Owners' portfolio diversification and firm investment: Evidence from public and private firms

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Abstract

We empirically examine the effects of imperfect portfolio diversification of controlling firm owners on firms' investment. In a large sample of private and public firms we find that investment-to-assets ratios of public firms are positively related to their owners' portfolio diversification, while the opposite is true for private firms. These relations are economically sizable and are not driven by omitted owner characteristics, selection of firms by owners, reverse causality, or endogeneity of firms' mode of incorporation. We find that a likely reason for the differential effects of owners' portfolio diversification on private and public firms' investment is the difference in financial constraints that the two types of firms face. Consistent with private firms being more financially constrained on average than public ones, the sensitivity of firm's investment rate to its owner's portfolio diversification is positive (negative) for relatively unconstrained (constrained) firms. Overall, our results suggest that firms' controlling owners influence their firms' investment strategies in ways consistent with their utility maximization.

1 Introduction

The impact of portfolio diversification of a firm's controlling owner on the firm's strategies has not received much attention in the literature.[1] This is quite surprising, for two reasons. First, Rotschild and Stiglitz (1971) hinted at the effects of firm owner's underdiversification on the firm's objective function over forty years ago. Second, in practice, many firms are controlled by under diversified owners.(e.g., Benartzi and Thaler (2001), Moskowitz and Vissing-Jørgensen (2002), Agnew, Balduzzi and Sunden (2003), Heaton and Lucas (2004), Faccio, Marchica and Mura (2011), and Thesmar and Thoenig (2011)).[2]

The link between a firm's controlling owner's portfolio diversification and the decisions she makes on the firm's behalf is that the less well diversified the owner is, the more she is concerned with the firm's profit (or cash flow) variability (e.g., Faccio, Marchica and Mura (2011)). One of the most important decisions having consequences for cash flow variability is capital investtment (e.g., Kothari, Laguerre and Leone (2002)). In this paper we examine the effects of a firm's controlling owner's portfolio diversification on the firm's investment. Our hypothesis is that firms controlled by less well-diversified owners, who seek lower cash flow variability, would choose less aggressive investment strategies, i.e. invest less (e.g., Shah and Thakor (1988)).[3]

To test the investment channel behind the relation between a firm's controlling owner's portfolio diversification and the firm's risk taking, we empirically examine the relation between owners' diversification and firms' investment rates using a large sample of both public and private firms. In particular, we use Bureau Van Dijk's Amadeus Top 250,000 database, which contains comprehensive accounting and ownership data for over half a million firm-year observations from 34 European countries over the period 1999-2010.

We employ a dataset that covers both public and private firms in our empirical analysis because the role played by private companies in Europe, as well as in other markets, is crucial. 96% of medium and large European firms are private. In addition, we estimate that at the end of 2009, privately-held

[1] A related question, that of the effects of owner's portfolio diversification on firm valuation, has received substantially more attention (e.g., Chemmanur and Fulghieri (1999), Benninga, Helmantel and Sarig (2005), Bodnaruk, Kandel, Massa and Simonov (2008), Pastor, Taylor and Veronesi (2009), Chen, Miao and Wang (2010), and Chod and Lyandres (2011)).

[2] This lack of diversification may be due to corporate control (e.g., Demsetz and Lehn (1985)), costly information acquisition (e.g., Van Nieuwerburgh and Veldkamp (2010)), and/or asymmetric information (e.g., Gaspar and Massa (2007) and Goetzmann and Kumar (2008)).

[3] Additional important channels through which a firm's underdiversified owner may influence the firm's cash flow variability is operating strategy (e.g., Rothschild and Stiglitz (1971) and Chod and Lyandres (2011)), and capital structure and payout policy (e.g., Chen, Miao and Wang (2010)). Analyses of the effects of owners' portfolio diversification on firms' operating strategies and capital structure and payout choices are subjects of an ongoing research.

companies were responsible for over 70% of total investment in fixed assets and of revenues of all European non-financial firms.[4] Using this rich dataset, our paper contributes to the small but growing empirical literature that examines differences between public and private firms.[5]

A unique feature of our data is that they allow us to reconstruct significant portions of firms' controlling owners' portfolios, which we use to compute measures of owners' portfolio diversification. Our portfolio diversification measures take into account the number of holdings in firm owner's portfolio, the weight of each holding in the portfolio, and the correlation between the stock return of the firm's industry with the controlling owner's portfolio return.

Our first empirical result is that the unconditional relation between owner's portfolio diversification and firm's investment is economically weak and largely statistically insignificant. This result is unexpected given the strong positive relation between a firm owner's diversification and the firm's risk taking documented in Faccio, Marcica and Mura (2011). To explore possible reasons for this finding, we examine the relation between owner diversification and firm investment separately for publicly-traded and privately-held firms.

Conditioning on the firm's mode of incorporation produces a surprising yet robust result. While investment-to-assets ratios of public firms are increasing in firm owners' portfolio diversification – a one standard deviation increase in a typical public firm owner's diversification is associated with 7-8% increase in the firm's investment-to-assets ratio, the relation between an owner's portfolio diversification and her firm's investment rate is close to zero and sometimes negative for private firms.

The result for privately-held firms is counterintuitive given that the relation between owner's diversification and risk taking in Faccio, Marchica and Mura (2011) is significantly positive for private firms. Therefore, before analyzing its possible cause, we take great care to ensure that it is not due to possible biases caused by: 1) omitted variable (firm owners' characteristics, such as their risk aversion); 2) selection (of firms in owners' portfolios); 3) reverse causality (according to which firm investments influence

[4]Asker, Farre-Mensa and Ljungqvist (2013) document that private companies play an important role in the U.S. market as well, accounting for over 50% of aggregate non-residential fixed investment and of sales. Further, Marchica and Mura (2012) report that, worldwide, employment by non-publicly traded firms accounts for 86% of total non-government employment.

[5]Brav (2009) and Asker, Farre-Mensa and Ljungqvist (2011) find that private firms have higher leverage ratios than public firms, while Saunders and Steffen (2011) document that private firms face higher borrowing costs than public ones. Asker, Farre-Mensa and Ljungqvist (2011, 2013) and Sheen (2011) report that private firms invest more than public ones. On the other hand, Mortal and Reisel (2013) and Gilje and Tailard (2013) report that European public firms and public firms operating in the natural gas industry invest more than private ones, a finding that we confirm in our paper. Brav (2009) and Marchica and Mura (2012) find that private firms tend to have higher return on assets (ROA) and return on equity (ROE) than public ones. Michaely and Roberts (2012) report that public firms tend to smooth dividends more than private ones.

their owners' portfolio diversification); and 4) endogeneity of firms' mode of incorporation.

We address the potential problem of omitted owner characteristics, which could make our estimates of the relation between owner's portfolio diversification and firm investment biased and inconsistent, by including owner fixed effects, which capture time-invariant owner characteristics (e.g., utility function, risk aversion).

We employ a quasi-natural experiment to tackle the selection story, according to which more diversified owners may select to invest in companies with high investment rates, which are consistent with their risk preferences. In particular, we examine instances of changes in owner's portfolio diversification and the effects of the latter on investment strategies of existing firms in the owner's portfolio. In particular, we examine cases in which a firm's owner invests in additional firms (an acquisition event). While acquiring a stake in a firm is clearly an endogenous decision, such an acquisition should not affect the investment rates of *other* portfolio firms unless owner's portfolio structure is important for determining firms' investment strategies.

We address potential reverse causality by using an instrumental variables approach. In particular, we instrument the owner's portfolio diversification with the geographical distance between the owner and her country's stock market, following the findings in Goetzman and Kumar (2008) that investors' (under)diversification is related to the severity of home bias, which, in turn, is higher for investors located far from the stock markets (e.g., Zhu (2003) and Grinblatt and Keloharju (2001)).

Further, a firm's mode of incorporation is not random as well. We address the endogeneity of firms' public/private status in two ways. First, we document that our results hold in a matched sample, in which we use propensity score matching procedure to find for each public firm a private counterpart along multiple dimensions. Second, we employ a Heckman-type two-stage selection model, in which we first model firms' decision to be publicly-traded or privately-held and then re-estimate the relations between owners' diversification and investment, while controlling for the self-selection of firm's mode of incorporation.

In all these tests we find that the relation between owner's portfolio diversification (or instrument for it) and firm's investment rate is positive and significant for public firms and is negative and often significant for private firms. Moreover, accounting for omitted owner characteristics, selection of firms in owners' portfolios, reverse causality, and endogeneity of firms' incorporations mode generally increases the economic significance of the relation between owner's portfolio diversification and firm investment for both public and private firms.

We perform a battery of additional tests to examine the robustness of our main results. First, the results are robust to using alternative measures of investment. Second, they are not driven by the

possible separation of firm ownership and controldue to prevalence of dual-class shares in some countries, and by potential agency conflicts stemming from it. Third, the results are unlikely to be due to potential measurement errors in our portfolio diversification proxies. Fourth, they are not driven by owners for whom the controlled firm represents a small fraction of wealth. Finally, our findings are not due to potentially subpar accounting and reporting standards of private firms.

We hypothesize that an important reason for the large difference in the owner diversification – firm investment relation between public and private firms is the difference in the average level of financial constraints between public and private firms. There is a vast literature that suggests that public firms tend to have cheaper access to external funds than private ones (e.g., Pagano, Panetta and Zingales (1998), Derrien and Kecskés (2007), Brav (2009), Hsu, Reed and Rocholl (2010), Schenone (2010), Saunders and Steffen (2011), and Farre-Mensa and Ljungqvist (2013)). The reason is that information asymmetry surrounding public firms is lower than that around private ones (e.g., Benveniste and Spindt (1989), Dow and Gorton (1997), and Derrien and Kecskés (2007)). Lower information asymmetry results in lower costs of external financing, i.e. stronger financial constraints (e.g., Myers and Majluf (1984) and Fazzari, Hubbard and Petersen (1988)). We show that in our sample public firms are indeed less financially constrained than private ones, on average.

The reason why financial constraints may be important for the relation between owner's portfolio diversification and firm investment is as follows. A better diversified owner cares less about the variability of her firm's profit (cash flow). Two types of strategies that increase expected profit (while also increasing its variability) are larger capital investment and higher output (for any given level of capital investment).[6] Financial constraints affect the way in which a firm's strategy can be altered in response to a changes in its owner's portfolio diversification.

A relatively financially unconstrained firm, with cheaper access to external capital, can increase both investment and output (e.g., both buy new machines and produce larger output using existing machines) in response to higher owner's portfolio diversification. Thus, within the subset of relatively unconstrained firms, those firms that are controlled by well diversified owners may choose to invest more than firms whose owners are not as well diversified. The resulting relation between owner diversification and firm investment is, therefore, expected to be positive for relatively unconstrained firms.

[6]An example of the first type of strategy is a purchase of a more efficient machine that requires a lower quantity of variable input to produce a given output quantity of final good. (The logic of the model extends to a setting in which investment is in an existing production technology. See Benmelech and Bergman (2011) for a discussion of the differences between investments in new and "vintage" technologies.) An example of the second type of strategy is utilization of an existing machine over multiple shifts.

A relatively financially constrained firm faces high external financing costs and responds to higher owner's portfolio diversification by producing higher output using mostly existing physical capital. Thus, the relation between owner portfolio diversification and firm investment is expected to be weaker for relatively constrained firms than for relatively unconstrained ones. In addition, higher output due to higher owner's portfolio diversification may lead to higher asset base (e.g., higher average level of inventories and current assets in general) and lower resulting investment-to-assets ratio for a financially constrained firm. It is important to distinguish between a *strategy* (level of investment) and its *observed outcome* (investment-to-assets ratio or investment rate). Higher portfolio diversification has a weakly positive relation with the level of investment for constrained firms. However, portfolio diversification for such firms may have a negative relation with the investment-to-assets ratio if the positive effect of owner diversification on equilibrium asset base is stronger than the effect on the level of investment.

To examine the financial-constraints-based explanation for the differential sensitivity of firm investment rate to owner's portfolio diversification for public and private firms, we analyze the relation between diversification and investment for firms with various levels of financial constraints, computed according to Campello and Chen's (2010) index. Our first finding is that the relation between diversification and investment is positive for relatively unconstrained firms and is negative for relatively constrained ones. Second, the relation is more positive (less negative) for unconstrained firms than for constrained ones within both subsamples of private and public firms. These findings suggest that financial constraints play an important role in determining the owner diversification–firm investment relation for both private and public firms.

To summarize, in this paper we find that controlling owner's portfolio diversification is an important determinant of her firm's investment rate. A firm's mode of incorporation is crucial in determining the effects of firm owner's diversification on the firm's investment. Our findings also suggest that a likely reason for the importance of the mode of incorporation for the investment-diversification relation is the difference in the degree of financial constraints that public and private firms face.

The remainder of the paper is organized as follows. The next section describes the data and variable construction. In Section 3 we study the relation between owner's portfolio diversification and capital investment by public and private firms. In Section 4 we examine the financial constraints hypothesis for the investment-diversification relation. Section 5 concludes.

