Institutional ownership and investment by private companies

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Abstract

We examine whether institutional shareholders in established private companies promote investment by alleviating funding constraints. Our sample is derived from company share registers and is comprehensive with respect to type of institution and size of shareholding. Institutions give rise to higher levels of investment in intangible assets, and higher external finance. The effects are largest for companies with minority institutional stakes, suggesting that alleviation of constraints is a primary motive for ownership in private companies without taking control. Institutions have more impact on external equity than debt, which differs from the case of companies taken over in leveraged buyouts.

JEL classification codes: G24, G23, G32

Keywords: corporate investment, funding constraints, private companies, private equity, investing institutions

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1. Introduction

Institutional investment in private companies has been growing in recent years, and the reasons for this development are unclear. One hypothesis is that institutions alleviate funding constraints in investee companies, directly by buying newly issued shares themselves, or indirectly by facilitating investment or lending by other financiers. Easier access to external funds is recognised as an advantage of being listed on a stock market, and institutional ownership could provide a similar benefit, serving as a substitute for a listing.[1] However, existing evidence on whether institutions do in fact promote investment and alleviate constraints is limited to the case of leveraged buyouts (LBOs) (Bernstein, Lerner and Mezzanotti, 2019; Boucly, Sraer and Thesmar, 2011; Cohn, Hotchkiss and Towery, 2021).

We extend the evidence to a broader spectrum of institutional owner types and to ownership positions that include minority as well as controlling stakes. To do so we use data on UK-registered private companies, which face more stringent disclosure requirements than their counterparts in other developed markets. The UK Companies Act requires that firms file both annual financial statements and a register of shareholders at a national registrar, called Companies House. Our sample includes all types of private equity (PE) and venture capital (VC) fund as well as non-PE institutions such as banks, insurance companies and mutual funds.[2] Our baseline sample features 1,852 private companies with institutional ownership of varying types over the years 2009 to 2019. To help identify the effects of institutional ownership, each of these is matched to a control company in the same industry with similar characteristics in terms of size, age and profitability. We also examine changes in outcomes after firms transition to having institutional ownership for the first time. Given the extent of the financial disclosures available, we examine the impact of institutions on intangible as well as tangible investment.

We find that institutional ownership is associated with higher investment by private companies, compared with control companies which do not have institutional shareholders. Total investment is higher by 4.1 percentage points per year, an increase of 20% compared with average investment by control companies. The effect is entirely concentrated on investment in intangible assets. There is no discernible impact on investment in tangible assets.

[1] For evidence that being listed promotes investment or innovation, see Acharya and Xu (2017); Gilje and Taillard (2016); Mortal and Reisel (2013); Phillips and Sertsios (2017). Asker, Farre-Mensa and Ljungqvist (2015) exceptionally find that large private firms invest more effectively than public firms.

[2] We use the term 'non-PE' to refer to any institution which does not invest by means of an explicit PE-style closed fund structure. PE-style funds include buyout, VC and growth equity funds.

As well as promoting the level of intangible investment, institutional ownership enables firms to respond better to investment opportunities. The impact is again concentrated on intangible investment and most prominent in firms in which a PE-style fund has control.

Institutional ownership is also associated with higher levels of external funding in private firms, both in the form of equity and debt, with a stronger impact on equity. Share issuance per year as a proportion of assets is 2.7 percentage points higher, an increment of 117% compared with share issuance by control firms. Debt increases are 2.8 points higher, which is an increment of 24% compared with control firms. Firms which raise external equity or debt report higher contemporaneous and subsequent investment, supporting the view that external fundraising is used at least in part to finance investment.

We further examine whether institutions alleviate constraints by calculating several direct measures of constraint, consisting of the cash flow sensitivity of investment, the cash flow sensitivity of cash, and an index of constraints developed for private companies. We find that companies with institutional ownership are less constrained than control companies according to all three measures.

To explore the impact of different types of institutional ownership, we divide the sample into four groups, namely companies with PE control, non-PE institutional control, a PE minority stake and a non-PE minority stake. We define a minority stake as one that either is not the largest stake of a shareholding party (e.g. a family), or one that consists of less than 20% of the ordinary shares, or consists of a holding of non-voting shares. A controlling stake is a holding of at least 20% of the ordinary shares that is also the largest holding. All types of institutional ownership except non-PE control are associated with both an increased propensity to raise external equity and higher investment by the investee companies. The increases in external equity and investment are greater when institutional investors have minority as opposed to controlling stakes. But the picture is different for debt. The positive impact of institutions on borrowing is confined to companies under PE control. When institutions have minority stakes, equity is the more important channel for the provision of external funding to the investee company. Companies under PE control also differ in that they exhibit greater responsiveness of investment to industry growth opportunities than control firms.

A benefit of our research design is the heterogeneity of the ownership stakes and institutions in our sample. In particular, the subsample of firms with minority stakes enables us to test alleviation of constraints more cleanly than previous research, which focuses on LBOs. If an institution has control, as is typically the case for a PE fund after an LBO, higher investment could be due to the institution's impact on the company's investment policy, rather

than to alleviation of constraints. This possibility is less likely if the institution does not have control, because it is less likely to control the company's investment policy—without control, institutions will be less willing and able to add value through intensive oversight of the company, of the sort that is often conducted by PE investors after a buyout, or by venture capitalists in the case of young companies. Lerner and Nanda (2020) discuss the recent growth of founder friendly terms, whereby the founder retains control rather than the VC investor. They view retention of control by the founder as a negative development, because it implies reduced levels of VC oversight. But perhaps the motive for institutions which take a non-controlling stake is to provide external finance rather than to exert managerial control. Provision of finance can be achieved without control of the company being required.

We contribute to the literature on the role of institutional investors in private companies. Ewens and Farre-Mensa (2020) and Kown, Lowry and Qian (2020) argue that late stage VC-backed startups are sufficiently able to raise external equity that they choose to remain longer as private firms, rather than listing on the stock market. Our evidence extends theirs, showing explicitly that institutional ownership promotes investment and reduces constraints on external equity in established firms in general. Previous studies on the effects on investment of PE control, or of having a listing, examine either capital expenditure on its own, or innovation. We find that the impact of institutional ownership is concentrated entirely on intangible investment. The impact of institutions could be understated if investment is measured solely by capital expenditure.

We also broaden substantially the evidence on institutional activity in private markets. Existing research (reviewed below) is limited primarily to LBOs and VC investment in startups. Consequently, the evidence to date is skewed towards institutions with controlling stakes. In addition, there is little research on the activity of non-PE institutions as independent investors in private markets, as opposed to co-investors in companies which have PE or VC backing.[3] Our sample consists of established companies rather than startups, and it is comprehensive with respect to the size of institutional holdings and the types of institutional investor. Companies with minority institutional stakes make up over 40% of the sample, and in these cases we find that the institution promotes external finance by means of external equity rather than debt. This contrasts with LBOs, in which the PE fund tends to take control, and external finance is provided mainly via debt. Our evidence shows that a non-controlling

[3] Fang, Ivashina and Lerner (2015) study independent as well as co-investments by non-PE institutions. But their paper is not concerned with the effects on investee companies. We discuss co-investment further in Section 2.

position, together with provision of external finance via equity, constitutes an important alternative model to the LBO for institutional involvement in established companies. By allowing an institution to take a minority stake, the controlling founder or family can both retain control and gain easier access to external equity.

2. Previous evidence

This section reviews research on whether institutional ownership reduces the funding constraints faced by private companies. Reduction in constraints is not a foregone conclusion. Institutional ownership can arise through the purchase of existing rather than new shares, as occurs for example in many LBOs. Hence, the presence of an institution on the share register does not guarantee that the company has ever received funds from it. In addition, there are other possible motives for institutional ownership, including the introduction of superior management into the company, reduction of agency costs, reduction of corporation tax through higher leverage, and investment followed by a passive role.[4]

Do buyouts alleviate constraints? Boucly et al. (2011) report that LBOs of French private family firms are followed by increased growth and capital expenditure, especially in industries with greater dependence on external finance, and by increases in leverage. They conclude that PE investors alleviate constraints by facilitating borrowing. Bernstein et al. (2019) use UK data and document that during the financial crisis (2008-11), companies controlled by buyout funds have higher levels of investment and external finance, especially debt, than matched companies. Consistent with these results is the finding of Ivashina and Kovner (2011) that PE backing helps companies raise debt on better terms.

Cohn, Mills & Towery (2014) study LBOs of US public companies. They report no increase on average in operating performance or growth. But leverage increases at the time of the LBO, and is sustained in subsequent years. They suggest that, in the case of public-to-private LBOs, the main source of gain is tax savings through higher leverage, rather than higher growth. Cohn et al. (2021) study buyouts of private firms, the majority of which were subsidiaries before the buyout. They find that profitability and growth increase on average after the buyout, in contrast to their evidence for buyouts of public firms. Leverage increases, from already high levels. There is often an injection of external equity in the year of the buyout, but

[4] For improvements in performance resulting from PE or VC backing, see Acharya, Gottschalg, Hahn and Kehoe (2013); Bergström, Grubb and Jonsson (2007); Bernstein and Sheen (2016); Boucly et al. (20111); Chemmanur, Krishnan and Nandy (2011); Cohn et al. (2021); Eaton, Howell and Yannelis (2020). For evidence of gains primarily from reduced tax payments, see Cohn, Mills and Towery (2014) and Guo, Hotchkiss and Song (2011). For gains from better monitoring, see Bernstein, Giroud and Townsend (2016).

little in subsequent years. The authors argue that there are gains from both improvement in operating performance and higher investment through alleviation of funding constraints. In a related study, Erel, Jang and Weisbach (2015) present evidence that stand-alone private firms acquired by operating companies become less constrained afterwards.

Lerner, Sorensen and Stromberg (2011) study innovation, proxied by patents, following LBOs. They find that patent citations increase, suggesting a higher quality of innovation, while the quantity of patents does not increase. They argue that PE control does not imply sacrifice of long-term investment; rather, PE investments 'appear to be associated with a beneficial refocusing of firms' innovative portfolios' (p. 447). A study of UK LBOs by Amess, Stiebale and Wright (2016) finds that patent applications increase after private-to-private buyouts, implying that the quantity of innovation increases, possibly due to better access to finance.

Does VC backing alleviate constraints? There is no direct evidence on whether VC backing promotes investment and alleviates constraints. But in the case of young firms with no revenue, it seems very likely that VC backing will alleviate constraints. Such firms are completely dependent on external funds, and the prevalence of funding rounds as a feature of VC ownership implies that VC investors do make frequent injections of funds.

Ewens and Farre-Mensa (2020) study the impact of the National Securities Markets Improvement Act (NSMIA) 1996 on US VC-backed startup companies. 'Late-stage' startups, that have received a third funding round from their primary VC investor, raise more external equity and debt after 1996 than before, and a smaller proportion of VC-backed startups become public companies after 1996. Much of the external equity provided in later funding rounds comes from co-investment by non-VC institutions, i.e. direct investment by the institution in a VC-backed firm. The authors infer that the NSMIA made it easier for VC partnerships and startups themselves to raise funds, and that this helps to explain the decline in IPOs in the 2010s. Similarly, Kwon et al. (2020) document that co-investment by mutual funds is incremental—it involves purchase of newly issued shares (mainly preference shares)—and that firms with co-investment choose to stay private for longer periods than other VC-backed firms.[5] However, neither paper studies company investment, and it is unclear to what extent their evidence relates to established companies with positive revenues. Many companies that

[5] Other aspects of co-investment which have been studied include the returns to institutions on co-investments (Braun, Jenkinson and Schemmerl, 2020), the contractual terms on which mutual funds co-invest in later funding rounds (Chernenko et al., 2021), the returns made by new compared with existing investors in rounds after the first round (Ewens, Rhodes-Kropf and Strebulaev, 2016), and the effects of co-investment on IPO underpricing (Huang, Mao, Wang and Zhou, 2021).

are late stage in terms of funding rounds will still be at an early stage of their life-cycle, with no revenue.

Phillips and Sertsios (2017) compare the response of public and private companies in the US medical device industry to National Coverage decisions, which improve selling opportunities. Private companies in the industry raise external equity almost entirely from VC or growth equity funds. But public companies raise more equity and invest more effectively, especially in devices which offer the most gains from being brought to market quickly. The authors conclude that public firms are less constrained than private firms with access to VC funding. This raises a question about how effective VC funding is in alleviating constraints, at least in established private firms.

3. Ownership of UK private companies

3.1 Ownership data

Our ownership and financial data are from Financial Analysis Made Easy (FAME), produced by Bureau van Dijk. FAME derives its data from filings with Companies House, a public registry. Under the UK Companies Act, all companies registered in the UK are required to submit an annual financial statement to Companies House, though the level of detail depends on the size of the company. Companies also submit an annual Confirmation Statement, formerly known as an Annual Return, in which they disclose their share register, i.e. the names of shareholders and the numbers of shares held by class of share in issue.

