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Huijzer, M.J.; Heemskerk, E.M.

ORIGINAL ARTICLE

Delineating the corporate elite: Inquiring the boundaries and composition of interlocking directorate networks

M. Jouke Huijzer[1,2] | **Eelke M. Heemskerk[3]**

[1] Department of Political Science, Vrije Universiteit Brussel, Brussels, Belgium

[2] CORPNET, University of Amsterdam, Amsterdam, The Netherlands

[3] CORPNET/Amsterdam Institute for Social Science Research, University of Amsterdam, Amsterdam, The Netherlands

Correspondence
M. Jouke Huijzer, Vrije Universiteit Brussel, Department of Political Science, Pleinlaan 5, 1050 Elsene, Brussels, Belgium.
Email: Jouke.Huijzer@vub.be

Abstract

Corporate elite studies have for long investigated networks of interlocking directorates to test and corroborate key theoretical expectations regarding the cohesive organization of such an elite and their ability and willingness to act on behalf of general business interests. These studies typically collect data on a list of 50, 100, 200 or 500 corporations ranked by economic size, sometimes stratified in sectors. The sampling approach often follows previous studies in order to increase comparability. These relatively arbitrary sampling practices are problematic because they impact the empirical results and our therefore the conclusions drawn from it. Using a sample of 3251 Canada-based corporations, we establish that indeed different sampling criteria – that is sample size, proportion of financial firms, inclusion of state-owned enterprises and so on – significantly impacts network properties of corporate elite networks. We establish rather disturbing differences, especially for smaller sample sizes (<100). Subsequently, we develop alternative demarcation criteria of the corporate elite based on a *k*-core decomposition. We conclude by emphasizing that the sampling decisions in interlocking directorate studies should much more be carefully be thought through in future research on the topic, both in corporate elite studies and beyond.

KEYWORDS
capitalist class, corporate power, elite networks, interlocking directorate, network analysis

INTRODUCTION

A key question in social science research pertains to the organization of elites in society. Business elites in particular have received ongoing scholarly attention since the beginning of the 20th century. In order to empirically study the cohesion of the business elite, scholars resorted to the analyses of corporate elite networks, and in particular patterns of interlocking directorates, where a director sits simultaneously on at least two corporate boards. This has proven to be a very fruitful line of research (Mizruchi, 1996), addressing questions such as how the corporate elite is organized (Carroll, 2010; Fennema, 1982); how firms reduce resources dependencies (Burt, 1980; Pfeffer & Salancik, 1978) or exercise power (Mintz & Schwartz, 1985); how information and innovation spreads through the business elite (Davis, 1991); or to better understand how business networks develop over space and time (Heemskerk & Schnyder, 2008; Kogut, 2012; Stokman, Ziegler, et al., 1985; Van Veen & Kratzer, 2011; Windolf, 2002).

However, much of this research suffers from an unaddressed problem regarding the operationalization of key concepts and subsequent sampling issues that impede a comprehensive understanding of intercorporate networks, especially when compared over space and time (Mintz, 2002). The main problem we address here are un(der)specified (and sometimes even unsubstantiated) sampling criteria, leaving us with work investigating corporate elite patterns in samples ranging from 20 to 1500 (and beyond) corporations, sometimes stratified and sometimes not, sometimes including only listed firms, and sometimes not. Yet, the consequences of these different selection criteria for the findings remain systematically ignored.

The problem is however not unknown. Already in the early 1970s, Allen (1974, p. 396) astutely observes the drawbacks of limiting a sample to a particular subset of companies and corporate directors for those who study the structure of the corporate elite:

> The type of analysis confronts sampling problems which cannot be resolved by the conventional random sample. The most satisfactory sampling design for structural analysis is a saturation sample of the entire universe or population; however, this alternative is clearly not feasible for large social structures. Nevertheless, it is possible to construct a saturation sample of a population which has been delimited in accordance with relevant theoretical criteria.

With some notable exceptions (Fox & Ornstein, 1986; Larsen & Ellersgaard, 2018; Scott, 1985), very few scholars have extensively reflected upon the criteria for sample selection after Allen (1974). Yet the question remained pressing.

The first comparative study of interlocking directorate networks in 10 different countries edited by Stokman, Ziegler, et al. (1985) settled on a sample of 200 industrial firms ranked by turnover, and 50 financials ranked by total assets. This type of stratified sampling was soon to become somewhat of a standard for later work on corporate elite networks, notwithstanding significant changes in the economic structure, bank mergers and concentrations of capital were recorded in the decades that followed (Carroll, 2004; David & Westerhuis, 2014; Heemskerk, 2007). Indeed, a contemporary reviewer of the comparative 10 nations study already questioned why there were 'equal-size samples in each country (ca. 200 industrial and ca. 50 financial corporations per country/"ethnic group") when the sample in the smallest country is equivalent (in selection-criteria values) to a minute subset of that in the largest country (the Austria-equals-Illinois phenomenon)' (Von der Ohe, 1987, p. 83). Only in the scholarly debates between Carroll and Fennema (2002, 2006) and Kentor and Jang (2004, 2006) the issue of sample selection is extensively discussed, but in this case it is particularly focused on how to delineate a transnational corporate elite (cf. Burris & Staples, 2012). To be fair, we fully acknowledge that time constraints or limited resources are valid reasons for scholars to limit their samples to a certain number of firms. What is less understandable is that there has been so little reflection upon how findings are affected by different sampling criteria, despite this being recognized in network theory (Leskovec & Faloutsos, 2006; Wang et al., 2012). Today, thanks to developments in information technologies, databases with large numbers of firms and their directors set us free from much of the previous concerns regarding laborious data

collection and availability and even allow us to indeed study the entire universe of interrelated firms and directors (Heemskerk & Takes, 2016; Heemskerk, Takes, et al., 2016). This revolution in data availability also presents us with new opportunities to study which demarcations of the corporate elite are most meaningful.

This study takes up the empirical question to what extent applying the different demarcation criteria of the corporate elite affects empirical outcomes, and therefore our understanding of this elite. Proper selection and demarcation criteria necessarily relate to the theoretical understanding of the corporate elite. Theoretically, our question is which criteria should inform a meaningful demarcation of intercorporate elite networks. We therefore start this paper with a review of the very sources of elite power in various scholarly approaches to (corporate) elites or ruling classes. Once we have established the basic theoretical underpinnings, we present a review of sampling criteria used by corporate elite studies using interlocking directorate networks. In order to assess to what extent different sampling criteria impede a robust understanding of elite networks, we examine how network analytic variables change under various sampling criteria. We establish rather disturbing differences, especially for smaller sample sizes (<100). We continue by developing an alternative sampling strategy that is not based on a ranked list of corporations but utilizes the growing availability of network data and demarcates the corporate elite based not on firm size but on their relations (using a k-core decomposition approach, see Larsen & Ellersgaard, 2017). We compare the quality of this novel approach in demarcating the corporate elite to a traditional ranked-by-size approach through an investigation of the extra-corporate activities of the corporate elite membership. Our results show that the k-core decomposition approach aligns better with the theoretical underpinnings of corporate elite studies and performs better in the top tiers than a ranked-by-size sampling approach of a similar size. In the final section, we discuss the implications of the findings for previous research and outline some future research avenues.

THEORETICAL UNDERPINNINGS OF THE RESEARCH ON CORPORATE ELITE NETWORKS

Fundamental to the study of elites is the observation that they wield disproportional control over various sources of power in society that potentially stands in tension with democratic rule. This section discusses how most research approaches to (corporate) elites are informed by positional and relational aspects of power (see Mokken & Stokman, 1976). The next section, then, discusses how these criteria are operationalized empirically, while the third section identifies the unaddressed problems regarding the demarcation criteria.

Positional power is central to institutional approaches which hold that the power of certain elites is associated with their capacity to make decisions in the upper echelons of large political and corporate institutions (Domhoff, 1967, 1970; Mills, 1956). Power increases if someone climbs the institutional hierarchy and, as such, gets more instruments at his/her disposal to influence certain outcomes. Power increases with the size and importance of a particular institution, whether corporate, governmental or otherwise, and the capacity one has to determine its course.

Important to the positional understanding of power is that power is foremost regarded as an attribute of a person. In institutional approaches, this attribute is typically someone's position in the institutional hierarchy, yet other approaches identify different sources of power. The early elite theorist Pareto (1935, pp. 1421-1432) argued, for instance, that one's superior qualities in whatever social domain is what determines a person's elite membership. Some Marxist approaches understood power of the ruling class strictly in economic terms by focusing on production and put the watershed between those who own the means of production and those who do not. Managerialist approaches, advocated by scholars who argued the 'managerial revolution' or the 'separation of ownership and control' had led to more 'soulful' and less profit-oriented corporations also follow this principle (Berle & Means, 1932; Burnham, 1941). Their hypothesis, although convincingly disproved (Useem, 1980; Zeitlin, 1974), is mainly that (positional) power has shifted from the owner to the manager who became better positioned to independently make decisions.