2 Data and variables

2.1 Sample

The data used in the paper are assembled from Amadeus Top 250,000. Amadeus is maintained by Bureau Van Dijk Publishing and covers European public and private companies. From this database we gather ownership and accounting information for every European publicly-traded firm and also for all privately-held companies that satisfy a minimum size threshold. For France, Germany, Italy, Spain, and the United Kingdom, the database includes all companies that meet at least one of the following criteria: (1) revenues of at least €15m, (2) total assets of at least €30m, (3) at least 200 employees. For the other countries, the database includes all companies that meet at least one of the following criteria: (1) revenues of at least €10m, (2) total assets of at least €20m, (3) at least 150 employees. Disclosure requirements in Europe obligate private companies to publish annual information. Consequently, we are able to gather accounting and ownership information for a very large set of firms.[7]

We collect the data from the Amadeus Top 250,000 DVDs using the April issue of each year during the period 1999-2010. Information is typically incomplete for the year that just ended. Further, Amadeus removes firms from the database five years after they stop reporting financial data.[8] In order to avoid biases related to both survivorship and incomplete information, we ensure that no firm-year observations are dropped from the sample because of delisting. We do so by collecting accounting data starting with the 2012 DVD and progressively moving backward in time, each year collecting data on firms that were alive in that year. By doing so, no firms are dropped from the sample. We gather accounting data for all firms having data available for the variables included in the empirical tests of our model's predictions for at least one year during the period 1999-2010.

Amadeus data are being used by an increasing number of scholars and policy-making institutions. Previous studies have checked the accuracy of Amadeus data with respect to representation of the population (e.g., Arellano, Bai, and Zhang (2012) and Bena and Ortiz-Molina (2013)), employment rate (e.g., Klapper, Laeven, and Rajan (2006)), and both accounting and ownership data (e.g., Faccio, Marchica, and Mura (2011) and Faccio, McConnell, Marchica and Mura (2012)). Nonetheless, we undertake a number of steps to further confirm the quality of our data by comparing them to alternative sources. First, we randomly select 500 privately-held companies from Amadeus with available information on sales in 2010 and we search for them in the Dun & Bradstreet Private Company Database (D&B). We then compute

[7] In Germany, Portugal, Bosnia, Macedonia, Serbia, and Switzerland not all companies comply with the filing requirements, while in Austria the disclosure of financial information covers fewer items than elsewhere.

[8] These drawbacks are also discussed in Popov and Roosenboom (2009), Faccio, Marchica, McConnell and Mura (2011), and Klapper, Leaven and Rajan (2012).

the correlation coefficient between the sales as reported in Amadeus and those reported in D&B. The correlation coefficient is 0.98. Second, we repeat the same exercise for a random sample of 500 public companies with available data on sales in Amadeus and search for them in Worldscope. The correlation coefficient equals 0.99.

In addition to the accounting data, for all firm-years in our sample we collect direct ownership data. In doing so, we follow Faccio, Marchica and Mura (2011). In particular, in each DVD the information on ownership is only given as of the current year. Therefore, we collect these data one year at a time for each DVD. After cleaning the ownership information from those shareholders that are only generally defined in Amadeus, we identify the ultimate shareholder for each firm in the sample and reconstruct her equity portfolio (more details below). We exclude all firms in which a government is a shareholder, as these firms may have objectives other than value maximization. After combining accounting and ownership information, we end up with the final sample of 528,110 firm-year observations for 162,688 unique firms. Further, we use Datastream to gather information on weekly stock returns for all publicly-traded European firms over the 1998-2009 period to construct one of our portfolio diversification measures.

Indirect (pyramidal) ownership is quite common in our sample (e.g., de Jong, DeJong, Hege and Mertens (2012)). Thus, for each company that has available ownership data, we identify first all ultimate shareholders. That is, in cases in which the direct shareholder of a firm is another firm, we identify its owners, the owners of its owners, and henceforth until we cannot trace back any further. We trace back pyramids of any length without imposing any cut-off threshold. Following Claessens, Djankov and Lang (2000), Faccio and Lang (2002) and Faccio, Marchica and Mura (2011), we calculate the cash flow rights of each ultimate shareholder as the product between links along the ownership chain; and her control rights as the weakest link along the chain. After tracing each ownership stake to its ultimate shareholders, we call the shareholder controlling the largest fraction of control rights in each firm the firm's largest ultimate shareholder. In what follows we frequently refer to the largest ultimate shareholder as firm owner.

An important implicit assumption in our analysis is that the firm's controlling owner, whom we identify, is the decision maker on the firm's behalf. To validate this assumption, we exploit the information on the full names of directors in each company available in Amadeus. For a random sample of five per cent of public and private firms we check whether the controlling owner (or a member of her family) sits on the board of the controlled company. We find that ultimate owners that we identify sit on their firms' boards in more than half the cases or have their relatives (i.e. people with the same last names) sitting on firms' boards in additional 11% of the cases. In addition, ultimate owners act as their firms' CEOs in about 30% of the cases. This evidence is consistent with our presumption that controlling owners have a

significant say in their firms' investment decisions.

2.2 Variables

In what follows we describe the variables used in the analysis. We first describe the construction of the main dependent variable – investment-to-assets ratio. Then we discuss our measures of owner's portfolio diversification. Finally, we describe the control variables. To reduce the impact of outliers, across all analyses, most ratios are winsorized at the top and bottom 1% of their distribution. (Some variables are winsorized differently, as discussed below.)

Dependent variable

Investments-to-assets ratio is defined as the year-to-year change in gross fixed assets divided by lagged total assets. Total assets are computed as the sum of fixed and current assets.

Measures of owner's portfolio diversification

Ln(number of firms) is used commonly as a proxy for portfolio diversification (e.g., Barber and Odean (2000) and Goetzman and Kumar (2008)). The motivation behind this measure is that diversification is increasing in the number of stocks in investor's portfolio. It is defined as the natural logarithm of the total number of firms in which the company's owner (e.g., the ultimate shareholder controlling the largest fraction of voting rights in the firm) holds shares, directly or indirectly, in a given year, across all countries in our sample. While this measure of portfolio diversification is admittedly crude, it has an important advantage of not requiring any information regarding the distribution of stock returns, which is particularly important in our sample that consists mostly of privately-held firms.

1–Herfindahl index is another commonly-used measure of portfolio diversification (e.g., Bodnaruk, Kandel, Massa and Simonov (2008) and Goetzman and Kumar (2008)). To compute the Herfindahl index of firm owner's holdings, we first calculate the dollar value of her investment in each firm in her portfolio as the book value of the company's equity, multiplied by the shareholder's ultimate ownership stake in the firm. We use book equity instead of market equity because our sample consists predominantly of private firms. In the calculation of the Herfindahl index of holdings we only include firms with available data on the book equity. We then compute the weight of each stock in the owner's portfolio. The Herfindahl index of portfolio holdings is the sum of these squared weights. In the analysis, we use one minus the Herfindahl index to make the interpretation of the coefficients comparable to the number-of-firms-based measure. The advantage of using a value-weighted measure, such as one minus the Herfindahl index, over

an equally-weighted measure based on the number of firms, is that it reduces the potential downward bias due to exclusion of (very) small holdings from the construction of the portfolio (see also below).

–Correlation is the correlation of the mean stock return of public firms in the firm's industry with the shareholder's overall portfolio return, multiplied by -1, as in Bodnaruk, Kandel, Massa and Simonov (2008) and Faccio, Marchica and Mura (2011). This measure of diversification is higher for firm owners whose portfolio returns are less correlated with the returns in the industry in which their firm operates. We use the mean industry return as a proxy for the stock return of a given firm, which is unavailable for private firms. The drawback of this measure is that it is likely to further understate diversification, as the returns of two stocks within the same industry are assumed perfectly correlated by construction. The industry (weekly) return is defined as the weekly average return across all publicly traded European firms within a given 3-digit SIC industry. We include only firms that have stock price data available in Datastream. For each controlling owner, the portfolio returns are computed as the weighted average of returns of individual stocks in her portfolio (or industry returns in cases in which individual stock returns are unavailable). In this calculation, we use the weights of each firm in the owner's equity portfolio at the beginning of each year.

It is important to note that despite the wide coverage of firms in Amadeus, our portfolio diversification measures are subject to some limitations. First, small ownership stakes as well as positions in companies below the size threshold are not covered in Amadeus and, therefore, are not included in the portfolios. The exclusion of the smallest companies, though, is unlikely to have a major impact on value-weighted portfolio diversification measures discussed above. Second, we do not capture non-equity investments, such as investments in bonds and real estate, and, more importantly, we do not capture indirect equity investments, e.g., investments through mutual funds. For instance, the exclusion of investments in mutual funds and hedge funds may bias our measures of diversification downwards. To control for this potential bias, we perform a number of robustness tests that show that this issue has a very limited impact on our main empirical findings. Third, we are unable to include equity investments in firms incorporated outside Europe. Thus, we may possibly understate the diversification of investors who are well diversified across continents. However, since investors typically exhibit a home bias (e.g., French and Poterba (1991) and Coval and Moskowitz (1999)), the magnitude of this measurement error is likely to be small. To further support this argument, Faccio, Marchica and Mura (2011) find that only a very small proportion of European firms' controlling owners hold larger-than-5% shares of equity in non-European firms. In addition, Fons-Rosen, Kalemli-Ozcan, Sørensen,Villegas-Sanchez and Volosovych (2013) show that the presence of foreign ownership is not widespread worldwide. In fact, only 4% (3%) of European (U.S.)

companies have non-zero foreign ownership).

Control variables

The following additional variables were found in past literature to be related to investment. We, therefore, include them in the set of control variables.

Sales growth is used as a proxy for investment opportunities, as an available substitute for Tobin's q, which is the usual measure of investment opportunities (e.g., Kaplan and Zingales (1997) and Cleary (1999)). We use sales growth instead of Tobin's q, since the latter is unavailable for private firms, which constitute the majority of our sample. In addition, Erickson and Whited (2000), Gomes (2001), and Alti (2003) show that there may be a measurement error in estimated average Tobin's q, which may bias coefficient estimates in investment regressions. Sales growth is defined as the annual relative growth rate in total revenues. As sales growth exhibits large positive skewness, it is winsorized at the bottom 1% and at the top 5% of its distribution.

Cash flow, which has been shown to be related to investment (e.g., Fazzari, Hubbard and Petersen (1988), Kaplan and Zingales (1997), and Erickson and Whited (2000, 2002)) is the ratio of income plus depreciation to beginning-of-year total assets.

Firm age has been shown to be related investment opportunities (e.g., Anderson and Reeb (2003)) – investment opportunities of mature firms may be different from those of young firms. Firm age is defined as the number of years since a firm's incorporation. Because of its skewness, we winsorize age at the top 1% of its distribution and use $\ln(1 + Age)$ as the measure of age.

3 Owners' portfolio diversification and investment rates of private and public firms

3.1 Descriptive statistics

Table 1 reports the descriptive statistics for our sample that includes 528,110 firm-year observations from 1999 to 2010, corresponding to 162,688 unique firms across 34 different European countries. As evident from Panel A of Table 1, the most represented countries in our sample are: United Kingdom (23.36%), France (20.31%), Spain (11.37%), and Italy (8.98%). In almost all countries (with the exception of Liechtenstein, Macedonia, and Russia) we have at least 100 observations. The vast majority of firms are

privately-held (95.9%).

Insert Table 1 here

Panel B of Table 1 shows the differences in means (medians) of our main dependent variables across privately-held and publicly-traded firms.

On average, public companies have a significantly higher investment-to-assets ratios than private firms: mean (median) investment rate of public firms is 10.9% (6.1%), compared with 6.9% (3.1%) for private firms. This result is consistent with the evidence in Mortal and Reisel (2012), obtained using a sample of Western European firms. This evidence is also in line with the idea that public firms tend to be less financially constrained than private ones.[9]

Panel C of Table 1 reports descriptive statistics at firm level of the main independent variables and the control variables included in the regressions. The first three columns report full-sample statistics, which are followed by those for public and private firms separately. The ultimate largest shareholder in our sample holds on average 21 firms in her portfolio (20 for private firms and 42 for public ones).[10] However, the median number of firms in the largest shareholder's portfolio is two (four for public firms). Thus, a typical largest shareholder is only moderately diversified. This evidence is consistent with Faccio, Marchica and Mura (2011) in a similar sample and to the evidence reported in Barber and Odean (2000), Moskowitz and Vissing-Jørgensen (2002), and Goetzman and Kumar (2008) in the U.S. market, and Karhunen and Keloharju (2001) in the Finnish market. Portfolio diversification exhibits large heterogeneity. For instance, 42% of our largest ultimate shareholders hold more than two companies in their portfolios, 10% of them hold at least 5 companies, and 0.5% of controlling shareholders hold at least 50 companies in their portfolios. Further, the average largest shareholder holds more than 62% of the cash flow rights and 63% of the voting rights in her company (untabulated statistics). This corroborates the presumption that the relation between portfolio diversification and investment is indeed a consequence of the decisions of the largest ultimate shareholder. Untabulated results, obtained when we either include cash flow rights in all our regressions or when we restrict the sample to companies in which the largest shareholder owns more than 20% of the cash flow rights or she sits on the board of directors, are similar to those reported below. Average (median) values of all portfolio diversification measures are significantly different between public and private firms. Mean (median) (1-Herfindahl Index of holdings) of private firms is 0.33% (0.26%), compared with 0.42% (0.46%) for public firms, consistent with public firm own-

[9]Interestingly, this evidence differs from the results in Asker, Farre-Mensa and Ljungqvist (2013), who show that in the U.S. publicly-traded firms invest less than matched private firms.

