

The Role of Tax Havens and Offshore Financial Centers in Shaping Corporate Geographies: An Industry Sector Perspective

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Abstract

This paper investigates the role of tax havens and offshore financial centers (THOFC) in the global economy. Network analysis of 24 industry sectors suggests that THOFC feature prominently in knowledge-intensive activities such as Pharmaceuticals, Biotechnology, and Semiconductors, and are least significant in industrial activities such as Automobiles and Consumer Durables, and place-bound activities such as Real Estate and Retailing. Contrasting with the notion that most THOFC are ‘rogue’ offshore territories, the most significant are either continental nation-states or British territorial dependencies. We conclude that global firm networks often mimic the geographies of taxation more than actual production or consumption activities.

Keywords: economic geography, strategic management, network analysis, financial geography, tax havens, offshore financial centres

Introduction

The role of tax havens and offshore financial centers (THOFC) in the global economy is an increasingly salient research topic, particularly since the global financial crisis (GFC) of 2008 (Aalbers, 2018; Buckley, 2015; Cantwell, 2014; Haberly and Wójcik, 2014b; Jones et al., 2018; Wójcik, 2013b; Zucman, 2015). As the recent ‘Panama Papers’ and ‘Luxleaks’ scandals have revealed, firms seek to minimize their tax liabilities through opaque financial instruments that deliberately obfuscate transactional details, while individuals do so through ‘offshore’ trusts and the like. Though the magnitude of THOFC activity is difficult to gauge due to its oft-secretive nature, various studies estimate that: such jurisdictions mediate 30% of global foreign direct investment (FDI) (Haberly and Wójcik, 2015a); global revenue losses from corporate tax avoidance total approximately US\$500 billion annually (Cobham and Janský, 2018); and, 40% of multi-national corporate profits are shifted to THOFC each year (Tørsløv et al., 2018). THOFC also play a fundamental role in private wealth accumulation and management, harboring \$12 trillion of the wealth of the global rich (Palan et al., 2010), or 8% of the world’s total household financial wealth (Alstadsæter, 2018).

Despite the apparent importance of THOFC in the global economy, there remains a paucity of insight into the role of specific jurisdictions in mediating offshore capital flows, and the relational role they play in industry group networks. This paper contributes to the growing body of literature on THOFC by investigating how various ‘offshore’ jurisdictions are distinguished across globalized industry networks, and how networked firms embed THOFC broadly within their global corporate structures. To this end, it draws together the strategic management (SM) and economic geography (EG) literatures to elucidate the functional and sectoral specialization of THOFC. Although both SM and EG scholars have recently shifted attention to THOFC (Demere et al., 2017; Janský and Prats, 2015; Haberly and Wójcik, 2015a, 2015b), there remains little cross-dialogue, and virtually no literature on THOFC that integrates

the firm-based approach of the former with the systems perspective of the latter. We argue that such a dialogue is critical in better understanding firm dynamics, e.g. their locational choices and internationalization strategies. The integration of THOFC into firm networks has reoriented the role of ‘place’ in firm decision-making from one based on either supply-side or demand-side advantages, to one tied to purely financial considerations derived from complex regulatory arbitrage.

In what follows, this paper applies network theory to empirically support the notion that THOFC are fundamental building blocks of the global economic system. We first focus on the specialization of THOFC as embedded nodes within global firm networks, before shifting attention to differences between industry groups. The geo-economic configurations revealed in the network topologies demonstrate that corporate network structures often replicate the geographies of taxation rather than actual firm activities.

THOFC in a Rapidly Changing Global Political Economy

The surging interest in THOFC by both scholars and policymakers in the recent past has been driven by changing conditions in the global political economy. FDI flows have increased markedly since the 1960s and accelerated rapidly since the 1990s, reaching a high of \$1.8 trillion in 2016 (UNCTAD, 2018). Much of this is tied to the geographic expansion of multinational corporations (MNCs) beyond the Global North, with FDI to developing countries now comprising nearly half of global flows. Furthermore, unlike their domestically oriented predecessors, MNCs of the 21st century are often highly footloose, with labor, resources and capital inputs sourced internationally according to firm and industry requirements (Hampton and Levi, 1999; Doh, 2005). For example, the world’s five largest corporations (by current market capitalization) are in the information technology (IT) sector (in contrast to past industry giants in manufacturing, bricks-and-mortar retail, or energy) with key assets lying in

intellectual property, brand, and data —assets that are often intangible, and can be transported across borders with ease. As Pellicelli (2018) argues, major changes in the global economy have led to corporate innovation and flexibility through agile organizational structures such as the ‘virtual’ firm.

Given the large-scale movement toward offshoring or outsourcing of production, THOFC have increasingly been critical to anointing complex geo-economic structures. This is largely the result of the increasing ‘financialization’ of global production, linking global capital markets to daily staples such as commodities, housing, and utilities. The implication of these changes has been the rapid expansion of capital markets, with emerging financial technologies and platforms driving much of the growth. By corollary, this has led to the emergence of global financial centers as major services hubs (Wójcik et al., 2018), which include both ‘onshore’ world cities such as New York, Tokyo, and London as well as the lesser-known ‘offshore’ locations—the focus of this paper. More specifically, we focus on the role of THOFC within MNE networks so as to better understand how financialization has redirected global economic networks from a focus on ‘core’ and ‘periphery’ economies providing access to capital and innovation, and resources and labor, respectively, toward a more complex picture whose geographical contours are best explained by territorial taxation and regulation regimes.

Furthermore, ‘innovations’ in financial instrumentation have estranged financial markets from production, with derivatives such as mortgage-backed securities (MBS), collateralized debt obligations (CDO), credit default swaps (CDS) and the like being strongly linked to the banking turmoil that caused the GFC (Aalbers, 2018; Brunnermeier, 2009; Crotty, 2009). This becomes even more salient as cryptocurrencies are untethered from jurisdictions, and as the line between multinational and domestic firms becomes increasingly blurred by large border-free trading blocs (e.g. the European Union), and by the digital nature of quotidian financial transactions.

Firm Strategic Organization in THOFC

Analyzing the role of THOFC in global corporate networks requires an understanding why firms locate where they do, and how this choice has both shaped and been shaped by regional alliances and networks (Barney, 1991; Gulati, 1998). Whilst this is a rising subject within the EG and SM literatures, there has been limited cross-dialogue despite their increasingly spatial thinking of the relationship between firm-level decisions and corporate geographies (Cantwell, 2014; Jones, 2018; Mudambi et al., 2018). Similar intersections have been explored in other ideologically similar theories, such as world city networks (WCN) and global production networks (GPN), in which collaborative projects examined the relationship between actor decision-making in production and global economic connections (Coe et al., 2010; Taylor et al., 2014). As such, this special issue of *Regional Studies* exploring SM and EG intersections as a framework of analysis is both timely and relevant.

