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Structures of Alliance Networks and Impact on Industry Profitability

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1 Introduction

Industry profitability has been a central notion studied by industrial organization economists (e.g. Bain, 1949).An important hypothesis in this field, namely concentration-profitability hypothesis, is stated by Bain (1951) as "The hypothesis in brief is that the average profit rate of firms in oligopolistic industries of a high concentration will tend to be significantly larger than that of firms in less concentrated oligopolies or in industries of atomistic structure." The main argument of this hypothesis is that, in oligopolistic industries, firms can easily collude and use their coordination to facilitate developing means of deterrence of potential market entry as well as setting higher prices and increasing profitability. In the extreme case, profit maximization is achieved most easily in monopolistic markets. On the other hand, Demsetz (1973) raises the criticism that this causal relationship is not necessarily correct and might have important policy making implications: "In a world in which information and resource mobility can be secured only at a cost, an industry will become more concentrated under competitive conditions only if a differential advantage in expanding output develops in some firms. Such expansion will increase the degree of concentration at the same time that it increases the rate of return that these firms earn." As such, he argues that efficiency might be acting as an omitted variable. This debate has led to many works from old ones to more recent ones (e.g. Clarke et al. 1984, Martin 1988, Bolarinwa and Obembe 2017), which show that both the hypotheses hold in some cases. Martin (1988) concludes that "controlling for differences in efficiency across groups of firms within industries, the margins of all groups rise with the concentration of sales among large firms. The exercise of market power reflects concentration as well as efficiency." Schmalensee (1989) summarizes the findings at the time regarding these hypotheses.

What this line of research, nevertheless, clearly establishes is that the intra-industry structure plays an important role in determining the profitability of the corresponding industry. As it was pinpointed long ago by industrial organization economists, the inter-firm connections are the underlying channels which drive the above mentioned hypotheses. For example, Kwoka and Ravenscraft (1986) show that the nature of the oligopoly, differentiated as cooperation and rivalry, can change the relationship between market concentration and profitability. Similarly, Cool and Dierickx (1993) analyze in their work the U.S. pharmaceutical industry and show once again that it is not the concentration, segment interdependence or strategic distance which determines industry profitability, but rather the rivalry reflecting itself in the strategic group structure. As such, inter-firm relationships and their influence on industry profitability need more attention.

2 Strategic Alliances and Networks

In this paper, I study the influence of alliances and joint ventures across whole industries and their influence on the corresponding industry's profitability. The strategic alliance literature started mostly with systematic studies focused on joint ventures in 1980s, initially by Harrigan (1988) and Kogut (1988), which eventually lead to many other lines of research in the field such as strategic blocks, supplier networks, learning in alliances, interfirm trust and network resources (Gulati et al. 2000). The common definition of alliances is offered by Gulati and Singh (1998) referring to Harrigan (1986), Parkhe (1993) and Gulati (1998): "An alliance is commonly defined as any voluntarily initiated cooperative agreement between firms that involves exchange, sharing, or co-development, and it can include contributions by partners of capital, technology, or firm-specific assets. [...] At one end are joint ventures, which involve partners creating a new entity in which they share equity and that most closely replicate the hierarchical control features of organizations. At the other end are alliances with no sharing of equity that have few hierarchical controls built into them." Hence, it is clearly expected that the presence of alliance networks, whether the industry is oligopolistic or not, should have influence on industry profitability due to cooperation involving sharing and co-development. While joint ventures might lead to stronger effects due to ownership, alliances will also influence how the industry evolves collectively.

