Vishny (1992) that an asset's liquidity, defined as the difference between its selling price and its value in best use, depends on the performance of other firms in the same industry. If the firms that are likely to be the next-best users of the assets for sale (i.e., other firms in the industry) are also experiencing problems and liquidity constraints, then it will be difficult for the selling firm to find a buyer that will pay a price close to the value in best use, and thus, the seller will likely have to resort to outsiders (i.e., firms in a different industry). Outsiders incur reconversion costs and agency costs, since as outsiders they are likely to know less than insiders about the quality of the assets. Consequently, an outsider will only buy at a considerably lower price than an insider would be willing to pay if only he were not liquidity-constrained (see Shleifer and Vishny, 1992; Guiso and Parigi, 1999; Panousi and Papanikolaou, 2012). This reasoning suggests that asset illiquidity (i.e., investment irreversibility) is likely to plague industries that suffer common shocks more severely than industries where idiosyncratic shocks are more important. Following Guiso and Parigi (1999), we measure the investment irreversibility of a firm using the return comovement in its industry.

Comovement is computed by regressing the monthly returns for each public firm on an equally weighted market return index and an equally weighted industry return index (Parrino, 1997).[13] The partial correlation coefficient for the industry return index is averaged across all firms in each industry to obtain the first proxy for the investment irreversibility in an industry. Higher comovement suggests higher investment irreversibility in the industry.

Our second proxy for industry irreversibility follows from Schlingemann et al. (2002), who use the volume of mergers and acquisition (M&A) transactions in an industry as a measure of the liquidity of corporate assets in the industry. As Schlingemann et al. (2002) discuss, the intuition for this proxy also follows from Shleifer and Vishny (1992), who argue that a high volume of M&A transactions in an industry is evidence of high liquidity and that the discounts that sellers must offer to attract buyers are smaller in more active markets. When the market for corporate assets is more liquid, firms' investment decisions are less irreversible. We compute this proxy by aggregating all M&A transactions in an industry each year from the Securities Data Company (SDC) Mergers and Acquisitions database and scaling it by the aggregate book value of equity of all firms in that industry (see Schlingemann et al., 2002). We multiply this measure by minus one to obtain our second proxy for asset *il*liquidity, or investment irreversibility.

Finally, we follow Panousi and Papanikolaou (2012) and use the industry-level ratio of expenditure on new capital goods to all (i.e., new plus used) capital goods. The intuition for this proxy is that when a greater fraction of the capital goods purchased by firms come from the primary market as opposed to the secondary market, investment decisions are more irreversible. Our data to construct this proxy come from the Annual Capital Expenditures Survey (ACES) published by the Census Bureau in their 2003 survey, and we use three-digit NAICS codes for industry groupings.

[13] A firm's stock price reflects the present value of its future residual cash flows. As a result, if the firms in an industry are affected by common shocks, such as changes in economic conditions or technological innovations, their cash flows, and therefore their stock prices, are likely to move together.

Table 4 presents the results from our regressions. Consistent with the earlier evidence, we find that the coefficient for *SALES_GR* x *PUBLIC_PROP_S* is positive and significant indicating that an increase in public firm presence leads to an increase in the responsiveness of investment to investment opportunities. Further, we find that the coefficient for *SALES_GR* x *PUBLIC_PROP_S* x *IND_IRR* is positive and statistically significant at the 5% level (or better) for all three measures of investment irreversibility.[14] These coefficients indicate that public firm presence has a larger effect on the investment sensitivities of private firms when the industry has a higher degree of investment irreversibility. Collectively, these cross-sectional tests help strengthen support for our overall inference that public firm presence facilitates private firms' investment responsiveness by reducing uncertainty in the industry.

5. Endogeneity

We find that private firm investment is more responsive to investment opportunities in industries with greater public firm presence. Our intuition is that the information available in the public domain due to the presence of public firms helps reduce uncertainty in the industry, which allows private firms to respond more quickly to their investment opportunities because they are more confident about the future payoffs from their investments (Dixit and Pindyck, 1994; Bloom et al., 2007). However, it is plausible that public firm presence is correlated with industry-wide growth opportunities, as changes in public firm presence may indicate changes in firms' interest in accessing equity capital to fund growth. Thus, greater public firm presence may be associated with greater investment opportunities and hence greater investment.

It is important to note, however, that our empirical predictions relate to the *sensitivity* of investment to investment opportunities rather than the *level* of investment. An increase in growth

[14] In untabulated analyses, we verify the robustness of our results to using two additional measures of irreversibility: 1) the average ratio of sales of property, plant, and equipment to total capital at the industry level, as it is easier to disinvest in industries in which the used capital market is active, and 2) the depreciation rate of capital at the industry level, since investment is less irreversible when capital depreciates faster. These proxies are used and described in Panousi and Papanikolaou (2012).

opportunities is likely to explain an increase in the level of investment, but its relation with the sensitivity of investment to investment opportunities is less clear. Moreover, we include the main effect of public firm presence in our regressions to capture its direct effect on the level of investment. That said, it is possible that public firm presence and our investment opportunities measure are both noisy proxies for industry-wide growth opportunities. Thus, the incremental responsiveness of investment to investment opportunities in industries with greater public firm presence documented in our tests may be a result of increased precision obtained from interacting two imperfect proxies for industry-wide growth opportunities. We address this endogeneity concern with the following tests.

5.1. Instrumental variable approach

First, we estimate a two-stage-least-squares (2SLS) regression and instrument for public firm presence using two variables: 1) an estimate of the incremental audit fees induced by the Sarbanes-Oxley Act of 2002 (SOX) and 2) the location of firms in the industry. Prior research finds that SOX significantly increased the cost being public and served as a catalyst for firms to go private or deregister their common stock, thereby suspending their obligation to comply with SEC reporting requirements (Foley and Lardner, 2007; Leuz et al., 2008). Among other costs, the internal control requirements in Section 404 of SOX are cited as especially costly as it significantly increased the audit fees paid by public firms (Financial Executives International (FEI), 2005; Iliev, 2010).[15] Based on this observation, we argue that increases in audit fees due to SOX are likely to affect the proportion of firms that are public but these audit fee changes do not directly affect industry growth opportunities, thus meeting the requirements for a valid instrument (Wooldridge, 2002).

[15] In fact, President Obama unveiled the Jumpstart Our Business Startups (JOBS) Act in January 2011, which recognizes the significant costs imposed by SOX on firms wanting to go public. The Act is designed to postpone the additional costs of compliance that originated with SOX for "emerging growth companies" and encourage these firms to go public.

To identify variation in audit fees that can be attributed to SOX, we estimate a regression of audit fees on the determinants of audits fees as documented in prior research (e.g., Venkataraman et al., 2008; Badertscher et al., 2013). Specifically, we regress log audit fees on firm size, growth, the number of business segments, big-four vs. other auditor, leverage, abnormal accruals, the fraction of assets in inventories and receivables, and indicator variables for foreign operations, losses, operating in a litigious industry, and the presence of an internal control weakness. This regression is estimated using all firms available in Audit Analytics for the years 2001 to 2010. The residual from this regression (*RAUDIT_FEES*) is aggregated by industry and year, and it proxies for the audit fees incurred due to SOX. Fig. 2 plots *RAUDIT_FEES* over time. Consistent with audit fees increasing due to SOX, the figure shows that *RAUDIT_FEES* significantly increases in 2003 and 2004, but remains relatively constant after that.

Our second instrument is based on the location of firms in the industry. A number of prior studies find that investors are biased towards investing in nearby companies (Coval and Moskowitz, 1999, 2001; Malloy, 2005; Ivkovic and Weisbenner, 2005; Bae et al., 2008).[16] As a result of this investor preference for nearby firms, the ability of a firm to issue equity and its cost of equity depends on the distance between the firm and potential investors (Loughran, 2008; Saunders and Steffen, 2011). Specifically, Loughran (2008) finds that firms headquartered near a large population of potential investors find it easier and less costly to issue equity. Therefore, the distance between firms in an industry and potential investors is likely to affect the proportion of public firms in that industry. However, the distance between firms and potential investors should not directly affect investment opportunities in the industry.

[16] One explanation for this bias is that proximity to companies provides investors with an information advantage. For example, Ivkovic and Weisbenner (2005) find that retail investors earn 3.2% more per year on local stocks than on their other investments. Coval and Moskowitz (2001) find that local stocks that are held by mutual funds earn annual returns that are about 3% higher on average than other local stocks that are not held by mutual funds, indicating that mutual funds are able to pick out the winners among the local firms.

Based on the above line of reasoning, we construct our second instrument for public firm presence as the proportion of the firms in the industry headquartered near potential investors. Following Loughran (2008), we classify firms headquartered in a state with a major metropolitan area (i.e., an area with 1,000,000 people or more), as identified in the 2000 Census, as being near a large population of potential investors.[17] We also classify firms headquartered in states without metropolitan areas, but whose state border is less than 150 miles from a metro area in a neighboring state, as being near a large population of potential investors. Following prior research, the location of a firm's headquarters is used to approximate the firm's location (e.g., Coval and Moskowitz, 1999, 2001; Ivkovic and Weisbenner, 2005; Loughran, 2008). After classifying all firms (both public and private) as 'nearby' or 'faraway' from potential investors, we construct our instrument as the proportion of firms in an industry located near investors weighted by firm sales. Our identifying assumption is that industries with a greater proportion of firms near investors are likely to have greater public firm presence, but the distance from investors is uncorrelated with growth opportunities in the industry.[18]

The results from our 2SLS regressions are reported in Table 5. In Panel A, we report the results from the first-stage regressions, where the dependent variables are the two endogenous variables, i.e., *PUBLIC_PROP_S* and *SALES_GR* x *PUBLIC_PROP_S*. We argue that audit fees increase the cost of being public and proximity to investors reduces the cost of being public.

