Original Article

Where is the backbone of the transnational corporate elite?

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Abstract
The transnationalization of corporate activities has contributed to a rise in the number of transnational professionals and transnational corporate elite members. These transnational actors establish ties within and across national borders and contribute to the formation of a more connected global corporate network. And yet little is known about the geographical locations through which these transnational corporate elites operate, both nationally and internationally. This article aims to fill this gap by applying the network backbone detection algorithm to detect the global cities that are connected through the operations of the transnational corporate board members. The article detects the backbone of around 300 global cities, centered around London, New York and Hong Kong. The findings show that the backbone is currently structuring over a set of border-crossing communities and expanding to the locations beyond the Anglophone corporate world. The study interprets the presence of these new communities as the first signs toward the convergence of practices, norms and possibly identities of national elite members.

Keywords
board interlock networks, elite networks, transnationalism, world city networks
1 | INTRODUCTION

Since the closing decades of the twentieth century, as many aspects of social and economic life have become increasingly globalized (Sassen, 2007), scholars have begun speculating about the internationalization of the interests and networks of elites and upper classes. From the 1970s onwards, the literature has started to recognize the rise of internationalized national corporate elites, with an interest in the globalization of the economy and characterized by the support of global capitalism (Hymer, 1979). In these early contributions, this burgeoning elite group was identified in a number of ways, such as the Atlantic ruling class (Van Der Pijl, 1984), the international wing of the managerial bourgeoisie (Becker, Frieden, Schatz, & Sklar, 1987), the emerging global class (Cox, 1987), or the transnational capitalist class fraction (Gill, 1990). This increasingly international, as opposed to exclusively national, orientation of corporate elites has been explained by, and conceptualized as, the turn of corporations toward operating in multiple nation states (Barnet & Muller, 1974). This expansion of corporate activities has, in turn, contributed to the formation of a group of corporate elites and transnational professionals, densely tied to these multinational corporations, while also deeply embedded in transnational policy planning groups, think tanks and international organizations (Harrington & Seabrooke, 2020; Henriksen & Seabrooke, 2021).

One of the oldest questions in this field of literature is what the network structure of locations might be through which members of the transnational corporate elite operate. While earlier literature focused more or less exclusively on the northern transatlantic connection between corporate elites (see, e.g., Fennema, 1982; Van Der Pijl, 1984), that is, the strengthening ties between European and the Northern American business communities, more recent studies show that we might be witnessing a restructuring within the global corporate elite network (Heemskerk & Takes, 2016; Heemskerk et al., 2016). This restructuring is most prominent in the rising new economies (such as China), that are characterized by particularly strong national business elite communities, while also successfully integrating in international corporate elite networks (see De Graaff, 2020; De Graaff & Valeeva, 2021 on the Chinese corporate elite, building transnational ties).

However, this integration of national elite groups into international circles does not take place at the same pace, and some individual elite members have higher chances of entering them than others. National-international links, forged by transnational professionals tend to follow particular class, educational and linguistic affinities, and transnational elite members are often characterized by common backgrounds and origins (Harrington, 2017; Harrington & Seabrooke, 2020; Young et al., 2021). While one might argue that today we are observing the rise of new powerful economic centers, which could be said to be rebalancing power relationships among various elite groups, others will be more prone to conclude that only actors with highly specific backgrounds and origins are able to join the forces of this newly flourishing network of transnational corporations, organizations and policy-planning groups (see e.g., a discussion on hegemony, fields and institutional approaches to understanding transnational elites in Henriksen & Seabrooke, 2021).

To contribute to this debate, this article focuses on the current locations through which transnational corporate elite members operate. The study applies the network backbone detection methodology to the network of corporate board interlock ties between cities (N = 1628 cities), which is later analysed by applying community detection and centrality analysis methodologies. The backbone is a set of ties that are significant for preserving the global- and local-level network structures around the city, and reveals the set of the most influential cities through which the transnational elite operates. The findings show that the network backbone consists of around 300 global cities and is centralized around London, New York and Hong Kong. While around half of its network communities consist of cities from one country or region, another half of communities already spreads across cities from different regions and continents. These are, for instance, Asian-European communities that connect Chinese cities with some European capitals. Positions of particular cities in the backbone and the rise of continent-crossing communities are interpreted as the first move toward the convergence of practices, norms, and possibly identities of national elite members.
The rest of the article is structured as follows. The upcoming sections situate the study in the field of literature on the transnationalization of elites and introduce the concept of the network backbone. Section 5 presents an empirical case and the methodological approach. Section 6 gives an overview of the results, presenting the backbone properties, community structure and the most central actors. The final section concludes the article by discussing potential applications of the presented approach and elaborating on the future studies about the transnationalization of elite networks.

2 | PERSISTENT NATIONAL ORIENTATIONS OF THE TRANSNATIONAL CORPORATE ELITE

The transnationalization of corporate activities has resulted in the formation of the transnational corporate elite network (Carroll et al., 2010). In empirical literature, this network is often represented by corporate board members who obtain board membership positions in multiple nation states and, therefore, connect these locations (Carroll, 2009). By being affiliated with multiple corporations across the globe, these individuals create transnational board interlock ties between firms that potentially allow to increase elite cohesion and coordinate actions of national elites (Mizruchi, 1996). The oldest question in the literature on transnational board interlock networks deals with the locations through which the transnational corporate elite members operate. If the transnational network of corporate elites is under formation, along which geopolitical axes is it created? If it has been already established, what is its underlying network structure?

