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Family Ownership and the Cost of Under Diversification

Abstract

We argue that the cost to a family of holding a large block of shares in a company, or under diversifying, is reflected in the diversification benefits that the family forfeits. These costs can be substantial. For example, given a constant relative risk aversion parameter of two the median cost to our sample of families controlling large Swedish firms is 13% of the market value of firm's shares. We find that this cost is reduced by pyramid structures but not by the use of dual class shares.

JEL Classification: G32

Key words: Shareholder diversification; Ownership structure; Dual class shares, Pyramid structures.

1. Introduction

A central principle of financial theory is that individuals seek portfolio diversification. Yet, when individuals seek a concentrated portfolio they choose not to be fully diversified and thus face the costs arising from this choice, the cost of being under diversified. In general, the expected return from a fully diversified portfolio will exceed the expected return generated by a concentrated portfolio for a given level of risk. It is the certainty equivalent value of this difference, in the hands of a family, that we define as the cost of under diversification. It is common for both individuals and families to forfeit diversification benefits choosing, instead, to focus their investment in one firm. For example, Moskovitch and Vissing-Jorgensen (2002) report that U.S. households, with entrepreneurial private equity investments, hold 45% of their net worth in own-company stock on average.¹ Furthermore, Anderson and Reeb (2003) show that families listed among the Forbes' "400 Wealthiest Americans" and controlling shareholders in S&P 500 firms have almost 70% of their wealth invested in family owned company stock. Thus, it appears that families controlling very large and successful firms bear even higher costs of under diversification than entrepreneurs in private equity firms. Even though the costs of entrepreneurial investment and the motivation for becoming an entrepreneur have been discussed in the literature,² little is known about the costs associated with family control of large public firms and why these families choose to hold under diversified portfolios.

This paper investigates the ownership structure of large public Swedish firms that are controlled by a family and estimates the cost to the family of holding an under diversified portfolio.³ Exploring the cost of under diversification for families controlling large Swedish public corporations offers some advantages. First, we have

access to shareholder wealth due to Swedish law which simplifies access to individual portfolio information such that we are able to estimate the cost of under diversification using estimates of family wealth. Second, Sweden has an extreme separation of ownership and control. It ranks #1 in terms of the use of dual class shares and #2 in terms of the frequency of pyramid structures (after Belgium) among large firms (La Porta, Lopez-de-Silanes and Shleifer, 1999).⁴ Faccio and Lang's (2002) more recent and more comprehensive study of the ownership structure of more than 5000 Western European firms ranks Sweden #1 in terms of dual class shares and #6 in terms of frequency of pyramid structures.

By issuing shares with differential voting rights and keeping all high voting stock, a family can maintain control of a Swedish firm with much lower levels of capital investment. A larger fraction of the family's total wealth can then be invested in other assets, improving the family's portfolio diversification and thus reducing the cost of under diversification. Similarly, when a family sets up a second firm (B) it can let it be controlled by the initial firm (A) in a pyramid structure instead of controlling B directly (Almeida and Wolfenzon, 2006). If the family holds 50% of the shares in firm A and firm A holds 50% of the shares in firm B, the family holds 25% (0.5×0.5) of the cash flow rights in firm B but controls 50% of the votes in that firm. For the family to control firm B directly, it would have to acquire 50% of the shares in the firm giving it 50% of the cash flow rights. Thus, a pyramid structure allows a family to keep control of multiple firms with less invested capital. Essentially, a pyramid structure can improve portfolio diversification and reduce the cost of under diversification.

We use wealth data for a sample of 113 families in Sweden. The average family has roughly 50% of their wealth invested in the firm. Using a modified version

of the Lambert, Larcker and Verrecchia (LLV) (1991) executive compensation model we report a median cost of under diversification equal to 17% of the certainty equivalent of the family's optimal portfolio given a constant relative risk aversion parameter of two. The median cost of under diversification is also equal to 13% of the market value of firm equity. With information on ownership structure, level of concentration of family wealth in the firm and a measure of the cost to the family of maintaining a concentrated portfolio we are able to test whether families keep control of firms and simultaneously reduce the cost of under diversification through the use of dual class shares and pyramid structures. We find that the family's cost of under diversification is not reduced by the use of dual class shares though it is apparent that pyramid structures significantly reduce the cost associated with controlling a firm.

Earlier studies have also documented that the cost of holding an under diversified portfolio can be substantial. For example, LLV (1991) show how differential diversification abilities of managers and outside shareholders result in different valuations of option and stock compensation schemes. Hall and Murphy (2002) also investigate the estimation of the value of stock options in the hands of undiversified executives and Kahl et al. (2003) analyse the cost to entrepreneurs of selling restrictions that are placed on securities issued by the firm. Our study differs from these studies in at least two dimensions. First, we use actual Swedish family portfolio holdings, including both investments in the firm and investments in other assets. This is an important contribution of the paper as actual wealth data is rarely used in empirical analysis of this question. Second, we focus on ownership of unrestricted shares. Thus, the cost of under diversification in this paper is purely driven by share ownership.⁵ It should be noted that there are no restrictions applying to purchase or sale of the firm's securities for the families in our sample.

Bergström and Rydqvist (1990) investigate whether controlling shareholders use dual class shares for the purpose of expropriating wealth from minority shareholders. They find that large Swedish shareholders own much more equity than is required for control.⁶ This is consistent with our result that families do not appear to reduce the cost of under diversification by the use of dual class shares. However, Bergström and Rydqvist (1990) do not take pyramid structures into account. Our results suggest that families do indeed reduce the cost of under diversification associated with controlling a firm through the use of pyramid structures. Thus, one implication of our results is that dual class shares and pyramid structures are not perfect substitutes. But, even if we take pyramid structures into account, the separation between votes and ownership of cash flow rights is still far from the theoretical limit. Theoretically, a family could control (50%) firm A, firm A could control (50%) firm B and firm B could control (50%) firm C and so on. The family controls firm C (50% of the votes) but only owns 12.5% ($1/2^3$) of the firm. The family's cash flow rights in firms at the bottom of the pyramid would approach zero as the number of levels in the pyramid increases. If firms A, B and C also use dual class shares, and assuming that 25% of the shares is sufficient to achieve voting control (50% of the votes), the family controls firm C yet it holds only $1/64$ ($1/4^3$) of the cash flow rights in firm C. Thus, if pyramids are used in combination with dual class shares the separation between votes and ownership increases multiplicatively.

The paper is organized as follows. The next section describes the data. In section 3 we outline the model that we use to estimate the cost of under diversification. We analyse the cost of under diversification in our sample in section 4. Section 5 summarizes and concludes.

2. Data Sources and Descriptive Statistics

In this section we first describe how our sample was constructed. We then outline how personal wealth was estimated. Finally, we provide firm characteristics.

2.1 Data Sources and Sample Construction

First we collect ownership data for all firms listed on the Stockholm Stock Exchange (A-list, OTC, or unofficial list) for the years 1988 and 1991 including, with few exceptions, the largest corporations in Sweden.⁷ The shareholder data is obtained from Sundqvist (1988 and 1991), who reports the major shareholders for all listed firms. In the beginning of 1988 (1991) there were 257 (220) firms listed on the Stockholm Stock Exchange of which 119 (101) were controlled by families or individuals. Since we only have accurate estimates of the wealth of individuals and families, the 148 (119) firms controlled by institutional investors (financial institutions, foundations, other public firms without a family or individual in ultimate control, venture capital funds, associations, or state or community in control) are deleted from the sample. Firms where the largest vote-holder is a family controlled foundation are deleted since the families have no access to the capital in the foundation, i.e. the family's portfolio diversification is not directly affected by the foundations' investments. This exclusion means that the most powerful family in Sweden, the Wallenbergs, is not included in the sample since the vast majority of the Wallenberg group's investments on the Stockholm Stock Exchange are owned by foundations. This structure is motivated by taxes since the foundations are tax exempt if they distribute 90 percent of received dividends for scientific, societal and humanitarian purposes. Furthermore, the wealth estimates we use in this study do not include family controlled foundations. For example, Peter Wallenberg was reported as the 64th (68th) wealthiest Swede in 1988 (1991) even though the Wallenberg

foundations were the largest shareholder on the Stockholm Stock Exchange. As a result we are not able to estimate the portfolio diversification of the Wallenberg family with any accuracy.

The list of individual and family shareholders that are the largest vote-holders in a listed firm is compared to the list of the wealthiest Swedes published by *Affärsvärlden* (1988 and 1991).⁸ *Affärsvärlden* reports the richest Swedish individuals and families with a net wealth of 100 million SEK (approximately 15 million USD at the USD/SEK exchange rates in 1988 and 1991) or more.⁹ Therefore, firms whose largest shareholder is an individual or a family with net wealth of less than 100 million SEK are excluded from our sample.

Our final sample consists of 113 firm observations, 66 in 1988 and 47 in 1991. This represents 26% (21%) of the firms on the Stockholm Stock Exchange in 1988 (1991). In terms of market value it represents 18% (11%) in 1988 (1991). The average size of the firms in our 1988 (1991) sample is equal to (half of the) the average size of the firms on the Stockholm Stock Exchange in that year.

The majority of the individuals and families who are the largest vote-holder are insiders (107 out of 113 observations). Of the 6 observations where the largest individual or family shareholder does not have a clear insider position we observe two observations with a clear “group” representation. That leaves four observations where we can’t find an obvious inside connection—although there might be one. We have performed all tests with and without these 4 observations; the results are essentially unchanged.

