The Role of Ownership Concentration Measures in Exploring the Ownership - Performance Relationship

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Abstract

While interconnection of performance and ownership structure holds an important place in studies of corporate governance, empirical research in this field has delivered contradicting results. The paper aims to provide evidence on how choice of ownership concentration measure used in the analysis may affect the empirical findings on the ownership – performance relationship. For this purpose, three categories of ownership measures are considered, and their behaviour patterns in Tobin's Q regression analysis on UK top companies sample is assessed. The major findings are two-fold. First, all models demonstrate significant positive relationship regardless of the ownership measure or control set used. Herfindahl index and concentration ratios perform similarly across the three sets of control variables. Second, concentration ratios consistently produce higher results in terms of both predicting power of the model and their own significance in the models, despite the weakest theoretical underpinning among the three categories. Banzhaf index, representing the power indices category, does not seem to perform in accordance with Herfindahl and concentration ratios. Furthermore, though it is less frequent to take leading positions in highest quality models, it is able to contribute to the model more.

SECTION 1

INTRODUCTION

The question of interconnection of such fundamental characteristics of the company as ownership structure and performance holds an important place in studies of corporate governance. Starting with Berle and Means, 1932, numerous papers put forward various arguments on why and in what way ownership structure may be linked to performance. As they point out, decision making process in a company depends on who and to what extent is able to exercise effective control over the company. Since shareholders are supposed to be ultimate controllers of the company, share ownership structure might be useful to

describe the control structure. Theoretical arguments on relationship with performance mainly developed around the two key characteristics of these structures: distribution of holdings, as proxy for the balance of control, and the identity of controllers, as factor that determines controllers' goals and capabilities (for overview, see the first half of Section 2).

While the developed theories called for validation on real data (Morck et al, 1988), empirical works failed to reach unanimity (for overview, see second half of Section 2). Partial theories and econometric considerations have been most commonly named among the possible reasons (e.g. Bøhren and Ødegaard, 2004). Recently, some papers have expanded their arguments with the choice of ownership structure measures, arguing that the way ownership is described to be incorporated into the research might as well be accountable for the differences in findings (e.g. Manjón-Antolín, 2004). Section 3 reviews theoretical and empirical works that provide insight into the behaviour of ownership concentration measures in exploring the relationship.

The purpose of the paper is to provide new empirical evidence on whether and in what way choice of measure of ownership structure may affect findings on the relationship between ownership and performance. The focus is a purely methodological issue of how different measures behave in exploring the relationship with regression analysis, without, to paraphrase Short (1994), forcing the assumption of its existence on the results. Three categories of ownership structure measures are included into the research: concentration ratios, Herfindahl index and power indices. Section 4 reports comparative analysis of their behaviour patterns in each of three Tobin's Q regression models on a sample of large UK firms. For each model, the key factors compared are: (i) overall explanatory power of the model, (ii) increase in the explanatory power as compared to reference model (none of the measures included), (iii) sign and significance level of the measure's regression coefficient, (iv) the subset of control variables which delivers significant levels. Finally, robustness of these factors to the three control sets is analysed for each measure.

The main finding is that although all models demonstrate strong positive relationship between performance and ownership regardless of the measure used, the choice of the measure affects the analysis. Out of the three categories, concentration ratios are more likely to deliver models with higher prediction power, although theoretically they are in the worst position to do so. Concentration ratios and Herfindahl index seem to behave in a similar pattern, as opposed to Banzhaf power index. Further, though the latter is unlikely to take leading positions in models with highest explanatory power, it is able to contribute to the model more.

SECTION 2

OWNERSHIP - PERFORMANCE RELATIONSHIP. LITERATURE OVERVIEW.

2.1 **THEORETICAL ARGUMENTS**

LOW OWNERSHIP CONCENTRATION: POWERFUL MANAGERS

Implications of diffuse ownership for performance are typically discussed in the context of agency theory[1] (e.g. Jensen and Meckling, 1976; Shleifer and Vishny, 1997; Fama and Jensen, 1983). Such papers interpret shareholders as principals and managers as agents, and argue that diffuse outside ownership creates free-riding problem for the company owners, who choose not to involve in costly monitoring[2]. This effectively puts control in the hands of management, whose primary interests are not necessarily the maximisation of company's profits.

In accordance with the agency theory, such setting gives rise to two kinds of agency costs : loss in principal's potential welfare due to agent's intentional failure to maximize it ("residual loss") and costs of measures to prevent residual loss, e.g. monitoring costs by principal (now on from Shleifer and Vishny, 1997). First, management can engage in direct expropriation of funds and assets, such as taking cash out in forms of excessive compensation, transfer pricing or gaining on stock fluctuations by manipulating stock price. Second, management can indirectly reduce the value of funds and assets. These activities may vary from shirking, coupled with efforts to conceal it, entrenchment and indulging in non-pecuniary "private benefits of control" to large-scale misallocation of funds (empire building, pet projects, unnecessary risk-taking and diversification). On the contrary, concentrated ownership eliminates the free-riding problem, makes monitoring more attractive and thus may be beneficial for performance.

However, low ownership concentration is not necessarily straightforward determinant of poor performance. There is a view that managerial discretion can also be restricted by a number of inside and outside mechanisms involved in corporate governance (Short, 1994; Fama and Jensen, 1983; Stulz, 1988). Incentive contracts and insider ownership are some

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[1] For overview of preceding "managerialist" theories on managerial utility maximisation and its implications for firm's performance, please see Short (1994), p 204.
[2] Although stricter monitoring may restrict managerial discretion and improve performance, a typical owner chooses to refrain from taking on monitoring costs which would otherwise overweigh increase in the value of her small holding. Analogically, neither is management disciplined by takeover market, as benefits of takeover are likely to be divided among the current shareholders in form of price premium (Shleifer and Vishny, 1997)

examples of in-house techniques to align management's actions with shareholder wealth maximization (Jensen and Meckling, 1976; Short, 1994). The free cash flow problem can be solved via introducing strict payout policy (Jensen, 1986). Among outside mechanisms, competition in managerial labor market and active takeover market are believed to discipline management (Jensen and Meckling, 1976) although neither of them operates costlessly: Demsetz and Lehn (1985) name information, transaction and regulatory costs of the latter.

HIGH OWNERSHIP CONCENTRATION: POWERFUL OWNER

Further, it is argued that high concentration of ownership in hands of one entity may adversely affect the performance (Pound, 1987; Fama and Jensen, 1983). To set aside "side" effects such as reduced liquidity and possibility of takeover, the controlling blockholder can expropriate funds from other stakeholders including employees and minor shareholders and compromise the performance of the company by pursuing her personal goals[1] (e.g. Crama et al., 2003).