Our first step is to identify the ownership of established private companies, which include both limited companies and unlisted 'public limited companies' (PLCs).[6] We exclude financial-sector companies because their financial statements are not comparable with those of other companies. We also exclude companies controlled by infrastructure and real estate funds, because many are not normal operating companies (they are special-purpose vehicles established to fulfil a specific development contract).

We concentrate on established firms, with material revenues. Many are able to fund investment from retained earnings or by borrowing, without institutional backing. Therefore, it is uncertain whether institutional shareholders alleviate funding constraints in established firms. In contrast, startups often have no revenue and are likely to be constrained in the absence of VC backing. To ensure that the sample consists of established firms, each firm must have

[6] PLCs tend to be larger, with more shareholders. Their shares can be offered to the public, though most plcs are not listed companies. The only remaining distinct requirement for registration as a plc is that the company must have shares in issue with a nominal value of at least £50,000 (Companies Act, 2006, section 763).

non-zero revenue every year it is in the sample, and it must have revenue exceeding £1m in at least one of the sample years.

We are interested in stand-alone and parent companies, rather than subsidiaries, because the impact of constraints is more likely to be observable at the level of the parent company. We therefore exclude subsidiaries, i.e. companies which are more than 50% owned by another operating company. We define the controlling party of each firm as the party with the largest holding of ordinary shares, subject to a minimum of 20%.[7] If no party owns more than 20%, the firm is classed as widely held. Other firms—the vast majority—are classified under the following types of controlling owner: family or individual, institutional investor(s), operating company (with a stake between 20% and 50%), government or non-for-profit institution, and nominee accounts (the owners of which have not been disclosed). Identifying ownership is a major task, and correct identification of institutional owners involves extensive checking by hand. Appendix 1 summarises our procedures for dealing with data that are missing or inaccurate in FAME, identifying the ultimate owners of shares held by operating or holding companies, and identifying institutional and family shareholders.

We divide institutions broadly into PE and non-PE. PE institutions include buyout, growth equity and VC funds, including the investment offices of wealthy families. They invest by means of a closed fund, with a fixed amount of funding raised from outside investors (limited partners), and a fixed lifespan. Non-PE institutions include banks, insurance companies, pension funds, investment management companies, and financial consulting firms that make proprietary investments. The behaviour of PE and non-PE institutions might differ, and we wish to study their impact on investee companies separately. We assume that institutions of the same broad type will co-ordinate their voting and monitoring. Hence, we sum the holdings of PE-style funds and treat the total as a single shareholding party, and the same for the holdings of non-PE investors.

We distinguish between companies with a controlling institutional party and minority (non-controlling) party. A minority holding is not the largest holding, or it is less than 20% of the ordinary shares, or it is a holding of non-voting (including preference) shares. If a firm has both PE and non-PE minority holdings, it is classed as a firm with a PE minority stake even if the non-PE stake is larger. This rule enables us to examine the effects of non-PE minority

[7] The 20% threshold for control is widely used in literature concerning ownership, for example Aminadav and Papaioannou (2020).

ownership on its own, separately from the effects of PE ownership.[8] In summary, we classify firms with institutional ownership under four types: PE control, non-PE control, PE minority stake, and non-PE minority stake. The types are mutually exclusive by firm-year.

3.2 Ownership of private companies by type of shareholder

Table 1 around here

Table 1 presents an overview of the ownership of established UK private operating companies. The sample period is 2009-19. Of the 97,620 companies that we classify, 47.7% are subsidiaries and 12.1% have missing or untraced owners. These companies play no further role. The remaining 39,304 (40.2%) are stand-alone companies that are eligible for inclusion in our sample for analysis, as firms with institutional ownership or as matching control firms. The vast majority (86.1%) of stand-alone firms are controlled by a family or individual. Of the remainder, 4.6% are controlled by an operating company, 3.9% by investing institutions, 1.1% by a government or non-for-profit institute, and 1.8% by nominee accounts, while 2.6% are widely held (some of these could be unidentified family firms).

While most stand-alone companies are family firms, there are sizable numbers in the other categories when compared with the number of listed firms. In particular, there are rather more established firms controlled by institutional investors in the sample period than there are listed firms. The 1,560 institution-controlled firms compare with around 1,500 non-financial listed UK firms in 2009, which falls to 850 in 2019.

Table 2 around here

Table 2 presents the distribution of the 2,388 stand-alone firms that we identify as having institutional ownership for at least one sample year. This is 6.1% of the 39,304 firms eligible for our sample for analysis. Note that we include firms with minority as well as controlling institutional ownership. We believe that Table 2 captures most of the population of established private firms that have institutional ownership and are not subsidiaries, financial

[8] Most (88.1%) of the firms with a non-PE *controlling* stake also have no PE ownership. We do not assign the remaining 11.9% of such firms to the 'PE minority' group because their non-PE stakes are much larger.

firms or infrastructure/special-purpose companies.[9] Of the firms with institutional ownership, 48.5% are controlled by PE-style funds, 10.9% are controlled by non-PE institutions, 27.0% have a PE minority stake, and 13.7% have a non-PE minority stake.

Institutions have a minority stake in a substantial 40.7% of cases, leaving another party such as a family or individual in control. For non-PE institutions, minority stakes are more prevalent than controlling stakes, but minority stakes are also important for PE-style funds, accounting for more than one third of their stakes. The controlling stakes are much larger on average than the minority stakes, for both PE and non-PE institutions. The average institutional stake is 63.0% in the PE control group, and 61.8% in the non-PE control group. This indicates that PE or non-PE control means outright control, with over 50% of the shares, in the majority of cases. Minority institutional ownership, in contrast, involves quite small holdings, of less than 15% of the shares on average, or zero if the holding consists of non-voting shares only.

Table 2 also shows that non-PE institutions are important agents as independent investors. Existing research identifies a growing role for mutual funds as co-investors in firms controlled by venture capital, especially in later funding rounds (e.g. Ewens and Farre-Mensa, 2020; Kwon et al., 2020). Consistent with this, some of our firms with PE ownership also have non-PE minority shareholders, though these cases are not identified in Table 2. But separately from co-investments, almost one quarter of the firms with institutional ownership have non-PE controlling or minority stakes.

To provide further detail, we attempt to categorise the institutional stakes by subtype. Under the PE heading the subtypes are buyout funds, growth equity, venture capital, and unclassified PE.[10] Stakes of PE-style funds are most commonly held by VC funds, which constitute the primary shareholding party in 25.4% of the firms with institutional ownership. Buyout funds account for 17.4%—this is a smaller proportion than might be expected, given our focus on established companies. Both proportions will be understated, because we are unable to classify a sizable proportion (24.6%) of the PE stakes. VC and growth equity funds hold nearly as many minority as controlling stakes, whereas buyout funds usually hold a controlling stake (as expected).

[9] The main reason for omissions is that FAME occasionally misclassifies investing institutions as companies. We do not identify all of these errors as we do not manually check the parent company of (what appears to be) a subsidiary, if the parent is classed by FAME as a company and it is not a holding company.

[10] Growth equity investors tend to invest in relatively mature firms which are already generating revenue. The largest in the UK is the Business Growth Fund, which invests in firms with a 'clear growth strategy' and sales of more than £1m per year, and typically holds between 10% and 40% of the equity. Unclassified PE stakes are held by funds of PE institutions which operate in more than one area (buyout, growth equity, or VC), or which do not specify their area.

The subtypes under the non-PE heading are banks, insurance companies and pension funds, investment funds including mutual funds and investment trusts (listed investment companies), and consulting firms. The most common non-PE subtypes are investment funds and banks, accounting respectively for 15.2% and 5.3% of firms with institutional ownership. Existing research has focused on mutual funds as co-investors with PE funds, and banks as investors via their PE subsidiaries. Our evidence shows that mutual funds, banks and other non-PE institutions are also active as independent investors in private markets.

4. Financial variables, matching process and sample for analysis

We now explain about other aspects of our data and sample construction, starting with company investment. Our measure includes estimates of investment in both tangible and intangible assets. Capital expenditure is not available as a data item, because most private companies do not report a cash flow statement. Instead, we follow Asker et al. (2015) and use investment in tangible assets, measured by the change in property, plant and equipment (PPE), plus depreciation. This measure is a noisy estimate of capex, and we discuss it further in Section 5.1. To measure intangible investment, we follow studies of intangible and organisational capital, for example Peters and Taylor (2017) and references therein. Our measure consists of three components. (i) Investment in organisation capital, measured by 30% of selling, general and administrative (SG&A) costs, where SG&A is calculated net of R&D and amortisation to avoid double-counting these items. (ii) Investment in knowledge capital measured by R&D, which is an expense item in the income statement. (iii) The change in intangible assets on the balance sheet, plus amortisation. This component captures investment in externally purchased intangible assets, plus the portion of R&D expenditure that has been capitalised, if any.[11] If R&D or intangible assets are missing in FAME, they are treated as zero.[12] The investment measures are scaled by total assets as at the start of the financial year. We note that each measure includes increases in assets that result from both organic growth and acquisitions (though we do not study acquisitions specifically).

Investment opportunities *InvOpp* are measured by the change in sales in the relevant industry and year, proxied by the median change for firms with the same 3-digit Standard

[11] Peters and Taylor (2017) do not include the change in intangible assets in their measure of intangible investment, presumably because they test the *q* theory which relates to investment in a firm's existing business only. As we wish to measure total intangible investment, we include the change in intangible assets.

[12] A possible concern is that intangible investment is affected by revaluations of intangible assets on the balance sheet (permitted under IFRS and UK accounting principles if the asset is actively traded). Firms that report a revaluation reserve are uncommon. Our results are unaffected if we exclude such firms.

Industrial Classification (SIC) code as the sample firm. We use industry rather than firm sales growth because the latter is likely to be endogenous.[13] Other studies which use *InvOpp* to proxy for opportunities include Mortal and Reisel (2013) and Asker et al (2015). Alternative proxies in the literature include natural gas prices and shale gas discoveries for firms in the shale gas industry (Gilje and Taillard, 2016), and Medicare National Coverage approval decisions for firms in the medical device industry (Phillips and Sertsios, 2017).

For external finance, we use three measures of external equity and debt. *ExtEquity* (*IncrDebt*) is the external equity raised (increase in debt) in a given year, scaled by assets, with reductions replaced by zero. Changes in external equity are inferred from changes in share capital plus the share premium account. *LargeExtEquity* (*LargeIncrDebt*) is a dummy variable set to 1 if *ExtEquity* (*IncrDebt*) exceeds 10% of lagged assets, and zero otherwise. Δ*Equity* (Δ*Debt*) is the scaled change in equity (debt), and includes negative changes.

Six control variables are included: firm size measured by the natural log of total assets (*Size*); lagged leverage ($Leverage_{t-1}$); return on assets (*ROA*); lagged cash holdings scaled by assets ($Cash_{t-1}$); dividends declared scaled by assets (*Dividend*); and the natural log of the firm's age (*Age*). Asker et al. (2015) include these variables in their augmented model; most are also included by Bernstein et al. (2019). All the variables are defined in Appendix 2. We winsorize continuous variables at the 1st and 99th percentiles.

We attempt to match each firm with institutional ownership (a 'treated firm') with one control firm, drawn without replacement from the pool of untreated firms—this pool excludes subsidiaries and firms with missing ownership (Table 1). The matching is based on industry, size, age and ROA, variables that are likely to affect investment and commonly used in previous research. We match in order to better isolate the impact of the treatment on the outcome, i.e. institutional ownership on investment. Because nearly 90% of our treated firms have no pre-treatment data, we match at the first year of treatment, which in most cases is also the first year the firm is in the sample. We do not match on the key outcome variables themselves, which are investment and external finance. Doing so when most firms are already treated would bias downwards the estimated impact of institutional ownership on these outcomes.

In the reported results we employ nearest-neighbour caliper-based matching. As a robustness check we alternatively match firms by entropy balancing, as explained later. We set

[13] As a robustness check we measure *InvOpp* by firm-specific sales growth instead, as in Mortal and Reisel (2013). Our results are qualitatively similar.

the matching algorithm to find potential matches from firms in the same SIC section (there are 21 sections). For each variable, the value for a would-be match must be no more than 0.25 standard deviations away from the value for the treated firm. The standard deviation is calculated from values of the variable in all firm-years for treated and control firms. If more than one potential match is identified, we select the closest one based on the sum of the absolute distances of all the matching variables. If no match is found, the treated firm is excluded. We find appropriate matches for 1,852 treated firms, and these together with their control firms form the sample for our analysis. Data for each treated and control firm are used for all available years, including any years before or after the treated firm had institutional shareholders.