2.2 Ownership and Wealth

We collect wealth data from *Affärsvärlden* (1988, 1991). In order to approximate the net wealth of individuals and families, *Affärsvärlden* has carried out

interviews and exploited various official data sources such as: real estate registers, tax authority records, annual reports, and various commercial data bases. Due to the principle of public access to official records (Offentlighetsprincipen) the journalists at Affärsvärlden (and everybody else) have access to all papers and files that arrive into an agency, or are finished by a civil or municipal servant.¹⁰ We are unaware of any other country, with the exception of Finland, where it is possible to construct such accurate estimates of individual wealth.

Annual reports were used to find the book value of private companies. Due to the offentlighetsprincipen, manager held company annual reports are publicly available. Private companies are subject to the same accounting standards as public firms.¹¹ Private companies were then given valuations similar to public companies based upon size and line of business. Real estate values were estimated by using recent valuations completed by independent appraisers or by approximating the value by the amount of assessments and rental revenues.

Due to the “offentlighetsprincipen” all Swedes’ tax returns are publicly available. Additionally, since Sweden levies wealth taxes, taxable wealth is also publicly available.¹² Affärsvärlden used taxable wealth to refine their estimates of the market value of total wealth.¹³ Finally, Affärsvärlden carried out interviews to check the reliability of their estimates. Affärsvärlden only reports the total wealth estimate, not the components that make up total wealth.

Affärsvärlden approximated the indebtedness that underlies large shareholdings by basing the loan values on the length of time that the stock-holdings were in the individual’s or family group’s possession. If the founder was still the major shareholder, then he or she was regarded as being debtless. Taxable income and wealth were used to refine indebtedness estimates. For example, if taxable wealth was

substantially below the taxable value of an individual's known assets, the difference was attributed to debt. Also, if taxable income was below known income from dividends and salary the difference was assumed to be interest payments. Debt can then be estimated given an assumed interest rate.

Affärsvärlden aggregates the wealth of family members. Thus, our wealth estimates generally apply to a family, not a single individual. Our source for share ownership (Sundqvist, 1988 and 1991) also aggregates family ownership. For 76 of the observations in our sample the largest shareholder is defined as a family. Thus, our measure of portfolio diversification generally applies to families, not to single individuals.

Table 1 panel A shows that the median controlling block of shares attracts 43% of the firm's cash flow rights (*UNADJ OWNERSHIP*). The median family's net ownership of cash flow rights after adjustment for pyramid structures (*OWNERSHIP*) is 34%. We adjust for the effect of pyramid structure in the following way. If the family controls the public firm A and firm A controls firm B, *UNADJ OWNERSHIP* in firm B is multiplied the family's *UNADJ OWNERSHIP* in firm A to give *OWNERSHIP*. This definition is in line with e.g. Claessens et al. (2002) and Faccio and Lang (2002).¹⁴ It is common that the families also make direct investments in the firms lower in the pyramids (firm B). Any direct ownership of cash flow rights in pyramidal firms is of course included in the *OWNERSHIP* variable.

[Insert Table 1 about here]

The median family holds more than 60% of the *VOTES* in the firm. *VOTES* is defined as the controlling family's fraction of the voting rights in the firm unless the firm is part of a pyramid structure. If the firm is part of a pyramid structure, *VOTES* is equal to the fraction of voting rights in the weakest link in terms of voting rights in

the pyramid. For example, if the family holds 40% of the voting rights in firm A and firm A holds 50% of the voting rights in firm B, *VOTES* in firm B is equal to 40%, i.e. $\text{Min}(50, 40)$. This definition is consistent with Claessens et al. (2002) and Faccio and Lang (2002).

We measure the separation of voting rights from cash flow rights in three ways. First, the total separation (*TOT_VC_DIFF*) is measured as *VOTES less OWNERSHIP*.¹⁵ The median family holds 21% more voting rights than cash flow rights. In order to investigate whether dual class shares and pyramid structures relate to the cost of under diversification differently, we split up the total separation into two additional variables. *DUAL_VC_DIFF* is defined as *VOTES less UNADJ_OWNERSHIP* and this is intended to capture the effect of dual class shares. *PYR_VC_DIFF* is defined as the minimum fraction of cash flow rights in the pyramid *less OWNERSHIP* and thus is intended to capture the effect of pyramid structures. The median *DUAL_VC_DIFF* is 17%. The median *PYR_VC_DIFF* is equal to 0 since less than half (33 observations) of the sample firms are part of a pyramid structure. Note that if the family uses dual class shares in combination with pyramid structures, both *DUAL_VC* and *PYR_VC_DIFF* will be different from zero (see example below).

In our sample 104 firms have dual class shares. Yet, if the family's investments in the firms were driven purely by the possibility of extracting private benefits of control from the firm, the families could have substantially reduced their share investment in the firm and still maintained voting control (Bergström and Rydqvist, 1990). Typically the A shares are one share – one vote while the B shares carry 1/10 of a vote. Yet, both A and B shares have the same cash flow rights. If, for example, firm X has 20 high voting A-shares and 80 low voting B-shares the family could hold 50% of the votes in firm X by investing in 14 of the firm's A-shares.¹⁶

Thus, by holding 14% of firm X's shares the family could control 50% of the voting rights. If the family also sets up a pyramid structure, i.e. the family lets firm X be controlled (50% of the votes) by firm Y which has a similar equity structure (20 A shares and 80 B shares) and invests in 14% of the shares in firm Y, the family can control firm X by owning less than 2% (0.14^2) of the firm's shares.¹⁷ Under these conditions, *TOT_VC_DIFF* in firm X would be 48% (50%-2%), *DUAL_VC_DIFF* would be 36% (50%-14%) and *PYR_VC_DIFF* would be 12% (14%-2%).

After adjustment for pyramid structures, the median family has invested 52% of their net wealth in the firm (*DIVERSIFICATION*). Thus, the median family has more than one half of their wealth invested in the firm's shares. This compares reasonably well with the family investment noted in literature for US firms. For a few families the market value of the family's investment in the firm is larger than their total wealth. This is most likely due to borrowing though it could also arise through wealth hidden in offshore accounts.

The shares held by the majority families are not part of compensation packages and are not restricted in any way. The family's position is typically long term with only minor changes generally observed after the initial public offering (Holmen and Högfeltdt, 2004). We investigate whether the families in the sample are still in control of the firm 10 years after 1988 and 1991, respectively. Roughly one-third of the families are still in control of the public firm after 10 years while 17 firms were privatised by the families. Fourteen families had lost control due to restructuring, corporate bankruptcy or personal bankruptcy. Thus, after 10 years roughly 60% of the families were either still in control, had privatised their firm, or had lost control due to financial problems.¹⁸ The remaining 46 families sold their

controlling block either as part of takeover (28 observations) or as block trades (18 observations).

2.3 Other Control Variables

When testing for a relationship between the separation of voting rights from cash flow rights and the cost associated with under diversified portfolios we control for other factors, which potentially affect the family's diversification decision. The family could reduce its share investment in the firm and still keep control by increasing firm leverage (Stulz, 1988). Equity as a proportion of total assets decreases as leverage increases, all else held fixed, and so the level of investment required to maintain control of levered firms must be less than that required to maintain control of an unlevered firm. It is important to control for leverage before focusing on other possible explanations for under diversification. We measure the firm's *LEVERAGE* as the book value of long-term debt divided by the book value of total assets at the beginning of the year. Maintaining control a larger firm should, *ceteris paribus*, increase the cost of under diversification. A greater level of investment is required to gain and maintain control of a larger firm and so it is expected that greater levels of under diversification will also be required of family investors if they are to control larger firms. Alternatively, smaller firms will not require as great a level of investment and so the family controlling a smaller firm will tend to be better diversified. *SIZE* is measured as the book value of total assets at the beginning of the year.¹⁹ Given that we expect leverage and size to be related with under diversification it is critical that we control for these firm specific characteristics as well as focusing on other explanations for variation in the level of under diversification across the sample.

It is also possible the family may trade off the cost of under diversification in return for future monetary benefits if the firm has profitable growth opportunities. We estimate growth opportunities as the change in total sales from the previous year (*SALES_GROWTH*). Further, we include a firm age variable to capture the possibility that older firms have greater opportunity to build strong political links (Morck et al., 2000 and Faccio, 2006). Thus, controlling families in older firms may be more willing to trade off reduced diversification for the greater political influence that has been built up over time.²⁰ *FIRM AGE* is defined as the number of years since the firm was founded.

Finally, a potential element affecting the cost of underdiversification is the firm-level diversification, i.e. the covariance between the cash flows generated by the different business segments of the firm if the firm is active in several industry segments. The costs of large shareholders' underdiversification should be decreasing in the firm-level diversification. We approximate the effect of corporate diversification by an indicator variable (*SINGLE_SEGMENT*) equal to one if the firm only reports activity in one industry segment, and zero otherwise.

Firm characteristics are reported in table 1, panel B. We find that the median firm has financed roughly 25% of its total assets with long term debt, has total assets worth 1231 Million SEK (roughly USD 185 Million at the exchange rate at the time), has increased total sales by 18% on the previous year, and is 38 years old. Roughly half (47%) of the firms are single segment.