Shleifer and Vishny (1997) argue the following typical ways of expropriation by a dominant shareholder. Firstly, it is extraction of non-pecuniary benefits from the company. Additionally, she can involve in paying herself special dividends or in targeted share repurchases. In case the controlling blockholder is an institution, it can use the control over the company in favour of other businesses including itself. Finally, indirect harm of the expropriation practices is reduced initiative and underinvestment into relationship-specific capital by managers, as well as reduced investments by outside investors.

IDENTITY OF OWNERS: WHEN OWNERS ARE MANAGERS

Since McEarchen (1975), which proposed to discern between outside owners and owners who are also managers, it has been argued that relationship between ownership structure and performance ought to only be studied when identities of owners are taken into account (Cubbin and Leech, 1983).

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[1] Such behaviour may be explained by differences in the incentives she faces from the incentives of other shareholders. Firstly, the expropriation allows compensating for lower diversification and other costs associated with being dominant shareholder (e.g. Bøhren, Ø. and Ødegaard, 2004). Secondly, the controlling blockholder might not be quite affected by low performance of the company, in case her control rights significantly exceed cash flow rights (Shleifer and Vishny, 1997). Finally, the problem is getting more acute when investors are of different type, for their preferences diverge. For example, a controlling blockholder may be more risk-loving rather than debtholders and may induce some undesirable risk on the latter (Shleifer and Vishny, 1997).

The main argument behind this is that identity of the shareholding party defines its incentives and capabilities to control, which ultimately affects the company's performance (Cubbin and Leech, 1983; Thomsen and Pedersen, 2004). In particular, shareholders may have interests different from (and sometimes conflicting with) the maximizing of shareholder value; Thomsen and Pedersen (2004) give a detailed overview of such interests for certain shareholder types[1].

In this "location of control" strand of literature, insider ownership has perhaps been discussed most; however, its relationship with performance has remained an unsettled question. On the one hand, the famous "convergence of interests" hypothesis by Jensen and Meckling (1976) argues that with growing insider ownership, the interests of management and shareholders become increasingly aligned, which results in higher performance. On the other hand, at high levels of managerial ownership, entrenchment is more likely, and its negative effect on performance questions the originally suggested linearity, along with the overall conclusion of benefits of insider ownership for performance (Fama and Jensen, 1983).

ENDOGENEITY OF OWNERSHIP

Another issue that needs to be taken into account is direction of causation. It is not uncharacteristic of studies of the relationship between ownership structure and performance to assume that ownership structure is exogenous, while this assumption is not necessarily correct. For example, Demsetz (1983) formulates the hypothesis that ownership structure of any particular firm is an endogenous outcome of shareholders' value-maximizing trading decisions. Since the balance of benefits and costs of ownership structure is a specific optimal point for each firm, there should be no detectable pattern of relatedness between structure and performance. Although somewhat neglected in the earlier papers, endogeneity of ownership has been explored in more detail in recent econometric-focused papers. For example, Cho (1988) stipulates direction of causation reverse to the traditionally assumed, by showing that Tobin's Q affects the insider ownership, and explains this by increased managerial willingness to retain equity in well-performing firms.

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[1] Some of the possible effects of shareholder identity on performance are briefly discussed in the Empirical Research Section, where corresponding control variables are described.

2.2 EMPIRICAL STUDIES

The above listed theoretical arguments, diverse and occasionally contradicting each other, call for validation by empirical evidence (Morck et al., 1988). The first part of this subsection shows that empirical research too failed to deliver consistent results (Short, 1994). The second part addresses possible reasons for the inconsistencies, of which choice of proxy for shareholder control may not be least important.

MAJOR FINDINGS

Generally, empirical papers tend to find either no or positive link between ownership concentration and performance, but a few have reported the negative link (Bøhren and Ødegaard, 2004[1]; Weigand and Lehmann, 1999).

Finding no relationship may be interpreted as evidence for endogeneity of ownership. In accordance with Demsetz hypothesis, Demsetz and Lehn (1985) acknowledge implications of ownership structure for performance but expect and find no relationship between the two in their empirical research. In a similar fashion, Demsetz and Villalonga (2001) report no statistically significant link, basing on a more sophisticated regression model. Using yet different techniques, Holderness and Sheehan (1988) find no difference in Tobin's Q of majority-owned and dispersely owned companies, while pointing out   influence of the identity of the dominant shareholder. McConnell and Servaes (1990) find no link between holdings of large blockholders and performance, reporting that it only becomes significant when combined with insider ownership.

Significant majority of the early works emphasized the positive link, reporting worse performance of firms with disperse ownership structure (e.g. Palmer, 1973 and followers of this study). Leech and Leahy (1991) show that concentration of control in the hands of the largest shareholder is favorable for performance. However, Crama et al. (2003) find positive influence of increased control exercised by second largest shareholder as opposed to the dominant shareholder, and explain this result by reduced opportunities for expropriation by the latter. Interestingly, Pederson and Thomsen 1997 find a positive link between concentration and Tobin's Q but, basing on a negative link with concentration squared, interpret it as the first fragment of a bell-shaped relationship.

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[1] Bøhren and Ødegaard (2004) show that the result is robust to several sets of instruments in two-step-least-squares regression models, which rule out possible wrong causality.

As for the insider ownership concentration, considerable evidence on its non-linear relationship with performance seems to support the theoretically argued trade-off between convergence of interests and entrenchment. Morck et al. (1988) use piecewise regression technique and find non-linear relationship[1], which is later replicated on a different sample by Gulger et al (2004). McConnell and Servaes (1990) too find significant non-linearity, but in the shape of inverted parabola, and with different turning points. However, in its structural model of the firm, Coles at al. (2002) formally show that the curvilinear relationship can be a result of work of some other exogenous forces; Cho (1998) demonstrates this empirically using two-stage-least-squares techniques.

Recently, earlier results have been claimed potentially biased and have been reconsidered using improved econometrical techniques. The most common finding of this generation of studies is proving the link much weaker, sometimes to the extent of non-existence (Bøhren and Ødegaard, 2004). However, some studies do not find statistically significant difference in results derived from models with and without the IV instruments (e.g. Edwards and Weichenrieder, 2004). At the other extreme, it is only after taking endogeneity into account that Manjón-Antolín (2004) finds significant relationship. As for direction of causation, some studies, e.g. Cho (1998), indeed show that ownership is driven by performance, not vice versa. Some yet do not support this view, e.g. Bøhren and Ødegaard, 2004.

POSSIBLE REASONS FOR INCONSISTENCIES

The obvious inconsistency of empirical findings may be interpreted as evidence that the link between performance and structure is just not existent in the form it is sought for. This very inconsistency, however, may also stem from issues less related to theory. Namely, Börsch-Supan and Köke (2002) claim that "empirical studies on corporate governance tend to be subject to a host of econometrical problems", of which Becht et al (2002) mention mistakes in sample selection, measurement in variables, missing variables and the way possible endogeneity is treated.