Table 3 and Figure 1 around here

Panel A of Table 3 shows summary statistics for the 3,704 treated and control firms. The data confirm that most of the firms are well established and profitable. They have average assets of £35.1m (median £12.6m), ROA of 9.2% (9.3%) and age of 11.9 years (8.0 years). Total investment is 23.4% (15.9%) of assets, of which intangible investment is 19.8% (12.3%), and tangible investment is 3.7% (1.9%). It is striking that intangible investment is much the larger component. This is due primarily to investment in organisational capital, estimated by 30% of SG&A expenses; data for the components of intangible investment are: mean (median) of 15.1% (9.3%) for organisational capital, 0.2% (0.0%) for R&D, and 4.5% (0.0%) for intangible assets.

Our figures for tangible investment are comparable with estimates for US companies in Asker et al. (2015, Table 2, first row) using the same measure. They report mean (median) tangible investment of 4.1% (2.0%) in unmatched public firms, and 7.5% (1.4%) in private firms. We know of no previous evidence on intangible investment that uses our comprehensive measure.[14]

Panel B compares the means of the variables for the treated and control groups. The three variables on which the matching is conducted are not significantly different except for ROA, where the difference is small in economic terms (treated firms have mean ROA of 7.2%, compared with 8.9% for control firms).[15] But there are substantial differences in the key

[14] Summary data in Peters and Taylor (2017) for US public firms indicate that intangible investment is larger than tangible investment, though the difference appears to be much less than in our data. Their measure of intangible investment excludes the change in intangible assets plus amortisation, which we include.

[15] The closeness of the match by ROA is potentially important. Asker et al. (2015) do not match by ROA, and mean ROA in their sample is −2.8% for public firms compared with 11.1% for private firms. This could help

variables of interest, namely investment, *ExtEquity* and *IncrDebt*. These differences are illustrated in Figure 1 for each sample year. Treated firms (with institutional ownership) have higher annual total investment, of 27.0% of assets compared with 20.8% for the control group. This difference is due entirely to investment in intangibles, which is 23.7% for treated and 17.1% for control firms. Both differences are significant at the 1% level. Hence, a simple comparison of means suggests that institutional ownership is associated with significantly higher intangible investment, though not with higher tangible investment.

In addition, firms with institutional ownership raise substantially more external equity and debt. For example, mean *ExtEquity* is 6.9% of assets for treated firms and 2.3% for control firms, while mean *IncrDebt* is 16.5% of assets for treated and 11.8% for control firms. These differences are significant at the 1% level. The absolute increments for treated firms are similar for external equity and debt, but the proportionate increment is clearly much greater for external equity. A final point is that mean lagged leverage is substantially higher in treated firms, at 40.3% compared with 28.0% in control firms.

5. Results

The question we examine is whether institutional ownership in private companies promotes investment by reducing funding constraints. We use panel regression to show first that institutional ownership is associated with higher investment, and (to a lesser extent) with investment that is more responsive to opportunities. We then test whether the impact on investment is due to greater external financing in firms with institutional ownership, as predicted if such ownership reduces constraints. Having presented results for the full sample of treated firms, we break the sample into groups defined by size of institutional shareholding and type of institution. Further tests examine whether treated firms are less constrained according to direct measures of constraint, and whether investment and external finance increase after firms first transition to having institutional shareholders.

5.1 Institutional ownership and investment

We assess whether institutional ownership promotes higher levels of investment by running the following OLS regression:

$$Investment_{it} = \alpha + \beta InstOwn_{it} + \gamma InvOpp_{it} + X_{it} + \zeta_{it} + \varepsilon_{it} \quad (1)$$

explain why they find that investment is larger and more responsive in private firms than in public firms. Maksimovic et al. (2019, p. 3) argue that their matching is awry: 'very successful private firms are matched with underperforming public firms'.

InstOwn is an indicator set to 1 if firm *i* has institutional shareholders in firm-year *t*, and 0 otherwise. The coefficient on *InstOwn* measures the difference in levels of investment between firm-year observations with institutional ownership and those without, controlling for factors other than ownership that might affect investment. *InvOpp* is a control variable in regression (1); we examine later whether treated firms respond better to changes in investment opportunities. X is a vector of control variables, and ζ represents industry-year fixed effects. Panel regression with matched firms is used by analogous studies that compare investment or innovation across public and private firms (Asker et al., 2015; Mortal and Reisel, 2013).[16]

Table 4 around here

Table 4 presents regression results with measures of investment as the dependent variable. Column 1 shows results for total investment. The coefficient on *InstOwn* is 0.041 (t = 6.40), implying that institutional ownership promotes investment. Conditional on investment opportunities and the other controls, investment per year by treated firms is 4.1 percentage points higher than by control firms. Compared with mean investment by control firms of 20.8% of assets (Table 3), this implies that investment by treated firms is 19.7% higher per year. Since firms are typically treated for several years, this annual increment implies a large cumulative effect over time.[17] Columns 2 and 3 show results for investment in intangible and tangible assets, respectively. The impact of institutional ownership is concentrated on intangible investment; in this regression the coefficient on *InstOwn* is 0.041 (t = 6.63). Compared with mean intangible investment by control firms of 17.1%, the coefficient implies that intangible investment by treated firms is 24.0% higher per year.[18] When the dependent variable is tangible investment, the coefficient on *InstOwn* is positive but close to zero, and is not statistically

[16] An alternative to using matched firms is to use the two-stage treatment effect model, as in Acharya and Xu's (2017) study of the effect of being listed on innovation. The first stage is to model the treatment. Doing so requires identification of plausibly exogenous exclusion restriction(s) which must be relevant determinants of the first-stage dependent variable. There are no obvious candidate variables that meet the exogeneity and relevance criteria. It is possible to estimate the first-stage model without an exogenous variable(s), however doing so can introduce alternative econometric biases which can lead to unreliable inference (e.g. Lennox, Francis and Wang, 2012; Little, 1985).

[17] The average (median) number of years in which treated firms have institutional shareholders is 4.7 (4.0) years. This understates institutions' holding period, because most treated firms are already treated when they join the sample (see Section 5.6), and some still remain treated at the end of the sample period.

[18] We run regression (1) separately with each of the three components of intangible investment as dependent variable in turn (not shown). Institutional ownership appears to promote all three components. The coefficients on *InstOwn* are 0.025 (t = 4.27) for investment in organisation capital, 0.001 (t = 3.03) for R&D, and 0.018 (t = 6.00) for change in intangible assets plus amortisation.

significant. We note that intangible investment is likely to be harder to assess by outsiders, and to be more vulnerable to financing constraints.

The higher level of investment associated with institutional ownership is similar in scale to the higher capital expenditure found by Boucly et al. (2011) after LBOs of French family firms.[19] In similar vein, several studies find that being listed promotes investment measured by capex, which they attribute to lower financial constraint (Gilje and Taillard, 2016; Mortal and Reisel, 2013; Phillips and Sertsios, 2017). However, we find that the impact of institutions is on intangible investment, with essentially no impact on capex as proxied by tangible investment. The lack of impact on tangible investment is therefore somewhat surprising. Tangible investment as we measure it (change in PPE plus depreciation) is a noisy estimate of capex, which is a cash flow item. It is possible that use of this measure as a proxy for capex could result in understatement of the impact of institutions on capital expenditure. Specifically, institutional ownership could plausibly give rise both to more additions to assets from acquisitions than in control companies, and also to more disposals of assets. Neither item is part of capex. If institutional ownership is associated with larger reductions in assets due to disposals than increases due to acquisitions, use of tangible investment would result in downward-biased estimate of the impact of institutions on capex. We do not have data on asset sales, so we cannot test this possibility, but we acknowledge that it exists.[20]

Turning to the control variables, the coefficient on *InvOpp* (median sales growth in the relevant industry and year) is positive as expected and is significant for tangible but not intangible investment. This result suggests that intangible investment is not affected by investment opportunities as measured. For intangible investment the coefficients on *Size* and *ROA* are negative and significant at the 1% level, and $Cash_{t-1}$ is positive, implying that smaller and less profitable firms with more cash holdings have higher intangible investment. *Age* also has a negative coefficient, that is marginally significant. For tangible investment, in contrast, the coefficient on *Size* is almost zero, *ROA* is positive and significant at the 1% level, and $Cash_{t-1}$ is negative and significant, as is *Dividend*.

The results for the control variables suggest that the determinants of company investment differ materially between intangible and tangible investment. Our inference is that

[19] The coefficient on their post-LBO year dummy × LBO dummy implies that capex per year is 24% higher after the LBO, compared with control firms that are not bought out (Boucly et al., p. 1350). They do not study intangible investment.

[20] Bernstein et al. (2019) measure investment by change in total assets plus depreciation. This is a much broader measure than our tangible investment, and it includes some of what we define as intangible investment. Using their measure, we obtain similar results to those in Table 4 for total investment.

intangible investment is relatively high in firms at an earlier stage of their development, i.e. when they are relatively small, less profitable, and more dependent on having cash available. In addition, intangible investment is not related to *InvOpp*, suggesting longer-term and firm-specific determinants of this type of investment. Our results for tangible investment are more as one might expect given previous evidence (e.g. Asker et al., 2015; Mortal and Reisel, 2013), since tangible investment is positively related to *InvOpp* and *ROA*. However, the negative coefficients on $Cash_{t-1}$ and *Dividend* are unexpected.

5.2 Responsiveness to investment opportunities

An alternative measure of investment efficiency is the responsiveness of investment to changes in opportunities. Arguably, use of this measure provides a more ambiguous test regarding alleviation of constraints, because higher responsiveness could be explained by lower agency costs rather than lower constraints. Nevertheless, we run the following regression to test whether institutional ownership affects firms' sensitivity of investment to opportunities:

$$Investment_{it} = \alpha + \beta InstOwn_{it} + \gamma(InvOpp \times InstOwn)_{it} + \delta InvOpp_{it} + X_{it} + \zeta_{it} + \varepsilon_{it} \quad (2)$$

The key explanatory variable is *InvOpp* × *InstOwn*. Its coefficient captures the difference in the sensitivities of investment to opportunities between treated and control firms. The other explanatory variables are the same as in Table 4.

Table 5 around here

Table 5 shows abbreviated results. The coefficient on the interaction term is positive and statistically significant at the 1% level when the dependent variable is total or intangible investment, but insignificant when the dependent variable is tangible investment. The results suggest that firms with institutional investors are more responsive to changes in investment opportunities than control firms. In addition, the impact of institutional ownership is on the responsiveness of intangible rather than tangible investment, as is the case for the impact of institutions on the level of investment.[21] This is despite the fact that, across all firm-years for treated and control firms, intangible investment is not significantly related to *InvOpp* (Table

[21] We run alternative specifications (not tabulated). Instead of the *InstOwn* dummy we add (i) firm fixed effects, as in Mortal and Reisel (2013), or (ii) firm fixed effects and the control variables interacted with *InstOwn*, as in Asker et al. (2015). The coefficients on *InvOpp* × *InstOwn* remain positive for total and intangible investment, but are only marginally significant.

4). The relation for responsiveness is less statistically significant than that for the level of investment, and we show later that the impact of institutions on responsiveness is mostly found in the case of firms under PE control.

5.3 Institutional ownership and external funding

A natural way in which institutional ownership might promote investment is by making it easier for investee companies to raise external funds. Institutional investors could reduce funding constraints through direct investment themselves, or by facilitating external investment or lending by other parties. For consistency with our evidence on investment, we run regressions with the same set of control variables:[22]

$$ExtFinance_{it} = \alpha + \beta InstOwn_{it} + \gamma InvOpp_{it} + X_{it} + \zeta_{it} + \varepsilon_{it} \quad (3)$$

The dependent variable is one of three measures of external equity or debt raised. In addition to the explanatory variables in regression (1), we include $\Delta Debt$ in regressions for equity finance, and $\Delta Equity$ in regressions for debt finance, in order to hold constant the effect of the alternative source of funds.

Table 6 around here

Panel A of Table 6 shows regressions for external equity. The coefficients on *InstOwn* are positive and highly significant, and their size is economically significant. For example, the coefficient when *ExtEquity* is dependent variable is 0.027 (t = 5.51), which implies that equity fundraising per year, ignoring repurchases, is on average 2.7 percentage points higher by firms with institutional ownership than by control firms. This is a large increment representing 117% of the mean *ExtEquity* for control firms of 2.3%. Regarding the control variables, equity financing is positively related to *InvOpp*, $Cash_{t-1}$ and *Dividend*, and negatively related to *ROA*, *Size*, *Age*, and $\Delta Debt$. These results imply that firms tend to raise equity in response to better investment opportunities, and that share issuance scaled by assets is greater for less profitable, smaller and younger firms, that have relatively high cash holdings that are being used to fund their growth. The positive coefficient on *Dividend* is a little surprising; perhaps dividend

[22] An approximately correct set of control variables, to proxy for determinants of decisions to raise external funds, would include free cash flow. This is because the most important determinant is the existence of a cash flow shortfall (e.g. DeAngelo, DeAngelo and Stulz, 2010, for share issues; Brav, 2009, for debt, using data for private firms). But we cannot include free cash flow, because cash flow is directly affected if institutions promote investment by reducing constraints. Firms that invest more because they are less constrained will have both lower free cash flows as a result, at least in the short term, and higher external funding.

payment makes it easier for private firms to raise new equity. The negative coefficient on Δ*Debt* implies that private firms raising equity tend to use some of the funds to repay debt. In unreported tests we confirm that this is the case.