[17] Loughran (2008) identifies the city where each firm is headquartered and classifies firms as nearby or faraway from investors based on the city. However, since we do not have access to cities where private firms are headquartered, our classification is based on the state where a firm is headquartered.

[18] It is plausible that firms in large metropolitan areas are likely to be closer to potential investors *and* are also likely to have access to a larger pool of potential customers. Therefore, such firms not only have access to cheaper equity financing but also may have greater growth opportunities, leading to a correlation between firm location and growth opportunities. To address this concern, we examine the association between firm location and our growth opportunity proxies, i.e., Tobin's *Q* and sales growth. We find little evidence that firm location is related to its growth opportunities. One reason why we might not observe an association between growth opportunities and firm location is that if urban areas have more growth opportunities (e.g., more potential customers) than rural areas, then new firms are more likely to set up their businesses in urban areas. As more firms set up their businesses in urban locations, these additional growth opportunities are likely to be competed away until new firms are indifferent between locating at an urban or rural area. Therefore, in equilibrium, we might not observe an association between firm location and growth opportunities.

Consistent with these arguments, we find that *RAUDIT_FEES* (*SALES_GR* x *RAUDIT_FEES*) is negatively related to public firm presence (public firm presence interacted with sales growth) and *DISTANCE* (*SALES_GR* x *DISTANCE*) is positively related to public firm presence (public firm presence interacted with sales growth).

Table 5, Panel B presents the results from the second-stage regressions. The first two models report regressions where the instruments are used one at a time such that the model is exactly identified and Model 3 presents the results from our overidentified model, where both instruments simultaneously are included in the regression. Consistent with the results documented in earlier tables, we find that the coefficient for *SALES_GR* x *PUBLIC_PROP_S* is positive and statistically significant at the 5% level, irrespective of the instrument used for public firm presence. Staiger and Stock (1997) propose a test for the strength of an instrument under the null hypothesis that the coefficients for the instruments in the first stage are zero. The diagnostic section of Table 5, Panel B shows that we can reject this hypothesis at any confidence level, and both our instruments clearly pass the threshold for this *F*-test (*F*-statistics = 26.70 and 20.96), thereby mitigating concerns of a weak instrument bias. The partial *F*-statistic from the first-stage regression in the overidentified model (Model 3) is also statistically significant at the 1% level (*F*-statistic = 29.93). Further, the overidentified model allows us to test for overidentifying restrictions using a *J*-test (Sargan, 1958). Consistent with our instruments being jointly valid, we find that the *J*-statistic is statistically insignificant (*p*-value = 0.21).

5.2. Falsification test: Public firm presence and private firm investment in the U.K.

Our hypothesis is that private firms operating in industries with greater public firm presence find it easier to identify and exploit investment opportunities because greater public firm presence is indicative of a more comprehensive set of firms publicly disclosing information. In the United Kingdom, however, private firms are also required to publicly disclose their financial statements (Ball and Shivakumar, 2005). Therefore, in the U.K., the proportion of

public firms does not capture the proportion of firms publicly disclosing information, and thus is less likely to capture variation in the information environment of the industry as a whole. To the extent greater public firm presence does not help reduce industry uncertainty in the U.K., our prediction is that public firm presence will *not* be associated with greater investment sensitivities in the U.K. However, if public firm presence is a proxy for industry growth opportunities, we would find that private firm investment is more sensitive to investment opportunities in industries with greater public firm presence even in the U.K.

To test this prediction, we obtain data on both private and public firms in the U.K. from the Amadeus database supplied by Bureau van Dijk. Amadeus provides financial statement data for a vast set of European companies and is compiled from several well-established national information collectors (Burgstahler et al., 2006). We use all public and private firms with non-missing data on sales and industry codes in the U.K. to compute the proportion of public to total firms in the industry, which is identical to our proxy using U.S. firms. We then estimate our main analysis (which uses U.S. data) on the sample of U.K. private firms.

The results from this test are reported in Table 6. In the first column, we estimate a regression of private firm investment (*INV*) on our proxy for investment opportunities (*SALES_GR*) to validate our proxies in the U.K. setting.[19] In the next column, we include additional covariates for *PUBLIC_PROP_S* and *SALES_GR* x *PUBLIC_PROP_S*, and in the final column, we include all control variables used in our earlier analyses. Consistent with our hypothesis, we find that the coefficient for *SALES_GR* x *PUBLIC_PROP_S* is statistically insignificant in both the simple model without controls (*t*-stat = -0.21) and the full model with all control variables included (*t*-stat = -0.04). Finally, note that the coefficients for all the other variables in the model are consistent with our expectations and those reported in the earlier tables. Given the above results, any alternative explanation would not only have to explain why

[19] Note that we use the same variable definitions in both the U.K. and U.S. settings.

we find evidence that public firm presence affects investment sensitivities in the U.S., but would also have to explain why we find no such evidence in the U.K. This result helps further reduce concerns that our results are driven by an omitted variable bias.

6. Additional analyses and robustness tests

6.1. Firm fixed-effects and change analysis

We re-examine our results using both a firm fixed-effects and a changes specification to mitigate concerns that an unobserved time-invariant characteristic confounds our results. In the firm fixed-effects specification, we include an indicator variable for all but one unique firm in our sample. For the changes specification, we compute the change in investment, investment opportunities, and our control variables from the years 2004 to 2007 and re-estimate our regressions. We choose 2004 because this is the earliest year that Sageworks has a large sample of firms, and we use 2007 because we have current Census data on aggregate industry sales for 2007. Since we use the change in our variables of interest over a single period rather than using annual changes, our sample size drops to 3,647 observations, where each observation represents a unique firm.

Panel A (B) of Table 7 presents the results for the fixed-effects (changes) specification. Panel A indicates the coefficient for the interaction between investment opportunities and public firm presence is positive and significant (5% level) across all three investment opportunities proxies. Panel B shows that the coefficient for the interaction between the change in investment opportunities and the change in public firm presence is positive and statistically significant at the 5% level when investment opportunities are measured using sales growth and Tobin's Q (t-stat = 2.03 and 2.17, respectively) and is significant at the 10% level when we use industry Q as our proxy for investment opportunities (t-stat = 1.63). These results indicate that a change in public firm presence is positively associated with the change in the responsiveness of investment to investment opportunities.

6.2. Public firm presence and financing constraints

It is plausible that public firm presence reduces *creditors*' (rather than *private firms*') uncertainty about industry prospects, which provides private firms easier access to credit. That is, it is plausible private firms are fairly certain about industry prospects and would like to invest but are unable to take advantage of potential investment opportunities because of financing constraints. In such a scenario, an increase in public firm presence might reduce creditors' uncertainty about the industry and make them more willing to supply credit, thereby relaxing private firms' financing constraints.

To examine this possibility, we test whether an increase in public firm presence leads to an increase in the amount of debt used by private firms. To the extent private firms' financial constraints have been relaxed as a result of increased public firm presence, we should observe an increase in the amount of debt held by private firms.[20] Note that the financing constraints argument is one-sided and only applies to an increase in debt, and thus an increase in investment. In contrast, if public firm presence helps mitigate industry uncertainty for private firms (as we suggest), there is no clear reason to expect changes in debt financing. The information obtained by private firms may be just as likely to discourage investment as it is to encourage investment. Moreover, firms that are not financially constrained may use internal funds rather than external funds to finance investment. Accordingly, we examine whether an increase in public firm presence is associated with an increase in private firms' debt. We focus on changes in debt financing because prior research finds that bank financing is the primary source of external capital for privately held firms in the U.S. (e.g., Berger and Udell, 1998).

Table 8 presents the results from a regression of the change in long-term debt on the change in public firm presence from 2004 to 2007. We find the coefficient for the change in

[20] While it is possible that banks and private firms simultaneously learn information that reduces uncertainty for both parties, to the extent this happens, our inferences remain unchanged. That is, we only contend that private firms learn information that makes them more responsive to their investment opportunities. We *do not* make any statement about whether other parties besides the firm also learn information from public firm disclosures.

public firm presence is statistically insignificant suggesting that an increase in public firm presence is not associated with a change in private firm debt. This result suggests that public firm presence does not incrementally affect financing constraints by reducing uncertainty for creditors. This is perhaps because creditors, unlike individual private firms, are able to obtain large amounts of information about the industry from both public and private firms in the industry through loan documentation since they lend to and obtain loan applications from a number of firms in the industry. Therefore, an increase in public firm presence might not provide any incremental information that significantly impacts creditor uncertainty.

6.3. Public firm presence and public firm investment

As noted earlier, our prediction that public firm presence reduces industry uncertainty, and thus increases the responsiveness of investment to investment opportunities, readily extends to both private and public firms. However, thus far we focus our analyses on private firms to facilitate empirical identification. In this section, we examine whether public firms are also more responsive to their investment opportunities when there is greater public firm presence. Specifically, we re-estimate Eq. (1) for all public firms in the Compustat database with available data to construct our variables of interest.