Sample bias may stem from selecting largest companies or companies from a specific industry only, which often is the case (Short, 1994). Moreover, most of studies use the US and the UK samples, and there is little evidence from continental Europe (Bøhren and Ødegaard, 2004), where legal environment and typical corporate governance system are different. Further, factors that may have influence on performance, e.g. capital structure,

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[1] Namely: strongly significant positive relation for insider ownership less than 5%, negative in the 5-25% range, and insignificantly positive beyond 25%.

firm's life cycle and competition in takeover market, are often omitted from analysis (Short, 1994).

The "third generation" of studies were motivated by necessity to address at least some of the issues listed above, by means of advanced econometric apparatus they employed. However, they too have methodological drawbacks, which may be the reason why they too failed to deliver consistent results (e.g. Edwards and Weichenrieder, 2004). Indeed, the results of these studies are sensitive to the choice of instruments they employ to handle the endogeneity and direction of causation, but so far there is no compelling theory to guide this choice (Bøhren and Ødegaard, 2004).

Given this massive critics, it might seem that the choice of measure of ownership structure does not play a major role in establishing the link between ownership and performance. The next section shows that though there is still little evidence on this issue (Manjón-Antolín, 2004), this may be not quite true.

SECTION 3
MEASURES OF OWNERSHIP STRUCTURE

CHOOSING A MEASURE

Expressing the degree of a shareholder's control with use of share in voting equity of the company is not straightforward[1]. First, there is no obvious way (and the measuring of voting weights is not exception) to demonstrate empirically that a party has a given amount of power, due to the qualitative and subtle nature of this notion (Morriss, 1987; Leech, 2002). Second, voting power distribution does not necessarily correspond to the distribution of voting weights. The same ownership stake can imply different degree of control over the company, depending on, in the first place, concentration of residual holdings and regulation of the voting process in the given corporate governance model. An appropriate ownership concentration measure ought to reflect these differences (e.g. Prigge, 2007).

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[1] Even before discussing ownership concentration measures, it is important to note the following. First, control structure is not fully reflected by owners-managers dichotomy alone, since virtually all stakeholders (debtholders, regulators, state, clients and counterparties) in some extent have their say over how the company is governed (e.g. Short, 1994). Second, measures of concentration do not convey information on location of control, while, as shown earlier, controllers' influence on performance may vary depending on the type of their identity. In many papers (including this one) these two considerations are taken into account by adding to the analysis relevant control variables.

Several methods have been used to evaluate ownership structure measures. Leech (2002) constructs certain verbal criteria and applies them to data. Prigge (2007) mentions two other ways of such evaluation: using a reference measure (e.g. representation of shareholder on the board), and analysing consistency of results in ownership - performance research. The empirical section of the paper follows the latter way. This Section defines measures and gives overview of their comparative position, in both theoretical and empirical studies; for summary of the empirical results, please also see Appendix I.

BINARY MEASURES

Early works starting with Berle and Means, 1932, mostly used binary variables (also called dichotomous variables, or fixed rules) to describe ownership structure (Short, 1994). Typically, such variable served as an indicator whether the company has a shareholding larger than a certain parameter (cut-off point). Thus, companies could be classified into a number of categories, the key two of them being "managerially controlled" MC and "owner controlled" OC. (e.g. MC if there are no holdings more than 10% and OC if there is holding of more than 30%, as in Palmer, 1973).

Easy to calculate and to collect data for, dichotomous variables might seem useful for identifying whether the company is subject to the Berle-Means problem of "separation of ownership from control" in its original sense of owners versus management. However, the choice of one fixed cut-off point for all companies in the sample is likely to be arbitrary. Furthermore, binary variables do not take into account the distribution of shareholdings[1] (Cubbin and Leech, 1983), the majority rule and the degree of monopoly on the voting power of the dominant shareholder (Prigge 2007).

Empirical works seem to support these arguments. Though Short (1994) reports numerous studies that achieve significant results using dummies, Lawrovsky (1984) illustrated the inconsistency of this measure by achieving different results with different cut-off points on the same data set. Moreover, Leech and Leahy (1991) showed that dummies do not produce significant results as opposed to continuous control type variables defined by their model. Several studies including Cubbin and Leech (1983) conclude that dichotomous measures are inappropriate as measures of control structure. For all these reasons, fixed rules have not been included into the empirical analysis of the paper.

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[1] There have been attempts to take the rest of distribution into account (Koke, 2002; Cubbin and Leech, 1983), but many of them still have unsolved problem of an arbitrary cut-off point (Short, 1994) and are not quite realistic (Cubbin and Leech, 1983).

CONTINUOUS MEASURES

The widely used continuous measures are shareholdings, weakest link principle measures WLP (mainly used for pyramid structures) and concentration ratios Cn (the cumulative share of n largest shareholders). All of these measures do correspond to the view that "... degree of control ... is by nature a continuous variable" (Cubbin and Leech, 1983) but should not be regarded as flawless proxies for degree of control. Firstly, they still ignore holdings distribution and the majority rule (Prigge, 2007). Secondly, equating a holding to the control exercised by the shareholder wrongly assumes linearity of power (Edwards and Weichenrieder, 2004). Unlike WLP and Cn, Herfindahl index, defined as sum of squared holdings of all shareholders, takes the distribution into account.

Though a lot of empirical works have been written using voting holdings / concentration ratios and Herfindahl, hardly a few of them explicitly focused on analysing relative performance of the measures. Demsetz and Lehn (1985) use C5, C20 and Herfindahl index in three regression models to establish link between ownership concentration and the profit rate with, but find no significant relationship for any of the measures. On the contrary, Weigand and Lehmann (1999) employ C1 and Herfindahl and find a statistically significant negative link for each. Bøhren and Ødegaard (2004) report the same findings, having included C1 and Herf simultaneously in the same model.

The work by Leech and Leahy (1991) is one of the first to focus on measures' relative ability to reveal the link between ownership and performance. In accordance with Cubbin and Leech (1983), Leech and Leahy (1991) describe ownership structure along two dimensions: dispersion of ownership and shareholder power, and find that both significantly influence performance. The proxies for the former are measures of concentration (C1, C5, C10 and Herfindahl index), and for the latter - "control type" dummies indicating whether the dominant shareholder holds certain threshold of voting power. Voting power is calculated using Cubbin-Leech probabilistic model or fixed cut-off rules, and the control type is called "variable" or "fixed" correspondently. As the regression results show, the best to explain performance variables are C20 for concentration[1] and variable rules for control type.

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[1] However, this does not necessarily show that C20 is superior to Herfindahl, as the latter is used in Cubbin-Leech model and therefore in the calculation of the variable control type, which is superior measure in its dimension.

POWER INDICES

A power index of a player in a voting game measures the frequency of winning coalitions that lose in case the player exits them, with each possible coalition being treated equally probable in certain sense[1] (Leech, 2002). If shareholders are modelled to represent a game-theoretical voting body, a power index of a shareholder would intuitively mean ability "to impose his will to the company through coalitions with other players." (Crama et al, 2003).

