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CENTRO RICERCHE ECONOMICHE NORD SUD

FIRM PERFORMANCE WHEN OWNERSHIP IS VERY CONCENTRATED: EVIDENCE FROM A SEMIPARAMETRIC PANEL

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Title: FIRM PERFORMANCE WHEN OWNERSHIP IS VERY CONCENTRATED: EVIDENCE FROM A SEMIPARAMETRIC PANEL

First Edition: February 2015

Firm Performance when Ownership is very Concentrated: Evidence from a Semiparametric Panel

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Abstract
We consider the effect on performance of very large controlling shareholders, who are mostly organized in voting blocks and business groups, in a sample of Belgian listed firms from 1991 to 2006. Since the shape of the relation between ownership and firm value is a controversial issue in corporate finance, we use semiparametric local-linear kernel-based panel models. These models allow us not to impose a priori functional restrictions on the relation between ownership and performance. Our semiparametric analysis shows that the effect on performance varies depending on the size of ownership stakes and that there are departures from linearity.

Keywords: Semiparametric panel, Ownership concentration, Large shareholders, Firm performance, Family firms.
JEL Classification: C14; C23; G32.

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1 Introduction

Most of the literature that examines the impact of ownership structure on firm performance investigates the issue of managerial ownership in corporations with diffuse ownership. Giving managers a stake in the firm in the form of ownership is generally thought to align the interests of managers and dispersed shareholders, and to resolve the conflict of interest between them (see e.g. Berle and Means 1932, Jensen and Meckling 1976). A related issue is the effect of large shareholders. On one hand, they have the incentives to oversee the managers in order to maximize firm value and help overcome the agency problem (see Shleifer and Vishny 1986, Shleifer and Vishny 1997). On the other hand, there might also be costs associated with the presence of large shareholders. For instance, Stulz (1988) provides a theoretical framework, in which the relation between managerial ownership and firm value is concave. He shows that, beyond a certain point, managerial ownership has a negative effect on firm value, because managers have the ability to entrench themselves and block value-enhancing takeovers.

While there is no agreement on the direction of the relation between ownership and performance in the theoretical literature, there is also a controversy in empirical studies regarding its shape. A wide range of different functional forms have been entertained, see Demsetz and Villalonga (2001) for a summary.

In this paper we analyze the impact of ownership concentration on performance in a panel of Belgian listed firms, observed from 1991 to 2006 using semiparametric kernel-based local-linear pooled, random and fixed effects models, which can accommodate any type of functional form. We find that the effect of large shareholder ownership on firm performance is non-monotonic and that there is non-linearity captured by the nonparametric estimation. Our paper makes a number of contributions.

First, we use an innovative econometric technique, which has been developed recently and is not part of the standard toolbox in financial econometrics or empirical finance. We show how kernel-based local-linear semiparametric random effects (see e.g. Wang, Carroll, and Lin 2005), pooled and fixed effects (see Henderson, Carroll, and Li 2008) estimation can be performed in a unified framework. Moreover we derive closed-form solutions for the semiparametric random and fixed effects estimators, which avoid iterative procedures, are much easier to implement and lead to considerable gains in speed, particularly when the number of dependent variables is large. A semiparametric method allows us not to impose any a priori functional restrictions on the effect of ownership on firm performance, and including fixed effects allows us to deal with potential endogeneity of ownership concentration, our main variable of interest. To the best of our knowledge the only two papers that use a semiparametric approach to explore ownership and performance are Gorton and Schmid (2000) and Florackis, Kostakis, and Ozkan (2009). Gorton and Schmid (2000) fail to find evidence of non-linearities in two separate cross-sections of German firms in 1975 and 1986, but their results are based on fairly small sample sizes. More recently, Florackis, Kostakis, and Ozkan (2009) use a semiparametric pooled estimation for a sample of UK firms and find a non-monotonic association between executive ownership and performance with an alignment effect up to 15 percent ownership. Beyond that level they identify several possible turning points, but the effect is no longer statistically significant. While in panel data it is common practice to control for firm heterogeneity by including firm fixed effects, these papers fail to address this issue. Using nonparametric techniques is particulary relevant in this literature, since the shape of the relation between ownership and performance is very controversial. Indeed, almost every study seems to find a different shape, or impose a different functional form on the relation between ownership and performance. For instance, using a piecewise linear specification, Morck, Shleifer, and Vishny (1988) and Cho (1998) find a non-monotonic relation between managerial ownership and performance, while Hermalin and Weisbach (1991) report an inverse W shape, Cui and Mak (2002) find a W shape, McConnell and Servaes (1990) use a quadratic specification, Short and Keasey (1999) use a cubic specification, and Davies, Hillier, and McColgan (2005) a quintic form.[1]

Our second contribution is to provide evidence on very high levels of ownership concentration not considered before in the literature. We carefully construct a unique and detailed database of Belgian listed firms and the composition of their shareholdings for a period of sixteen years, from 1991 to 2006. The first quartile of share ownership of the leading shareholder is about 40 percent of voting rights, and the average shareholders holds

[1] See also Demsetz and Lehn (1985), Himmelberg, Hubbard, and Palia (1999), Demsetz and Villalonga (2001), and Chen, Ho, Lee, and Shrestha (2004), for a discussion of the use of non-linear specifications in corporate finance studies.

about 54 percent. This very high concentration is rather uncommon and it is a unique Belgian feature. While Belgium is an example of the continental European tradition of ownership concentration, there are specific legal mechanisms, such as the recognition of voting blocks and the prevalence of business groups, that exacerbate this concentration. Voting blocks are formal agreements amongst shareholders that are explicitly allowed by law. In this regard, Belgium offers a unique laboratory to examine the impact of powerful controlling shareholders, grouped in voting coalitions, on firm performance. Chen, Firth, and Xu (2009) observe comparable levels of ownership concentration in China, but this is very different from the Belgian case, since in China the largest shareholder is the State or one of its affiliates.

Our third contribution is that we depart from the mainstream literature on ownership and performance, which is based on U.S. firms and considers the share ownership of insiders who are usually managers and members of the board. These papers aim to test the hypothesis of Berle and Means (1932) on the separation of ownership and control and investigate whether managerial ownership provides an incentive for managers to maximize firm value and consequently reduce agency problems between them and dispersed shareholders. Instead, we focus on ownership concentration, because even though managerial ownership is present, the Belgian context is one of high levels of ownership concentration in the hands of a very small number of shareholders, who are mostly voting blocks and/or business groups. Thus the agency problem is not between managers and shareholders, but between large controlling shareholders and the smaller ones. Our paper differs also from most studies on ownership concentration, which are usually interested in the divergence between ownership and control and the deviation from one-share one-vote through devices, such as multiple class shares, pyramids, and/or cross-shareholdings (see for instance La Porta, Lopez-de Silanes, and Shleifer 1999, Claessens, Djankov, and Lang 2000, Faccio and Lang 2002, Bennedsen and Meisner Nielsen 2010). Our paper is related to Cronqvist and Fahlenbrach (2008), who investigate the role of large shareholders on corporate policy choices and performance in a sample of U.S. firms with blockholders. However, the size of blocks in their sample, which averages 9.6 percent, is much smaller than the average 54 percent in our Belgian listed firms.

Fourth, we contribute to the literature on the performance of family firms. In terms of the prevalence of family firms, Belgium is in line with the continental European tradition. Many studies analyze family firms for different countries and most of the results seem to support the view that family firms perform better than the others (see for instance, Anderson and Reeb (2003) and Villalonga and Amit (2006) for two different samples of U.S. firms, Sraer and Thesmar (2007) for a sample of French firms, and Maury (2006) for 13 Western European countries). The main argument in favor of the superior performance of family firms is that families are stable long-term investors who are there for several generations (see e.g. James 1999, Anderson and Reeb 2003). However, having a family as a controlling shareholder can also lead to poor performance if the family chooses to take advantage of its position, exchange profits for private benefits, and forgo profitable projects, see for instance Demsetz (1983). A number of studies report this adverse effect of ownership on performance in family firms, see for instance Bennedsen, Meisner Nielsen, Perez-Gonzalez, and Wolfenzon (2007) for Danish firms, Morck, Strangeland, and Yeung (2000) for a sample of Canadian firms, and De Angelo and De Angelo (2000) for a case study of the Times Mirror company.

Finally, we also explore the effect of ownership on performance for firms related to coordination centers and firms without such a link. Coordination centers were created in Belgium in 1982 to attract multinationals. These centers provide their group members with significant tax advantages. They were prohibited in 2008 (some continue to operate until 31 December 2010 under certain conditions), but were operating during our sample period.

The rest of the paper is organized as follows. Section 2 describes our data, and Section 3 is dedicated to the description of the large controlling shareholders. In Section 4 we present the estimation framework, Section 5 discusses the results, and Section 6 concludes.

2 Data

In this section, we discuss our sample selection, the construction of our ownership data from a number of different sources, as well as the sources we rely on for the other variables.

2.1 Sample selection

We focus on listed firms and exclude all financial firms, such as banks, insurance companies, common investment funds, companies active in or related to financial intermediation, as well as real estate firms. We also exclude some companies in coal mining and steel production, that were involved in a long liquidation process but were still listed and had incomplete data. We limit ourselves to firms with available balance sheet data and we end up with an unbalanced panel of 197 firms with 1697 firm year observations from 1991 to 2006.

2.2 Ownership data

In Belgium, the disclosure law of 1989 makes notifications to the Banking Commission of share ownership in listed firms mandatory for all shareholdings of at least 5 percent of voting rights. This threshold could be as low as 3 percent if the firm writes this into its statutes, see Appendix A for more details. Hence, ownership information is public, and it is featured in a number of databases: (1) BDPart at the Documentation and Statistics Department of the Brussels Stock Exchange records the current ownership of listed firms, but unfortunately it does not keep historical data; (2) the "Centrale des Bilans" database at the National Bank of Belgium (NBB) provides ownership data, but it only keeps track of Belgian shareholders; (3) "Belfirst" from Bureau Van Dijk starts recording ownership positions of listed firms in 1997, but this data is not of sufficient quality and it requires what amounts to an almost manual cleanup.[2] Due to these limitations with available databases, in order to carry out this study, we had to construct our own ownership data manually. We start in 1991, since there was a grace period of two years for some firms after the adoption of the law in 1989, but by the end of 1991 all firms were required to report their shareholdings. Our sample ends in 2006, since after 2006, the Belgian law regarding ownership notifications thresholds was modified. To collect ownership data, we rely on several sources: (1) annual reports of listed firms; (2) notifications available in the Documentation and Statistics Department of the Brussels Stock Exchange; and (3) yearly publications of the shareholdings of Belgian listed firms from the "Research and Strategy Department Equity Research" at ING bank

[2] For instance, for some firm year observations, shareholders appear twice with different shareholdings. In other instances shareholders disappear for a year and then reappear, and sometimes, after verification, it turned out that the data had not been updated.