Yet, most scholars working in any of the traditions acknowledge that the positional approach only yields a partial understanding of power and the extent to which someone can be considered part of an elite. A complete analysis of

an elite also requires that one examines power *relations* that manifest themselves in the organization of society. For Mosca (1939), social organization was the very source of power of any ruling minority – as well as the very reason it was a minority. In Marxist approaches, organization is also the key principle by which a mere 'class in itself' or 'class against capitalism' could turn itself into a 'class for itself' (see Andrew, 1983). Meisel (1958) argued in an extensive discussion of Mosca's work that one could only speak of an elite if the group met three criteria that came to be known as the three Cs: group-*consciousness, coherence* and *conspiracy* (of which the latter should be understood more as a general willingness to engage in common action). Since no single group in society met all three criteria, Meisel argued the existence of a ruling class was actually a myth. At about the same time Mills (1956) formulated his famous thesis about the existence of a powerful elite and, without using Meisel's framework, provided much evidence that an elite had emerged that actually did meet the three C's. Consequently, the question of whether one or multiple elites exist became central to the debate between elitists and pluralists (Dahl, 1958) in the years to follow. The relational aspect of elite was perhaps best expressed in the formulation by Clement (1975, p. 5), who wrote in his analysis of the Canadian corporate elite that

> the conditions [of being in a powerful position] are necessary but not sufficient to also consider the elite as a social group. To demonstrate that a particular elite is also a social group requires that its structure be specified, that members of the group interact and are related to one another to say they exhibit solidarity, cohesiveness, coordination and consciousness of the kind.

The implication of all this is that to speak of an elite that is able to exercise its power, one also needs to study their social relations.

A related discussion centres on what is the most appropriate concept to designate the group under study. Some academics, for example, used very similar concepts as the corporate elite such as 'economic' or 'business elites' (Clement, 1975; Mills, 1956; Porter, 1965). Other scholars prefer to consider the people they study to epitomize a 'governing' (Domhoff, 1967, 1970) or 'ruling class' (Carroll, 2010; Schwartz, 1987). Marxist scholars first used the term of 'finance capitalists', as coined by Hilferding (1981 [1910]), to designate the shared directors of financial and industrial firms. Yet, since the alleged 'managerial revolution' (Burnham, 1941) they have struggled long to locate the corporate executives and directors within the 'capitalist class' (see Bottomore, 1964; Sweezy, 1942; Zeitlin, 1974). Recently, the term or the 'corporate community', which denotes a certain consciousness or common belief system, has become more popular (Heemskerk, 2007; National Resources Committee, 1939). Further terms that circulate the field vary from the classic 'old-boys network' (Edling et al., 2012; Fennema & Heemskerk, 2005) to the recently more fashionable '1%' (Murray & Scott, 2012), or studies simply consider 'the powers that be' (Domhoff, 1978).

In the light of the discussion about what criteria need to be satisfied to speak of an elite, Useem's (1979) distinction between the 'corporate elite' and an 'inner group' or 'inner circle' (Useem, 1984) is particularly informative. According to Useem (1984, p. 63), the inner circle composed of 'those who serve on the boards of several large corporations'. What distinguishes the inner circle-members from other directors and executives (the 'corporate elite' in his terms) is that their concerns extend 'beyond the immediate welfare of their own firms' so that they had come to 'exercise a voice on behalf of the whole business community'. Substantiating his claim by much empirical evidence, Useem (1984, p. 76) conceptualized the inner circle as 'the leading edge of business political activity' (cf. Barnes, 2017; Maclean et al., 2017).

Yet, if we take the connectedness – or the existence of social relations between people in a powerful position – as a minimal criterion to speak of an 'elite', one might as well argue that the inner circle actually *is* the corporate elite (see Larsen & Ellersgaard, 2018). Such presumption has not only important implications for empirical studies and demarcations of the corporate elite, it also broadens the empirical requirements for considering someone part of the corporate elite. That is to say, one needs to demonstrate that someone is connected, before (s)he can be considered part of an elite. In order to do so, researchers have, like Useem (1984), typically used interlocking directorates as a key indicator of such connectedness, be it for very different purposes.

INTERLOCKING DIRECTORATES AS CORNERSTONE OF THE CORPORATE ELITE

Interlocking directorates – a director who holds a position in at least two different firms – have been studied throughout the 20th century in different research traditions. Marxists were among the first to acknowledge the significance of interlocking directorates thanks to a study of Jeidels (1905). When the Marxian economist Hilferding (1981, p. 119) was commenting on the developments in early 20th-century capitalism, he observed that not only owners but also managers sat on the boards so that 'a circle of people emerges who, thanks to their own capital resources or to concentrated power of outside capital which they represent (in the case of bank directors), become members of the board of directors of numerous corporations. There develops in this way a kind of personal union'. The idea of a personal union between capitalists and managers was later taken over by Lenin (1999 [1917]) and Bukharin (1929). In the United States, Brandeis (1914, p. 51) was the most vocal opponent of interlocking directorates by stating that it was

> the root of many evils. It offends law human and divine. Applied to rival corporations, it tends to the suppression of competition and … [a]pplied to corporations which deal with each other, it tends to disloyalty and to violation of the fundamental law that no man can serve two masters. In either case it leads to inefficiency.

Despite the legal prohibition of interlocks within the same sector in the United States, interlocking directorates were still considered of significant importance for binding the elite together and continued to hold the attention of some leading scholars. The managerialist scholar Means, for instance, conducted one of the first comprehensive studies of board interlocks in the United States, commissioned by the US Senate (National Resources Committee, 1939). And after the second world war, Mills (1956, p. 123) famously wrote that:

> 'Interlocking Directorate' is no mere phrase: it points to a solid feature of the facts of business life, and to a sociological anchor of the community of interest, the unification of outlook and policy, that prevails among the propertied class. Any detailed analysis of any major piece of business comes upon this fact, especially when the business involves politics. As a minimum inference, it must be said that such arrangements permit an interchange of views in a convenient and more or less formal way among those who share the interests of the corporate rich.

Mills' (1956) writings inspired much theorizing and empirical research on interlocking directorates as intercorporate relations or an indication of cohesion between corporate elites (for an overview, see Mizruchi, 1996). Research dependency theory held that interlocks are in place to maintain vital relations between corporations in order to secure resources (Pfeffer & Salancik, 1978). Yet, this was discredited once it was established that interlocks between corporations were often not renewed once a director passed away or retired (Koenig et al., 1979; Ornstein, 1984; Palmer, 1983; cf. Valeeva et al., 2020). Only when Davis (1991) demonstrated that the network of interlocking directorates served as a means to transmit management protection measures such as 'poison pills' and 'golden parachutes' (Davis & Greve, 1997), board interlock studies regained prominence, especially in the business literature (Borgatti & Foster, 2003).

Less concerned with the question of what interlocks *do*, the first comparative studies on corporate networks regarded board interlocks as an indication of the structure of national economies that revealed differences in corporate governance (Scott, 1991; Stokman, Ziegler, et al., 1985). Subsequent comparative work related the structure of corporate networks to a variety of capitalism literature (David & Westerhuis, 2014; Van Veen & Kratzer, 2011; Windolf, 2002). But the key question of elite cohesion remained the backbone of corporate elite studies. The empirical underpinnings of the 'elite cohesion' or 'class alliance' approach, although pioneered by Domhoff (1967, 1970, 1998), is againmost convincingly provided in Useem's (1984) landmark study of the inner circle. Useem demonstrated that interlocking directors were overrepresented in social clubs, business interest groups, as contributors of political

action committees (PACs) and in government committees. Scholars working within the class-alliance approach disagreed on the extent to which business unity through interlocking directorates also manifested itself politically. Burris (1987) for instance initially found no evidence for Useem's argument that inner circle-membership led to business unity when looking at PAC-contributions. In a later work, however, he did find interlocks to be a significant determinant (Burris, 2005; cf. Mizruchi, 1992). A related question regarding the class-alliance approach is whether corporate elite behaviour is informed by the positions of the firms within the corporate network, or the positions of the corporate directors and executives (Bearden & Mintz, 1987; Burris, 2001; Johnsen & Mintz, 1989; Palmer et al., 1986). While most studies have focused on intercorporate networks, Bearden and Mintz (1987) have demonstrated that, for instance, bank centrality in the intercorporate network does not necessarily lead to the centrality of bankers in the interpersonal network. This issue, again, relates very much back to the central question of this paper: How to meaningfully delineate the corporate elite in empirical studies to elite organization.