Support for this point can be found also in the work by Gulati et al. (2000). The authors take the perspective of social network analysis and emphasize how the embeddedness of the firms can influence their performance. However, they not only refer to firm-level heterogeneities such as strategic groups, but also mention that the embeddedness of firms lead to industry-wide outcomes as well: "We propose that a consideration of strategic networks allows a more refined understanding of industry structure - since industry participants can be seen as embedded in networks of resources, information, and other flows. Such networks can influence the nature of competition in the industry and the degree of profitability beyond traditional measures of industry concentration." They further argue that "tacit collusion is far easier to sustain in an industry in which the major players are connected in a dense network of interfirm ties than in one in which they are disconnected." The embeddedness of firms and their industry wide consequences were already studied by sociologists. For example, Podolny (1993) shows that high status investment banks can benefit from the Matthew effect, or concept of rich gets richer, and protect their leading status. In a different setting, film-production in Hollywood, Baker and Faulkner (1991) show that the emergence of roles and the changing of the nature of ties among film producers lead to a completely different level of profitability in the movie industry. From the industrial organization economics perspective, Scherrer and Ross (1990) also acknowledge that such heterogeneities can have influence on industry profitability.

2.1 From Inter-industry to Intra-industry

While the question "How does strategic network structures influence industry profitability?" was identified by Gulati et al. (2000) more than a decade ago, interestingly, to my knowledge, there is no systematic study of this question. However, over time there has been many developments surrounding this topic. First, we encounter an inter-industry network approach, which studies the influence of inter-industry networks on firm properties such as firm profitability, innovation capability and pricing behavior. A general look at literature shows that there has been diverse interest on this topic spanning from sociology to finance. Burt (1978) looks at how common corporate directorates are established between different economic sectors due to dependencies, or "constraints", on inter-industry level. Using 1967 input-output tables of U.S. economy, the author shows that "depending on the type of goods produced by a firm, one can expect the firm to interlock with firms in sectors constraining the firm's profits". On a different line of research, White (1981) argues that how much total profit a product market can make depends on its substitutability by another market as the buyers' bargaining power will depend accordingly. This, in turn, will dictate how firms in the corresponding market will position themselves according to each other as well as to other markets and buyers. His analogy of markets, as molecules held together by pressures exerted by other industries, is relevant here, in this paper, as the network structures in a way describe the "molecular shape" of the industry, firms being the nodes and alliances the connections between them.

In finance and industrial organization economics literature, the scholars look at how industrial developments can propagate through customer and supplier links. Horn and Wolinsky (1988) show how a change in the cost structure of one industry can lead to a change in incentives for mergers in another vertically related industry. Building on this work, more recently, Ahern and Harford (2014) conclude that "merger activity could be transmitted through economic links between industries, even without vertical integration." Ahern and Harford (2014) also make use of input output tables and demonstrate how merger waves propagate from one industry to the other. Finally, in field of management, we find another example by Anjos and Fracassi (2015) demonstrating the advantage of "internal information markets" that can be found in diversified firms or conglomerates. Using input-output tables, the authors show that the conglomerates have excess network advantages compared to a portfolio of other focused firms and this advantage leads to higher profitability as well as higher innovative capabilities. As such, overall there is an agreement that inter-industry networks have significant influence on the firm-level, which reflects itself in inter-firm connections as well as firm profitability.

2.2 Between Intra-industry and Industry-wide

Changing the direction of analysis, we see also an intra-industry approach looking at alliances as dyadic connections. Introducing social networks approach to strategic alliances research, Gulati (1998) states that "prior research on alliances has led to valuable insights on the behavior of firms in alliances and the performance consequences from such partnerships. Three related themes run across these prior efforts. First, the unit of analysis that is usually adopted is the firm or the alliance. [...] A second and related theme has been examining the formation and performance of alliances in an asocial context.[...] Finally, prior research on alliances has focused primarily on firm- and industry-level factors that impel firms to enter alliances." The author goes on to make a call for a more socially-embedded approach to alliances, similar to Gulati et al. (2000). However, some of the findings at the dyadic level are worth emphasizing here. First, in the context of international business, Tong and Reuer (2010) study the contingencies of how joint ventures influence industry profitability. They categorize joint ventures into horizontal and non-horizontal and domestic and international. Moreover, they look at the moderating effects of market concentration. Consistent with concentration-profitability hypothesis, their finding, which is relevant to the paper here, shows that the domestic horizontal joint ventures lead to more profitability and that higher concentration affects this relationship positively. For example, however, when the joint venture is international and non-horizontal, then we find lower profitability, underlining once again the importance of the nature of ties.