[10]Note that these statistics are reported at firm-year level. At investor-year level (i.e. each investor is counted once each year regardless of the number of firms she controls) the average number of firms in a portfolio is four in the full sample.

ers being better diversified than private firm owners. Similarly, mean correlation between private firm owners' portfolio returns and the returns in the industry in which the controlled firm operates is 81%, compared with 73% for public firm owners. As for additional, non-diversification-related variables, public firms tend to be older and larger, exhibit larger sales growth, and lower cash flow than private firms. All the differences are significant at the 1% level.

3.2 Multivariate analysis

We begin by estimating the relation between firm's investment-to-assets ratio and owner's portfolio diversification within the full sample:

$$Inv\_to\_assets_{i,t} = \alpha_{i,t} + \beta Diver_{i,t} + \overline{\theta X_{i,t}} + Country * IndustryFE + YearFE + u_{i,t}, \quad (1)$$

where $Diver_{i,t}$ stands for one of the three measures of controlling owner's portfolio diversification (ln(number of firms), 1-Herfindhal Index, and -Correlation). $\overline{X_{i,t}}$ is a vector of control variables that includes: 1) sales growth; 2) cash flow; and 3) ln(1+age). In line with Gormley and Matsa (2014), all regressions include country*3-digit SIC industry, and year fixed effects. Standard errors are clustered at the industry-country level.

Table 2 presents the results of estimating (1).

Insert Table 2 here

The results in Table 2 are inconclusive – in two specifications out of three the relation between owner's portfolio diversification and investment-to-assets ratio is insignificant. In the only specification in which it is significant statistically, the economic significance is not large – a one standard deviation increase in $-Corr$ is associated with a 1% increase in the investment-to-assets ratio, ceteris paribus.

Thesmar and Thoenig (2011) argue that owner's diversification may have different effects on risk taking of public and private firms. As our sample comprises both public and private firms, we proceed to examine the differential relations between investment on one hand and public and private firms' owner's diversification on the other hand. To that end, we estimate the following model:

$$Inv\_to\_assets_{i,t} = \alpha PUB_{i,t} + \beta PRI_{i,t} + \gamma(PUB_{i,t} * Diver_{i,t}) + \delta(PRI_{i,t} * Diver_{i,t}) + \overline{\theta X_{i,t}} + Country * IndustryFE + YearFE + u_{i,t}, \quad (2)$$

where $PUB_{i,t}$ is a indicator variable equalling one if company i is publicly-traded in year t, and equalling zero otherwise, while $PRI_{i,t}$ is an indicator equalling one if company i is privately-held in year t, and equalling zero otherwise. $\widehat{\gamma}$ and $\widehat{\delta}$ represent the estimated sensitivities of investment rate to variation in

owners' portfolio diversification for public and private firms separately. We also compute the economic impacts of these estimated coefficients. The economic impact is calculated as follows: $\widehat{\gamma}$ $(\widehat{\delta})$ is multiplied by one standard deviation of corresponding main variable. The product is then standardized by the mean of the dependent variable. Table 3 reports results of estimating the regression model in (2).

Insert Table 3 here

It is evident from the intercepts in all three specifications (6.8% to 9.7% for public firms and 3.8% to 4.2% for private ones) that public firms invest more than private ones, ceteris paribus. More interestingly, Table 3 shows that controlling owners' portfolio diversification has significantly different impacts on the investment rates of public and private firms. Across all three measures of owner's portfolio diversification, the relation between diversification and firm's investment-to-assets ratio is positive and significant for publicly-traded firms, while it is negative and significant for privately-held ones for two measures of diversification out of three. The overall impact of portfolio diversification is also economically important for public companies. For example, a one standard deviation increase in ln(number of firms) corresponds to an average increase of almost 8% in investment-to-assets ratio, ceteris paribus.

3.3 Endogeneity of portfolio diversification

One possible concern that arises when one regresses firms' investment rates on measures of their owners' portfolio diversification is that the latter maybe determined endogenously. Admittedly, while we cannot unequivocally rule out the effects of endogeneity on our results, we try to address this issue in several ways.

3.3.1 Omitted variable bias: panel data analysis with shareholder fixed effects

It is possible that in addition to the potential causal effect of owner's portfolio diversification on investment, owner's unobserved characteristics, such as her risk aversion parameter, simultaneously affect owner's portfolio diversification and firm's investment strategies. This omitted variable bias could make our estimates in Tables 2 and 3 biased and inconsistent (e.g., Wooldridge, 2002). To address this concern, we exploit the panel dimension of our database by including in the baseline regressions shareholder fixed effects that should capture all time-invariant owners characteristics (e.g., utility function, risk aversion).

Insert Table 4 here

In line with our baseline findings, the results in Table 4 show that a positive *change* in portfolio diversification is associated to a positive *change* in investment rate for publicly traded companies and a negative

change in investment rate for privately held firms. The effect is statistically significant across all our proxies of portfolio diversification with p-values lower than 0.05.[11] Interestingly, the economic impact now becomes important for both public and private companies. For instance, a one standard deviation increase in ln(1+number of firms) corresponds to an average increase of almost 10% in investment-to-assets ratio of public firms and to a decrease of about 6% in the investment-to-assets ratio of private ones.

3.3.2 Owner self-selection: acquisitions

An additional concern related to the owners' choices could be that more diversified owners may simply select companies with higher investment rates that suit better their own preferences towards risk, rather than directly affect the investment decisions of those companies. If this is the case, then the causality would run from firms' investment choices to owners' portfolio diversification, and not the other way around. To the extent that owners' risk preferences are stable over time, the tests in the previous section, using owner fixed effects potentially addresses this issue.

Nonetheless, as an alternative way to address the endogeneity concern, we use the event of acquisitions as instances of changes in the composition of owners' portfolios, and examine subsequent investment decisions of public and private firms. This test is close in spirit to the one in Faccio, Marchica and Mura (2011). Acquiring an equity stake in a company is obviously an endogenous decision. However, if an investor is simply acquiring a firm with investment characteristics that suit her preferences for risk, then we should observe no change in investment rates of the *existing* firms in her portfolio following an acquisition of another firm.

To perform this analysis, we first identify controlling owners who experience a net increase in the number of firms in their portfolios. Among these, we focus on those acquisitions that account for at least 50% of pre-acquisition portfolio value and that are, therefore, likely to create an important impact of the owners' portfolio diversification. We identify $8,867$ such instances. We then require: 1) the *existing* firms in the owner's portfolio to have information on investment-to-assets ratio before and after the acquisition; and 2) these existing firms to maintain the same private/public status before and after the acquisition to avoid possible confounding effects. We end up with a final sample of $2,357$ private and 97 public companies.

As Table 5 shows, an acquisition event indeed increases (mechanically) controlling owner's portfolio

[11] The only exception is the impact on private firms' investment when we consider Correlation as a proxy for portfolio diversification. Nevertheless, this result mirrors the one in Table 3.

diversification.

Insert Table 5 here

If a firm's controlling shareholders influence corporate investment decisions, then we should observe a change in the investment-to-assets ratio of existing firms in the owner's portfolio. In particular, we expect to observe, on one hand, a decrease in investment for private firms, and on the other, an increase for public ones. Table 5 demonstrates that following acquisitions, existing private companies in the acquirer's portfolio experience a decrease in investment of about 0.61 percentage points (8% of the pre-acquisition investment rate), which is consistent with the economic impact observed in the baseline regressions. This change in investment is also significant at 10% level. On the other hand, there is a significant increase in the investment-to-assets ratio for public firms following an acquisition, of about 4 percentage points (or close to 40% of the pre-acquisition investment-to-assets ratio), which is also significant at 10% level.

3.3.3 Reverse causality: Instrumental variables analysis

Although panel estimates with shareholder fixed effects and the event of acquisitions may address both the omitted variable bias and the potential endogeneity of owners portfolio composition, there may still be a feedback effect present from firm's investment decisions to owner's portfolio diversification. To address this issue we employ an instrumental variable approach as an alternative way to capture the tendency of firm owners to diversify their portfolios independently from their controlled firms' investment decisions. In particular, we use the *geographical distance* between an owner's location and the stock market of the country in which she is based as an instrument for her portfolio diversification.

A large literature shows how geographical proximity matters in shaping individual and institutional investors strategies. Several studies provide evidence of home bias, and suggest that proximity to investment opportunities facilitates the acquisition of accurate value-relevant information (e.g. Coval and Moskowitz (2001) and Ivkovic and Weisbenner (2005)). There is also evidence, however, that home bias is reduced for investors located closer to the stock market, indirectly suggesting higher diversification. For instance, Zhu (2003) documents that the proximity of individual investors to the New York helps them reduce their bias towards local companies. Further, Grinblatt and Keloharju (2001) show that Finnish individual investors living in the Greater Helsinki area are 1.41 times more likely to invest in companies in the same area; while individual investors located in the rest of Finland are 12 times more likely to invest locally. Goetzmann and Kumar (2008) demonstrate that the level of under-diversification of US individual investors is greater among those who invest locally. Based on this evidence we argue that high density of finance-related professionals around stock market areas is likely to help investors increase their portfolio diversification, while having no direct effect on firms' investment decisions.

Our instrument is constructed in the following manner. For each controlling owner we collect information on her location using the postal code provided by Amadeus and find its latitude and longitude. Similarly, for each country we identify the location of its main stock market area. We then calculate the spherical distance $d_(j, c)$ between each shareholder j and the stock market of country c, where she is based, using the following formula:

$$d_{j,c} = \arccos(\cos(lat_j) * \cos(lon_j) * \cos(lat_c) * \cos(lon_c) + \cos(lat_j) * \sin(lon_j * \cos(lat_c) * \sin(lon_c) + \sin(lat_j) * \sin(lat_c)) * r, \quad (3)$$

where *lat* and *lon* refer to the latitude and longitude in radians (converted from degrees by multiplying the angle by $\pi/180$) and r is the radius of Earth in miles. In cases in which a country has more than one stock market area (i.e., Denmark, Germany, Russia, Spain and Switzerland), we use the distance from the closest market. We are able to estimate the geographical distance for 82,726 unique owners, corresponding to 258,324 firm-year observations. Half of the owners in our sample are located less than 70 miles away from the stock market of their country.

In the first stage, we regress owner's portfolio diversification for each firm each year on the geographical distance between the firm owner and her country's stock market, along with all exogenous variables and industry,country, and year fixed effects. Further, since in our tests portfolio diversification is interacted with the private/public dummy, we use the product between geographical distance and private/public dummy as an instrument for that interaction term. In an additional first-stage regression we regress the interaction term on the product between geographical distance and private/public status along with all other exogenous variables, following Wooldridge (2010). In the second stage, we employ the predicted values of the owners portfolio diversification and the interaction term from the first stage regressions. In Panel A of Table 6 we report the second stage estimates. For brevity, in Panel B we report only the estimates of the instruments from the first stage regressions. We also report the F-statistics of the instruments from the first stage regressions.

Insert Table 6 here

The instrument of geographical distance is significantly correlated with the endogenous variable across all models, and the F-statistics suggest that this is not a weak instrument, as discussed in Staiger and Stock (1997).

In the second stage, we employ the predicted values of owner's portfolio diversification and its interaction with private/public status. In Panel B of Table 6 we focus on estimating the relation between investment-to-assets ratio and the instrument for owner's portfolio diversification. In the second-stage

regressions we observe that the investment sensitivity to the owners portfolio diversification is positive (negative) and significant for public (private) companies as in our baseline models.

3.4 Self-selection of the mode of incorporation

The second potential source of endogeneity is the firm's mode of incorporation. Descriptive statistics in Panel C of Table 1 show that the samples of public and private companies significantly differ across all independent variables. Thus, it is important to examine whether and to what extent our results are potentially affected by firms' self-selection into the public and private modes of incorporation. We address this issue in two ways.

3.4.1 Matched sample

First, we estimate the regressions of investment-to-assets ratio within a sub-sample of public firms matched with private firms. We use the propensity score matching procedure to find for each public firm a possible match within the sub-sample of private firms (e.g., Rosenbaum and Rubin (1983) and Michaely and Roberts (2012)). To implement this methodology, we calculate the probability (e.g., the propensity score) of being a public firm. This probability is computed using all firm characteristics that we include in the baseline model, along with year, country and industry (1-digit SIC code) fixed effects. To ensure that the two groups of firms are sufficiently similar, we require that the maximum difference between the propensity score of a public firm and that of its matching peer does not exceed 0.1% in absolute value. We then re-estimate the regressions in Tables 3 using the matched sample. The results are reported in Table 7.