Shapley-Shubik and Banzhaf power indices have received considerable coverage in the recent ownership-performance studies, as their strong theoretical underpinning would suggest they are potentially able to fend off other measures of shareholder power. Unlike any of the above mentioned measures, they take into account the abovementioned characteristics of voting body, i.e. the majority rule and the distribution of votes (Leech, 2002). On the other hand, the underlying assumption of all possible coalitions being equally probable may be unrealistic. Furthermore, since the two indices base upon different coalition models, they may produce substantially diverging results on the same set of data, which leads to undesirable ambiguity (Leech, 2002). This is particularly true for the rather typical case of dealing with the problem of incomplete data within the oceanic game framework, in which unobserved shareholdings are taken to be held by an infinite number of players with infinitesimal shares (Leech, 2002; Edwards and Weichenrieder, 2004). Another drawback in practicality, these highly informative measures are quite difficult to compute (e.g. the exact computation of Banzhaf or Shapley-Shubik in a finite game is NP-complete task of the number of players. Leech has developed algorithms that fast the process).

Leech (2002) gives a detailed comparison of Shapley-Shubik (SS) and Banzhaf (B) indices relatively to their ability to represent shareholder power, and concludes that SS is less appropriate for this goal, both theoretically[2] and empirically (using appraisal criteria partially based on Berle and Means, 1932). Prigge (2007) gives contrary evidence, finding Shapley-Shubik index slightly preferable in the comparison of shareholder's influence measures against a reference measure. The study concludes however, that in general, in existing empirical studies of corporate governance neither index is dominating.

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[1] This section uses a rather crude definition sufficient for the purposes of the paper; for precise definitions, please see Leech 2002 or Dubey and Shapley 1979.
[2] The idea behind SS is that the prize of the winning coalition is distributed among coalition members in a bargaining process (power as a prize). On the contrary, B has no such association with bargaining, and bases on assumption that all members of winning coalition achieve a fixed benefit that can not be re-divided (power as influence). Further, the behavioural assumptions behind SS are criticised as unrealistic, since it is more usual for shareholders to choose non-divisible policies rather than divisible benefits by voting.

Even though empirical findings on comparison of power indices with other measures seem to be more favourable for the former, this lead is subtle. Crama et al (2003) create their own measure of voting power largely basing on Banzahf index[1] and find that these measures (Z-indices) of the largest and second largest shareholdings are strongly related to share price performance. Classical Herfindahl indices (measured for the largest and five largest shareholders as sum of squares of holdings), on the other hand, exhibit a weaker relationship. Manjón-Antolín (2004) employs C1, C5, Cubbin-Leech degree of control, Shapley-Shubik and Banzhaf indices of the largest shareholder and for each of the five finds a significant positive link with performance. Interestingly, the significant links are found only after endogeneity is taken into account. Edwards and Weichenrieder (2004) compare indices to shareholdings and WLP both theoretically and empirically, and find Shapley-Shubik superior in the ability to reveal the link[2].

SECTION 4
STATISTICAL ANALYSIS

As Section 4 attempts to illustrate, it is not obvious that the theoretical suggestions on comparative behaviour of the measures in exploring ownership-performance relationship are supported by empirical research on comparison, the only exception being, perhaps, considering dummies ineffective. Indeed, concentration ratios often perform not worse, or even better, than the more information-intensive Herfindahl index or than sophisticated power indices.

At the same time, the empirical results on their own seem too scarce and often contradictory to reveal any particular patterns in measures' behaviour. Expanding them with the related information available from empirical studies of the ownership-performance relationship, which often only employ one measure in their analysis, may be misleading. First, certain measures have been more often employed than others, but, as Prigge (2007) notes for the case of concentration ratios, this is most likely to be due to their relative computation simplicity and low requirements for availability of data, rather than quality-related considerations. Second, comparison of measures' behaviour across studies is hindered by the fact that virtually all papers employ their own samples, control sets,

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[1] Z-index is a Banzhaf index in a game with a finite number of large shareholders and a large number of small voters as opposed to the oceanic case (Crama et al, 2003)
[2] Strictly speaking, the study does not find unambiguous evidence of Shapley-Shubik being superior to WLP; however, it is certain about Banzhaf performing the worst.

econometric techniques, etc, whose cumulative influence on research may make the patterns of ownership measure's behaviour (if there are any) hardly detectable.

To sum up, more direct evidence on empirical comparison of measures' behaviour is required; the next section aims to provide some additional evidence.

4.1 SAMPLE

The sample includes 575 largest UK public firms[1] and is drawn from Amadeus database, as of 31st of July 2008. The firms of the sample are highly dispersed in terms of size, yet quite large, with median market capitalisation of over 178.5 mln USD (please see Table 1). The companies span the majority of industries (as measured by four-digit SIC); the largest groups of firms operate in manufacturing, renting (e.g. real estates) and trade. The grouping of companies by industry is based on SEC-codes and is described in Table 2.

Ownership data is gathered from BvDep Ownership Database accessible directly from Amadeus[2]. Total known holdings add up to 50% on average, and the largest known shareholding is 19% with standard deviation of 16%. This is consistent with the UK samples of e.g. Leech and Leahy, 1991 and Crama et al., 2003. Classification according to owner type illustrates that the largest aggregate holdings on average belong to financial intermediaries, such as mutual funds, pension funds and banks.

4.2 VARIABLES

INDEPENDENT VARIABLES: MEASURES OF OWNERSHIP CONCENTRATION

The model analyses three ownership concentration measures: concentration ratios, Herfindahl index and Banzhaf index. Concentration ratios range from C1, C3, C5, C10 to

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[1] The 575 companies are a subset of the initially gathered sample of 700 largest, according to annual operating revenues in 2007, public firms registered in the UK. Eight companies did not have valid data on ownership and were excluded. The remaining sample of 692 was truncated in 5 and 95 percentiles of the distribution of TQ, to avoid outliers that have been detected with use of descriptive statistics (as e.g. in McConnell and Servaes, 1990)

[2] Of ownership links, only active direct ones are taken into account, i.e. only actual first-tier stakes. The database also offers a possibility of using so-called total ownership stakes, partly calculated on the basis of information on related holdings. Due to ambiguity of these links (doubled data in case of subsidiaries or different sources of information frequently leads to cases of more than 100% of total stakeholdings) and secondary role of pyramid ownership structures in the "outsider" corporate governance system of the UK, particularly compared with the insider system common for most of the rest of the world (e.g. Gugler et al., 2004), this possibility was foregone.

C20; however, C1 consistently outperforms other ratios, and is the only to be included in the three regression models reported. Herfindahl index is approximated by the sum of squares of all reported holdings (Herf), i.e. its lower bound. Herfindahl index and concentration ratios are severly skewed, and were modified with logistic transformation (as in e.g. Demsetz and Villalonga, 2002).

