Ownership dynamics in private firms

Øyvind Bøhren[1] Diana Iancu[2] Georgiana Radulescu[3] R. Øystein Strøm[4]

Abstract

We analyze a large sample of Norwegian firms during eleven years, utilizing detailed and partially confidential data on the firms' ownership structure, board composition, management, and the family relationships between these parties based on blood or marriage. We find that ownership concentration in private firms is much larger than in public firms, much more persistent, and changes by much more once change happens. These characteristics are particularly evident when the largest owner is a family. This evidence suggests that control rights held in private firms provide the owners with relatively high private benefits, and that these control rights are costly to trade. Using several econometric techniques to account for ownership persistence and for potential endogeneity due to omitted variables and reverse causation, we find that officers and directors in private firms tend to own more equity the higher the firm's profitability and leverage, and the lower its risk and size. These findings support the notion that well-informed investors acquire higher equity stakes when the firm has been doing well and when the cost of being undiversified is low. This evidence also suggests that, unlike what is often assumed by corporate governance researchers, the ownership structure is not exogenous relative to the firm's behavior and performance. Rather, investors self-select by moving in and out based on observable and dynamic firm characteristics.

September 2, 2013

[1]BI Norwegian Business School (oyvind.bohren@bi.no).
[2]Statistics Norway (diana.c.iancu@gmail.com).
[3]Ferd Private Equity (georgiana.radules@gmail.com).
[4]Oslo and Akershus University College (oystein.strom@hioa.no).

1 Introduction

Why do some firms have concentrated ownership, while others have a diffuse ownership structure? And why do some firms change ownership concentration over time, while others have persistent ownership concentration? These questions about the level and the dynamics of ownership concentration were raised at least thirty years ago (Demsetz, 1983). Nevertheless, the existing empirical evidence on the determinants of ownership concentration is limited, and several relationships remain unexplored. Our paper makes three contributions to the literature on how ownership concentration is established and how it develops over time.

Existing research studies large firms in the United States. which mostly have low ownership concentration. This is a setting where typically thousands of stockholders in the same firm can trade ownership rights at low costs in a liquid market. In contrast, we analyze private firms in Norway, which typically have much higher ownership concentration than public firms, and their much less numerous stockholders must trade their ownership rights at higher transaction costs in an illiquid stock market. Moreover, and just like in other countries, the private firms we study account for about four times more of aggregate value creation than public firms (Bøhren, 2011). Accordingly, our first contribution is to document key ownership characteristics in the large, unexplored sector of private firms. We show that private firms are very different from public firms both regarding the level and the dynamics of ownership concentration.

The second contribution is to provide deeper insight into the endogenous nature of ownership concentration. The primary focus in the current literature is not on the determinants of ownership concentration, but on how ownership concentration influences the firm's performance (Demsetz and Lehn, 1985; Morck et al., 1988; McConnell and Servaes, 1990; Demsetz and Villalonga, 2001; Zhou, 2001; Dahya et al., 2008). Nevertheless, an important concern in this research is whether ownership concentration can be considered exogenous relative to performance, or whether ownership concentration must be treated as endogenous. Therefore, key issues are how to account for potential endogeneity in empirical tests and how to interpret the estimates if one assumes that ownership is endogenous rather than exogenous (Coles et al., 2012). In contrast, we ignore ownership as a determinant of performance and explore how ownership concentration is determined by characteristics of the contracting environment, such as the firm's risk, size, and past ownership concentration.

Our third contribution is methodological. The possibility of omitted variables and reverse causation may create an endogeneity bias in the estimated relationship between ownership concentration and the contracting environment. Unlike existing research, such as Demsetz and Lehn (1985) and Fahlenbrach and Stulz (2009), we recognize that neither fixed effects, random effects, nor instrumental variables techniques can properly account for endogeneity when the dependent variable is persistent. We show that ownership concentration is very persistent in our sample of private firms, and we estimate the relationship between ownership concentration and the contracting environment using the feasible generalized least squares (FGLS) approach, which can validly handle this situation (Wooldridge, 2010). We also compare our findings to those based on methodologies

that have been used in the literature, such as systems GMM, concluding that the results are sensitive to how one accounts for endogeneity and persistence.

Our sample consists of about 29,000 private Norwegian firms per year during the period 2000-2011, and we use a partially confidential data set that is unusually wide, deep, and accurate. We find that the average largest equity holding in private firms is much higher than in public firms, is much more persistent, and changes by much more once it changes. These characteristics are particularly visible in firms controlled by families. This evidence suggests that control rights held in private firms provide the controlling owner with relatively high private benefits, and that these control rights are more costly to trade than in public firms.

We also find that officers and directors in private firms tend to own more equity the high the firm's profitability and debt, and the smaller its risk and size. These findings support the notion that well-informed investors acquire higher equity stakes when the firm does well and when the cost of being undiversified declines. The evidence also suggests that ownership concentration is endogenously related to the contracting environment. This happens because investors self-select by moving in and out of the ownership structure based on observable and dynamic firm characteristics.

Section 2 specifies our predictions, while Section 3 presents the data and the descriptive statistics. The empirical methodology is outlined in Section 4, the base-case model is estimated in Section 5, while Section 6 contains the robustness tests. We summarize and conclude in Section 7.

2 Predictions

Ownership concentration is irrelevant for the firm's behavior and performance in perfect capital markets with no conflicts of interest between principals and agents. With potential conflicts, however, higher ownership concentration may increase the value of the firm for two reasons. First, more ownership by the principal gives him both higher incentives and more power to ensure that the agent works in the principal's best interest. Second, more ownership by the agent aligns his interest with those of the principal (Jensen and Meckling, 1976; Demsetz, 1983; Shleifer and Vishny, 1986).

This logic does not imply that every firm should have maximum ownership concentration, i.e., just one owner. Concentrated ownership comes with several costs, and there are also more benefits than the one stemming from less separation between principals and agents. These costs and benefits relate to specifics of the firm's contracting environment.

Demsetz (1983) was the first to specify the expected relationship between the firm's ownership concentration and the contracting environment. The general idea is a causal link from the contracting environment to the ownership concentration. Specifically, certain exogenous characteristics of the firm may induce one particular ownership concentration that maximizes firm value. This optimal ownership concentration may vary from firm to firm at a given point in time and also over time for a given firm. Demsetz (p. 386) argues that "no single ownership structure is suitable for all situations if the value of the

firm's assets is to be maximized". Hence, both the level and the dynamics of ownership concentration are firm-specific properties because they are driven by heterogeneous and potentially dynamic firm characteristics.

The firm characteristics we will use in our empirical tests are the firm's size, risk, performance, growth, leverage, liquidity, and listing status. To account for possibly high costs of trading control rights, we also consider past ownership concentration a potential determinant of the current one. In the following we briefly present the logic behind each characteristic and predict the expected relationship with ownership concentration.

The *size* of the firm may influence its optimal ownership concentration through the effect on the stockholder's portfolio risk (Demsetz and Lehn, 1985). Because the price of a given equity fraction is higher the larger the firm, the stockholder must commit a larger part of his wealth to hold a given equity fraction when firm size increases. By allocating more of his wealth to the firm, the stockholder carries a larger cost of being undiversified. Hence, we predict that *ownership concentration and firm size are inversely related (H1).*

Demsetz and Lehn (1985) argue that the value of monitoring increases when the *risk* of the firm's cash flow goes up. The idea is that a more volatile cash flow makes it more critical that management works hard to avoid bad outcomes and ensure good outcomes. Hence, higher risk should optimally go along with higher ownership concentration because of the monitoring argument. On the other hand, the diversification argument suggests that when the risk increases, the optimal equity stake will drop. Therefore, higher risk means lower optimal ownership concentration for diversification reasons. Given these two conflicting effects, *the relationship between ownership concentration and risk is unspecified (H2).*

The firm's *performance* may matter for ownership concentration. Fahlenbrach and Stulz (2009) found that officers and directors of public firms in the United States tend to decrease their ownership when the firm has been doing well lately. The rationale is that owners relinquish control when they are well paid for doing so through a high stock price after good performance. Moreover, the authors argue that owners abstain from selling out in bad periods in order not to signal negative news. Using a financial contracting perspective, Aghion and Bolton (1992) argue theoretically that stockholders should retain more control in bad times than in good times. Based on these arguments, we predict that *ownership concentration and performance are inversely related (H3).*

Fahlenbrach and Stulz (2009) argue that firms with high *growth* will optimally have higher ownership concentration than other firms. These high stakes will be held by the insiders (officers and directors), who use their investment to ensure strong monitoring incentives, strong alignment between principals and agents, and to credibly signal a positive view on the firm's prospects. We predict that *ownership concentration and growth are positively related (H4).*

Leverage may influence optimal ownership concentration through at least two channels. Because creditors provide monitoring services which may partially substitute for monitoring by the stockholders, higher leverage should go along with lower ownership concentration (Jensen and Meckling, 1976). On the other hand, higher leverage means that the assets can be financed with less equity. This reduced need for equity financing means

that a given fraction of equity represents a smaller monetary amount and hence a smaller cost of being undiversified (Demsetz and Lehn, 1985). Because of these opposite effects, *the relationship between ownership concentration and leverage is unspecified (H5).*

A firm with large free cash flow has high *liquidity* and hence a wider room for the agent to expropriate the principal's wealth (Jensen, 1993). Hence, more liquid firms may benefit from closer monitoring by the principal or by stronger alignment with the agent. Both mechanisms presuppose higher ownership concentration. We predict that *ownership concentration and asset liquidity are positively related (H6).*

Lagged ownership concentration will matter whenever ownership concentration is persistent. Because determinants like size, risk, and leverage do not change randomly over time, ownership concentration will not be random either. Moreover, changes in these determinants may still not move ownership concentration if the cost of trading the stock are sufficiently high. Therefore, we predict that *ownership concentration is persistent (H7).*

