Accepted for publication at the

*International Journal of Operations and Production Management (IJOPM)*

# Making Supply Chains Great Again: Examining structural changes to US manufacturing supply chains

*Mehmet Chakkol*

*Warwick Business School, University of Warwick*

*Mark Johnson*

*Warwick Business School, University of Warwick*

*Antonios Karatzas*

*Norwich Business School, University of East Anglia*

*Georgios Papadopoulos*

*School of Economics, University of East Anglia*

*Nikolaos Korfiatis*

*Norwich Business School, University of East Anglia*

**Abstract**

**Purpose -** President Trump's tenure was accompanied by a series of protectionist measures that intended to reinvigorate US-based production and make manufacturing supply chains more 'local'. Amidst these increasing institutional pressures to localise, and the business uncertainty that ensued, this study investigates the extent to which manufacturers reconfigured their supply bases.

**Design/methodology/approach -** Bloomberg's Supply Chain Function (SPLC) is used to manually extract data about the direct suppliers of 30 of the largest American manufacturers in terms of market capitalisation. Overall, the raw data comprises 20,100 quantified buyer-supplier relationships that span seven years (2014-2020). The supply base dimensions of spatial complexity, spend concentration and buyer dependence are operationalised by applying appropriate aggregation functions on the raw data. The final dataset is a firm-year panel that is analysed using a Random Effects (RE) modelling approach, and the conditional means of the three dimensions are plotted over time.

**Findings -** Over the studied timeframe, American manufacturers progressively reduced the spatial complexity of their supply bases and concentrated their purchase spend to fewer suppliers. Contrary to the aims of governmental policies, American manufacturers increased their dependence on foreign suppliers and reduced their dependence on local ones.

**Originality -** The research provides insights into the dynamics of manufacturing supply chains as they adapt to shifting institutional demands.

**Keywords:** Supply chains, trade policy, consolidation, concentration, local sourcing, dependence

**Paper Type:** Research paper

## 1. Introduction

Soon after taking office in January 2017, U.S. President Donald Trump fulfilled his pre-election promise to impose tariff and non-tariff barriers to international trade, particularly on imports from countries such as China, Canada and Mexico (e.g., American Action Forum, 2020). During his tenure, various trade barriers were introduced especially on intermediate goods, which are typical inputs for manufacturing supply chains (Bown and Zhang, 2019). Meanwhile, he strongly encouraged, and sometimes threatened, American manufacturers to re-shore production (e.g., Reuters, 2017).

Re-shoring production can have significant benefits. These include a reduction in complexity and transaction costs (Delbufalo, 2022), and an increase in responsiveness (Palit et al., 2022). However, there are downsides, including a potential reduction in access to markets (cf. Dunning, 1993) and innovative technologies (Palit et al., 2022). In order to re-shore, firms, or their indigenous suppliers, must not only have the capacity to make goods, but also the capability (or knowledge) to do it. As manufacturers have outsourced and offshored production over the last few decades, capacity has disappeared and capabilities have eroded in developed economies (cf. Fine and Whitney, 1996). Capacity can be bought over time; however, there is a potential 'capability trap' (cf. Repenning and Sterman, 2002) at a national level, where significant investment is required in order to create the required capabilities.

The original import tariff increases were meant to target certain Chinese items for which U.S. consumers and businesses had other national sourcing options (U.S. Senate Committee on Finance, 2018). This policy drive towards local sourcing was intended to improve employment and foreign domestic investment at the US market. This represents the institutional logic of government which seeks to create and protect domestic jobs (cf. Perry and Rainey, 1988). Conversely, corporations seek to maximise profit (Thornton and Ocasio, 2008) and are likely to source from low-cost economies rather than the comparatively more expensive domestic US suppliers. Meanwhile, exogenous factors such as technology, geopolitics, ongoing wars, as well as resource scarcities (e.g., the semiconductor chip shortage) have brought more emphasis on local sourcing and re-shoring especially for manufacturing supply chains.

To reliably evaluate the extent to which manufacturers re-organised their supply chains amidst the current geo-political climate, the research examines the direct suppliers (i.e., supply bases) during the period from before Donald Trump's election to the moment he was officially replaced. As such, the aim of this work is to examine how the supply bases of key American manufacturers evolved from 2014 to 2020. Specifically, this research answers the following research question:

*How did the supply bases of American manufacturers change over the 2014-2020 timeframe?*

In doing so, this research responds to Helper et al.'s (2021) calls to "*uncover the impact of public policies on … supply chains of organizations outside the public sector*" (p. 780). It also contributes to the recent discourse on how political mandates and geopolitical disruptions result in changes to sourcing decisions (Handfield et al., 2020; Moradlou et al., 2021; Roscoe et al., 2022). This is important to understand at the supply chain level as policy is often targeted at firms with little consideration as to how it can affect the broader supply chains. Moreover, when designing and configuring supply chains, it is important to minimise a company's vulnerability to trade policy (Dong and Koufelis, 2020). This work is therefore equally important to both policy makers and managers.

The study is based on secondary data from 30 of the largest American manufacturers sourced through Bloomberg's Supply Chain (SPLC) function. Dyadic buyer-supplier relationship data is aggregated to construct proxy measures for three supply base dimensions: *spatial complexity*, supply base (spend) *concentration* and *buyer dependence* on local versus foreign suppliers. This results in a firm-year panel of 30 manufacturers observed over 7 years (2014-2020). Random Effects (RE) modelling is applied to estimate how the conditional means of the dimensions of interest evolved over the timeframe. The results reveal a reduction in spatial complexity and an increase in supply base concentration. Somewhat counterintuitively, and against the US administration's expectations, on average, American manufacturers seem to have increased their reliance on foreign suppliers and decreased their reliance on their local supply base during the studied period. This gives rise to several theoretical and policy implications regarding the effectiveness of policies in fostering changes in supply chains.

The remainder of the research is structured as follows. In the next section the theoretical background is provided, and hypotheses are developed. The methodology and findings follow, then the discussion and conclusions are presented.

## 2. Theoretical background

*2.1 Contrasting Institutional Logics*

There is an inherent tension in the intervention of governments in the business of corporations that can be explained through Institutional Logics (cf. Thornton and Ocasio, 2008). Institutional logics are: *"socially constructed, historical patterns of material practices, assumptions, values, beliefs and rules"* (Thornton and Ocasio, 1999, p.804). They have been widely used in operations and supply chain management research to explain how managers and firms respond to internal or external pressures. For example, Beer and Micheli (2017) examined how differing logics in profit and non-profit organizations affected staff's perspectives on performance measurement. McLoughlin and Meehan (2021) determined how logics emerge and diffuse across actors in a sustainable supply chain, and Schumm and Niehm (2023) researched how social enterprises manage competing logics in their purchasing function.

The bureaucratic state and capitalist markets (where corporations operate) are two of the key institutions of society (Friedland and Alford, 1991). During Donald Trump's tenure as US president, it can be argued that firms faced a competition between the government authority and market logics (cf. Zhang and Welch, 2023). On the one hand, the logic of government authority is to conduct work that benefits the home nation (Perry and Rainey, 1988; Zhang and Welch, 2023). In this case, through policy, it sought to encourage firms to re-shore production and rely more on their local supply base, with the intention to create more US jobs (Reuters, 2017). On the other hand, the market logic's focus is on capitalism and profit increase (Thornton and Ocasio, 2008), and has, for decades now, guided the move toward outsourcing to low-cost economies in search of competitiveness (Gerbl et al., 2016).

Within developed economies, the contrasting pressures present in these logics historically favoured globalisation through outsourcing to low-cost destinations. Conversely, localisation and regionalisation imply a move towards potentially higher cost suppliers. As there are heightened attempts to get US firms to procure from local suppliers, the reality may be far more challenging. A change in institutional logics can lead to a change in strategy (Ocasio and Radoynovska, 2016) which, here, could result in a move away from a global supply base and low-cost sourcing to re-shoring and a more local supply base. However, this is contingent on the resources and capabilities required, which can be scarce in the local supply base (McIvor, 2009). The Covid pandemic highlighted that local scarcity occurs with diverse products ranging from simple products such as personal protective equipment to more complex ones such as semiconductors. This is due to the absence of an indigenous supply base (Micheli et al., 2021). Kamakura (2022) argues that re-shoring of semiconductors is highly challenging, with companies such as Taiwan Semiconductor Manufacturing Company (TSMC) having a significant market share and leading capabilities. Conversely, simpler products and components are commodities (Venkatesan, 1992) and, contingent upon costs being acceptable, could be re-shored.

### *2.2 Supply chain reconfiguration: Local versus Global Sourcing*

In the face of institutional pressures, firms change their supply chain strategies. Broadly, these changes can be viewed through the lens of local versus global sourcing; where the latter takes the form of reshoring (or near-shoring, on-shoring, back-shoring) and the former largely involves offshore outsourcing (Roscoe et al., 2022). The increased interest in reshoring is a recent response to governmental institutional pressures on supply chains, particularly in developed economies (Hendry et al., 2019; Moradlou et al., 2021). It is suggested that a return to greater protectionism should lead to a change in the production footprint of manufacturers, with a potential return to more local sourcing (Helper et al., 2021) to mitigate the resultant risks associated with increased uncertainty (Handfield et al., 2020)

Local sourcing is often associated with supplier concentration and closer relationships with preferred suppliers (*cf.* Wagner and Bode, 2006; Steven et al., 2014). These trends towards localisation are not only driven by protectionism and nationalism, but also by technological advancements (Cohen and Lee, 2020; Dong and Kouvelis, 2020). For example, Nike has reduced its global supply chain by nearly 200 factories, while bringing production closer to U.S. markets through robotics and automation driven plants (Financial Times, 2017). Global sourcing, contrasted to sourcing from local markets, is often linked with higher levels of uncertainty and lower levels of transparency and visibility (Wagner and Bode, 2006). In general, global sourcing allows for a more diverse pool of suppliers and adds to the structural complexity of the supply chain as a whole (Hendricks and Singhal, 2005).

Past research suggests that the migration of production facilities during geopolitical disturbances is generally motivated by market accessibility and efficient flow of goods across supply chains (Moradlou et al., 2021). Roscoe et al. (2022) demonstrated that the existing supplier base and its associated assets are the major drivers for the location decision-making-logics in times of severe institutional constraints. As such, reconfiguring supply chains at least in the short-term is hard, since buyer-supplier relationships include specific investments that cannot be easily replaced by overseas or local alternatives (Chae et al., 2020). In addition, Ketokivi et al. (2017) point out that for manufacturing to be competitive in high-wage countries, there needs to exist an interlinked ecosystem of suppliers, intermediaries, and customers. This indicates that local sourcing or reshoring could be less feasible when such ecosystems are non-existent and supply chain assets are immobile. Therefore, deciding between local and global sourcing is not a straightforward option, and firms might respond in a variety of ways (Moradlou et al., 2021; Roscoe et al., 2022) which may not be aligned with the intentions of governmental policies.