One of the first empirical studies that investigate the level of transnational interlocking of the largest world corporations is a study by Fennema (1982), which shows that during the 1970s the number of ties crossing national borders significantly increased, and that this rising network was characterized by the presence of a strong northern transatlantic corporate elite component. In the follow-up study by Carroll and Fennema (2002), in which they evaluated the intensity of transnational interlocking between the largest world corporations only a few decades later, it was demonstrated that this transnational board interlock network remained stable, and that the Atlantic business system continued to develop from the 1970s until the 1990s. Their findings show that the global network of transnational interlocks remained centered around the northern transatlantic area, while they also recorded strong nationally-based clusters within this network. Japan, Australia, South Korea and Brazil remained isolated from the transnational board interlock network while European national elites were building a European corporate community. Fennema and Schijf (1985), in another seminal article on transnational interlocks between global corporations, analyse transnational financial participation of companies. Their study shows that the US-based companies were participating financially in the majority of transnational actions, confirming the findings in previous studies about the significant position of the American corporate elite in the global corporate world.

These earlier studies highlighted the importance of the transatlantic economic system with the American and some European corporations at its centre, but later contributions show that the corporate world is, in fact, transforming. In 2010, Carroll et al. (2010) published a detailed empirical study about the level of the transnational interlocking of Fortune 500 corporations from the 1970s until the 2000s. They find an increase in the level of the transnational interlocking among these corporations and intersections of these types of ties with other influential transnational policy-planning networks. Moreover, Carroll et al. (2010) establish that since the late 1990s, transnational interlocking has become a common practice among world corporations and has stopped being a unique practice limited to a small number of western multinationals. Related recent articles take a big data approach, and reveal that the current transnational board interlock network is spread over a few regional network communities, with a majority of activities remaining concentrated in the Anglo-American business world (Heemskerk & Takes, 2016; Heemskerk et al., 2016). Together with a strong network position of the North American and European corporate elites in the transnational board interlock network, these studies show that there are multiple national elite groups that form a number of more fractured network communities. For instance, Heemskerk and Takes (2016) find a distinct Asian network community.
within the global interlock board network that stands relatively disconnected from the rest of the world and is characterized by dense internal ties within the region.

This stream of literature indicates that there is an established global network of corporate board interlock ties that is characterized by small-world properties and has a distinct community structure with a list of key central players. At the same time, some studies show that the growing transnationalization of corporate elite interests did not lead to the decreased role of the national elite networks. On the contrary, a growing number of transnational ties contributed to the strengthening rather than weakening of the national corporate networks: ‘the transnational network is a kind of superstructure that rests upon rather resilient national bases’ (Carroll & Fennema, 2002, p. 414). This means that even if we observe a consolidating transnational corporate elite community, it is building up over already well-established national networks of relations.

This is also confirmed by recent empirical studies on transnational elite and transnational professional networks. González (2019), for example, in a study of the British corporate elite, demonstrates that the transnational class formation of corporate elite members is still taking place at the national level, which means that they are created, formed and reproduced as elites within their country state. Similarly, in an investigation of the Swiss corporate elite, Bühmann et al. (2013) show that transnational elite ties have not replaced connections between national elites, and members of the transnational corporate elite remain strongly tied to their national elite groups. International experiences that these elites, and the professionals within them, gain abroad can also be adapted to national realities and be applied for strengthening the position within national networks (Boussard, 2018; Dezalay & Garth, 2010). Finally, others reveal that internationalizing elite members, even though they come from different parts of the globe, often originate from similar socio-economic backgrounds and are characterized by particular educational and career patterns (Harrington & Seabrooke, 2020; Young et al., 2021). In sum, this stream of the literature reveals that while most of the transnational corporate elite members remain strongly embedded in their national power networks, they share many more similarities than differences.

Because of this simultaneous embeddedness in the networks of different levels (national vs. international), a fair question is how to identify the locations through which they operate as transnational actors. If in the earlier literature, it was revealed that nation states were the main locus of transnational elite operations (Fennema, 1982; Fennema & Schijf, 1985), today these transnationalizing elites and professionals build elite networks, and form their educational and professional paths, in a limited set of global cities such as London, Paris, or New York (Boussard, 2018; Fernandez et al., 2016). But the national level of the transnational corporate elite connections and operations is still artificially defined in line with national borders. However, as Heemskerk et al. (2016) argue, geographical borders of nation states do not necessarily coincide with the borders of elite communities, in which city-, country-, or regional-level corporate elite members operate. These particular elite network communities are often formed as a result of historical, political, cultural connections and the nation state is not necessarily the main spatial category for the transnational elite members to connect and organize as elites.