The firm's *listing status* may matter for ownership concentration. Most firms that can go public choose not to do so, despite potential benefits of listing such as better stock liquidity, continuous pricing, closer monitoring by analysts, and the ability for controlling stockholders to sell out at competitive prices and reduce the cost of being undiversified (Derrien and Kecskés, 2007). A major reason the IPO does not happen may be that private benefits are more difficult to protect when the firm is publicly listed (Cao et al., 2011). Hence, the benefit of being a large stockholder may be higher when the firm is private. We predict that *ownership concentration is higher in private firms than in public firms (H8).*

Finally, we specify two hypotheses on the *dynamics* of ownership concentration. Stockholders trade their ownership rights in markets that are either public or private. Because the market is more liquid for public stock than for private stock, the costs of trading are higher when the firm is private. Accordingly, the benefit of trade ex transaction costs must be higher for a trade to occur in a private firm's stock, and the trade will be larger once that threshold is reached. Hence, the frequency as well as the size of the trade depends on the firm's listing status. We predict that compared to public firms, *ownership in private firms changes less often and changes more once it happens (H9).*

The dynamics of ownership concentration may also depend on its *level*. Fahlenbrach and Stulz (2009) find that the change in ownership concentration from t to $t+1$ relates positively to ownership concentration at t. This relationship may be partially mechanical for an equity sale, since the more you own, the more you can sell. An economic reason for the positive association is that higher ownership concentration means larger potential for private benefits, which may not be transferrable unless the buyer acquires a controlling block. We predict that *ownership concentration changes more the higher it is before the change (H10).*

Summarizing, we hypothesize that ownership concentration relates inversely to size and performance, positively to growth, liquidity, and past ownership concentration, and that it is larger when the firm is private rather than public. We do not specify how ownership concentration relates to risk and leverage. Ownership concentration will be more persis-

tent and change by more once it changes when the firm is private. The change will be larger the higher the ownership concentration before the change.

3 Data and descriptive statistics

Our sample contains every Norwegian firm with limited liability that passes certain filters during the period 2000-2011.[5] The data quality is unusually high, because the law mandates a standardized set of full accounting statements and governance data certified by a public auditor regardless of the firm's listing status, age, size, and industry. Failure to submit this information within 17 months after fiscal year-end triggers automatic liquidation by the court.[6]

Starting from the population of all firms in Table 1, we apply filters that exclude financial firms in order to avoid the impact of their atypical capital requirements, ownership restrictions, and accounting regulations. We ignore utilities to avoid state-controlled firms, and we exclude firms that cannot be assigned to a main industry. Subsidiaries are ignored because they are often fully owned by the parent. We use several filters to ensure that the firm has consistent accounting statements. For instance, an asset value cannot be negative, and the sum of asset values in the firm must equal the sum of liabilities and stockholders' equity. To avoid passive firms, a sample firm must have positive sales, assets, and employment. In order to avoid firms with particularly low separation between ownership and control, we exclude single-owner firms and also the 15% smallest firms by assets and sales.

Table 1

The resulting sample involves about 29,000 firms per year and a pooled sample over eleven years of 322,250 firm years and 74,860 unique firms. This sample is roughly 15% of the population. The average length of the panel is 4.3 years, with a minimum of one year and a maximum of eleven. Public (listed) firms, which constitute less than 1% of all firms, will only be used as a benchmark for the private (non-listed) firms.

Table 2

Table 2 shows distributional properties of ownership characteristics in the upper part of the table and of firm characteristics in the lower part. Every variable used in the table is winsorized in the 1%/99% tails. The ownership characteristics, which are based on ultimate (direct plus indirect) equity stakes, reflect five alternative proxies for the owners' power and incentives to become actively involved in the firm's governance. The Herfindahl index, which is the sum of every squared equity fraction, is closer to its maximum of 100% the greater the large equity holdings and the fewer stockholders the

[5]We must ignore 2006 due to missing ownership data. The next version of the paper will include that year as well

[6]Accounting, ownership, and board data are delivered by Experian (www.experian.no). Data on family relationships are from Skattedirektoratet (www.skatteetaten.no). All data items were received in electronic form and organized as one integrated database by the Centre for Corporate Governance Research (www.bi.edu/ccgr).

firm has. The average Herfindahl index value in the sample is 42.9%, and about half the firms have an index value above 50%. These figures suggest that ownership concentration is high, which is also suggested by the 49.9% equity stake of the average largest owner. This stake is almost twice as large as in public firms (26.4%; not reported in the table). Hence, unlike in public firms, the average largest stockholder in private firms can single-handedly appoint the board and hence hire and fire the CEO.[7]

Unlike Herfindahl and Largest, the three other ownership concentration measures in Table 2 reflect both the percentage equity stake and the identity of the stockholder who owns the stake. On average, the CEO holds 34.2% of the equity, the largest owning family by blood and marriage holds 89.1%, while the firm's insiders as a group hold 75.7%. Hence, besides being able to elect the whole board in the average firm (simple majority), the largest family by ownership as well as the insiders as a group can also amend the charter (which requires a super majority of two thirds). Moreover, the average CEO can block charter amendments proposed by the super majority (negative majority). Hence, the stockholders with the best information (the insiders) and the stockholders with the closest social ties (the largest family by ownership) have on average very strong power and incentives to ensure the firm is run in their best interest. Also, the difference between control at the stockholder meeting and control in daily operations is generally low because the average CEO holds more than one third of the firm's equity.

The firm characteristics in Table 2 show that the average firm has sales of 14.9 million NOK (roughly 2 million Euros). The largest firm has sales of 16.5 billion NOK, while the minimum is 0.02 mill. Risk measured as volatility of sales per average sales varies between 1.1 and 0, while the mean is 0.2. Performance as measured by return on assets (ROA) is 9.1%, sales growth is 5.9%, while leverage is 68.8% on average. The current assets of the average firm are 89.0% higher than the current debt. Most distributions are reasonably symmetric.

Table 3 shows the distribution of insider ownership year by year. The striking feature in the table is the high and stable ownership concentration. Regarding the high level, the average (median) insider ownership is 75.7% (95.0%), and 75% of the firms have at least 60% insider ownership. The high persistence is illustrated by the fact that the annual mean stays in the narrow band from 74.0% to 78.4% over the years except in 2005, when the mean drops to 70.8%.[8]

Table 3

The year-by-year figures in Table 3 suggest that ownership concentration as measured by the insider stake is persistent. Table 4 documents this property more rigorously for

[7]This evidence supports hypothesis *H8* from Section 2. The next version of the paper will test this prediction formally.

[8]The 2005 drop is probably due to the tax reform, which became effective in 2006. After the tax reform firms could no longer pay tax-free dividends except to corporations, including holding companies. Individuals could sell their shares to such an intermediary without capital gains tax in 2005, only. This regulatory change triggered the establishment of thousands of holding companies that year. A family that establishes such a holding company can store tax-free dividends until they are paid out to the family members (Berzins et al., 2013).h is somewhat atypical ownership concentration in 2005 highlights the need for including year indicator variables in regressions with observations from several years.

each of the five ownership concentration measures introduced in Table 2. The autocorrelation coefficients in Table 3 range from 0.872 for the Family concentration measure to 0.945 for Herfindahl. Hence, ownership concentration is very persistent regardless of how concentration is measured empirically. Accordingly, this property must be reflected in the economic model of ownership concentration and also in the econometric method used to estimate it. Specifically, any viable economic model with ownership concentration as the dependent variable must include lagged ownership concentration as an independent variable. Moreover, panel data methods such as fixed effects and random effects will produce biased estimates in this case due to correlation between the residuals and lagged ownership concentration (Greene, 2008, p. 469). Also, although the cross-section of firms is very large (about 29,000 on average), the panel per firm is short (4.4 years on average). Following the advice of Wooldridge (2010), we estimate our model by pooling the observations and using the ordinary least squares (OLS) and the feasible generalized least squares (FGLS) methods. For robustness checks we use the system GMM method (Arellano, 2003) as the major alternative. We return to methodological issues in section 4.

Table 4

Table 5 documents the frequency and magnitude of all, positive, and negative changes in insider ownership, using six alternative lower thresholds for what is considered a change. Consistent with what we already shown for levels, the table documents that no change in insider ownership is the typical situation in our sample. With no lower bound on the magnitude of the change (first row), 80.4% of all cases involve no change. When a change does happen (19.4% of the cases), the average change is 20.2 percentage units when the stake increases and -25.9 percentage units when the stake decreases. Hence, a change in insider ownership is quite rare, but the change is typically large once it happens. Compared to the average level of insider ownership from Table 2, the average change once it occurs is about one third of the level.

As expected, a higher lower threshold reduces the frequency of change and increases the size of the change. For instance, increasing the threshold from 5 to 50 percentage units decreases the frequency of change from 19.6% to 2.0%, while the average positive change increases from 20.2 to 70.6 percentage units. Moreover, the table documents that the frequency as well as the magnitude of the change is larger for a decrease than for an increase.

Finally, unreported results show that change is much more common in public firms, while the change is much smaller once it happens. For instance, imposing no lower threshold produces no change in 2.3% of all cases for public firms, compared to 80.4% for private firms. Moreover, the average positive change once it happens is 7.4 vs. 20.2 percentage units, respectively.[9] Overall, these patterns are consistent with the notion that large ownership stakes change hands less frequently the higher the costs of trading the stake, which are larger the larger the stake and the less liquid the firm's stock.

Table 5

[9]This evidence is consistent with our hypothesis *H9* from Section 2. We will test this prediction formally in the next version of the paper.