### *2.3 Hypothesis Development*

Institutional governmental pressures in the forms of protectionist trade barriers such as tariffs, quotas, and subsidies, can have a number of implications for global supply chains. Some have argued that these trade barriers can hurt U.S. businesses and consumers, while others believe that they are necessary to protect domestic industries and reduce the trade deficit (Cox, 2021; Handley et al., 2020). To mitigate for tariff related disruptions, American manufacturers may resort to an extensive re-organization of their supply chains, by seeking new domestic suppliers, or strengthening supply relationships with existing domestic suppliers, at the expense of overseas ones. These potential changes in the supply base are theorised within this section.

Firms have direct control over their first-tier suppliers, so sourcing decisions following the institutional logics should be reflected on their immediate supply base (Choi and Hong, 2008). The focus of this work is on the supply base dimensions of spatial complexity, (spend) concentration and buyer dependence. These are discussed next with a view to develop hypotheses.

*Spatial complexity* is considered synonymous to geographical dispersion which is largely measured by the number of countries represented in the immediate supply base (Ateş et al., 2022; Delbufalo, 2022). The government and market driven institutional tensions between localisation and globalisation are very relevant to spatial complexity.

Globalisation, whereby manufacturers are in search of markets for cost and technological competitiveness, results in a larger supply base spanning many countries, whereas localisation would be reflected through a supply base spanning only few nations. A potential wholesale move towards reshoring, as a response to governmental pressures, would reduce the spatial complexity of supply bases. However, recent times have seen capabilities concentrating in specific regions, such as Taiwan emerging as the global centre of chip manufacturing. Globalisation requires firms to seek 'best in the world' capabilities and when these capabilities are centred around a specific region, it means that relationships might be restricted to the suppliers that reside in these regions. Therefore, during the studied period of heightened institutional pressures on manufacturing, it is hypothesized that:

H1: American manufacturers decreased their supply base complexity over time.

*Supply base concentration* refers to the extent to which a manufacturer's spend is concentrated on few suppliers. A highly concentrated supply base means that a firm relies on few primary suppliers (Wagner and Bode, 2006). For example, an extreme form of supplier concentration is single sourcing from a preferred supplier. There is little in the way of empirical research to indicate whether the manufacturers concentrated their spending to fewer suppliers (or not) in response to the recent governmental institutional pressures. It can be argued that institutional changes towards heightened protectionism make it more costly to form and maintain relationships with foreign suppliers, hence resulting in a higher concentration of spend with existing suppliers. In addition, the market logic of globalisation pushes manufacturers to seek best-in-class capabilities irrespective of where they are located around the world (Gerbl et al., 2016). Hence, leading manufacturers are likely to concentrate their efforts to forge stronger relationships with these preferred suppliers to secure long-term access to their capabilities. As such, according to both logics, one can expect US manufacturers to have concentrated their spend. Therefore, we theorize:

H2: American manufacturers increased their supply base concentration over time.

It has been argued that as supply base concentration increases so does dependence upon the supply base (Jiang et al., 2023). *Supply Base Dependence* refers to buyer's dependence on its immediate supply base (Elking et al., 2017; Kumar et al., 2020). This is the reverse of supplier dependence which is how reliant a firm is on a focal buyer

(Pulles et al., 2023). Institutional pressures from governments in terms of trade tariffs, intend to make manufacturers more dependent on their local supply bases by forging relationships with new local suppliers, or by increasing purchased volumes from existing ones. However, not all resources can be bought on-shore. Here, an example is ASML, a Dutch firm, which is the World's sole provider of advanced machinery that produces silicon chipsets. Therefore, world-leading technology firms such as Apple or Intel have no other choice than to procure from ASML since there are no equal alternatives. A firm's procurement spend is allocated across suppliers of various product categories, from commodities to strategic items. It has long been stated that strategic items are supplied by a limited number of global companies (Kraljic, 1982). As such, while it may be possible to re-shore commodities, many strategic items will remain with firms with significant expertise, such as ASML. As such, manufacturers may still be dependent on some foreign suppliers. Despite this, due to the heightened institutional pressure to localise during the studied period, it is hypothesized that:

> H3: American manufacturers became more dependent on their local supply base relative to their foreign suppliers.

## 3. Methodology

### *3.1 The research context and timeline*

The initial tariffs by the Republican administration were imposed on a number of products including steel and aluminium from certain countries, as well as solar panels and washing machines (Fan et al., 2021). The majority of new tariffs against China specifically, came into effect in 2018 and applied to raw materials such as steel and aluminium, intermediate goods such as computer and auto parts, and consumer goods ranging from telephones to furniture and lamps (USTR, 2018). The Trump administration justified the move by arguing that the associated industries were being unfairly subsidized by foreign governments, and that tariffs would help to protect American jobs within the domestic supply bases. These tariffs were designed to protect domestic industries and reduce the US trade deficit. China, Canada, the European Union, South Korea, and Mexico were considered the most affected international partners (Cox, 2021). President Trump even threatened US firms that the government would punish companies seeking to move operations overseas (Reuters, 2017).

As a result, many countries responded with retaliatory tariffs against US exports during 2018 and 2019. China trebled the tariffs imposed on American cars, and the EU filed a dispute with the World Trade Organization and substantially raised tariffs on a range of US exports (USTR, 2019). It is worth noting that the trade barriers against China continued under the Biden administration while tariffs against the EU, Canada and Mexico have been relaxed but not eliminated. These have had consequences for firms, consumers and supply chains. The focus of this work is on how they might have been reflected in the supply base structures of major American manufacturers.

*3.2 Data and sample*

To understand how institutional pressures were manifested in the supply bases of American firms, a longitudinal approach is required to monitor the dimensions of interest from before President Trump's inauguration to the conclusion of his presidency. As such, 2014 can be the starting year, when Donald Trump still seemed very unlikely to become the 45th US President. Data collection stopped in 2020 (31st December). This cut-off point is meaningful since the Covid-19 pandemic might have forced manufacturers to drastically re-evaluate their sourcing strategies. This would make it impossible to disentangle the effect of Covid-19 from the dynamics discussed in Section 2, muddling the results and discussion.

The longitudinal (7-year) design provided the study with valuable ‘depth’, but due to inevitable limitations in terms of time, finances, and resources, it imposed constraints with regard to ‘breadth’, i.e., the number of focal firms considered. As such, a pragmatic choice was made to focus on the largest American manufacturing firms in terms of market capitalisation. Nevertheless, it is argued that one criterion of success of the policies introduced by Donald Trump *must* be the extent to which large American multi-national corporations with long BOMs (bills of materials), and supply bases spanning many countries, responded by adjusting their sourcing strategies. Naturally these changes are expected to start with first tier suppliers. Hence, this study relies on secondary data about the supply bases (1st tier suppliers) of 30 of the largest American manufacturers from different industries. The list includes 3M, Abbott Laboratories, AMD, Apple, Boeing, Caterpillar, Cisco Systems, Cummins, Deere, Dell, Dow, Eaton, Emerson Electric, Ford, General Dynamics, General Electric, General Motors, Honeywell, Illinois Tool Works, Intel, Johnson Controls, Johnson & Johnson, Lockheed Martin, Nike, Northrop

Grumman, NVIDIA, Procter & Gamble, Raytheon, Tesla, Texas Instruments, and United Technologies (Raytheon Corporation since 2019).

All data used in the analysis comes from the Supply Chain Function (SPLC) of the Bloomberg terminal. Bloomberg SPLC is increasingly used by supply chain management researchers interested in the dynamics of networks (e.g., Bellamy et al., 2014; Elking et al., 2017), because, alongside the name of each partner (i.e., supplier or customer), it also quantifies (in US dollars) the value of each dyadic buyer-supplier relationship. Data for all direct supplier relationships of the 30 firms was extracted, from 2014 to 2020 on an annual frequency (starting from 31/12/2014 and finishing on 31/12/2020). The annual frequency (as opposed to a higher frequency such as quarterly or monthly) is more appropriate for capturing changes in the structure of supply bases, such as dissolution of relationships with Chinese suppliers or increases in the volume purchased from a local supplier, since such changes are outcomes of strategic decisions that might not materialise instantaneously. The proportion of quantified purchases for a given manufacturer in a given year varies considerably, from 0.5% to 100% of total spend, and is 28.6% on average in the final sample. This is not a surprise, since Bloomberg quantifies only a fraction of relationships between public firms *solely*, for which it can find information about contracts in annual financial statements or in the news. Bloomberg categorises any focal company's purchase spend with a given supplier into four 'account types': Cost of Goods Sold (COGS), Capital Expenditure (CAPEX), Sales, General and Administrative (SG&A), and Research and Development (R&D). Following previous literature (e.g., Ellinger et al., 2020; Gualandris et al., 2021), only COGS relationships were considered as they represent physical goods (raw materials, components, semi-finished products) that comprise inputs to the production processes of the chosen manufacturers. Since Donald Trump's rhetoric and policies targeted purchased goods, the other three account types are of less direct relevance. This leaves 20,010 observations from 5,400 unique dyadic (manufacturer–supplier) relationships of the 30 manufacturers.

A snippet of the extracted raw data at the dyadic (buyer-supplier relationship) data, including a description for each column in the first row, is presented in Table 1. For each observation, these include the (focal) manufacturer and supplier names, the supplier's country, the year the relationship is observed, and the value (in US dollars) of the relationship/contract. Crucially, Bloomberg also estimates what this value represents as a percentage of: a) the total (quantified and unquantified) spend of the buyer (Column

6); and b) the total revenues of the supplier (Column 7). For each dyadic relationship, the two figures are generally considered to be indicators of bilateral dependence (Elking et al., 2017; Kumar et al., 2020).

*Table 1 – Data Snippet (including variable names)*

*3.3 Variables*

The constructed outcome variables of interest are at the firm level, describing the structure of the manufacturers' supply bases. These are *spatial complexity*, *supply base concentration,* and *buyer dependence (by region)*. These outcome variables are constructed by aggregating the (relationship level) raw data (Table 1), with the aggregation function depending on the specific outcome measure. As such, the final dataset is a panel that includes a maximum of 210 observations (7 years of data with 30 firm-level observations per year). The process followed for each variable is explicated in what follows.

