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# SHAREHOLDER DIVERSIFICATION AND IPOs

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# ABSTRACT

## Shareholder Diversification and IPOs*

We study IPOs by focusing on the degree of portfolio diversification of the shareholders taking the company public. We argue that a less diversified shareholder has more to gain from taking the company public and would be more willing to accept a lower price for the sale of its shares, i.e. tolerate higher underpricing. We test these hypotheses by considering all the IPOs that took place in Sweden in the period 1995-2001. We have obtained detailed information on the portfolio composition of all the investors in the companies being taken public, both before and after the IPO, as well as the portfolio composition of investors in similar (in terms of size, book-to-market and industry) companies not taken public. The information is detailed at the stock level, for both private and public companies. We construct several proxies for portfolio diversification of the shareholders and relate them to both the probability of the IPO and the underpricing. We show that companies held by less diversified shareholders are more likely to go public and suffer a higher underpricing. We show that, as predicted, the degree of diversification explains a significant (economically and statistically) part of the probability of going public, and may account for between one third and one half of the reported underpricing. This suggests that the degree of diversification of controlling shareholders should play a prominent role in the discussion of the process of going public.

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## Introduction

Portfolio diversification is one of the cornerstones of Finance. Investors form portfolios to diversify away their idiosyncratic risk. The emergence of a publicly traded corporation with limited liability as a vehicle to allow owners of a firm to diversify their risk is widely credited with the success of capitalism. Textbooks state that the main reason for going public is diversification. In an IPO, a set of potentially non-diversified investors – the existing shareholders – reduce their holdings of a company, and become more diversified. While widely accepted, the conjecture that diversification is the main reason for IPOs is very hard to test directly, because it requires data on holdings of private and institutional investors in private companies. We utilize a unique data set that allows us to form proxies for the degree of diversification of shareholders of private companies, some of which end up going public. This feature allows us to test directly the effect of diversification on the propensity to initiate an IPO.

We are able to address the question of underpricing as well. The literature contains many theories on the determinants of underpricing, but little attention is paid to the role of diversification of the controlling shareholders. In fact, the degree of their diversification determines the premium between their valuation and the valuation of the same company by a well diversified investor. We conjecture that the degree of diversification of the controlling shareholders prior to the IPO has a profound effect on underpricing.

We test these hypotheses by studying all the IPOs that took place in Sweden in the period 1995-2001. For each IPO we have obtained (in addition to the standard variables) detailed information on the portfolio composition of *all* the investors in the companies being taken public, both *before* and *after* the IPO, as well as the portfolio composition of *all* the investors in *all* the other similar (in terms of size, book-to-market and industry) companies not being taken public. The information is detailed at the stock level, for both private and public companies. This allows

us to form a clear picture of the degree of diversification of the shareholders, as well as their holdings in other companies in the same line of business of the company being taken public. It is important to emphasize that we account for investments in *both* publicly traded and privately held financial assets.

We construct four proxies of portfolio diversification of shareholders before and after the IPO. We then relate both the probability of the IPO, and the underpricing to the degree of portfolio diversification of the controlling shareholders prior to the IPO. In doing this, we control for the other determinants that have been uncovered in the literature. We show that the probability of the IPO is negatively related to the degree of diversification of the controlling shareholders. Companies held by more diversified shareholders are less likely to be taken public. Variation in the diversification explains a significant part of the variance in the IPO decision. We also document a negative and significant relation between the degree of diversification and the underpricing. Companies controlled by more diversified shareholders suffer a lower underpricing in an IPO; between one third and a half of the magnitude of the underpricing may be attributable to a variation in diversification. Moreover, even after conditioning for the different probability of being taken public, companies held by more diversified shareholders are still displaying a lower underpricing.

These findings make two main contributions. First, they shed light on a hitherto unexplored dimension of the IPO process. Second, they provide additional evidence on the role of portfolio diversification in a clean experiment not examined before.

The closest papers in the literature are Loughran and Ritter (2002) and Edelen and Kadlec (2004). Loughran and Ritter (2002) show that behavioral biases in general, and prospect theory in particular, affect underpricing. Shareholders are willing to suffer underpricing if their "reference point" is low enough to make them perceive the selling price as satisfactory. In other words, they are "more tolerant of excessive underpricing if they simultaneously learn about a post-market

valuation that is higher than what they expected. In other words the greater the recent increase in their wealth, the less is the bargaining effort of issuers in their negotiations over the offer price with underwriters." Our findings are related to theirs and show that the level of the "reference point" can be explained in terms of risk aversion and portfolio diversification. Less diversified investors are willing to sell at a lower price if this allows them to diversify away. This effectively reduces their reference points.

Edelen and Kadlec (2004) offer a rational story. They show that issuers, in order to maximize the expected surplus from public versus private ownership, trade-off offer proceeds and the probability of offer completion. This implies that the probability of observing an IPO and the price at which it takes place are related. We will directly study this issue by focusing on one factor that directly affects both: the degree of portfolio diversification of the inside shareholders taking the company public.

The remainder of the paper is structured as follows. In Section 1, we describe our contribution, relate it to the existing literature, and lay out testable predictions. In Sections 2, we describe the datasets we use and the construction of the variables. In Section 3, we discuss the econometric issues and report the main empirical results. A brief conclusion follows.

## 1. The literature and our contribution

The literature on IPOs is vast and well developed, both theoretically and empirically. IPO has been seen as a way of increasing the visibility of a company to become a potential takeover target (Zingales, 1995), making it possible for entrepreneurs to regain control of their companies from venture capitalists (Black and Gilson, 1998) or increasing the dispersion of ownership (Chemmanur and Fulghieri, 1994, 1999).

The explanations for underpricing are even more numerous. Theories based on asymmetric information assume that the issuer is more informed than the investors, thus the underpricing is due to a "lemons problem". Higher asymmetry implies higher adverse selection risk premium, leading to higher underpricing (Allen and Faulhaber, 1989, Welch, 1989, Chemmanur, 1993). If, instead, the investors are more informed than the issuer and some investors are much better informed than the rest, the underpricing may be explained in terms of a "winner's curse" (Rock, 1986, Welch, 1992). Alternatively, the underpricing is viewed as a way to remunerate investors for truthfully revealing their information in the bookbuilding process (Benveniste and Spindt, 1989, Benveniste and Wilhelm, 1990, Cornelli and Goldreich, 2002).

Habib and Ljungqvist (2001) claim that underpricing may substitute for costly marketing expenditures, while Hughes and Thakor (1992) emphasize its role in reducing the expected legal liabilities of issuers. Booth and Chua (1996) develop a model where IPO underpricing arises as a result of issuer's demand for a broad ownership dispersion and a liquid secondary market. Underpricing may be also positively correlated to the trading volume in the secondary market, see. e.g. Krigman, Shaw and Womack (1999), Ellis, Michaely and O'Hara (2000), and Ellul and Pagano (2003). Finally, underpricing may be related to the way shares are allocated to the investors (Benveniste and Spindt, 1989, Sherman, 2000 and Sherman and Titman, 2002) and to the level of the conflict of interest between underwriters and issuers (Loughran and Ritter, 2002). Underpricing creates incentives to acquire a block of stocks and manage it (Stoughton and Zechner, 1998). Loughran and Ritter (2004) present the "spinning" hypothesis for why issuers are willing to hire underwriters with a high expected underpricing.

We claim that a significant part of the cross-sectional (across firms) differences in underpricing may be explained by differences in the degree of diversification of the controlling shareholders prior to the IPO. The degree of diversification determines the required rate of return, which, in turn, determines the valuation of the stock by the non-diversified shareholder relative to

the valuation of the same stock by well diversified investors. Therefore, the degree of diversification determines the size of the surplus that needs to be divided between the controlling shareholders and the investors at the IPO. How this surplus is divided depends on the bargaining power of the parties, and other IPO features described above. All else equal, if the controlling shareholders are well diversified, the surplus must be small and we cannot anticipate large underpricing – the owners will not agree to part with their shares below their valuation. Thus, if the IPO takes place, we should expect to observe a negative relation between the degree of diversification and underpricing.

Ritter and Welch (2002) suggest that "…simple fundamental market misvaluation or asset pricing risk premia are unlikely to explain the average first-day return…" (in an IPO). The assumption underlying this statement is a quantification of the required risk premia based on a standard asset pricing model with fully diversified investors. We challenge this assumption and conjecture that a significant part of the underpricing may be explained by the idiosyncratic risk premium. Ritter and Welch (2002) also point out, "…there has been no academic research investigating how money left on the table during the internet bubble was split among buy-side participants and sell side participants." This paper contributes to this line of inquiry as well.

*1.1 Our approach*

The extant empirical literature does not focus much on the size of the surplus created by the IPO, while we make it the main focus of the paper. We study how the shareholders' degree of diversification affects both the level of underpricing and the probability of the IPO. Standard theory posits that the valuation of an asset is a function of its expected return and of its systematic risk. Higher systematic risk yields higher required rate of return and lower valuation. The level of systematic risk depends on the degree of diversification of the investor. In a standard CAPM framework, systematic risk is a function of the correlation between the return of the asset and the

return of the market portfolio. The underlying assumption is that all the investors are well diversified and hold the market portfolio. This is not the case for a non-diversified investor who must take the idiosyncratic risk into account. At the limit, for a fully undiversified investor holding only one asset, the systematic risk of the asset coincides with its idiosyncratic risk.

Therefore, the more undiversified the investor is, the higher the fraction of the overall risk he perceives as systematic and the higher his required rate of return on the asset. It follows that a less diversified shareholder is willing to accept a lower price for the sale of shares in a company, than a more diversified shareholder would for the very same company. The undiversified investor has the private market valuation, while the diversified investor has the public market valuation. We focus directly on the difference between the valuations of diversified and undiversified shareholders, by constructing diversification proxies using investors' holdings. We show that the non-diversified investor valuation is less than 75% of that of the diversified investor. This is consistent with the evidence presented in Sarin, Koeplin and Shapiro (2000) that privately held companies are sold at a discount of 20-30% relative to the market price of similar public companies. Clearly, diversification of the controlling shareholders affects these valuations.