Included in our estimation of the cost of under diversification are share volatility (*SHARE VOLATILITY*, σ_S) and share beta (*SHARE BETA*, β_S). These are estimated using daily data over three years preceding 1988 and 1991, respectively. We adjust for the 1987 crash by deleting the 20 trading days beginning October 19,

1987.²¹ The median firm in our sample has a yearly share return volatility of 0.370 and an share beta of 0.587. Market data are collected from FINDATA.

3. Estimating the Cost of Under Diversification

We propose a framework for determining the cost associated with holding an under diversified portfolio that draws on the executive compensation model developed by LLV (1991). It is assumed that (i) a risk-averse family maximises end of period expected utility of wealth using a constant relative risk aversion utility function, (ii) a risk-free asset exists, (iii) a market portfolio exists and this portfolio earns a rate of return that is normally distributed, and (iv) the Capital Asset Pricing Model describes asset expected returns. We use family total wealth data, our estimate of the value of the family's investment in the firm, share beta and share volatility to generate a certainty equivalent measure of the cost of under diversification. This provides an estimate of what the family gives up by not investing in an optimal combination of the market portfolio and the risk free asset.

The LLV model is extended in two ways. First, we assume that the family invests a proportion of its wealth in the firm's shares, with the remaining wealth invested in an optimal combination of the risk free asset and the market portfolio. Second, the fully diversified alternative portfolio is assumed to be a utility maximizing combination of the risk free asset and the market portfolio. Thus, given the CAPM holds, the optimal amount invested in any firm, including the family's own firm, should be its weight in the market portfolio times the wealth invested in the market portfolio. Without these extensions the LLV model may generate negative costs of under diversification when a family with low risk-aversion is insufficiently diversified.²² The negative costs arise from the assumption that the alternative

investment constitutes the risk free asset alone in the LLV model. A risk averse shareholder would not ordinarily choose to invest their salary or wealth in risk free assets alone, particularly an investor with a low level of risk aversion, and thus as the level of shares in the specific firm increases from zero there will initially be diversification gains from investing in the firm's shares.

Our measure of the cost of under diversification is simply the difference between the certainty equivalent value to the family of their control-constrained investment in the firm and the certainty equivalent value to the family of a fully diversified portfolio consisting of a utility maximising combination of the risk free asset and the market portfolio.

Following LLV, the risk-averse family is assumed to maximise expected utility of wealth using the constant relative risk aversion utility function.

$$U(w) = \begin{cases} 1/(1-\alpha)w^{1-\alpha}, & \text{if } \alpha \neq 1 \\ \log(w) & , \text{if } \alpha = 1 \end{cases} \quad (1)$$

where $U(w)$ = utility function, ($U' > 0$ and $U'' < 0$)

$\text{Log}(w)$ = natural log of w

α = constant relative risk aversion parameter

w = wealth.

We choose a partial equilibrium framework for this analysis. Initial wealth (w) is split between the controlling interest in the firm, consisting of N_s shares at the current market value (S_0), and investment in an optimal combination of the market

portfolio (w_m) and the risk free asset (w_{rf}). The proportion of remaining wealth invested in the market portfolio is ϕ so we can write initial wealth as follows:

$$w = w_m + w_{rf} + N_s S_0 = (w - N_s S_0)\phi + (w - N_s S_0)(1 - \phi) + N_s S_0 \quad (2)$$

where $N_s S_0$ is the market value of the controlling block of shares (*MV OWNERSHIP*).

We use a one period model and assume that the family maximises end-of-period expected utility of wealth. The end-of-period wealth is a function of the level of investment in the controlled firm, investment in the market portfolio and investment in the risk free asset. It is assumed that the risk free asset earns a certain return over the period, r_{rf} . The market portfolio earns the risky return over the period, \tilde{r}_m , which is distributed as $N(\mu_m, \sigma_m^2)$.

The cash flow rights take an uncertain end-of-period value \tilde{S}_T where the valuation is based on end-of-period share value.²³ We assume that the uncertain value of the shares at time T is defined as

$$\tilde{S}_T = S_0 e^{r_s} \quad (3)$$

where

S_0 = value per share at time 0,

r_s = $\gamma_s + \beta_s r_m + \varepsilon$, normally distributed share return with $\gamma_s = r_{rf}(1 - \beta_s)$ in equilibrium, variance $\sigma_s^2 = \beta_s^2 \sigma_m^2 + \sigma_\varepsilon^2$, and covariance with the market,

$$\beta_s \sigma_m^2,$$

β_s = the share beta,

σ_ε = the idiosyncratic return standard deviation for the share.

We model the family's problem in terms of optimising end-of-period wealth given the existing interest in the firm. The maximisation problem is based on the assumption that the family chooses the preferred number of cash flow rights in the firm (the observed net investment in the firm) and invests the remainder of their wealth in a utility maximising combination of risk free assets and the market portfolio. We also assume that the families cannot short sell the market portfolio though they can borrow to increase their exposure to the market.

For each firm we observe w and N_S . However, data restrictions mean that it is necessary to estimate the allocation of remaining wealth to the risk free asset and the market portfolio of risky assets. Given w and N_S we solve for the utility maximising combination w_{rf} and w_m . Given that ϕ is the proportion of remaining wealth ($w - N_S S_0$) that is invested in the market portfolio such that utility is maximised, ϕ can be found by solving:

$$\max_{\phi} E \left\{ U \left[(w - N_S S_0) (\phi \exp(r_m) + (1 - \phi) \exp(r_{rf})) + N_S \tilde{S}_T \right] \right\} \quad (4)$$

This problem is solved numerically. The investment in the market portfolio is allowed to vary from zero to 200% of available funds. It should be remembered that the families could choose to lever up their investment though we restrict leveraging of the market portfolio. Further, consistent with present bankruptcy laws, the family's wealth will always be greater than or equal to zero regardless of the state of the world.

To attach a value to the family's investment portfolio we calculate the certainty equivalent value of $E\{U(\tilde{w}_T)\}$. This is achieved by solving for w_A within the equality:

$$\begin{aligned}
EU |_{\phi} &= \iint_{\tilde{w}_T \geq 0} U\left((w - N_s S_0)(\phi \exp(r_m) + (1 - \phi)\exp(r_{rf})) + N_s S_0 \exp(r_s)\right) f(r_s, r_m) dr_s dr_m \\
&= \iint_{\tilde{w}_T \geq 0} U\left(w_A \exp(r_{rf})\right) f(r_s, r_m) dr_s dr_m
\end{aligned} \tag{5}$$

The certainty equivalent of the expected utility obtained from an optimal portfolio for a diversified family with the same wealth and utility function as above is also calculated by solving for w_B within the equality:

$$EU |_{\phi} = \int_{\tilde{w}_T \geq 0} U\left(w(\phi \exp(r_m) + (1 - \phi)\exp(r_{rf}))\right) f(r_m) dr_m = \int_{\tilde{w}_T \geq 0} U\left(w_B \exp(r_{rf})\right) f(r_m) dr_m \tag{6}$$

Given the constraint implicit in the family's investment choice, $w_B > w_A$.

Admittedly, given the large investment in the firm, the family could possibly achieve a portfolio with higher expected utility when investing their remaining wealth in other than the optimal combination of the market portfolio and the risk free asset (Merton, 1971). Thus, it could be argued that w_A is downward biased. However, Holmen and Rasbrandt (2006) investigate the share portfolios of Swedish owner-managers in 2001. They find no indication that Swedish owner-managers hedge their ownership in the firm by strategically choosing other stocks. In fact, they argue that owner-managers would achieve a portfolio with a higher Sharpe ratio if they invested their remaining wealth in the market portfolio instead of the actual stocks chosen.

Another possible objection to our estimates is that investors in general do not appear to hold the market portfolio. In general, families hold portfolios made up of a limited number of stocks that appear to be chosen on the basis of geographical or professional nearness (Barber and Odeon, 2000; Goetzmann and Kumar, 2001; Grinblatt and Keloharju, 2001; Coval and Moskowitz, 2001). Thus, it could be argued

that w_B is upward biased. However, if the relevant benchmark for families is a portfolio made up of a limited number of highly correlated stocks, then for consistency, the families' investment of remaining wealth in w_A would have to be treated similarly. In our model i) the family's remaining wealth is invested in an optimal combination of the risk free asset and the market portfolio and this is compared to a situation where ii) total wealth is optimally invested in the risk free asset and the market portfolio. Thus, if using the optimal combination of the risk free asset and the market portfolio cause upward biases, these biases are present in both w_A and w_B .

4. Analysis

In this section we first provide some descriptive results. We then present the cost of under diversification estimated for our sample and discuss the implications of the cost of under diversification. Finally, we examine the relationship between our estimated cost of under diversification and the use of dual class of shares and pyramid structures.

4.1 The Model's Sensitivity to Parameter Values

In this section we provide some insight into the estimated costs associated with under diversified portfolios and the way they vary with the family's risk aversion, portfolio diversification, investment horizon, volatility, and share beta. The analysis is based on the median characteristics summarised in Table 1. The cost of under diversification is defined as the certainty equivalent wealth associated with holding the optimal combination of the market portfolio and the risk-free asset (w_B) minus the control constrained portfolio certainty equivalent wealth (w_A), scaled by w_B .