S*patial complexity*. Two different measures of spatial complexity are considered, aiming to comprehensively capture the dispersion of suppliers in the supply bases of the focal firms, as well as the distribution of the firms' spending in different parts of the world. The first measure is simply the number of countries represented in the supply base (see: Lu & Shang, 2017). The second measure is adapted from Stock et al. (2000) and Lorentz et al. (2012) and captures the g*eographical dispersion* of the quantified volume of purchases (*relationship value* – column 5 of Table 1), across different parts of the world in terms of relative distance from the 'home' country of the focal manufacturers. Six parts of the world are considered: USA, China & Taiwan, Americas, European Economic Area (including the UK), Asia (other), and rest of the world. The measure is defined as follows:

$$\begin{aligned} Dispersion = 1 - (&|US\% - 16.67| + |CN\&TW\% - 16.67| \\ &+|Amer\% - 16.67| + |EEA\% - 16.67| \\ &+|Asia\% - 16.67| + |RoW\% - 16.67|)/166.67 \end{aligned} \quad (1)$$

Subtracting 16.67 from each percentage, and dividing by 166.67 ensures that the measure ranges from 0 to 1, the former suggesting that the supply base is concentrated entirely in one part of the world (whatever that might be), while the latter would imply that the manufacturer allocates it's spend evenly to suppliers from these six parts of the world. Since the second measure considers the distribution of spend across the globe (as opposed to the distribution of firms in the supply base), the two alternative spatial complexity measurement approaches complement one another.

*Supply base concentration.* Two measures of supply-base concentration are constructed, both capturing the extent to which the bulk of a manufacturer's spend is allocated to a small number of suppliers. Then, a highly concentrated supply-base would suggest that a focal manufacturer has a small set of dominant suppliers (e.g., Vachon & Klassen, 2006). An increase in concentration over time would suggest that the manufacturer consolidates its purchase spend to fewer and fewer suppliers. Following Dong et al. (2020) and Schwieterman et al. (2018), for each manufacturer and year, a simple Herfindahl–Hirschman index (HHI) is constructed as follows:

$$HHI = \sum_{i=1}^{n} S_i^2 \quad (2)$$

In any given year, $S_i$ is the percentage of total COGS of a manufacturer allocated to supplier $i$ (column 6 in Table 1), and $n$ represents the total number of suppliers in the supply-base of the manufacturer in that year. The second measure of supply base concentration is the mean of the percentage of COGS allocated to the top 5 suppliers in each year (Kim and Davis, 2016).

*Buyer dependence.* Column 6 of the raw data (Table 1) is the estimated percentage of total spend of the firm that is allocated to a given supplier in a given year. At the dyadic buyer-supplier level, it is an indicator of the degree of dependence of the focal firm on a given supplier (Elking et al., 2017; Kumar et al., 2020); the higher the percentage of COGS that comes from a specific supplier, the more reliant the focal manufacturer is on the supplier for inputs (and the more money in absolute terms the manufacturer spends with the supplier – Column 5). One can distinguish between 'local' (US) suppliers, and 'foreign' ones. For each firm-year then, the values of buyer spend (Column 6) are summated according to whether the suppliers are local or foreign, to form two separate firm-level outcome variables capturing buyer dependence: *percentage spend with US* *suppliers*, and *percentage spend with foreign suppliers*. Since Donald Trump's policies targeted China specifically, it is also of interest to investigate whether manufacturers reduced their reliance on Chinese suppliers. Crucially, Taiwan is also examined. This is for two reasons. First, some of the tariffs that Donald Trump introduced against China did not apply to Taiwan, so American manufacturers might have treated their spend with Taiwanese suppliers differently. Second, the dependence of the sample firms on Taiwanese manufacturers (especially manufacturers of semi-conductors) is very large. In fact, at an aggregate level, the total spend (in American dollars) with Taiwanese suppliers across the 30 firms was higher than the spend with American suppliers in 2018 and 2021. This is not surprising since many firms in the sample rely considerably on microchips and electronic components, the bulk of which are produced in Taiwan. Therefore, the outcome variables *percentage spend with Chinese suppliers* and *percentage spend with Taiwanese suppliers* are also constructed after data aggregation and observed over the seven-year period.

Table 2 presents descriptive statistics for all constructed variables.

*********************************************************************

*Table 2 – Descriptive statistics*

*********************************************************************

### *3.4 Analytical framework*

The analysis consists in assessing how the average (across firms) values of each constructed outcome variable evolved over time from 2014 to 2020. Let these outcome variables be represented by $y_{it}$, with $i$ representing the firm (from 1 to 30) and $t$ representing time (from 1 to 7, corresponding to years 2014 to 2020). A simple approach would be to calculate the average $y_{it}$ for each year and make appropriate comparisons across time. But this is equivalent to estimating the following linear regression model, which is a preferable approach because it offers certain benefits (explained in the remaining of this section).

$$y_{it} = \alpha + \sum_{t=1}^{7} \beta_t D_t + v_{it}, \quad i=1, \ldots, 30, \; t=1, \ldots, 7. \tag{3}$$

In this model, $D_t$ are time dummy variables, taking the value of 1 for year $t$ and 0 otherwise and $v_{it}$ are the error terms containing unobserved firm-level factors affecting $y_{it}$. As the model includes a constant, $\alpha$, one of the 7 time dummies needs to be excluded to avoid perfect multicollinearity, with the excluded time dummy acting as the *base* or *reference* year. In the analysis, 2016 ($t = 3$) was treated as the base year, which is when the Republican Party won the elections. Then, the constant $\alpha$ represents the average $y_{it}$ in 2016, while the rest of the coefficients, $\beta_t$, represent the difference in average $y_{it}$ beween time period $t$ and 2016, commonly known as the *time effects*. All coefficients, $\alpha$ and $\beta_t$, can be estimated using an Ordinary Least Squares (OLS) estimator (Greene, 2011; Wooldridge, 2010).

The linear regression approach offers two main benefits. Firstly, it allows for statistical inference; that is, allowing to test whether the time effects are statistically different from each other; and whether time is overall important in terms of explaining variation in $y_{it}$ (the latter is a *joint* test of significance, commonly conducted using *Wald*-tests). But for valid inference, *standard errors* that represent the true impression of the OLS estimates are needed, and in general, a *consistent variance-covariance* estimator. An issue here is that $v_{it}$ contains time-invariant unobserved firm-level characteristics, call it $u_i$ (e.g., corporate culture and strategy, primary industry). The presence of $u_i$ generates some positive serial dependence in the error term, given by $\sigma_u^2/\sigma_v^2$, where $\sigma_u^2$ is the variance of $u_i$ and $\sigma_v^2$ is the overall variance of $v_{it}$ (assuming *homoskedasticity*, i.e. constant error variance). Such positive serial dependence creates *downward bias* in the standard errors, overstating the precision and statistical significance of the estimates. Instead of using OLS, a common solution to this issue to use a (feasible) Generalised Least Squares estimator, commonly known as the Random Effects (RE) model, which transforms the regression model in a way that removes the positive serial dependence due to the presence of $u_i$ (Baltagi, 2013). Although the RE model is the *efficient* approach in this context (i.e., the estimator that provides the most precise estimates), if there is any further serial correlation in $v_{it}$, or any *heteroskedasticity* (i.e., error-variance that is dependent on explanatory variables), the RE standard errors will still be biased. For this reason, 'clustered' standard errors at the focal firm-level are also used, which are *asymptotically* valid irrespective of the type of serial dependence in $v_{it}$ or any form of heteroskedasticity (Cameron & Miller, 2015).

Secondly, this regression framework allows one to produce average values of $y_{it}$ that are *free* from systematic changes over time in other firm-level factors that also affect $y_{it}$, simply by adding these factors as *control* variables to the linear regression equation. For example, consider *number of suppliers* in each focal firm's supply base per year. In recent years, manufacturers in various sectors have been increasingly consolidating their spend with fewer capable suppliers, who are required to coordinate suppliers in lower tiers (Womack et al., 2007), leading to a smaller number of direct supply relationships. At the same time, smaller supply bases are more likely to span across few countries, i.e., lower spatial complexity.

If *number of suppliers* is not 'controlled for' in the regression model, a reduction in average spatial complexity could be erroneously taken to reflect manufacturers' response to the protectionist policies, even though such a drop is really due to reductions in each focal firm's supply base. The second control variable is the *total volume of purchases* in dollars (for each firm-year, this is the sum of Column 5 in Table 1, deflated to 2015 base dollars). The increasing complexity and technological sophistication of some products leads to complicated bills of materials, larger volumes, and higher prices. This means that manufacturers need the most capable suppliers irrespective of their location, suggesting a more dispersed supply base, and, possibly, a larger share of spend going to foreign firms.

The third and final control variable is the *proportion of total spend quantified* by Bloomberg (for each firm-year, this is the sum of Column 6 in Table 1). As mentioned, this is generally much less than 100% (a mean of 28.6% across firm-year observations). Seemingly small values of supply base concentration or supply base complexity might be misleading if the proportion of quantified spend is small. At the same time, Bloomberg's coverage might be more comprehensive in recent years (i.e., larger fraction of quantified spend) due to advances in its web scraping algorithms, and/or an increase in firm transparency. Note that to reduce the potential influence of outliers in *total volume of purchases* and *number of suppliers* and to capture a potential logarithmic relationship between the outcome and these control variables, their natural logarithmic form is used.

Adding these three control variables, the model changes to:

$$y_{it} = \alpha + \sum_{t\neq 3} \beta_t D_t + \sum_{j=1}^{3} \delta_j C_{itj} + v_{it}, \quad i=1, \ldots, 30, \; t=1, \ldots, 7, \qquad (4)$$

Where $C_{itj}$ represents the three control variables and $\delta_j$ contains their coefficients. The parameters of this model are estimated using the RE estimator with clustered standard errors as described earlier.

## 4. Findings

The stated intent of Trump's protectionist policies was to revive domestic American manufacturers and their supplier bases. At first glance then, this should be illustrated through an increase in the number of local suppliers in the supply bases of the large manufacturers studied in this research. Table 3 shows that this is not the case as there is a reduction over the years 2014-2020 for all suppliers, both US and non-US.

*********************************************************************

Table 3. Comparison of US versus Non-US suppliers for the selected US manufacturers

*********************************************************************

Overall, the average number of Tier 1 suppliers dropped from 171 in 2014 to 125 in 2020. This reduction occurred for both US and non-US suppliers, with non-US suppliers accounting for a larger share of the supply base. Their share increases slightly over the seven years examined in this study.