Table 9 presents the results. We find that the coefficient for the interaction between investment opportunities and public firm presence is positive and statistically significant at the 1% level for all four measures of investment opportunities, i.e., sales growth, Tobin's *Q*, industry *Q*, and state tax changes. These results support our hypothesis that greater public firm presence in an industry facilitates the investment decisions of firms operating in that industry.

6.4. Untabulated sensitivity tests

A limitation of our empirical design is that we are able to obtain aggregate industry sales from the Census for only two years, 2002 and 2007, and therefore extrapolate/interpolate aggregate industry sales for the other years in our sample. In untabulated analyses, we examine

whether our results are robust to computing aggregate industry sales using the sum of sales of all firms in the Sageworks and Compustat databases. That is, instead of using Census data to obtain aggregate sales, we assume that the firms covered in Sageworks and Compustat are representative of the population of firms in the industry. We find that our inferences are unaffected by the alternative design. In untabulated analyses, we also restrict our sample period to include only the years for which we have Census data, i.e., 2002 and 2007. Here again, we find that all our results are similar, but statistically weaker than those reported in the paper. Finally, we use the ranks and decile ranks of *PUBLIC_PROP_S* as alternative measures of public firm presence to allow the relation between public firm presence and private firms' investment sensitivity to be nonlinear, and our results are robust to both of these measures.

7. Conclusion

Publicly owned firms disclose both mandatory and voluntary information to the public. Further, information intermediaries, such as analysts and the business press, analyze, summarize, and disseminate firm disclosures. As a result, there is a tremendous amount of public information about these firms that is not available for private firms. Therefore, the composition of public and private firms in an industry may affect the information environment in that industry.

In this paper, we examine whether the presence of public firms in an industry facilitates the investment decisions of private firms in that industry by reducing uncertainty in the industry. We find that public firm presence has a significant effect on the responsiveness of private firms' investment to their investment opportunities. Further, we find that this effect is greater in industries with better information quality and those with greater investment irreversibility. These inferences are robust to alternative explanations related to measurement error in our proxy for investment opportunities and a growth opportunity-based interpretation of public firm presence.

This paper contributes to the literature by providing insights into the process through which managers obtain industry-relevant information, which facilitates their investment

decisions. Our analysis suggests that public firms' disclosures help to provide a more comprehensive view of the industry, thereby facilitating more efficient investment. Further, by showing that public firms' disclosures can have positive externalities, we contribute to the literature on the merits of mandatory disclosure regulation. Disclosure regulation is often quite challenging to justify because of market-based incentives to disclose information (Admati and Pfleiderer, 2000; Leuz and Wysocki, 2008; Berger, 2011). Since the costs of obfuscating information are ultimately borne by the firm, the firm has incentives to disclose information to reduce such costs until the marginal net benefit of disclosure to the firm is zero. However, the presence of positive externalities to firms' disclosures is one potential justification for disclosure regulation.

Appendix. Two-period model of the effect of uncertainty on investment and investment sensitivity

We clarify our predictions concerning the effect of public firm presence on the responsiveness of investment to investment opportunities using a two-period model. The model is set up based on Pindyck (1993), Dixit and Pindyck (1994, Chapter 2), and Grenadier and Malenko (2010) and is as follows:

The existing demand state is P_0 and capital stock is K_0. At date 1, there is a demand shock and P_1 increases to $P_0 + \Delta$. The demand shock can be permanent or temporary. If the shock is permanent, demand at period 2 stays constant, i.e., $P_2 = P_0 + \Delta$ and if the shock is temporary, demand reverts back and $P_2 = P_0$. The shock is temporary with probability 0.5 and permanent with probability 0.5. The firm needs to decide how much to invest (i.e., expand capacity) in response to the demand shock.

The firm can buy any amount of capital I_t. The return on capital stock per-period is $P_t \times K_t^{\alpha}$, where $\alpha \in (0,1)$ to obtain decreasing returns to scale. Capital stock at period 1 is: $K_1 = K_0 + I_1$ and at period 2 is: $K_2 = K_0 + I_1 + I_2$. For simplicity, we set $K_0 = 0$ and $P_0 = 0$. Investment is irreversible, and hence cannot be undone without significant cost. The cost of capital (or discount rate) is constant and set equal to one for simplicity.

At the beginning of period 2, the firm observes the realization of P_2, (i.e., whether $P_2 = P_0 + \Delta$ or $P_2 = P_0$) and decides on additional investment, I_2.

We consider two regimes. In the first regime, there is no uncertainty and the firm knows whether the shock is permanent or temporary. In the second regime, the firm is uncertain about whether the shock is temporary or permanent. We assume that uncertainty about the demand shock can be diversified away, and hence, it does not affect the cost of capital.[21]

Regime 1: Investment without uncertainty (or high public firm presence)

In this regime, the firm knows if the demand shock is permanent or temporary. Because there is no news at period 2, $I_2 = 0$. At period 1, the firm solves the following problem to determine I_1 if the shock is permanent:

$$\max_{I_1} \{2 \times \Delta \times I_1^{\alpha} - I_1\}.$$

Hence,

$$I_1 = I_1^H = (2 \times \alpha \times \Delta)^{\frac{1}{1-\alpha}}.$$

[21] It is plausible that uncertainty affects the cost of capital and affects investment levels via the cost of capital. Our assumption that uncertainty is diversifiable follows from a long line of research on real options (e.g., Pindyck, 1991; Dixit and Pindyck, 1994; Bloom et al., 2007; Grenadier and Malenko, 2010). Further, Leahy and Whited (1996) provide some empirical validation for this assumption by showing that uncertainty affects investment directly (i.e., due to real options) rather than working through the cost of capital.

If the shock is temporary, the firm solves the following problem to determine I_1:

$$\max_{I_1} \{\Delta \times I_1^{\alpha} - I_1\}.$$

Hence,

$$I_1 = I_1^L = (\alpha \times \Delta)^{\frac{1}{1-\alpha}}.$$

Regime 2: Investment under uncertainty (or low public firm presence)

In this regime, the firm is uncertain whether the demand shock is permanent or temporary. We begin by solving the firm's investment problem in period 2, assuming that the firm invests I_1 in period 1.

In period 2, the firm observes whether the demand shock is permanent or temporary. If the demand shock is temporary, then P_2 reverts back to zero and $I_2 = 0$. If the demand shock is permanent, then P_2 stays at the same level (i.e., $P_2 = P_1 = P_0 + \Delta$) and the firm solves the following problem:

$$\max_{I_2} \{\Delta \times (I_1 + I_2)^{\alpha} - I_2\}.$$

Hence,

$$\alpha \times \Delta \times (I_1 + I_2)^{\alpha-1} = 1$$

$$I_2 = I_2^H | I_1 = max\left\{(\alpha \times \Delta)^{\frac{1}{1-\alpha}} - I_1, 0\right\}.$$

Consider the investment problem in period 1. The optimal choice of investment satisfies:

$$\max_{I_1} \{\Delta \times I_1^{\alpha} - I_1 + 0.5 \times (\Delta \times [I_1 + I_2^H | I_1]^{\alpha} - I_2^H | I_1)\}.$$

It can be verified that the following equation solves the investment problem:

$$I_1 = (\alpha \times \Delta)^{\frac{1}{1-\alpha}}.$$

Intuitively, if $I_1 = (\alpha \times \Delta)^{\frac{1}{1-\alpha}}$, then $I_2 = 0$ (see above). However, $I_1 = (\alpha \times \Delta)^{\frac{1}{1-\alpha}}$ also maximizes the static payoff at period 1.

Implications for the responsiveness of investment to investment opportunities

Uncertainty: The sensitivity of period 1 investment to the demand shock is

$$\frac{\partial I_1}{\partial \Delta} = \frac{1}{1-\alpha} \times \alpha^{\frac{1}{1-\alpha}} \times \Delta^{\frac{\alpha}{1-\alpha}} \equiv S_u.$$

No uncertainty: The sensitivity of period 1 investment to the demand shock if the shock is temporary is

$$\frac{\partial I_1}{\partial \Delta} = \frac{1}{1-\alpha} \times \alpha^{\frac{1}{1-\alpha}} \times \Delta^{\frac{\alpha}{1-\alpha}} = S_u.$$

The sensitivity of period 1 investment to the demand shock if the shock is permanent is

$$\frac{\partial I_1}{\partial \Delta} = \frac{1}{1-\alpha} \times (2 \times \alpha)^{\frac{1}{1-\alpha}} \times \Delta^{\frac{\alpha}{1-\alpha}} > S_u.$$

On average, the sensitivity of investment to the demand shock absent uncertainty is

$$\frac{1}{2} \times \left(\left[\frac{1}{1-\alpha} \times \alpha^{\frac{1}{1-\alpha}} \times \Delta^{\frac{\alpha}{1-\alpha}} \right] + \left[\frac{1}{1-\alpha} \times (2 \times \alpha)^{\frac{1}{1-\alpha}} \times \Delta^{\frac{\alpha}{1-\alpha}} \right] \right) > S_u.$$

Therefore, investment is less responsive to the demand shock (i.e., investment opportunities) when there is uncertainty.

Implications for the level of investment

Although the above model suggests that, on average, investment will be lower in the presence of uncertainty, note the intuition from the model can be applied to a firm's disinvestment decision as well. Specifically, instead of a demand shock, it is plausible that the firm experiences a cost shock and is deciding on whether to reduce capacity by disinvesting. In the case of disinvestment decisions, uncertainty would increase the firm's incentive to postpone disinvestment (i.e., take a 'wait and see' strategy), which would empirically show up as higher investment levels. Specifically, if some firms in an economy are investing in response to a demand shock while some other firms are disinvesting in response to a cost shock, we might observe that, on average, uncertainty is unrelated to investment (where investment is measured as investment less disinvestment, which corresponds to the variable used in our empirical analyses [i.e., changes in fixed assets]).