The results in Panel B for measures of debt funding are similar with regard to the effect of institutional ownership. The coefficients on *InstOwn* are positive and significant at the 1% level. For example, the coefficient when *IncrDebt* is dependent variable implies that the annual change in debt (when positive) is 2.8 percentage points higher in treated firms. This represents an increase 24% compared with the mean *IncrDebt* for control firms of 11.8%. The increase in debt associated with institutional ownership is proportionately smaller than the increase in equity issuance. The coefficients on *InvOpp* are positive, while those on *ROA* and *Age* are negative and significant. These results are consistent with the those for external equity, suggesting that less profitable and younger firms raise debt as well as external equity to fund their business. $Leverage_{t-1}$ has a negative coefficient that is large and highly significant (t = 23.4) when Δ*Debt* is the dependent variable, implying that relatively high (low) lagged leverage is associated with a decrease (increase) in debt. $Cash_{t-1}$ and *Dividend* both have negative and significant coefficients, in contrast to their sign when external equity is the dependent variable. The results for these two variables suggest that firms with relatively high cash holdings, and which pay dividends, tend to raise external funds via equity rather than debt, and to use to their cash to repay debt.[23]

In summary, the evidence from Table 6 indicates that institutional ownership is associated with more equity and debt issuance than occurs in control firms. This supports the hypothesis that institutional shareholders promote firm investment via alleviation of funding constraints. The proportionate impact of institutional ownership is greater for external equity finance than for debt.

Table 7 around here

[23] With Δ*Debt* as dependent variable, our results for several control variables (*Size*, *ROA*, *Age*) are consistent with those in Brav (2009, Table 4), with leverage as dependent variable and firm fixed effects. Asker et al. (2015) and Bernstein et al. (2019) do not report results for their control variables. Boucly et al. (2011) do not include control variables.

To check whether external finance is indeed used to fund investment, we run the following regression separately for treated and control firms:[24]

$$Investment_{it} = \alpha + \beta ExtEquityFinance_{it} + \gamma DebtFinance_{it} + \delta InvOpp_{it} + X_{it} + \zeta_{it} + \varepsilon_{it} \quad (3)$$

Table 7 displays the results. The coefficients on all the measures of external equity and debt are positive and highly significant, both for treated and control firms. This evidence confirms that in years when firms raise external equity or debt, total investment is higher than when they do not do so. One unit of external funds is associated with investment that is higher by about 0.2 units, in the year the funds are raised. The coefficients are slightly larger and more significant for equity than for debt, and they are more significant for treated than control firms, indicating that the relation between investment and external funding is more reliable in firms with institutional ownership. Coefficients on lagged values of external finance (not shown) are also positive and significant; they suggest that an additional 0.05 to 0.10 units of investment arise in the year after external finance is raised.

The coefficients on $\Delta Debt$, though positive, are much smaller than the coefficients on *IncrDebt*. These results suggest that both increases in debt, and also some reductions, are associated with higher investment. This is consistent with the proceeds of some share issues being used both to fund investment and to repay debt.

5.4 Results by type of institutional owner

We now proceed to divide the sample into four groups according to whether the institutional party is PE or non-PE, and whether it has a controlling or minority stake. We separate the two broad types of investor because the impact of non-PE institutions as independent investors (as opposed to co-investors in PE-backed companies) could differ from that of PE-style investors. We distinguish between controlling and minority stakes because companies with minority stakes provide a relatively unambiguous test of whether institutional ownership results in alleviation of funding constraints. Owners with control are able to influence firms' decisions along several dimensions, including their business strategy and investment policy. Investment could be higher in firms controlled by institutions (as in LBOs) because the institutions tend to increase firms' investment for strategic reasons, and not because the firm is less constrained. Owners without control are less able to affect investment policy

[24] Boucly et al. (2011) and Cohn et al. (2020) do not take this step. They show that leverage and capex or growth increase after buyouts by PE funds, without establishing that it is the firms with increased leverage that tend to invest or grow more.

directly. Therefore, any effect of minority institutional ownership on investment will be more certainly ascribable to reduction in constraints: the firm chooses to have higher investment because it is less constrained, not because its investment policy has been directed by the institution. In addition, reduction in constraints is more likely to be the primary motive for holding a minority stake rather than a controlling stake.

Table 8 around here

Table 8 shows the subsample results in summary form for the four regressions presented in Tables 4 to 7. Starting in column 1 with total investment as dependent variable, the coefficients on *InstOwn* are positive and significant at the 1% level for all the groups except firms under non-PE control. The coefficients for the two groups with minority stakes are about twice as large as those for the group under PE control, indicating that there is more impact on investment arising from minority than controlling institutional ownership. The separate results for intangible and tangible investment, in columns 2 and 3, show that across each group all the impact is via intangible investment.[25]

Columns 4 to 6 show coefficients on *InstOwn* × *InvOpp*, with measures of investment as dependent variable. The coefficient is positive and significant at the 1% level for the PE control group for total and intangible investment, with similar values for the non-PE minority group but significant only at the 10% level. The coefficients are not significant for the other two groups, nor for any group when tangible investment is the dependent variable. The evidence therefore suggests that greater investment responsiveness arises mostly in firms under PE control. This could be because intensive oversight of investment decisions by PE investors with full control leads to more efficient decisions. Columns 7 and 8 confirm that, across each group, external funds raised are used in part to fund investment.

Turning to external finance in columns 9 and 10, institutional ownership in all the groups is associated with higher share issuance (*ExtEquity*), except for firms under non-PE control. The coefficients on *InstOwn* are largest for the groups with minority stakes. They are 0.043 ($t = 4.51$) for PE minority stakes, and 0.033 ($t = 2.47$) for non-PE minority stakes, both of which are larger the coefficient of 0.016 ($t = 2.16$) for the group under PE control. The results for minority stakes show that non-controlling institutional ownership is associated with higher

[25] The absence of impact of PE control on tangible investment appears to be inconsistent with the finding in Boucly et al. (2011) that LBOs are followed by increases in investment measured by capital expenditure. We discuss in Section 5.1 why our results for tangible investment might understate the impact of institutions on capex.

share issuance. They support the idea that a primary motivation for institutions which take a minority stake is to benefit the company by reducing funding constraints. In fact, the evidence suggests that institutions have substantially *more* impact on investment and share issuance when they take a minority rather than a controlling interest. To help explain this, we observe that some of the external equity raised is via issuance of non-voting shares, which does not increase institutions' holdings of ordinary shares.[26] Also, some of the external equity raised by firms with PE minority stakes is co-investment by non-PE institutions, which does not increase the stakes of PE funds.[27]

The results are different for debt. With *IncrDebt* as dependent variable, the coefficient on *InstOwn* for the group under PE control is 0.039 (t = 3.86). This is larger and more significant than the coefficient for the same group with *ExtEquity* as dependent variable. The coefficient on *InstOwn* is not significant for any other group, including firms with PE minority stakes. The result for firms under PE control is not surprising, given that many of the institutional owners in the PE control group are buyout funds (Table 2), and given previous evidence that buyout funds tend to take majority stakes in LBOs and that LBOs are followed by increases in debt (Boucly et al., 2011; Cohn et al., 2021). The more novel results—for firms with minority institutional stakes—indicate that minority stakes are linked to provision of external equity rather than debt. This finding applies to both PE and non-PE institutions, with the PE institutions consisting mostly of VC and growth equity funds.

The evidence in Table 8 points to the existence of two different models of institutional investment in established companies. One model is full control by PE-style funds, associated with higher levels of investment than in control firms, greater responsiveness of firm investment to opportunities, and higher external funding that is primarily via debt. Higher leverage could also be motivated by tax saving. This evidence suggests that PE-style investors that take control improve investment efficiency both by reducing funding constraints, and by controlling investment policy, making it more responsive. PE partners themselves report that having majority control is an aspect of PE firms' investment model that helps PE funds alleviate constraints (Bernstein et al., 2019, p. 1350).

[26] Overall, PE-style institutions own non-voting shares in 401 firms, and non-PE institutions in 265 firms. Our data are such that we cannot separate out funds raised via issues of ordinary and non-voting shares. Hence, we cannot quantify the proportion of external equity that is raised via non-voting shares.

[27] We produce an alternative version of Table 8 in which a firm is counted as under PE control simply if the PE party owns at least 20%; it no longer needs to be the largest party as well. This change shifts 176 firms from the PE minority to PE control group. But there is no appreciable effect on the results. Therefore, the results for firms with PE minority stakes are not driven by those with relatively large PE stakes.

The second investment model involves the holding of a minority equity stake, either by PE-style or non-PE institutions. A minority stake is associated with a greater impact on levels of investment than in the case of a controlling stake, with higher external funding that is via equity only. There is much less evidence of greater responsiveness of investment than for the case of PE control. This pattern is what we would expect if a key motive for an institution to take a minority position is reduction of funding constraints, especially on raising equity, and the institution does not control investment policy. The greater reduction in constraints associated with minority stakes could arise because institutions take such stakes in firms which would benefit most from easing of constraints. The fact that increased external funding is via equity rather than debt could be due to aversion to leverage on the part of controlling family owners with undiversified wealth.

Firms under the control of non-PE institutions do not fit either of the above models. They constitute a separate and somewhat puzzling category. For this group we find no impact of institutional ownership on either firm investment levels, or responsiveness, or external finance. Non-PE institutions which take control therefore appear to be passive or perhaps ineffective investors as regards firm investment and financing, despite having control.

5.5 Institutional ownership and measures of financial constraint

We now examine more directly whether institutional ownership reduces funding constraints, by using three measures of constraint that can be calculated for private companies. The first is the sensitivity of investment to cash flow; higher sensitivity implies greater constraint (Fazzari, Hubbard and Petersen, 1988). The rationale is that greater difficulty in raising external funds implies greater reliance on internally generated cash flow to fund investment. Second is the sensitivity of cash holdings to cash flows. Almeida, Campello and Weisbach (2004) present a model which predicts that constrained firms will tend to save cash out of cash flows, in order not to forgo future investment opportunities. Unconstrained firms need not save out of cash flows, in which case their cash holdings will be uncorrelated with cash flows. Finally we exploit a constraints index constructed exclusively for private firms by Schauer, Elsas and Breitkopf (2019). To construct their index, the authors conduct interviews with managers of private firms, and regress the self-reported level of constraint on financial variables. The higher the index score, the less constrained a firm is.

Table 9 around here

The results are presented in Table 9, separately for treated and control firms. We find that firms with institutional ownership are less constrained according to all three measures. Panel A shows that investment is positively and significantly related to cash flow in control firms, which is suggestive of financial constraint, but the relation is negative in treated firms, suggesting absence of constraint in treated firms. The difference persists when firm fixed effects are added, in which case the coefficient on *Cashflow* measures the within-firm relation between investment and cash flow.

In Panel B, changes in cash holdings are significantly related to cash flow at the 1% level in control firms, but not in treated firms. The difference in the coefficients on *Cashflow* is robust to the inclusion of firm fixed effects. These results again suggest that treated firms are less constrained. For this test we use a slightly different set of control variables, as shown in the table, following Almeida et al. (2006). Finally, in Panel C the mean of the constraints index of Schaur et al. (2019) is significantly higher ($p = 0.000$) for treated than control firms.

5.6 Transition to institutional ownership

It is possible that our results in Tables 4 to 8 suffer from endogeneity. They might arise because there is an unobserved variable that explains both higher investment and whether a firm has institutional ownership. For example, a firm might develop good unobservable investment opportunities, which result in both higher investment and the arrival of an institutional investor. In this case the institution does not necessarily promote firm investment. Our results might also arise because of reverse causality: higher investment by a firm might itself attract institutional investors.

The case in which an unobserved variable explains higher investment and institutional ownership requires the further assumption that institutions do not affect financial constraints; firms can fund their investment just as easily without institutional ownership. Our evidence casts doubt on this assumption. First, institutional ownership is associated with higher external finance, which helps to fund firms' investment. This implies that institutions provide external finance, or facilitate its provision, which enables investment to occur. We do not merely report a correlation between higher investment and institutional ownership, without evidence for how institutions causally affect investment. Second, our evidence on financial constraints suggests that matched firms, with similar characteristics to treated firms but lacking institutional ownership, are in fact more constrained.