We derive two main empirical predictions: one that is related to the underpricing and another to the probability that the IPO takes place. Let us start with the underpricing. The underpricing at the IPO is defined as the difference between the offer price and the first day price. The offer price is determined by the degree of diversification of the *old shareholders* of the company; while the first day price is based on the degree of diversification of the *new shareholders*, most likely the institutional investors, who are *more diversified* than the existing shareholders. The difference between valuations of the two types creates a surplus, and if the outside investors are able to capture part of this surplus, underpricing should be positive. It should also decrease with the degree of diversification of the selling shareholders. This provides a first testable prediction:

*H1: The underpricing at the IPO is negatively related to the level of diversification of the controlling shareholders prior to the IPO.*

This hypothesis is consistent with Chemmanur and Fulghieri's (1999) view that IPO is a way of increasing the dispersion of ownership. That is, IPOs allow the transfer of property from "angel" investors or venture capitalists to diversified public-market investors. Given that the latter are better diversified, they are willing to pay a higher price for the company.

Why is it the case that outside investors are able to capture the surplus? Edelen and Kadlec (2004) link it to the desire to reduce the probability of a failed offering. The higher the cost of failed IPO, the lower the price they will demand. This cost depends on the increase in value following a successful IPO. Thus less diversified controlling shareholders with a low reservation price are also the ones with the strongest incentives to ensure the success of an IPO, therefore willing to offer price concessions.

The degree of diversification of the shareholders should also affect the probability of the IPO taking place. Indeed, if the IPO is a way of reducing the stake in the company by the existing shareholders, less diversified shareholders are more likely to resort to the IPO, since they have more to gain from rebalancing their portfolio. This leads to the second prediction.

*H2: The probability of an IPO is negatively related to the level of diversification of the controlling shareholders prior to the IPO.*

That is, the existing shareholders rebalance their portfolio away from the company by taking the company public and selling part of their stake. We assume (as is the case in our sample) that the proceeds are not reinvested in the company, nor do they accrue to the company – as would be the case if the IPO simply consisted of issuing new shares – but may be used by the shareholders to invest in other areas. If this is the case, we expect that the need to IPO increases with the lack of diversification of the existing shareholders.

We proceed to test these hypotheses by constructing measures of portfolio diversification of the shareholders of the company being taken public and relating them to the level of underpricing and the probability of the IPO. In the next section we describe the data and present our proxies for portfolio diversification.

## 2. The data and the measures of portfolio diversification

### *2.1 IPO data*

We analyze all the IPOs undertaken on Stockholm Stock Exchange (SSE) and Nordic Growth Market (NGM)[2] from July 1995 to June 2001. This leaves us with 124 companies. Offer price, first day close price, size of the issue, timing of the IPO, and name of the underwriter are provided by SSE and NGM. We cross-check this information with SDC, IPO prospectuses and Mediearkivet[3], a registry of publications in Swedish newspapers. Percentage of cash flow and voting rights offered to outside investors are collected from IPO prospectuses. There is a customary lockup period of six month following the IPO.

For each IPO company we have information about offer price and (unadjusted) first day close price, size of the issue, exchange of the listing, percentage of cash flow and voting rights offered to outside investors, and name of the underwriter. We define *underpricing* as the difference between the first day close price and the offer price of the issue normalized by the offer price.

[2] For the case of the NGM, we eliminate the companies which have been delisted because of merger, acquisition, or failure to comply with exchange rules within half a year period after the IPO date, or with unreliable data on offer or (unadjusted) first day close price. These are mostly very small companies with a market capitalization less that US$1Mln.

[3] For more information see www.mediearkivet.se

*2.2 Individual stockholdings*

We use the data on individual shareholders collected by Vardepappererscentralen (VPC), the Security Register Center. The data contain both stockholding held directly and on the street name, including holdings of US-listed ADRs. In addition, SIS Agarservice AB collects information on ultimate owners of shares held via trusts, foreign holding companies and the like (for details, see Sundin and Sundquist 2002). Our data cover the period 1995-2001. Overall, the records provide information about the owners of 98% of the market capitalization of publicly traded Swedish companies. For the median company, we have information about 97.9% of the equity, and in the worst case we have information on 81.6% of market capitalization of the company. We also possess information about equity holders of (almost) all privately held limited liability Swedish companies. For each investor we have detailed information about its individual holdings of stocks (broken down at the stock level) and its type (private person or institutional investor). For private investors, we also have information whether the investor is a member of the board of directors of a particular company or not.

We restrict our analysis to investors who may have influence over companies' decisions as in Faccio and Lang (2002). For private investors, we require an investor to control at least 10% of voting rights in the IPO company or to be a member of the board of directors of the issuing company or both. For institutional investors the requirement is to control at least 10% of voting rights. Our results are qualitatively unchanged if we exclude from our analysis members of the board with less then 10%-votes stake in the IPO companies.

*2.3 Company-level information and other data*

We use the SIX Trust Database to obtain individual security returns (including dividends), and to track the overall market index (SIX Index). We use the Market Manager

Partners Databases for various firm-level characteristics. These two databases are the equivalent, respectively, of CRSP and COMPUSTAT for the US. In addition, Market Manager Partners Databases contain information at the plant level, including the location of the plant (detailed at the level of municipality). For the analysis of private companies which did not undertake IPO during the sample period we require them to have reliable information on the total assets, return on assets, and book value of equity for a one year period prior to corresponding IPO date.

*2.4 Proxies of portfolio diversification*

We consider four different measures of portfolio diversification. The first two measures are derived from Goetzmann and Kumar (2002). We refer to their paper for a proper description and the rationale of their use. The first measure of diversification, $D_1$, is constructed as:

$$D_1 = -\sum_{i=1}^{N} \left( w_i - w_{mkt} \right)^2,$$

where $w_i$ is the weight of the stock in the portfolio of the investor and $w_{mkt}$ is the weight that the same stock would have in the market portfolio. This measure expresses diversification in terms of divergence of the financial portfolio of the investor from the market portfolio. Higher diversification implies a divergence that is closer to zero. It is defined so that as diversification increases so does the measure.

The second measure, $D_2$, is the average correlation of the return of the industry to which the company belongs with the rest of investor's portfolio, multiplied by –1. We define the industry return as the weighted average of returns of all the publicly traded companies that fall into the same industrial category (SNI92[4]), weighed by their market capitalization. There are 12 industries. $D_2$ proxies for the degree of industry diversification of the investor. Diversification

[4] For more information see www.scb.se

increases when the investor includes in her portfolio stocks from industries whose returns are not highly correlated with each other.

We also consider two additional proxies that capture the relative importance of the holdings in the company being taken public in the shareholders' portfolio. $D_3$ is the negative of the percentage of the portfolio of the investor allocated to the company being taken public and $D_4$ is the negative of the percentage of the portfolio of the investor allocated to the companies that belong to the same industry. The portfolio of the investor contains all his holdings in both public and private equity – we do not observe cash and bond holdings. The public equity is evaluated at the market close at the date of the IPO. The value of private equity is estimated as the most recent pre-IPO book value of investor's holdings multiplied by the corresponding average industry market-to-book ratio. The proxy $D_3$ ($D_4$) captures the sensitivity of the investor's equity portfolio to his exposure to the specific firm (the industry). As the fraction of her portfolio allocated to particular asset or industry goes down its diversification increases. We summarize the definitions of the proxies in the Appendix.

All the proxies, $D_1$ to $D_4$, are constructed first at the investor level and then aggregated at the company level by averaging the degree of diversification of each investor in the company. We consider both the simple average and the value-weighed one, where the weights are given by the percentage of company cash flow rights held by each investor. We consider an overall measure that contains all the investors, as well as measures based on subsets of investors. We make two partitions: institutional versus private investors, and controlling versus non-controlling ones. This yields four mutually exclusive investor groups. We use the superscript "*ip*" ("*inp*") to denote the institutional investors who have a controlling (minority) stake, and the superscript "*pp*" ("*pnp*") to denote the private investors who have a controlling (minority) stake. An investor is assumed to have a controlling stake if she is member of the board or has at least 10% of the votes in the company.

*2.5 Control variables*

We consider five sets of control variables which are taken from the literature described above: measures of ex ante uncertainty of issuer's valuation, IPO market conditions, momentum variables, measures of general market conditions, and underwriter's reputation.

We control for uncertainty of the IPO company valuation by including the following set of variables: the age of the company being taken public (*age*), its market capitalization on the first day close (*size*), and the fraction of cash flow rights in the post-IPO company offered to outside investors (*outside rights*). We also include telecom and carve-out dummies (*telecom dummy* and *carve-out dummy*). These are dummies taking the value of 1 if the IPO is a telecom (carve-out) and zero otherwise.

We control for the IPO market conditions controls by including the average underpricing (*market underpricing*) and the number of IPOs taken place in the previous six months (*number of IPOs*). We also include the return on the market portfolio in the previous six months (*momentum*) and its average daily standard deviation in the analogous period (*volatility*) to control for the market momentum and the riskiness of the investment environment respectively.

Finally, we include a variable that proxies for the reputation of the underwriter (*underwriter reputation*), which are claimed to explain part of the underpricing. The variable has been constructed as the highest number of deals conducted by the leading manager over the observed period.

## 3. The empirical findings

*3.1 Descriptive statistics*

The descriptive statistics about our sample are in Table 1. In Panel A, we describe the level of underpricing, the long-run abnormal return, and the main financial and accounting

variables of the firms being taken public. The mean underpricing is a little over 14% and the long term abnormal returns are negative, which is consistent with many studies around the world, and suggests that our sample is representative.