(previously BBL). We proceed as follows. First, we use the firms' annual reports to collect ownership, as this provides us directly with year-end ownership stakes. Second, in case of missing annual reports, we resort to the hardcopy notifications from the Documentation and Statistics Department of the Brussels Stock Exchange, which record every change in ownership composition. This is more detailed, but less practical for the purpose of constructing year-end positions.

We use our ownership data to construct the main explanatory variable *Largest shareholder*, for each firm and each year. To identify the *Largest shareholder*, we aggregate the ownership stakes over all business groups and voting blocks, whenever they are present in the firm. Depending on the firm, this *Largest shareholder* can be an individual shareholder or a collection of shareholders gathered in a voting block and/or in a business group. Table 2 provides descriptive statistics for our main explanatory variable, *Largest shareholder with voting blocks*, as well as for *Single shareholder*, which considers every declared shareholder individually (this means that there can be more than one in each firm at each point in time), and *Largest shareholder without voting blocks*, which considers only the shareholdings of the largest shareholder, but without aggregating over voting blocks or business groups.

2.3 Other data

Following the literature on ownership and performance (see e.g. Morck, Shleifer, and Vishny 1988, McConnell and Servaes 1990, Short and Keasey 1999, Davies, Hillier, and McColgan 2005), we control for firm size, proxied by log of total assets, leverage, which we measure as short and long term debt, investment, proxied by capital expenditures, R&D as a proxy for investment opportunities, and investment in financial fixed assets, which is an important part of Belgian firms' investments. All these variables are weighted by total assets. Our dependent variable is firm performance, which we measure as market to book ratio (as a proxy for Tobin's q). All the accounting data we need to construct these variables come from two sources. For the 1991-96 period we rely on the NBB's "Centrale des Bilans" database[3] and for the 1997-2006 period, we use the "Belfirst" database of Bureau Van Dijk[4]. In order

[3]We use two CD-ROMs with the data from NBB: the first one, edited in 1995, contains annual accounts for 1991, 1992, and 1993; the second one, edited in 1998, contains annual accounts for 1994, 1995, and 1996.

[4]We use the year end CD-ROMs for every year from 1997 to 2006.

to merge data from all these different source, we identify firms by their VAT code.[5] Finally, in order to compute Tobin's q, we collect year-end market capitalization of listed firms from the Brussels Stock Exchange.

Table 2 provides descriptive statistics for the different variables we use in our analysis. On average, Tobin's q is about 1.17 for the whole sample. Family firms have the highest average Tobin's q with 1.47 against 1.02 for non-family firms, with a statistically significant difference while it is 1.2 and 1.16 for firms related to coordination centers and those without such a link, but the difference is not significant. There is no statistically significant difference between family, and non-family firms in terms of size, debts, investment in financial fixed assets capital expenditures, or R&D. Firms affiliated to a coordination center are significantly larger in terms of size, short and long term debt, investment in financial fixed assets, than those without such a link, while in terms of capital expenditures there is no statistically significant difference.

3 Large controlling shareholders

In the literature there are two opposing views on the outcome of ownership concentration on firm value. One line of reasoning is that ownership concentration is a way to provide shareholders with an incentive to monitor managers, which will result in a positive association between ownership concentration and firm value. Shleifer and Vishny (1986) provide a theoretical justification for this argument, which they confirm in their survey of corporate governance in 1997 where they state that large shareholders have the ability to "address the agency problem in that they have both a general interest in profit maximization, and enough control over the assets of the firm to have their interest respected" (Shleifer and Vishny (1997), p.754). This positive effect of ownership concentration on firm value is confirmed for instance in Gorton and Schmid (2000) for a sample of German firms, in Xu and Wang (1999) for Chinese firms or in Sarkar and Sarkar (2000) for a sample of Indian firms.

However, there is an alternative theory, which holds that ownership concentration might

[5]In order to identify listed firms from the Brussels Stock Exchange, we look up their names in the "Mémento des Valeurs" to obtain their VAT codes, which allows us to uniquely identify them on NBB or "Belfirst" sources. This avoids any possible confusion between firms with similar names.

be a way of diverting resources. This view is also expressed in Shleifer and Vishny (1997), p.759: "As ownership gets beyond a certain point, large owners gain nearly full control of the company and are wealthy enough to prefer to use firms to generate private benefits of control that are not shared by minority shareholders." Claessens, Djankov, Fan, and Lang (2002) argue that the valuation discount prompted by large entrenched owners in East Asian countries is not due to actions related to blocking value-enhancing takeovers, but is related instead to extraction of private benefits and direct expropriation through transfer of financial wealth to affiliated firms. Johnson, La Porta, Lopez-De-Silanes, and Shleifer (2000) refer to the transfer of resources out of a company to its controlling shareholders as "tunneling". They point out that this expropriation can take different forms, such as the transfer by the controlling shareholder of resources from the firm to his own benefit through self-dealing transactions; transfer pricing advantageous to the controlling shareholder; excessive executive compensation; loan guarantees to the controlling shareholder; expropriation of corporate opportunities, and so on. Denis and McConnell (2003) argue that the evidence from around the world indicates that the relation between ownership structure and firm performance varies both by country and by block holder identity but most often ownership concentration has a positive effect on firm value.

Usually a distinction is made between Anglo-Saxon corporations with diffused ownership, and continental European ones where ownership is concentrated in the hands of a small number of shareholders (see e.g. La Porta, Lopez-de Silanes, and Shleifer 1999, La Porta, Lopez-de Silanes, Shleifer, and Vishny 2000, Becht and Mayer 2001, Franks and Mayer 1995). While the level of concentration is much lower than in continental Europe, even in the U.S. and the U.K. large share stakes and dominant shareholders are not that uncommon (see e.g. Holderness and Sheehan 1988, Zwiebel 1995, Leech 2002, Demsetz 1983, Shleifer and Vishny 1986, Morck, Shleifer, and Vishny 1988, Holderness 2003, Cronqvist and Fahlenbrach 2008, Holderness 2009). The literature generally considers that ownership is concentrated if the largest shareholder holds more than 10 percent of voting rights. Sometimes that threshold is set at 20 percent (see for instance studies such as La Porta, Lopez-de Silanes, and Shleifer 1999, Claessens, Djankov, and Lang 2000, Faccio and Lang 2002). In this paper we are far above these figures, since the average shareholder holds about 54 percent of voting rights. In Belgian listed firms, there exist three types of shareholders: (1) direct stakes, which are holdings of single shareholders, either moral or physical persons; (2) business group blocks, which are the stakes of companies that are part of a business group which are subject to consolidation rules under Belgian law; (3) voting blocks, which are composed of direct stakes and/or group blocks. A voting block is a coalition, whose members are shareholders who officially declare that they act in unison. By joining a voting coalition, shareholders gain greater power in terms of voting rights. The share ownership of the largest shareholders is already very high, even without taking into account voting blocks.

There are two ways to assess ownership concentration: the percentage of share ownership, and the number of declared shareholders in the same firm. In terms of the number of shareholders, Figure 1 shows that there are very few different shareholders in the same firm. For instance, in about 15 percent of firm-year observations, there is only one single declared shareholder and in about 62 percent there are between one and four shareholders in the same firm. There is only one percent of firm-year observations with more than 18 shareholders and a maximum of 26. While the number of shareholders is small to begin with, these shareholders generally join together and form voting blocks. When we consider voting blocks, the number of shareholders decreases even more. Panel A of Table 1 shows that in 29 percent of firm-year observations there exists only one voting block, in 1.81 percent there are two, and in 0.32 there are three. Panel B of Table 1 shows that there is a single business group in almost 37 percent of firm-year observations, while two business groups locate in the same firm in only 9 percent of observations. Finally, it is only in less than 1 percent of observations, that there are as many as 4 or 5 business groups. These business groups can also join together and form voting blocks. According to Panel C of Table 1, in almost 8 percent of firm-year observations one business group is a member of a voting block and in almost 7 percent there are between 2 and 4 business groups that form voting blocks.

There are also interesting patterns in terms of percentage share ownership. Table 2 shows that the distribution of all shareholders taken individually without making any distinction between them has an average of about 14 percent. However, this average jumps to

43 percent, when we consider only the largest shareholder in the firm but without taking into account voting blocks or business groups formations (Table 2). These figures are even higher when we further take into account voting blocks, and the average increases to around 54 percent.

The distribution of the large controlling shareholders shows that shareholders form voting blocks in order to gain more control. This is obvious if we compare Figure 3a, where we take into account all individual share holdings in the firm, to Figures 3b and 3c, in which we consider only the first largest shareholders. The histogram of Figure 3c shows the distribution of large controlling shareholders when we further take into account business groups and voting blocks. There are concave bumps in the distribution of share ownership that corresponds to thresholds that are meaningful in terms of control. Figure 3c shows a significant concave bump in the 50-55 percent range, which corresponds to absolute majority. There is also a bump in the 25-30 percent range, which could be due to the Belgian legislation on tax reduction on dividends. Indeed, according to Belgian law when a shareholder reaches 25 percent of voting rights she/he benefits from an exemption of taxes on dividends. The last bump is at 75 percent, which is the threshold required by Belgian law to modify the statutes of the firm. A comparison of Figure 3b with Figure 3c reveals that while the distribution of share ownership is different, bumps are found at the same thresholds, but with different magnitudes.

4 Estimation framework

We estimate a nonparametric panel, because this gives us the flexibility not to impose any a priori functional form on the variables of interest, while simple econometric models assume functional forms that are either linear, piecewise linear with arbitrary cut-offs, or sometimes quadratic or of even higher order. While economic theory often predicts the sign of the relation between variables, it rarely provides predictions about its shape. The nonparametric methodology allows us to be agnostic about the functional form of the relation between the variables of interest. This is of particular relevance for ownership and performance, where there is little agreement about the functional form.