We assume that the market risk premium is 6.5%.²⁴ The standard deviation of the underlying share returns (σ_S) is 37%, the risk free rate of return (r_{rf}) is 10%²⁵, and the share beta (β_S) is 0.587. We perform sensitivity analysis with respect to these numbers below. Shareholder total wealth (w) is assumed equal to SEK 0.639 Million. Wealth not invested in the firm is invested in a utility maximizing combination of the market portfolio and the risk-free asset.

In Figure 1 we show how the cost of under diversification varies with the level of risk aversion and the fraction of wealth invested in the firm. The constant relative risk aversion parameter is set to one, two, and three. With an increase in the level of risk aversion to two and then to three it is apparent that with increasing levels of risk aversion shareholders become more sensitive to additional investment in the firm's shares. There is clearly a cost to the shareholder of further investment in the firm. Given the characteristics above, a constant relative risk aversion parameter of two, a 10-year investment horizon, and 50% of total wealth invested in the firm, certainty equivalent wealth under the constrained (control) portfolio is 19.8% less than certainty equivalent wealth from an optimal combination of the market portfolio and the risk free asset.

The optimal investment choice with respect to remaining wealth of the controlling investor is to invest 99% in the market portfolio. This translates to approximately 49% of total wealth. Investing 99% of remaining wealth in the market portfolio implies that the shareholder invests just 1% of remaining wealth in the risk free asset in this case. The optimal proportions of market portfolio and risk free rate vary with constant relative risk aversion parameter and the proportion of wealth invested in the firm's shares.

In the following analysis we focus on the sensitivity of the cost of under diversification, to various parameter choices. Given a constant relative risk aversion parameter of two we note that the cost of under diversification is increasing in investment horizon (Figure 2) and share return volatility (Figure 3) though it is decreasing in share beta (Figure 4). The last result suggests that, holding total risk constant, it is better to bear market risk for which you are compensated by higher expected return than idiosyncratic risk. The impact on the cost of under diversification of changing the share market risk premium (4%, 6% and 8%) or the risk free rate (5%, 10% and 15%) is trivial, given our parameter choices and so these results are not reported separately here.

[Insert Figures 1, 2, 3, and 4 here]

4.2 Estimated Cost of Under Diversified Portfolios

In table 2 we report the estimated average and median costs associated with under diversified investment portfolios for constant relative risk aversion parameters one, two, and three. We assume a 10-year investment horizon ($T=10$) and report the estimated cost ($w_B - w_A$) scaled by either the certainty equivalent of the expected utility obtained from an optimal portfolio (w_B) or the market value of firm's shares.

[Insert table 2 about here]

The average (median) shareholder with a constant relative risk aversion parameter of two has given up diversification benefits equal to almost 24% (17%) of the certainty equivalent value of an optimal investment consisting of just the risk free asset and the market portfolio. This translates into almost 20% (13%) of the market value of the investment in terms of the firm's shares. The average (median) shareholder with constant relative risk aversion parameter of one and three has given

up diversification benefits equal to 18% and 27% (13% and 22%) of total wealth. This translates into 19% and 21 % (13 and 15%) of market value of the firm's shares.

In Table 2 the mean and median optimal investment in the market portfolio (ϕ) for the under diversified portfolio as well as for the well-diversified portfolio are also reported. For the constrained investor, the median optimal investment in the market portfolio for the sample constitutes 101% of remaining wealth ($w-N_S S_0$) given a constant relative risk aversion parameter of two. Investing more than 100% of remaining wealth in the market portfolio means that the median family would borrow an amount equal to 1% of remaining wealth to invest in the market portfolio. In comparison to the under diversified (constrained) investor, a similarly endowed well-diversified investor would have optimally invested 82% of their total wealth in the market portfolio.

4.3 Implications

In LLV's framework, the manager is given a share based compensation package. The stocks and options are restricted and managerial ownership is assumed to be exogenous. In our framework the family has chosen to invest a large fraction of their wealth in the firm. Furthermore, the shares held by the family are generally not restricted, i.e. they can be bought and sold freely. Thus, in our framework, the family's ownership in the firm is endogenous though we assume that their investment in the firm is optimal, i.e. it maximizes the family's expected utility, and that the family will hold the shares for a period of 10 years.²⁶ As indicated above it would seem that many Swedish families maintain control of their firms for longer, rather than shorter, than 10 years. More than half of the owners in our sample were still in

control of their firms after ten years, either as majority owners of a public firm or as the single owner of a private firm.

So why do families hold under diversified portfolios, $N_S > 0$ such that $w_B > w_A$? One possibility is that firm value increases with the family's concentrated shareholding in the firm through incentive and signalling effects (Jensen and Meckling, 1976; Leland and Pyle, 1977). Let Π denote the certainty equivalent cost associated with holding an under diversified portfolio,

$$\Pi = w_B - w_A, \quad (7)$$

Further, we define the value of the firm as a function of Π .

$$S_0 \equiv S_0(\Pi) \quad (8)$$

If the family investment is optimal in terms of maximising the value of the firm then they would only be able to sell the remaining shares at a market price below the current price. For example, a reduction in their shareholdings could constitute a reduction in incentive alignment. Thus, if the family chooses to reduce N_S , and thereby reduce Π , the current value of the share, S_0 , would decrease due to misalignment effects. Nevertheless, if $N_S [S_0(\Pi) - S_0(0)] > \Pi$ the family's investment in the firm is wealth increasing. This arises, even though the family is under diversified ($N_S > 0$), because the additional benefits generated by the family's investment in the firm exceeds the cost of under diversification.

Another possibility is that the family derives utility from control, λ , (i.e. there are private benefits of control). Zingales (1994) argues that there is little reason to hold a large block of shares in a company unless there are private benefits of control. Denis and Denis (1994) point out that private benefits of control may compensate families for the lack of diversification associated with large block ownership. As families increase their share ownership and become less diversified, they

simultaneously become more entrenched and are thus able to extract private benefits of control from the firm (Fama and Jensen, 1983).

Besides direct private benefits of control, indirect benefits in terms of political connections may compensate for the cost of under diversification. Morck et al.(2000) and Faccio (2006) argue that families (as controlling shareholders) have political influence because of their long control tenure. Being in control for several decades, the families are more likely to return past favours from politicians compared to managers in widely held firms. In fact, Högfeldt (2005) argues that the Swedish political and corporate incumbencies have been united historically by strong common interests. Incumbent owners (families) need political support to legitimize their corporate power, which some argue rests on extensive use of dual class shares and pyramids that hinders takeovers. The political incumbents (the Social Democrats), on the other hand, only get indirect support from the corporate sector if the largest firms remain under Swedish (family) control.

Let $E[U(w,\lambda)]$ denote the family's alternative expected utility function. Expected utility is now a function of both wealth (w) and control (λ). Thus, the observed N_S is the family's optimal investment in the firm in the sense that it maximizes $E[U(w,\lambda)]$. For example, the family could divert assets and ideas from the firm (pecuniary benefits) or be rewarded in terms of political favours. Thus, the alternative hypothesis is that families hold under diversified portfolios in order to derive private benefits of control.

In unreported tests we have tested the relation between firm performance and the cost of under diversification. We do not find any relation between firm performance and the cost of under diversification in OLS regressions, fixed effect regressions or simultaneous equation systems estimation. Firm performance is

approximated by Tobin's q and Return on Assets. A possible explanation for the flat relation between the cost of under diversification and firm performance is that the ownership structure is optimal and the family is compensated for the cost of under diversification by non-pecuniary benefits of control (Demsetz and Lehn, 1985). Non-pecuniary benefits include amenity utilities, prestige, and status from controlling the firm.

As an alternative (unreported) test of whether the families hold undiversified portfolios in order to derive private benefits of control we test for a relationship between the estimated costs of under diversification and estimates of private benefits of control, the voting premium (Nenova, 2003) and the premium paid in negotiated control block transfers (Dyck and Zingales, 2004). We are able to collect the voting premium for 28 firms and the premium in negotiated control block transfers for 15 firms in our sample. Neither the voting premium nor the control block premium show any significant correlation with our estimates of the family's cost of portfolio under diversification.

4.4 The Effect of Dual Class Shares and Pyramids

We now turn to the issue of whether the families use dual class shares and pyramids to reduce the cost of under diversification. We first estimate OLS regressions with the estimated costs of under diversification as the dependent variable. Since we have two years of data for 33 firms (66 firm years) we also estimate fixed effect panel data regressions. We use three variables to capture the effect of separation of voting rights from cash flow rights. *TOTAL_VC_DIFF* measures the total separation of voting rights from cash flow rights.²⁷ *DUAL_VC_DIFF* measures the separation of voting rights from cash flow rights due

to dual class shares while *PYR_VC_DIFF* measures the effect of pyramid structures. We control for leverage, firm size, sales growth firm age, industry effects and time effects.²⁸ The Huber/White Sandwich estimator for variance is used in all estimated models to adjust for heteroscedasticity and the fact that the estimated costs of under diversification are correlated among firms controlled by the same family.

