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LARGE SHAREHOLDER DIVERSIFICATION AND CORPORATE RISK-TAKING

Mara Faccio[1], Maria-Teresa Marchica[2] and Roberto Mura[2]

ABSTRACT

Using new data for the universe of firms covered in *Amadeus,* we reconstruct the equity portfolios of shareholders who hold equity stakes in private and publicly-traded European firms. We find great heterogeneity in the degree of portfolio diversification across large shareholders. Exploiting this heterogeneity, we document that firms controlled by diversified large shareholders undertake riskier investments than firms controlled by non-diversified large shareholders. The impact of large shareholder diversification on corporate risk-taking is both economically and statistically significant. Our results have important implications at the policy level because they identify one channel through which policy changes aimed at improving capital market development and diversification can improve economic welfare.

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Using new data for the universe of firms covered in *Amadeus,* we reconstruct the equity portfolios of shareholders who hold equity stakes in private and publicly-traded European firms. We find great heterogeneity in the degree of portfolio diversification across large shareholders. Exploiting this heterogeneity, we document that firms controlled by diversified large shareholders undertake riskier investments than firms controlled by non-diversified large shareholders. The impact of large shareholder diversification on corporate risk-taking is both economically and statistically significant. Our results have important implications at the policy level because they identify one channel through which policy changes aimed at improving capital market development and diversification can improve economic welfare.

LARGE SHAREHOLDER DIVERSIFICATION AND CORPORATE RISK-TAKING

This paper provides direct evidence that firms controlled by non-diversified large shareholders invest more conservatively than firms controlled by well diversified large shareholders. The impact of large shareholder diversification on corporate risk-taking is both statistically and economically meaningful.

The effect of portfolio diversification on corporate risk-taking has important macroeconomic implications. Prior macroeconomic studies have shown that entrepreneurs' willingness to take risks in the pursuit of profitable opportunities is a fundamental underpinning of long term economic growth (Barro, 1991, Baumol, Litan, and Schramm, 2007, DeLong and Summers, 1991). Sustained growth, in turn, results in higher levels of economic development. From a macroeconomic perspective, understanding the determinants of risk-taking helps to identify channels through which policy changes can improve economic welfare.

This study has also related implications for the microeconomic literature that uses ownership concentration as a proxy for shareholder portfolio diversification. A central theme in this literature is that *if* their *wealth* is largely concentrated in the firms they own, risk-averse owners will seek to avoid risk more than they would had they held a diversified portfolio.[1] In this literature, authors have used ownership concentration as a proxy for both well diversified and undiversified investors, making diametrically opposed assumptions about diversification, neither of which presumption is based on hard evidence.[2,3] Ironically, these studies have reached mixed conclusions. Anderson and Reeb (2003) find that

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[1] Alternatively, one could argue that insiders who choose to keep their wealth undiversified are risk-lovers (Carroll, 2000) so that portfolio concentration should be positively associated with insiders' willingness to invest in riskier projects.

[2] Anderson and Reeb (2003) provide some evidence that controlling families typically hold undiversified portfolios. Their evidence, however, is limited to those families that appear in *Forbes' Wealthiest Americans Survey*.

[3] In the agency literature, studies have focused more specifically on *managers'* risk-avoidance behavior in corporate investment decisions due to reputational concerns (Holmstrom and Ricart i Costa, 1986, and Hirshleifer and Thakor, 1992) or to their undiversified human capital (Amihud and Lev, 1981, Agrawal and Mandelker, 1987). Those papers focus on managers' incentives to lower risk and on the consequent conflict of interests between managers and shareholders.

the presence of block positions held by founder families, whom they assume to be undiversified investors, is surprisingly associated with higher operating risk. In contrast, Amihud and Lev (1981) find that risk reducing investments such as diversifying acquisitions, are less likely when a large blockholder, whom they assume to be a more diversified investor, is present. In a more recent study, John, Litov, and Yeung (2008) find no significant relation between ownership concentration and corporate risk-taking. The evidence presented in this study provides future researchers with new information regarding appropriate assumptions about shareholder diversification.

To investigate the impact of large shareholder diversification on corporate risk-taking, we exploit the data available in *Amadeus* to reconstruct the stock portfolios of a large panel of shareholders who hold equity stakes in privately-held and publicly-traded European firms. We reconstruct the portfolio for all shareholders of each firm with ownership data in *Amadeus*, for a total of 1,315,558 shareholder-year observations. For each company, we assume that a company's largest (ultimate) shareholder has enough power to control the firm's investment decisions.[4] We estimate both cross-sectional and panel regressions to investigate the relation between owners' portfolio diversification and corporate risk-taking. We use three proxies to measure diversification for each company's largest shareholder: (i) the (natural log of the) number of firms in which this investor holds shares across all countries in our sample; (ii) the Herfindhal index of wealth concentration; (iii) and the (natural log of the) number of different 4-digit primary SIC code sectors in which the companies in the largest shareholder's portfolio operate. Our primary measure of firm riskiness is the volatility of firm-level profitability over a given 5-year period. Profitability is measured as a firm's return on assets (ROA).

We find strong *statistical* evidence that firms controlled by non-diversified large shareholders invest more conservatively than firms controlled by well diversified large shareholders. Further, and more importantly, the *economic impact* of large shareholder diversification on risk-taking is non-negligible. Across all cross-sectional specifications, on average, an increase in the level of the largest shareholder's

[4] The data supports our assumption; in our sample, on average, the largest shareholder controls 63.96% of votes, clearly enough to give her effective control.

portfolio diversification from the first to the third quartile of the distribution results in an 8.94% increase in the volatility of ROA. The results are qualitatively similar when we analyze three alternative proxies for firm risk-taking: the likelihood of survival, the difference between the maximum and minimum ROA, and the volatility of return on equity. The results are also robust to using alternative proxies for portfolio diversification.

The positive association between portfolio diversification and corporate risk-taking persists in our panel regression analysis, which includes shareholder fixed-effects. Such a framework has the benefit of controlling for any investor-specific (time-invariant) omitted variables.

While we cannot fully eliminate concerns of endogeneity with non-experimental data, we take a number of steps to corroborate the claim that portfolio diversification has a causal impact on corporate risk-taking. First, we show that, in part because of the predominance of privately-held firms in our sample, on average the largest shareholder controls a super-majority of votes. As such, large shareholders control corporate choices.[5] Second, we run a number of tests using a sub-sample of start-up firms. For start-ups, it is undoubtedly the founder-shareholder who explicitly chooses her desired level of firm risk-taking. We show that firms started by investors who hold diversified portfolios are riskier than firms started by non-diversified founders. Thus, if all existing shareholders were non-diversified, we would observe a lower level of risk-taking among start-ups. In turn, as proposed in the economic development literature, there would be less long term growth in the economy.

Our results have important policy implications. A rich literature has emphasized the importance of developed capital markets as a key factor in stimulating economic growth. This literature goes back at least to Schumpeter (1912). More recent studies include, but are not limited to, Beck, Levine and Loayza (2000), Jayaratne and Strahan (1996) and Rajan and Zingales (1998). Further, studies cited above (Barro, 1991, Baumol *et al.*, 2007, DeLong and Summers, 1991) have shown that risk-taking is a fundamental determinant of long term economic growth. In this study, we show that diversification (at the shareholder

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[5] 94.61% of the firms in our sample are privately-held. The largest shareholders' dominance within their firms is discussed in detail in section III.

portfolio level) is conducive to more corporate risk-taking. To the extent that the presence of more developed capital markets allows investors to achieve higher levels of diversification, our results point to a channel through which policy changes can have a positive impact on economic welfare. Specifically, policies that promote capital market development and facilitate investors' portfolio diversification are likely to promote corporate risk-taking.

This paper relates in general to the literature investigating the determinants of risk-taking. Djankov, Ganser, McLiesh, Ramalho, and Shleifer (2009) show that corporate taxes have a large adverse impact on entrepreneurial activities. Djankov *et al.* (2009) and John *et al.* (2008) show that better protection of property rights has a positive effect on the propensity to start up new businesses and on corporate risk-taking. Morck, Wolfenzon, and Yeung (2005) survey the literature on the consequences of wealth concentration in an economy on the allocation of capital, innovation, and economic growth. The authors discuss how wealth concentration in an economy may lead insiders to augment rent-seeking and to curtail investment in innovation. We highlight an additional determinant of risk-taking -- the extent of diversification of a controlling shareholder's portfolio.

Finally, our study relates to a large literature on the economic behavior of firms. Our empirical analysis allows us to assess the validity of some stylized assumptions in this literature. A typical assumption is that corporate insiders are not well diversified. Examples of such studies include Anderson and Reeb (2003), John *et al.* (2008), Shleifer and Vishny (1997), and Stulz (2005).[6] Our study adds to this literature in two ways. First, while we provide hard evidence that the typical large shareholder is undiversified,[7] we also document a high degree of heterogeneity across large shareholders. There are in fact many cases in which the largest shareholder is very well diversified, holding stakes in hundreds of

[6] A limited number of papers have made the opposite claim, e.g., that large shareholders hold somewhat diversified portfolios (e.g., Jensen and Meckling, 1976, and Amihud and Lev, 1981). Limited empirical evidence that at least some large shareholders are well diversified is found in the literature on business groups (Bertrand, Johnson, Samphantharak and Schoar, 2008, Bertrand, Metha and Mullainathan, 2002, Faccio, Lang and Young, 2001, Khanna and Yafeh, 2005, Morck, 2005).