For the sake of comparison, we first use parametric panel data models, and we estimate pooled ordinary least-squares (OLS), fixed effects, and random effects models of the impact of ownership concentration on firm performance and other control variables. The basic pooled OLS model is:

$$Y_{it} = \mu_0 + Z_{it}\theta + X_{it}\beta + \epsilon_{it}, \quad t = 1, \ldots, T_i, \text{ and } i = 1, \ldots, n, \tag{1}$$

where Y_{it} is performance, Z_{it} is shareholdings of the largest controlling shareholders, X_{it} includes other control variables, such as firm size, short and long term debt, investment in financial fixed assets, capital expenditures, R&D, and a set of time dummies, μ_0 is the intercept, θ and β are coefficients, ϵ_{it} is an error term, and we have an unbalanced panel with T_i time series observations for firm i.

We also estimate both fixed and random effects models, which corresponds to different assumptions on the error term, $\epsilon_{it} = \mu_i + \varepsilon_{it}$, where ε_{it} is assumed to be homoscedastic and uncorrelated over time. Under the random effects assumption, μ_i is a time invariant firm-specific zero mean homoscedastic random term, which is independent of ε_{it}. In the fixed effect case, the model changes to:

$$Y_{it} = \mu_i + Z_{it}\theta + X_{it}\beta + \varepsilon_{it}, \tag{2}$$

where μ_0 is omitted, as it is subsumed by the non-stochastic firm-specific intercepts μ_i.

We are interested in the following partially linear panel specification:

$$Y_{it} = \theta(Z_{it}) + X_{it}\beta + \mu_i + \varepsilon_{it}. \tag{3}$$

where $\theta(z)$ is now a potentially non-linear mean function, and its first derivative, $\frac{\partial\theta(z)}{\partial z}$ can be interpreted like a parameter: if $\theta(z)$ is linear, $\frac{\partial\theta(z)}{\partial z}$ is constant, and we are back in the parametric case. Our specification is a semiparametric one, where the effect of ownership Z_{it} is nonparametric, while control variables X_{it} enter linearly. This avoids the well-known curse of dimensionality, and focuses attention on the object of interest, which is the potentially non-linear relation between ownership and performance.

There has been recent interest in nonparametric panel data models in the econometric literature. For instance, using semiparametric fixed estimation, Kan and Lee (2012) study the effect of weight on wages, controlling for height, Zhou and Li (2011) analyze the effect of development on inequality, while Chen and Dong (2012) use such a model in the context of trade. Yet, the idea of carrying out nonparametric and semiparametric estimation in the context of panel is not new. Early references include Ullah and Roy (1998), who discuss various estimators. In the case of the random effect, Henderson and Ullah (2005) put forward feasible versions of some of the nonparametric random effects estimators considered in Ullah and Roy (1998), but they do not consider the semiparametric case. In the remainder of this section, we focus on a local linear kernel-based approach.

4.1 Random effects

We first analyze the random effects case when $\epsilon_{it} = \mu_i + \varepsilon_{it}$ and ε_{it} is assumed to be homoscedastic with variance σ_ε^2, uncorrelated over time, and independent of the time-invariant firm-specific zero mean homoscedastic random term μ_i, whose variance is σ_μ^2. The variance covariance matrix for cluster i takes the form $V_i = \sigma_\varepsilon^2 I_{T_i} + \sigma_\mu^2 e_{T_i} e'_{T_i}$, with inverse $V_i^{-1} = \sigma_\varepsilon^{-2}\left(I_{T_i} - \frac{\sigma_\mu^2}{\sigma_\mu^2 + T_i\sigma_\varepsilon^2} e_{T_i} e'_{T_i}\right)$ and diagonal $diag(V_i^{-1}) = \left(1 - \frac{\sigma_\mu^2}{\sigma_\mu^2 + T_i\sigma_\varepsilon^2}\right) I_{T_i - 1}$, where I_n is the identity matrix of dimension n, and e_n is an n-dimensional column vector of ones. Lin and Carroll (2000) suggest that in the case of a kernel-based nonparametric local polynomial regression with clustered data, unlike in the parametric case, it is best to ignore the cluster correlation. Lin and Carroll (2001) consider semiparametric regression in the clustered case, where the variable in the nonparametric part varies only at the cluster level, but is the same for all individuals within the cluster. The results are very different if the nonparametric variable varies at observation level. Wang (2003) is the first to show how to incorporate cluster correlation into the nonparametric estimation to achieve higher efficiency. We present the estimation procedure proposed by Wang, Carroll, and Lin (2005) for the efficient estimation of a semiparametric regression with cluster level random effects, which we combine with the one-step expression of Lin, Wang, Welsh, and Carroll (2004) for the nonparametric case.

The objective function of the semiparametric local linear kernel random effect estimator is a kernel-smoothed version of

$$L_i = -\frac{1}{2}(Y_i - \theta_i - X_i\beta_R)'V_i^{-1}(Y_i - \theta_i - X_i\beta_R),$$

where, at the level of cluster i, L_i is the loglikelihood, $Y_i = (Y_{i1}, \ldots, Y_{i,T_i})$ the dependent variable, $X_i = (X_{i1}, \ldots, X_{i,T_i})$ the explanatory variables with a linear effect and associated parameter β_R, and $\theta_R = (\theta_1, \ldots, \theta_n)$ with $\theta_i = (\theta_{i1}, \ldots, \theta_{i,T_i})$ is the nonparametric function estimate, which can be estimated using the following algorithm, given in Wang, Carroll, and Lin (2005):

Step I: Given an initial value of β_R, solve the first order condition

$$\sum_{i=1}^{n}\sum_{t=1}^{T_i} K_h(Z_{it} - z)G'_{it}(z)V_i^{-1}[Y_i - \mu^*] = 0, \tag{4}$$

where $G_{it}(z)$ is a T_i by $(q+1)$ matrix of zeros except that for the local linear estimator, the t-th row is $g_{it}(z,h)' = [1, \{(Z_{it} - z)/h\}']$, the s-th element of μ^* is $X'_{is}\beta_R + \mathbb{1}_{\{s=t\}}\{\hat{\alpha}_0 + \hat{\alpha}_1(Z_{it} - z)/h\} + \mathbb{1}_{\{s\neq t\}}\tilde{\theta}_R(Z, \beta_R)$, where $\tilde{\theta}_R$ is the current estimate of θ_R. With q variables in the nonparametric part of the model, the estimation uses a product kernel $K_h(v) = \prod_{j=1}^{q} h_j^{-1}k(v_h/h_j)$, where $k(.)$ is a univariate kernel, and $h = (h_1, \ldots, h_q)$ is the vector of bandwidths. We use the Gaussian kernel, and thus the bandwidth is simply the standard deviation of the Gaussian kernel. Given the current estimate of $\tilde{\theta}_R$, the updated estimate is given as $\hat{\theta}_R(z, \beta_R) = \hat{\alpha}_0(z, \beta_R)$.

Step II: The coefficient β_R of the parametric part of the model is estimated by a profile likelihood approach. In Step I, we computed the optimal nonparametric function θ_R for any given value of β_R. In Step II, we have to find the optimal β_R that takes into account both the direct effect of β_R on the criterion and also its indirect effect, via θ_R, $\frac{\partial\hat{\theta}_R}{\partial\beta_R}$. Thus, given an estimate of $\frac{\partial\hat{\theta}_R}{\partial\beta_R}$, β_R can be found by solving the following optimization problem:

$$\min_{\beta_R}\sum_{i=1}^{n}(Y_i - \hat{\theta}_R - X_i\beta_R)'V_i^{-1}(Y_i - \hat{\theta}_R - X_i\beta_R).$$

The method consists in iterating between step I and step II until convergence.

Instead, we apply Proposition 1 of Lin, Wang, Welsh, and Carroll (2004), who show that the solution to Equation (4) for θ_R, the seemingly unrelated kernel estimator of Wang

(2003) obtains in closed-form as $\hat{\theta}_R = W_R(Y - X\beta_R)$, with smoother

$$W_R = \left[I_Q + K_w(\tilde{V}^{-1} - \tilde{V}^d)\right]^{-1} K_w \tilde{V}^{-1}, \tag{5}$$

where $\tilde{V} = diag(V_1, \ldots, V_n)$ is block diagonal, while $\tilde{V}^d = diag(diag(V_1^{-1}), \ldots, diag(V_n^{-1}))$ is diagonal. Thus $\tilde{V}^{-1} - \tilde{V}^d$ has a zero diagonal and $\hat{\theta}_R$ is a column vector containing the evaluation of the nonparametric function at all design points, and given

$$K_{wh}(z)' = \delta_1' \{\tilde{T}'(z)\tilde{V}^d K_{dh}(z)\tilde{T}(z)\}^{-1}\tilde{T}'(z)K_{dh}(z),$$

we define the Q-dimensional square matrix $K_w = (K_{wh}(Z_{11}), \ldots, K_{wh}(Z_{1T_1}), \ldots, K_{wh}(Z_{nT_n}))'$, where δ_1 is a $(q+1)$-dimensional column vector, which is one in the first element and zero otherwise, $K_{dh}(z) = diag(K_h(Z_{11}-z), \ldots, K_h(Z_{nT_n}-z))$, and $\tilde{T}(z) = (T_{11}'(z), \ldots, T_{nT_n}'(z))'$ is a Q by $(q+1)$ matrix, with $Q = \sum_{i=1}^n T_i$ and $T_{it}(z) = (1, (Z_{it} - z), \ldots, (Z_{it} - z)^q)$. Using the linearity of $\hat{\theta}_R = W_R(Y - \hat{\beta}_R X)$, we get an explicit solution for the derivative $\frac{\partial \hat{\theta}_R}{\partial \beta_R} = W_R$, which can be used to find the solution of Step II in matrix notation:

$$\hat{\beta}_R = \left(X'[I_Q - W_R']\tilde{V}^{-1}[I_Q - W_R]X\right)^{-1} X'[I_Q - W_R']\tilde{V}^{-1}[I_Q - W_R]Y,$$

where $X = (X_1', \ldots, X_n')'$ is a Q by d matrix with the linear regressors, and $Y = (Y_1', \ldots, Y_n')'$ is a Q-dimensional column vector of the dependent variable. This expression can then be plugged into the equation of $\hat{\theta}_R$, and along with Equation (5), it delivers the final expression of the semiparametric kernel-based random effects estimator of the nonparametric function. This leaves open the problem of the variance covariance matrix. We follow the suggestion of e.g. Lin and Carroll (2006), and we do a first run with the working independence (WI) assumption $V_i = \sigma_\varepsilon^2 I_{T_i}$, which delivers the pooled semiparametric estimator. In that case $\tilde{V}^{-1} = \tilde{V}^d = \sigma_\varepsilon^2 I_Q$, and we have $W_P = K_w$, where the expression of K_w obtains by leaving out $\tilde{V}^d$ in the equation of $K_{wh}(z)'$. The pooled estimators thus obtains as

$$\begin{aligned}
\hat{\beta}_P &= \left(X'[I_Q - K_w'][I_Q - K_w]X\right)^{-1} X'[I_Q - K_w'][I_Q - K_w]Y \\
\hat{\theta}_P &= K_w(Y - X\hat{\beta}_P).
\end{aligned}$$

