# Owners' portfolio diversification and firm investment: Theory and evidence from private and public firms

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# Motivation

# Firms and investors

- Neoclassical economics is based on two main assumptions:
  - Risk-averse investors maximize their expected utilities
  - Risk-neutral firms maximize their expected values/profits
- Empirically, the separation between investors and firms is not always clear
  - Firms are often controlled by imperfectly diversified and risk-averse owners (Benarzi and Thaler (AER, 2001), Moskowitz and Vissing-Jorgensen (AER, 2002), Faccio, Marchica and Mura (RFS, 2011))

# Controlling owners' diversification and risk taking by firms

- Owner's risk aversion affects the controlled firm's objective function
- A risk-averse owner has incentives to reduce risk taking by her firm
  - Expected-utility-maximizing risk-averse owner takes into account the variance of her overall wealth when making decisions on behalf of the firm she controls
  - Imperfect portfolio diversification increases the variance of portfolio return and its covariance with the firm's cash flow
  - This raises firm owner's risk avoidance incentives that lead to reduced risk taking by the firm

# Controlling owners' diversification and firm investment

- Empirically, firms controlled by less diversified owners make risk-reducing investments, which result in:
  - lower volatility of cash flows and/or stock returns (Low (JFE, 2009), Faccio, Marchica and Mura (RFS, 2011), Gormley, Matsa and Milbourn (JAE, 2013))
  - lower correlation with firms' existing cash flows (Amihud and Lev (Bell, 1981), Anderson and Reeb (JLE, 2003), Gormley, Matsa and Milbourn (JAE, 2013))

# Controlling owners' diversification and firm investment

- Changing the riskiness of capital investments is not the only way to affect firm's cash flow volatility
- Another option is to change the level of capital investment
  - The level of capital investment is related to operating leverage (Lev (JFQA, 1974), Peterson (JFE, 1994), and Kothari, Laguerre and Leone (RAS, 2002))
- Existing theoretical and empirical literature is silent on this channel
- We model a situation in which an imperfectly diversified firm owner chooses both the level of capital investment and its riskiness
- Modeling the interaction between the level and riskiness of investment is crucial for understanding the role of owners' portfolio diversification

# What we do: Theory

- We build a simple model that allows us to examine the effects of a firm's controlling owner's portfolio diversification on the firm's investment strategy:
  - Level of capital investment
  - Riskiness of capital investment
- The model shows that
  - The sign of the relation between a firm's investment and its owner's portfolio diversification depends crucially on the firm's degree of financial constraints

# What we do: Empirics

- We examine empirically, for the very first time, the relation between firms' investment strategies and their owners' portfolio diversification
  - We use data on private and public firms in 34 European countries over a 12-year period and are able to reconstruct (to a certain degree) firm owners' portfolios

# Model setup

# Controlling owner

- Controlling shareholder owns a proportion $\lambda$ of the firm
- In addition, she invests $x$ in an imperfectly diversified portfolio with a normally distributed return, whose mean is $R$, whose standard deviation is $s$, and whose correlation with the shock affecting the firm (to be discussed) is $\rho$
- The owner is risk-averse and maximizes the expected utility of her terminal wealth, $w$, given by

$$u(w) = \frac{1 - \exp(-aw)}{a}$$

- Assuming the firm's demand shock is normally distributed, the owner's expected utility simplifies into

$$\mathbb{E}u(w) = \mathbb{E}w - \frac{a}{2}\mathbb{V}\text{ar}(w)$$

# The firm

- The firm is endowed with the following production technology:
  - Investment of size $K^2$ produces cash flow $\alpha K$
  - $\alpha$ is the productivity parameter, distributed normally with standard deviation $\sigma$ and mean $\mu(\sigma)$ ($\mu'(\sigma) > 0$ and $\mu''(\sigma) < 0$)
    - The firm trades off the riskiness of investment against its expected return
  - $K\sigma$ is the firm's cash flow volatility
- The firm's investment may be constrained in equilibrium
  - There is a rigid investment capacity constraint $\left(\overline{K}(f,\sigma)\right)^2$
    - Consistent with credit rationing (Jaffe and Russell (QJE, 1976), Stiglitz and Weiss (AER, 1981))
    - $f$ describes the severity of the constraint, $\frac{\partial \overline{K}(f,\sigma)}{\partial f} < 0$
    - Investment capacity is decreasing in investment riskiness, $\frac{\partial \overline{K}(f,\sigma)}{\partial \sigma} < 0$