Industry distribution of the IPO firms is presented in Panel B: Business Services and Hi Tech constitute the majority. Panel C presents the distributions of types of financial institutions in the sample: Swedish non-financial institutions dominate. Panel D reports the descriptive statistics for the main control variables as described in Section 2.4.

Table 2 focuses on diversification measures. In Panel A, we report the descriptive statistics of shareholders' diversification, partitioned into the four shareholder groups. Panel B shows the correlation matrix between various diversification measures of controlling shareholders. The findings can be summarized as follows: the majority of shareholders are poorly diversified, but there is also significant variation in diversification levels. The four measures are correlated within each investor group, but the correlation is far from perfect, suggesting that they capture additional aspects. The correlation of the same proxy between the institutional and private investors is very low, suggesting that investments of the two groups are driven by different considerations.

Panel C presents a test of differences between the firms going public and those that stay private. We first partition all firms into High and Low groups based on whether their diversification proxy is above or below the median of the entire sample. We then present the distribution of these among the two samples of firms. Firms that stay private exhibit a bit higher chances to end up in high diversification part of the sample. On the contrary, firms that end up going public are disproportionately located in the low diversification category; the difference between the two is in excess of 15%, and is statistically significant. This suggests that diversification may affect the decision of going public.

Panel D shows similar results but from a different angle. It presents the comparison of diversification proxies before and after the IPO for firms that end up going public. It is clear that private investors significantly reduce their holdings and increase their portfolio diversification. We do not find the same result for institutions.

We have also looked at the distribution of the number of controlling shareholders in the sample of firms going public. Over a quarter of the companies have just one controlling shareholders, while 80% of the companies have 4 or less. This suggests that these are quite tightly controlled companies.

In Table 3, we report the required rate of return of the company's shareholders and compare it to the required rate of return for a well-diversified shareholder before the IPO. The *diversified required rate of return* is the rate of return that would be asked by a diversified shareholder. We calculate it using the Fama-French three-factor pricing model. The results based on one factor model are similar (omitted for brevity)[5].

The undiversified required rate of return depends on the degree of diversification of their portfolios. It is constructed in the following way. For each investor, we calculate the "beta" between the return on the stock and the average return on the investor portfolio. This is then multiplied by the excess return of the investor portfolio over the riskless (3 month T-bill) rate. Then, the required rate of return for each investor is aggregated across all the shareholders of each taken public company. As before, we consider a breakdown for institutional and private investors as well as for controlling and minority shareholders. We estimate the parameters using either 36 or 60 months.

Let us, for example, consider the required rate of return of the controlling institutions. This is determined as follows. First, we identify the institutions with controlling power among the

[5] We did not use four-factor model. As it was shown by Rouwenhorst(1998), momentum effect in Sweden is negligible.

shareholders. Then, for each of them, we calculate their required rate of return on the basis of their portfolio holdings. Finally, we construct the aggregate required rate of return for the institutions with controlling power by averaging the required rate of returns individually constructed for all the controlling institutions.

Both in the case of diversified and undiversified shareholders, the return on the company stock before the IPO as well as the return of all stocks held in the portfolio of the investors which are not listed, are proxied by the return on "similar" (in terms of size, book-to-market, and industry) listed stocks. We use two criteria to select such companies: a) we first select companies with a market capitalization within 30% of the market capitalization of the company at the date of IPO; b) among the companies satisfying condition a) we pick those that have the book-to-market ratio closest to the book-to-market ratio of the company going public.

We report the *mean values* of the estimates of the required rates of return, the t-*stat* and the significance levels (one-sided) for the *mean test*, *Wilcoxon z-score* and significance level (one-sided) for *median test* of the undiversified required rate of return of particular group of investors being larger than that required by diversified investors. It is always the case that the rate of return required by the main classes of investors holding shares in the firm before the IPO, being private investors or institutions, controlling or minority shareholders, is higher than that required by the market (i.e., diversified investors). This difference is always strongly statistically significant, both in terms of mean and median tests.

These findings show that the existing shareholders have a significantly higher required rate of return than the fully diversified shareholder. Figure 1 presents the discount implied in the valuation of the non-diversified investors (similar to those presented in Table 3) relative to the valuation of a fully diversified investor. The discount depends on the expected growth rate of cash flows, but it starts at almost 30% and may go as high as 60%. This implies that a variation in the degree of diversification may create significant variation in the size of the surplus. This

suggests that lower diversification should induce higher probability of an IPO, and higher degree of underpricing in companies going public. In the next section we proceed to test this hypothesis.

*3.2 Probability of an IPO*

The decision to go public has been the subject of many studies. We consider the specification used by Pagano, Panetta, Zingales (1998), adding our measures of portfolio diversification of the main classes of shareholders. In particular, we estimate the probit model:

$$l_i^* = \alpha_1 + \beta_1 D_i + \gamma_1 C_{1,i} + \varepsilon_{1,i}\,, \qquad 1)$$

where, for the $i^{th}$ company, $l_i^*$ is a latent unobservable variable that represents the decision to list the company. In practice we observe $l_i$, a dummy that takes the value of 1 if the company is listed and zero otherwise. That is, $l_i = 1$ if $l_i^* > 0$ and $l_i = 0$ if $l_i^* < 0$. The probability of listing ($Prob(l_i=1)$) is modeled as a normal c.d.f. All the other variables are defined as before.

We consider an expanded dataset that contains all the non-listed companies that are similar (in terms of size, book-to-market and industry) to the one being taken public. The dataset includes a total of 1,309 companies/observations for non-listed companies. For these companies, we construct all the control variables as defined before. $C_{1,i}$ is the vector of control variables defined above and $D_i$ is one of our measures of portfolio diversification.

We recall that Hypothesis 2 requires that $\beta_1 < 0$. The results are reported in Table 4: the sample is restricted to companies with assets exceeding 20 Mln. SEK (over $2 Mln.). For robustness, we also considered a sample made of companies with assets exceeding 50 Mln. SEK. The results are qualitatively unchanged. We consider four different specifications, based on the different measures of portfolio diversification. In Panel A, we report the results for the measures

of portfolio diversification based on simple average; in Panel B we report the same measure as in Panel A, but for 50 Mln. SEK cutoff; in Panel C, the results for the measures of portfolio diversification based on the value-weighed average, where the weights are the fraction of the company capital held by the shareholders. In Panel D, we report the results for the measures of portfolio diversification based on the value-weighed average, considering only the investors with a controlling stake at least equal to 10% of the voting rights.

The results show a strong and negative correlation between the degree of portfolio diversification and the probability of going public. This holds for all our measures of diversification. As in the previous case, we consider measures of portfolio diversification for both institutional investors and private investors who have a controlling stake. A separate regression was also estimated for the minority investors, but the results (not reported) are neither statistically nor economically significant for all investor types. In fact, it is quite clear that the non-controlling shareholders do not matter; only the controlling shareholders decide whether to take the company public. Also, it seems that the institutional investors play a stronger role in deciding whether to proceed with an IPO.

These results are consistent across specifications. In particular, an increase of 1 standard deviation of the degree of portfolio diversification of the institutional controlling shareholders decreases the probability of the company being taken public by 1.38% if we consider $D_1$, by 1.44% if we consider $D_2$, by 2.72% if we consider $D_3$, and by 2.13% if we consider $D_4$. The unconditional probability of going public in our sample is 8.65%, which means that diversification explains a significant part of the reported variation, making it an economically significant feature of the IPO process.

*3.3 Underpricing and portfolio diversification*

Next we relate the degree of underpricing to our measures of portfolio diversification. We estimate:

$$u_i = \alpha_2 + \beta_2 D_i + \gamma_2 C_{1,i} + \varepsilon_{2,i}, \qquad 2)$$

where, for the $i^{th}$ company being taken public, $u_i$ is the underpricing, $C_{2,i}$ is the vector of control variables defined above and $D_i$ is one of our measures of portfolio diversification for the controlling shareholders. Equation (2) is estimated by using HWhite heteroskedasticity-consistent estimator.

We recall that Hypothesis 1 implies that $\beta_2 < 0$. The results are reported in Table 5. We consider 4 alternative specifications, based on the different measures of portfolio diversification described in section 2.3. In Panel A, we report the results for the measures of portfolio diversification based on simple average; in Panel B, the results for the measures of portfolio diversification based on the value-weighted average, where the weights are the fraction of the company capital held by the shareholders. In Panel C, we report the results for the measures of portfolio diversification based on the value-weighted average, considering only the investors with a controlling stake at least equal to 10% of the voting rights.

The results show a strong and negative correlation between the degree of portfolio diversification and underpricing for all our measures of diversification for controlling shareholders. We replicate the same estimation procedure with the minority shareholders and find no relation between their diversification and the degree of underpricing. We do not report these results for brevity, but the comparison clearly indicates that the controlling shareholders are the ones who matter as they decide whether to IPO the company and set the offer price.

An interesting result is that the negative relationship is entirely due to private controlling investors. Institutions with a controlling stake, while strongly affecting the probability of the IPO, do not seem to be affecting the price. These results, that are consistent across specifications, may arise for two reasons. First, the institutional investors with controlling stakes are Venture Capitalists or "Angels", while the private investors are mostly the original inventors or

entrepreneurs. The former are mostly interested in a profitable exit, and are willing to sacrifice the price for the sake of the success of an IPO. This is because they are interested in raising the next round of financing, which depends on their ability to deliver profitable exits. The private investors may be much more averse to price concessions (they usually view it as a one shot game), and perhaps less anxious for an exit. This would mean that undiversified institutional investors (the VCs) would push for an exit, while the diversified private investors must be bribed by a lower underpricing.

Alternatively, our findings may be due to the fact that the estimation of equation 2) does not account a potential selection bias: the same factors that determine the underpricing may also determine the probability of the company being taken public. We address this issue in the next section.