[7] In the U.S., the portfolios of households investing in the private equity market also appear to be quite concentrated (Moskowitz and Vissing-Jørgensen, 2002). Further evidence of a general lack of portfolio diversification for small individual investors is reported in Barber and Odean (2000), Goetzmann and Kumar (2008), Karhunen and Keloharju (2001).

firms. Second, while we find some empirical support for the trade-off between holding a dominant position in a *relatively large* firm and achieving a reasonable degree of portfolio diversification (Demsetz and Lehn, 1985), we find that the correlation between ownership concentration and portfolio diversification is relatively low. For example, the correlation coefficient between ownership concentration and the number of firms in which a company's largest shareholder holds shares is -0.31. This means that, while shareholders who hold large ownership stakes in a firm tend to be less diversified than shareholders who hold smaller stakes, this relation is relatively weak. This result suggests that caution should be exercised when ownership concentration is used as a proxy for the degree of an individual's presumed portfolio diversification, as many large (small) shareholders are in fact well (poorly) diversified.

The rest of the paper is organized as follows. In Section I we describe the data sources used. Section II presents descriptive statistics as well as the results of regressions of risk-taking variables against our measures of large shareholder's portfolio diversification. Section III addresses endogeneity concerns. Section IV presents the results of various robustness tests. Section V summarizes our findings and concludes.

I. Data

To address our question, we gather (direct) ownership and accounting data for all companies included in "*Amadeus top 250,000.*" *Amadeus* is one of the *Bureau van Dijk Electronic Publishing*'s databases. This database includes European privately-held and publicly-traded companies that satisfy the following criteria. For France, Germany, Italy, Russia, Spain, Ukraine, and the United Kingdom, *Amadeus top 250,000* includes all companies with revenues of at least €15m, or total assets of at least €30m, or at least 200 employees. For the other countries, it includes all companies with operating revenues of at least €10m, or total assets of at least €20m, or at least 150 employees. The database excludes companies with operating revenues per employee or total assets per employee of less than €1,000. Disclosure requirements in Europe require private companies to submit their annual accounting and ownership data, so that this information is publicly available. However, some limitations exist. For example, in Portugal and Germany many companies fail to comply with the filing requirements. In

Bosnia, Macedonia, Russia, Serbia & Montenegro, Switzerland, and Ukraine, publication is not required. As a consequence, the number of companies with available data is limited in these countries. In Austria, the disclosure of financial information only covers a few basic items for small and medium sized enterprises.

A. Risk-taking Variables

Our primary measure of corporate risk-taking behavior is the country-adjusted volatility of firm profitability, $\sigma(ROA)$. Profitability is measured by the firm's return on assets (ROA), defined as the ratio of earnings before interests and taxes to total assets. For each year, we compute the difference between a firm's ROA and the average ROA across all non-financial firms in the country in which the company is registered. By removing the influence of the home country's economic cycle, we have a cleaner measure of the level of risk resulting from corporate decisions. In the cross-sectional regressions, we calculate the standard deviation of the adjusted returns for each firm over the entire sample period (1999-2007), requiring a minimum of 5 observations. This approach is similar to the procedure used by John *et al.* (2008). In the panel regressions, we measure performance volatility over 5-year over-lapping periods (1999-2003, 2000-2004, 2001-2005, 2002-2006, and 2003-2007).

B. Ownership and Wealth Diversification Variables

For each company that has available ownership data, we identify all ultimate shareholders. That is, whenever the direct shareholder of a firm is another firm, we identify its owners, the owners of its owners, and so on. If a shareholder i owns a fraction α_{iy} of the shares of firm *Y*, which owns a fraction β_{yj} of the shares of firm *J*, we measure shareholder i's control over voting rights in *J* (*Ultimate Control*) by the weakest link along the chain, i.e., the minimum of α_{iy} and β_{yj}.[8] A clear improvement in this calculation over prior studies is that *Amadeus* provides information on the ownership of private, as well as public firms, which allows us to trace the ownership of unlisted companies. Overall, the data used to

[8] This approach was earlier used by Claessens, Djankov, and Lang (2000) and Faccio and Lang (2002). Consistent with the procedure used in those papers, we trace ownership of pyramids of any length.

calculate the ownership and diversification variables discussed in this section include 1,315,558 shareholder-year observations.

After tracing each ownership stake to its ultimate shareholders, we identify the shareholder controlling the largest fraction of voting rights in each firm, whom we label as the firm's *Largest Ultimate Shareholder.* The ownership, control, and diversification variables employed throughout the paper always refer to each firm's largest ultimate shareholder. We focus on the shareholder controlling the largest fraction of voting rights in the firm because control of voting rights indicates more power in corporate decision making.

For each shareholder, we also compute the cash flow rights in the firm's earnings. Using the example above, if a shareholder i owns a fraction α_{iy} of the shares of firm *Y*, which owns a fraction β_{yj} of the shares of firm *J*, then i will be entitled to a fraction $uo_{ij} = \alpha_{iy}\beta_{yj}$ of the cash flows of *J*, which we label *Ultimate Ownership*. Because a high level of ownership serves to align the controlling shareholder's incentives with those of minority shareholders, later in the paper we use the ownership variable to address the possibility that some of our results may in fact reflect tunneling.

We develop three proxies of portfolio diversification for each largest shareholder. The first measure, *Ln No. Firms*, is the natural log of the number of companies in which a company's largest ultimate shareholder holds shares, directly or indirectly, in a given year, across all countries in our sample. We build this variable exploiting all information available in *Amadeus*, including ownership in companies for which *Amadeus* does not disclose any accounting data. We only require that, for a given year, based on the data in *Amadeus*, we are able to identify a particular investor as one of the ultimate shareholders of a given firm in a specific year. A firm is considered part of the shareholder's portfolio regardless of the size of the investor's stake in that firm.

The second proxy for portfolio diversification is the *Herfindhal Index,* a measure of wealth concentration for the portfolio owned by each firm's largest ultimate shareholder. To compute this index, we first calculate the dollar value of the investment made by a given shareholder in each firm in her portfolio, as the book value of equity of that company, BE_j, multiplied by the shareholder's ultimate ownership stake in that given firm, uo_{ij}. Because we have both public and private companies in the sample, we have to rely on book values for this calculation. Additionally, in the calculation of the Herfindhal Index we can include only firms with available data for the book value of equity.[9] After computing the value of a shareholder's investment in each firm in her portfolio, we sum the value of these investments to obtain the shareholder's total wealth, $W_i = \sum_{j=1}^{J} BE_j \cdot uo_{ij}$. Next, we compute the incidence of the investment in each firm in the shareholder's portfolio, as the ratio of the value of the investment made in that given firm over the shareholder's total wealth, $\omega_{ij} = (BE_j \cdot uo_{ij})/(\sum_{j=1}^{J} BE_j \cdot uo_{ij})$. The *Herfindhal Index* is the sum of the squared values of these weights, $\sum_{j=1}^{J} \omega_{ij}^2$. The index ranges from 0 to 1, with 1 indicating that all wealth is invested in one firm (fully concentrated wealth), and 0 indicating a well a totally diversified portfolio. To ease the interpretation of our results, in the regressions we use (1-*Herfindhal Index*) as an independent variable, so that a higher value of the index denotes a more diversified portfolio.

The third proxy for portfolio diversification, *Ln No. Sectors*, is the natural log of the number of 4-digit primary SIC code sectors for the firms in the largest shareholder's portfolio.

In the calculation of all ownership or portfolio diversification variables discussed in this section, we include ownership in (1) privately-held and publicly-traded firms; (2) domestic and foreign firms; and (3) non-financial as well as financial firms. We also include both minority as well as dominant equity stakes held by large shareholders. Despite the wide coverage of firms, some limitations nevertheless exist. First, we capture equity investments, but we miss other significant investments, such as in bonds and real estate. Second, due to *Amadeus's* coverage, we are unable to include equity investments in firms incorporated outside Europe. Given the well known home bias of investors, this limitation is likely to be

[9] We exclude companies with negative book value of equity. As with the *Ln No. Firms* proxy, we include companies that are controlled through pyramids. This leads to some double counting, because the value of a firm controlled through a pyramid is counted once in the equity value of that firm itself, and it is counted again in the equity value of its parent. In unreported tests, we find that our results are robust to the exclusion of firms controlled through pyramids.

inconsequential. Third, we are unable to track investments in smaller companies that are not covered in *Amadeus*. Given that these companies are small, their exclusion is unlikely to have a major impact on our value-based portfolio concentration measures, such as the Herfindhal index.

C. Control Variables

As control variables, we use: (1) *Size*, defined as the natural log of total assets (in thousands US$), expressed in 1999 prices,[10] where total assets is the sum of fixed assets (tangible and intangible fixed assets and other fixed assets) and current assets (inventory, receivables,and other current assets). (2) *Leverage*, defined as the ratio of total debt to total assets, where total debt includes non-current liabilities (long term debt and other non-current liabilities) and current liabilities (loans, accounts payable and others). (3) Profitability, measured by the firm's return on assets (*ROA*), defined as the ratio of EBIT to total assets. (4) *Sales Growth*, calculated as the annual growth rate of sales. All variables are measured at the first year-end of the sample period over which the volatility of earnings is measured. In all cross-sectional tests, we also include country and industry fixed effects. In the panel analysis, we instead include shareholder and year fixed effects.

D. Data Quality and Selection Criteria

D.1. Ownership Data

The ownership data that we use to compute ultimate ownership, ultimate control, and the shareholder diversification variables are gathered by *Amadeus* from a variety of sources: official bodies, associated information providers (i.e., Jordans for Ireland and the U.K.; Coface for France; Lexis-Nexis for the Netherlands), and directly from the companies themselves. Our sample starts in 1999 because that is the year in which *Amadeus* started using a unique identifier for each corporate shareholder in the database. The identifier minimizes the chances of classification errors. The ownership sample ends in 2003 since we require 5 subsequent years of data to compute the risk-taking variables.

[10] Using country CPI data from the International Monetary Fund's *International Financial Statistics*.