# Controlling owner's problem

- The controlling shareholder's problem is:

$$\max_{K,\sigma} \mathbb{E}u(w) = \max_{K,\sigma}[-\lambda K^2 + \lambda\mu(\sigma)K + x(1+R) - \frac{a}{2}((\lambda K\sigma)^2 + (xs)^2 + 2\lambda K\sigma xs\rho)]$$

subject to $K \leq \overline{K}(f,\sigma)$

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subject to $K \leq \overline{K}(f, \sigma)$

# Comparative statics

# Main results

- For a firm that is unconstrained in equilibrium
  - Diversification $\uparrow$ (i.e. either $s \downarrow$ or $\rho \downarrow$) $\Rightarrow$
    - Investment level $(K^2) \uparrow$
    - Investment riskiness $(\sigma) \uparrow$
- For a firm that is constrained in equilibrium
  - Diversification $\uparrow$ (i.e. either $s \downarrow$ or $\rho \downarrow$) $\Rightarrow$
    - Investment level $(K^2) \downarrow$
    - Investment riskiness $(\sigma) \uparrow$

# Intuition: An unconstrained firm

- The marginal costs of both the level and riskiness of capital investment are decreasing in owner's portfolio diversification
  - Higher diversification reduces the impact of both $K^2$ and $\sigma$ on the variance of owner's terminal wealth
- The marginal benefits of the level and riskiness of investment are not directly affected by owner's portfolio diversification
  - The impact of $K^2$ and $\sigma$ on the profitability of investment is independent of diversification
- As a result, equilibrium level and riskiness of investment are increasing in owner's portfolio diversification

# Intuition: A constrained firm

- Higher diversification reduces the impact of investment riskiness, $\sigma$, on the variance of owner's terminal wealth
- As a result, equilibrium riskiness of investment is increasing in portfolio diversification
- Higher investment riskiness leads to tighter investment capacity constraint, $\left(\overline{K}(f,\sigma)\right)^2$
- Capital investment level, $K^2$, is determined by the capacity constraint
- As a result equilibrium level of investment is decreasing in owner's portfolio diversification