In order to mitigate endogeneity concerns further, we test whether the transition to institutional ownership tends to precede increases in firm investment and external funding. The

transition group is compared with non-transitioning control firms which have zero institutional ownership during the sample period. A positive relation between firm investment and institutional ownership is more likely to be causal if institutions tend to arrive before or in the same year as a firm increases its investment and external funding, than if they arrive after investment and funding have already increased, without the benefit of institutions. In addition, focusing on the transition sample enables us to implement matching by the outcome variables before transition. Our tests are similar in nature to those of recent studies that examine outcomes after takeovers by PE investors (e.g. Boucly et al., 2011; Bernstein and Sheen, 2016; Eaton et al., 2020).

There are 245 firms which transition to having institutional shareholders during the sample period, and which have at least one year of data before and one after the year of transition. This is a much smaller sample than our full sample of treated firms eligible for analysis (2,388). We exclude 139 firms which transition but the institution disinvested before two years after the transition year. Short transitory investments are unlikely to reduce funding constraints. The remaining firms either already have institutional ownership at the start of the sample period, or they join the treated sample afterwards but we lack their pre-transition data, or they lack one year of data after transition because they transition in the final sample year. A possible reason for absence of data before transition is that 'small' companies can choose to submit abridged accounts to Companies House, which for example do not include revenue.[28]

Table 10 around here

Table 10 shows the transition matrix. The transitions are from 'untreated' to 'treated' only: we do not include transitions from one subtype of institution to another. The transition sample is similar to the full treated sample (Table 2) in terms of ownership type, with 38% of firms transitioning to PE control, 14% to non-PE control, 26% to PE minority and 21% to non-PE minority. Regarding pre-transition ownership, 56% of transition firms were controlled by a family or individual, and 30% by an operating company, i.e. they were subsidiaries before transition (none remains a subsidiary afterwards).

For the tests below, we match by industry and by the average values of total investment, *ExtEquity* and *IncrDebt* calculated over the two years before transition (years $t-2$ and $t-1$).

[28] Small means two of: revenue below £10.2m; assets below £5.1m; no more than 50 employees. See https://www.gov.uk/annual-accounts/microentities-small-and-dormant-companies

It is crucial that transition and control firms share similar values for these variables before transition, because we test for differences in their values between transition and control firms on and after transition.[29, 30] In each case the average value of a variable for a would-be matched firm must be within ±0.25 standard deviations of the average value for a given transition firm (the results are very similar using a stricter caliper of ±0.10 standard deviations). We find matches for 177 transition firms. We confirm that there are no statistically significant differences between treated and control groups in the pre-transition means of the variables (not tabulated but see Figure 2). Hence, any differences between transition and control firms on and after transition are likely to be due to the effects of institutional ownership.

Figure 2 around here

Using the sample of 354 transition and control firms, we test whether transition leads to higher investment and external finance. Figure 2 shows the means of the differences between transition and control firms for total investment, *ExtEquity* and *IncrDebt*, before and after the year of transition. The differences are negligible in years $t - 2$ and $t - 1$, by construction. They become mostly positive and material in years $t = 0$, 1 and 2. We test the effects of transition more formally through the following regressions:

$$Y_{it} = \alpha + \beta Post_{it} + \gamma(Transition_i \times Post_{it}) + \delta InvOpp_{it} + X_{it} + \zeta_{it} + \theta_i + \varepsilon_{it} \quad (6)$$

where Y is one of the variables measuring investment or external finance, *Transition* is a dummy variable equal to one for firms which transition, and *Post* is equal to one for years $t =$ 0, 1 and 2, for each transition firm and its matched control firm. The effect of transition is captured by the interaction term *Transition* × *Post*. The coefficient on this term measures the difference in the outcomes between transition and control firms for years $t = 0$, 1 and 2. Also included are firm fixed effects (θ), in order that we measure the within-firm changes after transition, *InvOpp*, the same set of control variables (X) as in regression (1), and industry-year fixed effects (ζ). Data are included for up to two years before the year of transition ($t = 0$) and up to two years after, if available.

[29] For our main panel regressions the matching is different—we cannot match on investment, *ExtEquity* or *IncrDebt* because we match as at the first year a firm is treated, as noted above. For the panel regressions, we match by variables which might affect investment, rather than by investment itself.
[30] Boucly et al. (2011) match by number of employees (to proxy for size), ROA, and industry. This is because the focus in their paper is on the effects of takeover by PE funds on size and ROA.

Table 11 around here

Table 11 shows abbreviated results. With total or intangible investment as dependent variable in Panel A, the coefficient on *Transition* × *Post* is positive and significant at the 5% level. The values are similar though less statistically significant than those in the equivalent panel regressions (Table 4). For example, with total investment as dependent variable, the coefficient is 0.034 ($t = 2.09$) on *Transition* × *Post* in Table 11, compared with 0.041 ($t = 6.40$) on *Transition* in Table 4. The coefficient is not significant when tangible investment is the dependent variable, as in the panel regressions. The results confirm that total and intangible investment increase, in relation to control firms, after firms first obtain institutional ownership. Panel B shows that firms become more sensitive to investment opportunities after transition. In these regressions the variable of interest is the triple interaction term *Transition* × *InvOpp* × *Post*, and we include *Transition* × *Post*, *InvOpp* × *Post* and *Transition* × *InvOpp* in the explanatory variables.[31] With total investment as dependent variable, the coefficient on *Transition* × *InvOpp* × *Post* is positive and significant at the 5% level. Again, the effect of institutions on responsiveness is concentrated on intangible investment.

Panel C shows results with measures of external equity as dependent variable. For all three measures, the coefficients on *Transition* × *Post* are positive and significant at the 1% level. With *ExtEquity* as dependent variable, the coefficient is 0.036 ($t = 3.04$). This compares with a coefficient on *Transition* of 0.027 ($t = 5.50$) in the equivalent panel regression (Table 6, Panel A). The effect on debt is weaker (Panel D). With *IncrDebt* as dependent variable, the coefficient on *Transition* × *Post* is 0.026 ($t = 1.54$), compared with 0.024 ($t = 4.64$) on *Transition* in Table 6, Panel B. For intangible investment, the coefficient is 0.074 ($t = 2.16$).

Overall, the evidence for firms that transition supports the evidence for the much larger sample in the main panel regressions. After firms obtain institutional ownership, they investment more, are more responsive to opportunities, and raise more external funds, especially equity.[32]

5.7 Further tests

[31] For an analogous panel difference-in-differences regression involving a triple interaction term, see Cohn, Nestoriak and Wardlaw (2021, p. 4845).

[32] If we extend the post-transition period to up to five years, the coefficients on investment, *ExtEquity* and *IncrDebt* are only slightly smaller, and remain nearly as significant (not tabulated). This suggests that the impact of institutional ownership is not restricted to the immediate period after the stake is first acquired.

(i) Continuous measures of institutional ownership. In our analyses so far, institutional ownership is captured simply by a dummy variable, or in Table 8 a distinction is made between controlling and minority stakes. A natural question is whether explanatory power improves using a continuous ownership variable. A continuous variable might capture better the potential for institutional impact, for example if institutions promote investment or external funding by creating a network of co-investing institutions. Such a network would be suggested by larger institutional ownership as a percentage of the shares, or a larger number of distinct institutional shareholders.

To investigate this possibility, we either replace or supplement *InstOwn* by (i) the proportion of ordinary shares owned by institutions, or (ii) the number of separate institutions owning ordinary shares (we do not have these data items for non-voting shares). We re-run the regressions in Tables 4 to 7, for the level and responsiveness of investment, and for external finance. To conserve space, these and the other results summarised in the current section are not tabulated. However, neither continuous variable has greater explanatory power than *InstOwn*, if it replaces *InstOwn*. When *InstOwn* is retained and the continuous variable is added, the coefficients on the latter are negative though not always statistically significant. This evidence suggests that the impact of institutional ownership on investment and external finance does not increase with the size of the stake, nor with the number of institutional shareholders. However, our estimates might be biased downwards because we lack the requisite data for non-voting shares.

(ii) Entropy balancing of matched firms. Our tables show results in which each treated firm is matched with a single control firm. As a robustness check, we run the panel regressions after performing entropy balancing on the sample of control firms. This technique assigns different weights to the same set of control firms, with a view to balancing the two distributions of each continuous control variable across the treated and control firms (Hainmueller, 2012). In our case the control variables are size, age and ROA. The weights are estimated by minimising the differences between the first three moments across each pair of distributions. The result is that the distributions become more similar for the two groups of firms, which arguably results closer matching. We conduct the rebalancing separately for firms within each SIC industry section. The results using entropy-balanced control firms are all qualitatively similar to those shown in previous sections, indicating that our results are robust to this method of matching.

(iii) Results by size of firm and excluding young firms. We argue that a benefit of institutional ownership is alleviation of funding constraints in established firms, that are not

startups dependent on external funding to survive. The full sample includes treated firms of various sizes and ages. Although all have positive sales for every firm-year they are in the sample, some of them are small or very young, and may be at the startup stage.

To examine whether our results are explained by possible startups, we split the firm-years into quartiles by total assets, and run the regressions in Tables 4 to 7 for each quartile. For investment and external finance (equity and debt), the coefficients on *InstOwn* are positive for all quartiles, and significant at the 5% level or better. Some of the coefficients are larger for the smaller quartiles, but they are not more significant. To conduct a formal test of whether the coefficients differ for quartile 1 (containing the smallest firms) compared with the rest of the sample, we run regressions for the full sample with the additional dummy variables *Quartile*1 and *Quartile*1 × *InstOwn*. The coefficients on the interaction term are 0.038 (t = 3.05) with total investment as dependent variable, 0.013 (t = 1.52) with *ExtEquity*, and −0.006 (t = −0.53) with *IncrDebt*. In summary, the tests show that our results hold for firms of all sizes. They are not restricted to the smallest firms, though the impact of institutions on investment is strongest for the smallest firms.

We also run the regressions excluding firm-years in which the firm's age is three years or younger. The exclusion of young firms makes little difference to the results. This shows that the results are not explained only by young firms.

(iv) Family firms only. The above results involve treated and control firms with various different types of owner, aside from any institutional ownership. For example, some of the firms with minority institutional ownership are widely held, or controlled by an operating company, and they might be less financially constrained than family firms. In addition, the incidence of ownership classification errors in FAME is lowest for shareholders who are individuals, from whom we identify family control. To obtain a homogeneous and possibly more reliable sample in terms of controlling ownership, we restrict the sample to firms with minority institutional ownership that are controlled by a family, and to control firms that are all also controlled by a family. The results on the effects of minority ownership are similar to those for the full sample of firms with minority stakes, summarised in Table 8. Therefore, our results for minority stakes are not somehow due to the inclusion in the full sample of firms with various non-family shareholders.

6.0 Conclusion

Our evidence supports the hypothesis that promotion of company investment by alleviation of constraints is an important benefit of institutional ownership in established private companies. We find that the impact of institutions is on investment in intangible rather than tangible assets. The positive effects on company investment and external fundraising are found for both PE-style and non-PE ownership, and for both controlling and minority shareholdings. In fact the evidence is stronger for companies in which institutional investors own minority stakes. This supports the idea that a primary motive for investing without taking control is to facilitate provision of external funds. In cases of minority institutional ownership, most of the increased external funding is via equity (including non-voting shares) rather than debt. Promotion of equity investment, along with minority ownership, is a different model of institutional involvement than the more familiar case of an LBO, in which the PE fund takes control and promotes external funding mainly in the form of debt.

Beyond the important areas of LBOs, and of VC backing for startup companies, comparatively little is known about the involvement of institutions in private companies. This paper focuses on company investment and external financing. Other aspects to explore include the effects on company performance, governance, and financial policies such as leverage and payout. A further interesting question is how minority investment in private companies by institutions comes about, i.e. how institutions select companies to invest in, and companies decide to admit institutional shareholders.

Appendix 1: identifying ownership using FAME data

Missing or inaccurate data. FAME's ownership data has improved following a major upgrade in 2016. The online interface now provides historic data for ten years, rather than the most recent year only, and it provides lists of shareholders that are complete, rather than complete only if there are up to 25 shareholders.[33] However, ownership data are completely missing for some firm-years, and in other cases data about certain shareholders are missing or recorded into the wrong year, such that the total number of shares does not add up to around 100%.[34] Around 20% of firms have at least one year's ownership missing due to one or other of these reasons. We only retain firm-years for which the shareholdings shown sum to between 98% and 102%, otherwise we treat the data for the year as missing. To avoid discarding all these firms, we impute missing values of shareholdings as follows. For potential control firms, we simply use the previous year's holding, if available. For treated firms (with institutional ownership), we use the previous year's holding only if this is also the same as the holding in the following year. Otherwise, we hand-collect missing data for treated firms from Confirmation Statements, to ensure we have accurate data for treated firms.