Another important relevant work is by Oxley et al. (2009). The authors look at how the public announcements of alliances between two firms affect the market valuation of the rival of those firms. They offer a novel approach to understanding whether an alliance leads to more competition or less, as "if an alliance is expected to make partner firms more competitive, this should lead to negative abnormal returns for partners' rivals; if an alliance is expected to facilitate a reduction in competitive intensity, this should lead to positive abnormal returns for rivals." First, this work demonstrates that alliances and their formation have direct impact on capital markets of the corresponding industry. Moreover, we see that alliances do not only influence the involved partners, but also others; hence, they have non-local industry-wide effects. The findings of Oxley et al. (2009) show that their research and development alliance data in the telecommunications and electronics industries during 1996-2004 support that some alliances are expected to attenuate competition. They conclude that "results thus suggest that R&D alliances may have both competitiveness-enhancing and competition-softening effects; which of these two effects dominates depends on both the type of alliance that is established and the context in which the alliance takes place." As such, broadening the scope from dyadic level to network-wide level might improve our understanding regarding the influence of alliances on competitiveness, and eventually on industry profitability.

Finally, the work by Schilling and Phelps (2007) demonstrates how large-scale network structure can influence the firms' innovation capabilities. The authors look at alliance networks of 11 high-technology manufacturing industries for the period 1990-2000 where "knowledge creation is fundamental to the pursuit of competitive advantage" (Vonortas, 1997). As a dependent variable, the authors employ the number of patents published in a given industry and look at how this is influenced by network variables at the industry level. The two main independent variables of interest are the clustering and the reach, or in other words how dense the local communities are and in average how many firms are between two randomly chosen firms in the whole network, respectively. Using these variables, the authors find strong support for their only hypothesis, that R&D alliance networks which have more local dense communities as well as have firms located "nearer" to each other lead to higher amounts of patent publications. This work, however, aims how knowledge is created and looks for a relationship between innovation and global network structure; hence it omits analysis of profitability. Given that the "knowledge creation is fundamental to the pursuit of competitive advantage", the question remains whether alliances lead to less competition, hence to higher industry profitability, or actually to more rivalry, hence to lower industry profitability.

Following these works which either study the influences of macro-level inter-industrial ties on internal dynamics of industries or the influences of intra-industry ties or industry-wide outcomes and vice versa, I mainly aim at answering the question whether the intra-industry network structure as a whole is an indicator of industry profitability. As a secondary goal, I also investigate whether the location of an industry in the inter-industry network directly influences some topological properties of intra-industry alliance networks, which would also consequently influence the profitability of the industry as a whole. As such, this work primarily contributes to the industrial organization economics and strategy literatures by explaining industry level heterogeneities, as well as suggesting a new factor to be taken into account when it comes to managerial decision making involving market entry or exit and alliance formation/termination. The secondary goal, additionally, contributes to the social networks literature in terms of network evolution and simultaneously of the interaction of networks in different levels of analysis, a cumbersome topic remaining to be studied rigorously. As in the discussion of White (2004) regarding embedding and decoupling of markets, we face an alliance network which is decoupled as a lone-standing industry but embedded in a network of other industries. How the decoupled intra-industry network responds to the embedded industry position is an important question to be answered, which could be generalized to many other settings.