Because of data constraints, the procedure we use to identify a company's ultimate shareholders differs slightly from that used in Claessens *et al.* (2000) and Faccio and Lang (2002). There are three main differences. First, we exclude companies that exhibit cross-holdings in their ownership structure because the identification of ultimate owners is not always obvious.[11] We also exclude shareholders who are labelled "private shareholder," "private citizen," or "legal person" in *Amadeus*; these shareholders cannot be traced back to a specific individual.[12] (However, we keep the companies in which they own shares in the sample, and we track the ownership of all remaining shareholders.) Finally, because of the size of our sample, we are unable to aggregate investments by members of the same family; thus, each individual is treated separately.

Further, on the basis of ownership categories reported in *Amadeus*, and on the basis of a careful analysis of the owners' names, we identify firms in which the Government is a shareholder.[13,14] We exclude these firms from the analysis because the motivations for government intervention in the economy and governments' risk-taking preferences are typically different from those of private investors. After these filters, we are left with ownership data for 1,198,372 shareholder-year observations, which include 243,856 different firms. These screening criteria are summarized in Appendix A, Panel A.

To assess the quality of the ownership data in *Amadeus*, we compare the stake held by the largest direct shareholder, as reported in *Amadeus*, with the same information from alternative sources. We check data from three markets for which the collection of ownership data from online sources is relatively easy: Italy, Spain, and the U.K. For each of these countries, we collect year-end data for 2007 for a sample of 100 firms. For Italy, we obtain official data for publicly-traded firms from the *Italian Stock Exchange*.[15]

[11] This is unlikely to affect our analysis since the total number of cross-held firm-year observations is only 2,890.

[12] These are 41,878 shareholder-year observations.

[13] We check whether the shareholder's name reported by *Amadeus* contains terms such as "Ministry", "State of", "Government", "Treasury", "Council", in different languages.

[14] These are 24,482 firm-year observations.

[15] http://www.borsaitaliana.it/frame/torna.jsp?src=http://www.consob.it/main/emittenti/societa_quotate/index.html

For Spain, the official data are from the *Comisión Nacional del Mercado de Valores*.[16] For the U.K., the data come from the *Hemscott-Corporate Register.*[17]

For these companies, we compute the correlation coefficient between the ownership of the largest shareholder as reported in *Amadeus* and that reported in the alternative sources. The overall correlation coefficient is 0.87. Although this coefficient appears to be reasonably high, two caveats are in order. First, the ownership data in *Amadeus* appears to be noisier in the U.K. In particular, while the correlation coefficient between the ownership of the largest shareholder as reported in *Amadeus* and that reported in the alternative sources is 0.89 for the Spanish sample, and 0.83 for the Italian sample, it is only 0.67 for the U.K. sample. These discrepancies are due, at least in part, to differences in the dates on which ownership changes are recorded in the different data sources. Additionally, because the market for corporate control is relatively more liquid in the U.K., one would expect to find more discrepancies in the U.K. ownership data across different sources. To address this potential problem, we show in our robustness tests that our results are robust to the exclusion of U.K. firms. The second caveat is that in some cases, the name of the largest direct shareholder as reported in *Amadeus* does not match the name in the official data sources. Unfortunately, given the size of the database, it is not possible to manually check all entries. However, we have no reason to think that this inconsistency in the ownership data would result in anything other than noise in the data. Thus, if anything, it should bias against finding significant results.

D.2. Accounting Data

We gather accounting data for all non-financial[18] firms having data available for both total assets and EBIT for at least one year during 1999-2007. This results in an initial "accounting" sample of 1,754,714 firm-year observations. We use two tests to assess the accuracy of these data.

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[16] http://www.cnmv.es/Portal/consultas/DerechosVoto/BusquedaEntidad.aspx

[17] http://www.hemscott.com/

[18] We include investments in financial firms (e.g., companies with a primary 4-digit SIC between 6000 and 6999) in calculating ultimate control, ownership, and portfolio diversification. However, financial firms are excluded from subsequent analyses because their risk-taking behavior is heavily influenced by regulation.

First, for a random sample of 250 publicly-traded companies covered in *Amadeus*, we collect data on "total assets" at year-end 2007 from *Datastream*. We then compute the correlation coefficient between the total assets as reported in *Amadeus* for 2007 and that reported in *Datastream*. The correlation coefficient is 0.93. Further, for a sample of 250 privately-held firms, we gather data on total assets at year-end 2007 from *OneSource*, a database which contains a limited amount of basic information for more than half a million public and private businesses across nineteen European countries.[19] We then compute the correlation coefficient between the total assets as reported in *Amadeus* and that reported in *OneSource*. The correlation coefficient is 0.98. Based on these calculations, we conclude that the accounting data in *Amadeus* appear to be as reliable as the data available from alternative sources.

Further, we use a number of accounting identities to minimize the loss of observations due to missing data and to identify possible data errors. For example, when fixed assets is missing, we compute it by summing "intangible fixed assets," "tangible fixed assets," and "other fixed assets;" similarly, we compute "current assets" by summing "current assets stocks" (inventory), "current assets debtors" (receivables), and "other current assets." If the value of fixed assets or current assets is missing in *Amadeus*, but we are able to compute it using one of the accounting identities, we use the computed value.

To ensure the accuracy of the accounting variables, we compare them to values computed using accounting identities. We eliminate observations whenever the *Amadeus* value and the computed value differ by more than 5 percent. This process affects only a small number of observations, but it is important to remove possible data errors. In a number of cases, we discover a small difference between the *Amadeus* value and the computed value. Further verification indicates that this difference is usually due to *Amadeus* adding or dropping decimals, and is thus not consequential. When this occurs, we use the figures originally reported in *Amadeus*. To further reduce the impact of outliers, across all analyses, accounting variables other than sales growth and leverage are winsorized at the top and bottom 1% of the

[19] http://www.onesource.com

distribution. As sales growth and leverage exhibit large positive skewness, these two variables are winsorized at the bottom 1% and at the top 5% of the distribution. [20]

We then restrict the sample to companies with data available for both total assets and EBIT for at least 5 years, because a 5-year period is required to compute the volatility of ROA, our main dependent variable. These requirements reduce the sample to 1,208,666 firm/year observations from 168,193 firms. After merging these data with the ownership data sample, we retain only firms that meet two criteria. First, the firm must have enough data to compute the volatility of ROA for at least one period (t,t+4), i.e., at least 5 years of accounting data. And second, for each of these 5 year periods, the firm must have ownership data at the first year-end. Applying these criteria reduces the sample to 332,301 firm/year observations from 50,049 firms. Finally, we exclude firms with no data for the main control variables, leaving us with a final sample of 123,642 firm/year observations from 46,692 firms for the main cross-sectional and panel tests. These selection criteria are summarized in Appendix A, Panels B and C.

II. Results

A. Univariate Results

Table I reports descriptive statistics for all non-financial firms included in the panel regressions. This sample includes 123,642 firm-year observations. In Panel A, we provide information on the country distribution of observations. Although our sample includes at least two firms from 30 different countries, three countries represent an overwhelming fraction of the sample: the United Kingdom (27.39%), France (25.12%), and Spain (15.65%).

[Table I goes here]

In Panel B, we report descriptive statistics for the sample. The mean (median) 5-year volatility of ROA is 0.055 (0.044), with a standard deviation of 0.042. On average, the largest shareholder holds a stake in 4 firms. Thus, large shareholders are moderately diversified. This figure is similar to estimates

[20] The results are qualitatively similar if we trim observations at the top and bottom 1% of the distribution, or winsorize all variables at the top and bottom 1% of the distribution.

reported in Barber and Odean (2000), Goetzmann and Kumar (2008), and Karhunen and Keloharju (2001); they show that an average investor (not necessarily a blockholder) holds equity in 2-7 publicly-traded firms. A comparable level of diversification is documented by Moskowitz and Vissing-Jørgensen (2002) for U.S. households investing in the private equity market. The distribution of our portfolio diversification variable is relatively skewed. The median large shareholder in the sample is totally non-diversified, holding a stake in only 1 firm. However, 43.55% of investors are at least somewhat diversified, holding equity in two or more companies. In fact, 14.75% of investors hold stakes in 5 companies or more; 6.63% of investors hold equity in 10 companies or more; 0.87% of investors hold equity in 50 firms or more; finally, 0.34% of investors hold equity in over 100 firms. Some shareholders are extremely diversified, holding stake in as many as 972 firms. Thus, it is hard to make generalizations about large shareholders' level of portfolio diversification.

An alternative measure of portfolio diversification is (*1-Herfindhal Index*), for which a higher value denotes more diversification. For (*1-Herfindhal Index*), the highest possible value, 1, denotes perfect diversification, and the lowest possible value, 0, denotes no diversification at all. In our sample, the mean value of (*1- Herfindhal Index*) is 0.174. This value is relatively low, which means that although the average large shareholder holds equity stakes in four different firms, most of her wealth is concentrated in one of them. To give an example, if the average largest shareholder instead invested equally in the 4 firms, (*1- Herfindhal Index*) would equal 0.75. A coefficient of 0.174 is consistent with a shareholder putting about 91% of her wealth in one company and distributing the rest equally among the remaining 3 firms. Not all investors are the same, however: in fact, while many investors are totally non-diversified, some others are extremely well diversified.

We find that investors tend to diversify across industries, not just across firms. The average investor holds equity in 2.13 different industries. The most diversified shareholder in the sample holds equity in 232 different sectors.

The sample includes both very large and small firms. The typical firm is highly levered, with an average (median) leverage ratio of 67.5% (70.5%). Companies appear to be relatively profitable, with an average ROA of 7.1%. The sample firms exhibit a wide range of growth rates, with a mean (median) annual rate of growth of sales of 25.1% (9%).