Identifying ultimate owners. We identify the ultimate owners of shareholders that are operating or holding companies with a combined stake of at least 20%, unless one shareholder is an operating company with a direct holding of more than 50%—in which case the investee company is identified as a subsidiary without further ado. A shareholding company is classed as a holding company if it has zero assets, sales and employees. The indirect stake of an ultimate owner is defined by the minimum stake in the ownership chain. For example, if operating company A owns 20% of holding company B, which owns 50% of investee company C, A is an ultimate owner that indirectly owns 20% of C. We sum the direct and indirect stakes of each ultimate owner to arrive at their total stake. A company is identified as a subsidiary if the indirect, as well as direct, holdings of a given operating company exceed 50%.

We do not check the ownership of foreign-registered holding companies, because FAME does not include data on foreign companies. A company more than 50% owned by a foreign holding company is excluded from the sample eligible for our analysis (see Table 1).

[33] Historic data were previously available on DVD. To confirm the reliability of the online data, we manually checked the shareholdings in FAME of the 100 largest companies in our sample against the holdings in the Confirmation Statements, for our most recent sample year (2019).

[34] In FAME the shareholdings shown should always sum to 100% of the number of shares given for the firm-year. This is because, if a shareholding exists but is not listed in FAME, the relevant shares are also excluded from the total, which will therefore be less than the number of shares actually in issue. Our checks against Confirmation Statements suggest that it is rare for FAME's total to be less than the number of shares in issue according to the Statement.

But a company with a stake owned by a foreign holding company of up to 50% is retained, and the stake is counted as belonging to an operating company.

Identifying institutional investors. We start with all shareholders (in companies eligible for our analysis) that are categorised by FAME under its headings 'bank', 'hedge fund', 'insurance company', 'private equity', 'venture capital', and the rather mixed group 'mutual fund and pension fund, nominee, trust and trustees'. In addition, we include any shareholder whose name contains 'LP', 'Limited Partner' or 'VCT', regardless of FAME's classification, because the shareholder is likely to be a PE fund. Since the 'mutual fund...' group includes shareholders other than institutional investors, we only keep those that have certain key words in their names. For example, a potential pension fund is identified by the key words 'pension', 'retirement', 'RERT' or 'employee(s)'. To ensure that minority institutional ownership always involves a non-negligible stake, and to limit the task of checking shareholders, we check and classify institutional holdings of a minimum of two per cent of a firm's ordinary shares, plus any holdings of non-voting shares.

We check by hand the identity and type of all investors (over 3,000) that could be institutions given FAME's classification as described above. We search for each institution's name in Pitchbook, and use the primary investor type indicated by Pitchbook. If the name is not in Pitchbook, we search in CapitalIQ and Eikon. If that fails, we examine websites and media reports, and refer to the list of limited partners and general partners provided by the British Private Equity & Venture Capital Association (BVCA) and the European Private Equity & Venture Capital Association (EVCA). If we fail to establish an investor's identity from any of these sources, we exclude the investor and the companies it invests in from the sample eligible for analysis. The checks by hand are necessary; for example, many shareholders in FAME's 'mutual fund...' group turn out not to be institutions, but rather family or individual trusts, or (holding companies of) operating companies.

Our classification of institutions as either PE or non-PE is based on manual checks using the above sources. In most cases the institution's type is clear, but sometimes judgement is called for. For example, a few large banks have subsidiaries that conduct PE investment (for example, Barclays plc owns Barclays Unquoted Investment Ltd; Lloyds Banking Group plc owns Lloyds Development Capital Ltd). In these cases we class a shareholding held by the parent bank as non-PE (the investor is the bank), whereas a holding of the PE subsidiary is classed as PE. Similarly, if an asset manager has a separate PE operation, we follow the same classification rule as for a bank. If it has no separate PE operation, we judge its type by whether

it is registered as a limited or a general partner with BVCA or EVCA, or we rely on its primary type as indicated by Pitchbook.

We include institutional ownership of non-voting shares. This is important because VC and mutual funds frequently invest via such shares, especially convertible preference shares (e.g. Chernenko et al., 2021). FAME only records the owners of non-voting shares for the most recent year available, which is 2019. For the previous nine sample years we hand-collect whether non-voting shares have institutional owners from Confirmation Statements.

Identifying family ownership. To measure a family's holding, we sum the stakes held by family members and family trusts, on the assumption that shareholders in the same family co-ordinate their voting and monitoring. We use the surnames of shareholding individuals to determine whether they belong to the same family. A shareholding in joint names is counted as held by the first-named person. A shareholder is counted as a family trust only if its name includes the words 'trust' or 'trustee', and the relevant family's surname. If a trust represents more than one family, we split the shares it holds equally among the different families.

Appendix 2: definitions of financial variables

Name	Symbol	Definition
Total investment	n.a.	Intangible + tangible investment
Investment in intangible assets	n.a.	Sum of: (i) R&D expense, (ii) 30% of sales, general and administrative (SG&A) expenses, (iii) change in intangible assets from financial year $t-1$ to t, plus amortisation, all scaled by total assets at the start of year t (= $Assets_{t-1}$).
Investment in tangible assets	n.a.	Change in property, plant and equipment (PPE) from year $t-1$ to t, plus depreciation, scaled by $Assets_{t-1}$.
Presence of institutional ownership	*InstOwn*	Dummy variable set to one if the firm has institutional ownership in a given year, and zero otherwise
Investment opportunities	*InvOpp*	Median sales growth rate in the firm's industry section of the UK SIC system for the calendar year of financial year t. If the firm's year-end is between 1 January and 30 June, we use industry sales growth for the previous calendar year.
Size	*Size*	Ln($Assets_t$)
Lagged leverage	$Leverage_{t-1}$	(Short-term + long-term debt)$_{t-1}$/$Assets_{t-1}$
Return on assets	*ROA*	Operating profit$_t$/$Assets_{t-1}$
Age	*Age*	Ln(firm's age in years$_t$)
Lagged cash holdings	$Cash_{t-1}$	Cash holdings$_{t-1}$/$Assets_{t-1}$
Change in working capital	$\Delta WorkingCap$	Change in current assets – current liabilities from year $t-1$ to year t, scaled by $Assets_{t-1}$
Change in short-term debt	$\Delta ShortDebt$	Change in short-term debt from year $t-1$ to year t, scaled by $Assets_{t-1}$
External equity issuance	*ExtEquity*	Change in share capital + share premium account, scaled by $Assets_{t-1}$, with negative values replaced by zero
Large external equity issuance	*LargeExtEquity*	Dummy variable set to 1 if *ExtEquity* > 10%, and zero otherwise
Change in external equity	$\Delta ExtEquity$	Change in share capital + share premium account, scaled by $Assets_{t-1}$
Increase in debt	*IncrDebt*	Change in debt scaled by $Assets_{t-1}$, with negative values replaced by zero
Large increase in debt	*LargeIncrDebt*	Dummy variable set to 1 if *IncrDebt* > 10%, and zero otherwise
Change in debt	$\Delta Debt$	Change in debt scaled by $Assets_{t-1}$

Figure 1
Investment and external finance across treated and control companies

The figures show equally weighted mean values for total investment, external equity (*ExtEquity*) and increases in debt (*IncrDebt*) across 1,852 companies with institutional ownership and 1,852 control companies. The values are proportions of $Assets_{t-1}$.

Figure 1a: total investment

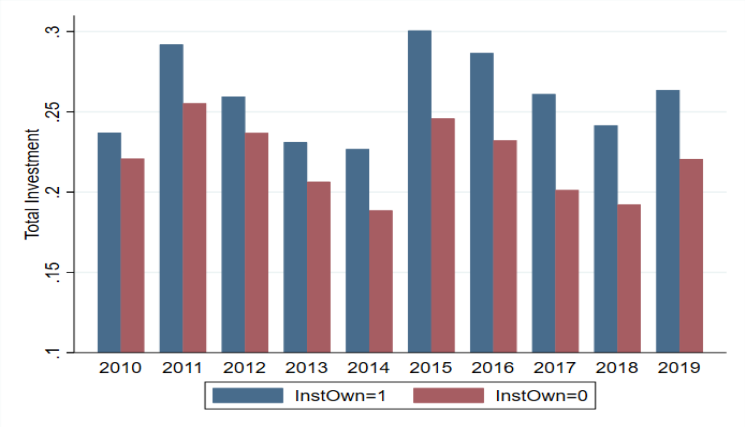

Figure 1a: external equity

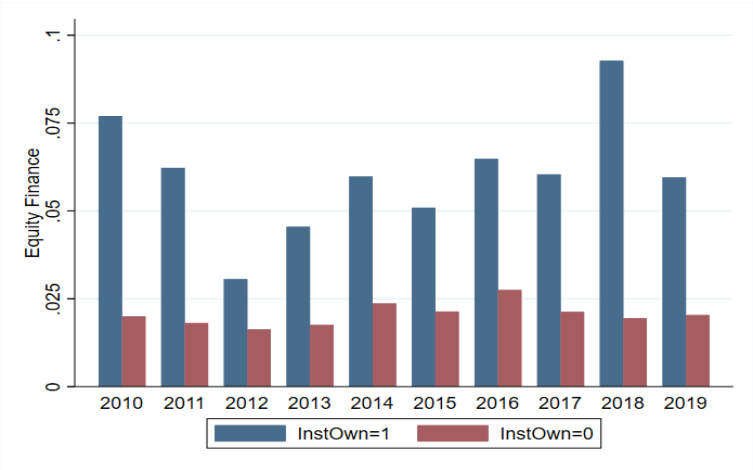

Figure 1a: increase in debt

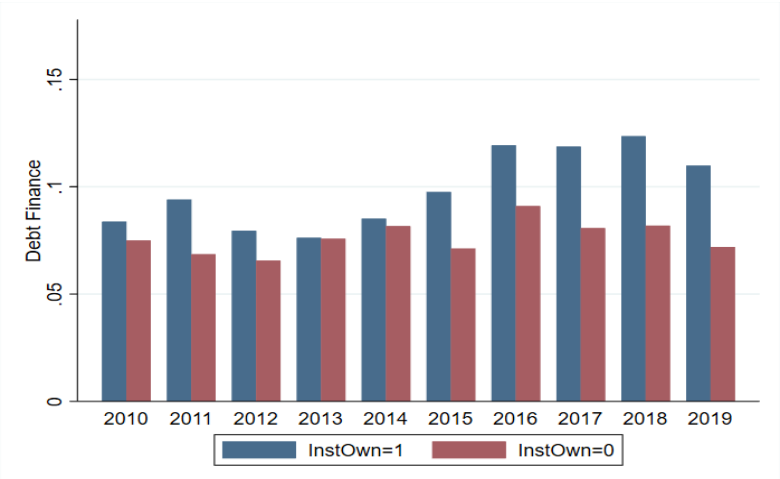

Figure 2
Investment and external finance before and after transition to institutional ownership

The figures show the mean differences between 177 transition and 177 control firms in their values for total investment, external equity (*ExtEquity*) and increases in debt (*IncrDebt*) over five years centred on the year of transition (year 0). This is the year a given transition firm first records institutional ownership. The values are proportions of $Assets_{t-1}$. The lines show ± one standard deviation around the means, i.e. the heights of the bars.