We then form $\hat{V}_i = \hat{\sigma}_\varepsilon^2 I_{T_i} + \hat{\sigma}_\mu^2 e_{T_i} e'_{T_i}$, to estimate V_i, and based on the residuals from the pooled estimator, we compute estimators $\hat{\sigma}_\varepsilon^2 = \frac{1}{\sum_{i=1}^n (T_i-1)} \sum_{i=1}^n \sum_{t=1}^{T_i} \hat{\epsilon}_{it}^2$ and $\hat{\sigma}_\mu^2 = \frac{1}{n} \sum_{i=1}^n \sum_{s\neq t}^{T_i} \frac{1}{T_i(T_i-1)} \hat{\epsilon}_{is}\hat{\epsilon}_{it}$ of σ_ε^2 and σ_μ^2, respectively, where $\hat{\epsilon}_{it} \equiv Y_{it} - \bar{Y}_i - (\hat{\theta}_{it} - \bar{\hat{\theta}}_i) - (X_{it} - \bar{X}_i)'\hat{\beta}_P$, $\bar{Y}_i$, $\bar{X}_i$, and $\bar{\hat{\theta}}_i$ are cluster averages of the dependent variable, the linear regressor and the nonparametric function estimate, respectively. We can now rerun the estimation with variance covariance $\hat{V}_i$ to derive the final estimator. This is akin to the feasible GLS approach that is commonly used for the parametric random effects estimator. We refrain from iterating also on the variance components, as suggested in Lin and Carroll (2006), since we do not expect that this would produce major improvements.

The asymptotic distribution of the estimator of the parametric part of the model is as follows, (see e.g. Wang, Carroll, and Lin 2005), where we have further used the fact that $\frac{\partial\hat{\theta}_R(z,\beta_R)}{\partial\beta_R} = -W_R X$:

$$\sqrt{n}(\hat{\beta}_R - \beta_R) \sim N\left(0, E\left[X'\left(I - W_R\right)' \tilde{V}^{-1}(I - W_R)X\right]\right).$$

The variance of the estimator of the nonparametric part of the model is as follows, (see e.g. Wang 2003):

$$Var[\hat{\theta}_R(z) - \theta_R(z)] = \frac{\kappa}{(nh_1 \dots h_q)} \sum_{i=1}^n \frac{1}{\sigma_\varepsilon^2} \left(1 - \frac{\sigma_\mu^2}{\sigma_\varepsilon^2 + T_i\sigma_\mu^2}\right) \sum_{t=1}^{T_i} K_h(Z_{it} - z).$$

4.2 Fixed effects

For the fixed effects estimation, which is generally considered the more relevant in economics, given concerns of endogeneity, the literature is more scant than for the random effect. Su and Ullah (2006) consider a partially linear fixed effects model based on a profile likelihood. Li and Stengos (1996) propose a method to estimate a semiparametric panel with endogenous regressors in an instrumental variable context. We rely on the recent methodology of Henderson, Carroll, and Li (2008), which generalizes the Wang, Carroll, and Lin (2005) approach to the fixed effects case. This method has been applied recently by Zhou and Li (2011) in the context of the relation between inequality and development.

4.2.1 Iterative procedure

Henderson, Carroll, and Li (2008), whose presentation we follow in this subsection, propose to estimate the nonparametric model along the lines of Wang (2003) and Lin and Carroll (2006). The clustered nature of the data somewhat complicates the estimation, which proceeds as follows. The fixed effect is handled by first differencing the data:

$$\tilde{Y}_{it} \equiv Y_{it} - Y_{i1} = \theta_F(Z_{it}) - \theta_F(Z_{i1}) + \tilde{X}_{it}'\beta_F + \epsilon_{it} - \epsilon_{i1},$$

where $\tilde{X}_{it} \equiv X_{it} - X_{i1}$. We further collect observations over time for firm i, in vector $\tilde{Y}_i = (\tilde{Y}_{i2}, \ldots, \tilde{Y}_{iT_i})$ for the dependent variable, in vector $\theta_i = (\theta_{i,2}, \ldots, \theta_{i,T_i})$ for the nonparametric part, and in matrix $\tilde{X}_i = (\tilde{X}_{i2}, \ldots, \tilde{X}_{iT_i})$ for the linear regressors and we denote $v_{it} \equiv \epsilon_{it} - \epsilon_{i1}$. First differencing introduces structure into the $(T_i - 1)$-dimensional variance covariance matrix Σ_i, which the estimation method takes into account: $\Sigma_i = \sigma_v^2(I_{T_i-1} + e_{T_i-1}e_{T_i-1}')$, and thus $\Sigma_i^{-1} = \sigma_v^{-2}(I_{T_i-1} - e_{T_i-1}e_{T_i-1}'/T_i)$. In the pure nonparametric case (no X_{it}s), the parameters are estimated by maximizing a kernel-weighted version of the following criterion:

$$L_{it} = -\frac{1}{2}\left(\tilde{Y}_i - \theta_i + \theta_{i1}e_{T_i-1}\right)' \Sigma_i^{-1} \left(\tilde{Y}_i - \theta_i + \theta_{i1}e_{T_i-1}\right),$$

for $i = 1, 2, \ldots, n$, where, in the presence of other subscripts in θ, we drop the F subscript to ease notation. Denoting the first and second order derivatives of the likelihood $L_{i,t\theta} = \frac{\partial L_{it}}{\partial \theta_{it}}$ and $L_{i,st\theta} = \frac{\partial^2 L_{it}}{\partial \theta_{it}\partial \theta_{is}}$, we have:

$$\begin{aligned} L_{i,1\theta} &= -e_{T_i-1}^T \Sigma_i^{-1}(\tilde{Y}_i - \theta_i + \theta_{i1}e_{T_i-1}), \\ L_{i,t\theta} &= -c_{t-1}'\Sigma_i^{-1}(\tilde{Y}_i - \theta_i + \theta_{i1}e_{T_i-1}) \quad \text{for } t \geq 2, \end{aligned} \tag{6}$$

where c_{t-1} is a $(t-1)$-dimensional column vector of zeros with 1 in the $(t-1)$ element. The unknown function $\theta_F(z)$ is estimated by solving the first order condition:

$$0 = \sum_{i=1}^{n} \sum_{t=1}^{T_i} K_h(Z_{it} - z) g_{it}(z,h)$$

$$L_{i,t\theta}\left(Y_i, \hat{\theta}_F(Z_{i1}), \ldots, \hat{\theta}_F(z) + \{(Z_{it} - z)/h\}' \frac{\partial \hat{\theta}_F(z)}{\partial z}, \ldots, \hat{\theta}_F(Z_{iT_i})\right), \quad (7)$$

where $g_{it}(z,h) = [1, \{(Z_{it} - z)/h\}']'$ is a column vector of dimension $(q+1)$. Since we use a local linear estimator, which is composed of a constant and a slope for every one of the q variables that enters the model nonparametrically. The argument of $L_{i,t\theta}$ is $\hat{\theta}(Z_{i1})$ for $s \neq t$, and $\hat{\alpha}_0(z) + \{(Z_{it} - z)/h\}'\hat{\alpha}_1(z)$ for $s = t$. This forms the basis for an iterative solution, where, given $\hat{\theta}_{[l-1]}(z)$, the value at step $l-1$, we have step l values $\left(\hat{\theta}_{[l]}(z), \frac{\partial \hat{\theta}_{[l]}(z)}{\partial z}\right) = (\hat{\alpha}_0, \hat{\alpha}_1)$, where $(\hat{\alpha}_0, \hat{\alpha}_1)$ are the solutions to

$$0 = \sum_{i=1}^{n} \sum_{t=1}^{T_i} K_h(Z_{it} - z) g_{it}(z,h)$$

$$L_{i,t\theta}\left(Y_i, \hat{\theta}_{[l-1]}(z), \ldots, \hat{\alpha}_0(z) + \{(Z_{it} - z)/h\}' \hat{\alpha}_1(z), \ldots, \hat{\theta}_{[l-1]}(Z_{iT_i})\right). \quad (8)$$