# Intuition: Graphical illustration

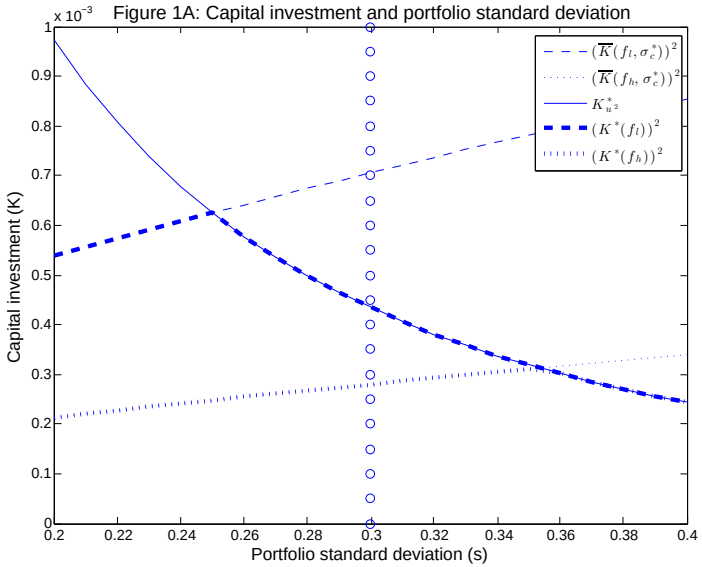

Figure 1A: Capital investment and portfolio standard deviation

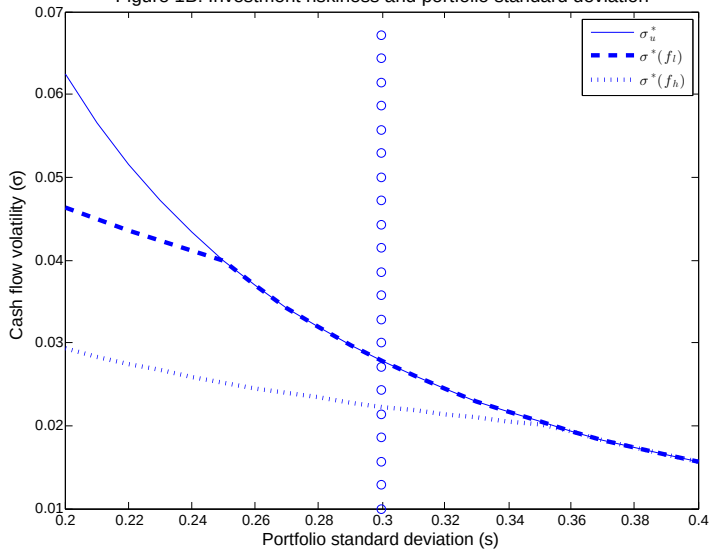

Figure 1B: Investment riskiness and portfolio standard deviation

# Data, measures, and empirical specification

# Data

- Our main data source is Bureau Van Dijk Amadeus Top 250,000
  - Contains ownership and accounting information for European private and public firms that satisfy a minimum size threshold (based on either revenues or book assets or number of employees)
  - Needs to be reassembled retroactively, since any given snapshot has a large survivorship bias
  - The sample period is 1999-2010
  - 528,110 firm-years belonging to 162,688 unique firms
  - 4.13% of these firms are public
  - Most represented countries are UK (22%), France (20%), Spain (11%), Italy (9%), Belgium (6%), Germany (4%), Sweden (4%), Norway (4%)

# Identifying controlling owner

- For each firm we identify all ultimate shareholders
- After tracing each ownership stake to its ultimate shareholder, we identify the shareholder controlling the largest fraction of voting rights – this is the largest ultimate shareholder or "controlling shareholder"
- We exclude firms (partially) controlled by governments

# Can largest shareholder influence firms' decisions?

- An average ultimate shareholder holds 62% of cash flow rights and 63% of voting rights in their firm
- In a random subsample of 5% of firms in our sample we find that
  - Ultimate shareholders tend to sit on their firms' boards (this happens in 51.2% of public firms and 50.8% of private firms)
  - Or have their relative sit on their firms' boards (this happens in at least 10.4% of public firms and 11.7% of private firms)
  - Are CEOs of their firms (this happens in 30% of cases)

# Measures of controlling owner's diversification

- For each controlling owner we identify all other holdings in firms covered by Amadeus
- We use 3 measures of controlling owner's diversification
  1. Log of the number of firms in which the controlling shareholder invests directly or indirectly, including firms for which Amadeus does not have accounting data ((Barber and Odean (JF, 2000), Goetzman and Kumar (RF, 2008))
  2. One minus the Herfindahl index of investor's portfolio (Bodnaruk, Kandel, Massa and Simonov (RFS, 2008))
  3. Correlation between returns of public firms in a firm's industry and the weighted average return of firms in the firm's controlling owner's portfolio (in case of public firms) and of public firms in the owner's portfolio firms' industries (in case of private firms), multiplied by -1