The OLS results are reported in table 3 panel A. *TOTAL_VC_DIFF* is negative and statistically significant for all three constant relative risk aversion parameters. Thus, the families' cost of under diversification is reduced by separation of voting rights from cash flow rights. However, when the total separation is split up into separate effects of dual class shares and pyramids, *DUAL_VC_DIFF* is insignificant. It appears as if families do not reduce the cost of under diversification by the use dual class shares. This result is consistent with Bergström and Rydqvist (1990). *PYR_VC_DIFF* is however negative and statistically significant. Since a pyramid structure facilitates family control of a firm with a smaller capital investment, this is not surprising. The fixed effect regressions are reported in panel B. The results for the three variables measuring the separation of voting rights from cash flow rights corroborate the OLS results, i.e. *TOT_VC_DIFF* and *PYR_VC_DIFF* are negative and statistically significant while *DUAL_VC_DIFF* is statistically insignificant. The different results for dual class of shares and pyramids imply that when the family is considering setting up a new entity, a pyramid structure will limit the cost of under diversification while a dual class structure will not (Almeida and Wolfenzon, 2006).

Firm size is negatively related to the cost of under diversification for where the family is assumed to exhibit constant relative risk aversion with parameter one in the OLS regressions but insignificant in the other OLS models. Thus, in the cross-

section families controlling larger firms do not hold less diversified portfolios. However, in the fixed effect regressions where we control for unobservable firm specific effects, the firm size coefficient is positive and significant in all models indicating that the family's investment portfolio becomes less diversified as the firm grows. Firm age is positively related to the cost of under diversification in the OLS regressions consistent with the notion that older firms develop stronger political links that the family can trade off against reduced portfolio diversification. Firm age is however insignificant in the fixed effect regressions. Sales growth, firm level diversification (SINGLE_SEGMENT), and leverage are insignificant in all models.²⁹

We do not include a year dummy in the fixed effect regressions since it is highly correlated with the firm age variable in fixed effect estimations. We note however, that our main results are insensitive to inclusion of the year dummy, the firm age variable or a combination of the two in either the OLS or fixed effect regressions.

4.5 Family control of more than one firm

Our methodology so far does not capture the effect that one family may control more than one firm. Sixteen families control more than one firm in our sample in a particular year (1988 or 1991). These shareholders control 40 firms in our sample. In this section we first estimate the cost of under diversification for the sixteen families controlling more than one firm by aggregating their holdings in various firms into one portfolio. The costs of under diversification for families controlling multiple firms are then compared to the cost of under diversification for families controlling a single firm. Finally we estimate the families' control multiplier,

i.e. the market value of the firms the family controls divided by the family's total net investment in these firms.

The costs of under diversification for families controlling multiple firms are presented in table 4 panel A. The average (median) family with a constant relative risk aversion parameter of two has given up diversification benefits equal to almost 47% (46%) of the certainty equivalent value of an optimal investment consisting of just the risk free asset and the market portfolio. This cost of under diversification is significantly higher than for families controlling a single firm. Even if pyramid structures allows a family to control a single firm at a lower cost (in terms of under diversification) it does not mean that the family per se reduces its cost of under diversification. The family still has to make a large investment in order to control the firm at the top of the pyramid. Additionally, the family usually makes direct investments in firms lower in the pyramids as well, i.e. the cost of under diversification for these families does not solely stem from the control of the firm at the top of the pyramid. These additional large investments translate into larger costs of under diversification compared to the situation where the family makes only one large investment.

Even if a pyramid structure does not allow the family to reduce the cost of under diversification it may result in the family being able to expand its control given a certain net investment. To explore this hypothesis we compare the market value under the family's control to the family's net investment. The market value under family control is the aggregate equity market value of firms in which the family is the largest vote holder. We define the family's control multiplier as the value under control divided by the family's net investment in the firms it controls. The results are presented in panel B. The average (median) family controlling multiple firms, partly

by a pyramid structure, has a control multiplier above six (three). This estimate is significantly higher than for families controlling a single firm. Thus, even if pyramids do not reduce the cost of under diversification, it appears as if a pyramid allows the family to expand its control given a particular capital investment.

5. Summary and Conclusion

What are the costs to a family of investing a large fraction of its wealth in a firm in order to become the majority shareholder? In this paper we shed some light on this question by using direct estimates of majority family shareholder wealth to estimate the cost of the family's under diversified portfolio. We compare the value to the family of their constrained investment with the value of a fully diversified portfolio consisting of risk free asset and the market portfolio. The median certainty equivalent wealth of the family is 17% lower for the constrained portfolio compared with the optimal combination of the market portfolio and the risk free asset, given a constant relative risk aversion parameter of 2. The median difference is equal to 13% of the firm's equity market value on average.

We believe that the paper makes two contributions to the literature. Earlier papers estimating the cost of under diversification have used hypothetical portfolios of options or restricted shares. Our first contribution is that we use real portfolios of unrestricted shares and show that families controlling large public firms bear significant cost of under diversification. Since Anderson and Reeb (2003) show that families listed in the Forbes' "400 Wealthiest Americans" and as controlling shareholders in S&P 500 firms have almost 70% of their wealth invested in family owned company stock, our results can probably be generalized beyond the Swedish market. Our second contribution is that we explore how dual class shares and

pyramids affect the cost of under diversification. The cost of under diversification is reduced by pyramid structures but not by the use of dual class shares. While the earlier literature has treated dual class shares and pyramids as perfect substitutes (Bebchuk et al., 2000) our results suggest that they may not be perfect substitutes.

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Table 1
Firm and Ownership Characteristics

Panel A: Ownership characteristics

	Mean	Min	Median	Max	Std.dev
<i>UNADJ_OWNERSHIP</i>	0.435	0.054	0.427	0.879	0.177
<i>OWNERSHIP</i>	0.369	0.025	0.341	0.879	0.198
<i>VOTES</i>	0.576	0.100	0.605	0.986	0.207
<i>TOT_VC_DIFF</i>	0.207	-0.136	0.211	0.595	0.138
<i>DUAL_VC_DIFF</i>	0.141	-0.241	0.171	0.801	0.143
<i>PYR_VCDIFF</i>	0.047	0.000	0.000	0.494	0.095
<i>MV_OWNERSHIP</i>	416	8	173	3574	649
<i>WEALTH</i>	1293	85	639	8087	1730
<i>DIVERSIFICATION</i>	0.498	0.004	0.519	1.473	0.328

UNADJ_OWNERSHIP = fraction of the firm's cash flow rights in the controlling block. *OWNERSHIP* = the pyramid adjusted fraction of the firm's cash flow rights held by the family. *VOTES* = the vote fraction held by the family. If the firm is part of a pyramid, *VOTES* is the weakest link in terms of voting rights in the pyramid. *TOT_VC_DIFF* = *VOTES* – *OWNERSHIP*. *DUAL_VC_DIFF* = *VOTES* – *UNADJ_OWNERSHIP*. *PYR_VC_DIFF* = minimum fraction of cash flow rights in the pyramid - *OWNERSHIP*. *MV_OWNERSHIP* = Market Value of the family's pyramid adjusted ownership of shares in the firm in million SEK. *WEALTH* = the family's total wealth in million SEK. *DIVERSIFICATION* = *MV_OWNERSHIP*/ *WEALTH*

Panel B: Firm characteristics

	Mean	Min	Median	Max	Std. dev
<i>SHARE_VOLATILITY</i>	0.389	0.198	0.370	0.787	0.098
<i>SHARE_BETA</i>	0.636	-0.121	0.587	1.704	0.365
<i>LEVERAGE</i>	0.275	0.016	0.247	0.828	0.178
<i>SALES_GROWTH</i>	0.323	-0.901	0.179	2.546	0.507
<i>SIZE</i>	3182	114	1231	29200	4989
<i>FIRM_AGE</i>	41	1	38	126	34
<i>SINGLE_SEGMENT</i>	0.473	0	0	1	0.501

SHARE_VOLATILITY = the yearly volatility of the firm's share returns (estimated over three years). *SHARE_BETA* = the share beta (estimated over three years). *LEVERAGE* = Long term debt to total asset ratio at the beginning of the year (book values). *SIZE* = book value of total assets in million SEK at the beginning of the year. *SALES_GROWTH* = the change in total sales the previous year. *FIRM_AGE* = number of years since the firm was founded. *SINGLE_SEGMENT* is equal to one if the firm only reports activity within one industry segment, and zero otherwise.

The sample used in this study consists of Swedish firms listed on the Stockholm Stock Exchange (the A-list, the OTC, or the Unofficial list) 1988 and 1991. N=113. Only individual or family controlled firms are included in the sample.

Table 2
Estimates of the Costs Associated with Under Diversification

Estimated cost of under diversification and optimal investment in the market portfolio given an under diversified portfolio and a well-diversified portfolio, respectively. Estimates reported for risk aversion parameters 1, 2, and 3, respectively.

	Cost under diversification, CRRA=1		Cost under diversification, CRRA=2		Cost under diversification, CRRA=3	
	Mean	Median	Mean	Median	Mean	Median
$(w_B - w_A)/w_B$	0.181	0.133	0.236	0.173	0.273	0.219
$(w_B - w_A)/MVE$	0.192	0.130	0.199	0.134	0.212	0.148
weight in market for under diversified portfolio	1.515	1.557	1.056	1.014	0.680	0.612
weight in market for well diversified portfolio	1.358	1.262	0.913	0.822	0.611	0.541

The sample used in this study consists of Swedish firms listed on the Stockholm Stock Exchange (the A-list, the OTC, or the Unofficial list) 1988 and 1991. N=113. Only individually controlled firms are included in the sample. The cost of under diversification is estimated as the certainty equivalent wealth of the optimal combination of the market portfolio and the risk-free asset (w_B) minus the certainty equivalent wealth of the under diversified portfolio (w_A) divided by w_B and MVE, respectively. MVE is the market value of the firm's shares. CRRA = constant relative risk aversion parameter.