Figure 2a: total investment

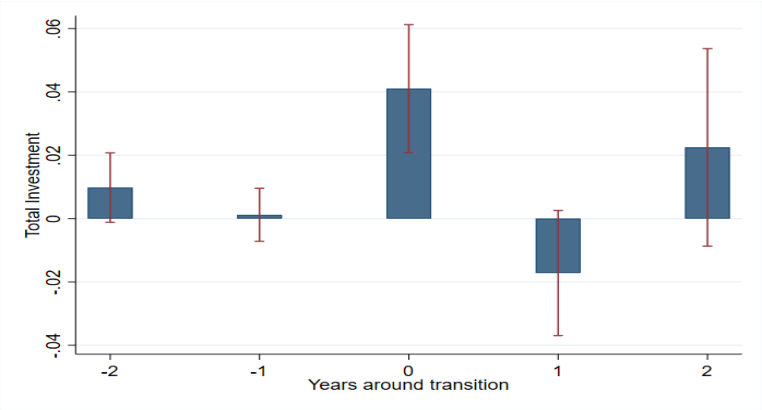

Figure 2b: external equity

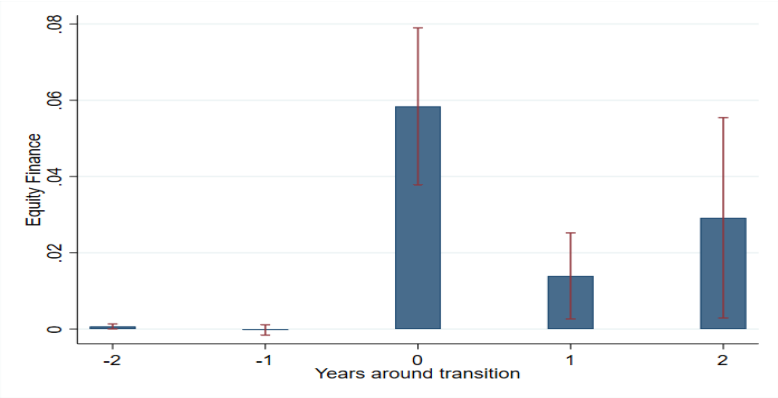

Figure 2c: increase in debt

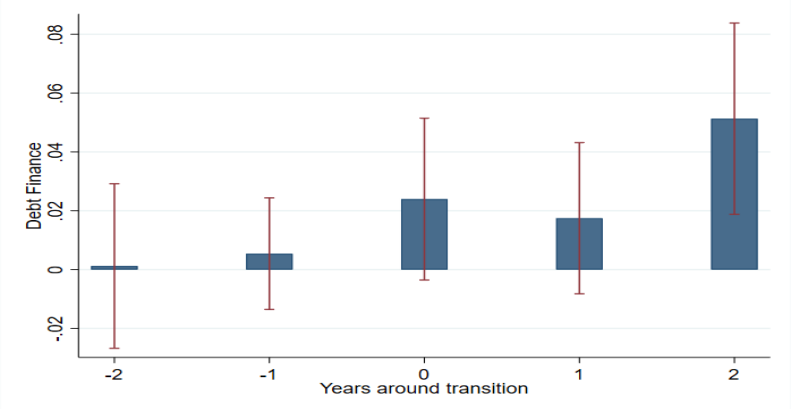

Table 1
Classification of established private companies by type of ownership

The sample in this table consists of all UK-registered non-financial private operating companies with (i) positive revenue in every firm-year available during the sample period of 2009-2019, and (ii) revenue of at least £1m in at least one firm-year. Section 3.1 and Appendix 1 explain our process for identifying and classifying shareholders. A controlling party is defined as one which owns at least 20% of the ordinary shares, and is the largest party. In the event of a tie, the firm is classified following the order: institutional control, corporate control, and family or other control. A company with no controlling party is classed as widely held. A shareholder party is either a single owner or a grouping of shareholders of the same type, e.g. members of the same family. A company more than 50% owned by an operating company is classed as a subsidiary. Companies that transition from one ownership type to another during the sample period are included under each type, and so they are counted more than once in the totals by type, which exceed the totals of unique companies. The average shareholding of the largest party is calculated over firm-years.

Type of ownership	*N* comp-anies by type	As prop'n of comp-anies by type (%)	Av. holding of largest party (%)	Eligible for our sample?
Stand-alone company controlled by:				
Family or individual	34,869	86.1	79.2	Y
PE party	1,274	3.2	62.7	Y
Non-PE institutional party	286	0.7	63.2	Y
Operating company	1,877	4.6	44.6	Y
Government or not-for-profit institute	436	1.1	94.8	Y
Nominee account(s)	720	1.8	83.9	Y
Widely held	1,034	2.6	11.6	Y
Total stand-alone companies by type	40,496	100.0		Y
Total unique stand-alone companies	39,304			Y
Subsidiary or owners not identified:				
Subsidiary	47,919		98.7	N
Owned by domestic holding co., owners missing	3,162		98.4	N
Owned by foreign holding co., owners not traceable	9,002		97.7	N
Total subsidiaries and owners not identified, by type	60,083			N
Total unique subsidiaries and owners not identified	58,316			N
Grand total of companies by type	100,579			
Grand total of unique companies	97,620			

Table 2
Classification of companies by type of institutional ownership

This table shows the classification of all companies with institutional ownership in at least one firm-year. The holdings of ordinary shares in a given company are grouped by type and subtype of institution, to form separate shareholder parties, and grouped by status of the holding (controlling or minority stake). The classification by the four main types of ownership is as follows. (i) PE control = PE-style funds are the largest party and own at least 20% of the shares. (ii) Non-PE control = non-PE institutions are the largest party and own at least 20%. (iii) PE minority stake = PE funds are not the largest party, or own less than 20%. (iv) Non-PE minority stake = non-PE institutions are not the largest party, or own less than 20%, *and* there is no PE ownership. A holding of non-voting shares only is counted as a minority stake. The above four ownership types are mutually exclusive by firm-year. Holdings of non-voting shares are not included in calculating the average of minority stakes held by a given party. Companies that transition from one ownership type to another are included separately under each type, and are counted more than once, as in Table 1. This means that the total of companies by type exceeds the number of unique companies with institutional ownership.

Type of institutional ownership	*N* companies by type	By type as prop'n of total by type (%)	By subtype as prop'n of total by type (%)	Average holding of largest party (%)
PE control	1,274	48.5		63.0
Buyout fund			*15.8*	*68.6*
Growth equity fund			*4.1*	*56.9*
Venture capital fund			*12.9*	*58.0*
Unclassified			*15.7*	*60.7*
Non-PE institutional control	286	10.9		61.8
Bank			*1.4*	*58.9*
Insurance company or pension fund			*0.8*	*63.0*
Investment fund			*8.4*	*61.0*
Financial consulting firm			*0.3*	*77.4*
PE minority stake	710	27.0		14.7
Buyout fund			*1.6*	*14.2*
Growth equity fund			*4.1*	*19.3*
Venture capital fund			*12.5*	*13.0*
Unclassified			*8.9*	*11.0*
Non-PE institutional minority stake	359	13.7		12.2
Bank			*3.9*	*12.4*
Insurance company or pension fund			*2.5*	*10.3*
Investment fund			*6.8*	*11.2*
Financial consulting firm			*0.6*	*8.1*
Total of companies by type	2,629	100.0	*100.0*	
Total of unique companies	2,388			

Table 3
Summary statistics and differences in means

The sample for our panel regressions (Tables 4 to 8) consists of 1,852 unique treated companies (i.e. they have institutional ownership), and 1,852 matched control companies. The sample period for financial data is 2010-19 (we lose 2009 because some variables require the year before to calculate). Our matching process is explained in Section 4. The variables are defined in Appendix 2. The values for the variables are proportions of $Assets_{t-1}$ except for *Size* (= $Assets_t$), *InvOpp* (= median sales growth in the firm's industry) and *Age* (the firm's age). In the regressions *Size* and *Age* are measured by their natural logarithms, but in this table they are shown before taking logs. Panel A shows summary statistics for treated and control firms together. Panel B shows differences in means for each variable between treated and control firms, as at the year of matching only. Values are shown after winsorization at the 1st and 99th percentiles. *** (**) (*) = significant at the 1% (5%) (10%) level.

Panel A: Summary statistics	Mean	Std. dev.	Min	Median	Max	*N* firm-years
Total investment	0.234	0.249	-0.049	0.159	1.449	16,821
Inv in intangibles	0.198	0.240	-0.002	0.123	1.601	16,821
Inv in tangibles	0.037	0.064	-0.093	0.019	0.432	18,941
Size (£m)	35.131	87.825	0.081	12.575	1183.775	18,941
InvOpp	0.059	0.057	-0.653	0.058	5.290	18,941
$Leverage_{t-1}$	0.338	0.405	-0.954	0.238	1.532	18,941
ROA	0.092	0.191	-0.561	0.093	0.995	18,941
Age (years)	11.862	13.316	1.000	8.000	94.000	18,941
$Cash_{t-1}$	0.148	0.173	0.000	0.083	0.844	18,557
Dividend	0.009	0.032	0.000	0.000	0.262	18,941
ExtEquity	0.036	0.226	0.000	0.000	3.150	18,941
LargeExtEquity	0.050	0.218	0.000	0.000	1.000	18,941
Δ*Equity*	0.030	0.209	-0.574	0.000	2.418	18,941
IncrDebt	0.092	0.290	0.000	0.000	2.686	18,941
LargeIncrDebt	0.178	0.382	0.000	0.000	1.000	18,941
Δ*Debt*	-0.039	0.464	-2.312	0.000	1.695	18,941

Table 3 cont.

Panel B: Differences in means	Mean for treated companies	Mean for control companies	Difference	*p*-value of difference
Total investment	0.270	0.208	0.061	0.000***
Inv in intangibles	0.237	0.171	0.066	0.000***
Inv in tangibles	0.037	0.037	0.000	0.964
Size (£m)	36.129	35.444	0.685	0.814
InvOpp	0.059	0.058	0.000	0.783
$Leverage_{t-1}$	0.403	0.280	0.123	0.000***
ROA	0.072	0.089	-0.017	0.005***
Age (years)	8.015	8.011	0.004	0.991
$Cash_{t-1}$	0.143	0.140	0.002	0.696
Dividend	0.004	0.010	-0.006	0.000***
ExtEquity	0.069	0.023	0.046	0.000***
LargeExtEquity	0.093	0.030	0.064	0.000***
Δ*Equity*	0.058	0.018	0.040	0.000***
IncrDebt	0.165	0.118	0.048	0.000***
LargeIncrDebt	0.265	0.184	0.080	0.000***
Δ*Debt*	0.021	0.007	0.014	0.401
N companies	1,852	1,852		

Table 4
Institutional ownership and investment

Regression results showing the relation between measures of company investment and *InstOwn* (= 1 if the company has institutional ownership in the given firm-year). The variables are defined in Appendix 2. Robust standard errors clustered at firm level are reported in parentheses. *** (**) (*) = significant at the 1% (5%) (10%) level.

	Total investment	Investment in intangible assets	Investment in tangible assets
	(1)	(2)	(3)
InstOwn	**0.041*** **	**0.041*** **	**0.002**
	(6.40)	**(6.63)**	**(1.06)**
InvOpp	0.139**	0.093	0.023***
	(2.18)	(1.20)	(3.82)
Size	-0.046***	-0.048***	0.000
	(-13.85)	(-15.03)	(0.38)
$Leverage_{t-1}$	-0.000	0.002	-0.003
	(-0.05)	(0.18)	(-1.42)
ROA	-0.041	-0.098***	0.036***
	(-1.59)	(-3.88)	(6.27)
Age	-0.007*	-0.007*	-0.001
	(-1.95)	(-1.92)	(-0.79)
$Cash_{t-1}$	0.051**	0.073***	-0.021***
	(2.29)	(3.39)	(-5.78)
Dividend	-0.045	0.060	-0.081***
	(-0.38)	(0.48)	(-5.27)
Constant	0.662***	0.648***	0.035***
	(18.89)	(19.23)	(3.94)
Industry-year fixed effects	Y	Y	Y
N firm-years	16,438	16,438	18,509
R^2	0.142	0.177	0.035

Table 5
Institutional ownership and responsiveness to investment opportunities

Regression results showing whether the relation between measures of investment and *InvOpp*, a proxy for investment opportunities, differs between companies with institutional ownership and control companies. Control variables are as in Table 4 and are omitted to conserve space. The variables are defined in Appendix 2. Robust standard errors clustered at firm level are reported in parentheses. *** (**) (*) = significant at the 1% (5%) (10%) level.

	Total investment	Intangible investment	Tangible investment
	(1)	(2)	(3)
InstOwn	0.024***	0.023***	0.002
	(2.71)	(2.71)	(0.84)
InvOpp* × *InstOwn	**0.302*** **	**0.307*** **	**0.000**
	(2.89)	**(2.90)**	**(0.01)**
InvOpp	0.099**	0.053	0.023***
	(2.22)	(0.91)	(3.96)
Control variables	Y	Y	Y
Industry-year fixed effects	Y	Y	Y
N firm-years	16,438	16,438	18,509
R^2	0.142	0.178	0.035

Table 6
Institutional ownership and external finance

Regression results showing the relation between measures of external funding and *InstOwn* (= 1 if the company has institutional ownership in the given firm-year). The variables are defined in Appendix 2. Panel A shows results for external equity and Panel B for debt. Robust standard errors clustered at firm level are reported in parentheses. *** (**) (*) = significant at the 1% (5%) (10%) level.

Panel A: external equity	*ExtEquity*	*LargeExtEquity*	Δ*ExtEquity*
	(1)	(2)	(3)
InstOwn	**0.027*** **	**0.037*** **	**0.023*** **
	(5.51)	**(8.08)**	**(5.07)**
InvOpp	0.107***	0.180***	0.100***
	(2.63)	(4.34)	(2.73)
Size	-0.004**	-0.001	-0.004**
	(-2.35)	(-0.84)	(-2.27)
Leverage	-0.002	-0.013*	-0.000
	(-0.23)	(-1.82)	(-0.06)
ROA	-0.327***	-0.270***	-0.302***
	(-9.72)	(-13.09)	(-10.27)
Age	-0.011***	-0.013***	-0.010***
	(-5.22)	(-5.86)	(-5.19)
Cash	0.055***	0.034**	0.051***
	(3.57)	(2.50)	(3.63)
Dividend	0.148***	0.015	0.126***
	(4.04)	(0.41)	(3.56)
Δ*Debt*	-0.026***	-0.017***	-0.023***
	(-2.67)	(-2.69)	(-2.78)
Constant	0.105***	0.090***	0.090***
	(4.79)	(4.81)	(4.74)
Industry-year fixed effects	Y	Y	Y
N firm-years	18,509	18,509	18,509
R^2	0.093	0.077	0.092

Table 6 cont.