# Main measure of financial constraints

- Traditional measures of financial constraints may fail to identify constrained firms (Farre-Mensa and Ljungqvist (2014))
- The firm's mode of incorporation seems to be related to financial constraints
  - Public firms have easier access to external funds than private ones (Pagano, Panetta and Zingales (JF, 1998), Derrien and Kecskés (JF, 2007), Brav (JF, 2009), Hsu, Reed and Rocholl (JF, 2010), Schenone (2010), and Saunders and Steffen (RFS, 2011))
  - Public firms seem to behave as unconstrained, while private firms seem to behave as constrained ((Farre-Mensa and Ljungqvist (2014))

# Descriptive statistics

| | All firms | | | Public firms | | Private firms | | p-values of diff. | |
|---|---|---|---|---|---|---|---|---|---|
| Variable | Mean | Median | St. dev | Mean | Median | Mean | Median | Mean | Median |
| Investment | 0.0709 | 0.0321 | 0.1624 | 0.1087 | 0.0612 | 0.0693 | 0.0313 | [0.000] | [0.000] |
| # firms | 20.70 | 2 | 70.49 | 42.38 | 4 | 19.77 | 2 | [0.000] | [0.000] |
| Ln(# firms) | 1.3241 | 0.6931 | 1.5286 | 1.8483 | 1.3863 | 1.3015 | 0.6931 | [0.000] | [0.000] |
| 1-HHI | 0.3320 | 0.2733 | 0.3413 | 0.4191 | 0.4643 | 0.3282 | 0.2605 | [0.000] | [0.000] |
| -Corr. | -0.8092 | -1 | 0.2344 | -0.7276 | -0.7531 | -0.8128 | -1 | [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 | 0.0755 | 0.0753 | 0.0880 | 0.0722 | [0.000] | [0.000] |
| Age | 25.18 | 18 | 21.56 | 35.44 | 22 | 24.74 | 18 | [0.000] | [0.000] |
| Total assets | 167,706 | 22,753 | 2,624,713 | 1,260,874 | 87,516 | 120,638 | 21,895 | [0.000] | [0.000] |
| Firm-year observations | | 528,110 | | 21,211 | | 506,899 | | | |
| No. of firms | | 162,688 | | 6,163 | | 156,525 | | | |

# Empirical specification

- We estimate the following baseline regression:

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

- $PUB_{i,t}$ is public firm indicator
- $PRI_{i,t}$ is private firm indicator
- $Diver_{i,t}$ is one of the 3 diversification measures
- $\overline{X_{i,t}}$ includes 1) sales growth; 2) cash flow; 3) 1+ln(age)

# Empirical results

# Baseline specification

| Measure of diversification | Ln(# firms) | 1-Herf. index | -Correlation |
|---|---|---|---|
| Public | 0.0682*** | 0.0741*** | 0.0965*** |
| | [0.000] | [0.000] | [0.000] |
| Private | 0.0382*** | 0.0421*** | 0.0425*** |
| | [0.000] | [0.000] | [0.000] |
| Public x diver. | 0.0037*** | 0.0145*** | 0.0213*** |
| | [0.000] | [0.001] | [0.000] |
| Private x diver. | -0.0003*** | -0.0025*** | 0.0003 |
| | [0.009] | [0.001] | [0.898] |
| Sales growth | 0.0554*** | 0.0555*** | 0.0552*** |
| | [0.000] | [0.000] | [0.000] |
| Cash flow | 0.2466*** | 0.2535*** | 0.2484*** |
| | [0.000] | [0.000] | [0.000] |
| Ln(1+age) | -0.0033*** | -0.0032*** | -0.0032*** |
| | [0.000] | [0.000] | [0.000] |
| R-squared | 0.161 | 0.163 | 0.162 |
| Obs. | 528,110 | 518,501 | 525,686 |

# Omitted variable bias: Owner fixed effects

- It is possible that owner's unobserved characteristics, such as her utility function or risk aversion, simultaneously affect owner's portfolio diversification and firm investment
- This omitted variable bias could make our estimates biased and inconsistent
- Thus, we include in the baseline regressions owner fixed effects, which should capture all time-invariant owner characteristics