*3.4 Selection bias and underpricing*

In the previous section we directly related underpricing to investor characteristics and a set of control variables. It is however, possible that the very same variables that determine the probability of the IPO, also determine the size of the underpricing. This may generate a sample selection problem. To address this issue we resort to an econometric specification that explicitly controls for it. Let us assume that:

$$l_i^* = \alpha_1 + \beta_1 D_{1i} + \gamma_1 C_{1i} + \varepsilon_{1i} \qquad 3)$$

$$u_i^* = \alpha_2 + \beta_2 D_{1i} + \gamma_2 C_{2i} + \varepsilon_{2i} \ . \qquad 4)$$

We also know that $u = u_i^*, l_i = 1$ if $l_i^* > 0$ and that $u_i$ is not observed and $l_i = 0$ if $l_i^* \leq 0$. Equation 4) represents the level of underpricing, conditional on the company being taken

public and equation 3) represents the probability that such IPO takes place. This specification captures the fact that we do not observe the underpricing for companies that are not taken public. However, the probability of being taken public is itself a function of the some of the explanatory variables that affect the premium. We assume the following correlation structure:

$$\begin{pmatrix} \varepsilon_{1i} \\ \varepsilon_{2i} \end{pmatrix} \approx NID\left( \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{matrix} \sigma_1^2 & \sigma_{12} \\ \sigma_{12} & \sigma_2^2 \end{matrix} \right).$$

In this case, the standard OLS estimates of equation (3) are biased (Maddala, 1983). We, therefore, adopt the Heckman (1979) two-stage procedure. We first estimate equation (3) using a standard probit choice model, and then we estimate:

$$u_i^* = \alpha_2 + \beta_2 D_j + \gamma_2 C_{2i} + \delta\lambda_i + \varepsilon_{2i} \qquad 5)$$

where $\lambda_i = \dfrac{\phi(\alpha_1 + \beta_1 O_{1i} + \gamma_1 C_{1i})}{\Phi(\alpha_1 + \beta_1 O_{1i} + \gamma_1 C_{1i})}$ is the Heckman's Lambda and is estimated from the results of the first stage. In equation (5) the standard errors are corrected for heteroskedasticity and selection bias (Greene, 1981). The value and significance of the δ provides a test of the null of no sample selection bias.

The results are reported in Table 6. As in the previous section, we consider 4 different specifications, based on the different measures of portfolio diversification. Again, in Panel A, we report the results for the measures of portfolio diversification based on simple average; in Panel B, the results for the measures of portfolio diversification based on the value-weighed average, where the weights are the fraction of the company capital held by the shareholders. In Panel C, we report the results for the measures of portfolio diversification based on the value-weighed

average, considering only the investors with a controlling stake at least equal to 10% of the voting rights.[6]

The results show two important things. First, selection bias does not seem to be important, since the coefficient of Heckman's Lambda is almost always insignificant. This suggests that the previous results were not due to selection bias. Moreover, the results concerning the ownership variables are consistent with the ones previously reported. Indeed, underpricing is negatively related to the degree of diversification of the shareholders before the IPO. This holds in all specifications and different sets of control variables.

As in the previous section, the negative relationship is restricted to private controlling shareholders, while the institutional controlling investors do not seem to play a role. These findings provide a useful robustness check and show that the underpricing at the IPO can be, at least partially, explained in terms of the degree of diversification of the private controlling shareholders. In particular, an increase of 1 standard deviation of the degree of portfolio diversification of the private controlling shareholders reduces the underpricing by 8.16% if we consider $D_1$, by 5.56% if we consider $D_2$, by 6.82% if we consider $D_3$, and by 5.55% if we consider $D_4$. Considering the unconditional underpricing of 14.2%, it implies that between one third and a half of the underpricing may be explained by the diversification of the controlling private shareholders. This is a very significant economic effect, which, in our opinion, ought to be introduced into the literature.

[6]As a robustness check, we also estimate a specification in which we restrict the sample to the private companies that have at least 50 million SEK in assets (roughly $5 Mln ). The results are consistent with the ones reported and available upon request.

**Conclusion**

We study IPOs from a new perspective, by focusing on the degree of portfolio diversification of the shareholders taking the company public. We argue that a less diversified shareholder is willing to accept a lower price for the sale of shares than a more diversified shareholder. At the same time higher idiosyncratic risk induces shareholders to rebalance their portfolio. This implies that the more undiversified the shareholder is, the more willing he is to diversify by taking the company public.

We test these hypotheses by considering all the IPOs that took place in Sweden in the period 1995-2001. We construct measures of portfolio diversification of the holders of the stocks of the companies being taken public, before the IPO and then we relate them to the probability of the IPO and the underpricing of the IPO. We find that the degree of portfolio diversification of the main shareholders matters. There is a negative and significant correlation between the level of underpricing and the degree of diversification of the controlling private shareholders and a positive correlation between this and long run abnormal return after the IPO. We also show that the probability of the company being taken public is negatively related to the degree of diversification of the controlling institutional shareholders. These results are robust across alternative specifications and different measures of the degree of shareholder portfolio diversification and after controlling for selection bias.

These findings shed some light on the one of the two of the most persistent puzzles of finance: the underpricing and underperformance around IPOs. They contribute to explain them in a simple finance set-up that uses the most elementary of financial tenets: portfolio diversification. These results also have important implications in terms of the debate on financial diversification. We expect that, if underpricing is related to the lack of diversification of the private controlling shareholders of the company being taken public, an increase in the fraction of the company's capital held by institutional investors should reduce the level of underpricing.

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# Appendix

We summarize here the definitions of our proxies for the degree of diversification.

1. $D_1$ is defined as follows:

$$D_1 = -\sum_{i=1}^{N} \left( w_i - w_{mkt} \right)^2,$$

   where $w_i$ is the weight of the stock in the portfolio of the investor and $w_{mkt}$ is the weight of the same stock in the market portfolio.

2. $D_2$ is the average correlation of the return of the industry to which the company belongs with the return of the rest of investor's portfolio, multiplied by –1. We construct the industry return as a weighted average of the returns of all the publicly traded companies in the same SNI92[7] industrial category, weighed by their market capitalization. The classification contains 12 industries.
3. $D_3$ is the negative of the percentage of the portfolio of the investor allocated to the company being taken public.
4. $D_4$ is the negative of the percentage of the portfolio of the investor allocated to the industry to which the company in question belongs.

[7] For more information see www.scb.se

## Table 1: Descriptive statistics for the companies going public

*Panel A* reports some descriptive statistics for the underpricing and main financial and accounting variables of the taken public companies. The data are obtained from the SIX Trust Database and the Market Manager Partners Databases. *Underpricing* is defined as the difference between the first-day close and offer price normalized by the offer price. *Size* is defined as the market capitalization of the company (in *Mln.* of SEK) on the first trading day. *Mkt/bk* is market-to-book value of the company at the closest end of January/June date after the IPO. *Total assets* and *ROA* are, respectively, the total accounting value of the company assets and the return on total assets at the closest available date before the IPO. *Own equity* is defined as a ratio of the company own equity to company total assets. *Panel B* reports the distribution of IPOs over industries based on SNI92 classification. *Panel C* reports the distribution of institutional investors by type. *Panel* D displays the descriptive statistics for the control variables we use in our regressions. We report the following variables: *age* – time in years from the registration of the IPO company to its IPO date, *outside rights* – fraction of the cash flow rights offered to the outside investors at the IPO, *telecom* and *carve-out* – telecom industry dummy and carve-out dummy, *market underpricing* and *number of IPOs* – average underpricing and number of IPOs over the previous six months period, *momentum* and *volatility* – total return and average daily standard deviation on the market portfolio in the previous six months, *underwriter reputation* – the highest number of deal conducted by the leading manager over the observed period.

### Panel A: Underpricing, underperformance, main financial and accounting variables

| Variable | Mean | Median | StdDev | Interquartile Range | Minimum | Maximum |
|---|---|---|---|---|---|---|
| *Underpricing* | 0.142 | 0.075 | 0.324 | 0.204 | -0.467 | 2.435 |
| *Size (Mln. SEK)* | 1915 | 512 | 4814 | 1431 | 20 | 32995 |
| *Mkt/bk* | 4.73 | 3.76 | 3.29 | 3.07 | 0.57 | 18.47 |
| *Total assets (Mln. SEK)* | 753 | 114 | 3649 | 249 | 15 | 38232 |
| *ROA* | 0.012 | 0.015 | 0.315 | 0.184 | -2.646 | 0.713 |
| *Own equity* | 0.655 | 0.689 | 0.242 | 0.354 | 0.076 | 0.999 |

### Panel B: Distribution of IPO's by industry

| Industry | Number | % |
|---|---|---|
| *Mining and heavy machinery manufacturing* | 11 | 9% |
| *Other manufacturing* | 7 | 6% |
| *Trade* | 12 | 10% |
| *Transport* | 5 | 4% |
| *Financials* | 3 | 2% |
| *Business services* | 51 | 41% |
| *High tech* | 32 | 26% |
| *News and entertainment* | 3 | 2% |

## Panel C: Distribution of Institutional Investors by Type

| Type of Institution | Number | Percentage in the Sample |
|---|---|---|
| *Foreign non-financial* | 11 | 6.63% |
| *Foreign financial* | 11 | 6.63% |
| *Swedish non-financial* | 92 | 55.42% |
| *Swedish financial* | 49 | 29.52% |
| *Others* | 3 | 1.81% |

## Panel D: Control variables

| Variable | Mean | Median | StdDev | Interquartile Range | Minimum | Maximum |
|---|---|---|---|---|---|---|
| *Age* | 15.089 | 11.000 | 16.088 | 9.500 | 1.000 | 96.000 |
| *Outside Rights* | 0.351 | 0.297 | 0.177 | 0.226 | 0.045 | 0.855 |
| *Telecom Dummy* | 0.250 | 0.000 | 0.435 | 0.500 | 0.000 | 1.000 |
| *Carve-Out Dummy* | 0.194 | 0.000 | 0.397 | 0.000 | 0.000 | 1.000 |
| *Market Underpricing* | 0.160 | 0.127 | 0.123 | 0.158 | 0.014 | 0.657 |
| *Number of IPOs* | 11.815 | 12.000 | 5.537 | 8.000 | 1.000 | 24.000 |
| *Momentum* | 0.132 | 0.179 | 0.166 | 0.198 | -0.299 | 0.525 |
| *Volatility* | 0.013 | 0.011 | 0.004 | 0.007 | 0.007 | 0.022 |
| *Underwriter Reputation* | 15.468 | 12.000 | 8.513 | 15.500 | 2.000 | 27.000 |