Normalised Banzhaf index was calculated for the largest and second largest shareholders (B1 and B2 correspondently), with the use of the algorithms created by Dr Dennis Leech and kindly made public at the website: http://www.warwick.ac.uk/cgi-vpi/ipgenf.cgi (oceanic case, majority-adjusted rule).

CONTROL VARIABLES: IDENTITY OF OWNERS

To capture possible effects of owners' identities on performance, cumulative holdings for certain shareholder types are included into the model as control variables. Insider ownership is reflected by the variable *Insiders*, which accounts for aggregate holdings of employees and management.

Other types of shareholders identities incorporated in the research include: corporations, individuals, state, banks, other financial institutions, etc (see Table 1). The choice was guided by the following arguments. First, it is important to differentiate between individual and institutional shareholders. According to Pound (1988), the latter may be more efficient in monitoring that the former, although may at the same time ally with expropriating management and produce negative effects on performance. Further, Bøhren and Ødegaard (2004) suggest that institutional owners, as well as foreign investors, may invest to diversify their portfolios rather than to improve governance. Second, banks lending to companies they also hold equity stakes in may negatively affect performance by extracting rents, which is made possible by informational advantage gained during the due diligence process (Shleifer and Vishny, 1997). Third, state ownership may be expected to induce a social welfare maximising performance, sometimes at the expense of maximising equity value. The related evidence reported in Shleifer and Vishny (1997) indeed shows that state ownership correlates with inefficient performance (yet fails to serve the public).

CONTROL VARIABLES: INDUSTRY AND COMPANY SPECIFIC FACTORS

The industry is reported to influence the company's performance, via degree of competition in the market, entry barriers and technology peculiarities (Leech and Leahy, 1991). In order to take such influence into account without necessarily exploring each particular factor, the

paper follows Leech and Leahy (1991) in the suggestion that it would be sufficient that all of them be incorporated in the model through a nominal parameter assigned to the industry[1] (see Table 2).

The firm-specific factors incorporated into the model are listed below:

- *Age*, measured in years from company's incorporation date, is included in the model as a proxy for learning curve and accumulated reputation on the one hand, and for bureaucracy and entrenchment of management on the other (Leech and Leahy, 1991).
- *Size* is reported to influence performance with both benefits of increased possibilities for economies of scale and scope and negative bureaucracy effects (Besanko et al., 2004). Number of employees is included in the research as a proxy for the latter. In a given industry, cash flow can be a proxy for market power, capacity for financial extension and growth opportunities, which may all influence managerial discretion (Leech and Leahy, 1991). Market capitalisation is included in the model as an equity-related proxy of size, presumably more appropriate for research involving equity holdings (Demsetz and Lehn, 1985). All 3 size proxies are logarithmised.
- The firm's *beta* controls for the degree of systematic risk associated with the company.
- *Ratio of revenues derived from export* sales serves as proxy for exposure to global competition (as in Leech and Leahy, 1991), which is reported to have disciplinary effect on management[2].
- Board of directors is one of the major corporate governance mechanisms against managerial discretion (Becht et al., 2002). Efficiency of BOD is represented in the model by *size of BOD,* in accordance with the empirical findings on inverse relationship of the two (Bøhren and Ødegaard, 2004).

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[1] Generally speaking, SIC classification may be misleading, e.g. in case of conglomerates operating in several industries. It is also possible that the classification is out-of-date or, more generally, does not correspond to real markets (Besanko et al., 2004). In this research, industry dummies were constructed on the basis of SIC codes, according to the field the company operates in. Such approach also allowed creating balanced groups in cases when certain industries are more frequently encountered in the sample.

[2] For example, Short 1994 cites empirical results that show that manager-controlled firms have lower returns than firms with concentrated ownership only when the firm holds monopoly power, which implies that otherwise management is disciplined by market competition. This argument has been questioned by Jensen and Meckling (1976), and again confirmed by recent work by Nickel et al 1997. The study by Nickel et al also shows that financial market pressure and shareholder control can be substitutes for competition in terms of their governance effects.

- *Capital structure* is incorporated in the analysis due to several reasons. First, it may reflect the range of investment opportunities available to management: the range may be, for example, too narrow and negatively affect performance, when management is short of working capital necessary for everyday operations, due to excessively high level of current liabilities; it may also be too wide, when management has excessive cash at hands which gives them opportunity to indulge in empire building, pet projects and other ways of funds misallocation (Jensen, 1986). Second, debtholders can too execute control over the company and their power should be taken into consideration (Short, 1994). Finally, setting aside governance effects, choice of capital structure may affect performance in imperfect capital markets of the reality (Weigand and Lehmann, 1999). In the model, capital structure is represented by three proxies: assets to debt ratio, interest cover rate and liquidity ratio.

DEPENDENT VARIABLE

Performance measure used in this study is Tobin's Q, i.e. market value of the company over replacement cost of its assets. It is reported that choice of performance measure is important in investigating ownership-performance relationship (e.g., empirical research reported in Bøhren and Ødegaard, 2004 demonstrates that estimated relationship depends critically on the performance measure used), but there has been much controversy about which measure should be used. While earlier works typically employed measures that were based on accounting rates (e.g. return on assets and operating ratio), more recent works tend to prefer TQ. To sum up their argumentation, described in detail in Demsetz and Villalonga (2002), the major theoretical differences between TQ and accounting rates are time perspective and identity of the evaluators, and the accounting rates are considered to be unrealistic along both dimensions. TQ is forward-looking and incorporates investors' expectations of performance[1], while ROA reflects historical values that may already have lost their actuality, and is calculated by accountant restrained by accounting conventions. It must be mentioned however that denominator of TQ is usually approximated, and is approximated in this research, by book value of assets, which also leads to accounting-based sort of problems.

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[1] At the same time, investors' expectations may sometimes be influenced by irrational factors. Moreover, as Stulz hypothesis states, higher market value may reflect expectation not of better performance, but of bigger takeover premium, particularly during or immediately prior to takeover bid.

4.3 **EMPIRICAL RESEARCH**

INDEPENDENT VARIABLES: MULTICOLLINEARITY TESTS

In attempt to explore the data further, and to anticipate multicollinearity in the regression models, correlation coefficients have been computed for each pair of dependent variables (Table 3[1]). To mark the coefficients close to 1, strong correlations are produced by size proxies, namely by cash flow, market capitalisation and number of employees; and by capital structure characteristics, namely assets to liabilities and liquidity ratios, obviously due to similar definitions of the two. The relatively high correlation of board size with size of the company (from .332 with cash flow to .649 with market capitalisation) is intuitive. Of practical interest is correlation of controls with the measures: logistic transformation of Herfindahl is correlated with holdings by individual investors as high as .348. In this case, to avoid bias of the measure's coefficient in regressions, we will substitute it with Herfindahl index.