In what follows, the analysis examines whether this reduction in the absolute number of suppliers was accompanied by: H1) a reduction in the global footprint of the supply bases (spatial complexity); H2) an increase in supply base concentration; and H3) an increase of the purchase spending with the local supply base. The results from the panel data RE models are displayed in Appendix A. For brevity, in what follows, that which is of interest to this study is presented, namely, the *estimated* conditional means of the outcome variables over the 2014-2020 timeframe. These estimates are obtained using the RE model, setting the control variables at their mean values in the sample.

*4.1. Spatial complexity of US manufacturers' supply-bases*

Figure 1 represent the estimated conditional means of the two alternative measures for spatial complexity. The time effects are jointly statistically significant in both models (see Appendix A1), suggesting that these conditional means indeed changed over the studied period.

*******************************************************************

Figure 1 – Spatial complexity (conditional means over time)

*******************************************************************

The downward trends in both measures (since 2016) imply that the supply bases of the sample manufacturers have progressively become less spatially complex, on average. As such, American manufacturers seem to have been reducing their global footprint; they have suppliers in fewer countries and their spend is relatively less dispersed across regions. This provides support to for H1. However, the measures are agnostic as to where in the world (if at all) these manufacturers intensified their sourcing efforts.

*4.2 Supply-base concentration*

Figure 2 displays the estimated conditional means of the two measures of supply base concentration: the simple HHI, and the mean of the proportion of purchase spend (i.e., mean dependence) corresponding to the top 5 suppliers (see Appendix A2).

*******************************************************************

Figure 2 – Supply base concentration (conditional means over time)

*******************************************************************

HHI increases over the period of the study, as does the mean dependence on the Top 5 suppliers. Although the time effects in the model for mean dependence are more statistically significant (*p-values* of 0.112 versus 0.006), they both suggest an increase in supply base concentration; manufacturers buy more (in monetary terms) from fewer suppliers and allocate a larger share of their COGS to their five most important, and most likely strategic, suppliers over time. Thus, H2 is also supported: American manufacturers increased their supply base (spend) concentration.

*4.3 Dependence of US manufacturers on suppliers from different regions*

The graphs in Figure 3 depict the estimated conditional means of the proportion of purchase spend with suppliers from the US, all non-US suppliers, China, and Taiwan. In all models, the time effects are either jointly statistically significant, or close to the 10% significance level (see Appendix A3).

*******************************************************************

Figure 3 – Proportion of purchase spend with suppliers by region (conditional means over time)

*******************************************************************

The figure suggests that US manufacturers have exhibited a tendency to reduce the fraction of their COGS allocated to their local supply base. One notices a significant decrease in the conditional mean of 2 percentage points between 2014 and 2020 (from 12.5% to 10.05%), which is statistically significant at the 5% level (*p-value* = 0.037). This suggests that despite the Republican administration's protectionist policies, US manufacturers spent progressively less with local suppliers over the timeframe. This decrease in local spend seems to have been fully compensated by an increase in the spend with foreign suppliers. Thus, H3 is not supported; in fact, the results suggest that American manufacturers increased the proportion of their spend allocated to *foreign* suppliers.

When it comes to Chinese suppliers in particular, Figure 3 exhibits a sudden and considerable increase in 2018. This reflects the introduction of tariffs, which made imports from China more expensive. The conditional mean in 2018 is more than four times larger than in 2017 (p-value = 0.012). In 2019 and 2020, there has been a gradual decrease, however, the difference remains significant at the 5% and 10% level, respectively. In contrast, the proportion of spend with Taiwanese suppliers has steadily increased between 2014 and 2020. This could be explained by Taiwan being the dominant source for the production of semiconductors.

*4.4 Supplementary analysis and robustness checks*

The main analysis focussed on the evolution of buyer dependence on suppliers from different regions (section 4.2), treating supplier dependence as a supply base dimension of interest. It showed that American manufacturers have become increasingly more reliant on their foreign partners, and less reliant on their local supply bases. Additional insight could be garnered if one also considered the evolution of *supplier dependence*. The variable construction process described in section 3.2 (*buyer dependence*) was thus replicated, but with proportion of supplier revenues being aggregated (Column 7 of Table 1). This assumes that at the dyadic (buyer-supplier relationship) level, the higher the fraction of revenues of the supplier that comes from a given focal firm, the higher the supplier's dependence on the buyer.

The same analysis procedures were applied, and the results are tabulated in Appendix A4. The conditional means of local and foreign supplier dependence over the study timeframe are illustrated in Figure 4. As discussed in Appendix A4, the time effects are insignificant and only for dependence on local suppliers there is a meaningful and statistically significant difference (between 2016 and 2019). Nevertheless, the downward trend in local supplier dependence and the upward trend in foreign supplier dependence are noticeable.

Considering these findings in conjunction with those about buyer dependence, the implication is the following: On average, the relationships between American manufacturers and American suppliers are becoming less interdependent and less intense (decreasing buyer and supplier dependence). Conversely, the relationships between these manufacturers and their foreign suppliers are becoming more interdependent (increasing buyer and supplier dependence). Thus, the bonds between American manufacturers and local suppliers might be becoming weaker, while their bonds with foreign suppliers might be getting stronger. This development is, arguably, the opposite of what the Republican administration intended.

*********************************************************************

Figure 4. Proportion of supplier revenues from focal manufacturers (conditional means over time)

*********************************************************************

A series of tests to probe the sensitivity of the baseline results was conducted. First, different measures of supply base complexity were considered. As Lu and Shang

(2017) note, the number of supplier countries is a crude and potentially biased measure of spatial complexity. For instance, there is little doubt that a supply base of a given country distribution with only 5% foreign suppliers *must* be less spatially complex than a supply base of the same numerosity and country distribution with 50% foreign suppliers. Since the original measure would assign the same complexity to the two supply bases, an alternative measure would weigh the number of countries by the percentage of foreign suppliers. Similarly, the measure of geographical dispersion (Equation 1) can be constructed differently, for example, by considering fewer 'parts of the world' in the formula, or categorising countries in a different way. Different variations were examined, based on four or five categories (e.g., US / Europe / Asia / RoW). All analyses produced results very similar to the baseline.

Secondly, two alternative measures of supply base concentration were considered; a simple HHI for only the top 5 suppliers in terms of purchase spend served as an alternative to the first measure, while the average of purchase spend with the top 3 suppliers was the alternative to the second measure. The results were very similar qualitatively, supporting the baseline findings.

Finally, in the baseline analysis, CAPEX, R&D and SG&A relationship types had been excluded from the raw data, in an attempt to approximate physical supply chains. Adding the excluded types (amounting to an additional 4,500 dyadic relationships), constructing the firm-year panel accordingly, and re-running the analysis, produced similar results.

All results from the robustness checks are available from the authors upon request.

## 5. Discussion

The aim of governmental policy is often job protection and creation (cf. Perry and Rainey, 1988) while corporations seek to maximise profits (Thornton and Ocasio, 2008). The tension between these differing goals plays a role in sourcing strategy, such as the decision to potentially re-shore. Manufacturers procure a range of different products and services, from commodities through to strategic items. If an item is more strategic, it is likely that there will be a constraint, typically around capability and intellectual property, to re-shoring it. These items will be produced wherever the supplier decides. Conversely, commodity items could be feasibly re-shored. Thus, while government policy may endeavour to reinvigorate the indigenous supply base and create jobs, it may not be able to do it with all types of goods and services.

The tension between the two institutional logics was clearly evident during Donald Trump's presidency, which served as the empirical context of this work. Towards investigating the evolution of US manufacturing supply chains during this timeframe, three hypotheses were tested: H1) a decrease in supply base complexity, H2) an increase in supply base concentration, and H3) an increase in dependence on the local supply base. The results showed support for the first two hypotheses, while the third one was not supported. In fact, this work found evidence that US manufacturers became more reliant on foreign suppliers rather than local suppliers during the Republican administration.

Considered jointly, the results indicate a move towards consolidation of spend with fewer, capable suppliers. The goal of supplier consolidation is to improve the efficiency and effectiveness of a company's supply base (Choi and Krause, 2006). To achieve this goal, American manufacturers also seem to have taken a more selective approach with regard to the countries they source from, reducing complexity and transaction costs (Bode and Wagner, 2015). However, the reduction in their dependence on local suppliers, relative to foreign ones, suggests that the supply base consolidation is happening primarily towards preferred foreign suppliers. This seems reasonable, and in certain cases, inevitable, when considering that for several strategic items, local suppliers might not possess the capability and capacity to satisfy the demands of large American manufacturers. A clear case is the Taiwanese semiconductor technology supply base; as shown here, buyer dependence on Taiwanese suppliers increased almost linearly between 2014 and 2020.

This trend towards closer relationships with preferred suppliers might indeed be a response to the increasing uncertainty around US trade policy (Dong and Koufelis, 2020). However, what policymakers might have neglected to consider, is the fact that those preferred, capable suppliers, are *not* located in the US but abroad. As such, to mitigate the risks of disruptions concerning strategic items (Handfield et al., 2020), American manufacturers have strengthened their existing relationships with those foreign suppliers. Switching away from these relationships entails risks and costs that manufacturers were hesitant to bear. Moreover, despite the increased transaction costs due to tariffs, it might simply not be feasible for them to switch, due to immobility of supply chain assets (Roscoe et al., 2022).

A relatively clear effect of the protectionist policies was a sharp increase in the costs of sourcing from Chinese suppliers in 2018, as the analysis suggests (Figure 3). Moreover, recent research has shown that these policies are partly responsible for a decrease in the operating performance of American firms with Chinese ties (Fan et al., 2022). Whether the gradual decrease in buyer dependence on Chinese suppliers from 2019 onwards is due to switching away from those suppliers is an open question. Answering this question will indicate whether Donald Trump's policies were at least partly successful in bringing about their intended outcomes. Last but not least, the supplementary analysis revealed that American suppliers of the focal manufacturers *also* decreased their dependence on these buyers. This means that the reduction in dependence was reciprocal. This decrease in *inter*-dependence suggests that the bonds between the actors in American manufacturing supply chains might be getting weaker, an implication that should be seriously considered by policymakers.

## 6. Conclusions, implications, and limitations

To our knowledge this is the first study that systematically examines the evolution of US manufacturing supply bases over the course of the Republican administration using an aggregated firm-year panel dataset. As such, it provides insights into the dynamics of manufacturing supply chains as they adapt to shifting institutional demands. It also adds to the extant theoretical discourse on how the tension between institutional logics can impact sourcing decisions. This is in line with calls for operations scholars to examine the link between public policy and global supply chains (Helper et al., 2021).