3 | GLOBAL CITIES AS THE LOCUS OF THE TRANSNATIONAL CORPORATE ELITE OPERATIONS

As a possible solution for overcoming the issue of the changing meaning of nation-state borders for transnational actors, some scholars have turned to the investigation of global cities in which transnational corporate elites are concentrated (Carroll, 2007). Cities, such as London, New York, or Tokyo, are historically major centers for production of financial, professional and creative services and they create a particular space of flows between them, thereby, easily crossing national borders (Castells, 2000; Sassen, 1991; Taylor, 2004). These are the cities where multinational corporations, transnational banks, international law firms are headquartered, and these are the places that attract highly-qualified professionals such as global accounting specialists, law consultants and tax advisers.
The first global cities were concentrated in the United States, Europe and Canada, reinforcing the northern transatlantic economic system, but today we are witnessing the emergence of global cities from the East such as Hong Kong, Shanghai, Mumbai and Singapore (Aalbers, 2009). These cities do not threaten the status of existing global cities, but rather expand the existing network, thereby strengthening ties between various world regions. Together with human flows of low-waged immigrants, creative professionals and tourists, global cities are also the key centers of attraction for transnational corporate, managerial and financial elites (Friedmann, 1986; Hannerz, 1996), bringing with them cosmopolitan culture and a variety of transnational practices.

The focus on global cities instead of nation states is a promising solution to the raised issue of a more comprehensive identification of the transnational corporate elite members’ geographical concentration. Scholarly interest in corporate elites literature has historically focused on countries, and there are only a few articles that concentrate on a set of cities through which transnational corporate elite members operate. For example, Carroll (2007) studies differences between the structure of the global cities network and the transnational board interlock network of the 350 largest corporations in the world. He shows that corporate elites are indeed clustered in a few global cities, but that the structure of the transnational board interlock network is much more nationally oriented than is predicted by the global cities literature. Carroll concludes that the network of transnational board interlocks remains concentrated in the global cities in a way that reinforces the northern transatlantic economic system. In another city-level article on global board interlocks networks, Heemskerk et al. (2016) problematize the substantial difference between the local and nonlocal ties of the global corporate elite, applying the terminology of Kono et al. (1998). While making this distinction between local and nonlocal ties, and avoiding the terminology of the ‘transnational vs. national’, they do not presuppose that the nation state is the most significant level of elite organization in the modern corporate world. This study confirms that established first-tier global cities have a central position in the transnational board interlock network, but it also detects the emergence of a new set of cities, such as Asian or Latin American cities, that are traditionally outside of the northern transatlantic economic system. Some scholars have also conducted case studies of particular global cities that attract transnational elites and professionals such as London, New York, Singapore, Paris (Beaverstock, 2002; Boussard, 2018; Fernandez et al., 2016), and analyse how transnational groups of actors build their personal and professional lives in these particular locations.

What is common for both streams of literature on corporate elites and global cities is the application of network-oriented theories and methodology. Articles on identifying transnational corporate elite members, and their connections and locations, detect the most powerful actors by applying network centrality measurements; they compare multiple national elite network structures by presenting their density or clustering, and they explore the existing subgroups within networks applying community detection techniques (e.g. Burris & Staples, 2012; Fennema & Heemskerk, 2018). Using network-oriented thinking and methodological approaches is also common in the global cities literature. Even if the early studies considered relationships between cities as a part of the global hierarchy (Friedmann, 1986), today these cities are theorized as nodes within one global network of flows (Taylor, 2004). Empirical literature, aimed at detecting the relative position of global cities in the world, applies a wide range of networks, such as corporate location, parent subsidiary and energy and financial networks (Alderson & Beckfield, 2004; Derudder et al., 2003; Martinus & Tonts, 2015; Neal, 2008; Sigler & Martinus, 2017).

We can conclude that transnationalizing actors, such as corporate elite members, are the types of actors that combine their national and international networks of power in particular ways. When they transition to international spaces, they do not lose their ties with national elite circles, but rather adapt these different types of ties to various environments, benefiting from their unique position. Because these transnational groups of individuals are able to build their ties in these multiple dimensions, there has always been a question about the precise identification of their places of operation. Focusing on countries as the key locus of their operations gave fruitful insights about the extent of this global network, but has shown to diminish the importance of some prominent locations such as global cities. Global cities, on the one hand, are parts of their respective nation states but, on the other hand, also belong to higher-level network of influential cities with comparable levels of influence and power. Analyzing global cities as these novel locations of the transnational elites seems to be a promising approach, but still the question remains: how
to detect the most influential locations that support the entire structure of the global corporate elite network? The following section presents the concept of the backbone as a new approach to answer this question of elite identification in global cities.

4 | THE BACKBONE OF THE GLOBAL CITIES THROUGH WHICH THE TRANSNATIONAL CORPORATE ELITE OPERATES

The term ‘backbone’ is not new for the literature on corporate elites, but it has never been clearly defined and was often mixed with other related network concepts. For example, the terms ‘backbone’ and ‘core’ are used interchangeably (see Carroll, 2009; Heemskerk & Fennema, 2009; Heemskerk, 2013) and the term ‘backbone’ is often applied to denote any central, densely connected or cohesive part of the network. Carroll (2009) uses the data about directors of the Fortune Global 500 firms and shows how national networkers form the backbone of the global corporate elite. In that article, the backbone consists of individuals who form cohesive subgroups within their national elite groups. In the case of the Dutch corporate network, analysed in Heemskerk (2007) and Heemskerk and Fennema (2009), the term ‘backbone’ is also applied to describe the cohesive and connected core of the network. In these articles, corporate directors are part of the backbone if they serve on multiple corporate boards, that is, participate in interlocking directorships. In Heemskerk (2013), where the establishment of the European transnational corporate elite network is investigated in detail, a group of central firms that together sustain the structure of the European corporate network is referred to as the network backbone.