Second, the effect of uncertainty on investment levels depends on whether we assume increasing or decreasing returns to scale. However, the sensitivity of investment to investment opportunities is lower in the presence of uncertainty irrespective of whether there is increasing or decreasing returns to scale.

Finally, note that while the simple two-period model described above suggests that investment levels will be lower in the presence of uncertainty, it is unclear whether this result will hold if the model is extended to three or more periods. Specifically, if the above model were extended to three or more periods, the incentives to invest in the second period following the realization of the shock can increase average investment levels in the presence of uncertainty.

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Fig. 1. Empirical distribution of public firm presence from 2001 to 2010. This figure presents the mean, 25th percentile, median, mean, and 75th percentile of public firm presence for the years 2001 to 2010. We measure public firm presence as the sum of all public firm sales (per Compustat) in each four-digit NAICS industry divided by total firm sales (per Census) in the same four-digit NAICS industry. The *x* axis represents years and the *y* axis represents public firm presence.

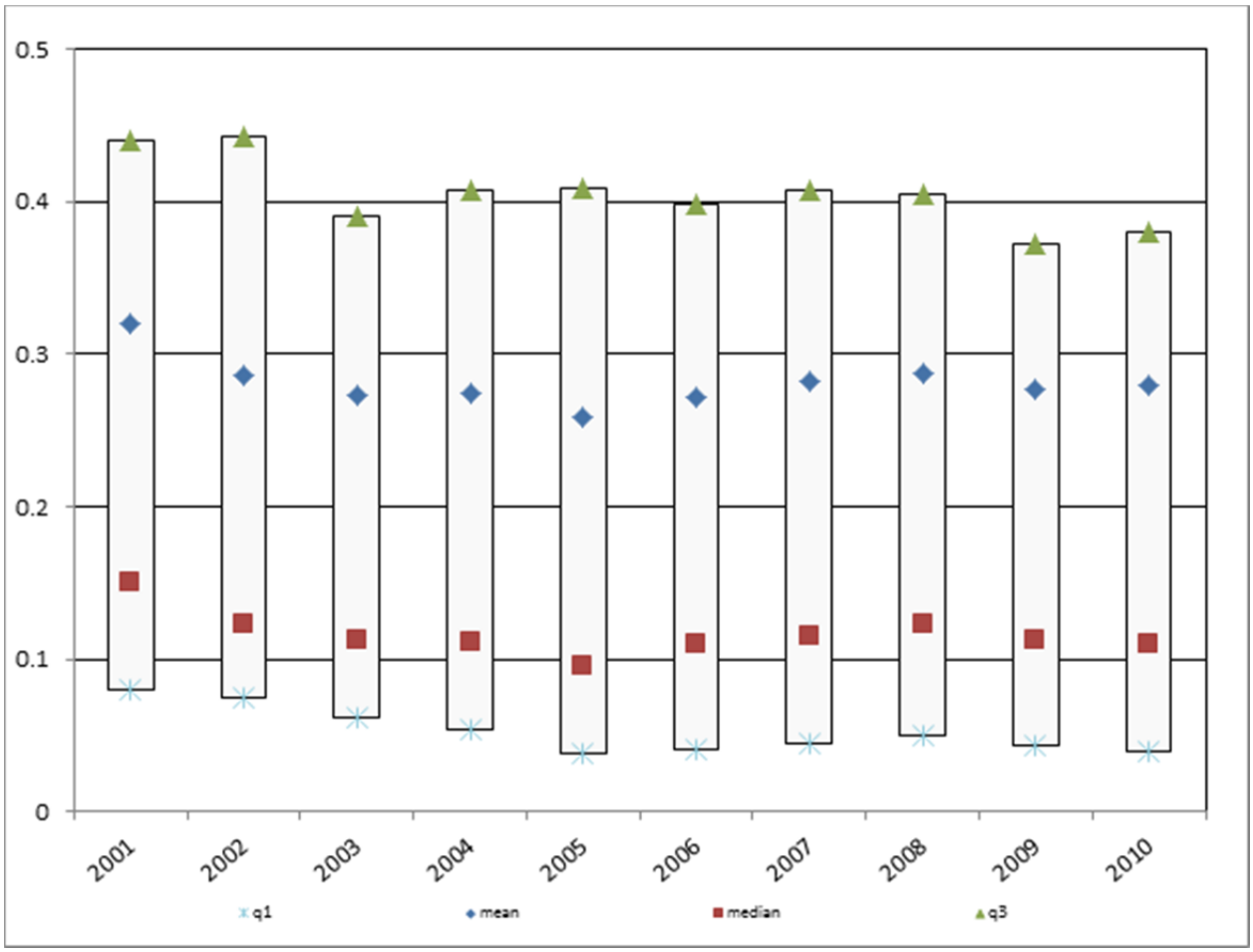

Fig. 2. The residual audit fees from 2001 to 2010. This figure presents the average residual audit fees after factoring out firm characteristics such as size, accruals, profitability, auditor, and firm complexity, among other things. The *x* axis represents the year and the *y* axis represents log residual audit fees.

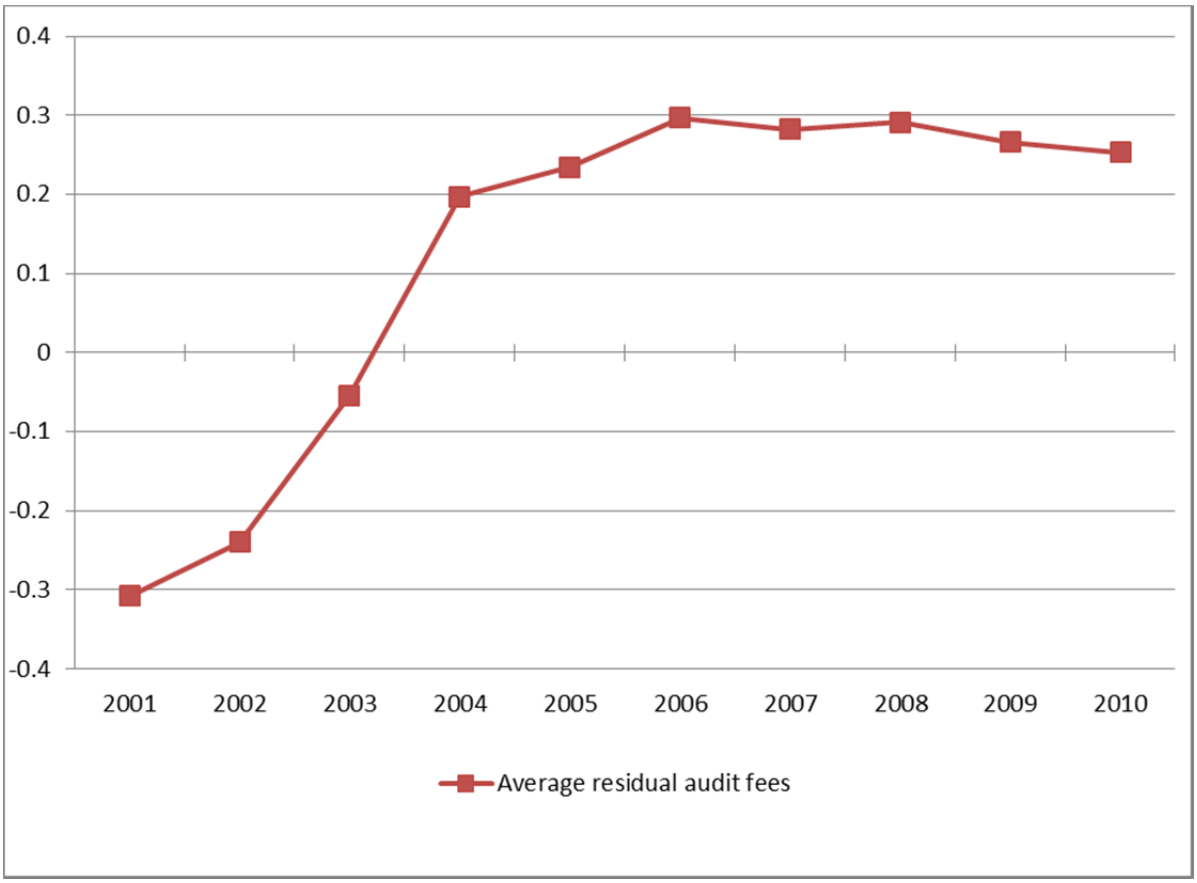

Table 1
Summary statistics for variables of interest

Panel A presents descriptive statistics of the variables used in our main regressions. Panel B reports the Pearson (Spearman) correlation coefficients above (below) the diagonal for the variables used in our main regressions. The bold coefficients are statistically significant at the 5% level or better. Panel C presents the proportion of public firms (i.e., PUBLIC_PROP_S, which is defined below) in each two-digit NAICS industry. *INV* equals the change in gross fixed assets from year *t*-1 to *t*, divided by beginning-of- year total assets. *SALES_GR* is the percentage change in sales from year *t*-1 to year *t*. *TOBIN'S_Q* is computed following Campello and Graham (2013): within each three-digit NAICS industry, we first regress each public firm's Tobin's *Q* on the firm's sales growth, ROA, net income before extraordinary items, book leverage, and year. We then use the regression coefficients to generate *TOBIN'S_Q* for each private firm. *INDUSTRY_Q* is the sum of aggregate market value of equity and aggregate book value of debt in an industry divided by aggregate total assets in that industry. *ROA* equals net income divided by beginning-of-year total assets. *CASH* is cash and cash equivalents divided by beginning-of-year assets. *LEVERAGE* is debt in current liabilities plus long-term debt divided by beginning-of-year assets. *ASSETS* is the natural log of total assets. *PUBLIC_PROP_S* is the sum of all public firm sales (per Compustat) in a four-digit NAICS industry, divided by the total firm sales (per Census) in the same four-digit NAICS industry. *PUBLIC_PROP_F* is the number of all Compustat firms (Compustat GVKEY) in a four-digit NAICS industry, divided by the total number of firms in the same four-digit NAICS industry (Census data). All variables are winsorized at the 1st and 99th percentiles.