On average, the largest shareholder owns 62.29% of a company's cash flow rights (i.e., is entitled to 62.29% of the dividends), and controls 63.96% of voting rights. Thus, the largest blockholders are indeed very large and influential investors. This raises the question of whether large investors are more or less likely to hold diversified portfolios than small investors. Our evidence suggests a tradeoff between owning a large fraction of cash flow rights and being able to hold a diversified portfolio. We find a negative correlation between the fraction of cash flow rights owned by the largest shareholder and the diversification level of her portfolio. However, the correlation coefficient between ultimate ownership and the number of firms in which a large shareholder holds equity is only -0.31. Similarly, we find a correlation of -0.32 between ultimate ownership and (*1- Herfindhal Index*), and a correlation of -0.34 between ultimate ownership and the number of sectors in which a large shareholder holds equity.

B. Regression Analysis

To analyze the economic impact of the largest shareholder's portfolio diversification on corporate risk-taking, we present two main sets of tests. The first set includes ordinary least squares cross sectional regressions of (country-adjusted) *volatility* of firm-level profitability, $\sigma(ROA)$, against proxies for large shareholder diversification, along with a number of variables, x_{nj}, that control for other determinants of risk-taking that might otherwise induce spurious correlations. (In particular, we control for leverage, profitability, sales growth, and firm size.) In a similar vein to John *et al.*, (2008), we isolate firms for which we have a minimum of five years of ROA data over 1999-2007. For these companies, we then compute the standard deviation of the (country-adjusted) ROA over all the available data points. Therefore, for each firm, we generate a single observation of $\sigma(ROA)$. The control variables are measured, for each firm, at the first available year-end (or, for the flow variables, during the first year). Our regression equation is:

$$\sigma(ROA) = \alpha_0 + \alpha_1 \cdot \ Large\ Shareholder\ Diversification_j + \sum_{n=2}^{N} \alpha_n \cdot x_{nj} + \tag{1}$$

$$+ \ Industry F.E. + \ Country\ F.E. + \varepsilon_j$$

In all cross-sectional regressions we include industry (*Industry F.E.*) and country fixed-effects (*Country F.E.*).

The second set of regression tests uses a panel of observations to investigate how the volatility of firm earnings changes in response to changes in the largest shareholder's portfolio diversification. The panel regressions allow us to control for unobservable shareholder-specific characteristics that impact the largest shareholder's risk-taking decisions by using fixed effects. For example, it is possible that the effect of risk-aversion on risk-taking depends not only on the dominant shareholder's level of portfolio diversification,[21] but also on the dominant shareholder's utility function. Shareholder-fixed effects control, among other things, for differences in the shareholder-specific utility function. More generally, the use of a panel of data, alongside the inclusion of fixed effects allows us to control for any shareholder specific characteristic which may be correlated with the omitted explanatory variables. Controlling for shareholder fixed effects helps reduce the omitted variable bias which would render our estimated coefficients biased and inconsistent (Wooldridge, 2002). In this second set of tests, our regression equation is:

$$\sigma\left(ROA_{j,(t,t+4)}\right) = \ \alpha_0 + \ \alpha_1 \cdot Large\ Shareholder\ Diversification_{jt} + \sum_{n=2}^{N} \alpha_n \cdot x_{njt} + \tag{2}$$

$$+ \ Shareholder F.E. + \ Year\ F.E. + \varepsilon_{jt}$$

[21] An alternative test of risk-aversion would be to look at the correlation between the firm's weight in the investor's portfolio, ω_{ij}, and the volatility of the firm's earnings. By construction, this variable is highly correlated with portfolio diversification; non-diversified shareholders by definition invest 100% of their wealth in the only firm they control. Therefore, we do not use include this variable in the regressions in which we control for shareholder diversification. As reported in the robustness tests section, we find that risk-taking is lower among firms having larger weights in large shareholders' portfolios.

Large Shareholder Diversification$_{jt}$ is the proxy for large shareholder diversification; x_{njt} are controls for other determinants of profitability that might otherwise induce spurious correlations; $Shareholder\ F.E.$ are shareholder fixed effects, and $Year\ F.E.$ are year fixed effects.

[Table II goes here]

The results for the cross-sectional tests are reported in Table II. In these tests, the standard deviation of the firm's ROA is the dependent variable. In the first regression, our measure of shareholder diversification is *Ln No. Firms*, the natural log of the number of companies in which a company's largest ultimate shareholder holds shares. In the second specification, we use (*1- Herfindhal Index*), and in the third we use *Ln No. Sectors*, the natural log of the number of 4-digit primary SIC code sectors for the firms in the largest shareholder's portfolio. In all three specifications, a higher value of the independent variable reflects a higher degree of portfolio diversification.

The results for all three specifications indicate that shareholder diversification is positively and significantly related to firm risk-taking. All three coefficients on the shareholder diversification variables are positive, with a p-value of less than 0.001. This result provides direct and robust statistical evidence that well diversified large shareholders are willing to accept greater firm-level risk. The economic impact of shareholder diversification on risk-taking is non-negligible. On average, an increase in the level of portfolio diversification, as measured by the natural log of the total number of companies in which a company's largest ultimate shareholder holds shares, from the top of the first to the top of the third quartile of the distribution results in a 6.74% increase in the volatility of ROA. An increase in (1-Herfindhal Index) from the first to the third quartile is associated with a 7.91% increase in the volatility of ROA. Similarly, an increase in the number of sectors in which a company's largest ultimate shareholder holds shares from the first to the third quartile is associated with a 5.12% increase in the volatility of ROA. Interestingly, diversification across firms has a greater impact on risk-taking than diversification across sectors.

By comparison, in the first regression, an increase in leverage from the first to the third quartile is associated with a 4.09% increase in the volatility of ROA; an increase in ROA from the first to the third quartile is associated with a 3.92% increase in the volatility of ROA; an increase in the rate of growth of sales from the first to the third quartile is associated with a 4.51% increase in the volatility of ROA; and, an increase in size from the first to the third quartile is associated with a 20.55% decrease in the volatility of ROA.

The control variables exhibit consistent signs across the specifications. Further, their signs are consistent with those reported in John *et al.* (2008). In particular, in their Table III, John *et al.* (2008) use the volatility of EBITDA/Total assets as a proxy for risk-taking. In their regressions, they find leverage to be positively but insignificantly associated with risk-taking. We find leverage to be positively and significantly related to the volatility of ROA. They find the level of profitability at the beginning of the sample period to be insignificantly related to risk-taking. We find that the initial ROA is positively and significantly associated with risk-taking. They find sales growth to be positively (sometimes significantly) related to risk-taking. We find it to be positively related to risk-taking. They find that firm size is negatively and significantly associated with the volatility of EBITDA/Total assets. We also find size to be negatively and significantly associated with the volatility of ROA. In their specifications, they also find some interesting results for a number of country-level attributes. As country-level variables are not the focus of our interest, we employ country fixed effects instead. Our country fixed effects incorporate those effects.

[Table III goes here]

Table III presents the results for the panel regressions. In this second set of tests we include shareholder fixed effects to control for time-invariant shareholder characteristics. The inclusion of these fixed effects alleviates endogeneity concerns due to omitted variables. In these regressions, the coefficients of the diversification variables can be interpreted as the impact of *changes* in portfolio diversification on *changes* in the level of risk-taking. These results show that an increase (decline) in portfolio diversification is associated with an increase (decline) in risk-taking. Across all specifications, we continue to find a statistically significant, positive relation between portfolio diversification and firm risk-taking, providing further evidence in support of the hypothesis that well diversified shareholders are willing to invest in riskier firms. While the statistical significance of our results is marginally diminished when shareholder fixed effects are included among the control variables, the shareholder diversification variables continue to remain statistically significant, with p-values of 0.017 or less.

In the panel regressions, the economic impact of changes in the level of shareholder diversification on changes in firm risk-taking is about two-thirds the magnitude found in the cross-sectional regressions. On average, an increase in the level of diversification, as measured by *Ln No. Firms,* from the first to the third quartile results in a 4.28% increase in the volatility of ROA. An increase in *(1-Herfindhal Index)* from the first to the third quartile of the distribution is associated with a 4.32% increase in the volatility of ROA. An increase in *Ln No. Sectors* from the first to the third quartile of the distribution is associated with a 4.16% increase in the volatility of ROA.

III. Reverse Causality

A possible concern relates to the direction of causality in our results. Reverse causality would require that there be some a feedback effect moving from risk-taking to portfolio diversification. In particular, the story would go as follows. Suppose that due to a "clientele effect", more (less) risk-averse shareholders select firms that they expect to be relatively less (more) risky in the future, without actually affecting the firms' risk-taking choices. If this were the case, a firm's level of risk-taking would be correlated with the shareholder's level of portfolio diversification, but the causality flows from the firm's riskiness to the investor's firm choices.

Several factors limit this possibility. First, the largest shareholders in our sample control a substantial fraction of votes, an average of 63.96% of votes across all firm-years.[22] As such, it is very realistic to assume effective (and active) control of the firm by this shareholder. As such, the risk-taking we observe is, at least in part, a consequence of large shareholder's choice.

[22] In only 8.0% of the sample do the largest shareholders control less than 10% of their firm's votes.

A reader could at this point still argue that these large non-diversified shareholders are willing to hold a large stake only because their firm is less risky. For our results to hold, however, it is also needed that large *diversified* shareholders hold stakes in companies that are *more* risky. These companies need to have been established by somebody in order to exist and enter the sample. We next provide evidence that it is large diversified shareholders who are more likely to set up riskier firms (e.g., if all existing shareholders were non-diversified, very risky firms would be less dominant).