In conclusion, this research provided evidence of a decrease in supply base complexity, and an increase in supply base concentration. It also showed that US manufacturers became more dependent on foreign suppliers rather than American ones, which is exactly the opposite of what the protectionist trade policies aimed at. These findings have important implications for policymakers and manufacturers alike.

Policy makers should note that trade policies directed at firms can result in potentially inadvertent outcomes. In the specific context of Donald Trump's presidency, this work showed that such policies did not achieve their intended objectives. As it has been argued in past research (Ketokivi et al., 2017), reshoring is not feasible without an established ecosystem of suppliers, intermediaries, and customers. Reintroducing trade barriers without adequate support for capability development in local supply chains is unlikely to result in stronger local supply relationships, and in extension, employment, or growth in the local economies. This work calls for American policymakers to further probe into why largest manufacturers' overall spending with local suppliers has diminished over the years. There can be a few potential explanations. One possibility could be related to a demand-capability gap caused by a shift in customer expectations that has not been fulfilled by the local supplier base, *i.e.,* technological developments. Another possibility could be that the cost of goods and services has increased more substantially for US suppliers, which has led to manufacturers spending less on local supply bases (*cf.* Wu et al., 2021). Finally, it is also possible that local supply chains are unable to satisfy the manufacturers' capacity requirements. Policy makers should investigate all of these potential explanations in terms of capacity, capability and cost to determine the root causes of this trend.

As for American manufacturers, managers should consider the potential risks associated with becoming more dependent on foreign suppliers, such as disruptions in the supply chain due to political instability or trade disputes (Dong and Koufelis, 2020). They may need to develop contingency plans to mitigate these risks, such as diversifying their supplier base across multiple regions or countries, at least for strategic items. In line with past research (Moradlou et al., 2021; Handfield et al., 2020; Roscoe et al., 2022), this work urges managers at manufacturing firms to take a more strategic and proactive approach to supply chain management in the face of institutional pressures. As the recent geopolitical disruptions vividly illustrated, managers need to carefully evaluate their options and develop a robust supply chain strategy that can withstand potential disruptions and changes in the global trade environment.

This work is not free from limitations. Firstly, this research captured the evolution of a set of outcome variables of interest over a period that encompasses the years before Donald Trump took office and up until the end of 2020. As such, this work provides a high-level indication of how large American manufacturers have reacted to the surrounding socio-political climate. Researchers could try to collect more fine-grained data from a large sample of firms that might allow (quasi-)natural experiments that will more confidently establish the impact of specific protectionist policies on supply chain design and sourcing decisions of American firms. This work was also subject to the limitations of the Bloomberg SPLC function. Despite its increasing popularity as a data source, Bloomberg SPLC only captures relationships between public firms, of which only a fraction is quantified. In addition, the quantified relationship dependencies do not include the nature of the traded commodity, or any other detail besides the account type. Identifying the traded commodity and understanding its importance, can provide an alternative (or additional) indicator of buyer dependence, since the fraction of COGS allocated to a supplier is admittedly a crude proxy of dependence. Moreover, Bloomberg SPLC notes only the location of the suppliers' headquarters, and not whether these suppliers own manufacturing plants inside or closer to the US. A multi-level research design that will focus on the evolution of buyer-supplier relationships should take into consideration such features. Further research should also use alternative (or complementary) data sources, that can help academics investigate the extent to which suppliers from countries such as Vietnam and Mexico (which are not widely covered in Bloomberg SPLC) benefitted from the US-China trade war.

Second, even though the panel data design accounted for unobserved time-invariant firm characteristics that might have affected the relationship between time and the variables of interest, the inferences made here should be treated with caution. This is because the analysis is effectively based on only thirty firms and does not consider potentially influential firm-specific features that might have changed over time (e.g., mergers and acquisitions of local or foreign suppliers, or diversification to new product markets). Future studies can expand on this sample of firms and theoretically motivate the importance of time-varying moderating variables. More generally, scholars can try, considering characteristics such as size, industry, and performance in the form of profitability or productivity, to empirically derive classifications of firms based on how their supply chain strategy and structure changed in the face of changing socio-political climate. For example, due to the tariffs on steel and aluminium, one could expect that large importers of such goods (e.g., aerospace) might have been forced to re-evaluate their sourcing strategy more extensively than manufacturers whose main input is chemicals (e.g., pharmaceuticals).

## 7. References

American Action Forum (2020). "The Total Cost Of Trump'S Tariffs", [online] Available at: <https://www.americanactionforum.org/research/the-total-cost-of-trumps-new-tariffs/> [Accessed 13 January 2021].

Ateş, A. M., Suurmond, R., Luzzini, D., & Krause, D. (2022). Order from chaos: A meta-analysis of supply chain complexity and firm performance. *Journal of Supply Chain*

*Management, 58*(1), 3-30.

Baltagi, B.H. (2013). *Econometric Analysis of Panel Data*. 5th ed. Chichester, UK: Wiley.

Beer, H.A. and Micheli, P., 2017. How performance measurement influences stakeholders in not-for-profit organizations. *International Journal of Operations & Production Management*, 37(9), pp. 1164-1184.

Bellamy, M. A., Ghosh, S. and Hora, M. (2014). 'The influence of supply network structure on firm innovation', *Journal of Operations Management*, 32(6), pp. 357–373.

Bode, C., & Wagner, S. M. (2015). Structural drivers of upstream supply chain complexity and the frequency of supply chain disruptions. *Journal of Operations Management, 36*, 215-228.

Bown, C., & Zhang, Y. (2019). Measuring trump's 2018 trade protection: Five takeaways. *Peterson Institute for International Economics, February, 15*.

Cameron, A. C., & Miller, D. L. (2015). A practitioner's guide to cluster-robust inference. *Journal of human resources, 50*(2), 317-372.

Chae, S., Yan, T., & Yang, Y. (2020). Supplier innovation value from a buyer–supplier structural equivalence view: Evidence from the PACE awards in the automotive industry. *Journal of Operations Management, 66*(7-8), 820-838.

Charpin, R., Powell, E. E., & Roth, A. V. (2021). The influence of perceived host country political risk on foreign subunits' supplier development strategies. *Journal of Operations Management, 67*(3), 329-359.

Choi, T. Y., & Krause, D. R. (2006). The supply base and its complexity: Implications for transaction costs, risks, responsiveness, and innovation. *Journal of operations management*, *24*(5), 637-652. Cox, L. (2021). *The Long-Term Impact of Steel Tariffs on US Manufacturing*. mimeo, Harvard University.

Cohen, M.A. and Lee, H.L. (2020), "Designing the Right Global Supply Chain Network", *Manufacturing and Service Operations Management*, Vol. 22 No. 1, pp.15-24.

Cox, L. (2021). *The Long-Term Impact of Steel Tariffs on US Manufacturing*. mimeo, Harvard University.

Delbufalo, E. (2022). Disentangling the multifaceted effects of supply base complexity on supply chain agility and resilience. *International Journal of Physical Distribution & Logistics Management*.

Dong, Y. *et al.* (2020). Supply base innovation and firm financial performance, *Journal of Operations Management*, 66(7–8), pp. 768–796.

Dong, L. and Kouvelis, P. (2020), "Impact of tariffs on global supply chain network configuration: Models, predictions, and future research", *Manufacturing and Service Operations Management*, Vol. 22 No. 1, pp.25-35.

Dunning, J. H. (1993). Trade, location of economic activity and the multinational enterprise: A search for an eclectic approach. *The theory of transnational corporations*, (1993), 183-218.

Elking, I., Paraskevas, J.P., Grimm, C., Corsi, T., and Steven, A. (2017). "Financial Dependence, Lean Inventory Strategy, and Firm Performance", *Journal of Supply Chain Management*, 53(2), pp. 22–38.

Ellinger, A. E., Adams, F. G., Franke, G. R., Herrin, G. D., deCoster, T. E., and Filips, K. E. (2020). A triadic longitudinal assessment of multiple supply chain participants' performance and the extended enterprise concept. *International Journal of Physical Distribution and Logistics Management*, 50(7), pp. 745–767.

Fan, D., Zhou, Y., Yeung, A. C. L., Lo, C. K. Y., & Tang, C. (2022). Impact of the U.S.–China trade war on the operating performance of U.S. firms: The role of outsourcing and supply base complexity. *Journal of Operations Management*, 68 (8), 928–962.

Fifarek, B. J., Veloso, F. M., & Davidson, C. I. (2008). Offshoring technology innovation: A case study of rare-earth technology. *Journal of Operations Management*, 26 (2), 222– 238.

Fine, C., & Whitney, D. (1996). Is the make or buy decision a core competence. *IMVP/MIT Working Paper*.

Friedland, R. and Alford, R.R., 1991. Bringing society back in: Symbols, practices, and institutional contradictions. Powell WW, DiMaggio PJ, eds. The New Institutionalism in Organizational Analysis.

Gerbl, M., McIvor, R. and Humphreys, P. (2016), "Making the business process outsourcing decision: why distance matters", International Journal of Operations & Production Management, Vol. 36 No. 9, pp. 1037-1064. https://doi.org/10.1108/IJOPM-04-2014-0192

Greene, W. (2017). *Econometric Analysys*, 7th edition. Pearson.

Gualandris, J., Longoni, A., Luzzini, D., and Pagell, M. (2021). The association between supply chain structure and transparency: A large-scale empirical study. *Journal of*

*Operations Management*, 67(7), pp. 803–827.

Gulati, R., Nohria, N., & Zaheer, A. (2000). Strategic networks. *Strategic management journal*, *21*(3), 203-215.

Handfield, R. B., Graham, G., & Burns, L. (2020). Corona virus, tariffs, trade wars and supply chain evolutionary design. *International Journal of Operations & Production Management*, *40*(10), 1649-1660.

Handley, K., Kamal, F., & Monarch, R. (2020). Rising import tariffs, falling export growth: When modern supply chains meet old-style protectionism (No. w26611). National Bureau of Economic Research.

Helper, S., Gray, J. V., Hughes, M. M., & Roman, A. V. (2021). Public policy and operations management. *Journal of Operations Management*, *67*(7), 780-802.

Hendry L, Stevenson M, MacBryde J, et al. (2019) Local food supply chain resilience to constitutional change: the Brexit effect. *International Journal of Operations & Production Management* 39(3): 429–453.