Panel A: Descriptive statistics

	Mean	Std	Q1	Median	Q3	N
	Private firm characteristics					
Investment spending						
INV	0.042	0.078	0.000	0.016	0.061	70,235
Investment opportunities						
SALES_GR	0.140	0.339	-0.044	0.070	0.233	70,235
TOBIN'S_Q	1.320	0.838	0.604	1.197	2.092	70,235
INDUSTRY_Q	1.392	1.402	0.929	1.256	1.632	70,235
Firm characteristics						
ROA	0.135	0.191	0.008	0.075	0.209	70,235
CASH	0.141	0.146	0.025	0.085	0.215	70,235
LEVERAGE	0.530	0.253	0.332	0.552	0.735	70,235
ASSETS	0.942	1.416	-0.031	0.928	1.864	70,235
	Public firm presence					
PUBLIC_PROP_S	0.281	0.319	0.048	0.113	0.418	70,235
PUBLIC_PROP_F	0.004	0.021	0.000	0.000	0.001	70,235

Table 1 (*continued*)

Panel B: Univariate correlations among our variables of interest

		1	2	3	4	5	6	7	8	9	10
1	INV		**0.09**	**0.04**	**0.02**	**0.16**	**-0.02**	0.01	**-0.08**	**0.02**	**0.02**
2	SALES_GR	**0.13**		**0.18**	**0.02**	**0.09**	0.00	**0.08**	**0.12**	0.00	**0.02**
3	TOBIN'S_Q	**0.05**	**0.15**		**0.12**	**0.05**	-0.01	**-0.07**	-0.01	**0.33**	**0.15**
4	INDUSTRY_Q	**0.06**	**0.06**	**0.26**		**0.05**	**0.04**	**-0.02**	**-0.04**	**0.05**	**0.04**
5	ROA	**0.17**	**0.13**	**0.05**	**0.12**		**0.21**	**-0.17**	**-0.22**	0.00	**0.02**
6	CASH	**-0.02**	**-0.02**	0.00	**0.04**	**0.20**		**-0.37**	**-0.22**	**-0.04**	-0.01
7	LEVERAGE	0.00	**0.08**	**-0.08**	**-0.04**	**-0.16**	**-0.37**		**0.18**	**-0.06**	**-0.03**
8	ASSETS	**-0.03**	**0.12**	**-0.01**	**-0.10**	**-0.15**	**-0.24**	**0.19**		**0.09**	**0.08**
9	PUBLIC_PROP_S	**0.02**	-0.01	**0.32**	**0.14**	**-0.02**	**-0.06**	**-0.04**	**0.10**		**0.37**
10	PUBLIC_PROP_F	**0.03**	**0.03**	**0.29**	**0.10**	**-0.03**	**-0.11**	**-0.03**	**0.23**	**0.72**	

Panel C: Public firm presence in each two-digit NAICS industry (based on sales)

Industry description	**NAICS code**	**Proportion of public firms**	**N**
Mining, quarrying, and oil and gas extraction	21	0.786	501
Information	51	0.750	978
Manufacturing	31-33	0.564	15,378
Real estate and rental and leasing	53	0.382	1,298
Retail trade	44-45	0.347	11,493
Accommodation and food services	72	0.294	1,867
Transportation and warehousing	48-49	0.290	1,088
Professional, scientific, and technical services	54	0.208	1,708
Educational services	61	0.117	270
Arts, entertainment, and recreation	71	0.114	640
Health care and social assistance	62	0.112	1,127
Construction	23	0.107	21,069
Wholesale trade	42	0.092	11,095
Other services	81	0.078	1,718
Agriculture, forestry, fishing and hunting	11	0.003	5

Table 2
Investment regressions conditional on public firm presence

Panel A (B, C, D) in this table reports the results from regressions of changes in gross fixed assets on past sales growth (lagged Tobin's *Q*, lagged industry *Q*, changes in state corporate income tax), the proportion of public firms in an industry, an interaction between the two, and control variables. *INV* equals the change in gross fixed assets from year t-1 to year t, divided by beginning-of-year total assets. *SALES_GR* is the percentage change in sales from year *t*-1 to year *t*. *TOBIN'S_Q* is computed following Campello and Graham (2013): within each three-digit NAICS industry, we first regress each public firm's Tobin's *Q* on the firm's sales growth, ROA, net income before extraordinary items, book leverage, and year. We then use the regression coefficients to generate *TOBIN'S_Q* for each private firm. *INDUSTRY_Q* is the sum of aggregate market value of equity and aggregate book value of debt in an industry, divided by aggregate total assets in that industry. *HI* is the Herfindahl index for competition, measured as the square of firm sales scaled by the sum of all firms (both private and public) in the same four-digit NAICS industry. *ROA* is net income, divided by beginning-of-year total assets. *CASH* is cash and cash equivalents, divided by beginning-of-year assets. *LEVERAGE* is debt in current liabilities plus long-term debt, divided by beginning-of-year assets. *ASSETS* is the natural log of total assets. *PUBLIC_PROP_S* is the sum of all public firm sales (per Compustat) in each four-digit NAICS industry, divided by total firm sales (per Census) in the same four-digit NAICS industry. *PUBLIC_PROP_F* is the number of public firms (Compustat GVKEY) in each four-digit NAICS industry, divided by the total number of firms (per Census) in the same four-digit NAICS industry. *TAX_CHANGE* is an indicator variable set to 1 (-1) for firm-years in which the firm is headquartered in states that decreased (increased) corporate income taxes, and zero otherwise. *TAX_INCREASE* (*TAX_DECREASE*) is an indicator variable set to 1 for firm-years where the firm is headquartered in states that decreased (increased) corporate income taxes, and zero otherwise. Regressions include industry and year indicator variables, which have not been tabulated. The *t*-statistics are adjusted to control for residual correlation in firms' investment. *,**,*** Indicate significance at the 10%, 5%, and 1% level, respectively, using a one-tailed t-test when a prediction is indicated and two-tailed *t*-test otherwise.

Panel A: Measuring investment opportunities using sales growth

Dependent variable = INV					
	Predicted Sign	*Measure of public firm presence (PUBLIC_PROP)*			
		PUBLIC_PROP_S		PUBLIC_PROP_F	
		Coefficient	*t*-Statistic	Coefficient	*t*-Statistic
Intercept		0.0179 ***	18.34	0.0185 ***	18.99
SALES_GR	+	0.0161 ***	9.69	0.0173 ***	10.36
PUBLIC_PROP		0.0048 ***	4.54	0.0566 ***	2.90
SALES_GR × PUBLIC_PROP	+	0.0127 ***	3.88	0.0544 **	1.89
HI		-0.0002 **	-2.37	-0.0001	-1.46
HI × SALES_GR		-0.0002	-0.48	0.0002	0.76
ROA		0.0645 ***	35.32	0.0647 ***	35.43
CASH		0.0177 *	1.91	0.0180	1.63
LEVERAGE		-0.0413 ***	-26.43	-0.0415 ***	-26.54
ASSETS		-0.0036 ***	-15.83	-0.0035 ***	-15.60
R-squared		7.60%		7.62%	
Industry indicators		Yes		Yes	
Year indicators		Yes		Yes	
Standard errors clustered by firm		Yes		Yes	
No. of observations		70,235		70,235	

Table 2 (*continued*)

Panel B: Measuring investment opportunities using Tobin's Q

Dependent variable = INV					
	Predicted Sign	*Measure of public firm presence (PUBLIC_PROP)*			
		PUBLIC_PROP_S		PUBLIC_PROP_F	
		Coefficient	*t*-Statistic	Coefficient	*t*-Statistic
Intercept		0.0179 ***	14.27	0.0194 ***	15.63
TOBIN'S_Q	+	0.0009 *	1.32	0.0006 *	1.56
PUBLIC_PROP		0.0185 ***	7.73	0.1072	1.23
TOBIN'S_Q × PUBLIC_PROP	+	0.0080 ***	5.98	0.0221 ***	2.28
HI		-0.0010 ***	-5.10	-0.0006 ***	-3.08
HI × TOBIN'S_Q		0.0006 *	1.68	0.0002 **	2.14
ROA		0.0684 ***	37.52	0.0681 ***	37.34
CASH		0.0178 **	2.22	0.0180	1.61
LEVERAGE		-0.0409 ***	-26.07	-0.0412 ***	-26.28
ASSETS		-0.0029 ***	-12.86	-0.0029 ***	-12.90
R-squared		4.67%		4.61%	
Industry indicators		Yes		Yes	
Year indicators		Yes		Yes	
Standard errors clustered by firm		Yes		Yes	
No. of observations		70,235		70,235	