Thus, we estimate $\theta_F(z)$, the value of the nonparametric function (the local constant), as well as its first derivative, $\frac{\partial \theta_F(z)}{\partial z}$, with respect to each of the nonparametric variables. The solutions of the kernel estimating equation above are given by $(\hat{\alpha}_0, \hat{\alpha}_1) = D_1^{-1}(D_2 + D_3)$, where

$$\begin{aligned}
D_1 &= \frac{1}{n} \sum_{i=1}^{n} \left\{ e'_{T_i-1} \Sigma_i^{-1} e_{T_i-1} K_h(Z_{i1} - z) g_{i1} g'_{i1} + \sum_{t=2}^{T_i} c'_{i,t-1} \Sigma_i^{-1} c_{i,t-1} K_h(Z_{it} - z) g_{it} g'_{it} \right\} \\
D_2 &= \frac{1}{n} \sum_{i=1}^{n} \Big\{ e'_{T_i-1} \Sigma_i^{-1} e_{T_i-1} K_h(Z_{i1} - z) g_{i1} \hat{\theta}_{[l-1]}(z_{i1}) \\
&\quad + \sum_{t=2}^{T_i} c'_{i,t-1} \Sigma_i^{-1} c_{i,t-1} K_h(Z_{it} - z) g_{it} \hat{\theta}_{[l-1]}(z_{it}) \Big\} \\
D_3 &= \frac{1}{n} \sum_{i=1}^{n} \left\{ -K_h(Z_{i1} - z) g_{i1} e'_{T_i-1} \Sigma_i^{-1} H_{i,[l-1]} + \sum_{t=2}^{T_i} K_h(Z_{it} - z) g_{it} c'_{i,t-1} \Sigma_i^{-1} H_{i,[l-1]} \right\},
\end{aligned}$$

and where $H_{i,[l-1]}$ is a $(T_i - 1)$ column vector with elements $\tilde{Y}_{it} - (\hat{\theta}_{[l-1]}(z_{it}) - \hat{\theta}_{[l-1]}(z_{i1}))$, for $t = 2, \ldots, , T_i$. The method then consists in iterating until convergence. The variance of the iterative estimate $\hat{\theta}_F(z)$ is $\kappa/(nh\hat{\Omega}(z))$, which depends on the second moment of the kernel, $\kappa = \int k^2(v)dv$ and on

$$\hat{\Omega}(z) = \frac{1}{n}\sum_{i=1}^{n}\frac{T_i - 1}{T_i}\sum_{t=2}^{T_i} K_h(Z_{it} - z)/\hat{\sigma}_v^2,$$

where $\hat{\sigma}_v^2$ is the estimated variance of the residuals

$$\hat{\sigma}_v^2 = \frac{1}{2n}\sum_{i=1}^{n}\frac{1}{T_i - 1}\sum_{t=2}^{T_i}\left(Y_{it} - Y_{i1} - \left(\hat{\theta}(Z_{it}) - \hat{\theta}(Z_{i1})\right)\right)^2.$$

The semiparametric aspect is handled by a profile-kernel approach, along the lines of Wang, Carroll, and Lin (2005), and the objective function is modified to

$$L_{it} = -\frac{1}{2}\left(\tilde{Y}_i - \tilde{X}_i{}'\beta_F - \theta_i + \theta_{i1}e_{T_i-1}\right)'\Sigma_i^{-1}\left(\tilde{Y}_i - \tilde{X}_i{}'\beta_F - \theta_i + \theta_{i1}e_{T_i-1}\right),$$

where $\hat{\theta}_F(z, \beta_F)$ replaces $\hat{\theta}_F(z)$ in the first order condition, since now everything also depends on the parametric coefficient β_F. It can be shown that $\hat{\theta}_F(z, \beta_F) = \hat{\theta}_y(z)' - \hat{\theta}_x(z)'\beta_F$, where $\hat{\theta}_y(z)$ is the estimator of the pure nonparametric model (without X_{it}), and $\hat{\theta}_x(z) = \left(\hat{\theta}_{x,1}(z), \ldots, \hat{\theta}_{x,d}(z)\right)'$, where $\hat{\theta}_{x,r}(z)$ is the nonparametric estimator in the regression of the r-th component of X on Z. The coefficient of the parametric part X, now obtains by GLS of the residuals of Y on the residuals of X, as follows:

$$\hat{\beta}_F = \left(\sum_{i=1}^{n}\tilde{X}_{i*}'\Sigma_i^{-1}\tilde{X}_{i*}\right)^{-1}\left(\sum_{i=1}^{n}\tilde{X}_{i*}'\Sigma_i^{-1}\tilde{Y}_{i*}\right),$$

where the residuals of the nonparametric regression of Y on Z are $\tilde{Y}_{i*} = \left(\tilde{Y}_{i2*}, \ldots, \tilde{Y}_{iT_i*}\right)$, with $\tilde{Y}_{it*} = \tilde{Y}_{it} - (\hat{\theta}_y(Z_{it}) - \hat{\theta}_y(Z_{i1}))$, and the residuals of the nonparametric regression of X on Z are $\tilde{X}_{i*} = \left(\tilde{X}_{i2*}, \ldots, \tilde{X}_{iT_i*}\right)$, with $\tilde{X}_{it*} = \tilde{X}_{it} - (\hat{\theta}_x(Z_{it}) - \hat{\theta}_x(Z_{i1}))$.

4.2.2 Non-iterative procedure

We now proceed to show how a one-step procedure can be devised in the fixed effect case, much in the same way as was done in the case of random effects. First we introduce the difference matrix $S = diag(S_1, \ldots, S_n)$, with the $(T_i - 1,T_i)$-dimensional matrix $S_i = (-e_{T_i-1}, c_1, \ldots, c_{T_i-1}) = (-e_{T_i-1}, I_{T_i-1})$, which allows us to write $\tilde{Y} = SY$, $\tilde{X} = SX$ and $H = S(Y - \theta)$, where $H = (H_1', \ldots, H_n')'$. Note that $\Sigma_i = S_i S_i'$, and that $S_i'\Sigma_i^{-1}S_i = \sigma_v^{-2}(I_{T_i} - e_{T_i}e_{T_i}'/T_i)$, thus $S_i'\Sigma_i^{-1}S_i$ is like a T_i-dimensional extension of Σ_i^{-1}, with σ_v^{-2} on the diagonal and $-\frac{\sigma_v^{-2}}{T_i}$ off-diagonal. Define the block diagonal matrix $\tilde{\Sigma}^{-1} = diag(S_1'\Sigma_1 S_1, \ldots, S_n'\Sigma_n S_n)$ and the diagonal matrix $\tilde{\Sigma}^d = diag(\tilde{\Sigma}^{-1})$. Using matrix notation, one can rewrite Equation (6) more compactly as $S_i'\Sigma_i^{-1}S_i(Y_i - \theta_i) = 0$, and Equation (8) can be rewritten as Equation (4), where $S_i'\Sigma_i^{-1}S_i$ replaces V_i^{-1}. Further note that $D_1 \equiv \tilde{T}'(z)\tilde{\Sigma}^d K_{dh}(z)\tilde{T}(z)$, and $K_{wh}(z)' \equiv \delta_1' D_1^{-1}\tilde{T}(z)'K_{dh}(z)$.

Again we apply Proposition 1 of Lin, Wang, Welsh, and Carroll (2004), and we obtain the closed-form expression $\hat{\theta}_F = W_F(Y - X\hat{\beta}_F)$, as the solution to the first order condition (7) with smoother matrix

$$W_F = \left[I_Q + K_w(\tilde{\Sigma}^{-1} - \tilde{\Sigma}^d))\right]^{-1} K_w\tilde{\Sigma}^{-1}.$$

Using the same notation, we obtain $\hat{\theta}_x = W_F X$, $\hat{\theta}_y = W_F Y$. Like in the random effects case and also using the fact that $\tilde{X} = SX$, and $\tilde{Y} = SY$, $\hat{\beta}_F$ can be written in matrix notation as

$$\hat{\beta}_F = \left(X'[I - W_F']\tilde{\Sigma}^{-1}[I - W_F]X\right)^{-1} X'[I - W_F']\tilde{\Sigma}^{-1}Y,$$

where $\hat{\theta}_F = (\hat{\theta}_1, \ldots, \hat{\theta}_n)'$ is a Q-dimensional column vectors of the nonparametric estimate. Moreover, since in the case of fixed effects, there is only one variance, σ_v^2, which drops out of the expressions for $\hat{\beta}_F$ and $\hat{\theta}_F$, unlike in the random effects case, there is no need for an initial estimation of the variance components. Thus, it is easy to see that the fixed effects estimators $\hat{\beta}_F$ and $\hat{\theta}_F$ obtain as special cases of the random effects estimators, when $S_i'\Sigma_i^{-1}S_i$ replaces $\tilde{V}_i^{-1}$.

The asymptotic distribution of the estimator of the parametric part of the model is as follows, (see e.g. Wang, Carroll, and Lin 2005), where we have further used the fact that $\frac{\partial \hat{\theta}_F(z,\beta_F)}{\partial \beta_F} = -W_F X$:

$$\sqrt{n}(\hat{\beta}_F - \beta_F) \sim N\left(0, E\left[X'\left(I - W_F\right)\tilde{\Sigma}^{-1}(I - W_F)X\right]\right).$$

As this estimation method is non-standard, we programmed it up in Matlab, and carried out the necessary adjustments to handle the nonbalanced case.

5 Results

Table 3 contains results for the full sample, and then separately for family and non-family firms, while Table 4 shows results when we split the sample between firms related to a coordination center and firms without such a link. In each case, we estimate both parametric and semiparametric versions of the pooled, fixed and random effects models. Panel A of the tables shows the parametric estimation, and Panel B shows the linear part of the semiparametric models.

We first analyze parametric results. In most cases a Hausman test favors the fixed effects model, which points to the inconsistency of the random effects estimator.[6] We focus on fixed effects results, as they are consistent under any assumption on the firm-specific effect. The parametric results show a positive effect of ownership concentration on firm performance in the full sample. This effect is positive and strongly significant for non-family firms while it is negative and only marginally significant for family firms. This suggests that there is an alignment effect for firms not related to families while there is an entrenchment effect for family firms. This negative effect of ownership on performance in family firms is consistent with empirical papers such as Bennedsen, Meisner Nielsen, Perez-Gonzalez, and Wolfenzon (2007), Bennedsen and Meisner Nielsen (2010), and Morck, Strangeland, and Yeung (2000).

While the effect of ownership of the largest shareholder on firm performance is positive both for firms with and without a link to a coordination center, the magnitude of the coefficient for firms related to coordination centers is only half the one we find for firms without such a link, and moreover it is not significant. Thus it seems that the overall positive

[6] The exception is the case of coordination centers, where ownership concentration is not significant.

effect is driven mainly by non-family firms, and firms not affiliated to a coordination center.

Next we examine the semiparametric results, which deliver a more nuanced picture with important departures from linearity. Figure 4 shows the nonparametric effect of ownership on performance for the whole sample for the pooled, random and fixed effects estimations. The shape is dramatically different from one estimation to the other. The pooled estimation shows a big decrease in performance between 0 and 10 percent, followed by small concave bumps at 20 and 50 percent, in an overall decreasing relation. With random effects, we get a decrease between zero and 10 percent and then a relatively flat curve.