# Omitted variable bias: Owner fixed effects

| Measure of diversification | Ln(# firms) | 1-Herf. Index | -Correlation |
|---|---|---|---|
| Public | 0.0598*** | 0.0593*** | 0.0992*** |
| | [0.000] | [0.000] | [0.000] |
| Private | 0.0458*** | 0.0443*** | 0.0392*** |
| | [0.000] | [0.000] | [0.000] |
| Public x diver | 0.0046** | 0.0245*** | 0.0375*** |
| | [0.014] | [0.004] | [0.000] |
| Private x diver | -0.0027** | -0.0075*** | -0.0035 |
| | [0.035] | [0.008] | [0.291] |
| Sales growth | 0.0551*** | 0.0553*** | 0.0550*** |
| | [0.000] | [0.000] | [0.000] |
| Cash flow | 0.2506*** | 0.2543*** | 0.2515*** |
| | [0.000] | [0.000] | [0.000] |
| Ln(1+age) | -0.0037*** | -0.0038*** | -0.0038*** |
| | [0.000] | [0.000] | [0.000] |
| R-squared | 0.207 | 0.206 | 0.206 |
| Obs. | 528,110 | 518,501 | 525,686 |

# Owner self-selection: Acquisitions

- Owners with different level of portfolio diversification may select to invest in companies with certain investment rates
- To address this possible self-selection, we use the event of acquisitions as instances of a change in the composition of an owner's portfolio
  - Acquiring an equity stake in a company is an endogenous decision
  - However, under the null, we should observe no change in capital investment of the existing firms in her portfolio following the acquisition of a new firm
- We then examine subsequent changes in investment rates of public and private firms controlled by that owner
  - We first identify controlling owners who experience a net increase in the number of firms in their portfolios
  - Among these, we focus on acquisitions that account for at least 50% of pre-acquisition portfolio value

# Owner self-selection: Acquisitions

| Panel A. 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 | [0.002] |
| 1-Herfindahl index (pre-acquisition) | 97 | 0.3160 | | |
| 1-Herfindahl index (post-acquisition) | 97 | 0.4799 | 0.1638 | [0.000] |
| Investment-to-assets (pre-acquisition) | 97 | 0.1058 | | |
| Investment-to-assets (post-acquisition) | 97 | 0.1480 | 0.0422 | [0.074] |

| Panel B. 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 | [0.000] |
| 1-Herfindahl index (pre-acquisition) | 2,357 | 0.4039 | | |
| 1-Herfindahl index (post-acquisition) | 2,357 | 0.5067 | 0.1028 | [0.000] |
| Investment-to-assets (pre-acquisition) | 2,357 | 0.0767 | | |
| Investment-to-assets (post-acquisition) | 2,357 | 0.0706 | -0.0061 | [0.088] |

# Reverse causality: Instrumental variable analysis

- There may be a feedback effect from a firm's investment decisions to its owner's portfolio diversification
- We employ an instrumental variable approach as an alternative way to capture the part of owners' portfolio diversification that is arguably independent of their controlled firms' investment decisions
- We use the geographical distance between the owner's location and the stock market of the country in which she is based as an instrument for her portfolio diversification
  - Home bias is inversely related to the degree of investors' portfolio diversification (Goetzmann and Kumar (RF, 2008))
  - home bias is lower for investors located closer to the stock markets (Grinblatt and Keloharju (JF, 2001) and Zhu (2003))
  - Thus, the degree of portfolio diversification is likely to be inversely related to firm owners' geographical distance from the stock markets