Instead of distinguishing between outside and inside stockholders, they may be classified by whether they are persons (direct ownership) or firms (indirect ownership). Because we measure ownership by ultimate holdings, a person's indirect ownership through corporations is automatically accounted for whenever the ultimate owner of the intermediary can be identified. However, state ownership cannot be traced back to its ultimate owners, and ultimate foreign owners cannot be identified in our sample because these stakes are mostly held through nominee accounts registered on foreign financials. Table 6 shows characteristics of ownership levels and dynamics for the firm's largest stockholder across family, state, and foreign owners. The table documents that the largest owner's stake is considerably higher when the owner is a family (one person or several persons related by blood or marriage). For instance, the average largest stake is 71.2% when held by a family and 45.0% when held by the state. Moreover, the largest stake changes hands less often when held by a family. To illustrate, no change is observed in 56.7% of the cases for families and in 28.6% for the state. Finally, the magnitude of the change tends to be considerably larger for families than for the state. For instance, the average increase of the largest stake is 6.2 percentage points for the family and 2.2 for the state.

Overall, Table 6 suggests that, compared to other stockholder types, families benefit more from being the largest stockholder, from holding a larger stake, and from holding the stake longer.

Table 6

Table 7 analyzes the identity of the seller and buyer when large ownership stakes change hands, using alternative thresholds of 2.5 (panel A) and 10.0 (panel B) percentage points, respectively. The table documents a very strong tendency of an owner type to trade with an owner of the same type. For instance, the family trades with another family in 99% of the cases when the lower threshold is 2.5 percentage units and in 98.0% of the cases when the threshold is 10. Given the dominance of families in the role as the firm's largest owner, however, this pattern follows by necessity. More surprising, however, is the finding that any other type is also heavily biased towards trading with its own type. For instance, the state typically trades with the state in 85% of the cases under the 2.5 threshold and in 75% when the threshold is 10.

The evidence in Table 7 supports the idea that a certain owner type is attracted to certain firm characteristics, and that the cost of finding a seller or buyer of ownership rights to such characteristics is lower when you trade with your own type.

Table 7

Table 8 shows coefficients of correlation between pairs of ownership and firm characteristics, measuring the variables both in in levels (panel A) and year-by-year changes (panel B). There is no potential multicolinearity problem between any pair of firm characteristics (variables 6-11), which will be independent variables in our statistical tests.[10] The table also shows that, whereas the ownership characteristics measured by the Herfindahl index and by the Largest owner correlate very strongly, the correlation is much smaller for the three measures that reflect not just the size of the equity stake, but also the identity of

[10]Kennedy (2008) argues that correlation coefficients above about 0.80 may cause serious multicollinearity in statistical tests.

its owner (CEO, Family, Insiders). Hence, these three measures tend to pick up different owner properties than the first two, and they are also more different from each other. We will use insider ownership as the base-case measure of ownership concentration in the statistical tests.

Table 8

4 Methodology

The choice of estimation method must reflect the facts that *(i)* our data set contains panel data of the type "large N (many firms), small T (few periods)", *(ii)* that there is strong autocorrelation in our dependent variable, and that *(iii)* there is potential endogeneity due to omitted variables and reverse causation. Thus, we start by specifying the following dynamic economic model for firm i at time t:

$$OC_{it} = \alpha OC_{i,t-1} + \beta X_{i,t-1} + c_i + u_{it} \tag{1}$$

OC_{it} is ownership concentration, X_{it} is a vector of observable independent variables, c_i is the unobservable firm specific effect, and u_{it} is random noise. The degree of persistence in ownership concentration is captured by α, which we call the persistence parameter (Mueller, 1977). The explanatory variables in $X_{i,t-1}$ capture the observed heterogeneity in the data. The unobserved effect c_i may vary across the firms, but the effect is assumed to be fixed over time for a given firm. This variable, which reflects the unobserved, persistent heterogeneity in the data stemming from firm i, may summarise features such as the firm's "culture" or "business acumen" (Bøhren and Strøm, 2010). Hence, we need to validly estimate α and β in (1) without knowing the time-invariant variable c_i (Arellano, 2003).

4.1 Base case

N reflects 74,860 unique firms in our sample, which is overwhelmingly much larger than T, which has a maximum of 11 years and a mean of 4.3 years per firm. Therefore, most of the asymptotic properties of the estimators come from the cross-sectional variation between sample firms rather than the time-series variation per firm. Given this setting, a key methodological question is whether we should use pooled data to estimate the coefficients in (1).

Stochastic modelling of dynamic effects requires large T and large N (Arellano, 2003). Wooldridge (2010, p. 191-201) shows how ordinary least squares (OLS) and feasible generalised least squares (FGLS) can validly be used to estimate (1) with pooled data. We follow this procedure.

For OLS to be valid, exogeneity must hold. That is, the explanatory variables and the error term must be uncorrelated. Thus, $E\left(X'_{i,t-1}u_{it}\right) = 0$ for $t = 1, 2, \ldots, T$ is required. Furthermore, the data must meet the rank condition, which means no collinearity between the explanatory variables. Also, the variance of the error term should be constant

(homoscedasticity), so that $E(\mathbf{u}_i\mathbf{u}_i') = \sigma^2\mathbf{I}_T$. Finally, the error term should not be serially correlated.

If the first two conditions are met (no endogeneity or multicollinearity), OLS estimation with pooled data gives consistent and asymptotically normal estimators. If the data also satisfy homoscedasticity and no serial correlation, the OLS estimator will be efficient.

If the errors are heteroskedastic ($E(\mathbf{u}_i\mathbf{u}_i') \neq \sigma^2\mathbf{I}_T$) and serially correlated, however, FGLS is generally a better alternative (Wooldridge, 2010) because it is more efficient (smaller standard errors and hence higher t statistics). However, this improved efficiency comes with the price that the heterogeneity dynamics needs to be assumed. Considering the atypical year 2005 (Table 3), we make no assumption about the correlation structure of the residuals. However, the OLS puts relatively more weight on the cross-sectional variation than the FGLS. Because our sample has a very large N relative to T, the two methods may produce quite similar estimates. In fact, Wooldridge (2010, p. 197) argues that a large cross section and a relatively short panel length jointly allow the researcher to be "agnostic" about temporal persistence when choosing the econometric approach.

It turns out that serial correlation in the error term is the most problematic property in our sample under standard OLS, with $\rho_1 = 0.05$ to $\rho_1 = 0.10$. Therefore, we perform regressions in the following way. First, standard errors are clustered at the firm level. Petersen (2009) shows that the variation in the data is considerably reduced when N is large, and that clustering mitigates this problem. Second, we lag all explanatory variables by one period. This approach removes some of the serial correlation. Lagging also controls for reverse causation, since the dependent variable (ownership concentration) this year cannot have produced the value of independent variables in former years. Third, we estimate (1) with a year and industry indicators.

Together, this approach produces estimates with only a small serial correlation in the error terms. Although it may be tempting to use more lags in the explanatory variables in order to remove all the remaining serial correlation, more lags makes it more difficult to interpret the estimates. Furthermore, adding lags reduces serial correlation in the error terms only slightly, and it adds little to the explanatory power. Thus, in the interest of economy, we keep the relationship as specified in (1).

Wooldridge (2010) suggests tests for endogeneity as well as for autocorrelation. We call these the endogeneity test and the autocorrelation test, respectively. To check for violation of the exogeneity assumption $E\left(X_{i,t-1}'u_{it}\right) = 0$ we run the OLS regression $u_{it} = aOC_{i,t-1} + bX_{i,t-1} + e_{it}$, where u_{it} is the OLS residual from regression (1). A simple t test will reveal if the zero hypothesis $b = 0$ is violated. To test for serial correlation, we run the OLS regression $u_{it} = d + \rho_1 u_{i,t-1} + g_{it}$. Again, a simple t test will suffice to show if $\rho_1 = 0$ or not.

The model in (1) relates the level of ownership concentration to the level of firms characteristics. However, we may also be interested in studying how changes in ownership related to changes in firm characteristics. Therefore, we also estimate the relationships with differenced variables, using OLS and FGLS, while clustering standard errors at the firm level. That is, we subtract $OC_{i,t-1}$ on the left-hand side and transform the right-hand

side correspondingly into differenced variables:

$$\Delta OC_{it} = \alpha \Delta OC_{i,t-1} + \beta \Delta X_{i,t-1} + \Delta u_{it} \tag{2}$$

where Δ means difference. Because first differencing also removes the unobserved fixed effects c_i from the relation, 2 accounts for potential endogeneity caused by omitted determinants of OC at the firm level.[11]

4.2 Robustness

We extend the base-case analysis in four ways. First, starting with insider ownership as the base-case measure, we use four alternative measures of ownership concentration as the dependent variable (the Herfindahl index, the largest shareholder's stake, the CEO's stake, and the family's stake). Second, we perform regressions with 2005 left out, since the descriptive statistics have shown that this year is atypical.

Third, we substitute the first-differenced ownership concentration in (2) by the lagged ownership concentration. The rationale is that when ownership concentration is high (low), it is more likely to fall (rise) in the next period. Such a relationship was found by Franks et al. (2007, 2012), where firms tend to have more dispersed ownership over time, especially when the firm grows. Fahlenbrach and Stulz (2009) find a similar pattern. Because $OC_{i,t-1}$ should be uncorrelated with the error term Δu_{it}, we may validly account for a possible relationship between the level and the change of OC.

Finally, we perform regressions with the system GMM dynamic framework (Greene, 2012), which is based on Arellano and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (1998). Systems GMM estimates the coefficients of the first-differenced variables in (2) using instruments from both (1) and (2).[12] The methodology has recently been used to analyze the determinants of capital structure (Flannery and Rangan, 2006; Lemmon et al., 2008; Huang and Ritter, 2009).

There are several reasons why we do not use system GMM as our main method. The first reason is that, due to the short panel and the large number of firms, most of the variation in our sample is cross-sectional. Second, we lack a good economic rationale why former realisations of variables in the model should be good instruments for current unobservables (Roberts and Whited, 2011). The third reason is that the instruments from our GMM approach are often weak, since they are generated by the same corporate decisions as the variables that are supposed to instrument for (Roodman, 2009).