3 Network Structures and Network Evolution

Rosenkopf and Schilling (2007) state that "most extant studies addressing the question of where interorganizational alliance networks come from either limit their scope to a single or few industries (e.g., Baum, Shipilov, and Rowley, 2003; Stuart, Ozdemir, and Ding, 2007), or to explaining the formation of dyadic alliances rather than the overall network (e.g. Gulati, 1999; Stuart, 1998).[...]this activity has been fruitful, but it does not address how these alliances aggregate into an overall structure, how these structures vary, or what broader industry characteristics may shape these alliance decisions." Consistent with the authors' statement, a brief look at the literature shows that there is a gap between the study of network structures and alliance networks. Provan et al. (2007) offer a review on the inter-organizational network research focusing on works that include "whole network" variables. However, their review reveals that "work at the network level has blossomed during the past decade, but it has primarily been conceptual (cf. Dhanaraj and Parkhe, 2006; Koka, Madhavan and Prescott, 2006), anecdotal, or based on single, descriptive case studies performed at one point in time." Following, I describe the network structures in general and mainly refer to Rosenkopf and Schilling (2007), as they already made an extensive study of industry specific alliance structures, and Provan et al.'s (2007) summary of structural variables.

3.1 Structural Variables

Provan et al. (2007) summarize the "unique network-level properties" as: i) Density, ii) Fragmentation and structural holes, iii) Governance, iv) Centralization, and v) Cliques. In this work, I omit governance as it is not expected to be relevant in the alliance network research; alliances are not supposed to be governed by another entity. Following are brief descriptions of the properties: i) Density is measured as the amount of ties present compared to the number of all possible ties that could be realized. Hence, a dense network would be when many firms are connected to many other firms, ii) Fragmentation and structural holes refer to the connectivity of the network. If many firms are not engaged in alliances, or there are many disconnected pairs of firms in an industry, then this network would be described as fragmented, iv) Centralization measures how uniformly the ties are distributed in a network. Clearly, when only one firm is connected to every other one and others do not have a second tie (i.e. a star shaped network), centralization would be at maximum. On the other hand, if every firm would be connected to every other, or, for example, simply had ties with exactly two other firms, then we would speak of complete decentralization (i.e. complete graph and ring graph respectively), v) Cliques emerge as a number of firms group up and they are all connected to each other. In addition to these variables, two other properties that should be mentioned are: vi) Network diameter, and vii) Average path length. The former quantifies the maximum shortest path (measured as number of firms to be crossed to go from one firm to another) in the network, while the latter is the average length of all paths possible, meaning all paths connecting all firms to all other firms.

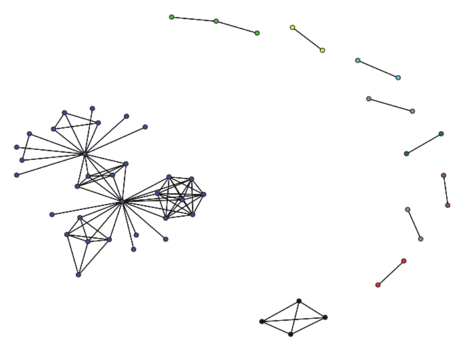

Figure 1: Taken from Rosenkopf and Schilling (2007). A disconnected graph with cliques and centralized nodes.

Rosenkopf and Schilling (2007) present visualizations of 18 different industries in their work, which demonstrate these properties. In Figure 1, first, we observe a graph which has low density almost half of the nodes are not connected to each other. We see that it is a fragmented network as there are disconnected pairs of firms located on the right side of the figure. We can see that there are two centralized firms in the cluster on the left side, as they are connected with many firms that are not necessarily connected to each other. Moreover, we observe the box in the lower part of the figure, where all four firms are connected to each other; this structure is a clique. In fact, guided missiles industry mostly has cliques (each pair is a clique and the component on the left side also includes many groups of firms completely connected to each other). Finally, the network diameter can be only defined for connected components and the maximum shortest path in this case is 5, and the average path length is presumably very short. It is important to note that Rosenkopf and Schilling (2007) also include the size of the biggest connected component compared to the total number of firms existing in the industry. In this example, we find 31 connected firms on the left side and 52 firms in total. Hence, more than half of the industry is connected to each other.