## EMPIRICAL DEMARCATIONS OF THE CORPORATE ELITE IN INTERLOCKING DIRECTORATE RESEARCH

Interlocking directorates have thus been central in various approaches to corporate elites over the past decades, but the question how to meaningfully demarcate the corporate elite remains. Mintz (2002, p. 62) eloquently explicated the problem when she stated that

> The details provided by Domhoff and Useem that allow us to identify the most active segment of office holders has certainly provided nuance to the definition. Nevertheless, it does not provide us with an opportunity to explain this type of power. Is it institutional power that is lost when positions are lost and, if so, what is the role of ownership? […] how precisely do we define which segment of the corporate elite to study? Is it the inner circle members of Useem (1984), the president, CEO, and chairman of the board of Burris or some other combination? Conceptually, these are not the same. And to the extent that our definition varies from study to study, it is very difficult to compare results with any confidence or to build a coherent portrait of elite behavior.

If we follow our suggestion that the corporate elite coincides with the inner circle (i.e., the group of interlocking directors), the question still remains how to demarcate the inner circle. Useem (1984, p. 63) based his findings on data of 1972 and 2799 interlocking directors of, respectively, 196 British and 212 U.S. firms. But he readily acknowledged that such demarcation did not offer 'a full description of the inner circle nor a precise definition of its *boundaries* or *membership*'. Indeed, he sampled about 200 firms that is a relatively arbitrary boundary.

Conceptually speaking, we may wonder why any analysis of the corporate elite should necessarily lead us to the *largest* corporations. The very reason scholars engage in the study of board interlocks is because they consider *relations* to be constitutive of elite power. Yet, if the only criterion for selecting corporate leaders is the size of the corporation they manage, the demarcation of the group under study is exclusively based on *positional* power. As a result, there seems to be a fundamental discrepancy between the motivations to inquire relations within a group of corporate leaders and criteria used to demarcate this group.

In the table in Appendix A, we provide an overview of the sampling criteria and sample size used in a large set of empirical studies on corporate elites that investigate interlocking directorate networks up until 2015. The table shows that there is indeed a large variety in the selection criteria to demarcate corporate elites. Some studies rely on rather small samples of less than hundred firms, whereas other datasets comprise directors from several hundreds of firms. The most common sampling criterion is to focus on the size of a company, but this can be measured by turnover, assets, market capitalization or the number of employees. As is well acknowledged (e.g., Scott, 1985) each measure of size is likely to benefit some firms or sectors over others. Hence, many of the samples are stratified by reserving a certain
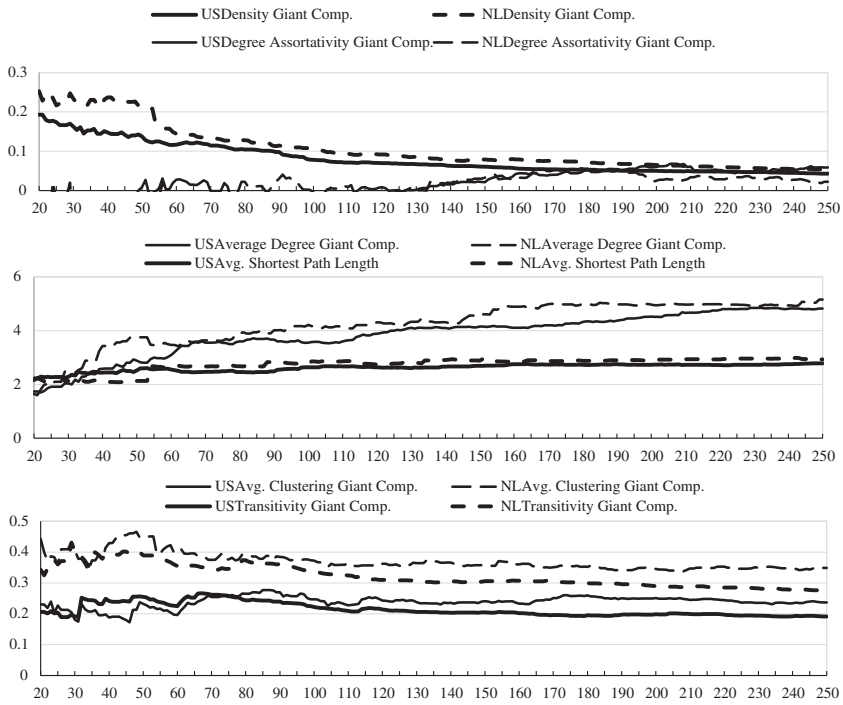
FIGURE 1 Various network properties for different sample sizes on data from 1976 that was used in the first comparative study on corporate elite networks

part of the sample for financial firms, although in a number of studies firms from other sectors are also explicitly included. Moreover, some samples only include listed firms, while others also include family-owned firms, foreign subsidiaries, cooperatives and state-owned enterprises. Finally, a number of studies on transnational elites apply specific regional criteria to ensure the inclusion of certain regional national elites in the sample.

How problematic is this diversity in sampling method? Let us reconsider the data used for the first comparative study on interlocking directorates (Meeusen & Cuyvers, 1985; Stokman, Ziegler, et al., 1985). We reanalyse two original samples of U.S. and Dutch firms, both comprising in total 200 industrial and 50 financial corporations. We report for this entire range six often used network properties: density, average degree, degree assortativity, transitivity, the average local clustering coefficient and the average shortest path length. Average degree and density indicate globally how well the firms are connected. Transitivity and average local clustering indicate to what extent firms tend to cluster together in the network. Degree assortativity increases when well-connected firms tend to connect to other well-connected firms and is lower if they connect to less well-connected firms. Finally, average shortest path length measures, on average, how many steps one need to take in the network to go from the one firm to another. The graphs in Figure 1 demonstrate for the United States and the Netherlands how these network properties differ for a sample ranging from 25 to 250 firms.[1] The results clearly indicate that increasing the sample size of a ranked-by-size approach means that the network properties change. Sometimes incrementally, but in other cases rather suddenly and shockwise.

Imagine now, several decades ago, the researchers who contributed to Stokman, Ziegler, et al. (1985) would, for instance, have taken a sample of 50 or 100, rather than 250 firms. This example shows that such sample size decisions are not trivial. For instance, the original study found that the United States and the Netherlands were very comparable in terms of network density, 0.04 and 0.05, respectively (Stokman & Wasseur, 1985, p. 31). In case they would they have studied 50 firms instead of 250, the results would have been very different. For this smaller set of firms, the Netherlands and the United States show marked differences in density (0.15 and 0.25, respectively). Such a finding
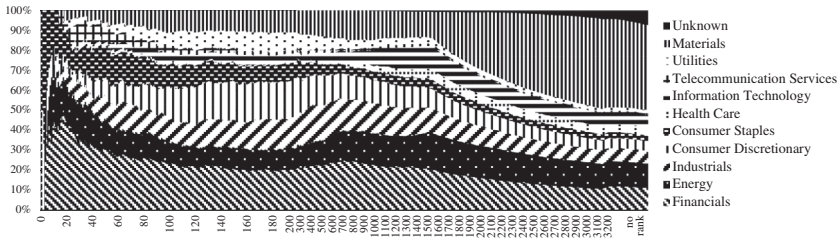
FIGURE 2   Proportion of firms in each sector for various sample sizes

may have compelled the authors to group the Netherlands with the Germanic countries instead of the Anglo-American countries. Clearly, different sample sizes may lead to different conclusions.

Yet, there is not *a priori* justification for studying either the largest 50, 100, 250 or even a larger sample of corporations and the relations between them. Whatever the purpose of the research and whichever sample decision one takes, one cannot be sure whether crucial corporations or whether crucial links are included in the sample. In what follows we therefore first further establish how problematic different sample criteria are, and subsequently develop an alternative relation-based approach for delineating the corporate elite.

ASSESSING THE IMPACT OF SAMPLING CRITERIA IN INTERLOCKING DIRECTORATE RESEARCH

To make a proper assessment of what the effects of different sampling criteria are, we compiled a novel dataset of 3580 Canadian corporations. With this size, we are confident that we have covered the lion share of the universe of Canadian 'big business'. The data were obtained from the *Financial Post Infomart* (or *fp.infomart*) and consists of information about their directors and executives, information on turnover and assets (for 3251 corporations) and whether they are cooperatives, foreign subsidiaries, traded on the stock-exchange, family-owned, institutionally owned or state-owned enterprises. Figure 2 shows how well all sectors are represented for each sample size. Additional analyses are carried out on a subset of 733 firms that are all in the *Financial Post top 500+300* list of largest Canadian enterprises. Some large firms have not been included because of missing data. These were mainly foreign subsidiaries such as Walmart Canada and General Motors Canada. In total, the data comprise 23.536 directors and executives, their directorships, and in information on their relations to a total of 697 non-corporate institutions such as business groups, universities, charities and cultural institutions. See Appendix B for further information. Following the exploratory analyses of the United States and the Netherlands above, we compare the most often used network properties of each network for different sample sizes and when different sampling criteria are applied.