Finally, Monte Carlo studies that replicate the "large N, small T" situation find that the system GMM performs poorly when the dependent variable has values that cluster around zero (such as changes in ownership in our case), and when the dependent variable is highly persistent (such as ownership in our case) (Flannery and Watson Hankins,

[11] Fahlenbrach and Stulz (2009) specify a model inspired by (2), using the percentage change instead of the difference.

[12] The moment conditions are $E\left(OC_{i,t-2}\Delta u_{it}\right) = 0$ $(t = 2, \ldots, T)$ give rise to valid instruments in the differenced relation. The levels instruments arise from the orthogonal conditions $E\left(\Delta OC_{i,t-1}\Delta u_{it}\right) = 0$ for each $t \geq 3$. The system GMM preserves data, as the number of observations is the same as in (1).

2013). Nevertheless, a major advantage of the system GMM approach is that it handles autocorrelation better than OLS or FGLS. These two latter methods are challenged under high serial correlation, causing a so called Nickell bias in the estimates (Nickell, 1981). Because the system GMM remedies this weakness, the methodology handles autocorrelation better than the base-case approach.

5 Statistical tests for the base case

We test hypotheses *H1-H7* from Section 2 using the approach outlined in Section 4.1. Hence, we use OLS and FGLS with clustered standard errors to regress insider ownership concentration on independent variables that are lagged one period. Every variable is first expressed in levels rather than changes, and we control for year and industry effects. The results are reported in Table 9.

Table 9

The table shows that the two estimation methods produce practically identical results. Moreover, R^2 is high under OLS, while Wald χ^2 is low under FGLS. Both features reflect that the independent variables as a group have high explanatory power. The endogeneity test statistic shows that the residuals are independent of the explanatory variables, reflecting a setting where the independent variables are indeed exogenous relative to the dependent variable. There are significant autocorrelations in the residuals, however, but the variation explained by the independent variables is less than 1%, and the persistence coefficient is a moderate -0.11. Thus, although our approach has not eliminated autocorrelation, the low autocorrelation coefficient and the strong results from the endogeneity test jointly suggest that the base-case results are reasonably reliable.

As predicted (*H7*), and also as indicated by the highly autocorrelated ownership concentration measures (Table 4), the estimates in Table 9 shows that ownership concentration is very persistent. That is, insider ownership this year tends to be close to what it was last year. This finding is consistent with the notion that the major determinants of optimal insider ownership are rather stable over time, and/or that the transaction costs are high when large equity blocks are traded.

Consistent with our prediction (*H1*), insider ownership and firm size are negatively correlated. This result supports the argument that because a larger firm requires a higher equity investment to obtain a given equity fraction, risk averse investors will hold smaller stakes in larger firms. Similarly, we find that increasing risk goes together with lower insider ownership. This finding supports the diversification argument rather than the monitoring argument for insider ownership (*H2*).

H3 predicts that insider ownership and performance are inversely related. In contrast, we find a positive relationship. This result suggests that higher performance in the past generates higher insider ownership now, such that insiders sell rather than buy when the firm has been doing poorly. This result is inconsistent with the rationale of *H3* that insiders systematically cash out when they get the highest price, and that they are reluctant to sell in downturns because of negative signals. Rather, it seems large

stockholders of private firms are less concerned with negative signalling effects of their trades, and that they value private benefits the highest when the firm has been doing well rather than poorly.

We find no significant relationship between insider ownership and growth (*H4*). However, insider ownership is significantly higher the more the firm finances with debt. This result supports a rationale for low ownership concentration based on lost diversification benefits rather than monitoring by creditors (*H5*). That is, the higher the firm's leverage, the smaller the investment and the lower the diversification loss needed to hold a given equity fraction.

Finally, and inconsistently with *H6*, more liquid firms have less rather than more insider ownership. This finding does not support the idea that the value of monitoring and the alignment of interest are both higher the better the insiders' access to assets that can easily be diverted. One possible reason is that because the vast majority of our sample firms have high insider ownership, conflicts between owners and managers are rare. Nevertheless, this possibility does not explain why the observed relationship is negative.

Table 10 shows the result of estimating the alternative base-case model as specified in (2), where the variables are stated as changes rather than levels.

Table 10

Just like in Table 9, the results are practically identical across the two estimation methods. Also, the endogeneity test shows that the independent variables are not correlated with the residuals, and the serial correlation is significant, but low. However, the explained variance is much smaller than earlier, which may partially explain why most of the estimated relationships are insignificant. Another reason is the high persistence of insider ownership reported in earlier tables. With so few changes, no change is by far the most common observation, which reduces the number of usable data points correspondingly. Nevertheless, Table 10 does find that a current change in insider ownership is inversely related to the past change, which is consistent with persistence (*H7*). Moreover, insider ownership continues to be inversely related to firm size (*H1*), and the relationship to ROA is negative, which is consistent with *H3*. No other relationship is significant.

Summarizing, we have found that, consistent with our predictions, the level of insider ownership relates positively to past insider ownership and leverage, while negatively to the firm's size and risk. Performance, growth, and liquidity do not relate to insider ownership in the hypothesized fashion. Due to the very high persistence of insider ownership, the tests based on differenced variables produce weaker results than the tests based on levels.

6 Robustness tests

This section first analyzes how the base-case findings change when we measure ownership concentration in alternative ways and when we ignore years with unusual dynamics in

ownership concentration. Finally, we compare the base-case findings to those based on the systems GMM approach.

6.1 Ownership concentration measures and atypical sample years

We first extend the analysis from Table 9 by comparing the results under five alternative measures of ownership concentration. The independent variables beyond lagged ownership (which varies from measure to measure) correspond to those of the base case. The findings are reported in Table 11. The remarkable pattern is the strong consistency between the estimates under the base case (model (5)) and the four alternative measures of ownership concentration (models (1)-(4)). Hence, the base-case results survive regardless of whether we consider just the size of the largest equity fraction (Largest), the distribution of all fractions (Herfindahl), or both the size and the identity of either one key stockholders (CEO) or coalitions of key stockholders (families and insiders).

Table 11

The corresponding results for the first differenced model are reported in Table 12. Like we found in the base case and for the same reason, the overall model fit is much weaker, and very few determinants beyond lagged ownership concentration are significant.

Table 12

We noted in Table 3 that 2005 is an atypical year, as the mean and median insider ownership concentration are unusually low relative to the years before and after. Table 13 reports the findings for the base case when 2005 is removed from the sample.

Table 13

The test statistics are marginally better than those from the base case in Table 9. The overall R^2 improves, and the autocorrelation is somewhat lower. The estimated coefficients for the independent variables are qualitatively almost identical to those of the base case. Thus, reassuringly, the base-case findings are not driven by one atypical sample years.

6.2 System GMM estimation

Table 14 shows the results of estimating the base-case relationship using systems GMM. We use the full sample in regressions (1)-(3), while (4)-(5) exclude 2005. Industry indicators are left out, since they contribute nothing to the results.

Table 14

The overall model fit is satisfactory in every case, since the Wald test rejects the hypothesis that the independent variables as a group are unrelated to insider ownership. However, the AR(2) statistic shows that we may reject the null hypothesis of no serial

correlation in the error term in models (1) and (2). Extending the number of lags from one to two does not mitigate this problem (results not reported).[13]

The estimates show that the persistence parameter for the lagged insider ownership term is typically 0.70 and always in the 0.65-0.75 range. This result means that changes in insider ownership are not unpredictable and abrupt, but predictable and drawn out. Hence, as expected, and as was indicated several times in the descriptive statistics and confirmed in OLS and FGLS results reported earlier, insider ownership is highly persistent. Accordingly, an economic model of insider ownership without a lagged ownership term would be misspecified. The persistence parameter is lower than under OLS and FGLS estimations in Table 9, but higher than in the first difference estimations in Table 10. This result is as expected due to the Nickell bias in the lagged dependent term in these specifications (Arellano, 2003).

Size, Performance, and Leverage are statistically significant at the 10% level or less in models (1)-(3), while Growth is significant in (2) and (3). These results do not carry over to the regressions (4) and (5), however, although the signs are always the same. This result may suggest that much of the results in models (1)-(3) are driven by the 2005 observations, and that the year indicators to not properly reflect this effect. Compared to the levels regressions in Table 9, the signs of Performance and Leverage are reversed. These results are in line with findings under OLS and FGLS in Table 10.

Finally, we estimate with system GMM using alternative ownership concentration measures. Table 15 shows the results.

Table 15

Comparing the results from the base-case model (5) to the four alternatives in (1)-(4), three features emerge. First, three of the seven determinants are significant in the predicted way almost regardless of how ownership concentration is measured. Particularly, the firm's ownership concentration tends to be higher the higher the ownership concentration used to be, the less profitable the firm, and the less the firm has borrowed. Second, Liquidity and Growth are insignificant determinants of ownership concentration except in one in model, and even then only at 10%). Third, Size is inconsistent with the predicted negative relationship in models (1) and (2), unrelated in (3) and (4), while being significant in the predicted fashion at the 10% level under the base-case model. Finally, consistency across models is widespread in (1) and (2) and across (3)-(5), but not between the two groups. The former group only reflects the magnitude of large holdings, while the latter group also reflects the identity of the holder(s).

Overall, the robustness tests have shown that the base-case is very insensitive to how we measure ownership concentration and to whether or not we include exceptional years. These results, which are based on OLS and FGLS with clustered standard errors, do not carry over to the system GMM approach. Because our sample involves a large cross-section of firms and a low number of observations per firm, we place higher trust in the findings based on OLS and FGLS.

[13]Serial correlation often occurs in models with year indicator variables (Wooldridge, 2010).

7 Summary and conclusions

This paper idocuments the level and dynamics of ownership concentration in a large sample of private firms with unusually rich and accurate ownership data. Unlike most of the existing literature, we explore how ownership concentration is endogenously determined by characteristics of the firm's contracting environment.