4 Hypotheses

As asserted by the "common definition" of Gulati and Singh (1998), I focus on the fact that alliances involve "exchange, sharing, or co-development, and it can include contributions by partners of capital, technology, or firm-specific assets". As also already shown, alliances facilitate knowledge flows as well as monitoring of the allies. Hence, first of all, I assume that existence of a tie between two firms leads to higher levels of collusion, resulting at least in coordination, if not cooperation (Gulati et al. 2012). Moreover, as alliances are voluntary, a first-order assumption is that the alliances are formed for the benefit of both firms; otherwise either one of the participants would not submit to such an arrangement. These factors would result in higher profitability according to the concentration-profitability hypothesis, even if the market power is not concentrated in the hands of a few firms. So, we expect positive influence of number of ties and connectedness of the network on the industry profitability and suggest as baseline that:

Hypothesis 1a: *The higher the density of the network, the higher will be the industry profitability.*
Hypothesis 1b: *The less fragmented the network is, the higher will be the industry profitability.*

As Provan et al. (2007) state, there is a trade-off between density and centralization. The more centralized a network is the number of possible ties necessarily decrease and achieving higher levels of density becomes prohibited. However, this statement holds in the case of fully connected networks. As such, when fragmentation increases, the relationship between density and centralization should be weakened and their influences should decouple. In this case, we would expect that cliques and centralization to behave similar to density and fragmentation respectively. An argument against cliques enhancing the profitability and the reverse effect of centralization can be made. However, centralization is expected to increase number of structural holes (see Figure 1, cluster on left side) and structural holes will lead to competitive behavior in an alliance network. On the other hand, in cliques social norms and trust are at stake, and as Gulati and Gargiulo (1999) alliances tend to form rather cohesive network structures to mitigate any opportunism. Hence, I hypothesize that:

Hypothesis 2a: *In presence of higher levels of fragmentation, the higher the centralization of the network, the lower will be the industry profitability.*
Hypothesis 2b: *In presence of higher levels of fragmentation, the more cliques there are, the higher will be the industry profitability.*

The network diameter and average path length also act in similar ways. The well-known small world networks tend to have higher amounts of clusters (or in this study more cliques), yet small network diameter. In such a case, for example, it is argued that innovation can take place in the clusters of frequent interaction and then be distributed to the rest of the network efficiently (Uzzi and Spiro, 2005). However, as Uzzi and Spiro (2005) also point out, there is a limit to the benefits of the small worlds. Either too small network diameter or too high clustering leads to counterproductive effects. However, in this study, we are looking at alliance networks, and rather than innovation, we are concerned with industry level profitability. In this case, we would expect that as the number of cliques increase and the network diameter decreases, the industry profitability would increase as possibility of collusion will increase. However, as the fragmentation increases, the effect should reverse sign; having several small-world competing each other should lead to fiercer competition and less industry profitability. The same argument holds of average path length, independent of clustering/clique numbers. Hence:

Hypothesis 3a/b: *In presence of low/high levels of fragmentation, the shorter the network diameter/average path length and the more cliques exist, the higher/lower will be the industry profitability.*

As next, I look at the nature of the alliance ties. As Zaheer et al. (2010) identify, there are four general categories of theoretical mechanisms driving network structures and dynamics, namely resource access, trust, power/control and signalling. However, in this study, rather than the micro-level mechanisms, I focus on the network level outcomes and assume that, independent of the antecedents, alliances will be categorized into two in accordance with the previous literature on alliances: Cooperative and competitive (Kim, 2017). According to Kim (2017), alliance with a rival indicates a cooperative tie and reduces competition, whereas alliance with the partner of a rival indicates a competitive tie and increases competition. In this case, we look at the influence of rivalry on industry profitability. When the rivals are in the immediate alliance neighborhood of the industry leader, we would expect a cooperative nature and, rival being located anywhere else in the network would lead to more competition. As such:

Hypothesis 4: *Industries, in which the leading rivals are located in each other's immediate neighborhoods, are more profitable.*

Finally, we look at the influence of inter-industry level ties on alliance networks. Hernandez and Shaver (2018) show that alliance networks play an important role in how M&A activities are undertaken. Optimizing the network synergies, defined in terms of either creating more than the sum of alliances or decreasing redundancy, is a factor of concern for firms. This finding not only shows that the firms actively monitor and coordinate their alliances and their alliances' alliances, but also could be extended to the logic of forming alliances, not only limited to undertaking M&As. Combining this work with Ahern and Harford (2014), I suggest that alliance formation or termination activities in a supplier or buyer industry will trigger such activities in the focal industry as well. Johnsen and Morrissey (1996) further find that similar network structures tend to evolve similarly. However, to my knowledge, in general there is no previous empirical works focusing on how interacting network structure evolve. Only a theoretical address by Koka et al. (2006) supports these suggestions. Hence, I offer an exploratory hypothesis:

Hypothesis 5a: *When neighboring industries undergo a change in alliance network, the focal industry will also initiate restructuring of its network.*
Hypothesis 5b: *Similar network structures, described by their corresponding parameters, will evolve similarly, when their neighboring industries undergo similar events (such as consolidation or fragmentation).*

Following, I suggest an empirical strategy to test these hypotheses. While the first four hypotheses (including the sub-hypotheses) require only industry specific constructions of the network variables and lead to rather cross-sectional time evolution of these variables, the hypothesis 5 (if supported) allows us to use inter-industry network as exogenous shocks to further test the first four hypotheses.

5 Empirical Strategy

Here, I propose an empirical strategy to test the hypotheses. As many of the variables are constructed earlier in previous works, I mostly refer to them when appropriate. After presenting the variables, I propose the sources of data.

5.1 Variables

The main dependent variable of interest is the industry profitability. For this, I use total return on assets (ROA) of the industry, total return on equity (ROE) and total return on invested capital (ROIC). As Schmalensee (1989) points out, all these measures are highly correlated. As such, the results are expected to be consistent among all these constructs, and in such a case, one of the results would be presented.

The independent variables include the network variables. According to the hypotheses, I construct the following variables: i) Density, D, is the ratio of number of ties and the number of all possible ties. It ranges from 0 for no ties to 1 all ties realized. ii) Fragmentation, F, (or disconnectedness) is inverse of number of disconnected components in the industry network minus the inverse of number of firms in the industry, ranging from 0 for no ties to 1 completely connected. iv) Centralization, C, can be measured as the skew of betweenness centrality distribution. Betweenness centrality of a firm measures how many paths that connect two other firms pass through the focal firm. Finding only one firm with very high betweenness centrality and many others with low centrality would indicate high centralization, and a skewed distribution of this construct. v,vi,vii) Number of cliques, NC, network diameter, ND, and average path length, APL, are constructed as defined. viii) The size of the biggest connected component, SBC, compared to the rest of the network is calculated as demonstrated in previous sections. Furthermore, to take rivalry into account, a new measurement is necessary. For this, I look at the ratio of weighted biggest connected component size and of second biggest connected component size, WSBC. Also, I construct a dummy variable and see whether the rival, defined as equal to 1 if the firm with second or third highest market share with similar magnitude to highest market share is one step away from the firm with highest market share and equal to 0 if the step length is more than one, or if there is no connecting path. This variable indicating cooperation, CO, is 1 when alliance is with a rival directly, or 0 when alliance is competitive.