Thus, we present a formal test for the sub-sample of start-up firms that provides further evidence that causality runs from investors' portfolio diversification to firm risk-taking. Among start-up firms, it is undoubtedly the case that the founder directly influences the firm's level of risk-taking. We identify start-ups based on the date of incorporation reported in *Amadeus*. Every firm in the sample that has a date of incorporation between 1998 and 2003 is included in the start-up sample. To limit the impact of survivorship bias in this set of tests, [23] we report the results using several estimates of firm-level risk: we use not only the standard deviation of firm-level profitability over a 5-year period, as in the main tests, but we also use the volatility of firm-level profitability over 4-, 3-, and 2-year periods. We run cross-sectional regressions comparable to those used in the full sample tests. The results are reported in Table IV.

[Table IV goes here]

We find that portfolio diversification is positively and significantly associated with risk-taking. In all specifications of the start-up sample, the p-value of the shareholder diversification coefficient is 0.009 or less. We also find that the economic impact of shareholder diversification on risk-taking is greater when risk-taking is measured over shorter horizons. For example, in Panel A, in which the large shareholder's portfolio diversification variable is *Ln No. Firms*, an increase in portfolio diversification from the first to the third quartile results in an increase of 8.7% in the volatility of firm ROA when using a 5-year interval, compared to an increase of 10.51% when using a 2-year interval. Most likely, this result

[23] It is well documented that start-up firms tend to have extremely low survivorship rates. In our regression sample, only about 23% of the start-up firms that are still in business at the end of their second year survive through the end of the fifth year. Among U.S. start-ups, Moskowitz and Vissing-Jørgensen (2002) document a survival rate of 34% over the first ten years of a firm's life. Dunne, Roberts, and Samuelson (1988) document a 38.5% survival rate in the five years following the first inclusion in U.S. Census.

is due to the large percentage of higher-risk start-ups that fail during their first years of existence, leaving only less risky firms in the longer period subsamples. This result also indicates that the previously estimated marginal effects are likely to understate the true economic significance of the impact of portfolio diversification on risk-taking.

To summarize, we have several reasons to think that that our models capture the hypothesized direction of causality. We present two types of evidence indicating that the large shareholders in our sample can and do influence their firms' risk decisions: 1) on average, our large shareholders control 63.96% of voting rights in their firms; and 2) for our subsample of start-up firms, in which large shareholders are usually founding entrepreneurs and almost surely direct firm risk-taking decisions, the test results are similar to the full sample results. While through these tests we attempt to confute the possibility that reverse causality drives our results, we recognize that such possibility cannot be completely ruled out with non-experimental data.

IV. Other Interpretations

In this section, we assess the robustness of our results to a number of alternative variable specifications, and we consider alternative interpretations of the relation between risk-taking and large shareholder diversification.

A. Alternative Variables Definitions

A.1. Risk-Taking

We verify the robustness of our results to three alternatives to our specification for the dependent variable, firm riskiness. First, we exploit the idea that firms that take more risk are less likely to survive through time. Hence, we look at the likelihood of surviving 5 years for all firms with accounting and ownership data for at least one year during 1999-2003. A clear advantage of this specification is that it does not suffer from any survivorship bias, as both surviving and non-surviving companies are included in the sample. To analyze the likelihood of survival, we employ Logit models, in which the outcome is 1 if a company survives 5 years, and 0 otherwise. In our sample, 45.15% of firms survive a 5-year period. The Logit results are reported in Panel A of Table V. They document lower survival rates for companies controlled by diversified shareholders; all coefficients for portfolio diversification variables are negative and highly significant. This is consistent with the notion that companies controlled by diversified shareholders tend to engage in riskier projects.

[Table V goes here]

The second alternative measure of firm risk that we test is the difference between the maximum and minimum ROA reported over the 5-year interval. Results are reported in Panel B of Table V. In columns (1) – (3), we report results for cross-sectional tests similar to those in Table II; in columns (4)-(6), we report results for panel regressions comparable to those in Table III. The results are qualitatively similar to those reported in Tables II and III and confirm that portfolio diversification is positively associated with risk-taking; all coefficients on portfolio diversification terms are positive and have p-values of less than 0.019.

Third, we use the standard deviation of a firm's return on equity (ROE), rather than the standard deviation of ROA, as the measure of firm riskiness. ROE is the ratio of net income to shareholders' funds. The standard deviation of ROE reflects both the riskiness of a firm's projects and the additional risk induced by the use of leverage in the capital structure. The results are reported in Panel C of Table V. As in Panel B, columns (1) – (3) report cross-sectional tests, and columns (4) – (6) report panel-regression results. Consistent with previously reported tests, the results indicate that portfolio diversification is positively and significantly related to firm risk-taking. Furthermore, the economic impact of portfolio diversification on risk-taking is greater when volatility of ROE, rather than volatility of ROA, is the firm risk-taking proxy. The larger economic impact suggests that diversified shareholders use leverage to further increase firm risk-taking.

A.2. Portfolio Diversification

We also consider two alternative proxies for portfolio diversification. First, we employ a dummy variable that equals 1 if a shareholder holds more than one company in her portfolio, and zero otherwise. Our cross-sectional test (Column (1) of Table VI) shows that this variable is highly significant in explaining risk-taking. Consistent with our previous findings, shareholders who hold a diversified portfolio are likely to take more risk (p-value < 0.001).

[Table VI goes here]

The second measure of investor portfolio diversification that we test is the weight of a firm in the largest investor's portfolio, ω_{ij}. For a totally non-diversified shareholder, her single investment will have a weight of 1 (e.g., 100%) relative to her total wealth. For a diversified shareholder, weights will be less than 1. For consistency with prior regressions, we use $(1-\omega_{ij})$, so that a larger (smaller) number denotes a more diversified (less diversified) portfolio. The results are reported in column (2) of Table VI. The results are consistent with our previous results; increased shareholder portfolio diversification is associated with greater firm risk-taking (p-value < 0.001).

B. Other Robustness Tests

B.1. Tunneling and Risk-Taking

An additional concern is that higher risk-taking by diversified large shareholders might simply reflect tunneling (Bertrand *et al.*, 2002, John *et al.*, 2008, Johnson, La Porta, Lopez-de-Silanes, and Shleifer, 2000). For example, consider a large shareholder who has fewer cash flow rights in one firm and more rights in a second firm. This investor would instruct the company in which she has fewer cash flow rights to take excess risk, and then she would siphon off any gains from this firm to the company in which she has more cash flow rights (see John *et al.*, 2008, pp. 1684-1685, for a formal discussion). As a consequence, over time, the performance of companies in which the dominant shareholder has fewer cash flow rights would be more volatile. If this were the case, the higher level of corporate risk-taking that we observe is not necessarily associated with high-risk positive-NPV investments, and this strategy might actually lead to lower growth ex-post. To rule out this possibility, we investigate the relation between ownership concentration and risk-taking.

The tunneling hypothesis predicts more (less) risk-taking by companies in which the largest shareholder holds fewer (more) cash flow rights. The inclusion of an ownership variable is also useful to compare our results with those in earlier work by Amihud and Lev (1981) and Anderson and Reeb (2003) who found greater higher ownership concentration to be associated with more firm risk – the opposite of what the tunneling hypothesis predicts. As shown in column (3) of Table VI, we find a positive and significant relation between ownership concentration and risk-taking (p-value < 0.001).[24] This result is inconsistent with tunneling.[25] While consistent with the results in Amihud and Lev (1981), our results are inconsistent with their interpretation, which is that the presence of blockholders, whom they assume to be more diversified investors, is associated with more risk-taking. We have shown earlier that larger blockholders tend to be relatively less diversified than smaller blockholders. The positive relation between ownership concentration and risk-taking is, however, consistent with empirical evidence that ownership and incentive schemes with convex payoffs induce insiders to take on more risk (e.g., Agrawal and Mandelker, 1987, Guay, 1999). For our purposes, the important finding is that the relation between risk-taking and portfolio diversification is unchanged after controlling for ownership concentration. The coefficient on the portfolio diversification variable is positive, and both statistically and economically significant.

B.2. Firm-Level Diversification and Risk-Taking

It might be argued that the association between large shareholders' portfolio diversification and firm risk is actually the result of the level of diversification at the firm-level. A firm with an overall well-diversified set of risky projects might have low volatility of profitability, even though the individual projects are high-risk and high NPV investments. In this situation, the low volatility of profitability would not be associated with low economic growth. To rule out the possibility that low firm risk is driven primarily by diversification at the firm level, rather than by investors' portfolio diversification, we add a

[24] Similarly, in unreported tests, we find less risk-taking in companies located further down in a pyramid, which are more likely to have a high discrepancy between ultimate control and ultimate ownership.

[25] This result is unchanged if we focus on diversified large shareholders for these tests.

control for the number of 4-digit SIC sectors in which a company operates. The results are reported in column (4) of Table VI. As expected, we find that firm-level diversification is associated with lower volatility of ROA. More importantly, after controlling for firm-level diversification, we continue to find that greater investor portfolio diversification is associated with more risk-taking at the firm level.

B.3. Institutional Determinants of Risk-Taking

In our earlier cross-sectional tests, we included country fixed effects to control for the effect of *any* country-specific factors that influence firm risk-taking choices. However, the analysis of which factors have an impact on risk-taking is potentially interesting. In this section, we include two variables representing the quality of institutions within each country; security of property rights and the level of earnings management.

As proxy for the security of property rights, we include the revised *Anti-Director Rights* index, which "is formed by summing: (1) vote by mail; (2) shares not deposited; (3) cumulative voting; (4) oppressed minority; (5) pre-emptive rights; and (6) capital to call a meeting." This index is taken from Djankov, La Porta, Lopez-de-Silanes, and Shleifer (2008). As a proxy for the quality of accounting information we use the *Aggregate Earnings Management Score*, computed as the average rank across "the country's median ratio of the firm-level standard deviations of operating income and operating cash flow," "the country's Spearman correlation between the change in accruals and the change in cash flow from operations," "the country's median ratio of the absolute value of accruals and the absolute value of the cash flow from operations" and the "number of "small profits" divided by the number of "small losses" for each country." This index is taken from Burgstahler, Hail, and Leuz (2006). It is built such that a higher value denotes a higher degree of earnings management.