The effect of sample size and cut-off decisions

Figure 3 presents the network properties for the Canadian network for the whole range of 25–3251 firms. In Figure 3a all measures are indexed at 100 for 25 firms (degree assortativity is excluded here because of its high volatility). Note that the horizontal axis is more compressed in the centre and at the right side). Figure 3b shows the same results but now with the real values. Average degree and average shortest path length are scaled to the secondary axis on the right. Figure 3 illustrates that, in general, network properties vary most at lower sample sizes. Once the sample size is increased beyond 200 companies, most measures increase or decrease fairly proportionally, without major fluctuations. Only degree assortativity increases steeply if the sample is increased from 800 to about 1000 firms, after which it remains fairly stable as long as the sample stays under 2800 firms.
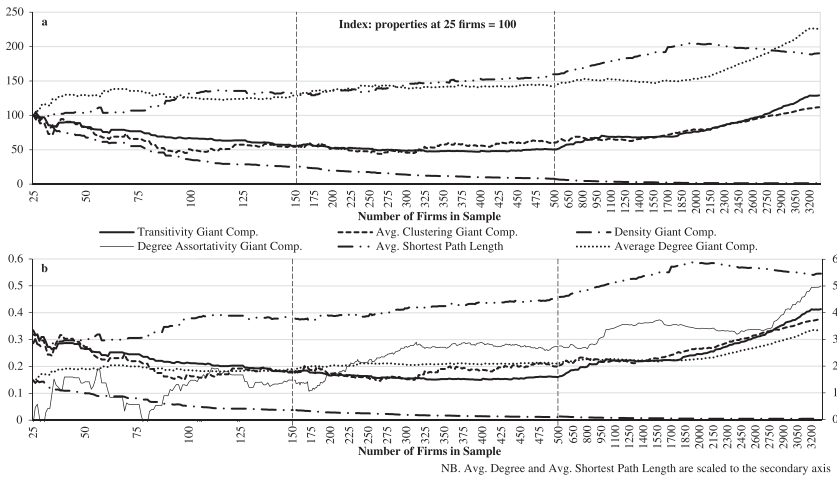
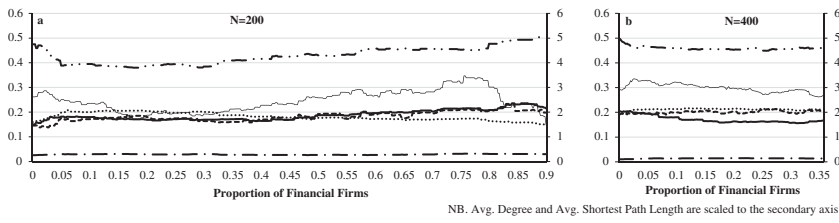**FIGURE 3**   Various network properties for different sample sizes

Most network properties are fairly robust once a sufficiently large sample of corporations is studied. But when studies look at sample sizes below 200, differences in sample size can significantly impact the outcomes. For instance, if the 50 largest firms are studied, the average clustering coefficient in the giant component is about 0.3, transitivity slightly lower and the average shortest path length 3.01. If sample size is then increased to 100, the average clustering coefficient is about half as large and transitivity declines to just over 0.2. At the same time, the average shortest path length increases by almost a third to 3.8. Yet, when the sample size is increased by another 75 firms, average clustering increases to about 0.2, while transitivity gradually decreases further to 0.18 and the average shortest path length remains fairly stable.

This shows that each decision on sample criteria results in quite different findings regarding key network properties but becomes more robust once one studies larger sets of corporations. In that sense, these findings prove more to be a problem for studies like the ones of Dudouet et al. (2012), Van Veen and Kratzer (2011) and Murray (2006), who base their findings on samples below 40 firms, than for most studies of samples comprising 250 or more firms as proposed by Stokman, Ziegler, et al. (1985).

The effect of stratified sampling of financial and industrial firms

Another key sampling decision is the proportion of the sample that is reserved for financial corporations. As mentioned, an often-used approach for scholars in elite studies is to use a stratified sample of one-fifth of financial corporations and four-fifths of non-financial firms. The decision for exactly those proportions, however, has never been very explicitly motivated, nor empirically tested, while changing the proportion of financial firms may well affect empirical analysis.

Figure 4 shows how various network properties change when the proportion of financial firms is increased for samples of 200 (Figure 4a) and 500 (Figure 4b) firms to, respectively, 90% and 36% of the sample.[2] In this case, as the figure shows, only in some instances the various network properties are significantly altered when a number of non-financial firms are substituted for financial ones. Mainly degree assortativity is sensitive to alterations in the proportion of financial firms. The other measures only show steep changes when the proportion of financial firms is decreased to below 10%. This suggests that, only when the largest financial institutions are removed from the sample and substituted for smaller industrial firms, the network characteristics change significantly. Smaller financial corporations clearly have less impact on the properties of the network when substituted with non-financial firms.

FIGURE 4 Various network properties for various proportions of financial firms for samples of 200 and 500 firms
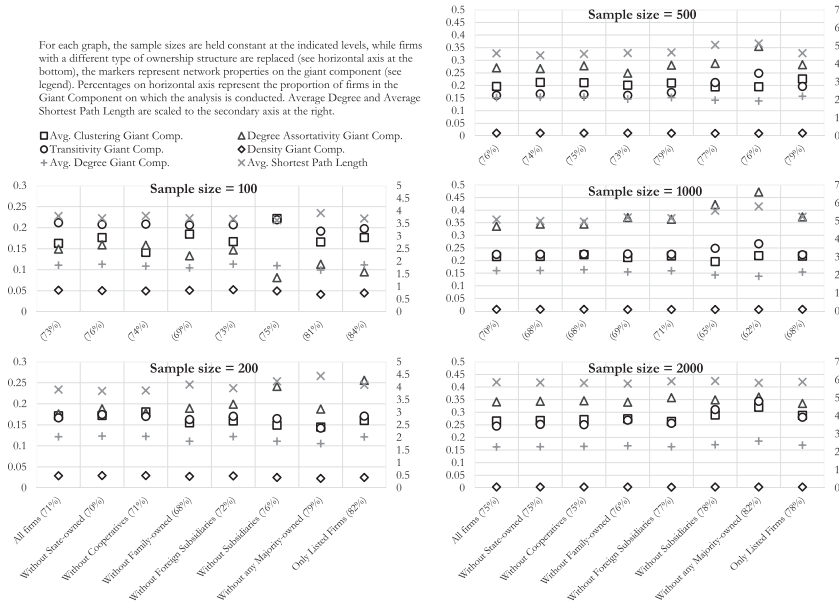
FIGURE 5 Network properties of giant component if firms with particular ownership structures are excluded

The effect of selecting firms based on ownership structures

Aside from sample size, many samples of corporate elite networks vary on the type of companies that are included. Some samples only comprise listed firms, whereas others also include state-owned enterprises, cooperatives, foreign subsidiaries or firms that are family owned. Like sample size, such decisions for inclusion or exclusion of particular firms may equally well-impact empirical outcomes (Carroll, 2004; Scott, 1997). Since our sample of Canadian firms also entails information on ownership, it is possible to examine what the effects are of excluding firms with a particular ownership structure.

Figure 5 shows the effects of excluding particular types of firms on various network properties. In each figure, the number of firms is held constant at levels of 100, 200, 500, 1000 and 2000 firms.[3] The percentages in brackets on the horizontal axis indicate the proportion of firms in the sample that are in the giant component. The markers on the most left side of each figure indicate the network properties when no type of firm is a priori excluded from the sample. The other markers represent network properties if corporations with particular ownership characteristics are substituted for the largest firms without such characteristics (e.g., majority owned firms are substituted for non-majority owned firms that would otherwise fall out of the sample). Average shortest path length and the average degree are again plotted along the secondary axis on the right side of the graphs.

Again, the results indicate that substituting firms affect the network properties most when sample sizes are small. When the sample size is 100, especially local clustering and degree assortativity increase or decrease significantly when some sets of firms are substituted for others. Also, the proportion of firms in the giant component changes when firms with particular ownership characteristics are replaced by smaller firms with other ownership characteristics. If, for instance, all firms that are (majority) owned by families are substituted by smaller firms that are not family owned, the proportion of firms in the giant component decreases from 73% to 69%, while the average clustering increases from 0.16 to 0.18 and degree assortativity decreases from 0.15 to 0.13. If, however, all institutionally owned firms (all subsidiaries) are replaced, degree assortativity decreases to about 0.08 while the average clustering coefficient increases to 0.22. The other properties remain at the same level if a number of firms with particular types of owners are substituted with other firms.