## Table 2: Descriptive statistics on diversification proxies

*Panel A* reports the descriptive statistics for the average levels of diversification of the shareholders of the companies being taken public, breaking them down into institutional and private shareholders, controlling and minority shareholders. The measures of diversification are defined as follows: $D_1$ is the negative of the sum of squared differences between the weight a particular position has in the investor's portfolio and its weight in the market portfolio, $D_2$ is the average correlation of the return of the industry to which the company belongs with the return of the rest of investor's portfolio, multiplied by –1. We construct the industry return as a weighted average of the returns of all the publicly traded companies in the same SNI92[8] industrial category, weighed by their market capitalization. The classification contains 12 industries, $D_3$ is the negative of the percentage of the portfolio of the investor allocated to the company being taken public, $D_4$ is the negative of the percentage of the portfolio of the investor allocated to the industry to which the company in question belongs. These variables are constructed at the investor level and then aggregated at the company level by averaging the degree of diversification of each investor in the company. We consider both the simple average and the value weighed one, where the weights are given by the fraction of shares held by the investors in the company. We consider the institutional and private investors as well as the controlling investors and the minority ones. We use the superscript "*ip*" ("*inp*") to denote the institutional investors who have a controlling (minority) stake and the superscript "*pp*" ("*pnp*") to denote the private investors who have a controlling (minority) stake. An investor is assumed to have a controlling stake if he is member of the board or has at least 10% of the votes in the company. *Panel B* displays the correlation matrix among the diversification proxies described above, but only for the controlling shareholders. *Panel C* reports the percentages of the IPO-ed and non-IPOed private companies in lower and upper half of the sample based on diversification measures *D1-D4*. We also report the result of Wilcoxon test of equality between the diversification proxies distribution of the two samples. *Panel D* reports time series changes of the degree of diversification for private and institutional investors before and after the IPO.

### Panel A: Diversification Proxies

| Variable | Mean | Median | StdDev | Interquartile Range | Minimum | Maximum |
|---|---|---|---|---|---|---|
| $D_1^{ip}$ | -0.723 | -0.858 | 0.316 | 0.580 | -1.000 | -0.053 |
| $D_1^{inp}$ | -0.757 | 0.999 | 0.306 | 0.531 | -1.000 | -0.048 |
| $D_1^{pp}$ | -0.935 | -0.992 | 0.122 | 0.074 | -1.000 | -0.205 |
| $D_1^{pnp}$ | -0.883 | -0.998 | 0.183 | 0.225 | -1.000 | -0.208 |
| $D_2^{ip}$ | -0.552 | -0.439 | 0.384 | 0.804 | -1.000 | 0.123 |
| $D_2^{inp}$ | -0.704 | -1.000 | 0.347 | 0.629 | -1.000 | -0.056 |
| $D_2^{pp}$ | -0.743 | -0.894 | 0.312 | 0.495 | -1.000 | 0.082 |
| $D_2^{pnp}$ | -0.757 | -0.947 | 0.292 | 0.481 | -1.000 | -0.043 |
| $D_3^{ip}$ | -0.636 | -0.776 | 0.390 | 0.677 | -1.000 | -0.001 |
| $D_3^{inp}$ | -0.655 | -0.995 | 0.407 | 0.767 | -1.000 | -0.001 |
| $D_3^{pp}$ | -0.926 | -0.995 | 0.152 | 0.065 | -1.000 | -0.179 |
| $D_3^{pnp}$ | -0.839 | -0.994 | 0.256 | 0.225 | -1.000 | -0.006 |
| $D_4^{ip}$ | -0.713 | -0.845 | 0.329 | 0.472 | -1.000 | -0.002 |
| $D_4^{inp}$ | -0.741 | -1.000 | 0.343 | 0.480 | -1.000 | -0.015 |
| $D_4^{pp}$ | -0.948 | -0.997 | 0.117 | 0.046 | -1.000 | -0.231 |
| $D_4^{pnp}$ | -0.879 | -0.999 | 0.209 | 0.180 | -1.000 | -0.074 |

[8] For more information see www.scb.se

**Panel B: Correlations among the Diversification Proxies**

| Variable | $D_1^{ip}$ | $D_1^{pp}$ | $D_2^{ip}$ | $D_2^{pp}$ | $D_3^{ip}$ | $D_3^{pp}$ | $D_4^{ip}$ |
|---|---|---|---|---|---|---|---|
| $D_1^{ip}$ | 1.000 | | | | | | |
| $D_1^{pp}$ | 0.074 | 1.000 | | | | | |
| $D_2^{ip}$ | 0.674 | -0.088 | 1.000 | | | | |
| $D_2^{pp}$ | 0.183 | 0.546 | 0.080 | 1.000 | | | |
| $D_3^{ip}$ | 0.824 | 0.064 | 0.717 | 0.161 | 1.000 | | |
| $D_3^{pp}$ | 0.094 | 0.778 | -0.005 | 0.472 | 0.051 | 1.000 | |
| $D_4^{ip}$ | 0.756 | 0.031 | 0.677 | 0.151 | 0.924 | 0.008 | 1.000 |
| $D_4^{pp}$ | 0.055 | 0.899 | -0.084 | 0.483 | 0.021 | 0.845 | 0.028 |

**Panel C: Diversification of shareholders of firms going public versus the shareholders of other firms.**

| | | | | Wilcoxon Test | |
|---|---|---|---|---|---|
| **Measures of diversification** | **Degree of diversification** | **% of IPO** | **% of NON-IPO** | **Z** | **Pr<Z** |
| $D_1$ | Low | 58.06% | 49.35% | 1.8542 | 0.0319 |
| | High | 41.94% | 50.65% | | |
| $D_2$ | Low | 56.45% | 49.50% | 1.4783 | 0.0697 |
| | High | 43.55% | 50.50% | | |
| $D_3$ | Low | 61.29% | 49.05% | 2.6054 | 0.0046 |
| | High | 38.71% | 50.95% | | |
| $D_4$ | Low | 58.87% | 49.27% | 2.0419 | 0.0206 |
| | High | 41.13% | 50.73% | | |

**Panel D: Test of changes in diversification before and after IPO for private and institutional investors.**

| | Private | | Institutional | |
|---|---|---|---|---|
| | *Wilcoxon's Z* | *p-value* | *Wilcoxon's Z* | *p-value* |
| $D_1$ | -1.570 | 0.058 | -0.466 | 0.320 |
| $D_2$ | -1.830 | 0.034 | 0.467 | 0.320 |
| $D_3$ | -1.800 | 0.036 | -1.403 | 0.0803 |
| $D_4$ | -1.675 | 0.047 | 0.038 | 0.4851 |

## Table 3: Required rate of return for the IPO companies

This table presents estimates of monthly required rate of returns for different groups of investors. We consider both the undiversified and the diversified rate of return. For each company, the diversified required risk premium is constructed as the product between the Fama and French factor risk premium and the loading of the company return on that factor. The company stock return in the years before the IPO is proxied by the return of a listed company with analogous characteristics (in terms of size and book-to-market). The undiversified required rate of returns is constructed as follows. For each investor, we calculate the loading ("beta") between the return on the stock and the return on the investor portfolio. This is then multiplied by the excess return of the investor portfolio over the riskless (30-days T-bill) rate. Then, for each company being taken public, we calculate the required rate of returns (undiversified as well as diversified) by aggregated across all the shareholders of the company. As before, we report a breakdown for institutional and private investors as well as for controlling and minority shareholders. We use the superscript "*ip*" ("*inp*") to denote the institutional investors who have a controlling (minority) stake and the superscript "*pp*" ("*pnp*") to denote the private investors who have a controlling (minority) stake.
We present the results for 3-factor (Fama-French) models using factor loadings estimated over 36- and 60 months prior to the IPO date. We use the following matching mechanism to identify listed companies most similar to the IPO companies in our sample: a) we select companies with a market capitalization within 30% of the market capitalization of the company at the date of its IPO; b) among companies satisfying condition a) we select the ones that have the book-to-market ratio closest to the book-to-market ratio of the company going public.
The notations on the types of investors are as in Table 1. We report the *mean values* of the estimates of required rates of return (for undiversified investors and for each group of investors), t-*stat* and significance levels for *mean tes*,(one-sided), and *Wilcoxon z-score* and significance level (one-sided) for *median test* of the undiversified required rate of return of particular group of investors being larger than that required by diversified investors. The number of observation is 124 and the number of degrees of freedom for mean and median test is 246.

| | ***Non Controlling Institutions (inp)*** | ***Controlling Institutions (ip)*** | ***Non Controlling Private (pnp)*** | ***Controlling Private (pp)*** | ***Diversified Investors*** |
|---|---|---|---|---|---|
| **Factors loadings estimated over 36 months** | | | | | |
| *Mean (%)* | 3.05 | 3.14 | 3.25 | 3.20 | 2.30 |
| *t-value* | 1.85 | 2.01 | 2.30 | 2.07 | |
| *p-value* | 0.033 | 0.023 | 0.012 | 0.020 | |
| *Wilcoxon' Z* | 1.05 | 1.47 | 1.73 | 1.61 | |
| *p-value* | 0.146 | 0.071 | 0.042 | 0.054 | |
| **Factors loadings estimated over 60 months** | | | | | |
| *Mean (%)* | 2.85 | 3.03 | 3.12 | 3.11 | 2.00 |
| *t-value* | 2.13 | 2.51 | 2.82 | 2.62 | |
| *p-value* | 0.017 | 0.007 | 0.003 | 0.005 | |
| *Wilcoxon' Z* | 1.13 | 1.61 | 2.04 | 1.89 | |
| *p-value* | 0.128 | 0.054 | 0.021 | 0.030 | |