The results reported in column (5) of Table VI show that risk-taking is significantly higher in countries that provide stronger protection of shareholder rights. Further, we find that earnings management is negatively correlated with risk-taking. Both results are consistent with earlier evidence in John *et al.* (2008). More importantly, shareholder diversification remains positively and significantly related to risk-taking after controlling for these two specific institutional differences across countries.

B.4. Non-U.K. Firms

As we pointed out earlier, the ownership data in *Amadeus* for the U.K. appears to be relatively noisy compared to the data from other countries in the sample. While this is likely to have no effect other than bias against finding significant results, we would like to confirm that this data problem does not affect our central finding. For this purpose, we re-run our tests excluding U.K. firms. The results are reported in column (6) of Table VI. For the non-U.K. sample, we continue to find a positive and significant association between shareholder diversification and risk-taking. Results are similar to those reported for the whole sample. Thus, we conclude that the noise introduced by the inclusion of U.K. firms does not impact our main result.

B.5. Majority-Controlled Firms

Another potential weakness in our argument is that the largest shareholders may not always have actual control over the risk-taking decisions made by firms. Among the largest shareholders who control at least 50% of a firm's voting rights, it is more likely that the large shareholder can and does influence the firm's risk-taking decisions. Thus, in column (7) of Table VI, we show results of the cross-sectional regression run on a subsample that includes only companies in which the largest shareholder controls 50% of voting rights or more. The results confirm our previous evidence: there is a positive and significant relation between portfolio diversification and risk-taking.

V. Conclusions

It is commonly assumed in the economics and finance literature that risk-averse insiders will avoid firm-level risk because their wealth is concentrated in a few firms. For example, John *et al.* (2008, p. 1683) argue that:

> "…[t]he resources available to dominant insiders, including both their equity ownership and the private benefits of control, are inevitably concentrated within the firms they control, that is, because of their large exposure to these firms, these dominant insiders are likely to direct the

> corporations they control to invest more conservatively than they would if they held a diversified portfolio of firms."

In this literature, because of data limitations, authors have traditionally used ownership concentration to proxy for portfolio diversification, despite the lack of hard evidence supporting any assumptions about diversification. They have reached mixed conclusions. As a preliminary step, we reconstruct the portfolios of shareholders who hold the largest equity position in privately-held and publicly-traded European firms. Our ownership data come from the *Amadeus* dataset, and our total sample comprises 1,315,558 shareholder-year observations, including 643,856 firms, over the period 1999-2003. These new data allow us to revisit some standard assumptions and thus contribute to this literature. Although our evidence indicates that, on average, a company's largest shareholder is highly undiversified, we observe great heterogeneity in the degree of diversification across shareholders. We show that there are many cases in which large shareholders hold well diversified portfolios. While the large shareholders who hold smaller equity stakes tend to hold more diversified portfolios, this correlation is relatively low. These findings will be useful to future researchers in making appropriate assumptions of two types: first, assumptions regarding large shareholder diversification; and second, assumptions regarding the trade-off between holding a reasonably diversified portfolio and holding a dominant position in a *relatively large* firm.

We exploit the heterogeneity in large shareholders' portfolio diversification to investigate the impact of large shareholder diversification on corporate risk-taking. We report strong statistical evidence that firms controlled by diversified large shareholders are more likely to undertake riskier projects than firms controlled by non-diversified investors. The economic impact of large shareholder diversification on risk-taking is also economically meaningful.

We also show that the positive association between portfolio diversification and corporate risk-taking is robust to the inclusion of shareholder fixed-effects which alleviates a possible omitted variable bias. Although concerns of endogeneity cannot be eliminated when using non-experimental data, we use several approaches to ensure that our results capture the true direction of causality. First, we find that, on average, large shareholders control 64% of votes, and thus they have effective control over corporate decisions. Second, since owners in start-up firms are likely to be founding entrepreneurs, and there is no doubt that they control firm decisions, we test a subsample of start-up firms to confirm our result. In this subsample, we find even stronger evidence that investments undertaken by firms started by large diversified founders are riskier than investments undertaken by firms started by non diversified founders.

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Table I. Descriptive statistics

No. Firms is the total number of firms in which a company's largest ultimate shareholder (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. The *Herfindhal Index* is the sum of the squared values of the weight that each investment has in a largest shareholder's portfolio, $\sum_{j=1}^{J} \omega_{ij}^2$. *No. Sectors* is the number of 4-digit primary SIC code sectors for the firms in the largest shareholder's portfolio. *Diversification Dummy* is a binary variable that equals 1 if a shareholder holds more than one company in her portfolio, and zero otherwise. *σ(ROA)* is the 5-year volatility of a firm's country-adjusted return on assets σ(ROA), where *ROA* is the ratio of EBIT to total assets. *Leverage* is defined as the ratio of total debt to total assets, where total debt includes non-current liabilities (long term debt and other non-current liabilities) and current liabilities (loans, accounts payable, and others). *Sales Growth* is the annual growth rate of sales. *Size* is the natural log of total assets, expressed in 1999 prices, where total assets is the sum of fixed and current assets. *Ultimate Ownership* measures the cash flow rights of the largest ultimate shareholder. In particular, assume that if a shareholder *i* owns a fraction α_{iy} of the shares of firm *Y*, which owns a fraction β_{yj} of the shares of firm *J*, then *i* will be entitled to a fraction $uo_{ij} = \alpha_{iy}\beta_{yj}$ of the cash flows of *J*. *Ultimate Control* measures the voting rights of the largest ultimate shareholder. If a shareholder *i* owns a fraction α_{iy} of the shares of firm *Y*, which owns a fraction β_{yj} of the shares of firm *J*, we measure shareholder *i*'s control over voting rights in *J* by the weakest link along the chain, i.e., the minimum of α_{iy} and β_{yj}.

Panel A: Country distribution of observations

Country	No. Firms	%	Country	No. Firms	%
Austria	476	0.38	Latvia	261	0.21
Belgium	3,347	2.71	Liechtenstein	2	0.00
Bulgaria	468	0.38	Lithuania	285	0.23
Croatia	813	0.66	Luxembourg	2	0.00
Czech Republic	191	0.15	Netherlands	3,711	3.00
Denmark	4,492	3.63	Norway	4,526	3.66
Estonia	204	0.16	Poland	1,622	1.31
Finland	1,152	0.93	Portugal	1,791	1.45
France	31,055	25.12	Russian Federation	1,001	0.81
Germany	2,518	2.04	Slovak Republic	13	0.01
Greece	5,128	4.15	Slovenia	9	0.01
Hungary	4	0.00	Spain	19,351	15.65
Iceland	12	0.01	Sweden	4,269	3.45
Ireland	48	0.04	Switzerland	63	0.05
Italy	2,965	2.40	United Kingdom	33,863	27.39
			Overall	**123,642**	**100.00**

Table I. Descriptive statistics (Cont'd)

Panel B: Summary statistics for the main dependent and independent variables

Variable	Mean	Median	Std. Dev.	Interquartile range	Min.	Max.
Investor-level statistics (82,502 investor-year observations)						
No. Firms	3.995	1	15.961	2	1	972
Ln No. Firms	0.615	0	0.906	1.099	0	6.879
1-Herfindhal Index	0.174	0	0.264	0.391	0	0.985
No. Sectors	2.129	1	5.004	1	1	232
Ln No. Sectors	0.367	0	0.655	0.693	0	5.447
Diversification Dummy	0.435	0	0.496	1	0	1
Firm-level statistics (123,642 firm-year observations)						
$\sigma(ROA)$	0.055	0.044	0.042	0.047	0.000	0.510
Leverage	0.675	0.705	0.220	0.311	0.000	1.018
ROA	0.071	0.060	0.102	0.099	-0.410	0.513
Sales Growth	0.251	0.090	0.889	0.451	-0.978	3.024
Size	10.246	10.038	1.404	1.729	6.659	14.680
Ultimate Ownership	62.287	57.420	34.738	65.000	0.000	100
Ultimate Control	63.964	59.000	33.369	58.000	0.010	100

Table II. Cross-sectional regressions

This table reports OLS regression results. The dependent variable is the volatility of a firm's country-adjusted return on assets σ(ROA)×100, where *ROA* is the ratio of EBIT to total assets. We calculate the standard deviation of the country-adjusted returns of each firm over the entire sample period (1999-2007), requiring a minimum of 5 observations, following John *et al.* (2008). *Ln No. Firms* is the natural log of the total number of firms in which a company's largest ultimate shareholder (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. The *Herfindhal Index* is the sum of the squared values of the weight that each investment has in a largest shareholder's portfolio, $\sum_{j=1}^{J} \omega_{ij}^2$. *Ln No. Sectors* is the natural log of the number of 4-digit primary SIC code sectors for the firms in the largest shareholder's portfolio. *Leverage* is defined as the ratio of total debt to total assets where total debt includes non-current liabilities (long term debt and other non-current liabilities) and current liabilities (loans, creditors and others). *Sales Growth* is the annual growth rate of sales. *Size* is the natural log of total assets, expressed in 1999 prices, where total assets is the sum of fixed and current assets. All independent variables are measured at the first year-end of the period over which the volatility of earnings is measured. All cross-sectional tests include country and industry fixed effects. P-values, adjusted for heteroskedasticity, are reported in brackets below the coefficients. The economic significance of the portfolio diversification variables is reported beneath the p-values (in bold); this number is the percentage change in the value of the dependent variable in response to an increase from the first to the third quartile of the portfolio diversification variables.