We find that the average largest equity holding in private firms is much higher than in public firms, is much more persistent, and changes by much more once the holding changes hands. Hence, control rights in private firms may provide the controlling owner with relatively high private benefits that are costly to trade. We also find that officers and directors in private firms tend to own more equity the higher the firm's past profitability and leverage, and the lower ist past risk and size. These findings support the notion that well-informed investors acquire higher equity stakes when the firm has been doing well and when the cost of being undiversified declines. The evidence also suggests that investors self-select into the firm's ownership structure based on observable and dynamic firm characteristics.

Overall, our findings strongly support the notion that, unlike what has been a common assumption in corporate governance research, the ownership structure is not an exogenous determinant of the firm's behavior and performance. Rather, ownership concentration depends endogenously on basic firm characteristics and on the cost of trading the ownership rights.

References

Aghion, P. and P. Bolton (1992). An incomplete contracts approach to financial contracting. *Review of Economic Studies 59*, 473–494.

Arellano, M. (2003). *Panel Data Econometrics*. Oxford, UK: Oxford University Press.

Arellano, M. and S. Bond (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *Review of Economic Studies 58*, 277–297.

Arellano, M. and O. Bover (1995). Another look at the instrumental-variable estimation of error-components models. *Journal of Econometrics 68*, 29–51.

Berzins, J., Ø. Bøhren, and B. Stacescu (2013). Tax concerns and agency concerns in dividend policy: Holding companies as a separating device. Working paper June, BI Norwegian Business School.

Blundell, R. and S. Bond (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics 87*, 115–143.

Bøhren, Ø. (2011). *Eierne, styret og ledelsen*. Bergen: Fagbokforlaget.

Bøhren, Ø. and R. Ø. Strøm (2010). Governance and politics: Regulating independence and diversity in the board room. *Journal of Business Finance & Accounting 37*(9-10), 1281–1308.

Cao, Q., Q. Sun, and W. H. S. Tong (2011). How do ownership and control affect the decision to go public? Working paper.

Coles, J. L., M. L. Lemmon, and J. F. Meschke (2012). Structural models and endogeneity in corporate finance: The link between managerial ownership and corporate performance. *Journal of Financial Economics 103*(1), 149–168.

Dahya, J., O. Dimitrov, and J. J. McConnell (2008). Dominant shareholders, corporate boards and coporate value: A cross-country analysis. *Journal of Financial Economics 87*(1), 73–100.

Demsetz, H. (1983). The structure of ownership and the theory of the firm. *Journal of Law & Economics 26*(2), 375–90.

Demsetz, H. and K. Lehn (1985, Dec). The structure of corporate ownership: Causes and consequences. *Journal of Political Economy 93*(6), 1155–1177.

Demsetz, H. and B. Villalonga (2001). Ownership structure and corporate performance. *Journal of Corporate Finance 7*, 209–233.

Derrien, F. and A. Kecskés (2007). The initial public offerings of listed firms. *Journal of Finance 62*(1), 447–479.

Fahlenbrach, R. and R. M. Stulz (2009). Managerial ownership dynamics and firm value. *Journal of Financial Economics 92*, 342–361.

Flannery, M. and K. Rangan (2006). Partial adjustment toward target capital structures. *Journal of Financial Economics 79*, 469–506.

Flannery, M. and K. Watson Hankins (2013). Estimating dynamic panel models in corporate finance. *Journal of Corporate Finance 19*, 1–19.

Franks, J., C. Mayer, and S. Rossi (2007). Spending less time with the family: The decline of family ownership in the United Kingdom. In R. K. Morck (Ed.), *A History of Corporate Governance around the World*, Chapter 10, pp. 581–607. Chicago, USA: University of Chicago Press.

Franks, J., C. Mayer, P. Volpin, and H. F. Wagner (2012). The life cycle of family ownership: International evidence. *Review of Financial Studies 25*(6), 1675–1712.

Greene, W. H. (2008). *Econometric Analysis* (6th ed.). New York: Prentice Hall.

Greene, W. H. (2012). *Econometric Analysis* (7th ed.). New York: Prentice Hall.

Huang, R. and J. Ritter (2009). Testing theories of capital structure and estimating the speed of adjustment. *Journal of Financial and Quantitative Analysis 44*, 237–271.

Jensen, M. C. (1993). The modern industrial revolution, exit and the failure of internal control systems. *Journal of Finance 48*, 831–880.

Jensen, M. C. and W. Meckling (1976). Theory of the firm: Managerial behavior, agency costs, and ownership structure. *Journal of Financial Economics 3*, 305–360.

Kennedy, P. (2008). *A Guide to Econometrics* (6th ed. ed.). Oxford, UK: Blackwell Publishing.

Lemmon, M., M. R. Roberts, and J. F. Zender (2008). Back to the beginning: Persistence and the cross-section of corporate capital structure. *Journal of Finance 63*, 1575–1608.

McConnell, J. and H. Servaes (1990). Additional evidence on equity ownership and corporate value. *Journal of Financial Economics 27*, 595–612.

Morck, R., A. Shleifer, and R. Vishny (1988, Jan-Mar). Management ownership and market valuation: An empirical analysis. *Journal of Financial Economics 20*, 293–315.

Mueller, D. C. (1977). The persistence of profits above the norm. *Economica 44*, 369–380.

Nickell, S. J. (1981). Biases in dynamic models with fixed effects. *Econometrica 16*(49), 1417–1426.

Petersen, M. A. (2009). Estimating standard errors in finance panel data sets: Comparing approaches. *Review of Financial Studies 22*(1), 435–480.

Roberts, M. R. and T. M. Whited (2011). Endogeneity in empirical corporate finance. In G. Constantinides, R. Stulz, and M. Harris (Eds.), *Handbook of the Economics of Finance*, Volume 2. Amsterdam: Elsevier.

Roodman, D. (2009). A note on the theme of too many instruments. *Oxford Bulletin of Economics and Statistics 71*(1), 135–158.

Shleifer, A. and R. W. Vishny (1986). Large shareholders and corporate control. *Journal of Political Economy 94*(3), 461–486.

Wooldridge, J. M. (2010). *Econometric Analysis of Cross Section and Panel Data* (2nd ed.). Cambridge, Mass.: The MIT Press.

Zhou, X. (2001). Understanding the determinants of managerial ownership and the link between ownership and performance: comment. *Journal of Financial Economics 62*(3), 559–571.

Table 1 Population, filters, and sample

Filters	All years	2000	2001	2002	2003	2004	2005	2007	2008	2009	2010	2011
Population	2,131.5	145.7	149.5	153.9	156.0	158.3	182.7	222.2	234.0	238.2	242.8	248.4
Financial	63.9	1.3	1.8	1.7	2.9	2.8	3.6	22.1	24.3	1.1	1.1	1.1
Utility	139.6	2.0	1.8	1.6	2.3	2.3	2.6	3.1	3.4	38.9	40.2	41.4
No main industry	43.0	3.0	2.7	2.6	5.2	6.1	10.4	1.9	1.9	2.6	3.2	3.4
No industry code	183.1	12.5	29.6	40.0	9.1	15.0	15.5	12.8	12.0	12.5	11.5	12.5
Non-positive operating revenue	258.4	16.8	15.6	15.1	18.1	16.9	20.0	29.8	33.7	30.2	30.6	31.8
Negative asset values	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1
Non-positive total assets	5.8	0.5	0.4	0.4	0.4	0.5	0.5	0.4	0.6	0.6	0.7	0.7
No employees	393.8	29.7	28.0	26.7	34.7	33.8	32.8	39.0	42.1	40.7	42.6	43.7
Largest equity fraction zero or missing	157.4	7.1	5.8	7.4	7.6	8.2	15.1	18.6	21.1	22.1	22.2	22.2
Subsidiary	194.9	11.0	10.1	9.0	12.2	11.6	16.6	24.5	25.5	24.5	24.8	25.2
Single-owner firm	284.3	22.2	19.1	17.8	23.1	22.5	26.3	30.6	31.0	29.6	30.6	31.5
Negative debt	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total assets differs from equity + debt	2.3	0.4	0.3	0.2	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.1
No salary	2.2	0.1	0.2	0.1	0.2	0.1	0.3	0.3	0.3	0.2	0.2	0.2
No operating expense	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Negative equity	53.9	5.2	4.7	4.1	5.4	4.8	5.2	5.0	5.3	4.8	4.9	4.6
15% smallest by assets and sales	25.9	3.0	2.4	2.0	2.8	2.4	2.6	2.3	2.2	2.1	2.1	2.1
Sample	322.3	30.9	26.9	25.1	31.8	31.0	30.9	31.5	30.5	28.2	27.8	27.6

This table shows the population, filters, and the sample of private Norwegian firms with limited liability used in the empirical analysis. The figures are stated in thousands. For each consecutive filter, we show the number of firms that are eliminated from the sample by the filter in question. The year 2006 is ignored due to missing ownership data. The accounting and ownership data are from the Centre for Corporate Governance Research (www.bi.edu/ccgr).