## Table 4: Probability of an IPO and portfolio diversification

This table reports results of the probit regression of the decision to go public on our proxies of investors' diversification and a set of control variables. We report the results for companies with at least 20 mln SEK (roughly 2 Mln. USD) in total assets (Panels A, C, and D). We also report a robustness check for for companies with assets above 50 mln SEK in Panel B. In Panel A, we report the results for the measures of portfolio diversification based on simple average; in Panel B we report the same measure as in Panel A, but for 50 Mln. SEK cutoff; in Panel C, the results for the measures of portfolio diversification based on the value-weighed average, where the weights are the fraction of the company capital held by the shareholders. In Panel D, we report the results for the measures of portfolio diversification based on the value-weighed average, considering only the investors with a controlling stake at least equal to 10% of the voting rights.
Our sample includes 124 companies which were taken public during the sample period and 277 companies which remain private (199 companies which remain private for the 50 mln SEK cut-off). The dependent variable is a dummy that takes the value 1 if the company got listed in the observed ½ -year period and 0 otherwise. The total number of observations is 1,433 in Panels A, C and D and 1,122 in Panel B. Definition of equally weighted and value weighted aggregation measures are the same as before. Diversification measures and control variables are defined in Table 1.

## Panel A: Equally weighted diversification measures

| *Variable* | *Estimate* | *t-stat* | *Estimate* | *t-stat* | *Estimate* | *t-stat* | *Estimate* | *t-stat* |
|---|---|---|---|---|---|---|---|---|
| *Intercept* | -2.686 | (-5.59) | -1.922 | (-6.20) | -2.879 | (-6.56) | -2.957 | (-6.33) |
| $D1^{ip}$ | -0.360 | (-2.13) | | | | | | |
| $D1^{pp}$ | -0.644 | (-1.69) | | | | | | |
| $D2^{ip}$ | | | -0.282 | (-2.05) | | | | |
| $D2^{pp}$ | | | 0.129 | (0.80) | | | | |
| $D3^{ip}$ | | | | | -0.579 | (-4.35) | | |
| $D3^{pp}$ | | | | | -0.782 | (-2.30) | | |
| $D4^{ip}$ | | | | | | | -0.561 | (-3.56) |
| $D4^{pp}$ | | | | | | | -0.848 | (-2.28) |
| *Carve-out Dummy* | 0.597 | (5.46) | 0.623 | (5.69) | 0.602 | (5.44) | 0.600 | (5.45) |
| *Log(Assets)* | -0.127 | (-3.62) | -0.117 | (-3.31) | -0.135 | (-3.82) | -0.143 | (-4.01) |
| *ROA* | 0.094 | (0.51) | 0.110 | (0.59) | 0.065 | (0.34) | 0.125 | (0.66) |
| *Own equity* | 0.501 | (2.46) | 0.469 | (2.32) | 0.556 | (2.67) | 0.504 | (2.44) |
| *Time Dummies* | yes | | yes | | yes | | yes | |
| *Log likelihood* | -366.395 | | -367.633 | | -357.641 | | -360.417 | |
| *Pseudo* $R^2$ | 0.132 | | 0.129 | | 0.152 | | 0.146 | |

## Panel B: Equally weighted diversification measures (assets > SEK 50 mln)

| *Variable* | *Estimate* | *t-stat* | *Estimate* | *t-stat* | *Estimate* | *t-stat* | *Estimate* | *t-stat* |
|---|---|---|---|---|---|---|---|---|
| *Intercept* | -1.912 | (-3.46) | -0.930 | (-2.57) | -2.042 | (-4.11) | -2.128 | (-4.03) |
| $D1^{ip}$ | -0.389 | (-2.12) | | | | | | |
| $D1^{pp}$ | -1.056 | (-2.41) | | | | | | |
| $D2^{ip}$ | | | -0.234 | (-1.58) | | | | |
| $D2^{pp}$ | | | -0.149 | (-0.85) | | | | |
| $D3^{ip}$ | | | | | -0.573 | (-3.97) | | |
| $D3^{pp}$ | | | | | -1.147 | (-3.08) | | |
| $D4^{ip}$ | | | | | | | -0.568 | (-3.33) |
| $D4^{pp}$ | | | | | | | -1.227 | (-3.00) |
| *Carve-out Dummy* | 0.672 | (5.67) | 0.673 | (5.73) | 0.667 | (5.56) | 0.671 | (5.61) |
| *Log(Assets)* | -0.332 | (-7.01) | -0.317 | (-6.73) | -0.340 | (-7.18) | -0.350 | (-7.32) |
| *ROA* | -0.207 | (-0.80) | -0.167 | (-0.65) | -0.164 | (-0.64) | -0.107 | (-0.41) |
| *Own equity* | 0.587 | (2.61) | 0.533 | (2.41) | 0.680 | (2.93) | 0.620 | (2.70) |
| *Time Dummies* | yes | | yes | | yes | | yes | |
| *Log likelihood* | -310.703 | | -315.148 | | -302.573 | | -304.567 | |
| *Pseudo* $R^2$ | 0.203 | | 0.192 | | 0.224 | | 0.219 | |

## Panel C: Value-weighted diversification measures

| *Variable* | *Estimate* | *t-stat* | *Estimate* | *t-stat* | *Estimate* | *t-stat* | *Estimate* | *t-stat* |
|---|---|---|---|---|---|---|---|---|
| *Intercept* | -2.071 | (-4.64) | -2.070 | (-6.91) | -2.691 | (-7.10) | -2.885 | (-6.66) |
| $D1^{ip}$ | -0.312 | (-1.86) | | | | | | |
| $D1^{pp}$ | -0.028 | (-0.08) | | | | | | |
| $D2^{jp}$ | | | -0.270 | (-1.96) | | | | |
| $D2^{pp}$ | | | -0.099 | (-0.63) | | | | |
| $D3^{jp}$ | | | | | -0.519 | (-3.90) | | |
| $D3^{pp}$ | | | | | -0.656 | (-2.31) | | |
| $D4^{ip}$ | | | | | | | -0.475 | (-3.04) |
| $D4^{pp}$ | | | | | | | -0.859 | (-2.45) |
| *Carve-out Dummy* | 0.609 | (5.61) | 0.603 | (5.52) | 0.626 | (5.65) | 0.625 | (5.68) |
| *Log(Assets)* | -0.125 | (-3.53) | -0.119 | (-3.40) | -0.128 | (-3.59) | -0.138 | (-3.81) |
| *ROA* | 0.103 | (0.55) | 0.112 | (0.60) | 0.070 | (0.37) | 0.130 | (0.69) |
| *Own equity* | 0.485 | (2.40) | 0.482 | (2.38) | 0.528 | (2.55) | 0.475 | (2.31) |
| *Time Dummies* | yes | | yes | | yes | | yes | |
| *Log likelihood* | -368.329 | | -367.732 | | -357.541 | | -360.552 | |
| *Pseudo* $R^2$ | 0.127 | | 0.129 | | 0.153 | | 0.146 | |

## Panel D: Value-weighted diversification measures (controlling stake >= 10% of voting rights)

| *Variable* | *Estimate* | *t-stat* | *Estimate* | *t-stat* | *Estimate* | *t-stat* | *Estimate* | *t-stat* |
|---|---|---|---|---|---|---|---|---|
| *Intercept* | -3.762 | (-5.87) | -2.392 | (-7.70) | -3.912 | (-7.50) | -3.975 | (-6.90) |
| $D1^{ip}$ | -0.255 | (-1.50) | | | | | | |
| $D1^{pp}$ | -1.774 | (-3.03) | | | | | | |
| $D2^{jp}$ | | | -0.200 | (-1.45) | | | | |
| $D2^{pp}$ | | | -0.575 | (-3.41) | | | | |
| $D3^{jp}$ | | | | | -0.445 | (-3.30) | | |
| $D3^{pp}$ | | | | | -1.989 | (-4.30) | | |
| $D4^{ip}$ | | | | | | | -0.415 | (-2.62) |
| $D4^{pp}$ | | | | | | | -2.016 | (-3.86) |
| *Carve-out Dummy* | 0.611 | (5.56) | 0.544 | (4.88) | 0.588 | (5.20) | 0.600 | (5.38) |
| *Log(Assets)* | -0.112 | (-3.09) | -0.116 | (-3.22) | -0.125 | (-3.35) | -0.133 | (-3.56) |
| *ROA* | 0.122 | (0.65) | 0.103 | (0.55) | 0.073 | (0.38) | 0.129 | (0.67) |
| *Own equity* | 0.481 | (2.36) | 0.524 | (2.56) | 0.549 | (2.59) | 0.495 | (2.37) |
| *Time Dummies* | yes | | yes | | yes | | yes | |
| *Log likelihood* | -361.055 | | -360.881 | | -344.747 | | -351.345 | |
| *Pseudo* $R^2$ | 0.144 | | 0.145 | | 0.183 | | 0.167 | |

## Table 5: Underpricing and portfolio diversification

This table presents the results of the regression of underpricing on our diversification measures. We report two sets of results, one for diversification measures equally weighted across investors with controlling stake (at least 10% of voting rights) in the company and one for value weighted (by cash flow rights) across investors with controlling stake or sitting on the board of directors or both. The dependent variable is underpricing defined as the difference between the first day close and offer price normalized by the offer price. The number of observations is 124. Diversification measures and control variables as defined in table 1. In Panel A, we report the results for the measures of portfolio diversification based on simple average; in Panel B, the results for the measures of portfolio diversification based on the value-weighted average, where the weights are the fraction of the company capital held by the shareholders. In Panel C, we report the results for the measures of portfolio diversification based on the value-weighted average, considering only the investors with a controlling stake at least equal to 10% of the voting rights.