Insert Table 7 here

The results in Table 7 are qualitatively similar to the full-sample results in Table 3. The coefficients on the interaction between public firm indicator and owner's diversification are positive in all specifications and are statistically significant in two out of three specifications. The coefficients on the interaction between private firm dummy and diversification are negative and significant in all specifications. In fact, in some cases the results within the matched sample are stronger and more economically significant that in the full sample. For example, both the size of the coefficients on the interaction between private firm indicator and portfolio diversification and their economic significance increase more than threefold relative to those in Table 3: a one standard deviation increase in a typical private firm owners diversification is associated with a 3% reduction in investment-to-assets ratio, compared to around 1% reduction in Table 3. Similar to Table 3, the intercepts demonstrate that, ceteris paribus, public firms invest more than private ones.

As a further alternative, we implement the propensity score matching procedure using also the portfolio diversification among the criteria to find for each public firm a possible match within the sub-sample of private firms. Results obtained using this alternative matched sample mirror those in Table 7 and are available upon request.

3.4.2 Treatment effects model

Self-selection of companies into private and public may be driven by characteristics that are not observable. To deal with this potential issue, we estimate a two-stage Heckman (1979) selection model. In the first stage we explicitly estimate the choice between public and private status using a probit regression, and in the second stage we re-estimate our baseline model while augmenting it by the inverse Mills ratio from the first stage regression in order to correct for potential self-selection. Following Maddala (1991) the binary choice model of the mode of incorporation is represented as:

$$P^*_{i,t} = \kappa' Z_{i,t} + v_{i,t}, \tag{4}$$

where $Z_{i,t}$ is a vector of exogenous variables that influence the choice of firm i to be either private or public: $P_{i,t}$=1 if $P^*_{i,t} > 0$ and $P_{i,t} = 0$ if $P^*_{i,t} \leq 0$. If a firms decision to be private is correlated with the investment decisions of that firm, we would have a non-zero correlation between the error term, $v_{i,t}$ in (4), and the error term in the investment model. Therefore, estimating the latter model via a simple OLS may lead to inconsistent estimates.

Instead, in the first stage of the Heckman (1979) model we estimate (4) with a probit regression and obtain consistent estimates of κ'. These coefficient estimates are then used to compute the inverse Mills ratio, the correction for self-selection.[12] This parameter is then included in the second-stage regressions along with all other independent variables. In this way, we can explicitly test whether a firm's private/public status is still related to its investment and operating decisions after the self-selection due to unobservable factors has been controlled for. This is similar to Çolak and Whited's (2007) control for self-selection in their estimates of the sensitivity of investment to industry q for refocusing firms.

For this model to be correctly specified, it is important to include at least one exogenous variable from the first-stage choice model (e.g., Lennox, Francis, and Wang (2011)). For this purpose, we use the fraction of privately held companies in each 3-digit SIC industry in a country in which a company is headquartered in order to predict the decision to be private without otherwise affecting corporate

[12]The inverse Mills ratio is equal to: $\lambda_1(\kappa' Z_{it}) = \frac{-\phi(\kappa' Z_{it})}{\Phi(\kappa' Z_{it})}$ for public firms and $\lambda_2(\kappa' Z_{it}) = \frac{\phi(\kappa' Z_{it})}{1-\Phi(\kappa' Z_{it})}$ for private firms, where ϕ represents the standard normal probability density function, and Φ represents the standard normal cumulative distribution function.

investment and operating decisions. One may argue that private firms could be more clustered in certain industries. In this case, the exclusion restriction may be correlated, although indirectly, with the left-hand side of the second-stage model. To mitigate this potential concern, we include industry, country, and year fixed effects in both the first-stage and second-stage regressions. The results of the second-stage regressions are reported in Table 8.

Insert Table 8 here

Augmenting the regressions by including the inverse Mills ratio to correct for self-selection provides results that are somewhat stronger and more significant than the baseline results in Table 3. In Table 8, the coefficients on the interaction between public firm indicator and portfolio diversification are positive and statistically significant across all three specifications. These coefficients are somewhat larger than the corresponding figures in the baseline specification (0.0044, 0.0170, and 0.0279 in Table 8 compared with 0.0037, 0.0145, and 0.0213 in Table 3). The coefficients on the interaction between private firm dummy and diversification are negative and significant in two specifications out of three.

Overall, from the results in Tables 4-8, endogeneity in either owner's portfolio diversification or firm's public/private incorporation mode does not appear to explain the different sensitivity of investment rates to public and private firms' controlling owners' portfolio diversification. While we acknowledge that none of these alternative tests in isolation can provide a fully convincing argument as to the direction of causality, their combination forms an important body of evidence that owners' portfolio diversification affects investment decisions differently for public and private firms.

3.5 Robustness tests

Having established that our main results are not likely to be driven by endogeneity and self-selection, in this section we assess the robustness of our results with respect to a number of alternative specifications and subsamples. In these tests we use the full (unmatched) sample of public and private firms and estimate the regressions using OLS, as in our baseline estimation. Importantly, the vast majority of the robustness results reported below continue to hold when we control for endogeneity of the mode of incorporation and of owners' portfolio diversification, and when we use matched samples of public and private firms. In what follows, to conserve space, we report results using only one measure of owner's portfolio diversification (ln(number of firms)). Results (available upon request) hold when we use the other two measures of portfolio diversification. Table 9 reports the summary of the results of robustness tests.

Insert Table 9 here

3.5.1 Alternative dependent variables

Since R&D expenditures may be as important as capital expenditures for some firms, we define an alternative variable for the investment model, which takes into account R&D expenditures in addition to capital expenditures. Following Giannetti (2003), we use the change in total (fixed) intangible assets as a proxy for R&D expenditures and assign the value of zero to R&D expenditures in cases in which they are missing. We define total investment-to-assets ratio as the year-to-year change in the sum of gross fixed assets and total intangible assets divided by lagged total assets. Panel A of Table 9 shows the results of estimating the investment-to-assets regressions using this alternative investment measure. Our main findings are robust to the alternative definition of investment: total-investment-to-assets ratio is increasing in owner's portfolio diversification for public firms, while it is decreasing in portfolio diversification for private firms.

3.5.2 Ultimate shareholders: Dual class shares

To trace back the ultimate owner of each company included in our sample we reconstruct ownership pyramids for each direct shareholder of each firm. One limitation of this procedure is that we are unable to take into account the presence of dual class shares. The use of dual class shares, when legally allowed, is observed not only within public firms, but also in private companies. However, there are no official sources providing accurate information on the extent of dual class shares use among privately-held firms. The omission of dual class shares in the calculation of both cash flow and voting rights of firms' ultimate shareholders may potentially create a measurement error in the identification of (ultimate) controlling owners and, therefore, in the construction of our proxies for portfolio diversification.

Previous studies, however, show that dual class shares are used extensively only in a few European countries (e.g., Faccio and Lang (2002) and Nenova (2003)). Further, Pajuste (2005) documents that an increasing number of firms in continental Europe have recently unified their shares into a single class. Similar result is reported by the ECGI in their study commissioned by the European Union (2007). In particular, Pajuste (2005) shows that, at the end of 2001, after several legal reforms aimed at improving investor protection across Europe, only six countries still seem to have at least 10% of their public companies using dual class shares: Sweden (46.3%), Denmark (36.6%), Italy (34.6%), Switzerland (26.4%), Finland (23.9%) and Germany (11.5%). Therefore, we believe that this potential measurement error has a limited impact on the identification of firms' ultimate shareholders. Nevertheless, we re-examine the results in light of this potential bias. As there is no accurate information on the use of dual class shares among private firms, we conservatively assume that public firms' use of dual class shares mirrors the one by private firms. Therefore, we exclude the countries above from our sample and re-

estimate the investment regression. The results, reported in Panel B of Tables 9, demonstrate that dual class shares are generally not responsible for our empirical results.

3.5.3 Tunneling

Although in the majority of cases, owners' cash flow rights coincide with their control rights, it is not always the case. Indeed, almost 24% of private companies in our sample are controlled by largest shareholders whose voting rights exceed their cash flow rights; while for public companies the figure is down to 17%. In cases in which there is a positive wedge between voting rights and cash flow rights, owners may have incentives to siphon ("tunel")firm's resources to other firms they have stakes in, at the expense of minority shareholders (e.g., Johnson, La Porta, Lopez-de-Silanes and Shleifer (2000), Bertrand Mehta and Mullainathan (2002), and John Litov and Yeung (2008)).

The possibility of tunneling may potentially affect the relation between investment and portfolio diversification. In particular, high diversification (i.e. large number of firms in an owner's portfolio) may facilitate the transfer of a firm's assets to other portfolio firms (disinvestment). To examine whether the possibility of tunneling is responsible for our results, we construct a measure of the likelihood of tunneling, which equals the difference between voting rights and cash flow rights of each largest shareholder (wedge), as in Claessens, Djankov, Fan, and Lang (2002). Then, we exclude firms in the top decile of the wedge distribution – i.e. observations in which controlling owners have the most incentives to engage in tunneling. For excluded companies, the average (median) wedge is over13% (11%) and the largest wedge is 49%. The results, reported in column C of Table 9 are similar to those in the baseline specification and suggest that tunneling is unlikely to be driving our results.

3.5.4 Portfolio diversification measures

As mentioned above, a potential limitation of our portfolio diversification measures is that we are not able to capture indirect equity investments, such as investments through mutual funds. The exclusion of investments in mutual and hedge funds may bias our measures of diversification downwards, especially if the presence of mutual and hedge funds in the European markets is as pervasive as in the U.S. market. For example, Gillan and Starks (2007) show that at the end of 2006 the proportion of total outstanding U.S. equities held by institutional investors was more than 70%. However, the descriptive statistics of our portfolio diversification measures are similar to the estimates reported in Barber and Odean (2000) and Goetzman and Kumar (2008) for U.S. investors, and in Karhunen and Keloharju (2001) for Finnish investors. In addition, a comparable level of diversification is documented by Moskowitz and Vissing-Jørgensen (2002) for U.S. households investing in the private equity market.

First, we look at the fraction of households' total financial assets invested in "Mutual fund shares" as reported in the National Accounts. We calculate this fraction at the end of 2006 to take into account that in the first half of the decade several European countries experienced a significant increase in the holdings of mutual fund shares (e.g., Ynesta (2008)). In 6 out of 22 countries with available information this fraction is above 10%: Belgium, Austria, Spain, Sweden, Germany, and Switzerland, suggesting that in these countries the downwards bias that may potentially affect our portfolio diversification measures is larger. Therefore, we exclude these countries from our sample and re-estimate the investment regression. The results, reported in Panel D of Tables 9, are generally consistent with our baseline findings, suggesting that this potential limitation of our portfolio diversification proxies is unlikely to be driving our empirical results.

Second, to proxy for the share of mutual fund investments in each country's stock market, we examine the fraction of market capitalization held by mutual funds as of 2005, reported in Ferreira and Matos (2008). The fraction of market capitalization held by institutional investors in general and by mutual funds in particular in Europe is well below the corresponding figures in the U.S. market. The average fraction of stocks held by institutional investors (mutual funds) in Europe equals 20% (4%), while in the corresponding figures in the U.S. are 66% (18%). In only 6 countries out of 34 in our sample, the ownership of the stock market by mutual funds exceeds 5%: Sweden, Ireland, Finland, Luxembourg, Netherlands, and Switzerland. As in the previous test, we exclude these countries from our sample and re-estimate the investment model. Results, which are available upon request, are consistent with the full-sample findings and with those reported in Panel D of Table 9.

As mentioned above, our measures of portfolio diversification are based on equity positions held by each investor in our sample, and, as such, they exclude investments other than equity, such as real estate. This exclusion may further bias our measures of owner diversification downwards. As we do not have information on asset allocation at the individual level, we gauge the magnitude of investments in real estate at the country level. We use the ratio of gross value added of the real estate industry to gross value added of the total economy as a proxy for the size of the real estate sector in each country. Gross value added represents output valued at basic prices less intermediate consumption valued at purchasers' prices. We calculate this fraction at the end of 2006 using data from National Accounts at both the sector and country level. The idea is that the larger the size of the real estate sector in each country, the higher the investments in real estate of the individuals in that country and, therefore, the larger the potential downward bias of our measures of owners' portfolio diversification.[13] In 8 out of 28 countries

[13]The results are similar when we use an employment-based proxy for the importance of the real estate sector. Specifically, we calculate the total employment of the real estate industry as a fraction of the total employment of the economy.

with available information, the gross value added of the real estate industry exceeds 10% of total gross value added: France, Italy, Greece, Germany, Finland, Estonia, Bulgaria, and Denmark. As above, we exclude these countries from our sample and re-estimate the investment regression. Results are reported in Panel E of Table 9, and are in line with our main findings.