Jiang, S., Yeung, A.C., Han, Z. and Huo, B., 2023. The effect of customer and supplier concentrations on firm resilience during the COVID-19 pandemic: Resource dependence and power balancing. Journal of Operations Management.

Kamakura, N., 2022. From globalising to regionalising to reshoring value chains? The case of Japan's semiconductor industry. *Cambridge Journal of Regions, Economy and Society*, *15*(2), pp.261-277.

Ketokivi M and Choi T (2014) Renaissance of case research as a scientific method. *Journal of Operations Management* 32(5): 232–240.

Ketokivi, M., Turkulainen, V., Seppälä, T., Rouvinen, P., & Ali-Yrkkö, J. (2017). Why locate manufacturing in a high-cost country? A case study of 35 production location decisions. *Journal of Operations Management*, **49–51**(1), 20– 30.

Kim, Y. H., & Davis, G. F. (2016). Challenges for global supply chain sustainability: Evidence from conflict minerals reports. *Academy of Management Journal*, 59(6), pp. 1896–1916.

Kumar, A., Steven, A., & Paraskevas, J. P. (2020). Impact of buyer-supplier TMT misalignment on environmental performance. *International Journal of Operations and Production Management*, 40(11), pp. 1695–1721.

Lorentz, H., Töyli, J., Solakivi, T., Hälinen, H. M., & Ojala, L. (2012). Effects of geographic dispersion on intra-firm supply chain performance. *Supply Chain*

*Management: An International Journal*.

Lu, G., & Shang, G. (2017). Impact of supply base structural complexity on financial performance: Roles of visible and not-so-visible characteristics. *Journal of Operations Management*, *53*, 23-44.

Mao, H. and Görg, H., 2020. Friends like this: The impact of the US–China trade war on global value chains. *The World Economy*, *43*(7), pp.1776-1791.

McIvor, R., 2009. How the transaction cost and resource-based theories of the firm inform outsourcing evaluation. *Journal of Operations management*, *27*(1), pp.45-63.

McLoughlin, K. and Meehan, J., 2021. The institutional logic of the sustainable organisation: the case of a chocolate supply network. *International Journal of Operations & Production Management*, 41(3), pp. 251-274.

Micheli, P., Johnson, M. and Godsell, J., 2021. Editorial How the Covid-19 pandemic has affected, and will affect, operations and supply chain management research and practice. *International Journal of Operations & Production Management*, *41*(6), pp.773-780.

Moradlou H, Reefke H, Skipworth H, et al. (2021) Geopolitical disruptions and the manufacturing location decision in multinational company supply chains: a Delphi study on Brexit. *International Journal of Operations & Production Management*. DOI: https://doi.org/10.1108/IJOPM-07-2020-0465.

New York Times (2019). "Trump'S Push To Bring Back Jobs To U.S. Shows Limited Results", [online] Available at: <https://www.nytimes.com/2019/08/13/business/economy/donald-trump-jobs-created.html> [Accessed 13 January 2021].

Ocasio, W. and Radoynovska, N., 2016. Strategy and commitments to institutional logics: Organizational heterogeneity in business models and governance. *Strategic Organization*, *14*(4), pp.287-309.

Oliver, R.K. and M.D. Weber. (1982) "Supply-Chain Management:Logistics Catches Up With Strategy." In M.L. Christopher(Ed.), Logistics: The Strategic Issues, Chapman & Hall, London , pp. 63-75.

Park, H., Bellamy, M. A., & Basole, R. C. (2018). Structural anatomy and evolution of supply chain alliance networks: A multi-method approach. *Journal of Operations Management*, *63*, 79-96.

Palit, S., Hora, M., & Ghosh, S. (2022). Global buyer–supplier networks and innovation:

The role of technological distance and technological breadth. *Journal of Operations Management*, *68*(6-7), 755-774.

Peters, M. A. (2022). Semiconductors, geopolitics and technological rivalry: the US CHIPS & Science Act, 2022. *Educational Philosophy and Theory*, 1-5.

Perry, J.L. and Rainey, H.G., 1988. The public-private distinction in organization theory: A critique and research strategy. *Academy of management review*, *13*(2), pp.182-201.

Powell WW and DiMaggio PJ (1991) *The New Institutionalism in Organizational Analysis*. University of Chicago Press.

Pulles, N.J., Ellegaard, C. and Veldman, J., 2023. The interplay between supplier-specific investments and supplier dependence: do two pluses make a minus?. *Journal of management*, *49*(4), pp.1430-1459.

Repenning, N.P. and Sterman, J.D., 2002. Capability traps and self-confirming attribution errors in the dynamics of process improvement. *Administrative Science Quarterly*, *47*(2), pp.265-295.

Reuters (2017). "Trump Talks To U.S. Automakers, Pushes For New American Plants", [online] Available at: <https://www.reuters.com/article/us-usa-trump-autos-idUSKBN1581CA> [Accessed 13 January 2021].

Roscoe S, Skipworth H, Aktas E, et al. (2020) Managing supply chain uncertainty arising from geopolitical disruptions: evidence from the pharmaceutical industry and Brexit. *International Journal of Operations & Production Management*. DOI: https://doi.org/10.1108/ijopm-10- 2019-0668.

Roscoe S, Aktas E, Petersen KJ, et al. (2022) Redesigning global supply chains during compounding geopolitical disruptions: the role of supply chain logics. *International Journal of Operations & Production Management* 42(9). Emerald Publishing Limited: 1407–1434. DOI: 10.1108/IJOPM-12-2021-0777.

Salancik, G. R., & Pfeffer, J. (1978). A social information processing approach to job attitudes and task design. *Administrative science quarterly*, 224-253.

Schwieterman, M. A., Goldsby, T. J., & Croxton, K. L. (2018). Customer and supplier portfolios: can credit risks be managed through supply chain relationships?. *Journal of Business Logistics*, *39*(2), 123-137.

Schumm, C.Z. and Niehm, L.S., 2023. Supplier selection at the base of the chain: navigating competing institutional logics for shared mutual value. *International Journal of Operations & Production Management*, (in press)

Spring, M., Hughes, A., Mason, K., & McCaffrey, P. (2017). Creating the competitive edge: A new relationship between operations management and industrial policy. *Journal of Operations Management*, **49–51**(1), 6– 19.

Steven, A. B., Dong, Y., & Corsi, T. (2014). Global sourcing and quality recalls: An empirical study of outsourcing-supplier concentration-product recalls linkages. *Journal of Operations Management*, *32*(5), 241-253.

Stock, G. N., Greis, N. P., & Kasarda, J. D. (2000). Enterprise logistics and supply chain structure: the role of fit. *Journal of operations management*, *18*(5), 531-547.

Thornton, P.H. and Ocasio, W., 2008. Institutional logics. *The Sage handbook of organizational institutionalism*, *840*(2008), pp.99-128.

Thornton, P.H. and Ocasio, W., 1999. Institutional logics and the historical contingency of power in organizations: Executive succession in the higher education publishing industry, 1958–1990. *American journal of Sociology*, *105*(3), pp.801-843.

U.S. Senate Committee on Finance (2018). "Hearing Before the Committee on Finance United States Senate 115th Congress Second Session," *https://www.finance.senate.gov/imo /media/doc/36528.pdf,* 2018. accessed May 01, 2022.

United States Trade Representative (USTR) (2018) "2018 Trade Policy Agenda and 2017Annual Report of the President of the United States on the Trade Agreements Program" *Executive Office Of The President Washington, D.C. USTR.GOV*

United States Trade Representative (USTR) (2022) "2022 Trade Policy Agenda & 2021 Annual Report of the President of the United States on the Trade Agreements Program" *Executive Office Of The President Washington, D.C. 20508 USTR.GOV*

Venkatesan, R., 1992. Strategic sourcing: To make or not to make. *Harvard Business Review*, *70*(6), pp.98-107.

Vachon, S., & Klassen, R. D. (2006). Extending green practices across the supply chain: the impact of upstream and downstream integration. *International journal of operations & Production Management*. July 1st.

Womack, J.P., Jones, D.T. and Roos, D., 2007. *The machine that changed the world: The story of lean production--Toyota's secret weapon in the global car wars that is now revolutionizing world industry*. Simon and Schuster.

Wooldridge, J. 2010. *Econometric Analysis of Cross Section and Panel Data*. MIT Press, Massachusetts, USA.

Wu, J., Wood, J., Oh, K. and Jang, H., 2021. Evaluating the cumulative impact of the US–China trade war along global value chains. *The World Economy*, *44*(12), pp.3516-3533.

Zhang, F. and Welch, E.W., 2023. Explaining Public Organization Adaptation to Climate Change: Configurations of Macro-and Meso-Level Institutional Logics. *Journal of Public Administration Research and Theory*, *33*(2), pp.357-374.

**APPENDIX**
Table A1 presents the estimation results from the Random Effects (RE) models of the two measures of spatial complexity.

Table A1 – Spatial complexity

| | (1)<br>№ countries | (2)<br>Dispersion |
|---|---|---|
| *Year (base: 2016)* | | |
| 2014 | -1.417*** | 0.000411 |
| | (0.453) | (0.0147) |
| 2015 | -1.088** | -0.00614 |
| | (0.423) | (0.0100) |
| 2017 | -0.392 | -0.0120 |
| | (0.347) | (0.0187) |
| 2018 | -0.799* | -0.00329 |
| | (0.410) | (0.0195) |
| 2019 | -1.893*** | -0.0305 |
| | (0.444) | (0.0227) |
| 2020 | -2.049*** | -0.0504* |
| | (0.520) | (0.0260) |
| ln(volume) | 0.595* | -0.0407** |
| | (0.331) | (0.0206) |
| ln(№ suppliers) | 5.309*** | 0.119*** |
| | (0.548) | (0.0182) |
| Total quantified | -4.945*** | -0.0852 |
| | (1.441) | (0.0705) |
| Constant | -12.76*** | 0.461* |
| | (3.540) | (0.244) |
| *N* (firms) | 30 | 30 |
| *Nt* (firm-years) | 203 | 203 |
| R-squared | 0.819 | 0.290 |
| $\hat{\rho}$ | 0.612 | 0.681 |
| Wald-stat (year) | 36.17*** | 11.21* |

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

First, note that despite observing 30 firms over 7 years (amounting to a maximum of 210 observations), the analysis is based on 203 observations. This is because two firms have very thin coverage in earlier years (Dow and Dell) making the construction of the outcome variables meaningless. In addition, two firms (Raytheon and United Technologies) merged in 2019, further reducing the effective sample size.