### Panel A: Equally weighted diversification measures

| *Variable* | *Estimate* | *t-stat* | *Estimate* | *t-stat* | *Estimate* | *t-stat* | *Estimate* | *t-stat* |
|---|---|---|---|---|---|---|---|---|
| *Intercept* | -0.438 | (-1.58) | -0.117 | (-0.56) | -0.255 | (-1.09) | -0.2777 | (-1.16) |
| $D1^{ip}$ | 0.042 | (0.52) | | | | | | |
| $D1^{pp}$ | -0.582 | (-2.68) | | | | | | |
| $D2^{ip}$ | | | -0.043 | (-0.54) | | | | |
| $D2^{pp}$ | | | -0.171 | (-1.79) | | | | |
| $D3^{ip}$ | | | | | -0.004 | (-0.07) | | |
| $D3^{pp}$ | | | | | -0.363 | (-2.37) | | |
| $D4^{ip}$ | | | | | | | -0.004 | (-0.06) |
| $D4^{pp}$ | | | | | | | -0.390 | (-2.23) |
| *Log(Age)* | 0.007 | (0.39) | 0.013 | (0.60) | 0.008 | (0.45) | 0.007 | (0.41) |
| *Outside Rights* | 0.124 | (0.54) | 0.119 | (0.51) | 0.111 | (0.48) | 0.106 | (0.45) |
| *Telecom Dummy* | 0.208 | (2.17) | 0.224 | (2.15) | 0.198 | (2.08) | 0.200 | (1.96) |
| *Carve-Out Dummy* | 0.091 | (1.28) | 0.109 | (1.61) | 0.095 | (1.40) | 0.091 | (1.34) |
| *Market Underpricing* | -0.014 | (-0.08) | 0.002 | (0.01) | -0.008 | (-0.04) | -0.004 | (-0.03) |
| *Number of IPOs* | -0.007 | (-1.97) | -0.008 | (-2.07) | -0.008 | (-2.03) | -0.008 | (-2.17) |
| *Momentum* | 0.296 | (1.72) | 0.337 | (1.87) | 0.301 | (1.69) | 0.298 | (1.66) |
| *Volatility* | -8.105 | (-1.02) | -7.906 | (-1.00) | -8.352 | (-1.05) | -8.268 | (-1.01) |
| *Underwriter Reputation* | 0.001 | (0.58) | 0.002 | (0.96) | 0.001 | (0.68) | 0.001 | (0.73) |
| *Adj R2* | 0.082 | | 0.088 | | 0.074 | | 0.073 | |

## Panel B: Value-weighted diversification measures

| *Variable* | *Estimate* | *t-stat* | *Estimate* | *t-stat* | *Estimate* | *t-stat* | *Estimate* | *t-stat* |
|---|---|---|---|---|---|---|---|---|
| *Intercept* | -0.205 | (-0.69) | -0.201 | (-0.91) | -0.167 | (-0.69) | -0.250 | (-0.94) |
| $D1^{ip}$ | 0.019 | (0.22) | | | | | | |
| $D1^{pp}$ | -0.329 | (-1.58) | | | | | | |
| $D2^{ip}$ | | | -0.047 | (-0.60) | | | | |
| $D2^{pp}$ | | | -0.226 | (-2.40) | | | | |
| $D3^{ip}$ | | | | | -0.032 | (-0.51) | | |
| $D3^{pp}$ | | | | | -0.257 | (-2.12) | | |
| $D4^{ip}$ | | | | | | | -0.039 | (-0.45) |
| $D4^{pp}$ | | | | | | | -0.333 | (-1.88) |
| *Log(Age)* | 0.008 | (0.42) | 0.018 | (0.94) | 0.009 | (0.47) | 0.008 | (0.46) |
| *Outside Rights* | 0.119 | (0.52) | 0.100 | (0.45) | 0.095 | (0.42) | 0.097 | (0.43) |
| *Telecom Dummy* | 0.182 | (2.00) | 0.195 | (2.08) | 0.175 | (1.86) | 0.186 | (1.85) |
| *Carve-Out Dummy* | 0.113 | (1.41) | 0.145 | (1.87) | 0.114 | (1.60) | 0.111 | (1.54) |
| *Market Underpricing* | 0.036 | (0.20) | 0.032 | (0.17) | 0.013 | (0.07) | 0.054 | (0.30) |
| *Number of IPOs* | -0.008 | (-2.13) | -0.008 | (-2.11) | -0.008 | (-2.16) | -0.007 | (-2.09) |
| *Momentum* | 0.301 | (1.70) | 0.38 | (2.06) | 0.292 | (1.62) | 0.275 | (1.52) |
| *Volatility* | -8.596 | (-1.06) | -6.00 | (-0.79) | -8.020 | (-1.01) | -9.130 | (-1.10) |
| *Underwriter Reputation* | 0.001 | (0.74) | 0.002 | (0.90) | 0.001 | (0.82) | 0.001 | (0.81) |
| *Adj R2* | 0.079 | | 0.108 | | 0.075 | | 0.074 | |

## Panel C: Value-weighted diversification measures (controlling stake >= 10% of voting rights)

| *Variable* | *Estimate* | *t-stat* | *Estimate* | *t-stat* | *Estimate* | *t-stat* | *Estimate* | *t-stat* |
|---|---|---|---|---|---|---|---|---|
| *Intercept* | -0.478 | (-1.76) | -0.128 | (-0.60) | -0.261 | (-1.11) | -0.294 | (-1.22) |
| $D1^{ip}$ | 0.034 | (0.43) | | | | | | |
| $D1^{pp}$ | -0.613 | (-3.02) | | | | | | |
| $D2^{ip}$ | | | -0.052 | (-0.65) | | | | |
| $D2^{pp}$ | | | -0.172 | (-1.85) | | | | |
| $D3^{ip}$ | | | | | -0.020 | (-0.32) | | |
| $D3^{pp}$ | | | | | -0.356 | (-2.43) | | |
| $D4^{ip}$ | | | | | | | -0.024 | (-0.28) |
| $D4^{pp}$ | | | | | | | -0.387 | (-2.26) |
| *Log(Age)* | 0.008 | (0.44) | 0.013 | (0.62) | 0.009 | (0.50) | 0.009 | (0.48) |
| *Outside Rights* | 0.126 | (0.55) | 0.123 | (0.53) | 0.109 | (0.47) | 0.105 | (0.45) |
| *Telecom Dummy* | 0.209 | (2.18) | 0.226 | (2.17) | 0.198 | (2.08) | 0.203 | (1.99) |
| *Carve-Out Dummy* | 0.092 | (1.31) | 0.109 | (1.61) | 0.096 | (1.43) | 0.093 | (1.37) |
| *Market Underpricing* | -0.001 | (-0.01) | 0.001 | (0.01) | -0.005 | (-0.03) | 0.002 | (0.02) |
| *Number of IPOs* | -0.007 | (-2.00) | -0.008 | (-2.11) | -0.008 | (-2.04) | -0.008 | (-2.18) |
| *Momentum* | 0.284 | (1.64) | 0.343 | (1.89) | 0.295 | (1.65) | 0.289 | (1.60) |
| *Volatility* | -8.161 | (-1.02) | -7.627 | (-0.97) | -8.432 | (-1.06) | -8.454 | (-1.02) |
| *Underwriter Reputation* | 0.001 | (0.58) | 0.002 | (0.95) | 0.001 | (0.70) | 0.001 | (0.76) |
| *Adj R2* | 0.083 | | 0.090 | | 0.075 | | 0.074 | |

## Table 6: Underpricing and portfolio diversification (accounting for the endogeneity of an IPO)

This table presents the results of the effect the diversification of investors has on underpricing controlling for self-selection bias. Heckman's lambda is estimated from probit regressions in Table 4. The definition of equally weighted and value weighted aggregation measures is the same as before. Diversification measures and control variables are defined in Table 1. In Panel A, we report the results for the measures of portfolio diversification based on simple average; in Panel B, the results for the measures of portfolio diversification based on the value-weighed average, where the weights are the fraction of the company capital held by the shareholders. In Panel C, we report the results for the measures of portfolio diversification based on the value-weighed average, considering only the investors with a controlling stake at least equal to 10% of the voting rights.

### Panel A: Equally weighted diversification measures

| *Variable* | *Estimate* | *t-stat* | *Estimate* | *t-stat* | *Estimate* | *t-stat* | *Estimate* | *t-stat* |
|---|---|---|---|---|---|---|---|---|
| *Intercept* | -0.894 | (-1.52) | -0.585 | (-1.26) | -0.692 | (-1.46) | -0.701 | (-1.43) |
| $D1^{ip}$ | -0.021 | (-0.18) | | | | | | |
| $D1^{pp}$ | -0.669 | (-2.48) | | | | | | |
| $D2^{ip}$ | | | -0.101 | (-0.88) | | | | |
| $D2^{pp}$ | | | -0.178 | (-1.85) | | | | |
| $D3^{ip}$ | | | | | -0.075 | (-0.70) | | |
| $D3^{pp}$ | | | | | -0.449 | (-2.36) | | |
| $D4^{ip}$ | | | | | | | -0.071 | (-0.57) |
| $D4^{pp}$ | | | | | | | -0.474 | (-2.23) |
| *Log(Age)* | 0.009 | (0.36) | 0.015 | (0.56) | 0.011 | (0.42) | 0.009 | (0.37) |
| *Outside Rights* | 0.151 | (0.63) | 0.161 | (0.66) | 0.139 | (0.58) | 0.136 | (0.56) |
| *Telecom Dummy* | 0.222 | (2.09) | 0.247 | (2.13) | 0.210 | (2.03) | 0.214 | (1.91) |
| *Carve-Out Dummy* | 0.167 | (1.34) | 0.210 | (1.65) | 0.166 | (1.48) | 0.158 | (1.43) |
| *Market Underpricing* | -0.023 | (-0.13) | -0.020 | (-0.09) | -0.022 | (-0.11) | -0.016 | (-0.09) |
| *Number of IPOs* | -0.003 | (-0.79) | -0.002 | (-0.59) | -0.004 | (-0.92) | -0.004 | (-0.99) |
| *Momentum* | 0.359 | (1.87) | 0.439 | (2.01) | 0.366 | (1.83) | 0.358 | (1.81) |
| *Volatility* | -9.351 | (-1.11) | -9.643 | (-1.15) | -9.311 | (-1.13) | -9.350 | (-1.10) |
| *Underwriter Reputation* | 0.001 | (0.23) | 0.001 | (0.53) | 0.001 | (0.31) | 0.001 | (0.38) |
| *Heckman Lambda* | 0.137 | (1.05) | 0.182 | (1.27) | 0.133 | (1.14) | 0.125 | (1.09) |
| *Adj R2* | 0.088 | | 0.104 | | 0.081 | | 0.078 | |