In the methodological literature on networks, however, the terms ‘core’ and ‘backbone’ measure completely different network substructures. The main aim of the core detection is to subtract a densely interconnected subgraph from the network. Thus, the network core analysis detects a group of nodes with high levels of degree centrality that are also densely interconnected with each other (Borgatti & Everett, 2000). Nodes that are outside of the core represent the network periphery: these are sparsely connected groups of nodes. The core nodes are well-connected both among themselves and to peripheral nodes. The network core detection has been applied in elite studies before. For instance, Larsen and Ellersgaard (2017) use a core detection algorithm to investigate the densely connected subpart of the Danish elite. They analyse the network of individuals connected by common board positions, participation in parties, affiliation with important institutions and, step-by-step excluding the least connected individuals from the network, come to the core of this national elite network. Young et al. (2021) also apply the core detection methodology to study racial and gender composition of the transnational elite, uncovering how it remains highly homogeneous and exclusive. In sum, the core detection is aimed at detecting a group of highly connected and highly clustered nodes within the network.

The network backbone analysis is, on the contrary, primarily a network filtering approach. The main aim of the backbone detection is to sufficiently reduce the entire network without destroying its complex structure. There are different existing approaches to define whether a particular node or a tie will be part of the backbone (Lindner et al., 2015). These decisions are often based on defining whether these nodes or ties are significant for representing the network structures at the local level (e.g., these nodes are central within their network community) and at the global level (e.g., these nodes connect distinct parts of the entire network and deleting them will lead to the network fragmentation). Backbone detection has already been used to analyse properties of various global networks such as corporate ownership (Glattfelder, 2012; Glattfelder & Battiston, 2009), online friendship (Nick et al., 2013), coauthorship, coattendance and cosponsorship (Neal, 2014).

In sum, core and backbone detection approaches are applied to detect completely different parts of the network. There is a clear distinction between the network core and the backbone in the methodological literature, while these concepts are used interchangeably in empirical articles. The problem is that it is unclear which part of the network can be referred to as the backbone, because the empirical literature is notoriously vague about this concept, even though this approach has already been used to describe intercorporate networks (see, for example, Glattfelder, 2012;
Glattfelder & Battiston, 2009). In this article, I conceptualize the 'backbone', starting from its already clearly established methodological definition and apply this concept to describe the set of global cities through which transnational corporate elite members operate.

What exactly is the backbone of the cities through which transnational corporate elite members operate? First of all, the backbone is a subset of the entire network of cities. This entire network consists of cities (nodes) that are connected with each other if they share the transnational corporate elite members (edges). These transnational corporate elite members, who are affiliated with multiple corporate boards, are the main actors who create the global space of flows between these cities because they transfer transnational practices, networks and lifestyles (Skair, 2001). If a city is in the backbone, transnational corporate elite members are significant for preserving the global- and local-level network structures around the city. These cities are significant points for corporate elites to accumulate national-level ties and to transfer them to the transnational space, binding both types of ties together within one location.

What can the backbone detection give us in comparison to other approaches typically used to detect locations through which the transnational corporate elite operate? As has been outlined already, there is an open question in the literature on how to identify important locations of the transnational elite operations without diminishing the significance of the nation-level elite networks they remain a part of. The backbone detection allows to take a data-driven approach to define the ties that are significant at local and global levels for preserving the entire network structure of the transnational corporate elite locations. In other words, the algorithm determines which ties are locally and globally significant (at the network level) and are crucial for sustaining the network of locations in which the transnational corporate elite members connect and operate. This article does not argue that the distinction between national and international levels of elite operations does not play a role anymore. Instead, the presented approach looks at this distinction in a novel way by, first, exploring cities as the main locations of the transnational corporate elite operations, and, second, by applying a data-driven network approach to detect the locally and globally significant actors and ties within the global city network.

5 | DATA AND METHODS

5.1 | Data extraction and preparation steps

The data were extracted from the Orbis Bureau van Dijk dataset in December 2017, available at orbis.bvdinfo.com. Orbis Bureau van Dijk is a rich dataset with information on corporations worldwide, collected from official country registrars. However, as any large dataset that was collected from different types of sources, it has data quality issues (Garcia-Bernardo & Takes, 2018; Heemskerk et al., 2018). In general, these data are of higher quality for large economies and large corporations, except for the Northern American corporate boards, where it is of moderate quality. To obtain data on corporate elite members, I extract individuals who obtain current positions at corporate boards (executive boards, supervisory boards and boards of directors). To detect transnational corporate elite members, I make a subset of only those individuals who serve on boards of at least two corporations located in different countries. This is a common approach of detecting transnational corporate elite members in the literature (Carroll, 2009), which follows the positional approach of detecting elite groups (Hoffmann-Lange, 2007). Focusing on individuals with positions in multiple nation states and omitting those who are part of only national elite networks has implications for the findings, which are discussed in more detail in the Section 7 of this article.