SM builds on theories from economics and business studies (marketing and finance) related to a firm strategic locational decisions and clusters (cf. Porter, 1991), as well as sociology and psychology. It is concerned with overall firm performance, examining how internal firm operations are positioned and managed to optimize opportunities external to the firm (Nag et al., 2007). This includes literature on decision-making regarding strategic location of offices (Birkinshaw et al., 2006) and the boundary-spanning nature of global enterprises (Schotter et al., 2017). In research specifically on THOFC and firm decisions to locate within them, SM has largely focused on determinants such as tax minimization and avoidance strategies (Demere et al., 2017), firm maturity and level of operations (Hasan et al., 2017), as well as corporate managerial behaviors (Christensen et al., 2015). The relevance of geography to SM research on THOFC is pronounced, with research questions increasingly overlapping and indistinctive from those in the newish field of financial geography (FG)—a sub-field of economic geography focused on the global contours of money and finance.

Indeed, EG's foray into the area of THOFC has largely centered on the nuanced geographies of taxation, regulation, and governance (Aalbers, 2018; Wójcik, 2013), with some more novel interpretations such as in the geographies of secrecy (Cobham et al., 2015). Much of this work draws upon branches of mainstream economics such as organizational studies and internalization theory (Buckley et al., 2015; Knight and Wójcik, 2017), employing data sets on producer services (Wójcik, 2013b) or foreign direct investment (Garcia-Bernardo et al., 2017; Haberly and Wójcik, 2015a, 2015b; Ledyeva et al., 2015). Nonetheless, EG has produced clear evidence of the strong geographic or regional component to global financial flows; for example, national preferences for particular OFCs from Russia (Ledyeva et al., 2015) and China (Buckley et al., 2015).

The intersection of SM and EG toward understanding THOFC activities and processes can be examined through two interrelated questions. First is how THOFC redistribute or reorient international capital flows. Here, firm decision-making is influenced by considerations that are fundamentally geographic in nature, such as where to locate global operations, and which national attributes form an attractive value proposition. Janský and Prats (2015) argue that corporation connections within THOFC lead to profit-sharing activities which reduce tax revenues of home governments, undermining policies targeting poverty and development. Jones and Temouri (2016) find that the variety of capitalism of a MNC home location, and the level of firms' technological intensity, have a strong impact on their decision to take capital offshore, while their home country corporate tax rate has minimal impact. Furthermore, Tørsløv et al. (2018) note that foreign firms are inherently more profitable than domestic firms as they move profits across borders to take advantage of lower tax rates elsewhere. This implies that MNCs are more competitive than their domestic counterparts, weakening efforts to promote and support national economies. However, as Desai et al. (2006) contend, the reduced costs of using THOFC may actually stimulate investment in high-tax countries.

Second is the question of how corporate strategic decision-making and financial flows relate to ‘place’ as regions and countries specialize through legal or institutional arrangements. Corporate strategies consider differential tax rates with regard to enhancing profitability (Glaister and Hughes, 2008), with Behrendt and Wamser (2018) observing how institutional arrangements between countries (e.g. bilateral taxation treaties) influence corporate locational decisions. Likewise, public scrutiny affects firm tax avoidance behavior as consumer reputation and/or reduced political efficacy can negatively impact profit (Dyreng et al., 2016).

The relatively recent systematic integration of THOFC into global economic networks provides additional motivation for integrating SM and EG theories and approaches. While several staple theories of SM and international business (IB) such as the resource-based view (Wernerfelt, 1984), and Dunning’s (1977) Ownership Location Internationalization (OLI), treat space and place as strategic assets (cf. Jones, 2018), or as part of a strategy to access factors of production or new markets, the integration of THOFC into firm networks suggests that new geographical considerations are at work. Financialization of the firm, and the economy more broadly, has meant that MNCs have shifted their locational considerations toward those that optimize balance sheets. This reorients firm networks to mirror the geographies of taxation, the global distribution of which is remarkably different than the geographies of production and consumption.

Tax Havens and Offshore Financial Centers

As Seabrooke and Wigan (2017) observe, ‘there is a general silence about the ‘offshore world’ in economics, which stays firmly within the boundaries of established national and international law rather than the gray zones in-between’ (p. 4). Despite their outsized influence in global economic transactions (Hudson, 2000), there is limited scholarship on how firms incorporate THOFC within their spatial organizational strategies, or about the economic

ecosystems of THOFC. Many are in fact small jurisdictions that would otherwise struggle to attract FDI and other forms of capital investment (Cobb, 1998)

The identification of THOFC presents a challenge in and of itself. Neither ‘tax haven’ nor ‘offshore financial center’ is an adequate term to reflect the true nature of such jurisdictions. Despite the perception that THOFC are associated with illicit activity, or remote islands with questionable legal and/or regulatory frameworks, research has demonstrated their ubiquity in global financial networks across every sector (García-Bernardo et al., 2017) and that good governance and strong institutions are a key attribute (Dharmapala and Hines, 2009). For firms and individuals from many nations in the global South, financial institutions in tax havens may in fact offer significantly *greater* regulation and/or stability.

THOFC are jurisdictions that offer non-resident individuals or corporations advantages unavailable in their home jurisdiction. These include low or no taxation of profits, income or other earnings such as dividends; secrecy; greater capacity to raise capital or bear debt; and, minimal financial regulation (Hampton and Christensen, 2002). Each firm has unique reasons for pursuing THOFC activity, with literature suggesting the strong role of: path dependence and geography (Buckley et al., 2015; Haberly and Wójcik, 2015a); levels of technological intensity (Jones and Temouri, 2016); legal systems (Dharmapala and Hines, 2006; Mudambi et al., 2018); varieties of capitalism (Jones and Temouri, 2016); and, favorable tax conditions (Rose and Spiegel, 2007; Weyzig, 2013).