Panel C: Measuring investment opportunities using industry Q

Dependent variable = INV					
	Predicted Sign	*Measure of public firm presence (PUBLIC_PROP)*			
		PUBLIC_PROP_S		PUBLIC_PROP_F	
		Coefficient	*t*-Statistic	Coefficient	*t*-Statistic
Intercept		0.0186 ***	17.90	0.0198 ***	19.23
INDUSTRY_Q	+	0.0091 *	1.52	0.0006 *	1.35
PUBLIC_PROP		0.0006	0.25	0.1500 **	2.54
INDUSTRY_Q × PUBLIC_PROP	+	0.0038 ***	2.43	0.0436 **	1.64
HI		-0.0003	-1.20	-0.0006 ***	-3.20
HI × INDUSTRY_Q		0.0000	0.06	0.0003 ***	2.68
ROA		0.0682 ***	37.39	0.0681 ***	37.33
CASH		0.0179 ***	8.46	0.0181 ***	8.55
LEVERAGE		-0.0411 ***	-26.25	-0.0413 ***	-26.32
ASSETS		-0.0029 ***	-12.74	-0.0029 ***	-12.66
R-squared		4.61%		4.58%	
Industry indicators		Yes		Yes	
Year indicators		Yes		Yes	
Standard errors clustered by firm		Yes		Yes	
No. of observations		70,235		70,235	

Table 2 (*continued*)

Panel D: Measuring investment opportunities using changes in state corporate income tax rates

	Dependent variable = INV							
	Predicted sign	Firms incorporated under IRS Subchapter C				Predicted sign	Firms *not* incorporated under IRS Subchapter C	
		Coefficient	*t*-Statistic	Coefficient	*t*-Statistic		Coefficient	*t*-Statistic
Intercept		0.0262 ***	22.95	0.0264 ***	22.90		0.0302 ***	28.97
TAX_CHANGE	+	0.0120 **	1.91	---	---		0.0020	1.17
TAX_DECREASE	+	---	---	0.0056 *	1.60		---	---
TAX_INCREASE	-	---	---	-0.0084 **	-2.07		---	---
PUBLIC_PROP_S		0.0065 ***	4.10	0.0062 ***	3.87		0.0033 **	2.33
PUBLIC_PROP_S × TAX_CHANGE	+	0.0214 **	1.77	---			0.0102	1.03
PUBLIC_PROP_S × TAX_DECREASE	+	---	---	0.0054 **	1.69		---	---
PUBLIC_PROP_S × TAX_INCREASE	-	---	---	-0.0064 **	-1.84		---	---
SALES_GR	+	0.0145 ***	5.58	0.0146 ***	5.58	+	0.0186 ***	8.63
SALES_GR × PUBLIC_PROP	+	0.0116 ***	2.35	0.0116 ***	2.35	+	0.0126 ***	2.86
HI		-0.0043 *	-1.74	-0.0003 *	-1.74		-0.0001	-0.41
HI × SALES_GR		0.0002	0.41	0.0002	0.40		-0.0004	-0.90
ROA		0.0740 ***	20.64	0.0740 ***	20.63		0.0645 ***	28.96
CASH		0.0082 **	2.52	0.0081 **	2.51		0.0275 ***	9.99
LEVERAGE		-0.0399 ***	-16.14	-0.0399 ***	-16.15		-0.0382 ***	-19.20
ASSETS		-0.0032 ***	-9.28	-0.0032 ***	-9.27		-0.0044 ***	-14.95
R-squared		4.39%		4.40%			5.13%	
Industry indicators		Yes		Yes			Yes	
Year indicators		Yes		Yes			Yes	
Standard errors clustered by firm		Yes		Yes			Yes	
No. of observations		28,037		28,037			42,198	

Table 3
Investment regressions conditional on public firm presence and information quality

This table reports the results from regressions of changes in gross fixed assets on past sales growth, the proportion of public firms in an industry, industry information quality (*INFO_QTY*), interaction terms between these variables, and control variables. *INFO_QTY* is measured using the following variables. *Earnings informativeness* is measured as the coefficient for changes in earnings (i.e., β_1) in the following regression estimated for each industry-year: $RET_{i,t} = \alpha + \beta_1 \Delta EARNINGS_{i,t} + \varepsilon_t$, where $RET_{i,t}$ is the stock returns for firm i in year t, $\Delta EARNINGS$ is the change in earnings before extraordinary items for firm i in year t. *Management guidance* is measured as the total number of firms providing at least one earnings guidance in each industry-year. *Analyst coverage* is measured as the average number of Institutional Brokers' Estimate System (I/B/E/S) analyst forecast estimates for each firm in a fiscal year and four-digit NAICS industry. All other variables are as defined in Tables 1 and 2. Regressions include industry and year indicator variables, which have not been tabulated. The *t*-statistics are adjusted to control for residual correlation in firms' investment. *,**,*** Indicate significance at the 10%, 5%, and 1% level, respectively, using a one-tailed *t*-test when a prediction is indicated and a two-tailed *t*-test otherwise.

Dependent variable = INV							
	Predicted sign	*Public information quality (INFO_QTY)*					
		Earnings informativness		Management guidance		Analyst coverage	
		Coefficient	*t*-Statistic	Coefficient	*t*-Statistic	Coefficient	*t*-Statistic
SALES_GR	+	0.0084 ***	3.60	0.0163 ***	9.31	0.0220 ***	10.03
PUBLIC_PROP_S		0.0054 ***	3.97	0.0045 ***	3.52	-0.0025	-0.88
SALES_GR × PUBLIC_PROP_S	+	0.0117 ***	2.81	0.0142 ***	3.62	0.0157 **	1.73
INFO_QTY		-0.0002	-0.80	-0.0008 ***	-6.89	-0.0018 ***	-15.91
SALES_GR × INFO_QTY		0.0007	1.02	-0.0008 **	-2.14	-0.0150 ***	-4.57
PUBLIC_PROP_S × INFO_QTY		0.0018 ***	2.66	0.0005 ***	4.68	0.0019 ***	4.98
SALES_GR × PUBLIC_PROP_S × INFO_QTY	+	0.0020 **	2.17	0.0025 **	2.26	0.0036 ***	2.98
HI		0.0001	0.52	0.0003 **	2.22	0.0000	0.38
HI × SALES_GR		0.0006 *	1.70	0.0002	0.62	0.0000	0.06
ROA		0.0619 ***	28.14	0.0646 ***	35.37	0.0625 ***	34.20
CASH		0.0224 ***	3.48	0.0170 ***	8.05	0.0160	1.41
LEVERAGE		-0.0373 ***	-20.08	-0.0418 ***	-26.73	-0.0411 ***	-26.43
ASSETS		-0.0038 ***	-13.95	-0.0037 ***	-16.27	-0.0035 ***	-15.26
R-squared		5.21%		5.41%		7.92%	
Year & industry indicators		Yes		Yes		Yes	
Standard errors clustered by firm		Yes		Yes		Yes	
No. of observations		47,940		70,235		70,235	

Table 4
Investment regressions conditional on public firm presence and degree of investment irreversibility

This table reports the results from regressions of changes in gross fixed assets on past sales growth, the proportion of public firms in an industry, industry investment irreversibility, interaction terms between these variables, and control variables. *IND_IRR* is measured using three proxies: 1) *Return comovement*, 2) *Asset illiquidity*, and 3) *New/used capital goods*. *Return comovement* is computed by regressing the monthly returns for each public firm on an equally weighted market return index and an equally weighted industry return index. The partial correlation coefficient for the industry return index is averaged across all firms in each industry to obtain our proxy. *Asset illiquidity* is computed by aggregating all corporate transactions in a four-digit NAICS industry each year from the SDC Mergers and Acquisitions database, then scaling it by the aggregate book value of equity of all firms in that industry. We multiply this measure by -1 to obtain asset *il*liquidity. *New/used capital goods* is computed as the ratio of total expenditures on new capital goods to total expenditures on both new and used capital goods at the three-digit NAICS industry level. These data are obtained from the Annual Capital Expenditures Survey (ACES), published by the Census Bureau in 2003. All other variables are as defined in Tables 1 and 2. Regressions include industry and year indicators. The *t*-statistics are adjusted to control for residual correlation in firms' investment. *,**,*** Indicate significance at the 10%, 5%, and 1% level, respectively, using a one-tailed *t*-test when a prediction is indicated and a two-tailed *t*-test otherwise.