For each corporate entity, Orbis Bureau van Dijk reports a unique company location at the city and country levels. If a company has several subsidiaries, each subsidiary has its own location, not the location of the mother firm. It is common for an individual to be on corporate boards of a number of firms that belong to the same corporate group. These ties do not create proper corporate board interlocks because they are formed within one corporate group. For this reason, ties between firms that are owned by the same global ultimate owner are dropped. The global ultimate owner of a company is a controlling shareholder (directly or indirectly owning at least 50.1 per cent in shares) that is not
owned by any other company. In total, 24 per cent of all ties are between firms that are owned by the same global ultimate owner. Individuals who obtain more than 100 positions are also dropped because they are likely to obtain this large number of positions on paper (382 individuals in total). Only the board interlocks among the very large companies (with more than 1000 employees) were selected for the analysis. The sizes of the firms were determined by the number of employees, in line with the Orbus Bureau van Dijk’s definition of the very large companies. There are 10590 large companies with 2685 known city locations.

To create a city-by-city network, city names, extracted from Orbus Bureau van Dijk, are assigned to corporations. Cities were aggregated to city clusters, using the procedure described in Heemskerk et al. (2016). There are two reasons for working with city clusters instead of cities. First, it is common to encounter the variation in the spelling of city names in the Orbus Bureau van Dijk dataset. For example, Bruxelles, Brussel and Brussels are different ways of spelling the capital of Belgium. Second, some suburban areas of a city can have a different name, even though they are part of one city agglomeration. The approach retrieves geographical coordinates of cities using the Google Maps API and then groups cities with close coordinates in one ‘city cluster’, using MeanShift algorithm (Fukunaga & Hostetler, 1975). Further in the article, I refer to ‘city clusters’ as ‘cities’.

At the final step, I create a firm-by-firm corporate board interlock network and assign city clusters to nodes, subsequently creating a one-mode city-by-city network. The final dataset is a network that consists of 1628 cities, connected by 7588 ties (shared transnational corporate board members). This network is weighted; the weight of ties indicates a number of shared transnational corporate elite members between cities. This network was used for the backbone detection.

5.2 Methods

A multiscale network backbone detection algorithm for weighted networks, presented in Serrano et al. (2009), is applied in this article. The backbone detection sufficiently reduces the network without destroying its multiscale nature: this is done by preserving significant ties at local and global levels, without belittling edges with small weights. The algorithm of the backbone detection proceeds by following two main steps: detecting local tie heterogeneities and filtering.

Weighted social networks have heterogeneously distributed weights of edges (Barrat et al., 2004). This means that a small number of edges in the network carry the largest proportion of a node’s strength. To apply the algorithm and not to belittle the position of nodes with low edge weights, the weights are normalized in the following way:

\[ p_{ij} = \frac{w_{ij}}{s_i} \]  

where \( p_{ij} \) is the normalized weight between nodes \( i \) and \( j \), \( w_{ij} \) is the weight of a tie between \( i \) and \( j \) and \( s_i \) is the strength of the node \( i \) (the strength is the sum of all weights of a node \( i \)). After the normalization, the disparity function \( \gamma \) for each node \( i \), having \( k \) neighbours is applied:

\[ \gamma_i (k) = k \sum_j p_{ij}^2 \]  

The disparity function reveals the presence of weight heterogeneities at the local level. It shows that some edges of nodes carry a disproportionate fraction \( p_{ij} \) of the node’s strength, while others carry a relatively small fraction of the strength.

To test for the randomness of the weight heterogeneity, a null model that would estimate the significance of these weight fluctuations needs to be introduced. The null hypothesis states that the normalized weights of a node with degree \( k \) are produced by a random assignment from a uniform distribution. These \( k−1 \) points are distributed
uniformly and their length equals to the expected values for the $p_{ij}$ normalized weights. The probability density function for one of these values taking a value $x$ equals to:

$$p(x) \, dx = (k - 1)(1 - x)^{(k-2)}dx.$$  \hspace{1cm} (3)

The null model will detect for each edge of a node $i$ the probability $\alpha_{ij}$ that its normalized weight value $p_{ij}$ is compatible with the null hypothesis. The statistically significant edges are those nodes that have weights, satisfying the following criteria:

$$\alpha_{ij} = 1 - \frac{p_{ij}}{0} \int_0^1 (1 - x)^{k-2} \, dx < \alpha.$$  \hspace{1cm} (4)

To select significant edges that carry statistically significant disproportionate weights, the filter will move step by step, looking at significant edges of each node and significant edges of its neighbours, aggregating results into the network backbone. The backbone is extracted by selecting the edges that satisfy the significance criteria at $\alpha < 0.05$ for at least two nodes. These nodes and edges between them form the backbone network. For more details about the model and its applications, see Serrano et al. (2009). The algorithm was implemented, using the Python code, presented at https://github.com/aekpalakorn/python-backbone-network.

For the analysis of the backbone network composition, I run a community detection on the giant component of the network (249 nodes, 364 edges). Average modularity score over 10 community detection algorithm runs equals 0.635 with a resolution 1. It gives on average 11.5 communities, below the resolution with 12 communities is presented. Degree, eigenvector and betweenness centrality measures are reported for the analysis of central positions of cities in the backbone network. Community detection, centrality analysis and the backbone visualization were conducted in Gephi (Bastian et al., 2009).

6 | RESULTS

This section does three things. First, it describes the properties of the entire city-by-city network and its backbone, it then interprets network communities of the backbone, and it concludes with an investigation of the position of central cities in the backbone.