We focus our attention on Figure 4c with fixed effects estimation. The effect of ownership on performance is negative until about 15 percent, and then it increases until 80 percent, but it seems that the increase is somewhat less strong after 50 percent, and between about 75 and 90 percent there is a decrease. These turning points occur at or around meaningful control thresholds in Belgian law. As mentioned in Section 3, according to Belgian law, a shareholder whose ownership reaches the threshold of 25 percent of voting rights gets an exemption of taxes on dividends. Thus, after 25 percent, the dominant shareholder has an incentive to act in such a way as to maximize firm value, in order to reap the benefits of the reduced taxation on their dividends. This contributes to the alignment of his interests with those of the dispersed shareholders. This positive effect at high levels of ownership is consistent with what Morck, Shleifer, and Vishny (1988) find in U.S. firms. This seems to change when ownership reaches about 75 percent, which is the legal threshold after which a shareholder can change the legal statutes of the firm. Thus, after 75 percent, it is not entirely clear what the intentions of the shareholder are with the firm. He could be engaging in mergers and acquisition, or prepare to delist the firm, and this could explain the decrease in performance after that threshold.

We now examine the results when we distinguish between different groups of firms. Figure 5 shows the effect of ownership on performance for family firms in Figure 5a, non-family firms in Figure 5b, firms related to coordination centers in Figure 5c, and firms without such a link in Figure 5d, computed from the fixed effects semiparametric estimates, with the corresponding 95% confidence bounds. Figures 5a and 5b clearly show the difference in the relation between ownership and performance between family and non-family firms.

These figures confirm findings in the previous literature about the different behavior of family and non-family firms. It appears that for family firms, below 15 percent, ownership has a negative effect on performance, and this effect becomes positive between 15 and 30 percent. From 30 percent on, the effect of ownership on performance is a negative one, which starts out very weak between 30 and 45 percent and progressively becomes stronger. Thus it seems that there is an entrenchment effect, which results in declining performance, that starts with 30 percent, and becomes more pronounced, once the shareholder reaches absolute majority. It appears that with as little as 30 percent stakes in the firm, the shareholders of family firms are already powerful enough to extract rents and have a negative impact on firm value, consistent with the findings of Bennedsen and Meisner Nielsen (2010) for a sample of continental European firms. The curve eventually plateaus out around 75 percent, and then decreases again for even higher levels of ownership concentration. Again, if we relate these turning points to the Belgian law on thresholds of control it seems that family firms act in the best interest of all shareholders when their ownership is in a very narrow range, that partly overlaps with the tax advantage on dividends, but very quickly, around 30 percent the entrenchment effect starts dominating.

Figure 5b shows a very different picture for non-family firms, with an overall increasing effect of ownership on performance up to 75 percent, and a number of tiny concave bumps around 20 percent, 40 percent, and 60 percent. Overall the shape is concave with a maximum reached at 75 percent, and a decrease between 75 and 85 percent of ownership, when the dominant shareholder has the power to modify the statutes of the firm. This slightly concave shape is qualitatively similar to the one found in U.S. firms by McConnell and Servaes (1990), with a maximum around 49% in 1976 and 38% in 1986.

Figures 5c and 5d show strong differences between firms related to coordination centers and those without such a link. Being related to a coordination center lets a firm and its affiliates enjoy tax advantages. Thus it is not surprising to see differences between firms related to coordination centers and those that are not, since it is likely that the thresholds of control written in Belgian law affect them differently. In firms with a link to a coordination center, there is a negative effect of ownership on performance until a level of 20 percent, followed by a steady increase until a maximum of 75 percent is reached. Beyond 75 percent, shareholders can modify the statutes of the firm for a merger or delisting of the firm, and we see a decrease in performance. As shown in Figure 5d, firms without an affiliation to a coordination center exhibit a mostly concave relation between ownership and performance with the exception of what happens after 90 percent. There is a steep increase from 0 to 20 percent, which is exactly the opposite of what happens with firms that have a link to a coordination center.

The results for the control variables are in line with the corporate finance literature. Size is inversely related to firm performance, long and short term debts impact performance negatively, indicating asymmetric information related to financing via debts. Investment in financial fixed assets variable, as well as capital expenditures have a positive effect on firm performance. Finally, R&D expenditures have a positive effect on firm performance, as they signal good investment opportunities.

6 Concluding Remarks

In this paper we analyze levels of ownership concentration seldom considered before in the literature and we show how large controlling shareholders affect firm value. We use a unique detailed database on share ownership of Belgian listed firms which exhibit levels of ownership concentration ignored in the literature. The very high levels of ownership concentration via the practices of voting blocks and/or business groups make Belgian listed firms a real laboratory to examine issues of ownership structure and performance. Our data set also makes it possible to investigate differences between family and non-family firms, or firms with or without a link to a coordination center.

We use kernel-based local linear semiparametric pooled, random and fixed effects models to study the effect of very large controlling shareholders on firm performance. Using semiparametric models means that we do not impose any a priori functional form on the relation between the ownership and performance, which is important in this context, given how controversial this issue is in the empirical literature. As a matter of comparison we also use traditional parametric panel data models.

Our semiparametric results show important departures from linearity. Many of the turning points we find in the full sample, or in the subsamples of family firms, non-family firms, firms related or not to coordination centers, seem to correspond to thresholds that are meaningful in terms of control, according to Belgian law. More specifically, we find turning points around the minimum level of ownership that gives rise to tax exemptions on dividends (25 percent), the absolute majority (around 50 percent), or around the level of ownership needed to make major changes in the statutes of the firm.

Our results show that the relation between ownership of large shareholders and firm performance is non-monotonic. Up to a level of 15 percent share ownership, large shareholders adversely affect performance, but in the range between 15 and 80 percent the effect is positive, which is consistent with an alignment effect. Non-family firms exhibit an increasing shape, particulary in the 0 to 15 percent range, with a maximum at 75 percent. We find a completely different behavior for family firms: the effect of shareholdings on performance is negative between 0 and 15 percent, it completely reverts between 15 and 30 percent, and starts decreasing at an increasing rate beyond 30 percent. There is also a strong non-monotonicity in firms with a link to a coordination center, and to a much lesser extent for firms without such a link.

In terms of policy implications our results indicate that the legal ownership thresholds specified in Belgian corporate law have an impact on the relation between ownership and performance. Moreover, these legal incentives seem to have a different impact, depending on whether firms are run by families or not, and whether they are related to a coordination center or not.

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Table 1: Frequency of the number of different categories of shareholders per firm (in terms of firm year observations)

	Panel A: Voting blocks		Panel B: Business Groups		Panel C: Business Groups per voting block	
N	Frequency	Percent	Frequency	Percent	Frequency	Percent
0	1294	68.79	946	50.29	1608	85.49
1	547	29.08	697	37.05	146	7.76
2	34	1.81	169	8.98	80	4.25
3	6	0.32	54	2.87	36	1.91
4	-	-	13	0.69	11	0.58
5	-	-	2	0.11	-	-

Table 2: Descriptive statistics (Firm/year observations)

	Whole sample	Family vs.	Non-family	Difference (t test)	CC firms vs.	Non-CC	Difference (t test)
		Family	Non-family		CC	Non-CC	
	N=1697	N=563	N=1134		N=549	N=1148	
Variable				p-value			p-value
Single shareholder (regardless of size)	0.14 (0.05)	0.13 (0.05)	0.14 (0.05)	0.0343	0.11 (0.03)	0.16 (0.07)	<0.01
Largest sharehoder (without voting blocks)	0.43 (0.41)	0.41 (0.39)	0.44 (0.44)	0.0523	0.39 (0.36)	0.45 (0.45)	<.01
Largest sharehoder (with voting blocks)	0.54 (0.54)	0.54 (0.55)	0.54 (0.54)	0.4859	0.48 (0.49)	0.57 (0.57)	<.01
Market to book value (Tobin's q)	1.17 (0.90)	1.47 (1.10)	1.02 (0.81)	<.01	1.20 (0.93)	1.16 (0.88)	0.4520
Size (in log)	18.72 (18.49)	18.80 (18.49)	18.68 (18.48)	0.1992	20.25 (20.46)	17.98 (17.98)	<.01
Long term debt	0.11 (0.06)	0.10 (0.06)	0.12 (0.05)	0.1009	0.16 (0.12)	0.09 (0.02)	<.01
Short term debt	0.26 (0.22)	0.27 (0.22)	0.25 (0.21)	0.1295	0.28 (0.24)	0.26 (0.20)	0.0139
Financial fixed assets	0.48 (0.51)	0.50 (0.53)	0.47 (0.51)	0.1444	0.63 (0.65)	0.41 (0.39)	<.01
Capital expenditures	0.02 (0.00)	0.02 (0.00)	0.02 (0.00)	0.9024	0.02 (0.00)	0.02 (0.00)	0.3242
R&D	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.6232	0.00 (0.00)	0.00 (0.00)	<.01

This table contains means (medians) of the variables we use, as well as t statistics of the test of the null hypothesis that means are equal across groups. Single shareholder is the percentage of all declared shareholders, regardless of their size. There can be several shareholders in the same firm and therefore the number of observations for this variable is 7629 in the whole sample, 2673 and 4956 for family and non-family firms, 2874 and 4755 for firms with and without a link to a coordination center. Largest shareholder (without voting blocks) is the percentage share holdings of the largest shareholder, without aggregating votes in the same voting block. Largest shareholder (with voting blocks) is the percentage share holdings of the largest shareholder, after aggregation of all votes that belong to the same voting block. Market to book value (Tobin's q) is the proxy we use for firm value. Size is the log of total assets. Long Term and Short Term Debt are all as a share of Total Assets. Financial fixed assets represents investment in financial fixed assets as a share of Total Assets. Capital expenditures represents new acquisitions, as a share of Total Assets. R&D expenditures are also normalized by total assets.

Table 3: The effect of concentration on firm performance: whole sample and family firms.