3.5.5 Disclosure requirements, and accounting and reporting standards

Although most of the countries in our sample require companies to file financial statements (albeit sometimes in reduced form), in some countries the regulations (and/or filing practices) are different. For instance, in Bosnia, Romania, Russia, and Switzerland private firms are not required to publish financial statements. In Portugal and Germany, few companies comply with the filing requirements. Additionally, in Liechtenstein, Malta, Monaco, and the Slovak Republic the criteria for publication of financial statements are undefined in Amadeus. Further, in some countries, firms that are not required to file financial reports choose to file them.[14] This could lead to a potential selection bias towards successful (private) companies that choose to file their financial reports. While in all our empirical specifications we include country fixed effects, which should control for different levels of disclosure requirements in various countries and/or differences in filing practices, we try to further mitigate this potential bias by excluding private firms incorporated in countries listed above and in other countries in which private firms are not required to file. The results, reported in Panel F of Table 9, mirror our previous findings.

A further potential concern relates to the quality of accounting information across countries in our sample. Although all countries have either adopted the International Financial Reporting Standards (IFRS) during the 2000s or decided to adopt them at some point in the near future (e.g., Russia), there could still be differences in reporting standards. This may potentially affect our findings, in particular those related to firms' operating strategies. We follow Porter and Schwab (2008) and use the Executive Opinion Survey conducted by the World Economic Forum between 2007 and 2008 to gauge the extent of these differences.[15] The Survey was completed by 2,881 top European business leaders with an average of 88 respondents per country. The Survey asks executives to provide their expert opinions on various aspects of the business environment in which they operate. We are interested in the question related to the strength of financial auditing and reporting standards of financial performance (item 1.16). The evaluation is on a scale between 1 and 7, where 1 represents the worst possible operating condition or

[14] See Faccio, Marchica, McConnell and Mura (2012) for a more detailed analysis of the disclosure requirements in European countries.

[15] The World Economic Forum has conducted the annual Survey for nearly 30 years. The Executive Opinion Survey results serve as a major component of research by a number of international and national organizations, government and research bodies, and companies.

situation, and 7 represents the best. In our sample, the highest score is 6.2 (Austria), while the worst is 3.6 (Bosnia and Herzegovina). Countries with the lowest score (in the bottom decile of the distribution) are: Bosnia and Herzegovina, Ukraine, Russia, and Bulgaria. To control for potential misreporting bias, we exclude the above countries from our main models and obtain results similar to those reported in Panel F of Table 9 (available upon request).

We also control for potential corporate corruption. We reason that the higher the perceived corporate corruption in a country, the higher the probability for firms in that country to cheat (also) in their financial statements. To control for this potential issue, we use a proxy of perceived ethical behavior of firms at country level (item 1.15 in the Executive Opinion Survey). In our sample, the highest score is 6.6 (Sweden) and the lowest one is 3 (Bosnia and Herzegovina). To obtain a sample with relatively reliable accounting information we exclude those countries in the bottom quartile of the business ethic ranking: Bosnia and Herzegovina, Ukraine, Russia, Romania, Macedonia, Bulgaria, Serbia, Greece, Hungary, Czech Republic, and Slovakia. The results, available upon request, are consistent with the baseline findings.

3.5.6 Fraction of owner's wealth invested in a controlled firm

Our measures of owner's diversification refer to the owner's overall portfolio and, by construction, do not capture the fraction of owner's wealth invested in the firm she controls. The fraction of wealth invested in the controlled firm, however, positively impacts the degree to which the owner cares about the variability of the controlled firm's profit. For example, keeping the overall level of owner's portfolio diversification constant, the utility of an owner who has most of her wealth tied into the controlled firm is more dependent on the firm's profit variability than that of an owner the majority of whose wealth is invested in firm(s) she does not control. The effect of the fraction of owner's wealth invested in a controlled firm on the firm's investment is the opposite of the effects of portfolio diversification: the higher the diversification of owner's portfolio, the less the owner cares about the controlled firm's profit variability. Thus, we should expect the relation between the fraction of wealth invested in the firm and investment-to-assets ratio to be the opposite from the relation between the latter and owner's portfolio diversification.

In Panel G of Table 9 we replace portfolio diversification with the fraction of owner's wealth invested in the controlled firm, computed at book values of equity. The results show that the relation between the fraction of wealth invested in a controlled firm and investment-to-assets ratio is negative for public firms and positive for private firms, consisted with the logic discussed above and with the model.

4 Owner's portfolio diversification, investment, and financial constraints

In this section we examine one possible explanation for the different sensitivity of firm investment to owner's portfolio diversification for private and public firms. Our explanation is based on the idea that private firms are typically more financially constrained (i.e. face costlier access to external finance than private ones (e.g., Pagano, Panetta and Zingales (1998), Derrien and Kecskés (2007), Hsu, Reed and Rocholl (2010), and Farre-Mensa and Ljungqvist (2013)).

The reason for the potential importance of financial constraints in shaping the diversification-investment relation is as follows. An increase in firm owner's degree of diversification lowers the importance of the firm's cash flow variability in the owner's expected utility. For a financially unconstrained firm, lower importance of cash flow variability leads to higher investment. This is because higher investment typically leads to larger output, which, in turn, may result in larger cash flow variability, as shown formally in an example in the Appendix.

For an owner of a constrained firm the incentives are similar: the higher the owner's diversification the higher the desired output. However, unlike an unconstrained firm, a constrained firm is limited in its ability to invest in capital assets. Thus, the main method of increasing output, is higher utilization of existing capital assets. Higher capital utilization is arguably less impacted by unavailability of external capital. Thus, investment of a relatively constrained firm is likely to be less sensitive to its owner's portfolio diversification than that of a similar unconstrained firm. In addition, higher output by a constrained firm is likely to result in higher non-capital assets, such as inventories, on the firm's balance sheet. The result is a possible negative relation between firm's investment-to-assets ratio and owner's diversification, which is driven by a larger proportional increase in non-capital assets than that in capital assets.

The discussion above, which is formalized in the example in the Appendix, leads to the following empirical leads to the following hypothesis: *the relation between investment-to-assets ratio and controlling owner's portfoliodiversification is more positive for public firms than for private ones.*

While we expect private firms to be on average more financially constrained than public ones, the two types of firms may be different along dimensions other than financial constraints. Therefore, to test the hypothesis according to which the difference between public and private firms' sensitivity of investment to owner's diversification is due to the difference in financial constraints, we construct a proxy for financial constraints that is not based on the mode of incorporation. The investment literature offers a number of alternative financial constraints indices (e.g., Kaplan and Zingales (1997), Lamont, Polk and Saa-Requejo (2001), Whited and Wu (2006), and Hadlock and Pierce (2010) among others). However,

since these indices are based on U.S. publicly-traded companies, they are less suitable for our sample that includes both public and private European firms. Therefore, we largely follow Campello and Chen (2010) in constructing our financial constraints measure, although a few changes to their methodology are necessary because of data availability in our sample.

First, each year we separately sort firms based on several characteristics employed in Campello and Chen (2010): size, coverage ratio (defined as the ratio of earnings before interest and taxes on interest paid), cash flow, and cash holdings (defined as the ratio of cash and cash equivalents to total assets).[16] We further include other characteristics that previous studies show to be associated with difficult access to external finance: age (included in Hadlock and Pierce (2010) index), firm sales growth and 2-digit SIC industry sales growth (both included in Whited and Wu (2006) index).[17]

Second, we rank firms in quintiles by each of the seven characteristics described above and give a score of 1 to 5, with a higher number indicating lower degree of financial constraints (except for industry sales growth, where ranking works in the opposite direction as documented by Whited and Wu, 2006). We then compute the total score of each firm by adding all seven scores. This final composite financial constraints index ranges from 7 to 35. Finally, we sort firms according to this index into three groups using 30% and 70% cut-off points. We consider firms in the lowest-ranked (highest-ranked) group as financially constrained (unconstrained).

Before we proceed to the empirical tests, we verify our assertion that private firms are on average more constrained than public ones. We find that among public firms belonging to either constrained or unconstrained samples as defined above, 67% (33%) are unconstrained (constrained), while the corresponding percentages among private firms are 48% (53%). Having verified the link between the mode of incorporation and financial constraints, we proceed to examine the relation between owner's portfolio diversification and financial constraints by re-estimating the regressions in (2), while replacing the public and private indicators by constrained and unconstrained indicators:

$$Inv\_to\_assets_{i,t} = \alpha UNCON_{i,t} + \beta CON_{i,t} + \gamma(UNCON_{i,t} * Diver_{i,t}) + \delta(CON_{i,t} * Diver_{i,t}) + \overline{\theta X_{i,t}} + Country * IndustryFE + YearFE + u_{i,t}, \quad (5)$$

where $UNCON_{i,t}$ and $CON_{i,t}$ are dummy variables equalling one for unconstrained and constrained firms

[16] Replacing coverage ratio with total leverage (as in Kaplan and Zingales (1997) and Whited and Wu (2006)) leads to similar results.

[17] We do not include Tobin's q (as in Kaplan and Zingales (1997)), dividend payout (as in Kaplan and Zingales (1997), Whited and Wu (2006), and Campello and Chen (2010)), and commercial paper and bond rating (as in Campello and Chen (2010)), as these variables are unavailable in our sample.

respectively. The results of estimating (5) are reported in Table 10.

Insert Table 10 here

The first three columns in Table 10 report the results obtained using the sample of both public and private firms. The results mirror our baseline evidence: investment-to-assets ratio is positively and significantly related to diversification measures for unconstrained firms, while the relation is negative for constrained firms.

In columns 4-9 of Table 10, we estimate (5) separately for private firms (in even columns) and public ones (in odd columns). In both subsamples, the investment-diversification relation is significantly lower for constrained firms than for unconstrained ones, as evidenced by the p-value of the difference between constrained and unconstrained firms' interaction variables. Moreover, the relation between owner's diversification and investment is significantly positive for public unconstrained firms, significantly negative for private constrained firms, and close to zero and insignificant for relatively constrained public firms and relatively unconstrained private ones. These results are consistent with our hypothesis and highlight the importance of financial constraints in shaping the effect of firm owner's portfolio diversification on firm's investment.

5 Conclusions

We empirically investigate the relation between firm owners' portfolio diversification and firms' investment rates. We examine this relation using Amadeus Top 250,000 database, which provides comprehensive accounting and ownership data on both private and public firms in 34 European countries over a twelve-year period. Using this dataset allows us to reconstruct equity portfolios of a large number of controlling owners, which we use to construct measures of portfolio diversification.

We find that investment-to-assets ratios of public firms are positively related to their owners' portfolio diversification, while they are negatively related to portfolio diversification of private firm owners. In many cases, owners' portfolio diversification has significant economic impact on firms' choices. We show in multiple ways that these results are not driven by the endogeneity of firm owners' portfolio diversification and possible self-selection of firms' mode of incorporation. Further, the results are robust to a battery of additional tests, which include: 1) alternative measures of investment; 2) controls for potential separation of firm ownership and control due to prevalence of dual-class shares in some countries; 3) potential agency considerations ("tunneling" incentives) of owners of firms with large wedge between voting and cash flow rights; 4) potential measurement errors in our portfolio diversification proxies; 5) controls for the quality

of accounting and reporting standards of private firms; 6) controls for owner's fraction of wealth invested in the controlled firm.

We hypothesize that a potential reason for our findings is the difference between the degree of financial constraints that a typical private firm faces relative to financial constraints of a typical public firm. Our findings of a positive relation between investment rate and owner's portfolio diversification for relatively unconstrained firms and a negative relation for relatively constrained firms support the financial constraints hypothesis and suggest that financial constraints play an important role in determining the sensitivity of firm investment to firm owner's portfolio diversification for firms with various modes of incorporation.

Overall, our results suggest that firms' controlling owners influence their firms' investment strategies in ways consistent with their utility maximization. The real effects of firm owners' portfolio diversification lead to important policy implications. In particular, if policymakers' goal is to encourage corporate investment then it is important not only to reduce firms' financial constraints by enhancing capital market development, but also to increase firm owners' portfolio diversification by fostering their participation in capital markets.

In this paper we focus on the effects of owners' portfolio diversification, mode of incorporation, and the interaction between them on firms' investment rates, while purposely abstracting from the effects on firms' financing strategies, such as their capital structures, cash holding policies, and payout policies. Given the strong effects of owners' portfolio diversification on firms' investment that we report, an analysis of its effects on private and public firms' financing strategies seems a promising direction of future research, which could enhance our understanding of the impact of firm owners' objectives on firms' strategies.