6.1 | Descriptive statistics of city network properties

Table 1 reports the key network properties of the entire city-by-city board interlock network and its backbone. Both networks are weighted and the tie weight indicates the number of shared transnational corporate board members between cities. The algorithm drastically decreases the size of the entire city-by-city network: there are 281 cities left in the backbone. On average, each city in the backbone is connected with three other cities and the average number of shared transnational board members between cities equals 61 individuals. While there are a few connected components in each network, the majority of activities take place in their giant components: only 11 per cent of nodes (32 cities) are not a part of the giant component of the backbone network. Both networks are small-world networks: it takes on average three steps to reach any other city in these networks, and they are highly clustered, as the average clustering coefficients indicate.
TABLE 1  Descriptive network statistics of the city-by-city interlock network and its backbone

|                                | City-by-city board interlock network | City backbone network |
|--------------------------------|--------------------------------------|-----------------------|
| Nodes (cities)                 | 1628                                 | 281                   |
| Edges (distinct ties between cities) | 7588                                 | 380                   |
| Max tie weight (shared board members) | 1285                                 | 1285                  |
| Min tie weight (shared board members) | 1                                    | 4                     |
| Average degree                 | 9.322                                | 2.705                 |
| Average weighted degree        | 25.022                               | 60.840                |
| Average clustering coefficient | 0.487                                | 0.481                 |
| Average path length            | 3.229                                | 3.257                 |
| Number of connected components | 26                                    | 17                    |
| Size of the largest component  | 1572                                 | 249                   |

FIGURE 1  Visualization of the network backbone. Nodes are cities, ties are the shared transnational corporate board members. The position of the nodes is a geolocation of a city. The colour of the node reflects its community membership. The size of the nodes reflects the betweenness centrality of a city; only nodes with the highest betweenness centrality measures are labelled.

6.2  The community structure of the backbone network

The composition of the backbone is further explored by applying the community detection on its giant component. Figure 1 is a geolocated visualization of the city-by-city backbone network with the detected 12 communities. The list of cities belonging to each community is presented in Supporting Information, Table S1A. Interestingly, around half of the detected communities consist of cities located within one country or a region, while another half includes cities that connect different regions and continents.

Among those communities within one country or a region are, for example, the North European community (including cities such as Copenhagen, Oslo, Stockholm), Indian community (including Kolkata, Mumbai, New Delhi), or Northern American community (including Chicago, Los Angeles, Toronto). These communities are well-studied cases of national elite networks, clustered within one particular region and sparsely connected to other locations outside of their national borders (see, e.g., Naudet et al. (2018) for the study of Indian corporate elites; Edling et al. (2012) for the research on Scandinavian board interlocks).

But the network communities that are probably most interesting are those that span a number of regions and cross continents. The first group of these types of communities consists of corporate networks that connect Europe with
the US, or the UK with Australia. The connection between Europe and the US is a well-investigated northern transatlantic path, the first that began to emerge since the 1970s between Europe and the US and later transformed in the strongest transnational connection between national corporate elites (Fennema, 1982; Van Der Pijl, 1984). These are, for example, communities that include cities such as New York, Washington, Geneva, Brussels, Amsterdam. A community between the UK and Australia, connecting Sydney, Melbourne, Glasgow and Leeds is another example of the continent-crossing community, based on a common Anglophone identity and built on former imperial networks.

A different group of continent-crossing communities are those that began to rise recently and connect Asia with Europe. But if Japan was one of the rising Asian powers in the 1980s, generating concern among some Western powers (Sklar, 1980), today it has lost its position, which is also reflected in its not having a highly central position in the backbone network. Instead, we observe a prominence of transnational network communities, with Southeast Asian and Chinese cities in the head. For example, the backbone has a community with Southeast Asian cities such as Jakarta, Singapore, Kuala Lumpur and European cities of Dublin or Hamburg. Besides that, there is a distinct Chinese community, consisting of key Chinese industrial and economic cities and offshore financial centre cities such as Hamilton or George Town (Palan et al., 2013). Cities from this Chinese community are also connected to the majority of the detected communities but they form the strongest ties with European cities and particularly London. These prominent Southeast and Chinese communities reflect the rise of these regions and are in line with the current shift of the global economic centre of gravity to the East (Quah, 2011). But because the global elite centre of gravity remains concentrated in the Northern Atlantic, and these elite groups tend to be characterized by particular backgrounds and origins (Young et al., 2021), the formation and strengthening of ties between the US and Europe and, for instance, China, is still an on-going process (De Graaff & Van Apeldoorn, 2018; De Graaff & Valeeva, 2021).

Here, we have outlined only substantial differences among the detected communities and provide examples of only some of the most prominent ones. It has been shown before that national and international connections, forged by transnational elites and professionals, tend to follow particular class and linguistic affinities, and these individuals often pursue similar educational paths and career choices (Harrington & Seabrooke, 2020). Following this line of thought, it is not surprising that we observe a number of Anglophone communities within the backbone, formed around shared history, language and identity. But the new types of paths, crossing the global corporate network and establishing into distinct network communities, are more likely to follow the logic of the economic attraction of particular regions. The presence of these distinct types of communities might be the first sign toward a practice and norm convergence among transnational actors and lead to the formation of a more coherent transnational identity. But because one of the most powerful economic actors today (such as China) is also present in the backbone and it does not necessarily share a common history with the Anglophone world, the question of the shared identity formation remains open. In the next section, we explore particular positions of cities in the backbone and elaborate more on the role of distinct cities and regions in the formation of a more connected or, on contrary, a more fragmented global corporate network.