OWNERSHIP CONCENTRATION MEASURES: STATISTICAL TESTS OF INTERRELATION

A first step in comparing the measures, their values are tested on being different in statistically significant way. Pearson coefficients (Table 5) show significant and high correlation, in particular between Herfindahl and concentration ratios and within the group of concentration ratios. Banzhaf indices for the largest and second largest shareholders are strongly and negatively correlated. At the same time, Wilcoxon signed-ranks tests demonstrate that medians of all measures are significantly different, i.e. that the measures are not really parts of one homogeneous group of measures (Table 6; Table 4 for descriptive statistics).

However, in terms of their correlation with Tobin's Q, there is hardly difference across the measures (Table 7). As the Pearson correlation coefficients show, neither of the measures besides B1 (sig .071) is linked to performance at at least as low as 0.13 significance level. Unlike in Bøhren and Ødegaard, 2004, the data implies that if values of the measures are indeed linked to performance, the relationship is vague or offset by other factors.

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[1] Only those variables that took part in regressions and produce significant correlations of above 0.4 are reported. Correlations among the ownership measures are not reported, as they will be described in detail in the following subsection.

REGRESSION MODELS

Finally, the measures are compared in terms of their behaviour in regression models. Certain methodological ambiguity1 is resolved in accordance with Manjón-Antolín (2007): a set of control variables is created, then measures are added to it one-by-one, and the measures' regression coefficients are compared. Unlike in Manjón-Antolín (2007) however, the present research employs three control sets for comparison. Each contains the same categories of factors (size, capital structure, other firm-specific factors, industry, owners identities), but different proxies within the categories. Further, the factors compared across the measures within each model are not only significance levels and signs of the regression coefficients, but also: (i) overall explanatory power of the model, (ii) increase in the explanatory power as compared to reference model (none of the measures included), (iii) the subset of control variables which delivers significant levels. Robustness of these factors to the three control sets is also analysed for each measure. On the other hand, unlike in Manjón-Antolín, 2007, the research does not attempt to take into account possible endogeneity of ownership; this is due to methodological considerations that are addressed in Discussion Section.

RESULTS

Regression results for each of the three models are reported in Table 8. R squared of the models varies from 0.159 to 0.330, which is satisfactory e.g. compared to 0.14 - 0.27 in Bøhren and Ødegaard, 2004. The measures' regression coefficients are positive regardless of the model and measure used (B2 being understandable exception), and, in majority of cases, significant at least at 0.1 level.

As for robustness of performance of the control variables, their regression coefficients are quite consistent in terms of both sign and significance level, across the three control sets for each measure, as well as across the three measures. Among the significant variables are: size (proxies: cash flow and equity value), capital structure (proxy: interest cover), age, beta, size of BOD, industry dummies. Size of board of directors, and share of debt in capital structure, are in significant negative relationship with performance, while insider ownership shows significant positive link. Holdings by pensions and mutual funds are insignificant (and have not been included in the reported models), in accordance with suggestion that institutional investors may be passive controllers as they often invest mainly

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1   Comparative analysis of ownership concentration measures in the context of ownership – performance relationship, unlike analysis of the relationship itself, has rarely been the focus of empirical studies.

for diversification. These results for the control variables are consistent with empirical findings of e.g. Bøhren and Ødegaard, 2004.

At the same time, the relative performance of the measures in the models does not seem to be consistent. The first model has highest reference R squared of 0.317 (this may perhaps be attributed to its having largest set of significant variables among the three models), and C1 is able to contribute to it most of the three measures, while also achieving the highest level of significance among the measures' regression coefficients in the research (0.002). Herf_logi nearly matches this result[1], with 0.005 significance, and R Square of the model just a little less (0.327 vs 0.330). B1 is insignificant, while B2 is at 0.01 level, thus almost matching Herfindahl index. Model 2 has lowest R square across the three, as well as smallest number of significant controls. It demonstrates quite different evidence: B1 is most significant of all measures at .017 level and contributes to the model even more than C1_logi does in Model 1(if assessed relatively to the reference R squared), while C1_logi is hardly within 0.1 significance level, and Herf_logi is insignificant. Finally, the third model demonstrates excellent performance of all measures (at least 0.01 sig level), in particular of C1_logi and B1 (significance levels at least 0.005; contribution of approx. 0.013 to reference R Square of 0.227), with a slight lead of the former over the latter.

SECTION 5
CONCLUDING REMARKS

DISCUSSION

The reported results suggest that relative performance of the measures much depends, at the least, on control set employed in the analysis, and thus any absolute rankings would be misleading. However, qualitative analysis of the results allows to make certain observations. Plain share measure seems to be more effective in terms of both its own and overall model's significance than the more theoretically sophisticated Herfindahl and power indices, which is consistent with Prigge (2007) and Edwards and Weichenrieder (2004). Further, in each of the models, concentration ratios and Herfinahl index tend to deliver significance of proximate levels, and may be considered as behaving similarly, as opposed to Banzhaf indices. Finally, although Banzhaf is not present in the best models, it is able to contribute

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1 Strictly speaking, this result may be misleading, since the model contains variable Individuals ("aggregate holdings by individuals"), significantly correlated with Herf_logi with coefficient 0.348. However, substituting Herf_logi for Herfindahl index also yields highly significant positive coefficient.

most of other measures to the overall predicting power, and in the model with less informative control variables, which is consistent e.g. with Crama et al., 2003.

The significant pattern which can be traced unchanged from model to model is the strong positive relationship of ownership with performance. Thus in terms of the shape and strength of relationship found, choice of measure seems irrelevant in this particular research. However, any hasty conclusions based on interpreting this result as evidence for the existence of positive relationship between ownership structure and performance, are not advisable. The reported research, although consistent with certain other studies in findings on the relative performance of the measures, occasionally contradicts the same studies as regards the shape of ownership-performance relationship found. One of the possible reasons behind this are limitations of the empirical research employed in the paper: for example, the shape of relationship may depend on parameters that remain fixed in the reported models, such as e.g. the model of corporate governance. Due to construction of the sample, it does not reflect the important differences in the ownership-performance relationship across different corporate governance systems, while Gugler et al (2004) show that the system, including its legal environment, has more powerful effect on performance than ownership concentration does. Further, the sample may be biased, since it only contains large firms and one-shot rather than continuous observations (e.g. Short, 1994). Finally, the findings of the analysis are questionable due to the possible endogeneity of the independent variables in the regression, including the concentration of ownership itself. However, attempts to tackle this issue before the choice of instruments appropriate for use in ownership-performance regressions is theoretically justified are likely to involve arbitrary decisions and too result in biased findings.

CONCLUSION

The heterogeneity of empirical findings on the nature of relationship between ownership structure and performance has recently urged increased attention to the methodology of these empirical studies, and in particular to the choice of measure used to describe ownership structure. The paper aims to provide evidence on how choice of ownership concentration measure may affect empirical findings on the relationship.