As control variables, I use the variables that are correlated with certain network structures identified by Rosenkopf and Schilling (2007) and market concentration to avoid the findings in industrial organization economics. Rosenkopf and Schilling (2007) propose that technological dynamism and uncertainty, separability of innovation activities and concentrated architectural control will lead to denser networks. Market concentration is constructed through Herfindahl index as usual. Moreover, as some works pointed out (Schilling and Phelps, 2007) R&D intensity can be an influential factor in industry profitability, as well as advertising intensity as some industrial organization economists suggest. These variables would be also controlled for. Finally, as an instrumental variable I propose to use the Bureau of Economic Analysis' input-output networks as well and follow the M&A wave findings by Ahern and Harford (2014). Hernandez and Shaver (2018) show that the alliance networks are important predictors of how the mergers will be realized. In case of an M&A wave, we would expect the alliance networks to be closely related to M&A behaviors. As such, using these waves as an exogenous shocks due to other industries, we can circumvent endogeneity problems which plague network analysis. Moreover, as a robustness check, it is important to note that alliances involve not only cooperation (a beneficial tie) but also coopetition (a beneficial tie to be managed, Hamel et al. 1989), and sometimes even resource dependence (a costly tie, Bae and Gargiulo, 2004). As such, looking at the average market concentration across connected components of the industry network could allow us to understand whether small firms are simply under control of monopoly firms or whether the alliances are balanced.

As Ahern and Harford (2014) show the exponential random graph models (ERGM) are the most suitable statistical models to be used in network analysis. However, they also note that "we repeat our analysis with OLS regressions. Regressing the value and count of mergers between industries on the four measures of their IO connectedness produces the same inferences." As such, OLS could be also used with the constructed variables. For the instrumental variable, then 2SLS method would be used. For the network evolution, we need industry fixed effect model to look at how the parameters describing the network evolve. Just like the study of M&A activities by Ahern and Harford (2014), we can then analyze the alliance formation or termination activities.

5.2 Data Sets

Following the previous literature, the alliance networks would be constructed from the data on Thomson's SDC Platinum database and the control variables of Rosenkopf and Schilling (2007) through expert surveys. One of the short-comings of this database is that the termination dates of the alliances are not announced, while initiations are. A general qualitative study of the industries can be made to approximate the average duration of the alliances for the corresponding industries. This would also be an improvement to the previous uses of this dataset. For the instrumental variable at the inter-industry level, the input-output tables obtained from Bureau of Economic Analysis will be used and mergers data can be obtained once again from Thomson's SDC Platinum database. The procedure to build the input-output networks is described by Ahern and Harford (2014) clearly. A preliminary presentation of the network can be seen in Figure 2. Finally, for the profitability measurements, the only available database is Compustat, although it is only limited to public firms. As such, the results have to be interpreted with caution. Fundamental annual data as well as business segment data would be used to construct the profitability measurements, but missing private firm data will influence the results.