Panel B: debt	*IncrDebt*	*LargeIncrDebt*	Δ*Debt*
	(1)	(2)	(3)
InstOwn	**0.028*** **	**0.041*** **	**0.033*** **
	(4.64)	**(5.62)**	**(4.91)**
InvOpp	0.074***	0.175***	0.057*
	(2.70)	(4.71)	(1.83)
Size	0.001	0.007**	0.020***
	(0.50)	(2.40)	(6.94)
$Leverage_{t-1}$	-0.118***	-0.024*	-0.384***
	(-8.50)	(-1.94)	(-23.36)
ROA	-0.141***	-0.176***	-0.091***
	(-5.03)	(-7.81)	(-2.65)
Age	-0.034***	-0.031***	-0.021***
	(-10.63)	(-7.49)	(-5.84)
$Cash_{t-1}$	-0.088***	-0.176***	-0.101***
	(-3.95)	(-8.76)	(-4.78)
Dividend	-0.281***	-0.159*	-0.429***
	(-4.86)	(-1.76)	(-7.56)
Δ*Equity*	0.068**	-0.006	-0.081***
	(2.49)	(-0.40)	(-2.80)
Constant	0.200***	0.198***	-0.047
	(7.55)	(6.18)	(-1.37)
Industry-year fixed effects	Y	Y	Y
N firm-years	18,509	18,509	18,509
R^2	0.063	0.049	0.361

Table 7
Investment and external finance

Regression results showing the relation between investment and external finance in the given firm-year, separately for treated and control firms. The dependent variable is total investment. Control variables are as in Table 4 and are omitted to conserve space. The variables are defined in Appendix 2. Robust standard errors clustered at firm level are in parentheses. *** (**) (*) = significant at the 1% (5%) (10%) level.

Sample firms:	Treated	Control	Treated	Control	Treated	Control
	(1)	(2)	(3)	(4)	(5)	(6)
ExtEquity	0.213***	0.219***				
	(11.11)	(5.05)				
IncrDebt	0.188***	0.183***				
	(10.67)	(8.22)				
LargeExtEquity			0.177***	0.190***		
			(9.23)	(6.76)		
LargeIncrDebt			0.125***	0.094***		
			(12.63)	(9.32)		
Δ*Equity*					0.243***	0.250***
					(12.45)	(5.69)
Δ*Debt*					0.070***	0.064***
					(6.69)	(3.40)
InvOpp	0.338***	0.049*	0.378***	0.021	0.362***	0.055*
	(2.92)	(1.66)	(3.40)	(0.60)	(3.03)	(1.83)
Control variables	Y	Y	Y	Y	Y	Y
Industry-year FE	Y	Y	Y	Y	Y	Y
N firm-years	7,813	8,653	7,813	8,653	7,813	8,653
R^2	0.265	0.169	0.231	0.147	0.232	0.137

Table 8
Results by type of institutional ownership

Summarised results for the regressions in Tables 4 to 7, for subsamples of treated and control companies sorted by the four main types of institutional ownership in the treated companies (Table 2). In columns 9 and 10 the samples consist of treated companies only. Control variables and industry-year fixed effects are included in all cases. Robust standard errors clustered at firm level are in parentheses. *** (**) (*) = significant at the 1% (5%) (10%) level.

Dependent variable:	Total investment	Intangible investment	Tangible investment	Total investment	Intangible investment	Tangible investment	*ExtEquity*	*IncrDebt*	Total investment	Total investment
Explanatory variable:	*InstOwn*	*InstOwn*	*InstOwn*	*InstOwn* × *InvOpp*	*InstOwn* × *InvOpp*	*InstOwn* × *InvOpp*	*InstOwn*	*InstOwn*	*ExtEquity*	*IncrDebt*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
PE control	0.026***	0.027***	-0.000	0.418***	0.453***	-0.025	0.016**	0.039***	0.161***	0.208***
	(2.86)	(3.14)	(-0.08)	(2.93)	(3.29)	(-0.82)	(2.16)	(3.86)	(6.69)	(8.16)
Non-PE inst. control	0.007	0.003	0.003	-0.303	-0.415	0.067	0.016	0.023	0.212***	0.207***
	(0.34)	(0.15)	(0.61)	(-0.69)	(-0.96)	(0.60)	(1.04)	(1.25)	(3.71)	(4.63)
PE minority stake	0.059***	0.060***	-0.001	0.149	0.209	-0.058	0.043***	-0.004	0.222***	0.144***
	(4.81)	(5.02)	(-0.22)	(0.67)	(0.95)	(-1.19)	(4.51)	(-0.35)	(7.87)	(4.33)
Non-PE inst. minority	0.045***	0.043***	0.006	0.428*	0.402*	0.053	0.033**	-0.012	0.201***	0.200***
	(3.14)	(3.10)	(1.39)	(1.75)	(1.71)	(0.79)	(2.47)	(-1.00)	(5.81)	(5.33)

Table 9
Institutional ownership and financial constraints

This table presents the results of three tests of whether treated firms are more financially constrained than control firms. Panel A compares the cash flow sensitivity of investment for the two groups. Panel B compares the cash flow sensitivity of cash. Since the dependent variables is cash holdings rather than investment or external finance as in our other tables, we include results for the control variables. Panel C shows a difference-in-means test for scores for an index of financial constraints, explained in Section 5.5. All variables are defined in Appendix 2. Robust standard errors clustered at firm level are in brackets. *** (**) (*) = significant at the 1% (5%) (10%) level.

Panel A: cash flow sensitivity of investment	Dependent variable: total investment			
	Treated firms	Control firms	Treated firms	Control firms
	(1)	(2)	(3)	(4)
Cashflow	**-0.056****	**0.089*****	**-0.012**	**0.065*****
	(-2.36)	**(2.64)**	**(-0.64)**	**(2.66)**
Control variables	Y	Y	Y	Y
Firm fixed effects	N	N	Y	Y
Industry-year fixed effects	Y	Y	Y	Y
N firm-years	7,813	8,653	7,448	8,364
R^2	0.175	0.112	0.533	0.580

Table 9 cont.

Panel B: cash flow sensitivity of cash	Dependent variable: cash holdings			
	Treated firms	Control firms	Treated firms	Control firms
	(1)	(2)	(3)	(4)
Cashflow	**-0.177**	**1.020*** **	**-0.180**	**0.870*** **
	(-0.62)	**(5.39)**	**(-0.64)**	**(4.66)**
InvOpp	0.130	0.020	0.313**	0.022
	(1.20)	(0.70)	(2.24)	(0.54)
Total investment	0.256***	0.187*	0.320***	0.268
	(4.22)	(1.67)	(3.83)	(1.42)
Δ*WorkingCap*	0.255	1.060***	0.268	1.005***
	(1.14)	(10.12)	(1.20)	(8.56)
Δ*ShortDebt*	0.350**	0.604***	0.357**	0.611***
	(2.00)	(44.15)	(2.10)	(40.35)
Size	0.009**	-0.018**	0.101***	-0.087*
	(2.10)	(-2.12)	(3.73)	(-1.82)
$Leverage_{t-1}$	0.040	0.033	0.062	0.097
	(1.21)	(0.63)	(1.36)	(1.00)
ROA	0.184	-1.059***	0.347	-0.712***
	(0.66)	(-4.86)	(1.11)	(-3.27)
Age	0.003	-0.008	-0.073**	-0.006
	(0.37)	(-1.00)	(-2.33)	(-0.14)
Dividend	0.012	-0.132	-0.164	-0.248
	(0.10)	(-0.87)	(-0.98)	(-1.41)
Constant	-0.146***	0.183*	-0.904***	0.777
	(-2.70)	(1.68)	(-3.44)	(1.63)
Firm fixed effects	N	N	Y	Y
Industry-year fixed effects	Y	Y	Y	Y
N firm-years	7,577	8,425	7,204	8,128
R^2	0.492	0.993	0.490	0.993

Panel C: index of financial constraints	Financial constraints index			
	Mean for firms with prof ownership	Mean for control firms	Difference	*p*-value of difference
Mean	-4.72	-8.97	4.25	0.000***
Std. dev.	30.11	46.10		
N firm-years	6,373	6,709		

Table 10
Companies that transition to having professional ownership

The sample in this table consists of 245 companies that transition during the sample period from having no institutional ownership to having such ownership. To be included, each company must have at least one year of data available before and after the transition year, and the institutional holding must persist for at least two years after transition, if two years of data are available. Each cell shows the proportion of companies by type of ownership before transition and by type of institutional ownership in the year of transition.

	Type of institutional ownership on transition				
	PE control	Non-PE control	PE minority stake	Non-PE minority stake	Total
Ownership before transition	%	%	%	%	%
Controlling stake owned by:					
Family or individual	18.8	4.5	17.1	15.1	55.5
Operating company	1.6	1.2	1.6	1.2	5.7
Government and not-for-profit	0.0	0.0	0.0	0.0	0.0
Nominee account	2.0	0.4	0.4	1.6	4.5
Widely held	0.8	0.0	2.0	1.6	4.5
Subsidiary	15.1	8.2	4.9	1.6	29.8
Total	38.4	14.3	26.1	21.2	100.0

Table 11
Tests around transition to institutional ownership

The sample consists of 177 companies which transition to having institutional ownership during the sample period, and 177 matched companies using the matching procedure described in Section 5.6. Data are used for firm-years from $t = -2$ to +2, where $t = 0$ is the transition year. *Transition* is a dummy variable equal to one for firms that transition, and *Post* is a dummy equal to one for firm-years $t = 0$, 1 and 2. Robust standard errors clustered at the *Firm* × *Post* level are in brackets (Boucly et al., 2011). *** (**) (*) = significant at the 1% (5%) (10%) level.

Panel A: level of investment	Total investment	Intangible investment	Tangible investment
	(1)	(2)	(3)
Post	0.016	0.016	-0.001
	(0.88)	(0.89)	(-0.20)
Transition* × *Post	**0.034****	**0.032****	**0.004**
	(2.09)	**(2.10)**	**(0.74)**
Control variables	Y	Y	Y
Firm fixed effects	Y	Y	Y
Industry-year fixed effects	Y	Y	Y
N firm-years	1,030	1,030	1,102
R^2	0.621	0.639	0.421

Panel B: responsiveness of investment	Total investment	Intangible investment	Tangible investment
	(1)	(2)	(3)
Post	0.023	0.018	-0.000
	(1.02)	(0.81)	(-0.04)
Transition × *Post*	-0.035	-0.030	0.001
	(-1.24)	(-1.15)	(0.13)
InvOpp × *Post*	-0.133	-0.032	-0.015
	(-0.46)	(-0.13)	(-0.12)
Transition × *InvOpp*	-0.418	-0.346	-0.020
	(-1.27)	(-1.23)	(-0.15)
Transition* × *InvOpp* × *Post	**1.199****	**1.074****	**0.041**
	(2.37)	**(2.26)**	**(0.26)**
InvOpp	0.142	0.042	0.015
	(0.50)	(0.17)	(0.12)
Control variables	Y	Y	Y
Firm fixed effects	Y	Y	Y
Industry-year fixed effects	Y	Y	Y
N firm-years	1,030	1,030	1,102
R^2	0.623	0.641	0.420

Table 11 cont.

Panel C: external equity	*ExtEquity*	*LargeExtEquity*	Δ*Equity*
Post	0.030*	0.068***	0.034**
	(1.90)	(2.61)	(2.12)
Transition* × *Post	**0.036***	**0.046****	**0.034****
	(3.04)	**(2.28)**	**(2.92)**
Control variables	Y	Y	Y
Firm fixed effects	Y	Y	Y
Industry-year fixed effects	Y	Y	Y
N firm-years	1,102	1,102	1,102
R^2	0.105	0.100	0.084

Panel D: external debt	*ExtDebt*	*LargeExtDebt*	Δ*Debt*
	(1)	(2)	(3)
Post	-0.006	-0.002	-0.013
	(-0.32)	(-0.04)	(-0.39)
Transition* × *Post	**0.026**	**0.074****	**-0.007**
	(1.54)	**(2.16)**	**(-0.24)**
Control variables	Y	Y	Y
Firm fixed effects	Y	Y	Y
Industry-year fixed effects	Y	Y	Y
N firm-years	1,102	1,102	1,102
R^2	0.410	0.183	0.352

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