	Tobin's q								
	Whole Sample N=1697			Family firms N=563			Non-family firms N=1134		
	(1) Pooled	(2) FE	(3) RE	(4) Pooled	(5) FE	(6) RE	(7) Pooled	(8) FE	(9) RE
Panel A: Parametric models									
Largest shareholder	-0.439***	0.308**	0.094	-0.984***	-0.586*	-0.650**	-0.255**	0.399***	0.255**
	(0.125)	(0.131)	(0.122)	(0.299)	(0.312)	(0.291)	(0.117)	(0.133)	(0.123)
Size	-0.045***	-0.404***	-0.212***	-0.085**	-0.702***	-0.372***	-0.045***	-0.251***	-0.126***
	(0.013)	(0.032)	(0.023)	(0.033)	(0.072)	(0.055)	(0.015)	(0.036)	(0.024)
Short term debt	-0.503**	-0.276**	-0.291***	-0.635***	-0.937***	-0.779***	-0.419	-0.072	-0.130
	(0.229)	(0.113)	(0.107)	(0.215)	(0.284)	(0.269)	(0.305)	(0.117)	(0.108)
Long term debt	-0.820***	-1.185***	-1.046***	-1.799***	-2.005***	-1.706***	-0.546***	-0.917***	-0.804***
	(0.149)	(0.150)	(0.146)	(0.344)	(0.375)	(0.370)	(0.155)	(0.153)	(0.145)
Financial fixed assets	0.242***	0.195*	0.175*	0.046	-0.212	-0.200	0.358***	0.390***	0.380***
	(0.092)	(0.100)	(0.095)	(0.215)	(0.227)	(0.215)	(0.089)	(0.104)	(0.097)
Capital expenditures	1.675**	0.678**	0.676**	5.360***	0.301	1.216	1.268**	0.598**	0.613**
	(0.677)	(0.310)	(0.317)	(1.269)	(1.204)	(1.230)	(0.524)	(0.287)	(0.287)
R&D	7.690**	5.396*	3.948**	16.499***	16.088**	20.972***	5.746**	1.749	2.674*
	(3.153)	(2.782)	(1.678)	(4.440)	(6.338)	(5.939)	(2.687)	(2.817)	(1.540)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,697	1,697	1,697	563	563	563	1,134	1,134	1,134
R-squared	0.123	0.276		0.196	0.411		0.124	0.244	
Panel B: Parametric part of semiparametric models									
Size	-0.043***	-0.407***	-0.13***	-0.111***	-0.53***	-0.223***	-0.039*	-0.308***	-0.125***
	(0.014)	(0.035)	(0.028)	(0.026)	(0.06)	(0.049)	(0.02)	(0.042)	(0.039)
Short term debt	-0.479***	-0.282**	-0.309*	-0.576**	-0.893***	-0.887***	-0.387***	0.01	-0.117
	(0.112)	(0.122)	(0.158)	(0.225)	(0.227)	(0.297)	(0.133)	(0.145)	(0.185)
Long term debt	-0.767***	-1.17***	-0.939***	-0.695***	-1.61***	-1.293***	-0.78***	-0.873***	-0.734**
	(0.154)	(0.162)	(0.218)	(0.22)	(0.245)	(0.301)	(0.209)	(0.211)	(0.288)
Financial fixed assets	0.224***	0.201*	0.167	0.263	0.279	0.143	0.174*	0.06	0.07
	(0.085)	(0.107)	(0.136)	(0.191)	(0.205)	(0.255)	(0.098)	(0.128)	(0.161)
Capital expenditures	1.677***	0.713**	0.819	3.419**	0.178	0.364	1.482***	0.714**	0.858
	(0.463)	(0.335)	(0.503)	(1.602)	(1.242)	(1.769)	(0.489)	(0.348)	(0.529)
R&D	7.735***	5.253*	4.452**	18.374***	12.206**	18.854***	3.562**	3.589	2.03
	(1.509)	(2.974)	(2.166)	(2.858)	(5.634)	(5.484)	(1.811)	(3.459)	(2.355)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.156	0.265		0.38	0.403		0.112	0.264	

Robust standard errors in parentheses: *** $p<0.01$, ** $p<0.05$, * $p<0.1$. The dependent variable is firm performance measured by market to book value. Largest shareholder is the percentage of shareholding of the largest shareholder in the firm, taking into account business groups and voting blocks. Size is the log of total assets. Short and Long term debt, Financial fixed assets, Capital expenditures, and R&D are all normalized by total assets. Financial fixed assets represents investment in financial fixed assets.

Table 4: The effect of concentration on firm performance: coordination center firms.

	Tobin's q					
	Firms affiliated to a coordination center N=549			Firms not affiliated to a coordination center N=1148		
	(1) Pooled	(2) FE	(3) RE	(4) Pooled	(5) FE	(6) RE
Panel A: Parametric models						
Largest shareholder	-0.877***	0.270	0.067	-0.214*	0.487***	0.249*
	(0.277)	(0.236)	(0.222)	(0.128)	(0.161)	(0.148)
Size	-0.140***	-0.539***	-0.330***	-0.035*	-0.308***	-0.201***
	(0.029)	(0.065)	(0.047)	(0.020)	(0.037)	(0.030)
Short term debt	-0.742***	-0.732***	-0.789***	-0.419	-0.002	-0.062
	(0.203)	(0.240)	(0.231)	(0.284)	(0.128)	(0.119)
Long term debt	-0.906***	-1.500***	-1.431***	-0.813***	-0.886***	-0.793***
	(0.196)	(0.260)	(0.243)	(0.234)	(0.185)	(0.180)
Financial fixed assets	0.379**	0.368*	0.252	0.127	0.057	0.071
	(0.181)	(0.215)	(0.200)	(0.101)	(0.113)	(0.107)
Capital expenditures	3.631*	0.085	0.217	1.432**	0.674**	0.694**
	(1.866)	(1.321)	(1.322)	(0.605)	(0.307)	(0.312)
R&D	17.088***	12.440**	17.418***	3.859*	3.696	1.686
	(4.216)	(6.055)	(5.017)	(2.012)	(3.083)	(1.791)
Observations	549	549	549	1,148	1,148	1,148
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.256	0.386		0.097	0.245	
Panel B: Parametric part of semiparametric models						
Size	-0.057*	-0.667***	-0.209***	-0.045***	-0.252***	-0.081***
	(0.032)	(0.076)	(0.064)	(0.014)	(0.039)	(0.027)
Short term debt	-0.604**	-1.021***	-0.742**	-0.414***	-0.051	-0.183
	(0.238)	(0.296)	(0.365)	(0.117)	(0.126)	(0.158)
Long term debt	-1.649***	-2.031***	-1.562***	-0.541***	-0.888***	-0.701***
	(0.396)	(0.384)	(0.527)	(0.149)	(0.167)	(0.213)
Financial fixed assets	-0.2	-0.113	-0.125	0.403***	0.384***	0.353**
	(0.187)	(0.235)	(0.292)	(0.087)	(0.112)	(0.138)
Capital expenditures	5.107***	0.123	2.116	1.258***	0.641**	0.743
	(1.535)	(1.228)	(1.827)	(0.428)	(0.311)	(0.46)
R&D	18.78***	17.064***	20.368***	5.891***	1.58	3.471*
	(3.788)	(6.446)	(7.782)	(1.512)	(3.021)	(1.952)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.286	0.495		0.14	0.206	

Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1. The dependent variable is firm performance measured by market to book value. Largest shareholder is the percentage of shareholding of the largest shareholder in the firm taking into account business groups and voting blocks. Size is the log of total assets. Total debt is total debt divided by total assets. Financial fixed assets is the investment in financial fixed assets divided by total assets. Capital expenditures is the variable for new investments, it is the amount of new acquisition divided by total assets. R&D are the expenses in research and development divided by total assets.

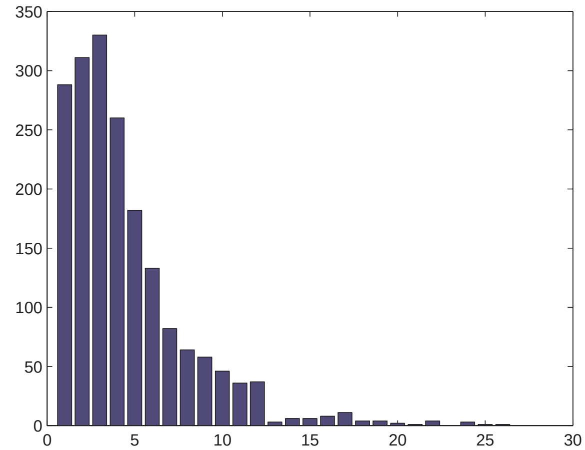


Figure 1: Histogram of the number of declared shareholders in a firm (in terms of firm year observations)

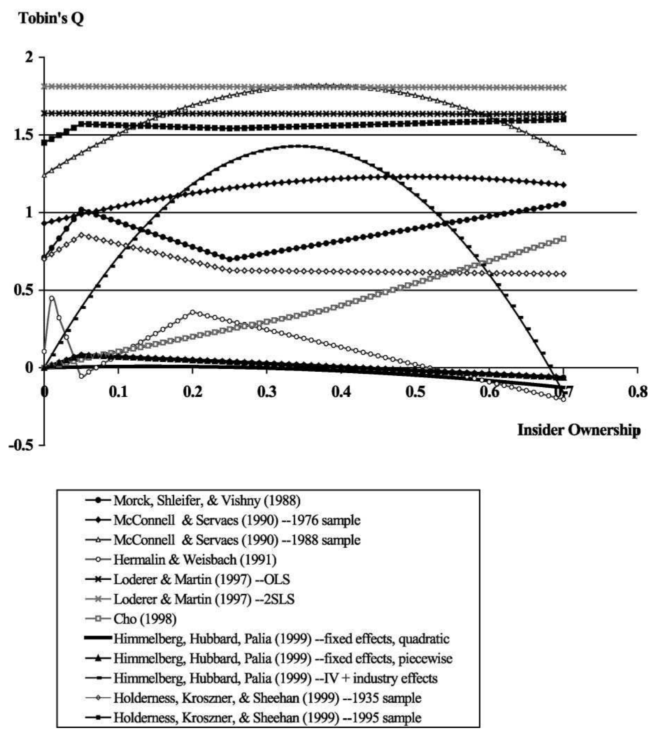
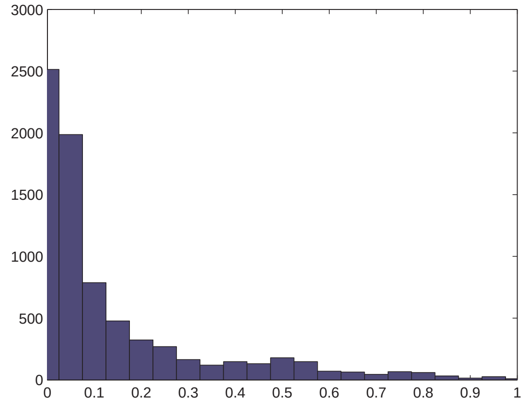
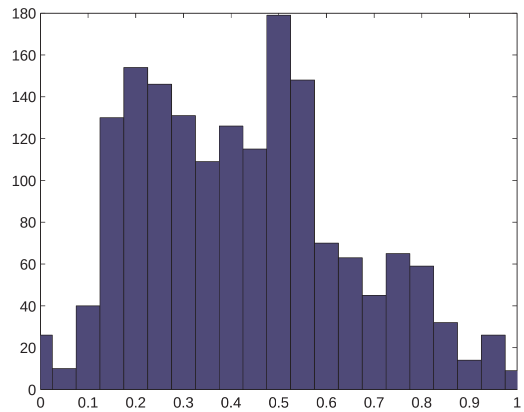