# Reverse causality: Instrumental variable analysis

| Measure of diversification | Ln(# firms) | 1-Herfindhal Index | -Correlation |
|---|---|---|---|
| Public | -1.8828 | -2.2171 | 7.0917* |
| | [0.104] | [0.111] | [0.076] |
| Private | 0.1352*** | 0.1609** | -0.0990 |
| | [0.005] | [0.020] | [0.264] |
| Public × predicted diver. | 1.4188* | 6.6196* | 8.8666* |
| | [0.086] | [0.093] | [0.083] |
| Private × predicted diver. | -0.0312** | -0.1704* | -0.2634* |
| | [0.045] | [0.060] | [0.061] |
| Sales growth | 0.0549*** | 0.0550*** | 0.0587*** |
| | [0.000] | [0.000] | [0.000] |
| Cash flow | 0.2502*** | 0.2484*** | 0.2515*** |
| | [0.000] | [0.000] | [0.000] |
| Ln(1+age) | -0.0234** | -0.0251** | -0.0212** |
| | [0.036] | [0.046] | [0.038] |
| Obs. | 258,324 | 254,888 | 257,407 |

# Self-selection of incorporation mode: Matched sample and treatment effect model

- Firms' mode of incorporation may be endogenous
- We address this potential endogeneity in two ways
  - Matched sample
    - We use the propensity score matching procedure to find for each public firm a possible match within the subsample of private firms (Michaely and Roberts (RFS, 2012))
  - Treatment effect model
    - We estimate a two-stage Heckman (Econometrica, 1979) selection model, where in the second stage, we include the inverse Mills ratio from the first-stage probit regression of the choice of being public

# Self-selection of incorporation mode: Matched sample

| Measure of diversification | Ln(# firms) | 1-Herf. index | -Correlation |
|---|---|---|---|
| Public | 0.1334*** | 0.1391*** | 0.1509*** |
| | [0.000] | [0.000] | [0.000] |
| Private | 0.1114*** | 0.1151*** | 0.1099*** |
| | [0.000] | [0.000] | [0.000] |
| Public x diver. | 0.0026** | 0.0058 | 0.0148** |
| | [0.013] | [0.251] | [0.033] |
| Private x diver. | -0.0013 | -0.0092* | -0.0012 |
| | [0.260] | [0.070] | [0.882] |
| Sales growth | 0.0587*** | 0.0584*** | 0.0584*** |
| | [0.000] | [0.000] | [0.000] |
| Cash flow | 0.3255*** | 0.3410*** | 0.3317*** |
| | [0.000] | [0.000] | [0.000] |
| Ln(1+age) | -0.0127*** | -0.0129*** | -0.0129*** |
| | [0.000] | [0.000] | [0.000] |
| R-squared | 0.160 | 0.163 | 0.161 |
| Obs. | 30,640 | 30,084 | 30,473 |

# Self-selection of incorp. mode: Treatment effect model

| Measure of diversification | Ln(# firms) | 1-Herf. index | -Correlation |
|---|---|---|---|
| Public | 0.0181*** | 0.0172*** | 0.0458*** |
| | [0.000] | [0.000] | [0.000] |
| Private | 0.0131*** | 0.0112*** | 0.0128*** |
| | [0.000] | [0.000] | [0.000] |
| Public x diver. | 0.0044*** | 0.0170*** | 0.0279*** |
| | [0.000] | [0.000] | [0.000] |
| Private x diver. | -0.0005*** | -0.0020*** | 0.0019 |
| | [0.000] | [0.000] | [0.125] |
| Inverse Mills ratio | -0.0140*** | -0.0145*** | -0.0144*** |
| | [0.000] | [0.000] | [0.000] |
| Sales growth | 0.0560*** | 0.0561*** | 0.0577*** |
| | [0.000] | [0.000] | [0.000] |
| Cash flow | 0.2565*** | 0.2635*** | 0.2583*** |
| | [0.000] | [0.000] | [0.000] |
| Ln(1+age) | -0.0025*** | -0.0024*** | -0.0025*** |
| | [0.000] | [0.000] | [0.000] |
| Obs. | 527,427 | 517,645 | 524,826 |