	(1)	(2)	(3)
Ln No. Firms	0.171***		
	[0.000]		
	6.740%		
(1-Herfindhal Index)		0.675***	
		[0.000]	
		7.913%	
Ln No. Sectors			0.206***
			[0.000]
			5.123%
Leverage	0.706***	0.519***	0.714***
	[0.000]	[0.000]	[0.000]
ROA	2.103***	2.959***	2.097***
	[0.000]	[0.000]	[0.000]
Sales Growth	0.155***	0.148***	0.158***
	[0.000]	[0.000]	[0.000]
Size	-0.636***	-0.589***	-0.630***
	[0.000]	[0.000]	[0.000]
Intercept	9.670***	9.234***	9.676***
	[0.000]	[0.000]	[0.000]
Country fixed effects	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes
Adj. R-squared	0.126	0.125	0.125
No. of observations	46,692	45,892	46,692

Table III. Panel regressions

This table reports OLS regression results. The dependent variable is the volatility of a firm's country-adjusted return on assets σ(ROA)×100, where *ROA* is the ratio of EBIT to total assets. We calculate the standard deviation of the country-adjusted returns of each firm over 5-year partially overlapping periods (1999-2003, 2000-2004, 2001-2005, 2002-2006, and 2003-2007). *Ln No. Firms* is the natural log of the total number of firms in which a company's largest ultimate shareholder (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. The *Herfindhal Index* is the sum of the squared values of the weight that each investment has in a largest shareholder's portfolio, $\sum_{j=1}^{J} \omega_{ij}^{2}$. *Ln No. Sectors* is the natural log of the number of 4-digit primary SIC code sectors for the firms in the largest shareholder's portfolio. *Leverage* is defined as the ratio of total debt to total assets where total debt includes non-current liabilities (long term debt and other non-current liabilities) and current liabilities (loans, creditors and others). *Sales Growth* is the annual growth rate of sales. *Size* is the natural log of total assets, expressed in 1999 prices, where total assets is the sum of fixed and current assets. All independent variables are measured at the first year-end of the period over which the volatility of earnings is measured. All regressions include shareholder and year fixed effects. P-values, adjusted for heteroskedasticity and clustering at the company level, are reported in brackets below the coefficients. The economic significance of the portfolio diversification variables is reported beneath the p-values (in bold); this number is the percentage change in the value of the dependent variable in response to an increase from the first to the third quartile of the portfolio diversification variables.

	(1)	(2)	(3)
Ln No. Firms	0.092**		
	[0.011]		
	4.279%		
(1-Herfindhal Index)		0.316**	
		[0.017]	
		4.323%	
Ln No. Sectors			0.128***
			[0.003]
			4.161%
Leverage	1.012***	1.008***	1.012***
	[0.000]	[0.000]	[0.000]
ROA	-0.752**	-0.653**	-0.752**
	[0.010]	[0.025]	[0.010]
Sales Growth	0.092***	0.095***	0.092***
	[0.000]	[0.000]	[0.000]
Size	-0.713***	-0.712***	-0.713***
	[0.000]	[0.000]	[0.000]
Intercept	11.532***	11.408***	11.549***
	[0.000]	[0.000]	[0.000]
Investor fixed-effects	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes
Adj. R-squared	0.664	0.655	0.665
No. of observations	123,642	121,851	123,642

Table IV. Cross-sectional regressions for start-up firms

This table reports OLS regression results for the subsample of start-ups. The dependent variable is the volatility of a firm's country-adjusted return on assets σ(ROA)×100, where *ROA* is the ratio of EBIT to total assets. In column (1), volatility is measured over a 5-year period; in column (2), it is measured over a 4-year period; in column (3), it is measured over a 3-year period; in column (4), it is measured over a 2-year period. *Ln No. Firms* is the natural log of the total number of firms in which a company's largest ultimate shareholder (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. The *Herfindhal Index* is the sum of the squared values of the weight that each investment has in a largest shareholder's portfolio, $\sum_{j=1}^{J}\omega_{ij}^{2}$. *Ln No. Sectors* is the natural log of the number of 4-digit primary SIC code sectors for the firms in the largest shareholder's portfolio. *Leverage* is defined as the ratio of total debt to total assets where total debt includes non-current liabilities (long term debt and other non-current liabilities) and current liabilities (loans, creditors and others). *Sales Growth* is the annual growth rate of sales. *Size* is the natural log of total assets, expressed in 1999 prices, where total assets is the sum of fixed and current assets. All independent variables are measured at the first year-end of the period over which the volatility of earnings is measured. All cross-sectional tests include country and industry fixed effects. P-values, adjusted for heteroskedasticity, are reported in brackets below the coefficients. The economic significance of the portfolio diversification variables is reported beneath the p-values (in bold); this number is the percentage change in the value of the dependent variable in response to an increase from the first to the third quartile of the portfolio diversification variables.

Panel A: *Log No. Firms* as a measure of portfolio diversification

	(1)	(2)	(3)	(4)
Span for the measurement of the volatility (years)	*5*	*4*	*3*	*2*
Ln No. Firms	0.179***	0.237***	0.237***	0.231***
	[0.001]	[0.000]	[0.000]	[0.000]
	8.700%	***10.886%***	***10.287%***	***10.513%***
Leverage	0.617*	0.783***	0.612***	0.325*
	[0.058]	[0.002]	[0.006]	[0.082]
ROA	-2.611**	-1.504*	-1.439*	-0.366
	[0.023]	[0.096]	[0.069]	[0.584]
Sales Growth	0.324***	0.240***	0.234***	0.201***
	[0.000]	[0.000]	[0.000]	[0.000]
Size	-0.920***	-0.906***	-0.957***	-0.935***
	[0.000]	[0.000]	[0.000]	[0.000]
Intercept	12.263***	12.119***	12.680***	13.147***
	[0.000]	[0.000]	[0.000]	[0.000]
Country fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Adj. R-squared	0.122	0.117	0.107	0.089
No. of observations	3,489	5,911	9,475	15,138

Table IV. Cross-sectional regressions for start-up firms (Cont'd)

Panel B: *(1-Herfindhal Index)* as a measure of portfolio diversification

	(1)	(2)	(3)	(4)
Span for the measurement of the volatility (years)	*5*	*4*	*3*	*2*
(1-Herfindhal Index)	0.607***	0.948***	0.969***	0.933***
	[0.009]	[0.000]	[0.000]	[0.000]
	8.238%	***12.404%***	***12.679%***	***12.303%***
Leverage	0.447	0.537**	0.418*	0.12
	[0.179]	[0.039]	[0.060]	[0.526]
ROA	-1.39	0.125	0.037	1.362**
	[0.242]	[0.894]	[0.964]	[0.046]
Sales Growth	0.305***	0.226***	0.214***	0.176***
	[0.000]	[0.000]	[0.000]	[0.000]
Size	-0.856***	-0.827***	-0.881***	-0.859***
	[0.000]	[0.000]	[0.000]	[0.000]
Intercept	10.447***	10.999***	11.807***	12.443***
	[0.000]	[0.000]	[0.000]	[0.000]
Country fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Adj. R-squared	0.113	0.106	0.100	0.088
No. of observations	3,344	5,672	9,072	14,472

Table IV. Cross-sectional regressions for start-up firms (Cont'd)

Panel C: *Log No. Sectors* as a measure of portfolio diversification

	(1)	(2)	(3)	(4)
Span for the measurement of the volatility (years)	*5*	*4*	*3*	*2*
Ln No. Sectors	0.238***	0.315***	0.326***	0.343***
	[0.000]	[0.000]	[0.000]	[0.000]
	7.854%	***9.371%***	***9.890%***	***9.398%***
Leverage	0.633*	0.793***	0.621***	0.341*
	[0.052]	[0.002]	[0.005]	[0.067]
ROA	-2.628**	-1.525*	-1.449*	-0.369
	[0.023]	[0.092]	[0.067]	[0.581]
Sales Growth	0.326***	0.243***	0.236***	0.200***
	[0.000]	[0.000]	[0.000]	[0.000]
Size	-0.918***	-0.905***	-0.956***	-0.935***
	[0.000]	[0.000]	[0.000]	[0.000]
Intercept	12.343***	12.197***	12.758***	13.218***
	[0.000]	[0.000]	[0.000]	[0.000]
Country fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Adj. R-squared	0.122	0.117	0.107	0.090
No. of observations	3,489	5,911	9,475	15,138

Table V: Robustness tests: Alternative definitions of the dependent variable

In Panel A, we report the results for Logit regressions analyzing the likelihood of survival over a 5-year period. In Panel B, the dependent variable is the difference between the maximum and minimum values of firm's country-adjusted return on assets, ×100. *ROA* is the ratio of EBIT to total assets. In Panel C, the dependent variable is the volatility of a firm's country-adjusted return on equity σ(ROE)×100. ROE is defined as the ratio of net income to total shareholders' funds. In Panels B and C, columns (1) - (3) report the results for cross-sectional regressions; Columns (4) - (6) report results for panel regressions. *Ln No. Firms* is the natural log of the total number of firms in which a company's largest ultimate shareholder (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. The *Herfindhal Index* is the sum of the squared values of the weight that each investment has in a largest shareholder's portfolio, $\sum_{j=1}^{J} \omega_{ij}^2$. *Ln No. Sectors* is the natural log of the number of 4-digit primary SIC code sectors for the firms in the largest shareholder's portfolio. *Leverage* is defined as the ratio of total debt to total assets where total debt includes non-current liabilities (long term debt and other non-current liabilities) and current liabilities (loans, creditors and others). *Sales Growth* is the annual growth rate of sales. *Size* is the natural log of total assets, expressed in 1999 prices, where total assets is the sum of fixed and current assets. All independent variables are measured at the first year-end of the period over which the volatility of earnings is measured. All cross-sectional tests include country and industry fixed effects. All panel regressions include shareholder and year fixed effects. P-values, adjusted for heteroskedasticity, are reported in brackets below the coefficients. In the panel regressions, standard errors are also adjusted for clustering at the company level. The economic significance of the portfolio diversification variables is reported beneath the p-values (in bold); this number is the percentage change in the value of the dependent variable in response to an increase from the first to the third quartile of the portfolio diversification variables.