Table 3
Regressions with the Costs of Under Diversification as Dependent Variable

Panel A: OLS regressions with the Costs of Under Diversification as Dependent Variable

	CRRA=1	CRRA=1	CRRA=2	CRRA=2	CRRA=3	CRRA=3
<i>TOT_VC_DIFF</i>	-0.236 (-2.29)**		-0.284 (-2.16)**		-0.300 (-2.05)**	
<i>DUAL_VC_DIFF</i>		-0.046 (-0.46)		-0.037 (-0.27)		-0.015 (-0.10)
<i>PYR_VC_DIFF</i>		-0.648 (-4.74)***		-0.888 (-5.24)***		-1.001 (-5.38)***
<i>LEVERAGE</i>	-0.105 (-0.94)	-0.131 (-1.25)	-0.102 (-0.65)	-0.138 (-0.93)	-0.133 (-0.78)	-0.174 (-1.10)
<i>L SIZE</i>	-0.026 (-2.23)**	-0.016 (-1.58)	-0.018 (-1.26)	-0.005 (-0.34)	-0.018 (-1.14)	-0.003 (-0.17)
<i>SALES_GROWTH</i>	-0.006 (-0.16)	0.006 (0.15)	0.005 (0.11)	0.021 (0.42)	0.009 (0.17)	0.027 (0.48)
<i>L FIRM AGE</i>	0.034 (2.40)**	0.033 (2.53)**	0.043 (2.26)**	0.041 (2.34)**	0.051 (2.47)**	0.049 (2.56)**
<i>SINGLE_SEGMENT</i>	-0.033 (-0.63)	-0.015 (-0.30)	-0.032 (-0.48)	-0.007 (-0.10)	-0.028 (-0.38)	0.002 (0.03)
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Adj R ²	0.309	0.370	0.259	0.333	0.256	0.344

Panel B: Fixed Effect regressions with the Costs of Under Diversification as Dependent Variable

	CRRA=1	CRRA=1	CRRA=2	CRRA=2	CRRA=3	CRRA=3
<i>TOT_VC_DIFF</i>	-0.455 (-1.83)*		-0.627 (-2.03)**		-0.705 (-2.16)**	
<i>DUAL_VC_DIFF</i>		-0.231 (-0.81)		-0.247 (-0.69)		-0.243 (-0.64)
<i>PYR_VC_DIFF</i>		-0.669 (-2.58)**		-0.910 (-2.59)**		-1.012 (-2.80)***
<i>LEVERAGE</i>	-0.129 (-0.42)	-0.149 (-0.50)	0.205 (0.48)	0.180 (0.44)	0.209 (0.47)	0.182 (0.43)
<i>L SIZE</i>	0.140 (2.11)**	0.152 (2.35)**	0.185 (2.28)**	0.201 (2.54)**	0.190 (2.23)**	0.208 (2.51)**
<i>SALES_GROWTH</i>	-0.019 (-0.50)	-0.009 (-0.21)	-0.038 (-0.72)	-0.023 (-0.40)	-0.036 (-0.64)	-0.018 (-0.30)
<i>L FIRM AGE</i>	-0.047 (-0.46)	-0.082 (-0.85)	-0.070 (-0.54)	-0.116 (-0.94)	-0.062 (-0.45)	-0.113 (-0.86)
<i>SINGLE_SEGMENT</i>	0.058 (1.19)	0.0667 (1.45)	0.078 (1.32)	0.088 (1.51)	0.087 (1.37)	0.097 (1.57)
Adj R ²	0.802	0.875	0.804	0.872	0.813	0.877

TOT_VC_DIFF is equal to the fraction of voting rights held by the family minus the fraction of cash flow rights held by the family. If the firm is part of a pyramid structure, the family's fraction of voting rights is equal to the weakest link in terms of voting rights in the pyramid structure. Then family's fraction of voting rights also adjusted for pyramid structures. *DUAL_VC_DIFF* is equal to the separation of voting rights from cash flow rights that is due to dual class shares. *PYR_VC_DIFF* is equal to the separation of voting rights from cash flow rights that is due to pyramid structures. *LEVERAGE* is equal to the value of long term debt divided by book value total assets at the beginning of the year. *L SIZE* is equal to the natural logarithm of the book value of total assets at the beginning of the year. *SALES GROWTH* is equal to the change in total sales the previous year. *L FIRM AGE* is equal to the natural logarithm of one plus firm age in years. *SINGLE_SEGMENT* is equal to one if the firm only reports activity within one industry segment, and zero otherwise. The sample used in this study consists of Swedish firms listed on the Stockholm Stock Exchange (the A-list, the OTC, or the Unofficial list) 1988 and 1991. N=113. Only individually controlled firms are included in the sample. The cost of under diversification is estimated as the

certainty equivalent wealth of the optimal combination of the market portfolio and the risk-free asset (w_B) minus the certainty equivalent wealth of the under diversified portfolio (w_A) divided by w_B . Parameters are reported with t-values in parenthesis. t-values are adjusted for heteroskedasticity and correlated observations among the same controlling family with the Huber-White Sandwich estimator. CRRA = constant relative risk aversion parameter. ***, **, and * denote significance at the 1%, 5%, and 10% respectively.

Table 4
The Cost of Under diversification for Families Controlling Multiple Firms

Panel A: Estimated cost of under diversification for families controlling multiple firms and families controlling one firm, respectively. Estimates reported for risk aversion parameters 1, 2, and 3, respectively.

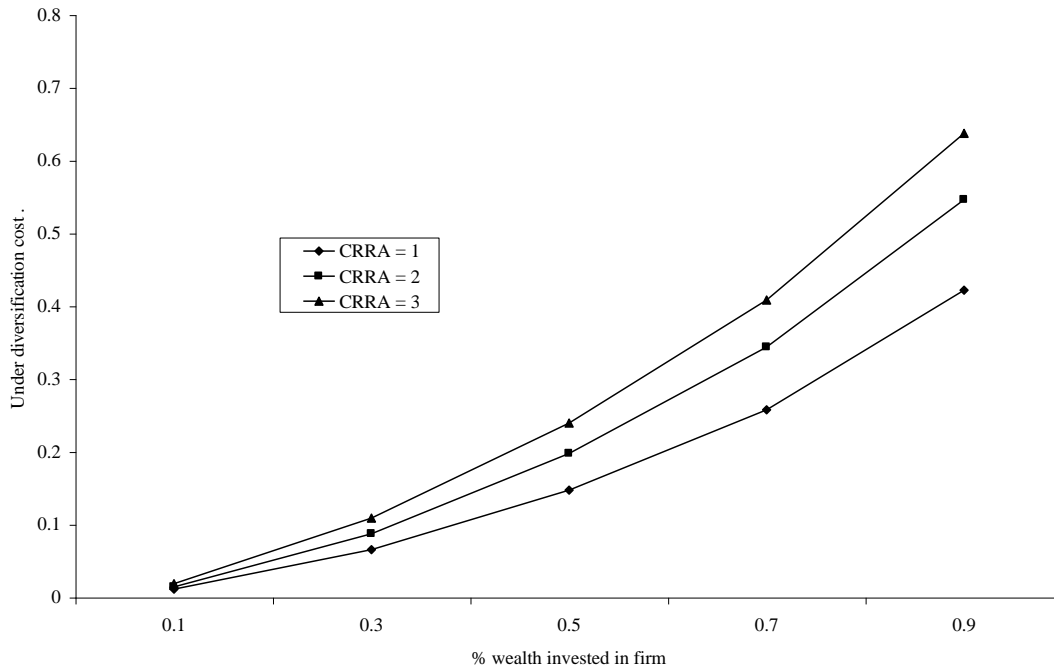
$(w_B - w_A)/w_B$	Families controlling multiple firms, n=16		Families controlling one firm, n=73		Difference test	
	Mean	Median	Mean	Median	t-test	Ranksum z-test
CRRA=1	0.373	0.381	0.232	0.198	2.553**	2.319**
CRRA=2	0.469	0.460	0.298	0.245	2.363**	2.286**
CRRA=3	0.505	0.505	0.343	0.290	2.129**	2.126**

Panel B: Control multiplier for families controlling multiple firms and families controlling one firm, respectively. Control multiplier estimated as the value under control divided by net investment.

Control multiplier	Families controlling multiple firms, n=16		Families controlling one firm, n=73		Difference test	
	Mean	Median	Mean	Median	t-test	Ranksum z-test
Control multiplier	6.141	3.161	3.173	2.725	3.023***	1.913*

The sample used in this study consists of Swedish firms listed on the Stockholm Stock Exchange (the A-list, the OTC, or the Unofficial list) 1988 and 1991. N=113. The cost of under diversification is estimated as the certainty equivalent wealth of the optimal combination of the market portfolio and the risk-free asset (w_B) minus the certainty equivalent wealth of the under diversified portfolio (w_A) divided by w_B . For families controlling multiple firms their holdings in various firms are aggregated into one portfolio. CRRA = constant relative risk aversion parameter. Median differences tested by Wilcoxon ranksum test. ***, **, and * denote significance at the 1%, 5%, and 10% respectively.