At larger sample sizes substitution of firms based on ownership structure has a more limited effect on network indicators. Notably, we find the largest differences when we compile a dataset with only stock-listed firms (regardless of whether they are majority owned) or when either all subsidiaries (institutionally owned) or all majority-owned firms are excluded from the sample. In these samples, more firms are in the giant component compared to the samples in which majority owned firms are included. In most samples, substituting the majority owned firms leads to a higher average shortest path length and degree assortativity. Average clustering and transitivity increase for the larger samples but decrease for the smaller ones. This can in part be explained by the fact that in the larger samples, some more densely interlocked clusters of firms in the natural resources sector enter the samples. Those are generally publicly listed and are not majority owned.[4]

Along with the findings on firm size and the proportion of financial firms, those results show how decisions for particular sampling criteria significantly affect network properties. Changing the sample size influences the network properties most, but once the sample is increased to beyond 200 or 300 firms, network properties seem more robust – that is, adding or removing a small number of firms is unlikely to change network properties significantly. The proportion of financial firms, or the inclusion or exclusion of firms with a particular ownership structure also influences certain network properties, but the effects are generally more limited.

ALTERNATIVE AND INDUCTIVE DEMARCATIONS OF THE CORPORATE ELITE

In this section, we explore a different, more inductive, sampling strategy that does not depart from the a priori assumption that the corporate elite resides on the boards of the *largest* corporations. Rather, we examine which boards are most well-connected and explore to whom they connect. We take a firm-oriented perspective, and as such we arrive at a demarcation that includes the firms in which the most well-connected elites reside, rather than one that takes an arbitrary number of firms and examines how well they are connected (see Larsen & Ellersgaard, 2017).

In practical terms the sampling strategy is slightly different. Here, we begin with all firms that were in the *Financial Post Top 500+300* for which we have data (733 total) and conduct a *k*-kore decomposition (see Seidman, 1983). This allows to identify the most well-connected firms in the core of the corporate elite network. By degenerating the graph to a certain level of *k* (where *k* is 0, 1, 2, 3, etc.), we exclude all firms that connect to less than *k* other firms. As a result, only the most well-connected firms in the core of the network remain present when *k* increases. Following Larsen and Ellersgaard (2017), we modified the strategy for identifying the *k*-cores by increasing the *reach* of a firm's *k*-score to 2 rather than 1. This means that *k* indicates not only to how many other firms (with a similar level of *k*) a firm connects but also takes the neighbours' neighbours into account. Thus, *k* indicates how many other firms a firm connects to at a distance of 2 that connect to an equal number of firms (at distance 2).[5]

Figure 6 shows a visual representation of the results. In each circle, the largest firms are plotted at the top of each circle, and the size decreases if one follows the circle clockwise. The more the firm is moved to the centre or inner circles, the higher the *k*-core they belong to, leaving a blank space in the outer circles. The size of the nodes (and node labels) is determined by degree centrality.
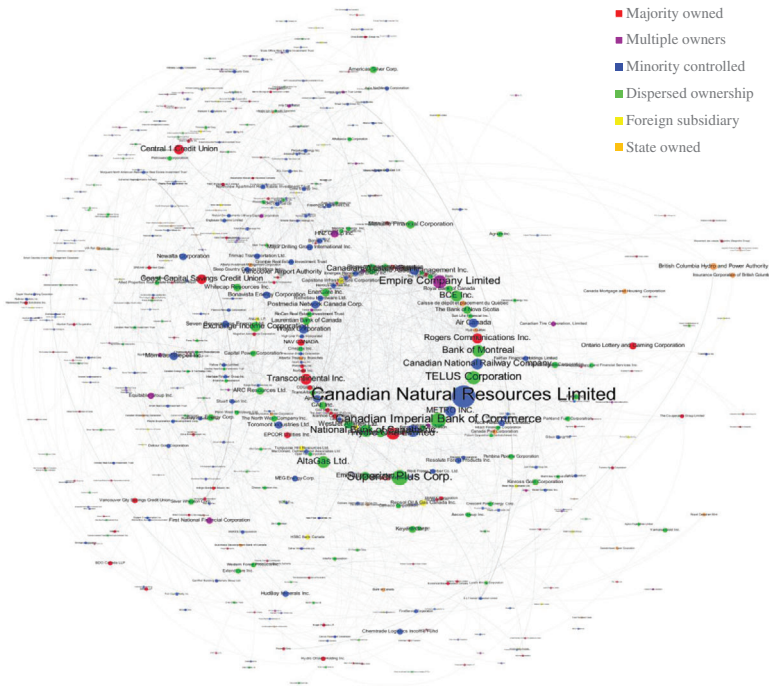
**FIGURE 6** Network visualization of k-core decomposition

As one would intuitively expect, most of the largest firms are in the inner cores, leaving the outer circles in the upper right quarter mostly empty. Amongst the largest companies, mostly foreign-owned companies such as Imperial Oil and Husky Energy fall outside the inner cores. More to the right there are a number of state-owned enterprises such as the British Columbia Hydro and Power Authority or the Canada Mortgage and Housing Corporation that are less integrated into the corporate elite networks. With regard to the sectoral composition, consumer-oriented firms (communications, staples and industrials) are somewhat overrepresented in the inner cores while the energy and materials sectors are underrepresented in the three inner-most cores. All big financial firms are in the inner core but comprise at most 25% of the sample and are therefore never overrepresented compared to the ranked samples.

The top tier (or most inner circle) comprises 71 firms that connect directly or indirectly to 21 other firms within this core. This number of firms gradually increases when the level of k is decreased so that for $k = 18$ the core comprises 201 firms and when $k = 13$ the sample increases beyond 300 firms. Note that aside from most of the larger firms, many small firms also enter into the k-cores. Those smaller firms would not be included if samples were only determined by firm size. Yet it makes a lot of sense to include them, since those firms may also play an important role in the corporate elite network. Figure 7 shows how many firms are included in each k-core that would not have been included if one would take a sample of equal size which only includes the largest firms (rather than the ones in the k-core). It also shows the relative distribution of firms (in terms of firm size) in the k-cores. That is to say, the k-core with $k = 4$, comprises 107 firms of which about 40% belongs to the top 100 firms, about 20% to the top 200, about 12% to the top 300 and so on. The white bar indicates that this sample overlaps for slightly under 40% with a sample of the top 107 largest firms. Thus, if we only determine our samples by which firms are largest, we miss out a significant number of connections and very well-connected firms on which corporate elites reside.

Finally, we compare the network properties of the k-cores with samples that comprise the largest firms but are of equal size. This is shown in Figure 8 where the ranked samples are determined by firm size. Perhaps not surprisingly,
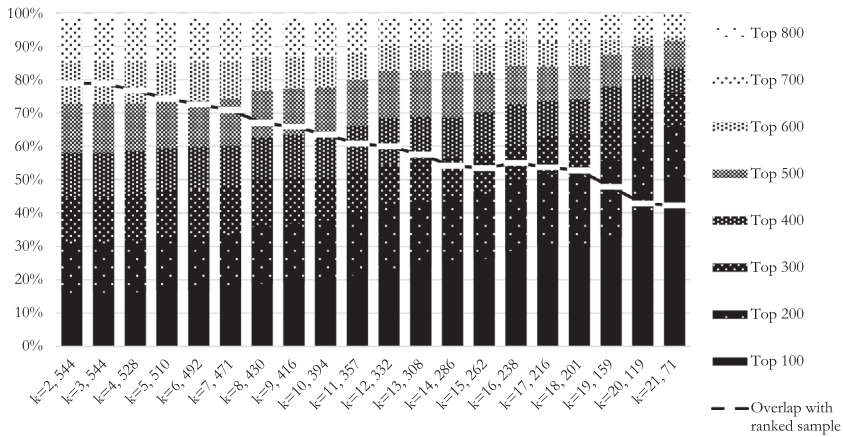
FIGURE 7 Percentage of firms with a particular rank within various k-cores
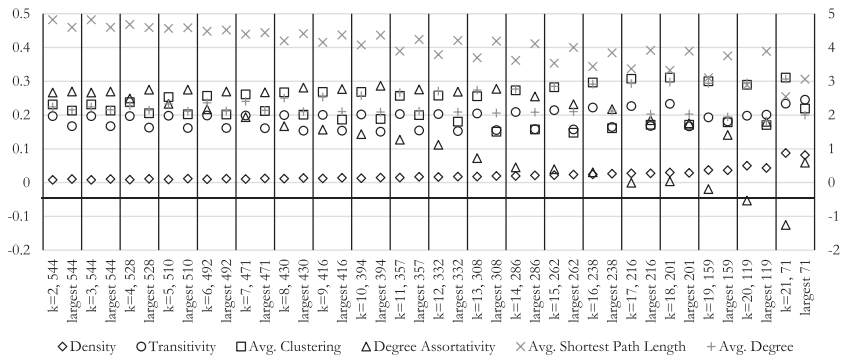
FIGURE 8 Network properties of *k*-cores and ranked samples of the same size

average clustering and average degree is higher for the samples determined by the *k*-cores, while average shortest path length and degree assortativity is higher for the ranked samples. The latter can be explained by the fact that the network properties of the ranked samples are only based on the giant component (so the actual number of firms is actually lower). Most importantly, we note again that the sampling strategy that is applied impacts the network properties of the corporate elite networks and our conclusions drawn from it.