Table 2 Sample firm characteristics

					Percentiles							
Variable	Mean	Std	Min	Max	p1	p5	p25	p50	p75	p95	p99	N
Ownership characteristics												
Herfindahl	42.9	16.6	0.0	100.0	5.3	14.7	32.8	49.3	50.3	68.9	89.4	322,250
Largest	49.9	17.5	0.4	100.0	13.1	21.7	36.0	50.0	60.0	81.6	94.4	322,250
CEO	34.2	26.5	0.0	100.0	0.0	0.0	0.0	35.2	50.0	75.0	90.0	322,250
Family	89.1	21.3	0.0	116.7	9.4	38.1	89.1	100.0	100.0	100.0	100.0	313,635
Insiders	75.7	31.2	0.0	100.9	0.0	0.0	60.0	95.0	100.0	100.0	100.0	322,250
Firm characteristics												
Size	14.9	92.8	0.0	16,500.0	0.2	0.7	2.2	4.9	11.6	45.4	141.0	322,250
Risk	18.9	19.6	0.9	107.2	0.9	2.1	6.3	12.4	23.8	60.8	107.2	251,588
Performance	9.1	15.6	-43.3	55.2	-43.3	-13.8	0.7	7.2	17.2	37.2	55.2	322,250
Growth	5.9	27.1	-64.0	140.7	-64.0	-28.3	-5.7	2.4	12.8	50.5	140.7	251,588
Leverage	68.8	21.4	8.6	98.6	8.6	25.5	55.9	73.8	86.5	94.1	98.6	322,250
Liquidity	189.0	210.1	15.1	1,612.3	15.1	53.5	105.4	133.6	191.6	469.3	1,612.3	322,154

This table shows descriptive statistics for ownership and firm characteristics in the sample firms. Herfindahl is the sum of all squared ownership fractions, Largest is the percentage equity holding of the largest separate stockholder, CEO is the percentage equity holding of the CEO, Family is the percentage equity holding of individual stockholders in the firm related by blood or marriage, while Insiders is the aggregate equity holding of the officers and directors. All equity holdings are ultimate, which equals direct holdings plus indirect holdings through intermediaries. Size is sales in millions of NOK as of 2011, Risk is the standard deviation of sales during the past three years divided by average sales during the same period, while Performance is operating earnings divided by total assets. Growth is the geometric annual increase in sales during the three previous years, Leverage is total debt divided by total assets, and Liquidity is current assets divided by current liabilities. The sample is all private Norwegian firms with limited liability during the period 2000-2011 (2006 excluded due to missing data). The sample consists of firms that have consistent accounting figures, multiple owners, positive sales and employment, that are not financials, utilities, subsidiaries, multi-sector firms, and that are not among the 15% smallest firms by assets and sales. The variables are winsorized by 1% in the tails.

Table 3 Insider ownership by year

					Percentiles							
Year	Mean	Std	Min	Max	p1	p5	p25	p50	p75	p95	p99	N
2000	74.7	30.7	0.0	100.0	0.0	0.7	60.0	89.2	100.0	100.0	100.0	30,868
2001	74.0	30.7	0.0	100.5	0.0	0.0	59.0	85.0	100.0	100.0	100.0	26,918
2002	76.6	29.4	0.0	100.5	0.0	6.4	61.5	92.0	100.0	100.0	100.0	25,136
2003	78.4	28.6	0.0	100.9	0.0	10.0	64.0	98.6	100.0	100.0	100.0	31,762
2004	76.5	29.9	0.0	100.5	0.0	4.7	60.0	93.0	100.0	100.0	100.0	31,034
2005	70.8	35.2	0.0	100.0	0.0	0.0	50.0	89.0	100.0	100.0	100.0	30,948
2007	76.0	31.5	0.0	100.0	0.0	0.0	58.2	98.0	100.0	100.0	100.0	31,509
2008	76.4	31.5	0.0	100.0	0.0	0.0	59.2	99.9	100.0	100.0	100.0	30,530
2009	76.0	31.8	0.0	100.0	0.0	0.0	57.0	99.0	100.0	100.0	100.0	28,164
2010	76.5	31.5	0.0	100.0	0.0	0.0	59.0	100.0	100.0	100.0	100.0	27,763
2011	77.0	31.3	0.0	100.0	0.0	0.0	60.0	100.0	100.0	100.0	100.0	27,618
All	75.7	31.2	0.0	100.9	0.0	0.0	60.0	95.0	100.0	100.0	100.0	322,250

The table shows distributional properties of the percentage ultimate equity fraction held by the firm's insiders, who are the officers and directors. All in the bottom row is the pooled sample. The sample is all private Norwegian firms with limited liability that have consistent accounting figures, multiple owners, positive sales and employment, that are not financials, utilities, subsidiaries, multi-sector firms, and that are not among the 15% smallest firms by assets and sales. The year 2006 is excluded due to missing data.

Table 4 The persistence of ownership concentration

	Herfindahl	Largest	CEO	Family	Insiders
Autocorrelation	0.945	0.942	0.914	0.872	0.885
p-value	0.000	0.000	0.000	0.000	0.000
N	210,000	210,000	210,000	210,000	210,000

This table shows the one-year autocorrelation coefficients of five different measures of ownership concentration. The p-value is the probability that the autocorrelation coefficient deviates from a true value of unity. Herfindahl is the sum of all squared ownership fractions, Largest is the percentage equity holding of the largest separate stockholder, CEO is the percentage equity holding of the CEO, Family is the largest percentage equity holding of individual stockholders in the firm related by blood or marriage, while Insiders is the aggregate equity holding of the firm's officers and directors. All equity holdings are ultimate, which is direct holdings plus indirect holdings through intermediaries. The sample is all private Norwegian firms from 2000 to 2011 (2006 excluded due to missing data) with limited liability that have consistent accounting figures, multiple owners, positive sales and employment, that are not financials, utilities, subsidiaries, multi-sector firms, and that are not among the 15% smallest firms by assets and sales.

Table 5 Frequency and magnitude of insider ownership dynamics

	Frequency				*Magnitude*			
Threshold			% of change cases		Positive change		Negative change	
±	No change	Change	Positive	Negative	Mean	Median	Mean	Median
0.0	80.4	19.6	100.0	100.0	20.2	14.7	-25.9	-17.6
2.5	84.0	16.0	79.1	83.3	25.3	20.0	-30.9	-24.6
5.0	85.6	14.4	71.3	75.2	27.7	24.0	-33.8	-28.0
10.0	88.3	11.7	56.8	61.8	32.7	30.0	-39.4	-33.3
33.0	94.2	5.8	25.3	32.8	48.2	45.0	-56.1	-50.0
50.0	98.0	2.0	6.2	13.6	70.6	66.7	-76.1	-70.0

This table shows the frequency and magnitude of changes in insider ownership for lower thresholds varying from 0 to 50 percentage units. The equity holdings are ultimate, which is the sum of direct holdings and indirect holdings through intermediaries. The sample is all private Norwegian firms from 2000 to 2011 (2006 excluded due to missing data) with limited liability that have consistent accounting figures, multiple owners, positive sales and employment, and that are not financials, utilities, subsidiaries, multi-sector firms, and that are not among the 15% smallest firms by assets and sales.

Table 6 Ownership levels and dynamics by owner type

Owner type	Average holding	No change, % of cases	*Mean (median)* Change	Positive	Negative	N
Family	71.2	56.7	6.0	6.2	5.8	258,366
			(0.0)	(0.2)	(0.0)	
State	45.0	28.6	2.8	2.2	3.5	2,085
			(0.0)	(0.0)	(0.0)	
Foreign	58.8	42.4	8.4	9.1	7.5	3,379
			(2.2)	(2.5)	(1.9)	
Unknown	41.3	31.6	6.8	6.8	6.7	55,302
			(1.1)	(1.1)	(1.0)	

This table shows the ownership dynamics when the firm's largest owner is classified as family, state, foreign, and unknown, respectively. Family is the largest percentage equity holding of individual stockholders in the firm related by blood or marriage. The magnitude of the change is measured in percentage units. All equity holdings are ultimate, which is the sum of direct holdings and indirect holdings through intermediaries. The sample is all private Norwegian firms from 2000 to 2011 with limited liability (2006 excluded due to missing data) that have consistent accounting figures, multiple owners, positive sales and employment, that are not financials, utilities, subsidiaries, multi-sector firms, and that are not among the 15% smallest firms by assets and sales.

Table 7 Ownership dynamics by buyer type and seller type

Year	All trades	Family → Family, %	State → State, %	Foreign → Foreign, %	Institutional → Institutional, %
Panel A: Threshold is 2.5 percentage units					
2001	1,463	99	79	73	82
2002	1,423	99	88	63	72
2003	2,277	99	82	85	72
2004	1,982	99	89	81	79
2005	1,890	99	88	80	95
2007	3,576	97	91	88	92
2008	1,680	97	88	76	91
2009	1,217	100	-	86	13
2010	1,258	99	-	91	14
2011	1,159	99	-	94	50
Average change	16.32	16.48	11.74	13.83	10.30
Median change	14.00	14.00	6.90	10.00	7.50
Std of change	20.10	20.21	17.18	17.22	13.28
Panel B: Threshold is 10.0 percentage units					
2001	769	99	50	53	89
2002	809	99	100	53	69
2003	1,287	99	50	76	50
2004	1,092	99	78	73	57
2005	1,118	99	91	77	100
2007	2,572	97	85	85	97
2008	906	96	100	67	85
2009	685	99	-	92	14
2010	698	100	-	94	0
2011	629	99	-	94	0
Average change	23.18	23.20	24.22	22.01	18.96
Median change	20.00	20.00	19.56	19.41	16.28
Std of change	25.53	25.52	28.65	23.66	20.82

This table shows how the size and dynamics of the largest equity holding in the firm depends on the owner's identity. A→B means a sale from owner type A to owner type B. All trades is the number of transactions conducted between all owner types. The numbers underneath a A→B heading shows the percentage of all transactions by type A that are made with type B. Family consists of individual equity owners in the firm who are related by blood or marriage. All equity holdings are ultimate, which is the sum of direct holdings and indirect holdings through intermediaries. A change is measured in percentage units. The sample is all private Norwegian firms from 2000 to 2011 with limited liability (2006 excluded due to missing data) that have consistent accounting figures, multiple owners, positive sales and employment, that are not financials, utilities, subsidiaries, multi-sector firms, and that are not among the 15% smallest firms by assets and sales.