Appendix: Financial constraints and investment-diversification relation – an example

The controlling owner

We consider a situation in which a firm's controlling owner is imperfectly diversified. In particular, we assume that she owns a proportion η of the firm she controls and in addition, she invests an amount x in an imperfectly diversified portfolio with a normally distributed return R_p, whose mean is $\mathbb{E}R_p$ and whose standard deviation is σ_p.[18] We assume that the controlling owner is risk-averse and that she maximizes the expected utility of her terminal wealth, w. This utility is given by

$$u(w) = a^{-1} - a^{-1}\exp(-aw), \tag{6}$$

where $a = u''/u'$ is the investor's Arrow-Pratt coefficient of absolute risk aversion. Assuming that, similar to the returns of the owner's portfolio, her wealth that is due to ownership of the firm (to be discussed below) is normally distributed as well, investor's expected utility maximization simplifies into the mean-variance criterion:

$$\mathbb{E}u(w) = \mathbb{E}w - \frac{a}{2}\sigma^2(w). \tag{7}$$

The firm

The inverse demand for a firm's product is given by

$$p(q) = \alpha - \beta q, \tag{8}$$

where $p(q)$ is the product's price and q is the quantity of the product supplied. The intercept of the demand function, α, is stochastic. We assume that it is normally distributed with mean μ and standard deviation s.[19] $\beta > 0$ determines the elasticity of the demand for the firm's product: low β corresponds to a price-taking firm, while high β corresponds to an oligopolistic competition environment.

[18] σ_p is clearly decreasing in the number of stocks in the investor's portfolio, n_p, and in the correlation among their returns, ρ_p. Because of these monotonic relations, we consider σ_p a deep parameter of the model, while our proxies for σ_p in the empirical tests are based on n_p and ρ_p.

[19] Under extreme demand shock realizations, the linear demand model can lead to negative prices. As is common in the industrial organization literature (e.g., Vives (1984)), we assume the variance of demand intercepts to be sufficiently small to make the probability of negative prices negligible. We also do not allow firms to withhold any output from the market after observing the demand shock realization. It can be shown that even if firms were allowed to withhold output from the market, they would never do so in equilibrium as long as the demand shock variance is sufficiently small.

The firm's marginal cost of production is assumed constant. The total cost of producing q units of output, $C(q)$, equals

$$C(q) = \left(c - \delta\sqrt{K}\right) q, \tag{9}$$

where c is the "benchmark" marginal cost, which can be reduced by investing capital, K, whose unit cost is assumed one without loss of generality, into a cost-reducing technology. The efficiency of the cost-reducing technology is determined by the "investment efficiency" parameter, δ. Importantly, all of the results of the model go through if $\beta = 0$ and marginal cost of production is increasing. In addition, in the case of increasing marginal production cost, the investment does not have to be into a cost-reducing technology, but instead into physical capital identical to the existing one.

The firm is endowed with initial capital, W. In addition, the firm can raise external funds to be used for expanding physical capital. We assume that the costs of other inputs required for production, such as inventories, can be financed from future revenues (e.g., these costs are balanced by accounts payable in the balance sheet). We denote the proportional deadweight cost of raising one dollar of external capital as f. $f = 0$ corresponds to a completely unconstrained firm, while $f \to \infty$ corresponds to a completely constrained firm. The firm's overall capital, K, equals, thus, the sum of its endowment, W, and capital financed by externally raised funds, $I \geq 0$. Combining (8) and (9), the firm's profit is given by

$$\pi = (\alpha - \beta q)\, q - \left(c - \delta\sqrt{W + I}\right) q - (W + I) - fI. \tag{10}$$

Assuming that the firm's investment and production decisions (i.e. the choices of I and q) are made before the realization of the demand shock, the firm's profit is normally distributed with mean, $\mathbb{E}\pi$, and standard deviation, $\sigma(\pi)$, given by

$$\mathbb{E}\pi = (\mu - \beta q)\, q - \left(c - \delta\sqrt{W + I}\right) q - (W + I) - fI, \tag{11}$$

$$\sigma(\pi) = sq. \tag{12}$$

Controlling owner's problem

The objective of the firm's controlling owner is to maximize her expected utility by choosing the level of its investment in the cost-reducing technology, I, and output, q:

$$\max_{I \geq 0, q \geq 0} \mathbb{E}u(w) = \max_{I \geq 0, q \geq 0} \left[x\mathbb{E}\left(1 + R_p\right) + \eta\mathbb{E}\pi - \frac{a}{2}\left(x^2\sigma_p^2 + \eta^2\sigma^2(\pi) + 2x\eta\rho\sigma_p\sigma_\pi\right)\right]. \tag{13}$$

To focus on the effects of owner's portfolio diversification on firm strategies we abstract away from possible agency conflicts between controlling shareholders and other claim holders of the firm, as well as from potential information asymmetries, which may have important effects on firms' decision makers' objective

functions (e.g., Ross (1973), Jensen and Meckling (1976), Fama (1980), and Bolton and Scharfstein (1990)). To solve the owner's optimization problem in (13) we need to impose the following constraints on the model's parameters:

$$\mu - c - a\rho s\sigma_p x > 0, \tag{14}$$

$$\delta < \sqrt{(1+f)\,(4\beta + 2a\eta s^2)}, \tag{15}$$

$$W \leq \frac{\delta(\mu - c - a\rho s\sigma_p x)^2}{((1+f)\,(4\beta + 2a\eta s^2) - \delta^2)^2}. \tag{16}$$

Equation (14) ensures positive output in equilibrium, equation (15) ensures finite output, and equation (16) specifies that the optimal investment of a completely unconstrained firm (whose external financing cost equals zero) is larger than the amount of available internal capital.

Maximizing the owner's expected utility in (13) leads to the following equilibrium capital investment and output quantity:

Lemma 1 *1) If the financing cost is lower than*

$$\overline{f} = \frac{\delta(\mu - c - a\rho s\sigma_p x) - \sqrt{W}(4\beta + 2a\eta s^2 - \delta^2)}{\sqrt{W}(4\beta + 2a\eta s^2)}, \tag{17}$$

(relatively unconstrained scenario henceforth), equilibrium investment and output are given by

$$K^* = \left(\frac{\delta(\mu - c - a\rho s\sigma_p x)}{(1+f)\,(4\beta + 2a\eta s^2) - \delta^2}\right)^2, \tag{18}$$

$$q^* = \frac{2(1+f)(\mu - c - a\rho s\sigma_p x)}{(1+f)\,(4\beta + 2a\eta s^2) - \delta^2}, \tag{19}$$

respectively;

2) If the financing cost is equal or higher than $\overline{f}$ in (17) (constrained scenario hereafter), equilibrium investment and output are given by

$$K^* = W,$$

$$q^* = \frac{\mu - c - a\rho s\sigma_p x + \delta\sqrt{W}}{2\beta + a\eta s^2}, \tag{20}$$

respectively.

Proof. Partially differentiating (13) with respect to I and q, equating these derivatives to zero and solving the resulting system of two equations results in unconstrained optimal K^* and q^* in (18) and (19) respectively. Equating I^* to zero (or K^* to W) results in $\overline{f}$ in (17). For $f > \overline{f}$, unconstrained I^* is negative. Given the constraint of $I^* \geq 0$, $I^* = 0$ for $f \geq \overline{f}$. Differentiating (13) with respect to q, while

setting I to zero (or, alternatively, K^* to W), equating the derivative to zero and solving the resulting equation with respect to q results in q^* in (20).

Note that the threshold financing cost in (17), above which the firm is fully constrained (i.e. the financing cost above which the firm does not raise money in the capital markets in order to invest in cost-reducing technology) is higher when expected demand, μ, is stronger and when the baseline marginal cost of production, c, is lower. The reason is that the higher the demand and the lower the cost, the larger the optimal investment and the higher the financing cost that makes raising external capital prohibitively costly. Note also that the threshold financing cost is increasing in the efficiency of the cost-reducing technology, δ, for the same reason. Finally, the threshold financing cost is decreasing in the amount of available internal funds: the higher the internal capital available to the firm the less it is willing to resort to costly external financing.

When the firm is not fully constrained, both investment in cost-reducing technology and output are increasing in the efficiency of that technology and in the expected demand net of marginal production cost, and are decreasing in the cost of external financing. When the firm is fully constrained, equilibrium output is increasing in the available capital (all of which is invested), as well as in the expected demand net of marginal production cost.

Comparative statics

The firm's decision variables are the size of the investment in cost-reducing technology and the output quantity. In this section we examine the effects of the model's parameters on equilibrium investment-to-assets ratio. In our setup, the firm's book assets are composed of investment in cost-reducing technology, K, and the cost of other inputs required for production, $\left(c-\delta\sqrt{K}\right)q$. Thus, our measure of the firm's equilibrium investment-to-assets ratio, $\mathbb{I}^*$, is given by

$$\mathbb{I}^* = \frac{K^*}{K^* + \left(c-\delta\sqrt{K^*}\right)q^*}. \tag{21}$$

In what follows we examine comparative statics of $\mathbb{I}^*$ with respect to the parameters (inversely) related to diversification of controlling owner's portfolio: the volatility of the return on her holdings outside of the firm, σ_p, and the correlation of her portfolio return with the demand shock, ρ. Differentiating $\mathbb{I}^*$ with respect to measures of portfolio diversification, σ_p and ρ, leads to the following results:

Proposition 1 *1) A relatively unconstrained firm's investment-to-assets ratio is increasing in owner's portfolio diversification:* $\frac{\partial \mathbb{I}^*_{unconst}}{\partial \sigma_p} < 0$ *and* $\frac{\partial \mathbb{I}^*_{unconst}}{\partial \rho} < 0$*;*
2) A constrained firm's investment-to-assets ratio is decreasing in owner's portfolio diversification: $\frac{\partial \mathbb{I}^*_{const}}{\partial \sigma_p} > 0$ *and* $\frac{\partial \mathbb{I}^*_{const}}{\partial \rho} > 0$.

Proof. Dividing the optimal capital investment in the unconstrained case in (18) by assets, as in (21), results in an unconstrained firm's investment-to-assets ratio:

$$\mathbb{I}^*_{unconst} = \frac{\delta^2(\mu - c - a\rho s\sigma_p x)}{(1+f)^2(4\alpha s^2\eta - 8\beta c) + (1+2f)\delta^2(\mu - a\rho s\sigma_p x) + \delta^2 c}. \tag{22}$$

Differentiating $\mathbb{I}^*_{unconst}$ in (22) with respect to σ_p results in

$$\frac{\partial \mathbb{I}^*_{unconst}}{\partial \sigma_p} = -\frac{2ac(1+f)sx\delta^2\rho((4\beta + 2as^2\eta)(1+f) - \delta^2)}{(4(2\beta c + acs^2\eta)(1+f)^2 - \delta^2 c - \delta^2\mu(1+2f) + asx\delta^2\rho\sigma_p(1+2f))^2}. \tag{23}$$

The denominator of (23) is clearly positive. The numerator of (23) is positive due to the constraint in (15). Thus, $\frac{\partial \mathbb{I}^*_{unconst}}{\partial \sigma_p}$ in (23) is negative.

Differentiating $\mathbb{I}^*_{unconst}$ in (22)with respect to ρ results in

$$\frac{\partial \mathbb{I}^*_{unconst}}{\partial \rho} = -\frac{2ac(1+f)sx\delta^2\sigma_p((4\beta + 2as^2\eta)(1+f) - \delta^2)}{(4(2\beta c + acs^2\eta)(1+f)^2 - \delta^2 c - \delta^2\mu(1+2f) + asx\delta^2\rho\sigma_p(1+2f))^2}. \tag{24}$$

$\frac{\partial \mathbb{I}^*_{unconst}}{\partial \rho}$ in (24) is negative for the same reason as $\frac{\partial \mathbb{I}^*_{unconst}}{\partial \sigma_p}$ in (23).

Dividing the capital investment in the constrained case, W, by assets, as in (21), results in a constrained firm's investment-to-assets ratio:

$$\mathbb{I}^*_{const} = \frac{W}{W + \frac{(c - \sqrt{W}\delta)(\mu - c - a\rho s\sigma_p x + \sqrt{W}\delta)}{2\beta + as^2\eta}}. \tag{25}$$

Differentiating $\mathbb{I}^*_{const}$ in (25) with respect to σ_p results in

$$\frac{\partial \mathbb{I}^*_{const}}{\partial \sigma_p} = \frac{asWx\rho(c - \sqrt{W}\delta)(2\beta + as^2\eta)}{(W(2\beta - \delta^2 + as^2\eta) + \sqrt{W}(2c\delta - \mu\delta + asx\delta\rho\sigma_p) - c^2 + c\mu - acsx\rho\sigma_p)^2}. \tag{26}$$

$c - \sqrt{W}\delta$ has to be positive to ensure positive marginal cost of production, therefore $\frac{\partial \mathbb{I}^*_{const}}{\partial \sigma_p}$ in (26) is positive as well.

Differentiating $\mathbb{I}^*_{const}$ in (25) with respect to ρ results in

$$\frac{\partial \mathbb{I}^*_{const}}{\partial \rho} = \frac{asWx\sigma_p(c - \sqrt{W}\delta)(2\beta + as^2\eta)}{(W(2\beta - \delta^2 + as^2\eta) + \sqrt{W}(2c\delta - \mu\delta + asx\delta\rho\sigma_p) - c^2 + c\mu - acsx\rho\sigma_p)^2}, \tag{27}$$

which is positive for the same reason as $\frac{\partial \mathbb{I}^*_{const}}{\partial \sigma_p}$ in (26).