Given the enhanced role of THOFC in global financial circuits, a number of organizations now catalogue and monitor their activity, including to varying degrees multinational organizations such as the OECD, G-20, and non-governmental organizations (NGOs) such as the Tax Justice Network and Oxfam, in addition to academic research (cf. Zucman, 2015). Palan et al. (2010), for example, provide a typology of corporate tax havens that includes incorporation centers with low regulation or tax rates; registration centers (e.g. British Virgin

Islands (BVI, Panama); secrecy locations (e.g. Liechtenstein); specialist service providers (e.g. Bermuda, Isle of Man); and market-entry conduits (notably, The Netherlands). García-Bernardo et al. (2017) identify ‘conduits’ and ‘sinks’ as THOFC that act as intermediaries and repositories of corporate financial flows, respectively. Conduits are mainly ‘onshore’ tax havens used to divert profits (and liabilities) such as The Netherlands, Ireland, and Switzerland, and exploit loopholes such as the infamous ‘Double Irish Dutch Sandwich’ (Loomis, 2011). While sinks are more traditional tax havens used to shelter capital wealth. Hampton and Christensen (2002) divide THOFC into two fundamental categories, including functional and notional. The former being where banks locate (e.g. Bermuda, Channel Islands) and the latter where they register (e.g. Seychelles, Labuan), with another category comprising hybrids (e.g. Cayman Islands).

Other factors further complicate the identification of THOFC. Many are large territorial states with economies seated in non-financial activities, such as Singapore and The Netherlands. The United States (US), for example, is widely cited as one of the world’s most significant THOFC as it does not generally share financial information on assets and income beyond its own borders. There are also cases where sub-national jurisdictions fit the criteria of THOFC, offering either low or no tax on economic activities, or unique corporate structures. Labuan is a Malaysian Federal Territory offering tax benefits through its International Business and Financial Center (IBFC), while a handful of US states such as Delaware and Wyoming offer ‘anonymous’ limited liability corporations (LLCs) and related benefits. Some may argue that the world’s many special economic zones (SEZs) are a form of tax haven in that they facilitate transfer pricing. Also, some of the most well-known tax havens are not fully sovereign, including: crown dependencies (Isle of Man, Channel Islands); unincorporated territories (Puerto Rico); overseas territories (BVI, Bermuda, Cayman Islands); constituent

countries (Aruba, Curaçao); and, free associations (Marshall Islands, Niue). Varying degrees of autonomy of these locations effects levels of reporting, compliance and data availability.

The emergence of THOFC has been a gradual process reflecting the transformation of firms into ‘lean profit centers increasingly oriented towards the collection of rents from intangible assets’ (Haberly and Wójcik, 2015b, p. 76). Increasing sophistication of firm processes is anointed by specialized law firms and the ‘Big Four’ consultancies in particular (Jones et al., 2018). A common practice is for firms to establish special purpose vehicles (SPVs) or special purpose entities (SPEs) in THOFC, which facilitate both tax efficiency through profit shifting and transfer pricing (Alstadsæter et al., 2018), and tax advantaged transactions such as a higher level of tax-deductible debts, depreciation and losses, and external finance for research and development (R&D) activities (Demere et al., 2017).

THOFC also offer ‘secrecy arbitrage’, which Ledyeva et al. define as ‘the interplay of onshore corruption and offshore secrecy’ (2015, p. 332). A distinct yet related practice is known as ‘round-tripping’, which enhances a firm’s bargaining power by routing capital overseas and back again as ‘foreign’ investment. Numerous studies have documented round-tripping to and from China (García-Herrero et al., 2015; Xiao, 2004), although both Buckley et al. (2015) and Jones and Temouri (2016) contend that the practice cannot be explained by tax-related issues alone. Thus there is no ‘standard’ practice amongst firms and related THOFC, and only through triangulating new perspectives and methods can the underlying processes in which they function be thoroughly understood.

Data and Methodology

Understanding the functional and sectoral specialization of THOFC vis-à-vis the networked structure of contemporary MNCs requires a global, systems-based approach. Network analysis provides one such perspective, facilitating the analysis of how THOFC are structurally

embedded in global financial circuits at the individual node (country) and system (industry group) level. Such a network approach is inspired by the recent ‘relational turn’ in urban and regional studies (e.g. Capello, 2000; Khanna, 2016), emphasizing that understandings of place should also be centered on how networks connect flows of people, knowledge, and capital. The applicability of network analysis is derived from its analytical features, as it is the interaction and exchange with other locations that allows THOFC to exert leverage in the global economic and financial system. Thus, rather than viewing THOFC as isolated clusters of capabilities and resources, a network perspective allows for their conceptualization as *nodes in networks of capabilities and resources*.

To empirically foreground this idea of THOFC as globally connected nodes, we draw upon firm headquarters and subsidiary data collected from 12 of the world’s most significant stock exchanges, including a total of 652,246 firm subsidiaries of 25,143 firms. These are taken from a geographically representative sample of all firms on the Australian Securities Exchange (Sydney), Bombay Stock Exchange (Mumbai), Bovespa (São Paulo), Deutsche Börse (Frankfurt), Euronext (multiple locations in Europe), London Stock Exchange, Nasdaq (New York), New York Stock Exchange, Shanghai Stock Exchange, Shenzhen Stock Exchange, and the Toronto Stock Exchange. The number of subsidiaries associated with listed firms ranges from 178,544 of NYSE-listed firms to 3961 of Euronext-listed firms, with at least one exchange in each major world region. Several stock exchanges located within THOFC were not included despite their large size (e.g. those in Hong Kong, Singapore, Zurich), as they would have conflated non-THOFC activities (e.g. local company listings) with MNCs whose local registry was motivated primarily by tax purposes.

Data preparation reduced the list of firms to those that were actively traded and had an identifiable country of registration between mid-2016 and mid-2017, when the sample was collected. Industry groups were derived from the Global Industry Classification System

(GICS), a standardized taxonomy that allows for harmonization across exchanges. The analysis was conducted using four-digit GICS code—a resolution that lies between 2-digit Sectors, and 6-digit Industries. Subsidiary data were extracted from Osiris, a commercial corporate data repository provided by Bureau van Dijk, and supplemented by data from Bloomberg, Morningstar, Yahoo!, and from the exchanges themselves. Firm headquarters locations were matched to subsidiary locations using firms’ International Securities Identification Number (ISIN)—a unique company identifier where the first two digits indicate country of registration. Thus, despite the complex organizational structure of firms, each headquarters or subsidiary location was attributed to a single jurisdiction. Countries were enumerated by ISO-2 code, so both sovereign nation-states and territorial dependencies were recorded, including the Chinese Special Administrative Regions (SARs) of Hong Kong and Macao. This study examines first-order relations between firms at headquarters and subsidiary locations, though it is likely that many corporate structures are routed through multiple jurisdictions that obfuscate ownership through arms-length corporations. This includes the likes of SPEs and SPVs that are custom-created with firm-specific needs in mind.

For this study, THOFCs were identified *a priori*, in contrast to other studies where they emerged from the data based on FDI and other proxy indicators (cf. García-Bernardo et al., 2017; Zoromé, 2007). 49 jurisdictions were identified using two indicators—one based on the OECD and other from the Institute on Taxation and Economic Policy (ITEP), a Washington-based non-partisan think-tank. These jurisdictions include a diversity of countries, divided roughly in half between fully sovereign states and territorial dependencies. 41 of the identified jurisdictions had at least one headquarters or subsidiary office location. Table 1 below lists the top 20 headquarters and subsidiary locations identified as THOFC.