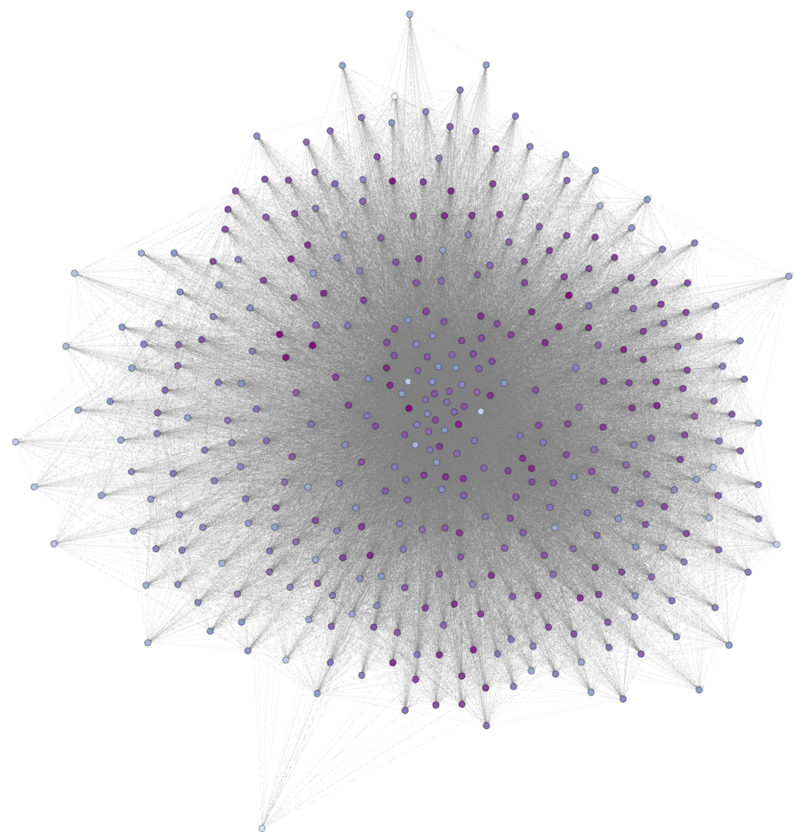

Figure 2: Input-output network of industries in U.S. 2017. The darker shade of purple indicates higher amounts bought by the corresponding industry. Each node contains an alliance network. For guided missiles, such a network is depicted in Figure 1.

6 Conclusion and Outlook

As Rosenkopf and Schilling (2007) note, "despite mounting evidence of the importance of alliance network structures, neither the variation in these structures nor the antecedents of this variation are well understood. There is very little research documenting systematic differences in alliance network structure, presumably because of difficulty in doing so." In this work, I address this research gap regarding the connection between industry profitability and alliance networks with tools of network analysis. Many previous works have investigated the evolution of the alliance networks either at the firm level or the behavior of firms facing macro-level constraints, such as inter-industry dependencies and uncertainties. Here, I look at the whole network level constructs, which are the outcomes of micro-level mechanisms, and study their influence on industry profitability. For this, I referred to the competitive and collusive mechanisms studied in industrial organization economics as well as to the alliance networks literature.

The general expectation is that the more connected the network is the more collusive the participants of the industry should behave. According to industrial organization economics, this leads to higher prices in average in an industry.

The findings would contribute to several lines of research. First, although over time industry profitability research changed its direction more towards strategic groups and firm profitability, the influence of social ties among firms, which are mostly approximated by concentration and many other accounting measures, on the industry-level outcomes is yet to be revealed. While Schilling and Phelps (2007) achieve this for innovation capability of networks, here I look at a more general setting and study the industry level profitability. As such, going to back to White (1981, 2004), we not only look at whether the markets and the underlying firm relationships are held together by buyer and supplier pressures, but also which network-wide shapes lead to better outcomes for the corresponding industry.

Second, studying the interaction between internal structure and the buyer-supplier pressures contributes to the network evolution and research in embeddedness of markets. As Granovetter (1985) points out, the economists undersocialize the actors, whereas sociologists tend to oversocialize; the balance between them is very difficult to pin down (Krippner and Alvarez, 2007). In this work, we encounter a setting, where the inter-industry ties act as “institutional” embeddings, that lead to some change in the network structure in the industry and consequently in its profitability. However, the change in the network structure is the outcome of the agents and not all agents reach in the same way to the external pressures. As such, the observation of such multi-level dynamics can improve our understanding of how actors react to external pressures. Finally, the results can have managerial implications. Industry profitability is an important factor considered by practitioners. The influence of industrial organization economists are still strong in management practice and clearly analyzing the external environment of a firm is an important part of making and implementing strategies (Ahlstrand et al. 2001). With the availability of more data and better understanding of alliances, the managers can make better decisions, when it comes to market entry and exit. While industry profitability is only an outcome of many processes that can be only obtained in retrospect, alliances are longitudinally more stable configurations and they are easier to track. Understanding their influence at the industry level would offer a more reliable source of information to the managers. Although there are empirical limitations as mentioned above, future research can benefit from some of the ideas developed here.

7 References

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