To determine whether the time dummies have an effect on a dependent variable, Wald tests of the joint significance of the time dummy coefficients are conducted. The 'null' hypothesis postulates that the time dummies (jointly) are not associated with the modelled dependent variable, *i.e.*, the latter has not changed statistically significantly over the timeframe. Henceforth, the joint impact of time dummies is referred to as the 'time effects'.

In both models of Table A1, the Wald test statistics are higher than the critical value of the chi-squared distribution for the 10% level of significance[1], indicating significant time effects. The estimated $\hat{\rho}$ represents the fraction of the total error variance explained by the term $u_i$, which captures time-invariant unobserved firm characteristics (as explained in section 3.3). This is 61% and 68% in the two models, indicating that the influence of unobservable firm-level characteristics is important and should not be ignored in the estimation. Intuitively, this points towards systematic differences in the supply base complexity, and sourcing strategy, among the studied manufacturers, justifying the Random Effects (RE) specification employed here.

Table A2 presents the estimation results from the Random Effects (RE) models of the two measures of supply base concentration: HHI (Model 1) and mean dependence on the Top 5 suppliers (Model 2).

Table A2 – Supply base concentration

| | (1)<br>HHI | (2)<br>Top5 (mean dependence) |
|---|---|---|
| *Year (base: 2016)* | | |
| 2014 | 0.000225 | -0.000597 |
| | (0.00383) | (0.00157) |
| 2015 | 0.00607 | 0.00168 |
| | (0.00603) | (0.00134) |
| 2017 | 0.00768 | 0.00138 |
| | (0.00478) | (0.00100) |
| 2018 | 0.00448 | 0.00164 |
| | (0.00487) | (0.00138) |
| 2019 | 0.00694 | 0.00417*** |
| | (0.00462) | (0.00141) |
| 2020 | 0.00552 | 0.00257* |
| | (0.00559) | (0.00135) |
| ln(№ suppliers) | -0.0119*** | -0.00711*** |
| | (0.00412) | (0.00192) |
| ln(volume) | -0.00656** | -0.000558 |
| | (0.00297) | (0.00171) |
| Total quantified | 0.214*** | 0.142*** |
| | (0.0346) | (0.0131) |
| Constant | 0.0991*** | 0.0274 |
| | (0.0337) | (0.0205) |
| *N* (firms) | 30 | 30 |
| *Nt* (firm-years) | 203 | 203 |
| R-squared | 0.854 | 0.929 |
| $\hat{\rho}$ | 0.623 | 0.784 |
| Wald-stat (year) | 10.30 | 18.03*** |

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

[1] Note that the critical values of the Chi-squared distribution with 6 degrees of freedom (*i.e.*, the number of restrictions) are: 10.645 for 10% significance level, 12.592 for 5%, 16.812 for 1% and 22.458 for 0.1%.

In both models, the coefficients of the time dummies seem to increase with time, indicating an increase in the conditional means, but the upward trend is clearer and stronger in Model (2) since 2016. The difference between the coefficients in that year and 2019 is in fact statistically significant at the 1% level.

Table A3 presents the estimation results from the RE models of purchase spend with suppliers (buyer dependence) from the four regions of interest (USA, China, Taiwan and all foreign locations).

Table A2 – Buyer dependence (% purchase spend)

| | (1)<br>USA | (2)<br>China | (3)<br>Taiwan | (4)<br>Non-US |
|---|---|---|---|---|
| *Year (base: 2016)* | | | | |
| 2014 | 0.00840 | 0.000398 | -0.00669 | -0.00840 |
| | (0.0101) | (0.00207) | (0.0104) | (0.01011) |
| 2015 | 0.00673 | -0.000638 | 0.000900 | -0.00673 |
| | (0.00734) | (0.00199) | (0.00912) | (0.00734) |
| 2017 | -0.00602 | 0.000975 | 0.00853 | 0.00602 |
| | (0.00845) | (0.00102) | (0.00759) | (0.0084) |
| 2018 | -0.00282 | 0.0185** | -0.00279 | 0.00282 |
| | (0.0116) | (0.00729) | (0.0110) | (0 .0115) |
| 2019 | -0.0126 | 0.0162** | 0.0157* | 0.01261 |
| | (0.00922) | (0.00725) | (0.00881) | (0.00922) |
| 2020 | -0.0121 | 0.00649** | 0.0233** | 0.01207 |
| | (0.00863) | (0.00331) | (0.00961) | (0.00863) |
| ln(volume) | 0.00258 | 0.00479 | -0.00448 | -0.00258 |
| | (0.0102) | (0.00366) | (0.00728) | (0.01021) |
| ln(№ suppliers) | 0.0262** | -0.00584 | -0.0324*** | -0.0262** |
| | (0.0126) | (0.00540) | (0.0115) | (0.01262) |
| Total quantified | 0.215** | 0.0422*** | 0.519*** | 0.784*** |
| | (0.101) | (0.0106) | (0.0875) | (0.10068) |
| Constant | -0.0905 | -0.0492 | 0.120 | (0.09046) |
| | (0.100) | (0.0323) | (0.0910) | (0.1002) |
| *N* (firms) | 30 | 30 | 30 | 30 |
| *Nt* (firm-years) | 203 | 203 | 203 | 203 |
| R-squared | 0.430 | 0.335 | 0.847 | 0.912 |
| $\hat{\rho}$ | 0.824 | 0.270 | 0.802 | 0.823 |
| Wald-stat (year) | 10.11 | 10.34 | 15.59** | 10.11 |

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

While the Wald tests suggest that time effects are jointly (marginally) insignificant at the 10% level in all models apart from Model (3) (Taiwan), the coefficients of the time dummies suggest some significant contrasts when compared amongst them. In Model (1), if the reference year is changed to 2014 (the start of the timeframe), the conditional mean in that year is 2.5 percentage points smaller than in 2020 and statistically significant at the 5% level (*p-value* = 0.037). This means that in 2020, US manufacturers allocated statistically significantly less of their spend (in proportion) to their local suppliers when compared to 2014. As visualised in Figure 3 (section 4.3 of the manuscript), the downward trend is almost linear since 2014.

In Model (2), the conditional mean of the fraction of purchase spend in 2016 (the base year) is almost five times lower than in 2018 (the year most tariffs against China came into effect), and the difference is statistically significant at the 5% level. This clearly illustrates that the introduced tariffs made purchasing from China much more expensive. It is also noteworthy that the $\hat{\rho}$ is much lower compared to the other models, suggesting that the studied manufacturers might be following a relatively homogenous strategy in terms of sourcing from China.

In Model (4), if the reference year is changed to 2014, the conditional mean of the fraction of purchase spend with all foreign suppliers in that year is statistically significantly smaller than the mean in years 2017-2020, with *p-values* ranging from 0.007 to 0.083. This reinforces the earlier finding that during the studied timeframe, American manufacturers have progressively reduced their spend with local suppliers and increased their spend with foreign ones.

Table A4 presents the estimation results from the Random Effects (RE) models of American (Model 1) and foreign (Model 2) supplier dependence on the focal manufacturers.

Table A4 – Supplier Dependence (% revenue)

| | (1)<br>US | (2)<br>Non-US |
|---|---|---|
| *Year (base: 2016)* | | |
| 2014 | -0.00249 | 0.00088 |
| | (0.00258) | (0.00308) |
| 2015 | -0.00385** | -0.00237 |
| | (0.00194) | (0.00298) |
| 2017 | -0.00315 | 0.001 |
| | (0.00205) | (0.00215) |
| 2018 | -0.00561 | 0.00315 |
| | (0.00433) | (0.00342) |
| 2019 | -0.00867* | 0.00237 |
| | (0.0051) | (0.00432) |
| 2020 | -0.00622 | 0.00278 |
| | (0.00489) | (0.00604) |
| ln(volume) | 0.0129*** | 0.01804*** |
| | (0.00327) | (0.00461) |
| ln(№ suppliers) | -0.0234*** | -0.02736*** |
| | (0.00876) | (0.00843) |
| Total quantified | 0.00713 | 0.03876** |
| | (0.01319) | (0.0195) |
| Constant | -0.04984 | -0.1157** |
| | (0.03055) | (0.04751) |
| *N* (firms) | 30 | 30 |
| *Nt* (firm-years) | 202 | 202 |
| R-squared | 0.274 | 0.438 |
| $\hat{\rho}$ | 0.677 | 0.642 |
| Wald-stat (year) | 8.30 | 6.52 |

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The time effects are jointly statistically insignificant in both models. However, in Model (1), the significant difference between 2016 and 2019 suggests a marked decrease in the dependence of local suppliers on American manufacturers. Regarding Model (2), despite the increasing trend in the conditional mean of foreign supplier dependence (Figure 4), only the difference between 2014 and 2015 is statistically significant.

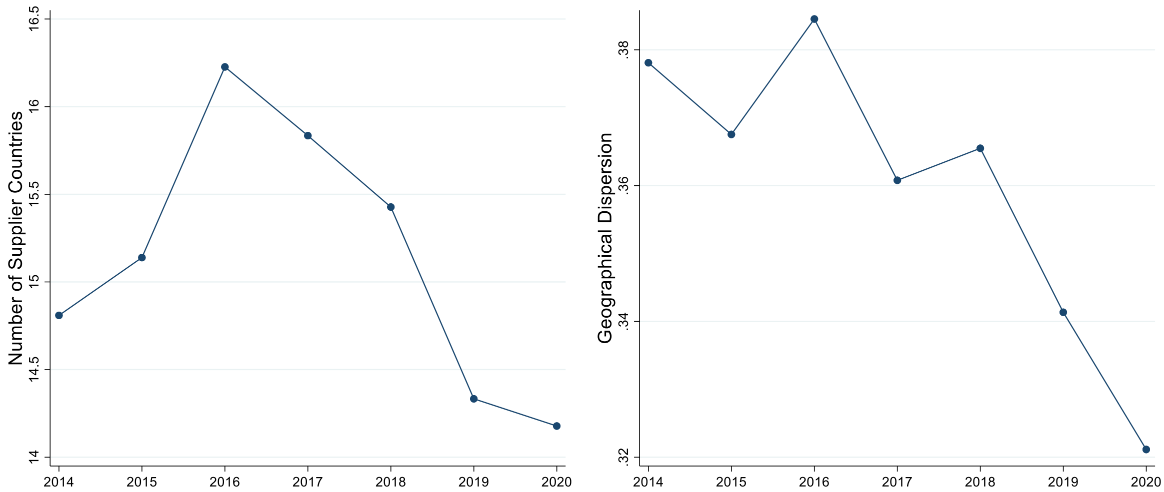


*Figure 1 – Spatial complexity (conditional means over time) - Source: Authors own creation*