<Insert Table One Approximately Here>

There are considerably more THOFC in subsidiary than headquarters locations, even when the relatively larger absolute number of subsidiaries is taken into consideration. The distribution of headquarters locations skews strongly toward a select few ‘sink’ jurisdictions. This includes the British dependencies of the Cayman Islands, Bermuda, Channel Islands (Jersey and Guernsey), and BVI, in addition to European ‘conduits’ such as The Netherlands, Belgium, and Ireland. Subsidiaries, on the other hand, are more broadly distributed and include many of the same countries as well as Singapore, Switzerland, and Malaysia. While a relatively small proportion of headquarters are located in THOFC (3%), 7.4% of subsidiary locations are in THOFC, ranging from Real Estate (3%) to Semiconductors & Semiconductor Equipment (14%). Knowledge-intensive industry groups display the highest level of THOFC activity, including Pharmaceuticals (12%), Biotechnology & Life Sciences, Software & Services (10%), and Technology Hardware & Equipment (11%). Conversely, highly localized industry groups such as Consumer Durables & Apparel (6%), Food & Staples Retailing (7%), Retailing (4%), and Utilities (5%) are less likely to have subsidiaries in THOFC.

Our primary interest is in inter-country connections, and as such our use of network analysis is conceptually similar to that of ‘world city network’ (WCN) analysis where corporate locations are a proxy for how strongly places are interconnected. This literature draws on a two-mode corporate location matrix (firm by city) to model a one-mode inter-city network where the links between cities (nodes) are formed by the relations between firms’ offices locations (edges) (Derudder and Taylor, 2018). This entails the projection of a two-mode matrix (firm by city) into a one-mode matrix (city by city), with this bipartite projection function making clearly defined assumptions about how the ‘co-behavior’ of agents (the ensemble of a firm’s offices) leads to networking (interaction between these offices; Neal,

2014a). A long-standing critique of WCN literature is that these assumptions are only loosely based on theoretical understandings of firm behavior (cf. Nordlund, 2004; Neal 2014b). Nonetheless, these assumptions on firms’ ‘co-behavior’ can be tangibly linked to the location of firms – forming inter-relationships between places – so that the different interactions in corporate structures can be condensed into a coherent conception of networking.

Here, we apply one of the most widely adopted bipartite projection functions in WCN research on corporate networks: that of Alderson and Beckfield (2004), Wall and van der Knaap (2011) and, Martinus and Sigler (2018); where it is assumed that a firm-subsidary relationship between two locations i and j represents a connection between those locations. The interaction represents an asymmetric corporate flow of information, knowledge, and direction between locations. Each of the 24 firm-by-country contingency tables are thus treated as a series of two-mode networks (firm-by-country), converted into one-mode (country-by-country) networks by industry group based on headquarters-subsidary location relationships in corporate structures. The mathematical specification is a directed weighted network $G^{[\alpha]}(\mathcal{V}, \mathcal{E}^{[\alpha]})$ constructed for each industrial sector α , where each of the $N = |\mathcal{V}|$ nodes represents a country. Relationships between countries within a given sector α are encoded in the set of links $\mathcal{E}^{[\alpha]}$. These 24 networks are fully described by the non-negative adjacency matrices $W^{[\alpha]} \equiv \{w_{ij}^{[\alpha]}\}$, one for each sector. An element $w_{ij}^{[\alpha]}$ of $W^{[\alpha]}$ is different from zero if a parent-subsidary relationship exists between the two countries i and j in the sector α , with the value quantifying the strength of the relationship. Weights are assigned by counting the number of subsidiaries located in a country that share a parent company in the other. More precisely, a weight $w_{ij}^{[\alpha]}$ associated to a directed link $(i, j) \in \mathcal{E}$ denotes the number of subsidiaries in country j that refer to parent companies located in country i , all belonging to the industrial sector α . Since only intercountry relationships were considered ($i \neq j$), the

information regarding subsidiaries operating in the same country as their parents are not retained. This produced networks without self-loops.

The network representation allows for a comprehensive study of the role of a country within a specific sector vis-à-vis the different centrality measures (Latora et al., 2017). Each reflects a different yet complementary element of ‘importance’ of a node (i.e. THOFC) in a network (i.e. corporate networks). The most basic and straightforward centrality measures are the in-strength and out-strength, which account for the total strength of the incoming and outgoing connections for a given node within a sector. As the weighted extension of degree (the number of connections of a node), the in-strength $s_{in}^{[\alpha]}(i)$ of a country $i \in \mathcal{V}$ for a sector α is defined as the sum of the weights of its incoming links. This can be computed from $W^{[\alpha]}$ as:

$$s_{in}^{[\alpha]}(i) = \sum_{j=1}^N w_{ji}^{[\alpha]} \quad (1)$$

Similarly, the out-strength can be written as the sum of the weights of the outgoing links, or:

$$s_{out}^{[\alpha]}(i) = \sum_{j=1}^N w_{ij}^{[\alpha]} \quad (2)$$

These two simple measures provide a useful description of the local properties of the networks at the level of nodes by focusing on first neighbors. Our second measure, eigenvector centrality (EC), looks at the global properties of the network by going beyond first neighbors. This takes into account the secondary effect of being connected to a node that is itself well connected. It can be considered as a generalization of degree centrality. The EC of a country $i \in \mathcal{V}$ for a sector α is given by:

$$EC^{[\alpha]}(i) = u_{1,i}^{[\alpha]} \quad (3)$$

with $u_{1,i}$ representing the i -th component $\mathbf{u}_1^{[\alpha]}$, the eigenvector associated to the eigenvalue $\lambda_1^{[\alpha]}$ of $A^{[\alpha]}$, such that it satisfies:

$$A^{[\alpha]}\mathbf{u}_1^{[\alpha]} = \lambda_1^{[\alpha]}\mathbf{u}_1^{[\alpha]} \quad (4)$$

In this case, $A^{[\alpha]} \equiv \{a_{ij}^{[\alpha]}\}$ is the adjacency matrix of $G^{[\alpha]}$, whose non-zero elements denote the presence of a link between country i and country j without a specified direction. The sectorial networks were visualized by using the layout produced by the Yifan Hu algorithm (Hu, 2005), while the size of the nodes is given by the respective betweenness centrality. Given the density of the networks, a disparity filter (Serrano et al., 2009) was applied before the visualization in order to retain only the statistically significant links (p-value=0.05).