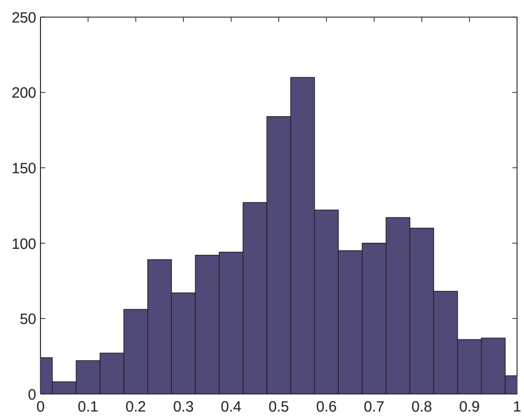
Figure 2: The relation between managerial ownership and firm performance found in the literature, from Demsetz and Villalonga, 2001, “Ownership Structure and Corporate Performance”, Journal of Corporate Finance, 7, 209-233.



(a) Shareholders taken individually

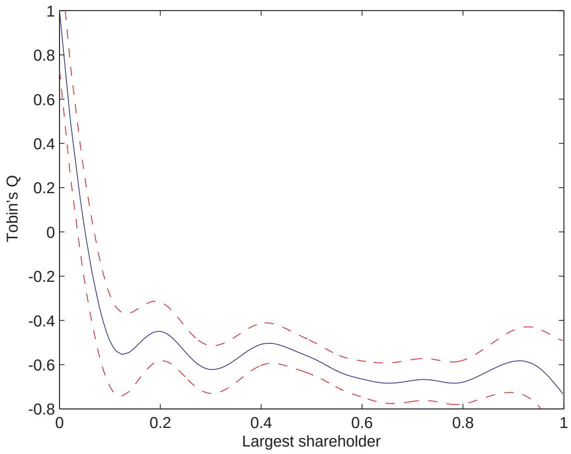


(b) Without considering voting blocks and business groups

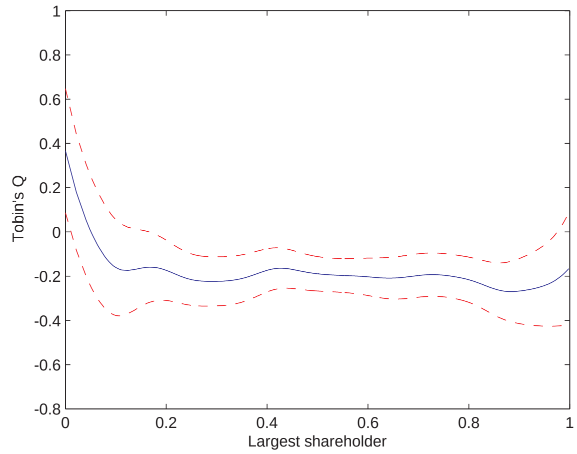


(c) Considering voting blocks and business groups

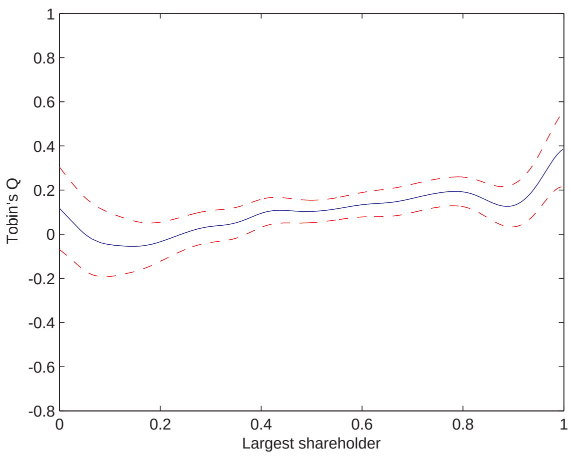
Figure 3: Distribution of the share ownership of the first largest shareholders



(a) Pooled estimation



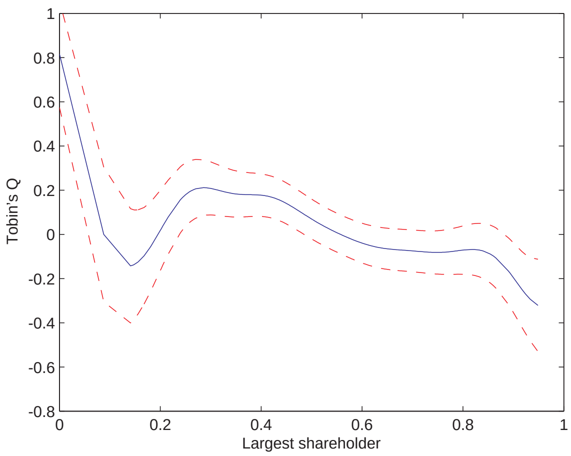
(b) Random effects estimation



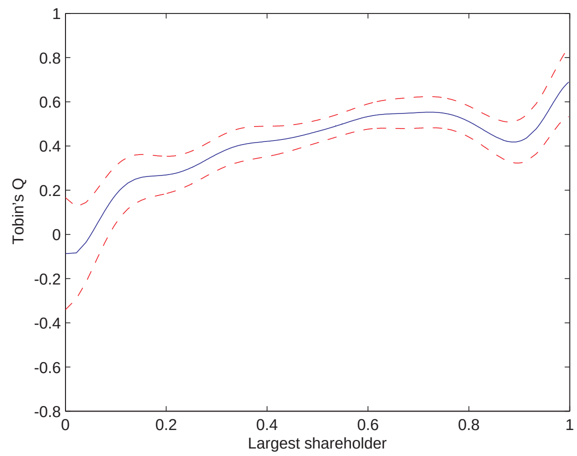
(c) Fixed effects estimation

Figure 4: Effect of the largest shareholder on firm performance: pooled estimation, random effects and fixed effects.

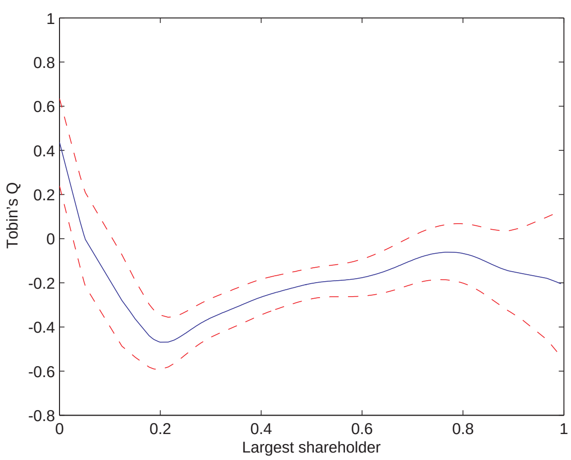
This figure shows the effect of the largest shareholder on firm performance for the whole sample with (a) pooled estimation (b) random effects, as well as (c) fixed effects. The estimates are based on the semiparametric local-linear kernel-based estimation, and correspond, respectively to Panel B of columns (1), (2) and (3) of Table 3. The solid blue line in the middle is the estimate, while the upper and lower (dashed red) lines are the 95% confidence intervals.



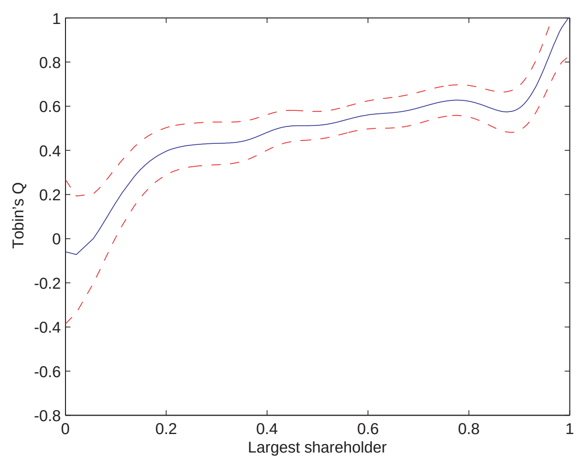
(a) Family firms



(b) Non-family firms



(c) Coordination Center



(d) No Coordination Center

Figure 5: Effect of the largest shareholder on firm performance for various subsamples. This figure shows the effect of the largest shareholder on firm performance for various subsamples of (a) family and (b) non-family firms, as well as firms (c) with an affiliation to a business center, and (d) without such an affiliation. The estimates are based on the semiparametric fixed effect panel estimation, where the effect of ,as well as year dummies, have ben taken into account linearly. The solid blue line in the middle is the estimate, while the upper and lower (dashed red) lines are the 95% confidence intervals.

APPENDIX A: Disclosure law requirements

The 1989 disclosure law makes notification to the Banking Commission mandatory for all shareholding of 5 percent or multiples thereof. The notification threshold may be as low as 3 percent if the company writes this into its statutes. However, there are exceptions where shareholdings below the 5 percent (or 3 percent) threshold lead to notification:

1. This may occur if the owners previously had an ownership of 5 percent or more, and reduced it to below 5 percent.

2. The notification takes into account stocks and warrants. For example, if the investor holds 1 percent in equity and 4 percent in warrants, he must notify the company.

3. When a shareholder leaves a voting pact, he/she is required to register this change.

The disclosure law applies directly to the owners of the voting rights, as well as to those investors who control voting rights indirectly via a pyramidal structure of intermediate companies. Investors are required to reveal whether they are affiliated to a group of companies or whether they act in concert with other investors.

Share ownership in Belgian listed firms can be organized in one of the three following ways.

1. Direct stakes: holdings of independent shareholders, either moral or physical persons.

2. Group blocks: stakes of companies that are part of a business group that is subject to consolidation rules under Belgian law.

3. Voting blocks: composed of direct stakes and/or group blocks. A voting block is a voting coalition, where shareholders declare that they act in unison together.

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