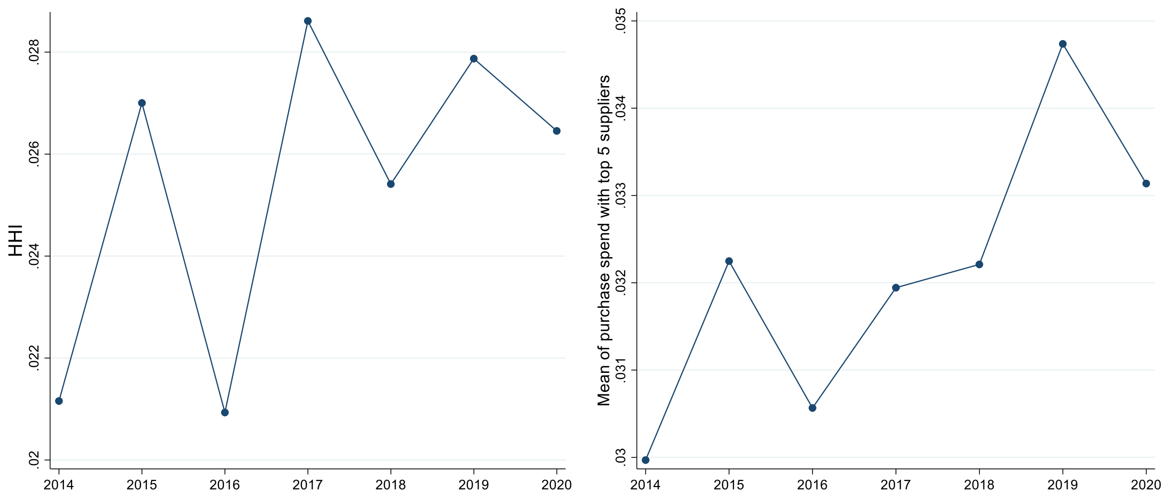


*Figure 2 – Supply base concentration (conditional means over time) - Source: Authors own creation*

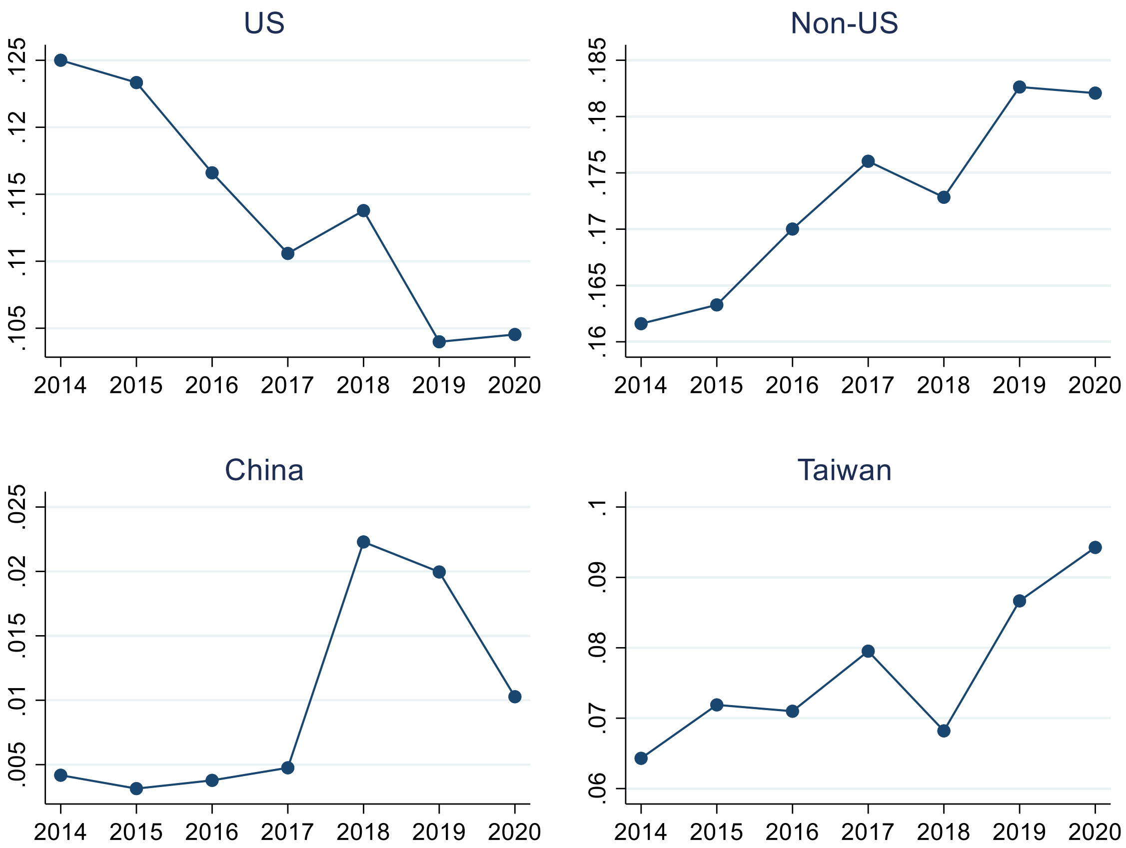


*Figure 3 – Proportion of purchase spend with suppliers by region (conditional means over time) - Source: Authors own creation*

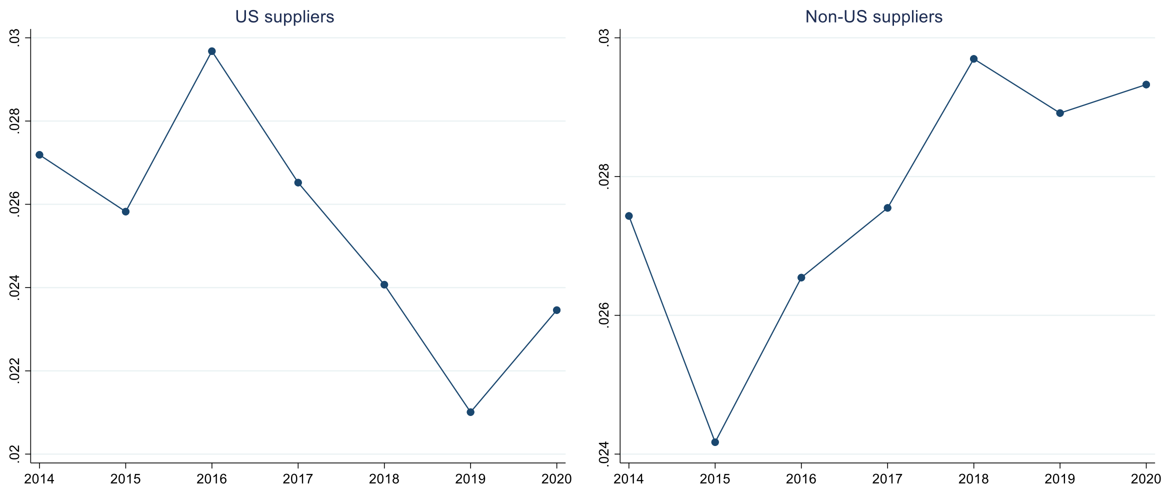


*Figure 4 – Proportion of supplier revenues from focal manufacturers (conditional means over time) - Source: Authors own creation*

*Table 1 – Raw data snippet - Source: Authors own creation*

| Firm name | Supplier Name | Year | Supplier Country | Relationship value (in thousand $) | Buyer spend (in %) | Supplier revenue (in %) |
|---|---|---|---|---|---|---|
| Boeing | Hexcel | 2015 | US | 142650 | 0.78 | 34 |
| Boeing | Hexcel | 2016 | US | 147520 | 0.69 | 31 |
| Boeing | Hexcel | 2017 | US | 144240 | 0.70 | 31 |
| Boeing | FACC | 2017 | AT | 2340 | 0.01 | 1.27 |
| Boeing | FACC | 2018 | AT | 19710 | 0.11 | 10.3 |

*Table 2 – Descriptive statistics - Source: Authors own creation*

| Variables | Mean | Median | Std. dev. | Min. | Max. |
|---|---|---|---|---|---|
| *Spatial complexity* | | | | | |
| № supplier countries | 14.97 | 15 | 6.63 | 1 | 33 |
| Geo. Dispersion | 0.36 | 0.37 | 0.14 | 0 | 0.65 |
| *Spend by region (in %)* | | | | | |
| USA | 11.13 | 7.80 | 10.07 | 0 | 41.95 |
| China | 0.98 | 0.12 | 2.72 | 0 | 17.38 |
| Taiwan | 7.82 | 0.05 | 19.06 | 0 | 100 |
| EEA & UK | 3.65 | 2.83 | 3.52 | 0 | 17.40 |
| (Rest of) Asia | 4.27 | 1.40 | 6.97 | 0 | 34.92 |
| Americas | 0.64 | 0.12 | 1.44 | 0 | 7.48 |
| Rest of the world | 0.15 | 0.03 | 0.24 | 0 | 1.73 |
| *Supply base concentration* | | | | | |
| HHI | 2.55 | 0.16 | 6.42 | 0 | 38.18 |
| Avg. of Top 5* | 3.21 | 1.44 | 4.05 | 0.03 | 20.08 |
| № suppliers | 97.13 | 75 | 77.3 | 1 | 324 |
| Total volume (in million $) | 3607.96 | 826.66 | 9590.86 | 1.56 | 61513 |
| Total quantified spend (in %) | 28.66 | 17.92 | 30.34 | 0.15 | 100 |
| *N* (firms) | | | 30 | | |
| *N*t* (firm-year pairs) | | | 206 | | |

*Table 3 – Comparison of US versus Non-US suppliers for the sampled US manufacturers - Source: Authors own creation*

| | | *2014* | *2015* | *2016* | *2017* | *2018* | *2019* | *2020* |
|---|---|---|---|---|---|---|---|---|
| ***All suppliers*** | ***Avg. #*** | 171.3 | 170.6 | 186.4 | 165.2 | 140.8 | 130.2 | 125.1 |
| ***US suppliers*** | ***Avg. #*** | 83 | 82.5 | 85.4 | 77 | 65.3 | 58.4 | 55.8 |
| | ***%*** | 48% | 48% | 46% | 47% | 46% | 45% | 45% |
| ***Non-US suppliers*** | ***Avg. #*** | 88.3 | 88.1 | 101 | 88.2 | 75.5 | 71.8 | 69.3 |
| | ***%*** | 52% | 52% | 54% | 53% | 54% | 55% | 55% |