6.3 | Network positions of cities in the backbone

We zoom in further on the backbone by exploring the position of cities in the backbone. Table 2 presents the list of the cities, highest by degree, eigenvector and betweenness centralities. These centrality measures are often applied to demonstrate the concentration and the diffusion of capital, ideas and people in city networks (Neal, 2011).

Degree centrality is related to the concentration of power located in the city: cities, high in degree, are those that have a large number of connections to other cities in the network. Among the top three cities, highest by degree are London, Hong Kong and New York. While London and New York have been obtaining a historically central position in many types of corporate, city and elite networks (see, e.g., Beaverstock & Smith, 1996; Fernandez, Hofman & Aalbers, 2016), Hong Kong is an emerging location for these types of ties to concentrate. The rest of the degree centrality list is also geographically diverse. Among European cities high by degree are Amsterdam, Dublin, London and Paris;
### TABLE 2
The list of 15 cities in the backbone, highest by degree, eigenvector and betweenness centralities

| Cities with the highest degree centrality | Cities with the highest eigenvector centrality | Cities with the highest betweenness centrality |
|------------------------------------------|-----------------------------------------------|-----------------------------------------------|
| London                                   | London                                        | London                                        |
| Hong Kong                                | Hong Kong                                     | Hong Kong                                     |
| New York                                 | New York                                      | New York                                      |
| Amsterdam                                | Amsterdam                                     | Mumbai                                        |
| Hamilton                                 | Hamilton                                      | Amsterdam                                     |
| Paris                                    | Dublin                                        | Madrid                                        |
| Dublin                                   | Singapore                                     | Hamilton                                      |
| Sydney                                   | Houston                                       | Vienna                                        |
| Mumbai                                   | Sydney                                        | Frankfurt                                     |
| Toronto                                  | Paris                                          | Chicago                                       |
| Houston                                  | Toronto                                        | Sydney                                        |
| Singapore                                | Chicago                                        | Toronto                                       |
| Chicago                                  | Calgary                                        | Paris                                         |
| Parramatta                               | Melbourne                                     | Dublin                                        |
| Melbourne                                | Montreal                                       | Singapore                                     |

Australia is represented by Melbourne and Sydney (with its suburban city Parramatta); among the US-American cities are Chicago, Houston and New York. Hong Kong, Mumbai and Singapore are Asian cities that are among the highest by degree. And finally, we have Toronto from Canada and Hamilton from Bermuda. Most of these cities are capital cities and are important business, financial and industrial centers within their respective regions. A large number of multinational companies and international financial service firms are headquartered in these cities and these locations are the points of concentration for transnational elites, professionals and corporations.

Eigenvector centrality gives different values to ties with highly and sparsely connected nodes (Bonacich, 1972). If a city is connected with other well-connected cities, this city would have a high eigenvector centrality. The top of Table 2 is the same for both degree and eigenvector centrality measures and consists of London, Hong Kong, New York, Amsterdam and Hamilton, while the rest of the list is only slightly different. Among the cities, high in their eigenvector positions, are cities that are not only connected to a large number of cities, but those that are connected to other influential cities across the globe. These are, for example, New York and London that are the centers of the Anglo-American corporate world, Paris and Dublin that are influential within Europe and strongly tied to London, and Singapore with Hong Kong which are prominent corporate and financial centers in Asia and well-embedded in European and American business networks. For example, Beaverstock (2018) in the study of the executive search firms, shows how talents all across the globe are attracted to Singapore to reproduce the transnational corporate elite within the region. Hong Kong also obtains a strategic position in the backbone because creating ties with New York and London is a priority for the largest Chinese financial institutions (Lai, 2012; Pan et al. 2018). Among the cities that are high in eigenvector centrality but are not in the list of cities, highest by degree, are Montreal and Calgary. Both these nodes are industrial and corporate centers of Canada with a large number of Canadian, US-American and international multinational firms incorporated there.

Cities that are high in eigenvector centrality are all strongly tied to London and largely reflect the former imperial network. Most of these cities are part of the Anglo-American world, where English is a common language (e.g., Dublin, Singapore and American, Australian, and Canadian cities). The prominence of these particular cities among the highest ones in the eigenvector centrality confirms that there is a part of the global corporate elite network which is formed...
and centered around the Anglo-American identity. Young et al. (2021) show similar patterns in their study of gender and race of the transnational elite members. This article establishes that there is a core group of the transnational elite; its members are highly homogeneous in terms of their race, gender, nationality. Moreover, Young et al. (2021) demonstrate that if non-whites and women achieve elite positions, they are often marginalized to the periphery of elite networks over time, while the core remains significantly more white and male.