The majority of ownership measures used in the modern empirical and theoretical research can be grouped into three main categories: concentration ratios, Herfindahl index and power indices. Concentration ratios (or, in other words, the cumulative share of n largest holdings) are generally the easiest to calculate, but may be a poor proxy for control as they ignore residual shares distribution and implies assumption of linearity of voting power.

Herfindahl index, defined as a sum of squares of all shareholdings, is free from these two particular shortcomings but may still prove to be inferior to power indices which, applied in corporate setting, measure specifically the ability of a shareholder to influence the company's policies via voting (Crama et al, 2003).

The empirical findings on relative behaviour of the measures in exploring ownership-performance relationship do not allow for any unequivocal conclusions, possibly due to still little research done in this direction (Manjón-Antolín, 2007). The paper employs Tobin's Q regression analysis to provide new empirical evidence on whether and in what way choice of measure of ownership structure may affect findings on the relationship between ownership and performance. The three measures are added, one by one, to three different sets of control variables, and their behaviour is then compared, the key factors being the sign and significance of regression coefficients and overall model explanatory power. The major finding of the research is that although all models demonstrate strong positive relationship regardless of the measure employed, the behaviour of the measures in the analysis, along with the results of the analysis, depend on the measure employed. First, despite being on the weakest theoretical footing, concentration ratios are often more efficient in terms of both predicting power of the model and significance level of their regression coefficient. Second, Herfindahl and concentration ratios seem to behave in accordance, delivering proximate results in the same set of control variables. Third, Banzhaf index, which represents the category of power indices, does not perform in a similar pattern with Herfindahl index and concentration ratios. It is less frequent to take leading positions in highest quality models, but is able to contribute to the model more.

More confident conclusions are precluded by the lack of comprehensive guidance to the choice of control variables, which remains a valid research question for future studies. Accordingly, the general methodological task of gearing the analysis tools to exploring the ownership-performance relationship more effectively is yet to be addressed. To be hoped, future studies on the methodology of ownership-performance link will extend their fields of interest from the single issue of ownership measure choice to other questions, including choice of control sets and choice of instruments for taking into account the possibility of endogeneity of ownership, and this more aggregate level approach will finally produce effective answers.

TABLES

Table 1. Firm-Specific Factors (Descriptive Statistics)

Factor	Variable	UOM	N	Mean	Median	St. Dev.
Market capitalisation to total assets	TQ		575	0.4382	0.3329	0.3233
Market capitalisation	Equity	USD, th	575	1,956,227	178,607	8,488,676
Cash flow	Cash Flow	USD, th	575	543,567	43,167	2,832,887
Number of employees	Employees		575	9,737	1,646	28,144
Age, since registration date	Age	yrs	575	36	22	35
Current assets to current liabilities	Assets to Debt		575	1.67	1.26	2.33
Current assets, excluding stocks, to current liabilities	Liquidity Ratio		575	1.27	0.97	2.11
Operating profits to interest paid	Interest Cover		575	24.52	4.88	88.67
Export revenues to total revenues	Export Rev.	$*10^{-2}$	575	52.35	49.77	35.91
Size of Board of Directors	BOD Size		575	8.53	8.00	2.50
Stock beta	Beta		575	0.46	0.39	0.47
Largest holding	C1	$*10^{-2}$	575	18.57	13.00	16.41
Sum of 5 largest holdings	C5	$*10^{-2}$	575	40.66	37.77	21.32
Sum of 10 largest holdings	C10	$*10^{-2}$	575	48.95	48.34	24.54
Sum of 20 largest holdings	C20	$*10^{-2}$	575	50.82	49.74	26.28
Banzhaf index for largest shareholder	B1		575	0.4811	0.3333	0.3124
Banzhaf index for second largest shareholder	B2		575	0.1299	0.1411	0.0929
Sum of squares of known holdings	Herf	$*10^{-4}$	575	843	429	1,284
Aggregate holdings of employees and managers	Insiders	$*10^{-2}$	575	0.13	0.00	0.69
Aggregate holdings by banks	Banks	$*10^{-2}$	575	6.01	3.02	9.74
Aggregate holdings by pension and mutual funds	–	$*10^{-2}$	575	15.41	11.33	14.72
Aggregate holdings by other financial companies	Financial inst, other	$*10^{-2}$	575	5.02	0.39	7.83
Aggregate holdings by industrial companies	–	$*10^{-2}$	575	7.85	0.00	16.32
Aggregate holdings by individuals	Individuals	$*10^{-2}$	575	10.94	1.77	18.47
Aggregate holdings by state	State	$*10^{-2}$	575	0.09	0.00	1.02
Aggregate holdings by research institutions	Research inst.	$*10^{-2}$	575	0.20	0.00	1.00

Table 2. Industries (Descriptive Statistics)

Industry	Variable	SIC codes	Freq.
Advertising activities	Advertising	7440	13
Consulting service	–	741,742,743,745	53
Financial intermediary	Finance	65 – 67	24
IT services	IT	72	27
Mining	Mining	10 – 14	23
Production of equipment	Equipment	29 – 35	60
Products manufacturing	Products	15–16, 24–28	81
Real Estate	Real Estate	70	29
Social Service	Social Service	55, 75 – 93	49
Trade	Trade	50–52	77
Transport	Transport	60 – 63	25
Miscellaneous	–	other	114
Total:			**575**

Table 3. Relationships of Dependent Variables (Pearson Correlation)

	ln(Equity)	ln(CF)	ln(Employees)	Beta	Assets to Debt	Liquidity Ratio	Export Sales	BOD Size	Industry: Finance	Owners: Individuals	Herf_logi
ln(Equity)											
ln(Cash Flow)	.456**										
ln(Employees)	.678**	.400**									
Beta	.484**	.278**	.442**								
Assets to Debt	-.054	-.099*	-.280**	-.078							
Liquidity Ratio	-.047	-.109**	-.244**	-.097*	.910**						
Export Rev.	.364**	.200**	.275**	.176**	.213**	.196**					
BOD Size	.649**	.332**	.484**	.328**	-.094*	-.077	.243**				
Industry: Finance	-.041	-.070	-.223**	-.029	.242**	.304**	-.034	-.031			
Owners: Individuals	-.234**	-.057	-.231**	-.126**	.034	-.028	-.172**	-.106*	.109**		
Herf_logi	-.273**	-.112**	-.169**	-.109**	.010	-.010	.019	-.106*	.029	.348**	

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

TABLE 4. Ownership Structure Measures (Descriptive Statistics)

	N	Mean	Std. Deviation	Minimum	Maximum
C1	575	18.57	16.41	.04	100.00
Herf	575	843	1,284	0	10,000
B1	575	0.4811	0.3124	0.0817	1.0000
B2	575	0.1299	0.0929	0.0000	0.3333