Table 8 Bivariate correlation coefficients of ownership and firm characteristics

Panel A: Level		1	2	3	4	5	6	7	8	9	10
1	Herfindahl										
2	Largest	0.933									
3	CEO	0.508	0.475								
4	Family	0.510	0.484	0.429							
5	Insider	0.358	0.220	0.480	0.522						
6	Size	-0.116	-0.094	-0.139	-0.127	-0.126					
7	Risk	-0.032	-0.013	-0.051	-0.040	-0.073	-0.112				
8	Performance	0.075	0.054	0.024	0.070	0.095	0.076	-0.035			
9	Growth	-0.052	-0.049	-0.087	-0.043	-0.038	0.064	0.161	0.058		
10	Leverage	0.091	0.046	0.001	0.069	0.128	0.167	-0.072	0.019	0.107	
11	Liquidity	-0.045	-0.022	0.022	-0.061	-0.094	-0.200	0.136	-0.081	-0.069	-0.458
Panel B: Change		1	2	3	4	5	6	7	8	9	10
1	Herfindahl										
2	Largest	0.921									
3	CEO	0.171	0.159								
4	Family	0.280	0.255	0.306							
5	Insider	0.089	0.048	0.405	0.419						
6	Size	-0.004	-0.002	-0.006	-0.011	-0.011					
7	Risk	-0.001	-0.002	0.003	-0.005	-0.005	0.008				
8	Performance	0.002	0.002	-0.001	-0.002	0.002	0.062	0.007			
9	Growth	-0.007	-0.006	-0.004	-0.014	-0.007	0.134	0.226	0.227		
10	Leverage	-0.005	-0.009	0.025	0.026	0.028	0.018	0.000	-0.199	0.048	
11	Liquidity	0.002	0.004	-0.012	-0.015	-0.014	-0.011	0.042	0.046	-0.045	-0.342

This table shows pairwise coefficients of correlation for ownership and firm characteristics expressed in levels (panel A) and year-by-year changes (panel B). Herfindahl is the sum of all squared equity fractions in the firm, Largest is the equity fraction of the largest separate stockholder, CEO is the equity fraction of the CEO, Family is the equity fraction of individual stockholders in the firm related by blood or marriage, while Insider is the equity fraction of the firm's officers and directors. The equity fractions are ultimate (direct fraction plus indirect fractions through intermediaries). Size is sales in millions of NOK as of 2011, Risk is the standard deviation of sales during the past three years divided by average sales during the same period, while Performance is operating earnings divided by total assets. Growth is the geometric annual increase in sales during the three previous years, Leverage is total debt divided by total assets, and Liquidity is current assets divided by current liabilities. The sample is all private Norwegian firms with limited liability from 2000 to 2011 (2006 excluded due to missing data). The firms in the sample have consistent accounting figures, multiple owners, positive sales and employment, that are not financials, utilities, subsidiaries, multi-sector firms, and that are not among the 15% smallest firms by assets and sales. The variables are winsorized by 1% in the tails.

Table 9 Determinants of insider ownership: The base case

Variable	Hypo-thesis	OLS	FGLS
Insider ownership	+	0.905***	0.907***
Size	−	-0.935***	-1.066***
Risk	?	-1.696***	-1.902***
ROA	−	0.013***	0.008***
Growth	+	0.000	0.000
Leverage	?	1.165***	1.296***
Liquidity	+	-0.129***	-0.133***
Constant		14.605***	23.093***
Year indicators?		Yes	Yes
Industry indicators?		Yes	Yes
N		170,969	170,969
Firms		42,809	42,809
R^2		0.799	
Wald χ^2			0.000
R^2, Endogeneity test		0.000	0.000
Autocorrelation test		-0.110***	-0.113***
R^2, Autocorr. test		0.008	0.009

This table uses ordinary least squares (OLS) and feasible generalised least squares (FGLS) to estimate the determinants of insider ownership as hypothesized in the second column. The independent variables are in levels, and every independent variable is lagged one period. Standard errors are clustered at the firm level. Insider ownership is the ultimate equity fraction of the firm's officers and directors. Size is sales in millions of NOK as of 2011, Risk is the standard deviation of sales during the past three years divided by average sales during the same period, while Performance is operating earnings divided by total assets. Growth is the geometric annual increase in sales during the three previous years, Leverage is total debt divided by total assets, and Liquidity is current assets divided by current liabilities. The variables are winsorized by 1% in the tails. The sample is all private Norwegian firms with limited liability from 2000 to 2011 (2006 excluded due to missing data) that have consistent accounting figures, multiple owners, positive sales and employment, that are not financials, utilities, subsidiaries, multi-sector firms, and that are not among the 15% smallest firms by assets and sales.

Endogeneity test is an OLS regression of the residuals on the independent variables. Every independent variable of that regression has an insignificant t value. Autocorrelation test is a an OLS test of dynamic completeness of the conditional mean. We report the coefficient value, its significance, and the R^2. A statistically significant relationship at the 1%, 5%, and 10% level is denoted ***, **, and *, respectively.

Table 10 Determinants of the change in insider ownership: The base case

Variable	Hypothesis	OLS	FGLS
Δ Insider ownership	-	-0.167***	-0.127***
Δ Size	−	-0.007***	-0.007***
Δ Risk	?	0.298	0.369
Δ ROA	−	-0.009***	-0.009***
Δ Growth	+	-0.002	-0.001
Δ Leverage	?	-0.145	-0.060
Δ Liquidity	+	0.002	0.004
Constant		0.215	-0.199
Year indicators?		Yes	Yes
Industry indicators?		Yes	Yes
N		114,007	114,007
Firms		34,388	34,388
R^2		0.049	
Wald χ^2			0.000
Endogeneity test		0.000	0.000
Autocorrelation test		-0.072***	-0.108***
R^2, Autocorr. test		0.002	0.005

This table uses ordinary least squares (OLS) and feasible generalised least squares (FGLS) to estimate the determinants of changes in insider ownership as hypothesized in the second column. The independent variables are first-differenced and also lagged one period. Standard errors are clustered at the firm level. Insider ownership is the ultimate equity fraction of the firm's officers and directors. Size is sales in millions of NOK as of 2011, Risk is the standard deviation of sales during the past three years divided by average sales during the same period, while Performance is operating earnings divided by total assets. Growth is the geometric annual increase in sales during the three previous years, Leverage is total debt divided by total assets, and Liquidity is current assets divided by current liabilities. The variables are winsorized by 1% in the tails. The sample is all private Norwegian firms with limited liability from 2000 to 2011 (2006 excluded due to missing data) that have consistent accounting figures, multiple owners, positive sales and employment, that are not financials, utilities, subsidiaries, multi-sector firms, and that are not among the 15% smallest firms by assets and sales.

Endogeneity test is an OLS regression of the residuals on the independent variables. Every independent variable of that regression has an insignificant t value. Autocorrelation test is a an OLS test of dynamic completeness of the conditional mean. We report the coefficient value, its significance, and the R^2. A statistically significant relationship at the 1%, 5%, and 10% level is denoted ***, **, and *, respectively.

Table 11 Determinants of ownership concentration using alternative concentration measures

Variable	Hypothesis	(1) Herfindahl	(2) Largest	(3) Family	(4) CEO	(5) Insiders
Ownership concentration	+	0.950***	0.948***	0.889***	0.919***	0.905***
Size	−	-0.139***	-0.113***	-0.571***	-0.631***	-0.935***
Risk	?	-0.276***	-0.156***	-0.990***	-1.035***	-1.696***
ROA	−	0.004***	0.004***	0.011***	0.005***	0.013***
Growth	?	+0.002	-0.002	-0.001	0.000	0.000
Leverage	?	0.227***	0.140***	1.449***	0.059***	1.165***
Liquidity	+	-0.020***	-0.022***	-0.059***	-0.075***	-0.129***
Constant		3.736***	3.844***	19.740***	13.239***	14.605***
Year indicators?		Yes	Yes	Yes	Yes	Yes
Industry indicators?		Yes	Yes	Yes	Yes	Yes
N		170,969	170,969	166,313	170,969	170,969
Firms		42,809	42,809	41,937	42,809	42,809
R^2		0.898	0.894	0.783	0.841	0.799
Endogeneity test		0.000	0.000	0.000	0.000	0.000
Autocorrelation test		-0.054***	-0.048***	-0.082***	-0.0697***	-0.110***
R^2, Autocorr. test		0.003	0.002	0.005	0.004	0.008

This table uses OLS with clustered standard errors to estimate the determinants of ownership concentration as hypothesized in the second column. The variables are in levels and are lagged one period. Herfindahl is the sum of all squared equity fractions in the firm, Largest is the equity fraction of the largest separate stockholder, CEO is the equity fraction of the CEO, Family is the equity fraction of individual stockholders in the firm related by blood or marriage, while Insider is the equity fraction of the firm's officers and directors. The equity fractions are ultimate(direct fraction plus indirect fractions through intermediaries). Size is sales in millions of NOK as of 2011, Risk is the standard deviation of sales during the past three years divided by average sales during the same period, while Performance is operating earnings divided by total assets. Growth is the geometric annual increase in sales during the three previous years, Leverage is total debt divided by total assets, and Liquidity is current assets divided by current liabilities. The sample is all private Norwegian firms with limited liability from 2000 to 2011 (2006 excluded due to missing data). The sample consists of firms that have consistent accounting figures, multiple owners, positive sales and employment, that are not financials, utilities, subsidiaries, multi-sector firms, and that are not among the 15% smallest firms by assets and sales. In the column for the Herfindahl index every independent variable except Ownership is scaled upwards by one million. The variables are winsorized by 1% in the tails.

Endogeneity test is an OLS regression of the residuals on the independent variables. Every independent variable of that regression has an insignificant t value. Autocorrelation test is a an OLS test of dynamic completeness of the conditional mean. We report the coefficient value, its significance, and the R^2. A statistically significant relationship at the 1%, 5%, and 10% level is denoted ***, **, and *, respectively.