Analysis of THOFC within Global Economic Networks

A number of well-known THOFC emerge as well-connected when contextualized within the global data set. As indicated by Table 2, out-strength (OS) and in-strength (IS) provide an overall impression of connectivity to headquarters and from subsidiaries in THOFC. OS measures how much a country i is used as a subsidiary location by firms located in other countries, while IS can be interpreted as how much firms across the entire world (within the respective industry group network) rely on country j as a headquarters location.

<Insert Table Two Approximately Here>

OS for subsidiary locations reveals that continental ‘conduits’, including Switzerland, The Netherlands, and Ireland, emerge as significant alongside ‘sinks’ such as Jersey and Bermuda. The top four countries comprise more than two-thirds of total OS, indicating a preference for particular reporting structures consisting of subsidiaries in Switzerland, The Netherlands, Jersey, and Ireland, which themselves may be parent companies (e.g. subsidiaries of subsidiaries). IS reveals a broader range of THOFC headquarters relations and includes both conduits, such as The Netherlands, Singapore, Ireland and Switzerland, and sinks such as the Cayman Islands and BVI. The latter two sinks are particularly relevant for Chinese firms, with Hong Kong listed as the third most significant subsidiary location. This range suggests a broad diversity of firm structures are used by headquarters, which often serve as holding corporations for a range of subsidiaries. The relatively small number of headquarters in Cyprus, for example, has hundreds of subsidiaries mainly in mining and real estate with ties to Russia, Israel and several African countries. The Marshall Islands’ 53 headquarters are linked to 947 subsidiaries almost exclusively through shipping companies, and related offshore oil & gas interests, tied to its historic ‘flag of convenience’ status.

Though geographical proximity does not fully explain THOFC relations, there is a strong level of regionalization with the data. This reflects both physical proximity, as well as socio-political ties as identified by Haberly and Wójcik (2015a). Australian subsidiaries' primary ties are to Luxembourg and Singapore, both attributable to Australia's strong industrial orientation toward mining and energy, respectively. Likewise, Australian firms' subsidiary locations in Jersey, The Netherlands, Ireland and Bermuda indicate a combination of tax-friendly holding corporations and strategic market entry points. Headquarters locations in France and Germany are strongly tied to European THOFC, including The Netherlands, Switzerland, and Belgium. German firms show a relatively stronger affiliation with Luxembourg-based subsidiaries. Offshore sinks are relatively uncommon in German and French corporate networks, with the exception of German corporations having subsidiaries in the Cayman Islands and Bermuda. Regionalization is especially relevant amongst Asia-based firms, with Japan's headquarters most connected to Singapore and Hong Kong. The Netherlands and Switzerland also feature prominently in Japanese firm networks, as do the Cayman Islands, Ireland, Panama, and BVI as subsidiary locations. China-based firms are by far most heavily tied to Hong Kong subsidiaries. This reflects the well-known structures documented within the literature (Buckley et al., 2015) through ties to BVI, Singapore and Cayman Islands subsidiaries. Hong Kong's conduit role for China is to some degree analogous to the role of Singapore and Mauritius for India-based firms, and of Cyprus for Russian corporations.

Furthermore, contrary to the perception that THOFC are somehow peripheral to the 'mainstream' global economy, the data indicate most relations involve the world's major industrial economies. Half of the top ten connections either to or from THOFC involve the United States, with subsidiary connections to The Netherlands, Cayman Islands, Luxembourg, Hong Kong, Bermuda, Belgium, BVI, and Mauritius, while Switzerland is the most significant

headquarters location for US-based subsidiaries. The UK's ties to The Netherlands and from Jersey also demonstrated The Netherlands' conduit role, as well as Jersey's special relationship to London and tendency toward Commonwealth locations with relatively stronger connectivity to the BVI.

Industry Group Analysis of THOFC within Global Economic Networks

Industry-specific trends reflect the varying financial-operational needs of firms within respective sectors. Knowledge-intensive industries such as Media (9.4%), Pharmaceuticals (7.9%), and various IT industry groups are the most connected to and from THOFC, suggesting firm strategies associated with high intellectual property and knowledge capital, and low physical requirements. Within those industries, almost all THOFC are 'onshore' conduits. Only Bermuda, BVI, Cayman Islands, and Jersey – all of which are British dependencies – are common in knowledge-intensive industry networks, indicating that most firms gravitate toward similar structures. Contrary to popular perception, the Financials sector (Banks, Diversified Financials) is not as well-networked through THOFC, potentially due to the use of affiliate/correspondent banks rather than subsidiaries. And the tendency for THOFC to be relatively absent in networks of industries with high requirements for access to final consumers and local inputs is demonstrated by the fact that the Real Estate (1.2%) had the lowest proportion of ties to and from THOFC, along with Utilities (1.7%), Food & Staples Retailing (2.1%), and Retailing (2.1%).

Figures 1-4 illustrate the network structure of four industry groups, with THOFC distinguished as orange circles, the size of which represent degree centrality. Two of these – Retailing and Utilities – indicate a weak role of THOFC through relatively few ties and low centrality. The other two – Technology Hardware & Equipment and Pharmaceuticals,

Biotechnology & Life Sciences – are illustrative of industry group networks in which THOFC are thoroughly embedded.

The Retailing network (Figure 1) includes relatively few ‘offshore’ THOFC, with The Netherlands represented in six of the top ten dyadic relations. Retailing includes distribution, marketing, and various branches of both online and bricks-and-mortar, with a skew toward the latter as newer firms (e.g. online retailers) may list in the Consumer Discretionary or Information Technology sectors. Firm relations in Retailing include a number of producer nations, as well as overseas relations such as French subsidiaries of Mauritian firms or American subsidiaries of Singaporean ones. An analysis of centrality shows much the same, with The Netherlands as the most important node by EC, also indicating that Hong Kong, Belgium, Jersey and Mauritius are central to the network. Appendix 1 further illustrates these relationships. Some regionality is indicated by ties between China and Hong Kong; Japan and Singapore; and The Netherlands as a pan-European conduit.

<Insert Figure 1 approximately here>

The Utilities network (Figure 2) provides another example of an industry group in which THOFC are relatively insignificant. The overall dominance of the US in Utilities is reflected by its strong ties to firms headquartered in The Netherlands, Bermuda, and Panama. Luxembourg features heavily in the networks of the European periphery (e.g. Romania, Bulgaria, Italy). In terms of centrality, the Cayman Islands and Singapore are the two most important nodes. The Netherlands, Bermuda, BVI and Luxembourg also play central roles. These relations are mainly formed by a relatively small number of firms. The network graph shows some degree of regionalization in Singapore’s connectivity to Malaysia and India; the infamous Dutch-Irish connection between the US, UK, and Germany, and France’s

connectivity to Belgium. THOFC in Utilities are primarily tied to corporate structures of renewable and alternative energy sources such as wind, solar, and biogas, indicating that state-related ‘legacy’ companies would be far less likely to incorporate in THOFC than start-ups in which intellectual property and data, rather than physical infrastructures, are key assets.