ASSESSING THE QUALITY OF ELITE DEMARCATION STRATEGIES: THE EXTRA-CORPORATE ACTIVITIES OF THE CORPORATE ELITE

Following the basic underpinnings of corporate elite theory, a corporate elite requires not only structural cohesion but also a willingness for common action to promote their (class-wide) interests. One important and well-established indicator that signifies such an orientation is their presence at other non-corporate organizations (Barnes, 2017; Carroll, 2004; Comet, 2019; Domhoff, 1967; Useem, 1984). These can either be interest groups or think tanks, but also charities, foundations, cultural institutions and universities. There may even be direct political influence via positions in government, commissions or other authorities. A proper delineation of the corporate elite would therefore capture that part of the set of corporate officers that are most engaged in such extra-corporate network ties. Using this as a
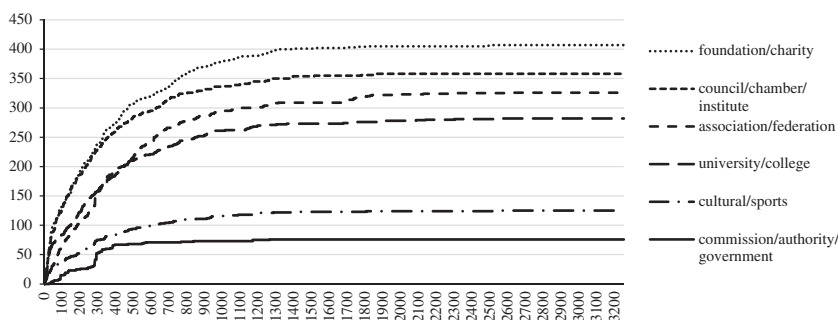
FIGURE 9 Interlocks between corporate and non-corporate institutions for different sample size

criterion allows us to compare the quality of the traditional ranked-by-size approach with our novel relational oriented method.

As noted, our data comprise information on 1537 interlocks with 693 of non-corporate institutions. We classified the institutions into six types as indicated in Figure 9. Similar to the initial analysis, the lines in this figure represent the number of interlocks to non-corporate institutions when sample size increases by one firm (based on firm size). The lines demonstrate that half of the relations are already identified if the sample comprises the 237 largest firms. When we increase the sample to 500 firms, the directors of these firms already cover 1164 of the 1537 interlocks with non-corporate institutions. Once we reach about 1200 companies in the sample, almost no new directors or executives with interlocks to non-corporate institutions enter into the sample when more firms are included. This may in part be because those people are generally less 'high profile', so data on their eventual side activities are more difficult to access. Nonetheless, this data indicates that it is mostly the directors and executives that reside on the boards of the larger corporations that participate in extra-corporate activities. People in command of smaller corporations are less likely to be present at other institutions, regardless of whether these are charities, universities, cultural or government institutions.

This finding reinforces earlier findings that the corporate elite mainly resides on the boards of the largest firms. But it also demonstrates that many connections with non-corporate institutions are already covered when the commonly used samples of 250 firms are used. A sample size of over 200 or 300 firms not only provides robust insights in the connectedness of the corporate elite but also covers the directors that are most engaged in extra-corporate activities, thereby indicating those are also most conscious and most active in promoting the class-wide interests.

Finally, we can also compare the extra-corporate activities of the directors and executives in the samples determined by firm size, as compared to those determined by the k-core decomposition. Similar to the analyses in Figure 9, we compared the number of relations to non-corporate institutions of the samples determined by the k-core decomposition with those of an equal number of firms determined by firm size. The results are presented in Figure 10 where the black bars represent the average number of relations per firm to non-corporate institutions for the various k-cores, whereas the white bars indicate the average number of links for each sample comprising the largest firms, with equal sample size.

With regard to most institutions there seems to be little difference, when either one or the other sampling strategy is applied. But there is a difference. If the samples are determined by the k-core, the top tiers ($k \geq 18$) outperform samples of the same number of firms determined by firm size. Only when it comes to relations to commissions, authorities and government, the ranked samples include more directors and executives that have these relations. This can be explained by the fact that those samples include a number of state-owned enterprises that are rather unconnected to other corporations (cf. Figure 6), but which do have a lot of relations with government institutions. Our results therefore suggest that the quality of the two methods, in so far as they are able to demarcate the part of the corporate
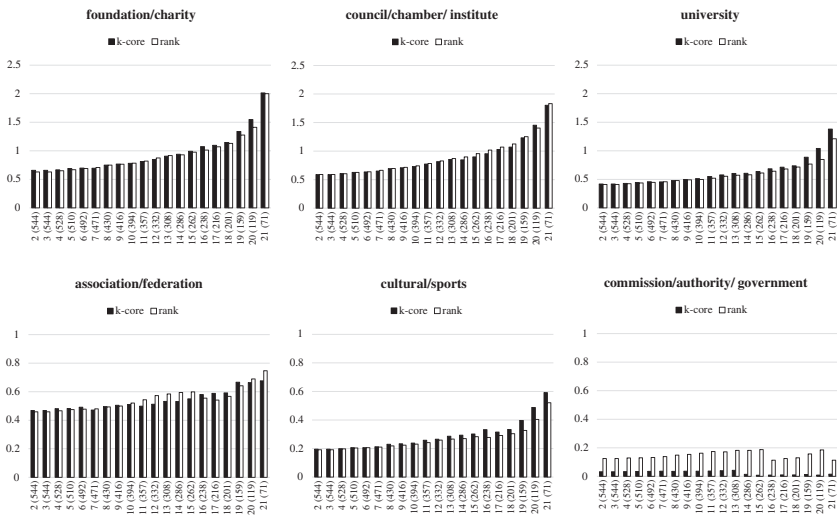
FIGURE 10 Average number of relations to non-corporate institutions from firms in *k*-cores and ranked samples

community that is most active in extra-corporate networks, is comparable, with an out performance of the *k*-core approach for the top-tier firms.

DISCUSSION

We sought to address a question regarding what sampling decisions should guide a meaningful delineation of the corporate elite. Our aim was to arrive at a theoretically meaningful and empirically useful demarcation of the corporate elite, while assessing the robustness of existing demarcations. In assessing our data, we applied both positional and relational criteria that are constitutive of the corporate elite following a range of theories and research traditions.

The central argument has been that if we are interested in studying the corporate elite, we should only include those who have a great deal of positional power *and* are related to others who have such power. In most studies, only one criterion is applied that generally leads scholars to only include an arbitrary number of the 'largest' firms ranging from 20 to 1500 and beyond. As there is no theoretically informed standard, we have attempted to assess what the effects of including or excluding more firms are while accounting for the nature of such firms.

We have demonstrated that the corporate elite networks have different properties when different sampling criteria are applied. Comparisons of corporate elite networks between different countries will often tell little about corporate governance or the way elites are organized when samples are too small. Only when samples comprise over 200 firms, network properties become more stable when more firms are added or substituted, leading to more reliable conclusions and demarcations of the corporate elite. In that respect the comparative studies that used samples of 250 firms (Stokman, Ziegler, et al., 1985; Windolf, 2002) or the longitudinal studies (Carroll, 2004; David & Westerhuis, 2014; Davis et al., 2003; Heemskerk, 2007) yield quite meaningful results, while findings of studies that only use samples less than 50 firms (e.g., Dudouet et al., 2012; Murray, 2001; Van Veen & Kratzer, 2011) may give unstable insights about elite organization in a specific country at all. Reversely, attempts to study the entire universe of firms, as those of Heemskerk and Takes (2016) and Heemskerk, Fennema, et al. (2016), may reveal important patterns of corporate elite organization, but do not necessarily tell more about their mobilization outside the corporate world.

In order to do right to the theoretical presumptions that inform studies on corporate elites, we have attempted an alternative sampling strategy. Rather than departing from the assumption that the corporate elite resides on the

boards of the *largest* corporations, we analysed which firms were most well-connected and subsequently examined their size. This resulted in a demarcation that performs similarly well to ranked-approached (and at the top tiers of the corporate elite even better) while at the same time satisfied the theoretical criteria of (corporate) elites in which relational power is as important as positional power.

This study triggers a number of questions regarding sampling decisions in corporate elite networks and prompts to explore alternative strategies. One such alternative may be a more snowball approach, already pioneered by Carroll (2017), in which the researcher starts with the 10 or 20 largest corporations and examines to which other corporations these relate. In that case, one avoids missing out on important links and venues of the corporate elite. As such, the question is not any longer how well the 100, 200 or, say, 500 companies in a particular geographic area are related, but could rather be on how many of the largest corporations the corporate elite resides. One could also think of taking a more qualitative cut-off point by taking what Perroux (1950) has called the 'dominant firms' in each sector as was done by Helmers et al., (1975) or take a number of firms which, in total, account for a certain percentage of gross domestic product, regardless of how many firms this comprises in a particular year. But if uncertain, our study suggests that if the goal is to probe the properties of a network of interlocking directorates, researchers should include at least 200 firms. On a methodological note, this study demonstrates that, most importantly, research on corporate elite networks can be fundamentally impacted by the sampling strategies applied. Therefore, any future study on the topic should carefully consider which demarcation is most meaningful for the purpose of the research and how such demarcation may or may not impact the robustness of the results.