Table 12 Determinants of change in ownership concentration using alternative concentration measures

Variable	Hypothesis	(1) Herfindahl	(2) Largest	(3) CEO	(4) Family	(5) Insiders
Δ Ownership concentration		-0.084***	-0.078***	-0.073***	-0.112***	-0.167***
Δ Size	−	0.001	0.001	-0.003**	-0.003***	-0.007***
Δ Risk	?	0.009	0.002	0.104	-0.054	0.298
Δ ROA	−	0.000	-0.002	-0.001	-0.003	-0.009***
Δ Growth	+	-0.001*	-0.001	-0.002*	-0.001	-0.002
Δ Leverage	?	0.035	-0.114	-0.116	-0.512	-0.145
Δ Liquidity	+	0.001	-0.004	0.003	0.009	0.002
Constant		-0.303	-0.386	-0.021	-0.884	0.215
Year indicators?		Yes	Yes	Yes	Yes	Yes
Industry indicators?		Yes	Yes	Yes	Yes	Yes
N		114,007	114,007	110,582	114,007	114,007
Firms		34,388	34,388	33,532	34,388	34,388
R^2		0.009	0.008	0.018	0.024	0.049
Endogeneity test		0.000	0.000	0.000	0.000	0.000
Autocorrelation test		-0.014***	-0.012***	-0.020***	-0.015***	-0.072***
R^2, Autocorr. test		0.000	0.000	0.000	0.000	0.002

This table uses OLS with clustered standard errors to estimate the determinants of ownership concentration changes as hypothesized in the second column. The independent variables are in changes and are lagged one period. Herfindahl is the sum of all squared equity fractions in the firm, Largest is the equity fraction of the largest separate stockholder, CEO is the equity fraction of the CEO, Family is the equity fraction of individual stockholders in the firm related by blood or marriage, while Insider is the equity fraction of the firm's officers and directors. The equity fractions are ultimate(direct fraction plus indirect fractions through intermediaries). Size is sales in millions of NOK as of 2011, Risk is the standard deviation of sales during the past three years divided by average sales during the same period, while Performance is operating earnings divided by total assets. Growth is the geometric annual increase in sales during the three previous years, Leverage is total debt divided by total assets, and Liquidity is current assets divided by current liabilities. The sample is all private Norwegian firms with limited liability from 2000 to 2011 (2006 excluded due to missing data). The sample consists of firms that have consistent accounting figures, multiple owners, positive sales and employment, that are not financials, utilities, subsidiaries, multi-sector firms, and that are not among the 15% smallest firms by assets and sales. In the column for the Herfindahl index every independent variable except Ownership is scaled upwards by one million. The variables are winsorized by 1% in the tails.

Endogeneity test is an OLS regression of the residuals on the independent variables. Every independent variable of that regression has an insignificant t value. Autocorrelation test is a an OLS test of dynamic completeness of the conditional mean. We report the coefficient value, its significance, and the R^2. A statistically significant relationship at the 1%, 5%, and 10% level is denoted ***, **, and *, respectively.

Table 13 Determinants of insider ownership when ignoring atypical years

Variable	Hypo-thesis	OLS	FGLS
Insider ownership		0.916***	0.921***
Size	−	-0.451***	-0.421***
Risk	?	-0.926***	-0.906***
ROA	−	0.027***	0.026***
Growth	+	-0.003*	-0.003**
Leverage	?	1.018***	0.934***
Liquidity	+	-0.086***	-0.081***
Constant		11.396***	12.126***
Year indicators?		Yes	Yes
Industry indicators?		Yes	Yes
N		153,109	153,109
Firms		42,267	42,267
R^2		0.844	
Wald χ^2			0.000
Endogeneity test		0.000	0.000
Autocorrelation test		-0.068***	-0.075***
R^2, Autocorr. test		0.005	0.006

This table uses ordinary least squares (OLS) and feasible generalised least squares (FGLS) to estimate the determinants of insider ownership, ignoring the year 2005, when ownership concentration is atypically low. The expected relationships are specified in the second column. The independent variables are in levels, and every independent variable is lagged one period. Standard errors are clustered at the firm level. Insider ownership is the ultimate equity fraction of the firm's officers and directors. Size is sales in millions of NOK as of 2011, Risk is the standard deviation of sales during the past three years divided by average sales during the same period, while Performance is operating earnings divided by total assets. Growth is the geometric annual increase in sales during the three previous years, Leverage is total debt divided by total assets, and Liquidity is current assets divided by current liabilities. The variables are winsorized by 1% in the tails. The sample is all private Norwegian firms with limited liability from 2000 to 2011, but excluding 2005 (atypical year) and 2006 (missing data). The sample firm have consistent accounting figures, multiple owners, positive sales and employment, that are not financials, utilities, subsidiaries, multi-sector firms, and that are not among the 15% smallest firms by assets and sales.

Endogeneity test is an OLS regression of the residuals on the independent variables. Every independent variable of that regression has an insignificant t value. Autocorrelation test is a an OLS test of dynamic completeness of the conditional mean. We report the coefficient value, its significance, and the R^2. A statistically significant relationship at the 1%, 5%, and 10% level is denoted ***, **, and *, respectively.

Table 14 Determinants of insider ownership: The base-case using system GMM estimation

Variable	Hypothesis	(1)	(2)	(3)	(4)	(5)
Insider ownership	+	0.648***	0.722***	0.723***	0.694***	0.752***
Size	−	-0.371*	-0.364*	-0.391*	-0.178	-0.123
Risk	?	-0.283	-0.191	0.132	0.105	0.210
Performance	−	-0.012***	-0.011**	-0.014***	-0.002	-0.003
Growth	+	0.002	0.006**	0.009***	0.003	0.005**
Leverage	?	-1.096**	-1.058**	-3.004***	-0.710	-0.860*
Liquidity	+	0.005	-0.021	-0.032	-0.016	-0.025
Constant		36.871***	28.166***	29.343***	27.535***	21.641***
Year indicators?		Yes	2005	No	Yes	No
N		170,969	170,969	170,969	153,109	153,109
Firms		42,809	42,809	42,809	42,267	42,267
Wald Chiχ^2(8) test		0.000	0.000	0.000	0.000	0.000
AR(2) p-value		0.037	0.021	0.131	0.517	0.667

This table uses systems GMM to estimate the determinants of insider ownership as hypothesized in the second column. Every independent variable is lagged one period, and every independent variables except Insider ownership is differenced one year. Insider ownership is the equity fraction of the firm's officers and directors. The equity fractions are ultimate(direct fraction plus indirect fractions through intermediaries). Size is sales in millions of NOK as of 2011, Risk is the standard deviation of sales during the past three years divided by average sales during the same period, while Performance is operating earnings divided by total assets. Growth is the geometric annual increase in sales during the three previous years, Leverage is total debt divided by total assets, and Liquidity is current assets divided by current liabilities. The sample is all private Norwegian firms with limited liability from 2000 to 2011 (2006 ignored due to missing data) that have consistent accounting figures, multiple owners, positive sales and employment, that are not financials, utilities, subsidiaries, multi-sector firms, and that are not among the 15% smallest firms by assets and sales. Models (1)-(3) use the the full sample, while (4)-(5) exclude the year 2005. The variables are winsorized by 1% in the tails. A statistically significant relationship at the 1%, 5%, and 10% level is denoted ***, **, and *, respectively.

Table 15 Using system GMM to estimate the determinants of ownership concentration: Alternative concentration measures

Variable	Hypo-thesis	(1) Herfindahl	(2) Largest	(3) CEO	(4) Family	(5) Insiders
Ownership_{t-1}	+	0.896***	0.896***	0.811***	0.858***	0.648***
Ownership_{t-2}	+	0.050***	0.046***			
Size	−	0.434***	0.292**	-0.013	-0.086	-0.371*
Risk	?	0.435*	0.362	-0.731**	0.222	-0.283
Performance	−	-0.005**	-0.005**	-0.006*	-0.004	-0.012**
Growth	+	-0.003*	-0.003	0.003	0.002	0.002
Leverage	?	-0.556*	-0.486	-1.032**	-0.946***	-1.096**
Liquidity	+	-0.034	-0.047*	-0.008	-0.005	0.005
Constant		-2.894	0.104	1.623	12.477***	36.871***
Year indicators?		Yes	Yes	Yes	Yes	Yes
N		125,480	125,480	170,969	166,313	170,969
Firms		37,691	37,691	42,809	41,937	42,809
Wald Chi$\chi^2(8)$ test		0.000	0.000	0.000	0.000	0.000
AR(2) p-value		0.870	0.803	0.734	0.214	0.037

This table uses systems GMM to estimate the determinants of ownership as measured in five alternative ways. The predictions are specified in the second column. The independent variables except Insider ownership are differenced one year, and every independent variable is lagged one period. Herfindahl is the sum of all squared equity fractions in the firm, Largest is the equity fraction of the largest separate stockholder, CEO is the equity fraction of the CEO, Family is the equity fraction of individual stockholders in the firm related by blood or marriage, while Insider is the equity fraction of the firm's officers and directors. The equity fractions are ultimate(direct fraction plus indirect fractions through intermediaries). Size is sales in millions of NOK as of 2011, Risk is the standard deviation of sales during the past three years divided by average sales during the same period, while Performance is operating earnings divided by total assets. Growth is the geometric annual increase in sales during the three previous years, Leverage is total debt divided by total assets, and Liquidity is current assets divided by current liabilities. The sample is all private Norwegian firms with limited liability from 2000 to 2011 (2006 excluded due to missing data). The sample consists of firms that have consistent accounting figures, multiple owners, positive sales and employment, that are not financials, utilities, subsidiaries, multi-sector firms, and that are not among the 15% smallest firms by assets and sales. In the column for the Herfindahl index every independent variable except Ownership is scaled upwards by one million. The variables are winsorized by 1% in the tails. A statistically significant relationship at the 1%, 5%, and 10% level is denoted ***, **, and *, respectively.