# Measurement errors in ownership and decision making

- Dual-class shares may create measurement errors in ownership levels, and may lead to errors in identifying controlling owners
- Ultimate controlling shareholders with low voting rights may not be their firms' decision makers
- Financial owners may not be risk-averse expected utility maximizers
- Controlling owners whose cash flow rights are different from voting rights may be subject to agency conflicts
  - We focus on sub-samples of firm-years in which ultimate shareholders are more likely to be risk-averse decision makers
    - Countries with relatively low use of dual-class shares
    - Firms in which ultimate controlling shareholders hold at least 10% of voting rights
    - Firms with non-financial ultimate controlling shareholders
    - Firms with low wedge between cash flow rights and voting rights

# Measurement errors in portfolio diversification

- Lack of data on mutual/hedge fund investments and real estate investments leads to potentially biased diversification measures
- We focus on sub-samples of countries in which the errors in measurement of owner's diversification are likely to be less severe
  - We exclude countries with large proportion of investments in mutual funds
  - We exclude countries with large real estate sectors

# Measurement errors in dependent and independent variables

- Sub-par disclosure and reporting standards in some countries could lead to selection bias towards more successful firms
- We focus on sub-samples of countries with satisfactory disclosure requirements and accounting standards
  - We exclude countries in which firms are not required to disclose or are less likely to satisfy disclosure requirements
  - We exclude countries with relatively poor accounting standards and high likelihood of misreporting

# An alternative measure of financial constraints

- Public firms may be different from private ones along dimensions other than financial constraints
- Thus, we also examine a measure of constraints that is not based on the mode of incorporation
- Our alternative measure is based on the sample distribution of several other firm's characteristics: size, coverage ratio, cash flow, cash holdings, age, firm sales growth, and industry sales growth (similar to Campello and Chen (JMCB, 2010) methodology)
- We rank firms into quintiles based on each of the characteristics and assign scores from 1 to 5
- We then sort firms according to this composite measure and assign firms above/below median to constrained/unconstrained samples
  - 67% (33%) of public firms and 48% (52%) of private firms are unconstrained (constrained)

# An alternative measure of financial constraints

| Measure of diversification | Ln(# firms) | 1-Herfindhal Index | -Correlation |
|---|---|---|---|
| Unconstrained | 0.0533*** | 0.0578*** | 0.0607*** |
| | [0.000] | [0.000] | [0.000] |
| Constrained | 0.0403*** | 0.0452*** | 0.0354*** |
| | [0.000] | [0.000] | [0.000] |
| Unconstrained x diver. | 0.0008** | 0.0029** | 0.0082*** |
| | [0.017] | [0.037] | [0.000] |
| Constrained x diver. | -0.0012*** | -0.0055*** | -0.0039*** |
| | [0.000] | [0.000] | [0.017] |
| Sales Growth | 0.0535*** | 0.0536*** | 0.0533*** |
| | [0.000] | [0.000] | [0.000] |
| Cash Flow | 0.2323*** | 0.2393*** | 0.2340*** |
| | [0.000] | [0.000] | [0.000] |
| Ln(1+age) | -0.0054*** | -0.0052*** | -0.0053*** |
| | [0.000] | [0.000] | [0.000] |
| R-squared | 0.164 | 0.166 | 0.165 |
| Obs. | 470,799 | 462,200 | 468,623 |

# Conclusions

# Conclusions

- We investigate theoretically and empirically the relation between firms' capital investment and diversification of their owners' portfolios
- The model shows that the sign of this relation depends crucially on whether the firm's investment is constrained or unconstrained in equilibrium
  - The relation is positive for unconstrained firms and negative for constrained ones
- The empirical results, obtained using a sample of over 500K private and public firm-years are consistent with the model's predictions
- The real effects of firm owners' portfolio diversification may have an important policy implication
  - It is important not only to reduce firms' financial constraints by enhancing capital market development, but also to reduce barriers to firm owners' portfolio diversification by fostering their participation in stock markets