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ENDNOTES

[1] While most studies about interlocking directorates study intercorporate networks, studies about the 'inner circle' have also often studied the interpersonal network. This may yield significantly different results (Bearden & Mintz, 1987). Yet, when it comes to sampling decisions and demarcations, even scholars studying interpersonal networks start out from a list of (large) corporations, rather than persons. For this reason, we decided to focus primarily on the interorganizational relations. Moreover, as is common in the literature, all properties are calculated on the giant connected component of the graph. The analyses were conducted using the NetworkX 1.11 package for programming language Python (Hagberg et al., 2008).

[2] Because there are only 186 financial firms in the subsample of 733 firms (for which the additional information is most reliable), the maximum proportion of financial firms examined is 36% for the sample of 500 firms and 90% in the sample of 200 firms. If one would *not* reserve a particular proportion of the sample for financial firms but only look at the ranks, the proportion of financial firms would be 25% in the sample of 200 and 26% in the sample of 500 firms (these points are indicated by vertical the thick black lines in the figures).

[3] This means, for instance, that if all state-owned owned firms are excluded, they are replaced by firms that are not state-owned so that the sample size remains at the same number of firms. Note that only the network properties of the giant component are reported.

[4] Recall that no data was available for a number of large foreign subsidiaries, so that they are already excluded. The effects of in- or excluding those firms may actually be larger than indicated in the graphs here.

[5] There are also some drawbacks to this analysis. Most important here, perhaps, is that particular highly clustered areas are likely to be in a *k*-core for high levels of *k*, while they not necessarily have to be very central to the network as a whole. This is relevant because, once the graph is degenerated to a small number of nodes, there is a chance that a densely connected local core is identified, rather than the global core that is eventually somewhat sparser. To (partly) mitigate these eventual misidentifications of nodes in the core, the following analysis excludes all firms that are not in the giant component of the *k*-core.

[6] Note that the ranking in this sample and the database deviate somewhat from the FP500+300 rank as we found some financial statistics to be different from the ones reported in this list. Moreover, as discussed in the text, several companies are excluded and thus replaced by the highest ranked company after them.

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APPENDIX A Samples and sampling criteria of most renowned studies to interlocking directorate networks until 2015

Sample year	Replicated at years	Sample size (subset)	Sample sizes of replications	Region	Criteria	Stratification	Ranked by	Used in studies	Replications used in studies
1896	1914, 1928, 1933, 1938, 1976, 1992, 2010†	211	346, 377, 405, 325, 363, 614, 252	Germany	Size	200 Non-financial, 50 financial‡	Market capitalization (assets and turnover in 1976 and 2010)	(Windolf, 2014)	(Windolf, 2002; Ziegler, Bender et al., 1985)
1904	1962, 1966, 1974, 1978, 1982, 1986, 1990, 1994, 1999, 2003, 2005, 2010†	166	All 250 or higher	USA	Size	Largest for various sectors; in replications 200 Non-financial, 50 financial‡	Assets	(Mizruchi, 1982; Windolf, 2002)	(Mizruchi, 1982; Schifeling & Mizruchi, 2014; Windolf, 2002)
1904	1938, 1958, 1976, 1983, 1993, 1997, 2003, 2010†	250	Same	UK	Size	200 Non-financial, 50 financial‡ (in 2010 only listed)	Assets, (1958: various measures; 1976: turnover and assets)	(Schnyder & Wilson, 2014; Scott & Griff, 1984)	(Schnyder & Wilson, 2014; Scott & Griff, 1984, 1985)
1911	1928, 1937, 1957, 1973, 1982, 1992, 1998, 2009†	250	Same	Japan	Size	200 Non-financial, 50 financial‡	Assets	(Koibuchi & Okazaki, 2014)	
1911	1927, 1936	793 (500, 250)	4657 (500, 250), 4306 (500, 250)	Italy	Size; listed; working capital > 1 million lire		Working capital	(Vasta & Baccini, 1997)	
1935	1965, 1970	250	Same	USA	Size;	200 Non-financial, 50 financial	Assets	(Allen, 1974; Dooley, 1969; National Resources Committee, 1939)	(Allen, 1978; Committee on the Judiciary - Antitrust Subcommittee, 1965; Dooley, 1969; Levine, 1972; Pfeffer & Salancik, 1978)

(Continues)

APPENDIX A (Continued)

Sample year	Replicated at years	Sample size (subset)	Sample sizes of replications	Region	Criteria	Stratification	Ranked by	Used in studies	Replications used in studies
1946–1976		100 (any year)		Canada	Size; sector; special criteria	70 Largest any year; 20 financial any year 10 Largest commercial	Assets	(Carroll, 1986; Carroll et al., 1982; Fox & Ornstein, 1986)	(Clement, 1975)
1950	1972	181	113	Canada	Dominance (size)		Employees, turnover	(Clement, 1975; Porter, 1965)	
1959	1979	250	251	Australia	Size		Assets	(Carroll et al., 1990)	
1962–1973		1131, 1111		USA	Size; listed; sector	Industrial firms, commercial banks, insurance companies, transportation firms, utilities, merchandisers, diversified financial institutions and non-classifiable companies		(Kono et al. 1998; Mintz & Schwartz, 1981, 1985; Schwartz, 1987)	
1966	1976, 1986, 1998, 2004	30		New Zealand		Index	Market capitalization	(Murray, 2006)	
1969	1972, 1996, 2006	76	84, 76, 76	The Netherlands	Dominance (size)		Turnover	(Helmers et al., 1975)	(Heemskerk, Mokken et al., 2012; Mokken & Stokman, 1978; Stokmana et al., 1988)
1969		797		USA	Size	500 Industrial, 50 retail, 50 banks, 50 insurance, 50 utilities, 50 transportation, 47 other	Turnover	(Koenig et al., 1979; Mariolis, 1975; Pennings, 1980; Useem, 1979)	

(Continues)

APPENDIX A (Continued)

Sample year	Replicated at years	Sample size (subset)	Sample sizes of replications	Region	Criteria	Stratification	Ranked by	Used in studies	Replications used in studies
1970	1976, 1996, 2006, 2013	176	176	World	Size; region;	135 Non-financial, 41 financial, distributed over eight economic regions		(Fennema, 1982)	(Fennema, 1982; Heemskerk et al., 2016)
1975		265		Malaysia	Size; listed		Market capitalization	(Lim & Porpora, 1987)	
1976	1996	250	250	Canada	Size	200 Non-financial, 50 financial	Turnover, assets	(Carroll, 2004)	(Carroll, 2004)
1976		250		USA		200 Non-financial, 50 financial	Turnover, assets	(Bearden & Mintz, 1985; Mizruchi, 1982)	
1976	1997; 2000; 2010	250	250	UK	size	200 Non-financial, 50 financial	Turnover, assets	(Schnyder & Wilson, 2014; Scott & Griff, 1984, 1985)	
1976	1996, 2001, 2006, 2011	250	250	Netherlands	size	200 Non-financial, 50 financial	Turnover, assets	(Heemskerk, 2007; Stokman, Wasseur, & Elsas, 1985)	
1976		250		Switzerland		201 Non-financial, 49 financial	Turnover, assets	(Rusterholz, 1985)	
1976		325 (259)		Germany		Aim is 200 non-financial, 50 financial (supplemented by 66 subsidiaries)	Turnover, assets	(Ziegler, Bender, et al., 1985)	
1976		259		Austria			Turnover, assets	(Ziegler, Reissner, et al., 1985)	
1976		237		Finland			Turnover, assets	(Heiskanen & Johanson, 1985)	

(Continues)

APPENDIX A (Continued)

Sample year	Replicated at years	Sample size (subset)	Sample sizes of replications	Region	Criteria	Stratification	Ranked by	Used in studies	Replications used in studies
1976		253		Italy		Aim is 200 non-financial, 50 financial	Turnover, assets	(Chiesi, 1985)	
1976		270		Belgium		200 Non-financial, 50 financial, 20 holdings	Turnover, assets	(Cuyvers & Meeusen, 1985)	
1976	1981, 1986	125	same	Hong Kong	size; listed	100 Non-financial, 25 financial	Market capitalization, assets	(Wong, 1996)	
1977		250		France		200 Non-financial, 50 financial	Turnover, assets	(Swartz, 1985)	
1976–1979		196		UK	Size			(Useem, 1984)	
1978–1979		212		USA	Size, sector	Industrial, banks, insurance, retail, transportation, utilities		(Useem, 1984)	
1980		1050		USA	Size; sector; listed		Turnover	(Burris, 2001, 2005)	
1980		57		USA	Size; sector; Pac	Three largest in each sector with PAC in Fortune 500	Turnover	(Mizruchi, 1992)	
1981		115		South Africa	Size; listed	100 Industrial, 5 banks, 5 property, 5 mining	Assets	(Cox & Rogerson, 1985)	
1981	250			Canada	Size		Assets	(Ornstein, 1989)	