Panel A: Likelihood of survival

	(1)	(2)	(3)
Ln No. Firms	-0.082***		
	[0.000]		
	-2.671%		
(1-Herfindhal Index)		-0.271***	
		[0.000]	
		-6.700%	
Ln No. Sectors			-0.097***
			[0.000]
			-2.102%
Leverage	-0.087***	-0.055*	-0.091***
	[0.006]	[0.086]	[0.004]
ROA	1.746***	1.705***	1.749***
	[0.000]	[0.000]	[0.000]
Sales Growth	0.040***	0.039***	0.039***
	[0.000]	[0.000]	[0.000]
Size	0.210***	0.197***	0.207***
	[0.000]	[0.000]	[0.000]
Intercept	-3.345***	-3.271***	-3.337***
	[0.000]	[0.000]	[0.000]
Country fixed effects	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes
Pseudo R-squared	0.098	0.097	0.098
No. of observations	103,403	101,055	103,403

Table V: Robustness tests: Alternative definitions of the dependent variable (Cont'd)

Panel B: Max(ROA)-Min(ROA)

	Cross-sectional tests			Panel regressions		
	(1)	(2)	(3)	(4)	(5)	(6)
Ln No. Firms	0.433***			0.213**		
	[0.000]			[0.013]		
	6.434%			***3.774%***		
(1-Herfindhal Index)		1.665***			0.741**	
		[0.000]			[0.019]	
		7.380%			***3.916%***	
Ln No. Sectors			0.528***			0.293***
			[0.000]			[0.004]
			4.950%			***3.276%***
Leverage	1.826***	1.373***	1.846***	2.453***	2.442***	2.454***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
ROA	5.990***	8.223***	5.972***	-1.362**	-1.092	-1.361**
	[0.000]	[0.000]	[0.000]	[0.045]	[0.107]	[0.045]
Sales Growth	0.429***	0.408***	0.435***	0.218***	0.226***	0.218***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Size	-1.650***	-1.526***	-1.636***	-1.716***	-1.714***	-1.717***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Intercept	24.007***	22.920***	24.041***	27.794***	27.526***	27.834***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Country fixed effects	Yes	Yes	Yes	No	No	No
Industry fixed effects	Yes	Yes	Yes	No	No	No
Investor fixed-effects	No	No	No	Yes	Yes	Yes
Time fixed effects	No	No	No	Yes	Yes	Yes
Adj. R-squared	0.123	0.122	0.122	0.666	0.656	0.666
No. of observations	46,692	45,892	46,692	123,642	121,851	123,642

Table V: Robustness tests: Alternative definitions of the dependent variable (Cont'd)

Panel C: $\sigma(ROE)$

	Cross-sectional tests			Panel regressions		
	(1)	(2)	(3)	(4)	(5)	(6)
Ln No. Firms	1.506***			0.632**		
	[0.000]			[0.015]		
	11.380%			***5.665%***		
(1-Herfindhal Index)		6.260***			2.167**	
		[0.000]			[0.041]	
		14.095%			***5.729%***	
Ln No. Sectors			1.767***			0.818**
			[0.000]			[0.010]
			8.424%			***5.125%***
Leverage	56.957***	54.332***	57.035***	60.272***	60.116***	60.278***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
ROE	4.505***	2.626***	4.514***	2.184***	2.207***	2.183***
	[0.000]	[0.001]	[0.000]	[0.000]	[0.000]	[0.000]
Sales Growth	-0.102	-0.023	-0.084	-0.335**	-0.327**	-0.336**
	[0.493]	[0.876]	[0.569]	[0.013]	[0.016]	[0.013]
Size	-0.185	-0.04	-0.115	-1.932***	-1.920***	-1.932***
	[0.280]	[0.814]	[0.499]	[0.000]	[0.000]	[0.000]
Intercept	-19.947***	-20.164***	-20.064***	2.287	1.944	2.371
	[0.000]	[0.000]	[0.000]	[0.277]	[0.336]	[0.258]
Country fixed effects	Yes	Yes	Yes	No	No	No
Industry fixed effects	Yes	Yes	Yes	No	No	No
Investor fixed-effects	No	No	No	Yes	Yes	Yes
Time fixed effects	No	No	No	Yes	Yes	Yes
Adj. R-squared	0.171	0.157	0.17	0.657	0.637	0.657
No. of observations	44,294	43,533	44,294	119,292	117,588	119,292

Table VI: Other robustness tests

The dependent variable is the volatility of a firm's country-adjusted return on assets σ(ROA)×100, where *ROA* is the ratio of EBIT to total assets. We calculate the standard deviation of the country-adjusted returns of each firm over the entire sample period (1999-2007), requiring a minimum of 5 observations, following John *et al.* (2008). *Ln No. Firms* is the natural log of the total number of firms in which a company's largest ultimate shareholder (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. *Diversification Dummy* is a binary variable that equals 1 if a shareholder holds more than one company in her portfolio, and zero otherwise. *Fraction of Wealth* the ratio of the value of the investment made in that given firm over the shareholder's total wealth. *Ultimate Ownership* measures the cash flow rights of the largest ultimate shareholder. In particular, assume that if a shareholder i owns a fraction α_{iy} of the shares of firm *Y*, which owns a fraction β_{yj} of the shares of firm *J*, then i will be entitled to a fraction $uo_{ij} = \alpha_{iy}\beta_{yj}$ of the cash flows of *J*. *Ln No. Sectors* is the natural log of the number of 4-digit primary SIC code sectors for the firms in the largest shareholder's portfolio. *Anti-Self-Dealing Index* "is formed by summing: (1) vote by mail; (2) shares not deposited; (3) cumulative voting; (4) oppressed minority; (5) pre-emptive rights; and (6) capital to call a meeting." This index is taken from Djankov, La Porta, Lopez-de-Silanes, and Shleifer (2008). *Aggregate Earnings Management Score* is the average rank across "the country's median ratio of the firm-level standard deviations of operating income and operating cash flow," "the country's Spearman correlation between the change in accruals and the change in cash flow from operations," "the country's median ratio of the absolute value of accruals and the absolute value of the cash flow from operations" and the "number of "small profits" divided by the number of "small losses" for each country." This index is taken from Burgstahler, Hail, and Leuz (2006). *Leverage* is defined as the ratio of total debt to total assets where total debt includes non-current liabilities (long term debt and other non-current liabilities) and current liabilities (loans, creditors and others). *Sales Growth* is the annual growth rate of sales. *Size* is the natural log of total assets, expressed in 1999 prices, where total assets is the sum of fixed and current assets. All independent variables are measured at the first year-end of the period over which the volatility of earnings is measured. All cross-sectional tests include country and industry fixed effects. P-values, adjusted for heteroskedasticity, are reported in brackets below the coefficients. The economic significance of the portfolio diversification variables is reported beneath the p-values (in bold); this number is the percentage change in the value of the dependent variable in response to an increase from the first to the third quartile of the portfolio diversification variables.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Type of Robustness Test:	Different proxy for portfolio diversification	Different proxy for portfolio diversification	Tunneling	Firm-level diversification	Institutional determinants of risk taking	Non-U.K. firms	Majority Control (e.g. > 50%)
Ln No. Firms			0.210***	0.165***	0.188***	0.187***	0.177***
			[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
			8.278%	***6.473%***	***7.961%***	***6.874%***	***5.066%***
Diversification Dummy	0.568***						
	[0.000]						
	10.190%						
(1-Fraction of Wealth)		0.649***					
		[0.000]					
		10.826%					

Ultimate Ownership			0.004***				
			[0.000]				
Ln No. Sectors				-0.141***			
				[0.000]			
Anti-Self-Dealing Index					1.775***		
					[0.000]		
Aggregate Earnings Management Score					-0.032***		
					[0.000]		
Leverage	0.729***	-0.041	0.682***	0.671***	0.768***	0.480***	0.876***
	[0.000]	[0.672]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
ROA	2.182***	4.605***	2.114***	2.084***	2.391***	2.463***	2.463***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Sales Growth	0.153***	0.129***	0.154***	0.151***	0.168***	0.123***	0.185***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Size	-0.627***	-0.546***	-0.638***	-0.626***	-0.606***	-0.554***	-0.623***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Intercept	9.358***	9.076***	9.339***	9.704***	9.311***	9.016***	9.439***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Country fixed effects	Yes	Yes	Yes	Yes	No	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adj. R-squared	0.126	0.132	0.126	0.128	0.099	0.124	0.119
No. of observations	46,692	44,671	46,692	42,435	42,210	34,941	32,483

Appendix A. Selection criteria

A. OWNERSHIP DATA	Total	B. ACCOUNTING DATA	Total
Initial ownership database (1999-2003)	1,315,558 shareholder-years	Initial accounting dataset for non-financial companies with at least one year of ROA data (1999-2007)	1,754,714 firm-years
- Cross-held companies	- 2,890 firm-years		
- Shareholders disclosed in *Amadeus* as "aggregate categories"	- 41,878 shareholder-years	- Firms with less than 5 years of ROA data	-546,048 firm-years
- State-owned firms	- 24,482 firm-years		
Total Number of Observations	1,198,372 shareholder-years 645,394 firm-years (243,856 firms)	Total Number of Observations	1,208,666 firm-years (168,193 firms)

C. MERGED PANEL	Total
Merged ownership (1999-2003) and ROA volatility data (1999-2007)	332,301 firm-years (50,049 firms)
- Firms with missing data for the main control variables	- 69,718 firm-years
Final sample	**123,642 firm-years** **(46,692 firms)**