Figure 1
Cost of Under Diversification
with Constant Relative Risk Aversion Parameters of One, Two and Three



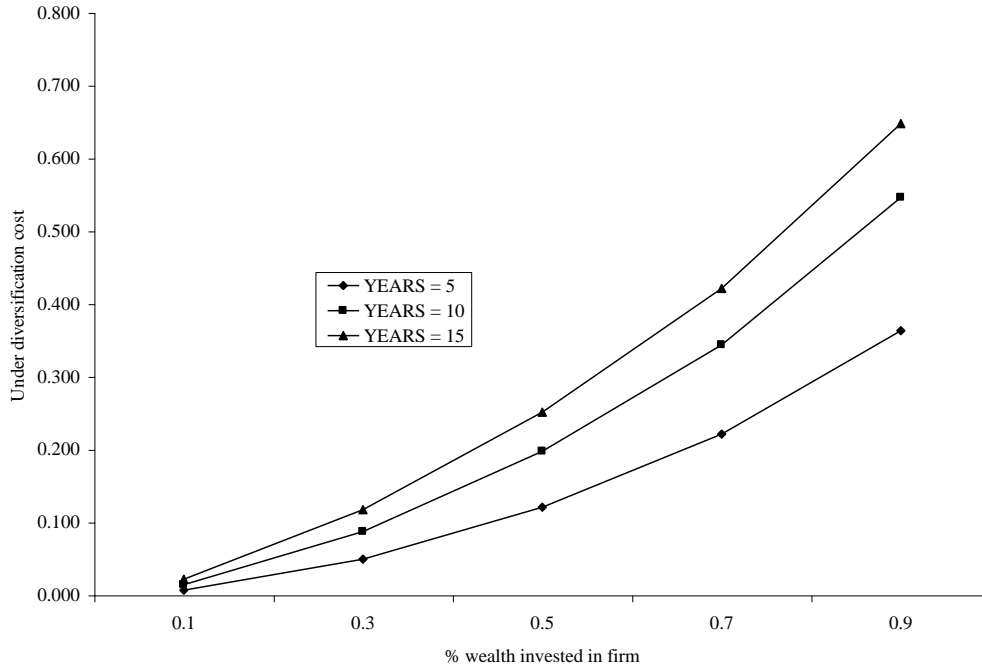
Note:

Each line represents the estimated cost of holding a under diversified portfolio to a risk-averse controlling shareholder for a given level of investment in the shares of the firm ranging from 10% to 90% of total wealth. The values, 1, 2 and 3, refer to the constant relative risk aversion (CRRA) parameter for the family. The cost of under diversification is equal to the certainty equivalent wealth of the optimal combination of the market portfolio and the risk free asset (w_B) minus the certainty equivalent wealth of the under diversified portfolio (w_A), divided by w_B . It is assumed that the firm's share return standard deviation is 0.370 and its share beta is 0.587, share market standard deviation is 0.18, the risk free rate is set at 0.10 and the share market risk premium is 0.065. Total shareholder wealth is SEK0.639 Million. The investment horizon is 10 years

Figure 1 is based on the following numbers:

		Investment in shares of the firm as fraction of total wealth				
		<u>0.1</u>	<u>0.3</u>	<u>0.5</u>	<u>0.7</u>	<u>0.9</u>
CRRA	1	0.011	0.065	0.147	0.257	0.422
	2	0.014	0.087	0.198	0.344	0.546
	3	0.019	0.109	0.239	0.408	0.637

Figure 2
Cost of Under Diversification
With Constant Relative Risk Aversion Parameter of Two and with Five, Ten and Fifteen Year Investment Horizons

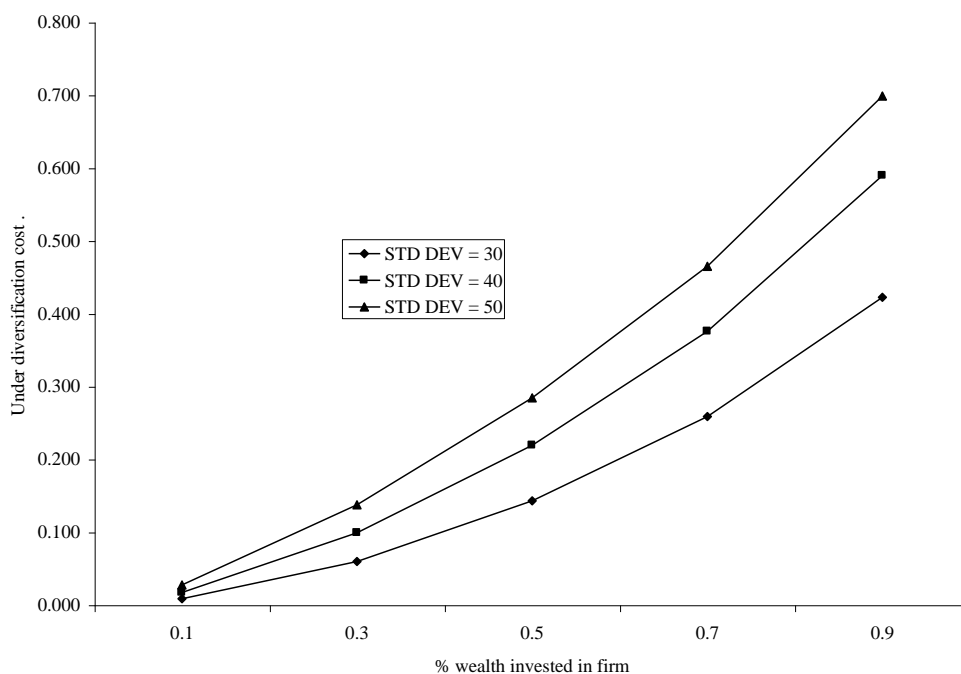


Note: Each line represents the estimated cost of holding a under diversified portfolio to a risk-averse controlling shareholder for a given level of investment in the shares of the firm ranging from 10% to 90% of total wealth. The values, YEARS = 5, YEARS = 10 and YEARS = 15, refer to the time in years to realisation of the investment. The cost of under diversification is equal to the certainty equivalent wealth of the optimal combination of the market portfolio and the risk free asset (w_B) minus the certainty equivalent wealth of the under diversified portfolio (w_A), divided by w_B . It is assumed that the firm's share return standard deviation is 0.370 and its share beta is 0.587, share market standard deviation is 0.18, the risk free rate is set at 0.10 and the share market risk premium is 0.065. Total shareholder wealth is SEK0.639 Million. The constant relative risk aversion parameter is two.

Figure 2 is based on the following numbers:

		Investment in shares of the firm as fraction of total wealth				
		<u>0.1</u>	<u>0.3</u>	<u>0.5</u>	<u>0.7</u>	<u>0.9</u>
Investment Horizon	5	0.007	0.049	0.121	0.221	0.363
	10	0.014	0.087	0.198	0.344	0.546
	15	0.022	0.117	0.251	0.421	0.648

Figure 3
Cost of Under Diversification
with Constant Relative Risk Aversion Parameter of Two, with Ten Year Investment
Horizon and with Share Return Standard Deviation of 30%, 40% and 50%



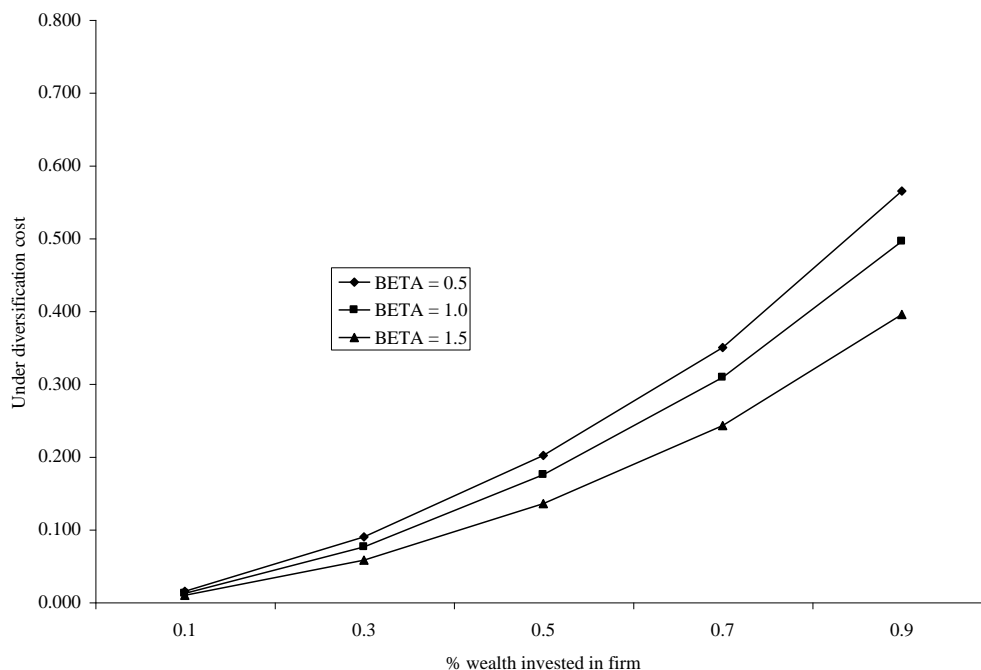
Note:

Each line represents the estimated cost of holding a under diversified portfolio to a risk-averse controlling shareholder for a given level of investment in the shares of the firm ranging from 10% to 90% of total wealth. The values, 30, 40 and 50, refer to the share return standard deviation. The cost of under diversification is equal to the certainty equivalent wealth of the optimal combination of the market portfolio and the risk free asset (w_B) minus the certainty equivalent wealth of the under diversified portfolio (w_A), divided by w_B . It is assumed that the investment horizon is 10 years, the firm's share beta is 0.587, share market standard deviation is 0.18, the risk free rate is set at 0.10 and the share market risk premium is 0.065. Total shareholder wealth is SEK0.639 Million. The constant relative risk aversion parameter is two.