This result is illustrated in Figure 1, which plots the relation between investment-to-assets ratio as defined in (21), and the standard deviation of controlling owner's portfolio, σ_p, for various levels of financing constraints.[20] The inputs are as follows: $a = 0.5$, $\mu = 30$, $s = 10$, $\beta = 5$, $c = 5$, $\delta = 2$, $\mathbb{E}R_p = 0.1$, $\rho = 0.5$, $\eta = 0.5$, $x = 5$, $W = 0.2$. We vary the financing cost, f, between 0 and 3 and we vary the standard deviation of investor's portfolio, σ_p, between 0 and 0.5.[21] Figure 1 illustrates

[20]The results are similar when we examine the relation between equilibrium investment and ρ.

[21]The qualitative results hold for various parameter values, as long as the constraints in equations (14)-(16) are satisfied.

that for relatively unconstrained firms (f lower than approximately 0.5), investment-to-assets ratio is decreasing in the standard deviation of controlling owner's portfolio outside the firm, i.e. investment-to-assets ratio is increasing in portfolio diversification. For relatively constrained firms, on the contrary, investment-to-assets ratio is decreasing in portfolio diversification.

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Figure 1: Investment−to−asset ratio as a function of portfolio standard deviation and financing costs

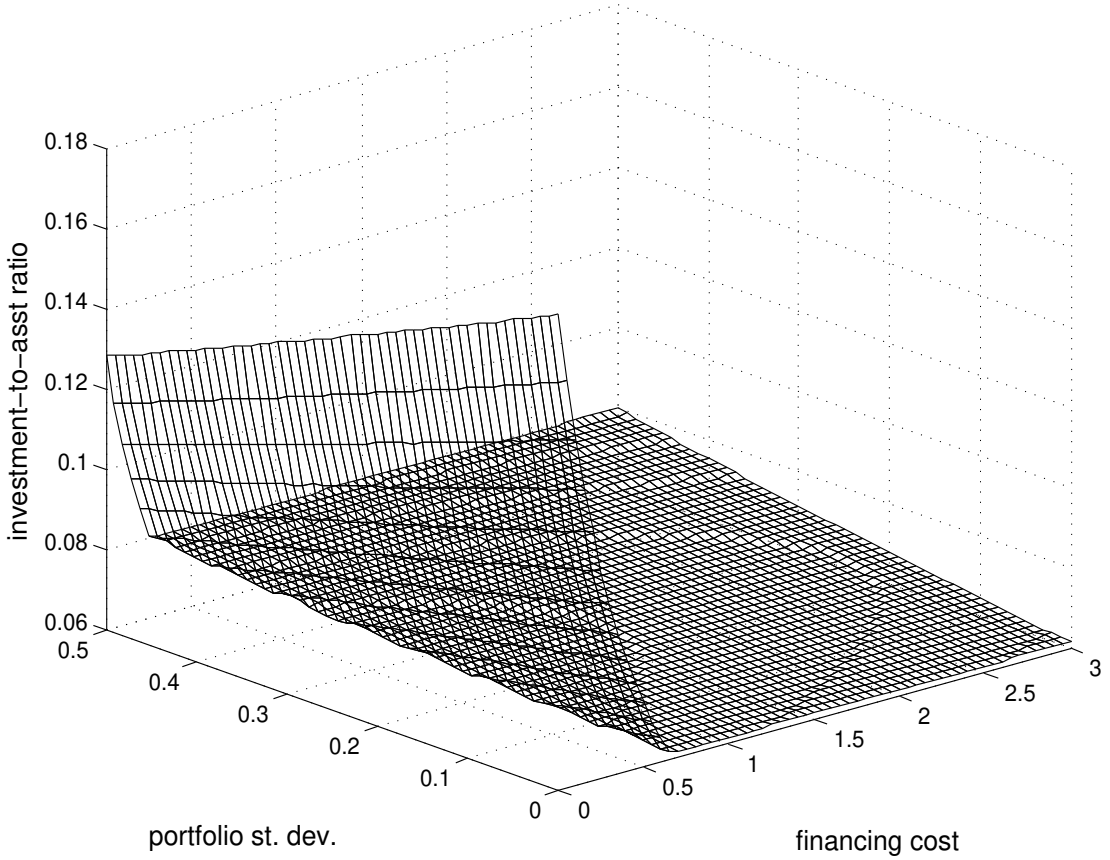

Table 1. Summary statistics

Panel A reports the country coverage in our sample and the proportion of public and private firms in each country. Panel B reports the difference in means of the main dependent variables between public and private firms. Investment-to-assets ratio is defined as the year-to-year change in gross fixed assets divided by lagged total assets. Total assets are computed as the sum of fixed and current assets. Panel C reports descriptive statistics of all control variables for the full sample, and separately for subsamples of public and private firms. Private is a dummy equalling 1 if a company is privately held in a given year and equalling zero otherwise. No. firms is the total number of firms in which a companys controlling owner holds shares, directly or indirectly, in a given year, across all countries in our sample. 1-Herfindahl index is one minus the sum of the squared values of the weight that each investment has in the controlling owners portfolio. -Correlation is correlation of the mean stock return of public firms in a firm's industry with the shareholder's overall portfolio returns, multiplied by -1. Sales growth is defined as the annual relative growth rate in total revenues. Cash flow is the ratio of income plus depreciation to lagged total assets. Firm age is the number of years since incorporation. Ln (size) is the natural log of total assets (in thousands $ U.S.), expressed in 1999 prices.

Panel A. Number of observations by country

Country	Obs.	% Public	% Private
Austria	2,388	0.02	0.44
Belgium	29,999	0.08	5.60
Bosnia-Herzegovina	247	0.02	0.02
Bulgaria	3,338	0.09	0.54
Croatia	4,848	0.13	0.79
Czech Republic	5,776	0.02	1.08
Denmark	16,194	0.11	2.95
Estonia	1,083	0	0.20
Finland	6,894	0.08	1.23
France	107,285	0.51	19.81
Germany	21,897	0.33	3.81
Greece	14,341	0.31	2.40
Hungary	647	0.01	0.12
Iceland	130	0.01	0.02
Ireland	126	0.01	0.02
Italy	4,7401	0.17	8.80
Latvia	102	0	0.02
Liechtenstein	8	0	0
Luxembourg	354	0	0.06
Macedonia	1	0	0
Netherlands	6,980	0.08	1.24
Norway	20,338	0.11	3.74
Poland	9,426	0.02	1.76
Portugal	8,661	0.03	1.61
Romania	5,663	0.05	1.02
Russia	32	0	0
Serbia	2,736	0.22	0.30
Slovak Republic	170	0.01	0.03
Slovenia	644	0.02	0.11
Spain	60,044	0.18	11.19
Sweden	22,922	0.16	4.18
Switzerland	466	0.03	0.05
Ukraine	3,619	0.02	0.67
United Kingdom	123,350	1.3	22.06
Total	528110	4.13	95.87

Panel B. Summary statistics: Dependent variables

	Mean	Median	St. dev	No. obs
	Investment-to-assets ratio			
Public	0.1087	0.0612	0.2265	21,800
Private	0.0693	0.0313	0.1589	506,310
p-value of difference	0.0000	0.0000		

Panel C. Summary statistics: Main and control variables

	All firms			Private firms		Public firms		p-values for differences	
Variable	Mean	Median	St. dev	Mean	Median	Mean	Median	Mean	Median
Private	0.9587	1	0.1989						
No. firms	20.70	2	70.49	19.77	2	42.38	4	0.000	0.000
Ln(No. firms)	1.3241	0.6931	1.5286	1.3015	0.6931	1.8483	1.3863	0.000	0.000
1-Herfindhal index	0.3320	0.2733	0.3413	0.3282	0.2605	0.4191	0.4643	0.000	0.000
-Correlation	-0.8092	-1	0.2344	-0.8128	-1	-0.7276	-0.7531	0.000	0.000
Sales growth	0.1116	0.0512	0.5161	0.1086	0.0510	0.1822	0.0543	0.000	0.106
Cash flow	0.0875	0.0723	0.1161	0.0880	0.0722	0.0755	0.0753	0.000	0.000
Age	25.1843	18	21.5692	24.7427	18	35.4424	22	0.000	0.000
Total assets ($)	167,706	22,753	2,624,713	120,638	21,895	1,260,874	87,516	0.000	0.000
Firm-year observations		528,110		21,211		506,899			
No. of firms		162,688		6,163		156,525			

Table 2. Regressions of investment-to-assets ratio on measures of portfolio diversification: Full sample

This table reports results of estimating (1) for the full sample of public and private firms during the period 1999-2010. See Table 1 for variable definitions. All regressions are estimated using OLS and include country*industry, and year fixed effects. P-values, adjusted for heteroskedasticity and clustering at the industry-country level, are reported in brackets below the coefficients.

	Ln(1+No.Firms)	1-Herf. Index	-Correlation
Portfolio Diversification	0.000004	-0.001	0.0030**
	[0.9855]	[0.2863]	[0.0262]
Sales Growth	0.0560***	0.0562***	0.0557***
	[0.0000]	[0.0000]	[0.0000]
Cash Flow	0.2451***	0.2516***	0.2467***
	[0.0000]	[0.0000]	[0.0000]
Ln(1+Age)	-0.0025***	-0.0024***	-0.0025***
	[0.0000]	[0.0000]	[0.0000]
R-squared	0.159	0.161	0.16
Firm year observations	528,110	518,501	525,686

Table 3. Regressions of investment-to-assets ratio on measures of portfolio diversification: Full sample

This table reports results of estimating (2) for the full sample of public and private firms during the period 1999-2010. See Table 1 for variable definitions. All regressions are estimated using OLS and include country*industry, and year fixed effects. P-values, adjusted for heteroskedasticity and clustering at the industry-country level, are reported in brackets below the coefficients. The economic significance of the portfolio diversification variables is reported beneath the p-values; this number is the percentage change in the dependent variable (relative to its mean) in response to an increase in the portfolio diversification variable equal to one standard deviation.

	Ln(1+No. firms)	1-Herf. index	-Correlation
Public	0.0682***	0.0741***	0.0965***
	[0.0000]	[0.0000]	[0.0000]
Private	0.0382***	0.0421***	0.0425***
	[0.0000]	[0.0000]	[0.0000]
Public x diver.	0.0037***	0.0145***	0.0213***
	[0.0000]	[0.0007]	[0.0002]
	0.0798	0.0698	0.0704
Private x diver.	-0.0003***	-0.0025***	0.0003
	[0.0093]	[0.0012]	[0.8976]
	-0.0065	-0.0120	0.0010
Sales growth	0.0554***	0.0555***	0.0552***
	[0.0000]	[0.0000]	[0.0000]
Cash flow	0.2466***	0.2535***	0.2484***
	[0.0000]	[0.0000]	[0.0000]
Ln(1+age)	-0.0033***	-0.0032***	-0.0032***
	[0.0000]	[0.0000]	[0.0000]
R-squared	0.161	0.163	0.162
Obs.	528,110	518,501	525,686

Table 4. Regressions of investment-to-assets ratio on measures of portfolio diversification: Owner fixed effects

This table reports results of estimating (2), augmented by owner fixed effects, for the full sample of public and private firms during the period 1999-2010. See Table 1 for variable definitions. All regressions are estimated using OLS and include country*industry, and year fixed effects. P-values, adjusted for heteroskedasticity and clustering at the industry-country level, are reported in brackets below the coefficients. The economic significance of the portfolio diversification variables is reported beneath the p-values; this number is the percentage change in the dependent variable (relative to its mean) in response to an increase in the portfolio diversification variable equal to one standard deviation.

	Ln(1+No.Firms)	1-Herf. Index	-Correlation
Public	0.0598***	0.0593***	0.0992***
	[0.0000]	[0.0000]	[0.0000]
Private	0.0458***	0.0443***	0.0392***
	[0.0000]	[0.0000]	[0.0000]
Public x diver	0.0046**	0.0245***	0.0375***
	[0.0137]	[0.0039]	[0.0002]
	9.92%	11.80%	12.40%
Private x diver	-0.0027**	-0.0075***	-0.0035
	[0.0345]	[0.0077]	[0.2909]
	-5.82%	-3.61%	-1.16%
Sales growth	0.0551***	0.0553***	0.0550***
	[0.0000]	[0.0000]	[0.0000]
Cash flow	0.2506***	0.2543***	0.2515***
	[0.0000]	[0.0000]	[0.0000]
Ln(1+age)	-0.0037***	-0.0038***	-0.0038***
	[0.0000]	[0.0000]	[0.0000]
R-squared	0.207	0.206	0.206
Obs.	528,110	518,501	525,686

Table 5. Post-acquisition changes in investment-to-assets ratios

This table reports changes in investment-to-assets ratios of (existing) firms belonging to portfolios of owners who acquire additional (new) firms to their portfolios. Panel A reports results for private existing portfolio firms, while Panel B reports results for public portfolio firms. The first column reports the natural logarithm of one plus the number of private and public firms belonging to portfolios of owners acquiring additional firms. The second column reports mean investment-to-assets ratios. The first two rows in each panel report the mean numbers of portfolio companies pre-acquisition and post-acquisition. Rows 3 and 4 in each panel report the mean investment-to-assets ratios pre-acquisition and post-acquisition. The third column reports the difference between the mean ln(1+ number firms) and mean investment-to-asset ratio after the acquisition and respective pre-acquisition figures. The fourth column reports p-values of the differences in column 3.