Dependent variable = INV							
	Predicted sign	*Degree of industry irreversibility (IND_IRR)*					
		Return comovement		Asset illiquidity		New/used capital goods	
		Coefficient	*t*-Statistic	*Coefficient*	*t-Statistic*	*Coefficient*	*t-Statistic*
SALES_GR	+	0.0157 **	2.60	0.0156 ***	8.43	0.0196 ***	5.36
PUBLIC_PROP_S		0.0345 ***	6.23	0.0077 ***	6.53	0.0089 ***	4.17
SALES_GR × PUBLIC_PROP_S	+	0.0411 ***	2.43	0.0138 ***	3.77	0.0239 **	1.87
IND_IRR		-0.0081	-1.30	0.0171 ***	7.80	0.0002 ***	2.93
SALES_GR × IND_IRR		0.0005	0.07	0.0051	0.70	0.0008	1.26
PUBLIC_PROP_S × IND_IRR		-0.0333 ***	-5.41	0.0213 **	2.43	0.0010 ***	5.17
SALES_GR × PUBLIC_PROP_S × IND_IRR	+	0.0335 **	1.77	0.0154 ***	2.75	0.0213 **	1.77
HI		-0.0002	-1.50	-0.0002 **	-2.23	-0.0003 **	-2.52
HI × SALES_GR		0.0000	0.14	-0.0002	-0.49	0.0010 **	2.15
ROA		0.0643 ***	34.88	0.0640 ***	35.05	0.0547 ***	20.94
CASH		0.0176 ***	8.28	0.0180 ***	8.53	0.0206 ***	6.33
LEVERAGE		-0.0411 ***	-26.13	-0.0407 ***	-26.08	-0.0278 ***	-12.98
ASSETS		-0.0036 ***	-15.59	-0.0035 ***	-15.69	-0.0024 ***	-7.43
R-squared		5.35%		5.40%		3.82%	
Year & industry indicators		Yes		Yes		Yes	
Standard errors clustered by firm		Yes		Yes		Yes	
No. of observations		70,235		70,235		59,366	

Table 5
Instrumental variables regressions with the residual audit fees and distance from investors as instruments for public firm presence

This table reports the results from two-stage-least-squares regressions of changes in gross fixed assets on past sales growth, the proportion of public firms in an industry, an interaction between the two, and control variables. Panel A (B) presents the results from estimating the first-stage (second-stage) regressions. We instrument for *PUBLIC_PROP_S* using 1) an estimate of the residual audit fees, which are unexplained by firm characteristics, and 2) the proportion of firms in the industry headquartered near potential investors. All variables are as defined in Tables 1 and 2. Regressions include industry and year indicator variables. The *t*-statistics are adjusted to control for residual correlation in firms' investment. *,**,*** Indicate significance at the 10%, 5%, and 1% level, respectively, using a one-tailed *t*-test when a prediction is indicated and a two-tailed *t*-test otherwise.

Panel A: First-stage regressions

Dependent variable =	**PUBLIC_PROP_S**		**SALES_GR × PUBLIC_PROP_S**		**PUBLIC_PROP_S**		**SALES_GR × PUBLIC_PROP_S**		**PUBLIC_PROP_S**		**SALES_GR × PUBLIC_PROP_S**	
	Model (1)				Model (2)				Model (3)			
	Instrument = Residual audit fees				*Instrument = Distance from investors*				*Overidentified model*			
	Coef.	*t*-Stat	Coef.	*t*-Stat	Coef.	*t*-Stat	Coef.	*t*-Stat	Coef.	*t*-Stat	Coef.	*t*-Stat
SALES_GR	0.027 ***	2.95	0.133 ***	16.55	0.042 ***	7.39	0.072 ***	14.69	0.028 ***	2.97	0.136 ***	16.69
RAUDIT_FEES	-0.095 ***	-20.45	0.001	1.39	---	---	---	---	-0.096 ***	-20.54	0.001	1.36
DISTANCE	---	---	---	---	0.019 ***	4.80	0.001	1.12	0.021 ***	5.30	0.001	1.02
SALES_GR × RAUDIT_FEES	-0.015	-1.29	-0.116 ***	-7.18	---	---	---	---	-0.015	-1.28	-0.116 ***	-7.21
SALES_GR × DISTANCE	---	---	---	---	0.005	1.49	0.021 ***	4.58	0.006	0.54	0.022 **	2.43
HI	0.035 ***	19.45	0.001 *	1.75	0.036 ***	37.49	0.001 *	1.73	0.035 ***	39.40	0.001 *	1.77
HI × SALES_GR	0.007 ***	6.51	0.038 ***	3.59	0.008 ***	7.26	0.004 ***	4.83	0.007 ***	6.52	0.038 ***	3.50
ROA	0.047 ***	7.65	0.021 ***	8.17	0.034 ***	5.71	0.020 ***	7.87	0.048 ***	7.69	0.021 ***	8.16
CASH	0.024 ***	2.89	0.003	0.99	0.025 ***	3.06	0.002	0.79	0.024 ***	2.84	0.003	0.97
LEVERAGE	-0.007	-1.35	-0.010 ***	-4.52	-0.008	-0.88	-0.010 ***	-5.02	-0.007	-1.17	-0.010 ***	-4.60
ASSETS	0.014 ***	16.33	0.003 ***	10.58	0.015 ***	17.56	0.003 ***	11.03	0.014 ***	16.00	0.003 ***	10.45
R-squared	17.37%		48.33%		17.04%		49.63%		17.41%		48.35%	
Year & industry indicators	Yes		Yes		Yes		Yes		Yes		Yes	
No. of observations	67,998		67,998		70,235		70,235		67,998		67,998	

Table 5 (*continued*)

Panel B: Second-stage regressions

		Dependent variable = INV					
		Model (1)		Model (2)		Model (3)	
	Predicted sign	*Instrument used*					
		Residual audit fees		Distance from investors		Overidentified model	
		Coefficient	*t*-Statistic	Coefficient	*t*-Statistic	Coefficient	*t*-Statistic
SALES_GR	+	0.0128 ***	3.43	0.0154 ***	7.19	0.0148 ***	4.06
PUBLIC_PROP_S		0.0377 ***	2.24	0.0460 ***	5.76	0.0518 ***	3.17
SALES_GR × PUBLIC_PROP_S	+	0.0385 **	1.93	0.0086 **	1.84	0.0321 **	1.80
HI		-0.0013 **	-2.16	-0.0117 ***	-5.67	-0.0018 ***	-3.11
HI × SALES_GR		-0.0008	-0.49	0.0004	0.49	-0.0007	-0.45
ROA		0.0678 ***	30.55	0.0681 ***	11.20	0.0690 ***	30.73
CASH		0.0222 ***	9.23	0.0219 ***	9.95	0.0226 ***	9.17
LEVERAGE		-0.0392 ***	-20.86	-0.0385 ***	-15.56	-0.0396 ***	-20.69
ASSETS		-0.0035 ***	-9.95	-0.0030 ***	-13.06	-0.0030 ***	-8.89
R-squared		5.97%		7.78%		6.12%	
First-stage partial *F*-statistic		26.70		20.96		29.93	
p-value of partial *F*-statistic		0.0000		0.0000		0.0000	
Overidentifying test (Sargan *J*-statistic)		----		----		3.12	
Overidentifying test (*p*-value)		----		----		0.21	
Year & industry indicators		Yes		Yes		Yes	
No. of observations		67,998		70,235		67,998	

Table 6
The U.K. setting: Investment regressions conditional on public firm presence

This table reports the results from regressions of changes in gross fixed assets on past sales growth, the proportion of public firms in an industry, an interaction between the two, and control variables. *INV* equals the change in gross fixed assets from year *t*-1 to year *t*, divided by beginning-of-year total assets. *SALES_GR* is the percentage change in sales from year *t*-1 to year *t*. *HI* is the Herfindahl index for competition, measured as the square of firm sales scaled by the sum of all firms (both private and public) in the same four-digit NAICS industry. *ROA* is net income, divided by beginning-of-year total assets. *CASH* is cash and cash equivalents, divided by beginning-of-year assets. *LEVERAGE* is long-term debt, divided by beginning-of-year assets. *ASSETS* is the natural log of total assets at the beginning of the year. *PUBLIC_PROP_S* is the sum of all public firm sales in each four-digit NAICS industry, divided by total firm sales (per Bureau Van Dijk) in the same four-digit NAICS industry. *,**,*** Indicate significance at the 10%, 5%, and 1% level, respectively, using a one-tailed *t*-test when a prediction is indicated and a two-tailed *t*-test otherwise.

		Dependent variable = INV					
	Predicted sign	Coefficient	*t*-Statistic	Coefficient	*t*-Statistic	Coefficient	*t*-Statistic
Intercept		0.0206 ***	69.40	0.0187 ***	40.12	0.0095 **	2.00
SALES_GR	+	0.0089 ***	19.15	0.0090 ***	11.19	0.0071 ***	6.56
PUBLIC_PROP				0.0094 ***	4.91	0.0305 ***	3.73
SALES_GR × PUBLIC_PROP_S				-0.0007	-0.21	-0.0003	-0.04
HI						0.0178	1.56
HI × SALES_GR						0.0000 ***	3.06
ROA						0.0724 ***	22.39
CASH						0.0144 ***	6.85
LEVERAGE						0.0280 ***	17.25
ASSETS						-0.0022 ***	-15.59
R-squared		0.26%		0.27%		3.07%	
Industry indicators		No		No		Yes	
Year indicators		No		No		Yes	
Standard errors clustered by firm		No		No		Yes	
No. of observations		286,055		286,055		182,184	

Table 7
Investment regressions using firm fixed-effects and changes specifications

Panel A reports the results from our main investment regression model using firm fixed-effects. Panel B reports the results from regressions of the change in firms' investment on the change in investment opportunities, change in the proportion of public firms in an industry, an interaction between the two, and the change in control variables. All variables are defined in Tables 1 and 2. In Panel B, we compute the change in our variables from 2004 to 2007, and each observation represents a unique firm. The *t*-statistics are adjusted to control for heteroskedasticity. *,**,*** Indicate significance at the 10%, 5%, and 1% level, respectively, using a one-tailed *t*-test when a prediction is indicated and a two-tailed *t*-test otherwise.