(Continues)

APPENDIX A (Continued)

Sample year	Replicated at years	Sample size (subset)	Sample sizes of replications	Region	Criteria	Stratification	Ranked by	Used in studies	Replications used in studies
1982		1000 (443)		USA	Size; sector; Pac	1000 Including: 500 Industrials, 100 diversified service, 50 banks, 50 insurance companies, 50 diversified financial, 50 retailers, 50 transportation, 50 utilities, 100 private		(Burris, 1987)	
1982	1986, 1990, 1994	648	592, 591, 634	USA	Size	50 Commercial bank holding, 500 industrial, 25 diversified financials, 25 retailers, 25 transportations		(Davis & Mizruchi, 1999; Davis et al., 2003; Schifeling & Mizruchi, 2014)	
1983	1998, 2006	500	same	World	Size		Turnover	(Kentor & Jang, 2004)	(Burris & Staples, 2012)
1986		250	same	Australia	Size; listed		Assets	(Alexander et al., 1994; Carroll et al., 1990)	
1990–2001		1696		Hungary				(Stark & Vedres, 2012)	
1990	2000	106	108	Switzerland	Size; sector; ownership	70 Industrial or service, 10 finance, 10 insurance, 3 cantonal banks, 3 private banks, 3 transportation, 5 electricity, any top 20 private company	Market capitalization, assets, turnover	(Heemskerk & Schnyder, 2008)	
1991		250		Australia	Size	200 Non-financial, 50 financial	Turnover	(Alexander et al., 1994)	

(Continues)

APPENDIX A (Continued)

Sample year	Replicated at years	Sample size (subset)	Sample sizes of replications	Region	Criteria	Stratification	Ranked by	Used in studies	Replications used in studies
1992	1998, 2004	30		Australia	Size	Index	Market capitalization	(Murray, 2001, 2006)	
1993		190		Spain	Size	100 Non-financial the 60 banks, 30 insurance	Turnover, assets	(Aguilera, 1998)	
1993		616 (300)		Germany	Size			(Windolf, 2002)	
1993		520 (300)		UK	Size			(Windolf, 2002)	
1993		250		Ireland	Size	200 Non-financial, 50 financial	Turnover, assets	(Mac Canna et al., 1998)	
1995		300		Switzerland	Size			(Windolf, 2002)	
1995		300		Netherlands	Size			(Windolf, 2002)	
1996		200		Hong Kong	Size		Market capitalization	(Au et al., 2000)	
1996		200		Thailand	Size		Market capitalization	(Peng et al., 2001)	
1996	2006	500		Europe	Size	400 Non-financials, 100 non-financials	Turnover	(Carroll et al., 2010)	(Carroll et al., 2010)
1996		350		World	Size	Financials with > 100 billion assets, non-financials > 14 billion turnover	Assets, turnover	(Carroll & Carson, 2003)	
1997		295		Singapore	Size; listed		Market capitalization, assets	(Ong et al., 2003)	
1997		374		France				(Windolf, 2002)	

(Continues)

APPENDIX A (Continued)

Sample year	Replicated at years	Sample size (subset)	Sample sizes of replications	Region	Criteria	Stratification	Ranked by	Used in studies	Replications used in studies
1998		100		France	Power score		Weighted values for total capital, turnover, net profit and number of employees	(Maclean et al., 2007)	
1998		100		UK	Power score		Weighted values for total capital, turnover, net profit and number of employees	(Maclean et al., 2007)	
1999		625		USA				(Davis et al., 2003)	
2000		177 (114)		Chile	Size; listed; nonfinancial			(Silva et al., 2006)	
2000–2010		2454 (1500 each year)		USA	Size; listed; s&p list		Market capitalization	(Chu & Davis, 2016; Schifeling & Mizruchi, 2014)	
2005		596		Scandinavia	Size; listed; country	149 Non-financial from Denmark; 200 from Norway; Listed on Stockholm Stock Exchange	Assets; turnover; market capitalization	(Edling et al., 2012)	

(Continues)

APPENDIX A (Continued)

Sample year	Replicated at years	Sample size (subset)	Sample sizes of replications	Region	Criteria	Stratification	Ranked by	Used in studies	Replications used in studies
2005	2010	300	same as original	Europe	Size; listed; ftse300		Market capitalization	(Heemskerk, 2011)	(Heemskerk, 2013; Heemskerk et al., 2013)
2006		362		EU15	Size; listed; country	4–38 Firms per country (depending on economy size)	Market capitalization	(Van Veen & Kratzer, 2011)	
2006–2007		129		Italy, France, Germany, Netherlands	Size; listed; in mayor index; large euro economy	Indices: AEX 25; CAC 40; MIB 40; DAX 30	Market capitalization	(Dudouet et al, 2012)	
2010		300		Latin America	Size; listed	200 Non-financial; 100 financial	Turnover; assets	(Cárdenas, 2015)	
2013		500		Mexico, Chile, Peru, Brazil, Colombia	Size	100 Each country, 75 non-financial, 25 financial	Turnover, assets	(Cárdenas, 2016)	

Since, as Burris (2005, p. 249) has stated, interlocking directorate research has 'virtually exploded' in recent years, the table above is far from complete. We have rather attempted to list the first several, and most well-known datasets in interlocking directorate research for each region.

[†] In some replications, data from other studies listed in the table were used and amended by, for instance, taking a subset, so that sampling criteria were more consistent.

[‡] In some replications, only listed companies are included.

APPENDIX B   Data selection

The data was collected in June 2016. In total, 3637 Canada-based corporations and another 167 non-Canada based corporations were identified for which information on the directors and top executives was available. In 3475 cases, there was also financial information available, so it was, in line with what is typically done in corporate elite research, possible to rank the corporations by turnover (see below). We decided *not* to rank the non-Canada based companies because, although they likely operate in Canada or are traded at the Toronto Stock Exchange, we are interested in the *Canadian* corporate elite. Using information on sector and ownership that was available from database, it was possible to classify the corporations as financial or non-financial and identify state-owned enterprises, foreign subsidiaries and family-owned firms. The database also provides information for each individual on their connections to the 693 non-corporate institutions.

There are two potential problems to the dataset. The first relates to the question of whether the companies in the dataset are also the actual *largest* companies in Canada. Since *fp.infomart* has no clear criteria for including or excluding a company in the database it is difficult to tell whether all companies in our sample are actually the largest ones. The best way to examine this was to use the most extensive rank of Canadian companies and their size available: the FP 500 + 300 that lists the largest 500 companies in Canada (plus another 300 making a total of the top largest 800 Canadian firms). We found that 115 companies in this rank of the 800 largest firms to be missing from the sample. Beyond the list of the 800 largest firms, no ranks are available, so we cannot say how many companies are not present in the list after the 800th largest firm. Yet, for most of the analyses that are conducted on samples larger than the largest 800 firms, the actual rank is less important.[6]

A second issue with the data, or with corporate data in general, is that there are many intercorporate ownership structures that make it difficult to determine who is actually in control of the corporations. This relates to the question, once posed by Berkowitz et al. (1978) of what a corporation actually is. As the *fp.infomart* lists for each corporation shareholders with a > 10% ownership block, it was possible to find that a number of companies in the sample were actually wholly owned subsidiaries of other firms in the sample and often shared multiple directors and executives. In those cases, one might say that those corporations are not so much different corporations, but rather different legal entities part of the same enterprise group. If those companies would be regarded as different firms, one would find a much more clustered network and likely overestimate the number of 'intercorporate' links. To account for this, we examined all companies that were majority owned as well as all companies who shared three or more directors or executives with other companies. If the companies were owned by a different company that was in the dataset, it was excluded. As a result, 224 companies were excluded of which 67 companies were among the largest 800 (resulting in a top 733). Furthermore, if two companies had a common owner which was not in the dataset, only the largest company was retained. In no other cases the companies were excluded. As a result of this filtering process, the dataset consists now of 3580 Canadian companies of which 3413 are also Canada-based. Since 162 firms had no financial statistics, there remain 3251 ranked companies on which the analyses can be conducted.

Finally, it should be noted that, in the vast majority of cases where single capitalists or families were majority owners of a firm, those capitalists (or members of the owning family) were typically represented at the boards of directors. As a result, we can assume that in only examining the networks of directors and executives, automatically includes the owners in the firm and no separate data or analyses are required.