Panel A. Private firms

	Obs.	Mean	Diff. mean	P-value diff.
Ln(1+no.Firms)(pre-acquisition)	2,357	1.5285		
Ln(1+no.Firms)(post-acquisition)	2,357	1.8699	0.3414	0.0000
Investment-to-assets ratio(pre-acquisition)	2,357	0.0767		
Investment-to-assets ratio(post-acquisition)	2,357	0.0706	-0.0061	0.0883

Panel B. Public firms

	Obs.	Mean	Diff. mean	P-value diff.
Ln(1+no.Firms)(pre-acquisition)	97	1.3101		
Ln(1+no.Firms)(post-acquisition)	97	1.8147	0.5046	0.0015
Investment-to-assets ratio(pre-acquisition)	97	0.1058		
Investment-to-assets ratio(post-acquisition)	97	0.1480	0.0422	0.0735

Table 6. Regressions of investment-to-assets ratio on measures of portfolio diversification: Instrumental variables

This table reports results of estimating (2), for the full sample of public and private firms during the period 1999-2010, while using an instrument for portfolio diversification. The instrument is the spherical distance between firm owner and the stock market in her country. We use the product between geographical distance of the owners from the stock market and private/public status as an instrument for the interaction terms and we estimate two first stage regressions. In the first stage, we regress owner's portfolio diversification on the geographical distance between the firm owner and her country's stock market, along with all exogenous variables and industry,country, and year fixed effects. In an additional first-stage regression we regress the interaction term on the product between geographical distance and private/public status along with all other exogenous variables. In the second stage, we employ the predicted values of the owners portfolio diversification and the interaction term from the first stage regressions. In Panel A of Table 6 we report the second stage estimates. All second-stage regressions are estimated using OLS and include country*industry, and year fixed effects. P-values, adjusted for heteroskedasticity and clustering at the industry-country level, are reported in brackets below the coefficients. In Panel B we report only the estimates of the instruments from the first stage regressions. We also report the F-statistics of the instruments from the first stage regressions.

Panel A. Second-stage regression

	Ln(1+No.Firms)	1-Herfindhal Index	Correlation
Public	-1.883	-2.217	7.092*
	0.104	0.111	0.076
Private	0.136***	0.161**	-0.104
	0.0054	0.0202	0.264
Public x diver	1.419*	6.620*	8.867*
	[0.086]	[0.093]	[0.083]
Private x diver	-0.040**	-0.178*	-0.2689*
	[0.0454]	[0.0603]	[0.0613]
Sales growth	0.055***	0.055***	0.059***
	[0.0000]	[0.0000]	[0.0000]
Cash flow	0.250***	0.248***	0.251***
	[0.000]	[0.000]	[0.000]
Ln(1+age)	-0.023**	-0.025**	-0.021**
	[0.036]	[0.046]	[0.038]
Obs.	258,324	254,888	257,407

Panel B. First-stage regressions

IV: distance	-0.005***		-0.001***		-0.003***	
	[0.0000]		[0.0000]		[0.0000]	
IV: distance X listing status		0.004***		0.004***		0.004***
		[0.0000]		[0.0000]		[0.0000]
F-test of excl. instr.	207.8	221.06	155.3	160.85	251.7	265.34

Table 7. Regressions of investment-to-assets ratio on measures of portfolio diversification: Matched sample

This table reports results of estimating (2) for the matched sample of public and private firms during the period 1999-2010. We use the propensity score matching estimator to find for each public firm a possible match in the sub-sample of private companies (Rosenbaum and Rubin, 1983). In the propensity score matching estimation we include: sales growth, cash flow, and firm age, along with year, country and industry (1-digit U.S. SIC code) dummies. We require that the maximum difference between the propensity score of the public firm and its matching peer does not exceed 0.1% in absolute value. See Table 1 for variable definitions. All regressions are estimated using OLS and include country*industry, and year fixed effects. P-values, adjusted for heteroskedasticity and clustering at the industry-country level, are reported in brackets below the coefficients. The economic significance of the portfolio diversification variables is reported beneath the p-values; this number is the percentage change in the dependent variable (relative to its mean) in response to an increase in the portfolio diversification variable equal to one standard deviation.

	Ln(1+No. firms)	1-Herf. index	-Correlation
Public	0.1804***	0.1134***	0.1240***
	[0.0000]	[0.0000]	[0.0000]
Private	0.1444***	0.0744***	0.0650***
	[0.0000]	[0.0000]	[0.0000]
Public x diver.	0.0020**	0.0067	0.0106*
	[0.0382]	[0.1528]	[0.0873]
	0.0376	0.0264	0.0300
Private x diver.	-0.0020***	-0.0083**	-0.0094*
	[0.0049]	[0.0283]	[0.0826]
	-0.0376	-0.0327	-0.0266
Sales growth	0.0528***	0.0520***	0.0520***
	[0.0000]	[0.0000]	[0.0000]
Cash flow	0.3259***	0.3377***	0.3299***
	[0.0000]	[0.0000]	[0.0000]
Ln(1+age)	-0.0132***	-0.0132***	-0.0130***
	[0.0000]	[0.0000]	[0.0000]
R-squared	0.183	0.185	0.183
Obs.	42,422	41,729	42,227

Table 8. Regressions of investment-to assets ratio on measures of portfolio diversification: Treatment effect model

This table reports results of estimating (2) for the full sample of public and private firms during the period 1999-2010 using a two-stage Heckman model. All second-stage regressions are estimated using OLS and include country, industry, and year fixed effects. The independent variables in second-stage regressions are those used in the baseline regressions, augmented by the inverse Mills ratio from the first-stage regressions. To conserve space, we do not report the coefficients on control variables. At the bottom of the table we include results from the first stage probit model of the exogenous variable. The exclusion restriction is the Fraction of private firms in each country, 3-dgt U.S. SIC code and year of the company of interest. In the probit model in the first stage regressions all other control variables are also included along with country*industry, and year fixed effects. The inverse Mills ratio is calculated from the predicted values of the first stage probit regressions. P-values, adjusted for heteroskedasticity and clustering at the industry-country level, are reported in brackets below the coefficients. The economic significance of the portfolio diversification variables is reported beneath the p-values; this number is the percentage change in the dependent variable (relative to its mean) in response to an increase in the portfolio diversification variable equal to one standard deviation.

	Ln(1+No. firms)	1-Herf. index	-Correlation
	Second-stage regressions		
Public	0.0181***	0.0172***	0.0458***
	[0.0000]	[0.0000]	[0.0000]
Private	0.0131***	0.0112***	0.0128***
	[0.0000]	[0.0000]	[0.0000]
Public x diver.	0.0044***	0.0170***	0.0279***
	[0.0000]	[0.0000]	[0.0000]
	0.0949	0.0818	0.0923
Private x diver.	-0.0005***	-0.0020***	0.0019
	[0.0001]	[0.0000]	[0.1252]
	-0.0108	-0.0096	0.0063
Inverse Mills ratio	-0.0140***	-0.0145***	-0.0144***
	[0.0000]	[0.0000]	[0.0000]
	First-stage probit model		
Fraction of private firms	5.5042***	5.5092***	5.5139***
	[0.0000]	[0.0000]	[0.0000]
Obs.	528,110	518,501	525,686

Table 9. Robustness checks

This table reports results of estimating (2) for the full sample of public and private firms during the period 1999-2010 using alternative variable definitions and samples. To conserve space, we only report results using ln(1+number of firms). See Table 1 for variable definitions. In Panel A we use an alternative measure of investment-to-assets ratio. In particular, we replace investment-to-assets ratio by the sum of investment in CAPEX and investment in R&D, normalized by book assets. In Panel B we re-estimate the regression while excluding observations from countries in which the proportion of dual-class shares exceeds 10%: Sweden, Denmark, Italy, Switzerland, Finland, and Germany. In Panel C we re-estimate the regression while using a subsample of firm-years in which the wedge between owners' voting rights and cash flow rights do not belong to the top decile. In Panel D we re-estimate the regression while excluding observations from countries in which the proportion of households wealth invested in mutual funds exceeds 10%: Belgium, Austria, Spain, Sweden, Germany, and Switzerland. In Panel E we re-estimate the regression while excluding observations from countries in which the proportion of the gross value added of the real estate sector exceeds 10% of the total gross value added: France, Italy, Greece, Germany, Finland, Estonia, Bulgaria, and Denmark. In Panel F we re-estimate the regressions while excluding countries in which the disclosure of accounting information by private firm is either voluntary or not enforced or in which the disclosure criteria are undefined in the Amadeus database: Bosnia, Romania, Russia, Switzerland, Portugal, Germany, Liechtenstein, Malta, Monaco, and Slovak Republic. In Panel G we replace the measure of portfolio diversification by the fraction of wealth invested by owner in a firm she controls. All regressions are estimated using OLS and include country*industry, and year fixed effects. P-values, adjusted for heteroskedasticity and clustering at the industry-country level, are reported in brackets below the coefficients.

	Panel A Alt. dep. var.	Panel B Dual-class	Panel C Tunneling	Panel D House. hold.	Panel E Real estate	Panel F Disc. req.	Panel G Frac. wealth
Public	0.0795***	0.0549***	0.0702***	0.0672***	0.1273***	0.0364***	0.0742***
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
Private	0.0355***	0.0259***	0.0381***	0.0372***	0.0993***	0.0694***	0.0422**
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
Public x diver.	0.0057***	0.0045***	0.0031***	0.0040***	0.0055***	0.0035***	-0.0106***
	[0.0000]	[0.0000]	[0.0009]	[0.0000]	[0.0000]	[0.0001]	[0.0044]
Private x diver.	-0.0003*	-0.0005**	0.0005*	-0.0006*	-0.0009***	-0.0005*	0.0054***
	[0.0519]	[0.0973]	[0.0395]	[0.011]	[0.0057]	[0.0973]	[0.0000]
R-squared	0.155	0.167	0.161	0.162	0.154	0.159	0.166
Obs.	528,110	434,233	475,299	390,394	309,677	493,540	503,875

Table 10. Regressions of investment-to assets ratio on measures of portfolio diversification: Financial constraints

This table reports results of estimating (2) for the sample of unconstrained and constrained firms, as defined in Section 4. See Table 1 for variable definitions. Columns 1-3 present results for the full sample of private and public firms, while columns 4-9 present the results for the subsamples of private and public firms separately. All regressions are estimated using OLS and include country*industry, and year fixed effects. P-values, adjusted for heteroskedasticity and clustering at the industry-country level, are reported in brackets below the coefficients.

	Const. and unconst.			Ln(1+No.Firms)		1-Herf. Index		-Correlation	
	Ln(1+No.Firms)	1-Herf. Index	-Correlation	Private	Public	Private	Public	Private	Public
Unconstrained	0.0533***	0.0578***	0.0607***	0.0565***	0.1465***	0.0551***	0.1474***	0.0586***	0.1657***
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
Constrained	0.0403***	0.0452***	0.0354***	0.0434***	0.1297***	0.0425***	0.1291***	0.038***	0.1204***
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
Unconst. x diver	0.0008**	0.0029**	0.0082***	-0.0001	0.0033**	-0.0004	0.0118*	0.0031	0.0178*
	[0.0173]	[0.0368]	[0.0001]	[0.7434]	[0.0205]	[0.7519]	[0.1000]	[0.1179]	[0.0653]
	1.75%	1.38%	2.71%	-0.23%	7.16%	-0.21%	5.69%	1.01%	5.89%
Const. x diver	-0.0012***	-0.0055***	-0.0039***	-0.0012***	-0.0021	-0.0053***	-0.0095	-0.0043***	-0.0074
	[0.0000]	[0.0000]	[0.0172]	[0.0000]	[0.2045]	[0.0000]	[0.2038]	[0.0085]	[0.4469]
	-2.65%	-2.68%	-1.29%	-2.82%	-4.49%	-2.76%	-4.58%	-1.44%	-2.46%
Sales Growth	0.0535***	0.0536***	0.0533***	0.0519***	0.0589***	0.0520***	0.0584***	0.0516***	0.0590***
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
Cash Flow	0.2323***	0.2393***	0.2340***	0.2274***	0.3742***	0.2347***	0.3798***	0.2292***	0.3742***
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
Ln(1+Age)	-0.0054***	-0.0052***	-0.0053***	-0.0049***	-0.0209***	-0.0048***	-0.0208***	-0.0049***	-0.0208***
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
P-val of diff	[0.0000]	[0.0000]	[0.0000]	[0.0029]	[0.0054]	[0.0016]	[0.0244]	[0.0017]	[0.0520]
R-squared	0.164	0.166	0.165	0.165	0.200	0.166	0.202	0.165	0.200
Obs.	470,799	462,200	468,623	451,014	19,785	442,590	19,610	448,896	19,727