<Insert Figure 2 approximately here>

On the other hand, THOFC are well integrated into several networks, including the Technology Hardware & Equipment network (Figure 3). The overall network is dominated by Chinese firms, though the US and Japan are the best connected, with other technology leaders at the center of the network including France, Germany, South Africa, Finland, Canada, and Israel. Despite strong role of Chinese producers and consumers in the industry group, headquarters-subsidiary relations are mainly linked to the US in relations with The Netherlands, Malta, Bermuda, Belgium, and Singapore. EC shows a strong role for European conduits in the industry group network, with Singapore, Switzerland, Ireland, Hong Kong and The Netherlands as leading countries. The network structure includes the known Chinese firm sinks of the Cayman Islands and BVI, with Hong Kong as a regional conduit.

<Insert Figure 3 approximately here>

Likewise, the Pharmaceuticals, Biotechnology & Life Sciences network (Figure 4) has vast THOFC relations. The majority originate from US-based subsidiaries of firms in The Netherlands, Singapore, Belgium, and Bermuda. Apart from the Ireland-United Kingdom dyad, the top ten bilateral relations in Pharmaceuticals, Biotechnology & Life Sciences involve the US. Ireland and The Netherlands are the top two respective countries by EC, reflecting not

only their role in global pharmaceutical production and biotechnology research, but also the various tax structures they harbor. Despite having little to no local activity in the industry group, Jersey, Luxembourg, BVI and Bermuda all emerge as significant by EC, reflecting their role at the core of the industry group. As Figure 4 reveals, network ‘extremities’ such as Malta, Mauritius, Panama, and BVI serve as sinks for firms, and a closer look at these firms reveals that many of these are early-stage or small firms. Biotechnology hubs such as Switzerland and Singapore may also play a prominent role both as THOFC but also as sites of particular infrastructures or progressive legislation.

<Insert Figure 4 approximately here>

Concluding Discussion

THOFC serve a fundamental role in the global economic network. Their relative importance differs by industry and sector, but appears to be clearly linked to knowledge-intensive activities. In other words, financial transactions are offshored when intellectual property is high and physical capital is low. The networks of industry groups such as Pharmaceuticals, Semiconductors & Semiconductor Equipment, Software & Services, and Technology Hardware & Equipment embed THOFC extensively, whereas localized industries such as Retailing, Food & Staples Retailing, Utilities, and Real Estate do not to nearly the same extent. In the case of the former groups, both ‘profit shifting’ and ‘transfer pricing’ (Aalbers, 2018; Janský and Prats, 2015) explain firm behavior as international financial movements are easily justifiable in the case of knowledge capital in the form of data or patent royalties. The rare cases in which the latter are connected through THOFC headquarters or subsidiaries are often linked to new industries, such as digital retail, newer energy sources and/or technologies (e.g.

wind, photovoltaic), or property investment SPVs more so than ‘traditional’ retail or industrial-era firm structures.

When individual THOFC are further scrutinized, a sharper image emerges regarding the specific role of each in industry networks. As García-Bernardo et al. (2017) corroborate, conduits such as Switzerland, The Netherlands, Singapore and Ireland are central to nearly every network, alongside sinks such as the Cayman Islands, BVI, and Bermuda. The THOFC core is indeed defined by structures such as the ‘Double Irish’ and ‘Dutch Sandwich’, as the literature suggests, defined within industries such as Materials, Diversified Financials, and Pharmaceuticals in which globalized production networks result in complex financial structures. Further, industry-specific THOFC are revealed, such as the Marshall Islands, Panama, and Cyprus in Transportation (shipping), and Jersey in Media. Certain geographical relationships also confirm the role of path dependence in shaping THOFC networks, evidenced by the Russia-Cyprus, India-Singapore-Mauritius, and China-Hong Kong-BVI-Cayman structures.

Our perspective, informed by theory from both EG and SM, helps shed light on the complex factors that determine the distribution of firm activity within THOFC, including both firm-level characteristics and the attributes of the jurisdictions themselves. There is also variation by industry and sector, including the level of technological sophistication, complexity of the production chain, and the degree of intellectual property. Further integration of the two fields should hone in on the role of regions and cities as financial command centers in global capitalism, as well as the role of producer service firms in shaping THOFC geographies (Goerzen et al., 2013); the coevolution of firms and locations (Mudambi et al., 2018); and, on understanding the redistributive impacts of globalization – which countries have gained most from the strategic decisions of firms.

Our concluding argument is that corporate network structures often mimic the geographies of taxation rather than actual distribution of production or consumption activities. Tax havens and offshore financial centers are in fact central to the global financial system, and will become increasingly important as corporate structures adapt to changing conditions and technologies faster than regulators can adapt. Network analysis reveals that the global economy's most central THOFC are not 'rogue states'—the vast majority of corporate structures involve either territorial nation-states or jurisdictions with strong rule of law and governance. As THOFC appear to harbor more corporations for which intellectual property law and data privacy come at the same premium as low taxes and banking secrecy, global regulation bring these jurisdictions under enhanced scrutiny. For this reason, new knowledge on the role they play in firm structures is critical, with a particular focus on how financial innovations and digitally-mediated capitalism have disrupted current regulatory and governance frameworks, and what impacts those may have on existing geo-economic structures.