## Panel B: Value-weighted diversification measures

| *Variable* | *Estimate* | *t-stat* | *Estimate* | *t-stat* | *Estimate* | *t-stat* | *Estimate* | *t-stat* |
|---|---|---|---|---|---|---|---|---|
| *Intercept* | -0.681 | (-1.20) | -0.728 | (-1.50) | -0.691 | (-1.41) | -0.777 | (0.16) |
| $D1^{ip}$ | -0.047 | (-0.39) | | | | | | |
| $D1^{pp}$ | -0.384 | (-1.65) | | | | | | |
| $D2^{jp}$ | | | -0.107 | (-0.97) | | | | |
| $D2^{pp}$ | | | -0.270 | (-2.38) | | | | |
| $D3^{jp}$ | | | | | -0.104 | (-1.01) | | |
| $D3^{pp}$ | | | | | -0.379 | (-2.19) | | |
| $D4^{ip}$ | | | | | | | -0.103 | (-0.86) |
| $D4^{pp}$ | | | | | | | -0.482 | (-1.94) |
| *Log(Age)* | 0.012 | (0.47) | 0.020 | (0.76) | 0.014 | (0.53) | 0.012 | (0.45) |
| *Outside Rights* | 0.152 | (0.63) | 0.142 | (0.60) | 0.125 | (0.53) | 0.129 | (0.54) |
| *Telecom Dummy* | 0.193 | (1.95) | 0.215 | (2.09) | 0.186 | (1.84) | 0.199 | (1.84) |
| *Carve-Out Dummy* | 0.205 | (1.46) | 0.253 | (1.84) | 0.203 | (1.67) | 0.192 | (1.60) |
| *Market Underpricing* | 0.038 | (0.20) | 0.008 | (0.04) | 0.008 | (0.04) | 0.055 | (0.29) |
| *Number of IPOs* | -0.003 | (-0.76) | -0.002 | (-0.62) | -0.003 | (-0.88) | -0.003 | (-0.71) |
| *Momentum* | 0.370 | (1.89) | 0.505 | (2.19) | 0.359 | (1.81) | 0.335 | (1.73) |
| *Volatility* | -10.153 | (-1.17) | -7.457 | (-0.95) | -9.224 | (-1.12) | -10.560 | (-1.21) |
| *Underwriter Reputation* | 0.001 | (0.33) | 0.001 | (0.46) | 0.001 | (0.38) | 0.001 | (0.40) |
| *Heckman Lambda* | 0.156 | (1.14) | 0.195 | (1.37) | 0.154 | (1.26) | 0.144 | (1.20) |
| *Adj R2* | 0.083 | | 0.127 | | 0.085 | | 0.085 | |

## Panel C: Value-weighted diversification measures (controlling stake >= 10% of voting rights)

| *Variable* | *Estimate* | *t-stat* | *Estimate* | *t-stat* | *Estimate* | *t-stat* | *Estimate* | *t-stat* |
|---|---|---|---|---|---|---|---|---|
| *Intercept* | -1.133 | (-1.60) | -0.681 | (-1.31) | -0.843 | (-1.43) | -0.8393 | (-1.37) |
| $D1^{ip}$ | -0.028 | (-0.25) | | | | | | |
| $D1^{pp}$ | -0.862 | (-2.40) | | | | | | |
| $D2^{jp}$ | | | -0.102 | (-0.97) | | | | |
| $D2^{pp}$ | | | -0.283 | (-1.85) | | | | |
| $D3^{jp}$ | | | | | -0.077 | (-0.78) | | |
| $D3^{pp}$ | | | | | -0.596 | (-2.10) | | |
| $D4^{ip}$ | | | | | | | -0.074 | (-0.63) |
| $D4^{pp}$ | | | | | | | -0.607 | (-2.02) |
| *Log(Age)* | 0.015 | (0.53) | 0.020 | (0.72) | 0.016 | (0.56) | 0.014 | (0.51) |
| *Outside Rights* | 0.150 | (0.62) | 0.153 | (0.63) | 0.130 | (0.54) | 0.127 | (0.52) |
| *Telecom Dummy* | 0.219 | (2.03) | 0.242 | (2.09) | 0.206 | (1.94) | 0.212 | (1.84) |
| *Carve-Out Dummy* | 0.182 | (1.39) | 0.201 | (1.69) | 0.170 | (1.49) | 0.162 | (1.41) |
| *Market Underpricing* | -0.008 | (-0.04) | -0.017 | (-0.08) | -0.010 | (-0.05) | 0.001 | (0.00) |
| *Number of IPOs* | -0.003 | (-0.69) | -0.002 | (-0.61) | -0.003 | (-0.87) | -0.004 | (-0.93) |
| *Momentum* | 0.354 | (1.80) | 0.457 | (2.03) | 0.358 | (1.78) | 0.349 | (1.74) |
| *Volatility* | -9.914 | (-1.17) | -8.980 | (-1.10) | -9.706 | (-1.17) | -9.650 | (-1.12) |
| *Underwriter Reputation* | 0.001 | (0.18) | 0.001 | (0.47) | 0.001 | (0.26) | 0.000 | (0.36) |
| *Heckman Lambda* | 0.155 | (1.08) | 0.184 | (1.28) | 0.137 | (1.08) | 0.126 | (0.99) |
| *Adj R2* | 0.092 | | 0.108 | | 0.082 | | 0.079 | |

**Figure 1:** This figure depicts the discount implied in the valuation of the non-diversified investors relative to the valuation of a fully diversified investor for the same expected cash flows by a diversified investor, as a function of the growth rate of cash flows. We assume that the discount rate of the fully diversified investor is 2% per period, while the discount rate of the non-diversified investor is 2.75% per period.

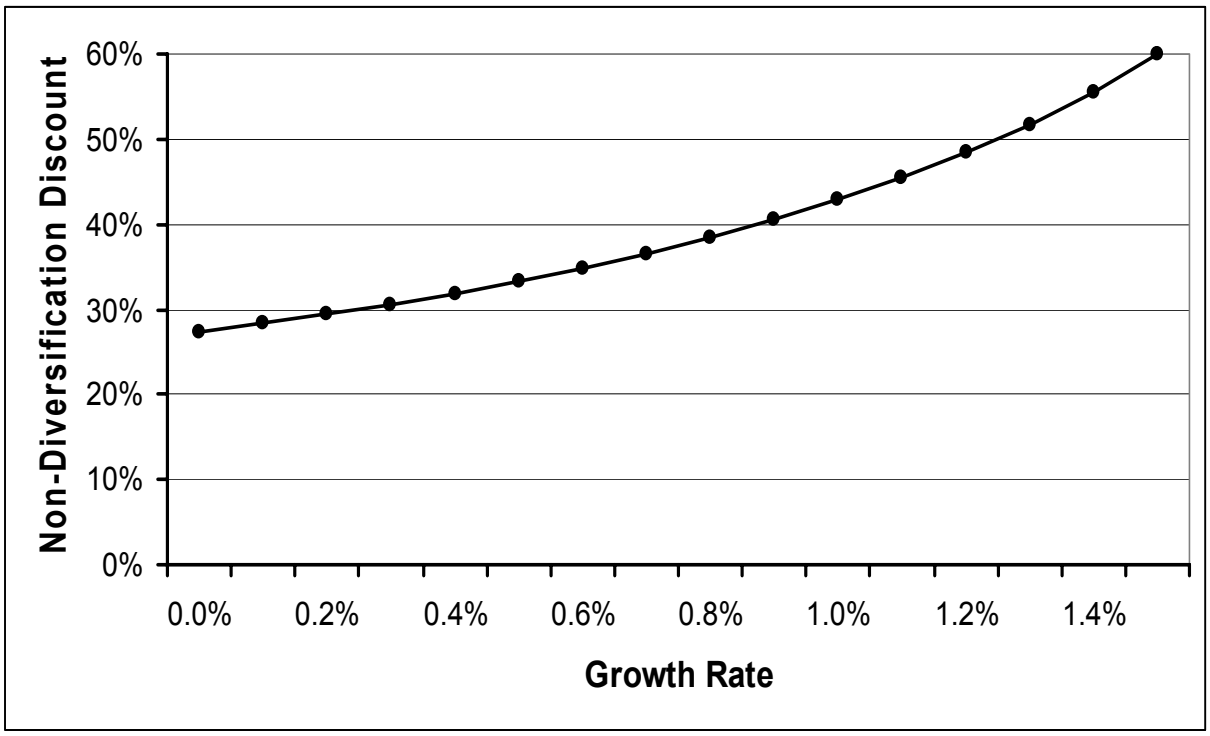

**Figure 2:** Frequency distribution of investors in control/company. Investors in control are defined either as insiders and owners of blocks in excess of 10% of equity (left bars) or as owners of blocks in excess of 10% (right bars).