Another type of centrality that is commonly used to demonstrate the significant position of cities in the global city network is the betweenness centrality. Cities that are high in betweenness are those that connect sparsely connected parts of the network. Among the new locations, here we detect Madrid, Vienna and Frankfurt. All of these cities are influential hubs within their country and within Europe, but at the same time they serve the function of network brokers (Burt, 2005, 2009) by connecting European corporate networks with elites from other world regions. Mumbai is characterized by a relatively high betweenness because of its unique position in-between Asian, European and Northern American corporate networks. These types of cities, high in betweenness, might be ‘foothold’ locations for national elites who intend to engage in transnational networks and activities. For instance, Boussard (2018), in her study of the financial professionals shows how French professionals go to centers of the transnational elite networks, such as London or New York, to gain experiences and build networks there, but at the same time remain strongly embedded in their national French network. These types of locations in-between, that allow to easily reach multiple powerful nodes within a network, might be beneficial for individuals who might apply these transnational experiences to strengthen their positions within national networks (Dezalay & Garth, 2010).

The exploration of node centralities shows that there are different types of positions, obtained by global cities in the backbone, and they can tell us different sides of the story about the transnationalizing network of elites and corporations in these locations. On the one hand, we observe the strong dominance of the Anglo-American corporate ties, formed among former imperial paths, and based on common Anglophone identity. On the other hand, we detect a set of cities around these key locations, that are situated in-between multiple national communities. In addition to the centrality analysis, the community detection confirms the presence of communities, significantly intersecting with nation state or regional borders, but there are also communities that bridge regions and continents. This particular structure of the detected backbone network might indicate that there is a trend toward a formation of a more connected corporate world, with shared practices, norms and even identity. Recently emerging empirical studies discover that transnationalizing corporate elites and professionals are characterized by common background and origins, similar educational and career patterns (Harrington & Seabrooke, 2020; Henriksen & Seabrooke, 2021). These individual-level similarities, together with the strengthening establishment of continent-crossing elite network communities might be the first steps toward the formation of a common transnational identity. But this assumption needs detailed qualitative investigations on the transnational convergence of practices and the transforming self-image of individuals, engaging in transnational experiences.

7  I  CONCLUSIONS

This article asked what the current locations are through which the transnational corporate elite operates. To avoid a problematic distinction between national and international ties, this article investigated the locations of the transnational corporate elite in global cities, applying the network backbone detection algorithm. The intentional focus on cities rather than countries as main locus of the transnational elite operations is justified by the unique role and function of these global cities. The cities, on the one hand, are part of nation states but, on the other hand, are also part of a global city network, a unique network of major transnational flows of capital and resources. These cities are the key locations, in which national and international ties of the transnational corporate elite members concentrate.

The network backbone detection approach applied in this article, presents a fine-grained analysis of geographical locations through which the transnational corporate elite members operate. The findings show that the backbone of transnational corporate elite cities consists of around 300 cities, connected by sharing transnational corporate board
members. The article shows that while the Anglo-American corporate elite remains the most prominent historically strong community of the transnational corporate elite, there is also a rise of Asian-European communities, connecting prominent European cities with a number of Chinese cities, Singapore and Hong Kong. The cities from these regions attract transnational flows of capital and human resources due to their unique geographical position in-between influential core countries and as a result of their favourable business and financial environment for international firms. The rise of these new kinds of communities might be the first move toward the formation of more coherent transnational norms and practices of national elite members engaging in transnational activities and network-building.

The article has a number of limitations. First, the study focuses exclusively on transnational corporate elite members and intentionally omits those elite members who build ties only within one nation state. One of the implications of this particular selection is a possible overestimation of the level of global elite connectedness. If the article would analyse all corporate board members, both national and transnational, we would probably find a smaller number of trans-continent communities and a stronger clustering within respective national communities (as, for example, has been already done in Heemskerk et al., 2016). Instead, this study focuses exclusively on transnational corporate elite members and the networks that they form. This empirical choice has the described limitations but it also allows to paint a more precise picture of the types of connections that transnational elite members form, sustain and develop.

Second, the presented network of cities, corporate locations and shared corporate directors gives a specific picture about the global city network. As Neal (2012) criticizes in his article on structural determinism in interlocking city networks, the number and size of firms, applied to determine the interlocks between cities, may influence the structure of these city networks and, moreover, affect the conclusions that we draw about these interlocking cities. In this article, the cities were considered as key locations of the transnational elite operations, and the uncovered city backbone structure has been interpreted from the perspective of global elite cohesion and potential convergence of practices among different parts of this network. Testing these assumptions on converging transnational network-building and other types of practices needs to be confirmed with further qualitative investigations of specific national elite groups across the globe.

Finally, the study suffers from not paying enough attention to describing the meaning of the establishing ties. When individuals engage in transnational activities, what are the national and international practices that they apply to reach these spaces, what are the meanings that they put in their activities, and are these kinds of activities and networks able to modify their identity as elites? These types of questions were out of the scope of this article but need to be addressed in qualitative investigations of individuals who engage in these transnational networks.

These findings raise a question about the diverse strategies that individual corporate elite members and national elite groups use to integrate into the transnational corporate elite network. The diversity of cities and regions that we see in the network backbone might serve as a reflection of the diversity of applied strategies. For some regions, this integration is still under construction (e.g., the case of the Asian corporate elite) while for others (e.g., the case of the European corporate elite) it has already taken place. How these integration strategies are applied by various national elite groups is a question that needs further investigation.

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CONFLICT OF INTEREST
There is no conflict of interest to declare.

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