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Headquarters		Subsidiaries		Headquarters		Subsidiaries	
1	Cayman I (105)	The Netherlands (9661)		11	Isle of Man (37)	BVI (2033)	
2	Guernsey (102)	Hong Kong (6751)		12	Switzerland (24)	Mauritius (1293)	
3	Bermuda (98)	Cayman I (5987)		13	Singapore (14)	Cyprus (928)	
4	The Netherlands (92)	Singapore (5791)		14	Cyprus (11)	Marshall I (756)	
5	Belgium (83)	Ireland (5086)		15	Gibraltar (6)	Panama (602)	
6	Ireland (82)	Luxembourg (4330)		16	Hong Kong (4)	Barbados (397)	
7	Jersey (82)	Switzerland (4031)		17	Panama (4)	Malta (351)	
8	BVI (80)	Bermuda (3539)		18	Antigua & Barbuda (2)	Liberia (311)	
9	Marshall I (53)	Malaysia (3459)		19	Malta (2)	Costa Rica (297)	
10	Luxembourg (38)	Belgium (2922)		20	Mauritius (2)	Gibraltar (295)	

Table 1. Top 20 Headquarters and Subsidiary Locations of THOFC

Out-strength (OS)		In-strength (IS)		Out-strength (OS)		In-strength (IS)	
1	Switzerland (5159)	The Netherlands (9872)		11	Cayman Islands (294)	Mauritius (1288)	
2	The Netherlands (4537)	Cayman I. (7168)		12	BVI (127)	Marshall I.(947)	
3	Jersey (4029)	Hong Kong (6582)		13	Cyprus (110)	Cyprus (765)	
4	Ireland (3288)	Singapore (5473)		14	Liberia (82)	Panama (634)	
5	Bermuda (1787)	Luxembourg (5212)		15	Hong Kong (77)	Malta (339)	
6	Belgium (1322)	Ireland (4611)		16	Neth. Antilles (48)	Costa Rica (322)	
7	Luxembourg (1021)	Switzerland (4441)		17	Guernsey (27)	Liberia (321)	
8	Singapore (530)	Bermuda (4124)		18	Gibraltar (17)	Gibraltar (319)	
9	Marshall I. (503)	Belgium (2937)		19	Panama (16)	Barbados (306)	
10	Isle of Man (413)	BVI (1604)		20	Malta (15)	Bahamas (255)	