TABLE 5. Relationships of Ownership Structure Measures (Pearson Correlation)

	C1	C3	C5	C10	C20	Herf	B1	B2
C1	1.000	.911[**]	.819[**]	.660[**]	.606[**]	.952[**]	.598[**]	-.524[**]
C3	.911[**]	1.000	.972[**]	.858[**]	.803[**]	.862[**]	.371[**]	-.324[**]
C5	.819[**]	.972[**]	1.000	.943[**]	.896[**]	.775[**]	.204[**]	-.242[**]
C10	.660[**]	.858[**]	.943[**]	1.000	.985[**]	.632[**]	-.021	-.182[**]
C20	.606[**]	.803[**]	.896[**]	.985[**]	1.000	.583[**]	-.071	-.183[**]
Herf	.952[**]	.862[**]	.775[**]	.632[**]	.583[**]	1.000	.473[**]	-.414[**]
B1	.598[**]	.371[**]	.204[**]	-.021	-.071	.473[**]	1.000	-.771[**]
B2	-.524[**]	-.324[**]	-.242[**]	-.182[**]	-.183[**]	-.414[**]	-.771[**]	1.000

**. Correlation is significant at the 0.01 level (2-tailed).

TABLE 6. Wilcoxon Test of Ownership Structure Measures as Related Samples

	Herf - C1	B1 - C1	B2 - C1	B1 - Herf	B2 - Herf	B2 - B1
Z	-20.774[a]	-20.774[b]	-20.776[b]	-20.774[b]	-20.776[b]	-19.641[b]
Asymp. Sig. (2-tailed)	.000	.000	.000	.000	.000	.000

TABLE 7. Relationship between Ownership Structure Measures and Tobin's Q (Pearson Correlation)

C1	C1_logi	Herf	Herf_logi	B1	B2
0.034 (0.42)	-0.006 (0.88)	0.026 (0.53)	-0.020 (0.64)	0.075 (0.071)	-0.062 (0.136)

Significance levels are in parentheses.

TABLE 8. Comparative Analysis of Behaviour Patterns of Ownership Structure Measures in Tobin Q Regression Models

	MODEL 1					MODEL 2				MODEL 3				
	Ref	C1	Herf	B1	B2	Ref	C1	Herf	B1	Ref	C1	Herf	B1	B2
R^2	0.317	0.330	0.327	0.321	0.326	0.159	0.171	0.162	0.176	0.227	0.240	0.236	0.239	0.238
constant	-***	-***	-***	-***	-***	+***	+**	+***	+***	-***	-***	-***	-***	-***
SIZE														
ln(Equity)	+***	+***	+***	+***	+***					+***	+***	+***	+***	+***
ln(Cash Flow)						+*	+*	+*	+*					
ln(Employees)						-	-	-	-					
CAPITAL STR														
Assets to Debt										+	+	+	+	+
Liquidity Ratio						+	+	+	+					
Interest Cover	+**	+**	+**	+**	+**	+	+	+	+	+***	+***	+***	+***	+***
FIRM SPECIFIC, OTHER														
Age	-**	-***	-***	-**	-**									
Beta	-***	-***	-***	-***	-***	-	-	-	-					
Export Sales						+	+	+	+*					
BOD Size	-***	-***	-***	-***	-***					-***	-***	-***	-***	-***
INDUSTRY														
Advertising						-*	-*	-*	-**	-	-	-	-*	-*
Equipment	+***	+***	+***	+***	+***	+*	+*	+*	+*					
Finance										-*	-*	-*	-*	-*
IT										+***	+***	+**	+***	+**
Mining	+*	+*	+*	+*	+*	+*	+*	+*	+*					
Products						-	-	-	-					
Real Estate	-***	-**	-**	-**	-**	-	-	-	-					
Social Service										-	-	-	-	-
Trade						-	-	-	-					
Transport										-	-	-	-	-
OWNERS														
Insiders	+*	+*	+*	+*	+*	+	+	+	+*	+	+	+	+	+
Banks	-	-*	-*	-	-	+	+	+	+	-	-	-	-	-
Financial inst, other										+	-	-	+	+
Individuals	+	-	-	-	-									
Research inst.										-*	-	-	-*	-*
State	-	-	-	+	+	+	+	+	+					
OWNERSHIP CONCENTRATION														
C1_logi		+**					+				+**			
Herf_logi			+**					+				+**		
B1				+*					+*				+**	
B2					-*									-**
R^2	0.317	0.330	0.327	0.321	0.326	0.159	0.171	0.162	0.176	0.227	0.240	0.236	0.239	0.238

***. Correlation is significant at the 0.001 level.
**. Correlation is significant at the 0.01 level.
*. Correlation is significant at the 0.1 level.

ANNEXES

Annex 1. Overview of Empirical Results on Comparison of Measures of Ownership Structure.

	Dummies	C1	Cn	Herf	B	SS	CL
Dummies							
C1							
Cn		C20, as concentration: *Leech and Leahy 1991 (UK ; -)* C1 and C5 equally: *Manjón-Antolín 2004 (Spain; +)*	C20, as opposed to C5 or C10, as concentration: *Leech and Leahy 1991 (UK ; -)*				
Herf		Equally: *Weigand and Lehmann 1999 (Germany ; -)*	Herf, C5, C20 equally : *Demsetz and Lehn 1985 (US ; none)* C20, as opposed to Herf, as concentration: *Leech and Leahy 1991 (UK ; -)*				
B		Equally: *Manjón-Antolín 2004 (Spain; +)* C1 (as WLP): *Edwards and Weichenrieder 2004 (Europe, -)*	B and C5 equally: *Manjón-Antolín 2004 (Spain; +)*	B: *Crama et al 1999 (UK; - for B1; + for B2)*			
SS		Equally: *Manjón-Antolín 2004 (Spain, +)* C1 (as WLP) and SS equally: *Edwards and Weichenrieder 2004 (Europe, -)*	SS and C5 equally: *Manjón-Antolín 2004 (Spain; +)*		Equally: *Manjón-Antolín 2004 (Spain; +)* SS: *Edwards and Weichenrieder 2004 (Europe, -)*		
CL	CL, as control type: *Leech and Leahy 1991 (UK; +)*	CL and C1 equally: *Manjón-Antolín 2004 (Spain; +)*	CL and C5 equally: *Manjón-Antolín 2004 (Spain; +)*				

The table reports results of some empirical studies of comparative behaviour of ownership structure measures in regression analyses of ownership-performance relationship. The value in a cell shows: (i) which measure of the two was found superior, (ii) the study reporting the finding, (iii) country of the sample and (iv) sign of relationship found.

Legend

Dummies: binary measures of ownership concentration;
C1, Cn: respective concentration ratio;
Herf: Herfindahl index;
B: Banzhaf power index;
SS: Shapley-Shubik power index;
CL: Cubbin-Leech measure of voting power.

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