Figure 3 is based on the following numbers:

		Investment in shares of the firm as fraction of total wealth				
		<u>0.1</u>	<u>0.3</u>	<u>0.5</u>	<u>0.7</u>	<u>0.9</u>
Share Standard Dev	30	0.009	0.060	0.143	0.259	0.422
(Yearly)	40	0.017	0.099	0.219	0.376	0.590
	50	0.028	0.137	0.284	0.465	0.699

Figure 4
Cost of Under Diversification
with Constant Relative Risk Aversion Parameter of Two, with Ten Year Investment
Horizon and with Share Beta of 0.5, 1.0 and 1.5



Note:

Each line represents the estimated cost of holding a under diversified portfolio to a risk-averse controlling shareholder for a given level of investment in the shares of the firm ranging from 10% to 90% of total wealth. The values, 0.5, 1.0 and 1.5, refer to the share beta. The cost of under diversification is equal to the certainty equivalent wealth of the optimal combination of the market portfolio and the risk free asset (w_B) minus the certainty equivalent wealth of the under diversified portfolio (w_A), divided by w_B . It is assumed that the investment horizon is 10 years, the firm's share standard deviation is 0.370, share market standard deviation is 0.18, the risk free rate is set at 0.10 and the share market risk premium is 0.065. Total shareholder wealth is SEK0.639 Million. The constant relative risk aversion parameter is two.

Figure 4 is based on the following numbers:

Share Beta	Investment in shares of the firm as fraction of total wealth					
	<u>0.1</u>	<u>0.3</u>	<u>0.5</u>	<u>0.7</u>	<u>0.9</u>	
0.5	0.015	0.089	0.202	0.350	0.564	
1.0	0.012	0.076	0.175	0.309	0.495	
1.5	0.009	0.058	0.135	0.242	0.395	

Endnotes

¹ Moskowitz and Vissing-Jorgensen (2002) find that households invest about 10% of net worth in own-company public firms. While own-company stock investment for entrepreneurial private equity appears to reflect a controlling owner-manager position, own-company stock investment for public equity simply means that a household member is or has been employed in the firm.

² See e.g. Hamilton (2000) and Heaton and Lucas (2001).

³ As distinct from widely held firms that employ a manager where problems of agency costs can be quite severe (Chen, Steiner and White, 2001; Mudambi and Nicosia, 1998; Shaffer, 2002)

⁴ Typically, Swedish firms issue A and B shares. The A-shares are one-share one-vote while the B shares are one-share 0.1 votes. A pyramid structure exists where an investor controls a large fraction of the voting rights in the public firm X and firm X is the largest shareholder in the public firm Y for example.

⁵ Brennan and Torous (1999) also study the cost of under diversification of pure equity portfolios, though they work with hypothetical portfolios, not actual portfolios.

⁶ This result is consistent with the view that large shareholders reduce moral hazard problems, adverse selection, and the free rider problem (Jensen and Meckling, 1976; Leland Pyle, 1977; Shleifer and Vishny, 1986). This result is inconsistent with the expropriation hypothesis (see e.g. Fama and Jensen, 1983; Bebchuk, Kraakman, and Triantis, 2000).

⁷ We limit our study to these two years since these were the two last occasions our source (Affärsvärlden) for estimates of the market value of the largest shareholders' wealth was published.

⁸ The Affärsvärlden report for wealthy Swedes is equivalent to the Forbes Magazine report for wealthy Americans. However, due to the Swedish "Principle of public access to official records" (Offentlighetsprincipen), more information about individual wealth is part of the public domain than occurs in most other countries (see below).

⁹ Affärsvärlden reports 163 (250) individuals or families with net wealth larger than 100 million SEK in 1988 (1991).

¹⁰ The offentlighetsprincipen has been part of the Swedish constitution since 1766. Although it has been amended the basic principles have never been changed. It states that all official records collected by the government must be handled in the following manner (the word paper stands for information, on paper or electronic, and the word agencies includes courts): First, a paper arrives into an agency, or a paper is finished by

a civil or municipal servant. Second, this constitutes the paper "a common public paper", and as such, it is irrevocably archived for eternity (with exceptions stated in a separate law). Third, the paper's existence is registered. If some part of it is classified (e.g. for national security reasons), that is flagged in the register. Fourth, anyone may, anonymously and without giving any reason, immediately read the paper without any cost, and get copies against a fee "without undue delay". Fifth, the offentlighetsprincipen is part of the right to print and distribute daily papers; the constitution's extremely clear wording allows a publisher to get a copy of a public paper and print it. No one, not even the government or the parliament or the original author, can stop that printing (Johannison, 1981). With modern data processing techniques the information has become readily available to the general public.

¹¹ Listed firms are of course subject to tougher disclosure rules than non-listed firms.

¹² The general principle of the wealth tax is that all wealth is taxable, including foreign assets. This means that all stocks, bonds, bank-deposits, cash, cars, boats, machines, animals, and real estate are taxable. A special taxable value is assigned to all Swedish real estate. It should represent 75% of the market value with two years lag, i.e. taxable value 2004 should represent 75% of the estimated market value in 2002. In 1988 and 1991 listed stocks (in Sweden or abroad) were valued at 75% of the market value. OTC traded stocks were valued at 30% of the market value. Non traded stocks, private firms and partnerships were valued at book values. Some assets are however, not taxable. Insurance other than life insurance is not taxable. Other examples of assets that are not taxable include art and coin collections (if they are not part of a business' inventory). Furthermore, furniture, household utensil, works of art etc that are intended for a family's own use are not taxable. Most debt is tax-deductible, i.e. the wealth tax is levied on net wealth. In 1988 (1991), net wealth below 400'000 SEK (800'000 SEK) was not taxable (Bratt et al., 1987; Rabe, 1991).

¹³ The wealth tax creates incentives to hide wealth in offshore accounts. However, hiding wealth in Sweden is illegal and studies have shown that Sweden has a very high rate of tax compliance (La Porta et al, 1999; Dyck and Zingales, 2004).

¹⁴ In Sweden, cross-holdings sometimes occur between firms within institutional spheres, i.e. not among firms controlled by individuals and families. No firm in our sample was involved in major cross-holdings.

¹⁵ Faccio and Lang (2002) and Giannetti and Simonov (2006) analyze the ratio of voting rights and cash flow rights. We follow Claessens et al (2002) and analyze the difference between voting rights and cash flow rights.

¹⁶ In Swedish dual class firms, the A-shares typically constitute roughly 20% of outstanding equity. There are no legal restrictions on the split between number of A and B shares. The maximum vote differential is however ten to one.

¹⁷ In the 29 observations in our sample where dual class shares are used in combination with a pyramid structure, the median controlling family still owns almost 24% of the firm in the second level in the pyramid. Typically, the pyramids only have two levels. Thus, the full potential of dual class and pyramids in terms of separating votes from ownership is not utilized.

¹⁸ These results indicate that consumers appear to choose asset portfolios with the run long run in mind (see Oinnides, 1992).

¹⁹ Total Assets are deflated to 1991 prices using the consumer price index.

²⁰ We thank the reviewer for suggesting the possibility that families that control firms may build up political influence over time and thus there is an argument for inclusion of firm age as a control in the model. We find support for a firm age effect in later analysis.

²¹ This adjustment does not qualitatively change the results.

²² Hall and Murphy (2002) are aware of this problem and ignore cases when the certainty equivalent value is higher than the Black-Scholes value in their analysis of managerial stock options. With our extensions of the LLV model, negative estimates of the cost of under diversification are ruled out.

²³ An alternative to assuming a certain investment horizon would be to value the shares in the firm as an option written on the assets of the firm with exercise price equal to the face value of the zero coupon debt by approximating the firm's debt with a zero coupon bond whose maturity and face value equal the firm's debt duration and face value (Galai and Masulis, 1976; Jensen and Meckling, 1976).

²⁴ The median yearly risk premium on the Swedish stock market between 1945 and 1988 was 6.5%. The yearly risk premium is estimated as the yearly return on Affärsvärldens General Index less the one year Treasury bill rate at the beginning of the year. Affärsvärldens General Index is a value weighted index comprising roughly 95 percent of the stock market capitalization.

²⁵ The assumed riskfree interest rate roughly corresponds to the Swedish Treasury Bill rate in 1988 and 1991.

²⁶ Lambert, Larcker, and Verrechia (1991), Hall and Murphy (2002), and Kahl et al (2003) all use 10-year investment horizons.

²⁷ We thank the reviewer for suggesting the analysis of overall difference as well as the identifying the impact of dual shares and pyramid structures.

²⁸ We have run all regressions with Tobin's q and investment level (Total investments/ Total assets) as alternative proxies for growth opportunities. We have also estimated sales growth as the three year average. The results are virtually unchanged.

²⁹ Leverage of course affects equity volatility which in turn is included in our estimation of the cost of under diversification. To control for this problem we run the regressions without leverage. It does not change the other results.