Table 2. Out-strength and In-strength of THOFC by Country

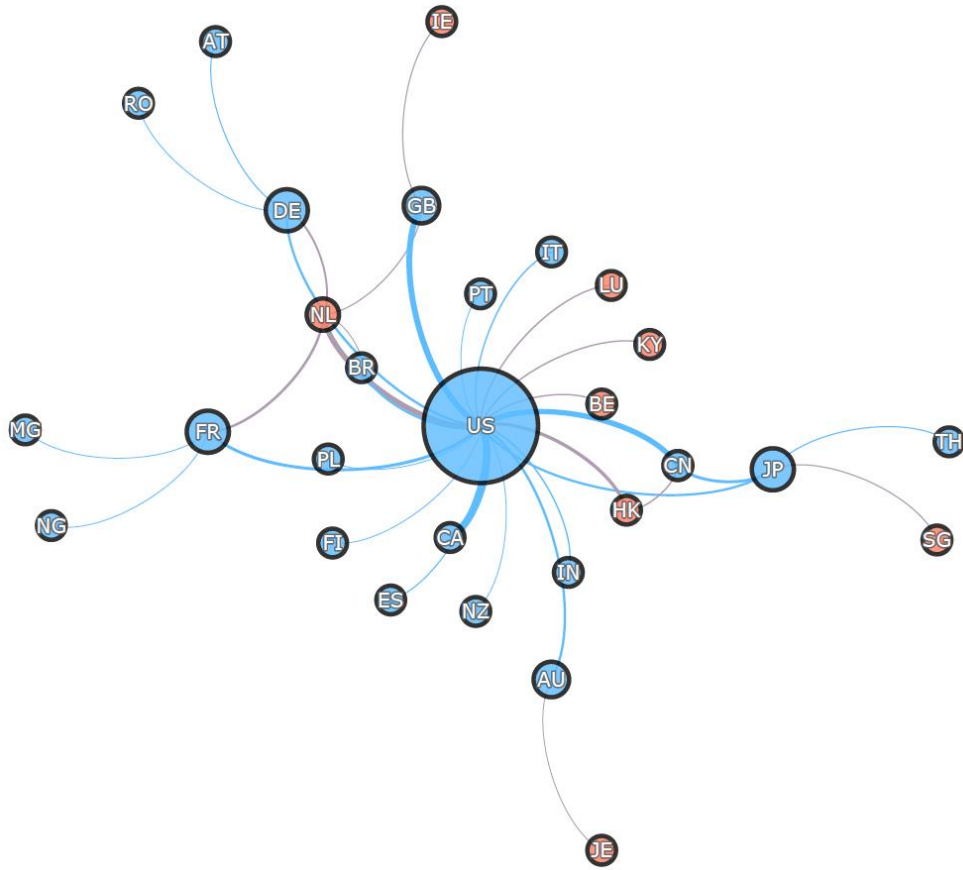


Figure 1: Retailing industry group backbone network

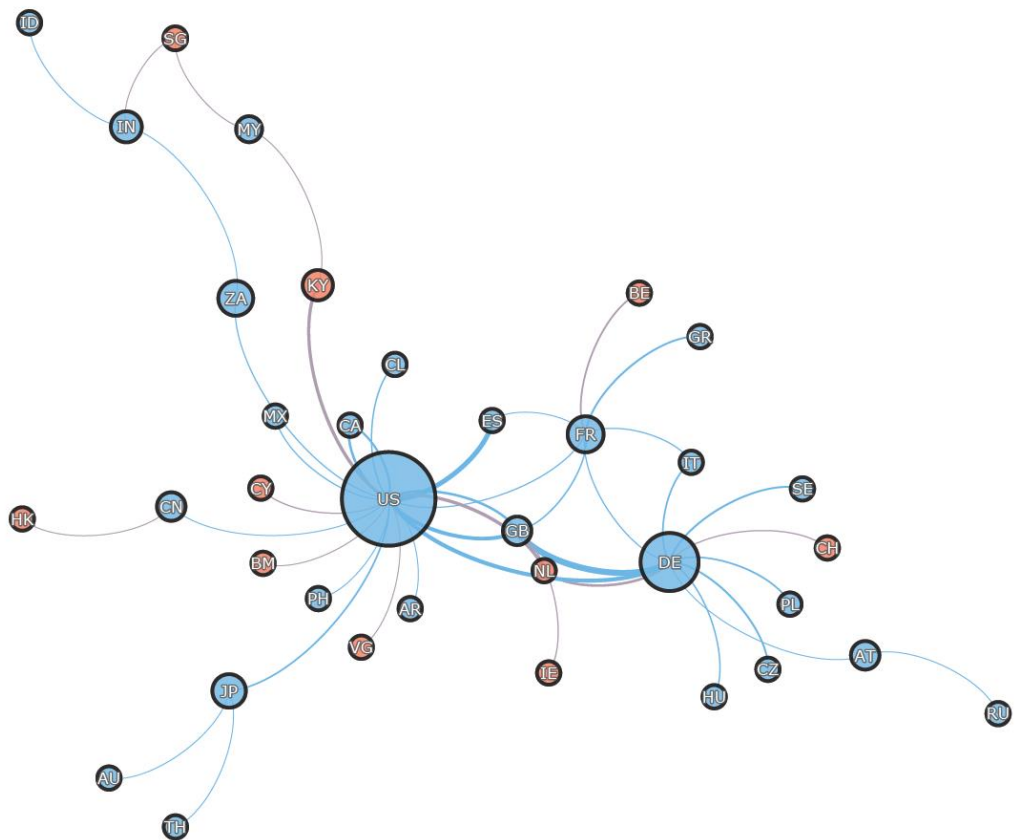


Figure 2: Utilities industry group backbone network

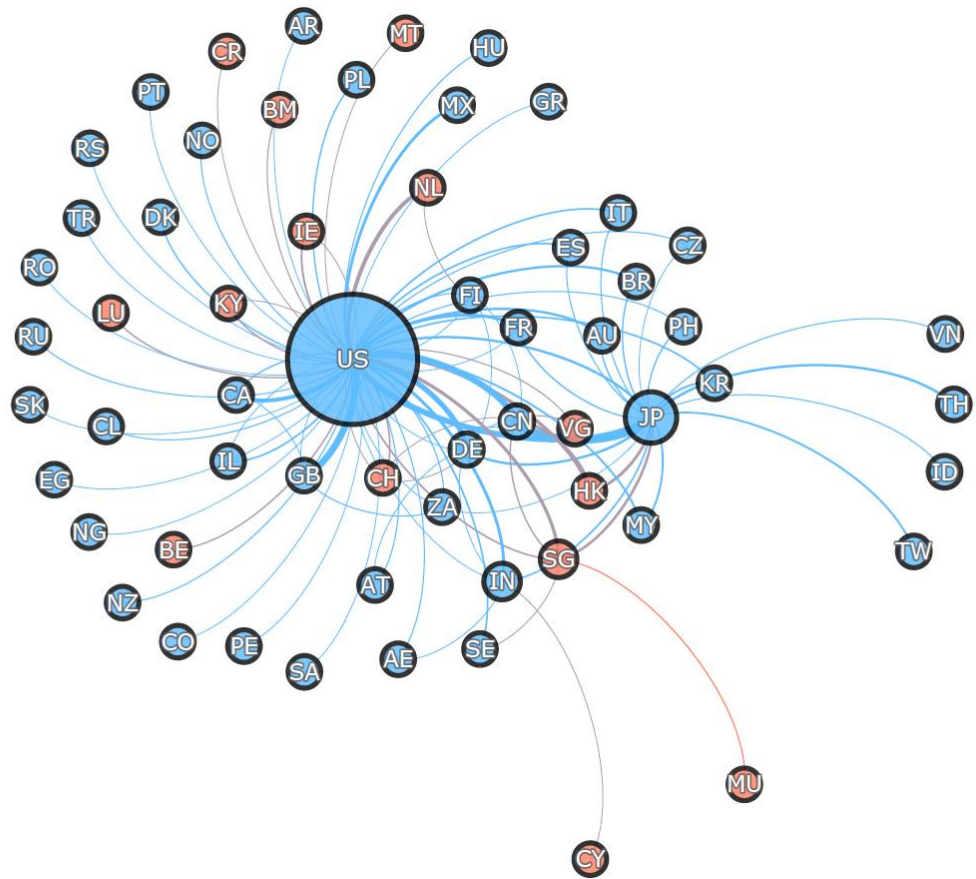


Figure 3: Technology industry group backbone network

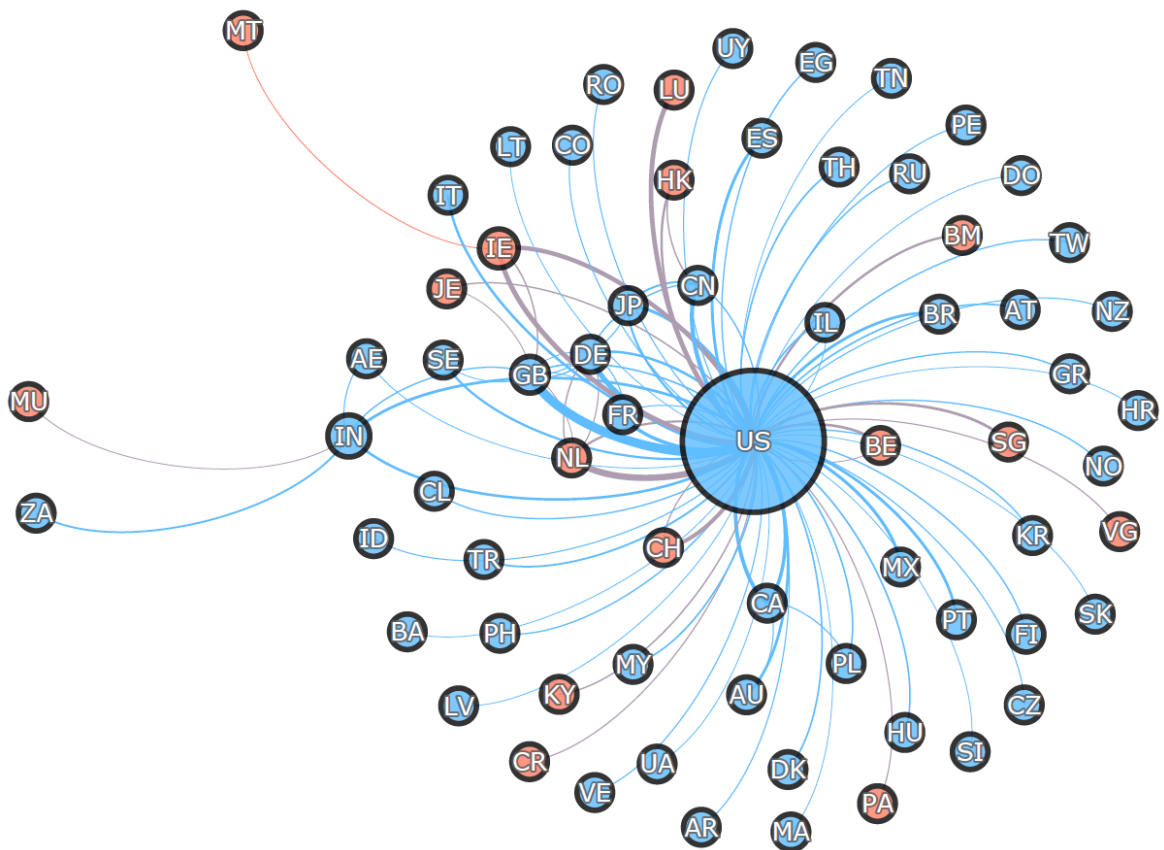


Figure 4: Pharmaceuticals, biotechnology and life sciences industry group backbone network