Panel A: Firm fixed-effects specification

Dependent variable = INV							
	Predicted sign	*Measure of investment opportunities (INV_OPP)*					
		Sales growth		Tobin's *Q*		Industry *Q*	
		Coefficient	*t*-Statistic	Coefficient	*t*-Statistic	Coefficient	*t*-Statistic
INV_OPP	+	0.0144 ***	4.26	0.0061 *	1.46	0.0087 *	1.38
PUBLIC_PROP_S		-0.0076	-0.85	0.0046	1.07	-0.0008	-0.34
INV_OPP × PUBLIC_PROP_S	+	0.0092 **	1.72	0.0012 **	2.17	0.0031 **	1.96
HI		-0.0001	-0.15	-0.0002	-1.48	-0.0006 ***	-2.78
HI × INV_OPP		0.0000	0.03	0.0000	0.59	0.0004 **	2.30
ROA		0.0620 ***	15.00	0.0701 ***	37.86	0.0696 ***	37.53
CASH		0.0238	1.17	0.0206 ***	9.59	0.0210 ***	9.77
LEVERAGE		-0.0320 ***	-6.78	-0.0378 ***	-23.84	-0.0382 ***	-24.09
ASSETS		-0.0039 ***	-6.02	-0.0033 ***	-14.64	-0.0032 ***	-14.12
R-squared		9.65%		8.08%		8.14%	
Firm indicators		Yes		Yes		Yes	
Year indicators		Yes		Yes		Yes	
No. of observations		70,235		70,235		70,235	

Panel B: 'Changes' specification

Dependent variable = Change in investment (Δ INV)							
	Predicted sign	*Measure of investment opportunities (INV_OPP)*					
		Sales growth		Tobin's *Q*		Industry *Q*	
		Coefficient	*t*-Statistic	Coefficient	*t*-Statistic	Coefficient	*t*-Statistic
Δ INV_OPP	+	0.1413 **	1.68	0.0784 **	1.85	0.0455 *	1.55
Δ PUBLIC_PROP		0.0034	0.05	0.0100	0.14	-0.0288	-0.39
Δ INV_OPP × Δ PUBLIC_PROP	+	0.7484 **	2.03	0.0783 **	2.17	0.0671 *	1.63
Δ HI		-0.0017	-0.20	-0.0035	-0.37	-0.0017	-0.18
Δ HI × Δ INV_OPP		-0.0231	-1.10	-0.0028	-0.13	-0.0031	-0.14
Δ ROA		0.2797 **	2.31	0.2822 **	2.27	0.2828 **	2.28
Δ CASH		0.3943 *	1.69	0.4000 *	1.69	0.3980 *	1.68
Δ LEVERAGE		0.2787 *	1.80	0.2994 *	1.92	0.2928 *	1.88
Δ ASSETS		0.4477	1.58	0.4134	1.49	0.4177	1.52
R-squared		10.74%		10.16%		10.04%	
Industry indicators		Yes		Yes		Yes	
No. of observations		3,647		3,647		3,647	

Table 8
Public firm presence and financing constraints

This table reports the results from a regression of the change in firms' long-term debt on changes in the proportion of public firms in an industry and control variables. *Long-term debt* is the firm's long-term debt, scaled by assets. *PUBLIC_PROP_S* is the sum of all public firm sales (per Compustat) in each four-digit NAICS industry, divided by total firm sales (per Census) in the same four-digit NAICS industry. *PUBLIC_PROP_F* is the number of public firms (Compustat GVKEY) in each four-digit NAICS industry, divided by the total number of firms (per Census) in the same four-digit NAICS industry. *INTEREST_COVERAGE* is earnings before interest, taxes, and depreciation, divided by interest expense. *CURRENT_RATIO* is the total current assets, divided by total current liabilities. PPE is the net property, plant, and equipment, divided by total assets. *LEVERAGE* is total liabilities divided by total assets. *COST_OF_DEBT* is the interest expense in year *t*+1, divided by the average debt in year *t*+1 and year *t*, where debt is the calculated as: short-term debt plus current portion of long-term debt plus total long-term liabilities. *LN_ASSETS* is the natural log of total assets plus one. *SALES_GROWTH* is the percentage change in sales in year *t*. *AUDIT* is an indicator variable equal to one if the firm received a financial statement audit, zero otherwise. All variables are measured as the change from 2004 to 2007. Regressions include industry indicator variables. The *t*-statistics are adjusted to control for heteroskedasticity. *,**,*** Indicate significance at the 10%, 5%, and 1% level, respectively, using a one-tailed *t*-test when a prediction is indicated and a two-tailed *t*-test otherwise.

Dependent variable = Change in long-term debt					
	Predicted sign	*Measure of public firm presence (PUBLIC_PROP)*			
		PUBLIC_PROP_S		PUBLIC_PROP_F	
		Coefficient	*t*-Statistic	Coefficient	*t*-Statistic
Intercept		-0.0173 ***	-2.76	-0.0171 ***	-2.72
Δ PUBLIC_PROP	+	0.0151	0.44	0.1484	0.12
Δ INTEREST_COVERAGE		-0.0029 ***	-8.03	-0.0029 ***	-8.04
Δ CURRENT_RATIO		-0.0228 ***	-7.30	-0.0228 ***	-7.30
Δ PPE		0.0500 **	1.97	0.0502 **	1.97
Δ COST_OF_DEBT		-0.0550	-0.77	-0.0548	-0.77
Δ LN_ASSETS		0.0746 ***	3.01	0.0746 ***	3.01
Δ SALES_GR		-0.0250 *	-1.91	-0.0249 *	-1.91
Δ AUDIT		0.0029	0.13	0.0030	0.13
R-squared		22.99%		22.98%	
Industry indicators		Yes		Yes	
Robust standard errors		Yes		Yes	
No. of observations		3,647		3,647	

Table 9
Analysis of public firms: Investment regressions conditional on public firm presence

This table reports the results from regressions of investment on investment opportunities, the proportion of public firms in an industry, an interaction between the two, and control variables for the sample of public firms in Compustat. *INV* equals the change in gross fixed assets from year *t*-1 to *t*, divided by beginning-of-year total assets. *SALES_GR* is the percentage change in sales from year *t*-1 to year *t*. *TOBIN'S_Q* is the market value of equity plus the book value of debt, scaled by the book value of assets. *INDUSTRY_Q* is the sum of aggregate market value of equity and aggregate book value of debt in an industry, divided by aggregate total assets in that industry. *HI* equals the Herfindahl index for competition, measured as the square of firm sales scaled by the sum of all firms (both private and public) in the same four-digit NAICS industry. *ROA* equals net income, divided by beginning-of-year total assets. *CASH* is cash and cash equivalents, divided by beginning-of-year assets. *LEVERAGE* is debt in current liabilities plus long-term debt, divided by beginning-of-year assets. *ASSETS* is the natural log of total assets. *PUBLIC_PROP_S* is the sum of all public firm sales (per Compustat) in each four-digit NAICS industry, divided by total firm sales (per Census) in the same four-digit NAICS industry. *PUBLIC_PROP_F* is the number of public firms (Compustat GVKEY) in each four-digit NAICS industry, divided by the total number of firms (per Census) in the same four-digit NAICS industry. *TAX_CHANGE* is an indicator variable set to 1 (-1) for firm-years headquartered in states that decreased (increased) corporate income taxes, and zero otherwise. Regressions include industry and year indicator variables. The *t*-statistics are adjusted to control for residual correlation in firms' investment. *,**,*** Indicate significance at the 10%, 5%, and 1% level, respectively, using a one-tailed *t*-test when a prediction is indicated and a two-tailed *t*-test otherwise.

Dependent variable = INV									
	Predicted sign	*Measure of investment ppportunities (INV_OPP)*							
		Sales growth		Tobin's *Q*		Industry *Q*		Tax changes	
		Coefficient	*t*-Statistic	Coefficient	*t*-Statistic	Coefficient	*t*-Statistic	Coefficient	*t*-Statistic
INV_OPP	+	0.0902 ***	24.27	0.0133 ***	17.98	0.0048 ***	4.35	0.0073 **	2.10
PUBLIC_PROP_S		0.0028 **	2.31	0.0127 ***	7.44	0.0211 ***	7.62	0.0067 ***	5.37
INV_OPP × PUBLIC_PROP_S	+	0.0356 ***	7.91	0.0056 ***	6.32	0.0112 ***	6.84	0.0069 ***	2.58
HI		0.0009 ***	16.97	0.0010 ***	13.81	0.0010 ***	10.79	0.0004 ***	9.44
HI × INV_OPP		0.0015 ***	9.04	0.0003 ***	8.88	0.0004 ***	5.82	0.0044 ***	48.91
ROA		0.0798 ***	36.39	0.1049 ***	46.40	0.1007 ***	43.32	0.0844 ***	38.04
CASH		0.012 ***	6.10	0.0104 ***	4.81	0.0363 ***	17.11	0.0220 ***	11.09
LEVERAGE		-0.0675 ***	-36.01	-0.0638 ***	-31.76	-0.0870 ***	-43.34	-0.0737 ***	-38.47
ASSETS		-0.0019 ***	-10.06	-0.0008 ***	-4.04	-0.0032 ***	-15.19	-0.0022 ***	-11.15
R-squared		20.91%		14.86%		10.40%		18.84%	
Year & industry indicators		Yes		Yes		Yes		Yes	
Standard errors clustered by firm		Yes		Yes		Yes		Yes	
No. of observations		56,950		56,950		56,950		56,950	