Do the Structural Hole States Affect the Network Rent within Triadic Supply Chains? The Manufacturer's Perspective

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Abstract

With increasingly complex relationships among companies, the concept of triads becomes an essential tool for investigating the structure of contemporary supply chains. Within the triadic arrangements, one may identify a 'structural hole' defined as a gap, occupied by a specific company and positioned between two disconnected actors in a triad. In our study we consider the manufacturer sitting on the structural hole, who is capable of establishing three basic structural hole states. They are determined by the *so-called* relational posture of dyads ranging from adversarial (negative) to cooperative (positive). The goal of the paper is twofold. First, we aim to explore the ability of the manufacturer to achieve the network rent, which is modeled as the outcome of joint-effect between the relational performances of two dyads (supplier-manufacturer and manufacturer-customer) within triads. Secondly, we seek to recognize how the structural hole states, shaped by the manufacturer, affect the network rent in triads. The findings of our research demonstrate that the network rent is yielded in the investigated triads; however, its value, as evidenced in our study, is dependent upon the specific structural hole state. More specifically, the highest value of rent is generated by triads with cooperative posture of both dyads, whereas the value of rent close to zero is revealed in triads with negative relational posture of both dyads. Interestingly, the lowest level of network rent is reported by a hybrid type of arrangement, in which one dyad demonstrates a more cooperative relational posture, whereas the other one indicates an adversarial relational posture. The obtained result not only suggests that there is no rent, but it goes further to indicate a negative return (or loss) derived by the manufacturer in this group of triads.

1. Introduction

Over the past few years, triads have attracted increasing attention when investigating the complex business relationships; and hence they can be used as a powerful methodological tool for further exploration of certain network processes (Dubois, 2009). Wu *et al*. (2010) advocated that triads are built on dyads; therefore, any study on triads has to consider a dyadic framework. Each dyad consists of two nodes and the connecting link between them. To date, the vast majority of studies on triads have been focusing on the companies positioned upstream the supply chains and investigating buyer-supplier-supplier relationships (Choi and Wu, 2009a; Wu *et al.*, 2010; Li *et al.*, 2010; Mena *et al.*, 2013). Our study shifts the research interest to the companies located more downstream in a supply chain with the central role of the manufacturer. Consequently, a basic triadic structure consisting of three subsequent tiers supplier-manufacturer-customer represents the type of network within a manufacturing setting (Li and Choi, 2009) and serves as the research context for our study. In this paper, we link two research perspectives – structural hole and relational posture, and consequently

argue that the concept of relational posture can be successfully applied into the structural hole arrangement. Within the triadic arrangements, formed by three subsequent actors that establish linear product and information flows, one may identify a 'structural hole'. It is defined as a gap, occupied by a specific company and positioned between two disconnected actors in a triad. In our study, we explore the manufacturer sitting on top of the structural hole. The central position of the manufacturer stems from the fact that it establishes direct relationships with its supplier and customer in a triad, and at the same time, both the supplier and the customer do not have a direct link with each other (Burt, 1992; Choi and Wu, 2009b). The concept gives clarification on how the position on the structural hole in a triad brings additional benefits. Therefore, drawing upon the structural hole concept, we argue that the manufacturer in a triad is the one that looks for the opportunity to gain additional profit by filling the gap between the supplier and the customer (Burt, 1992). The privileged position in a triad is primarily used to maximize own benefits, even at the expense of two other actors (Burt, 1997). In line with this assumption, the company sitting on the structural hole can play two actors against each other, or form a coalition with one actor against the other one (Choi and Wu, 2009a). In order to emphasize this hostile attitude, Burt (1992) quotes the Italian phrase: *Between two fighters, the third benefits*. Based on that, we assume that, to some extent, the benefits derived by the manufacturer can be produced as the outcome of joint effect between the relational performance generated by two dyads – one dyad established by the manufacturer and its supplier, and another one established by the manufacturer and its customer. Drawing upon the study of Dyer and Singh (1998), this supernormal profit jointly generated in an exchange relationship between two dyads in a triad may be referred to as a network rent. Although the manufacturer may apply a radical strategy of using the structural hole only to maximize own benefits, we argue that, at times, it can also use its privileged position, to some extent, in favor of the other actors – suppliers and customers. This attitude may not only be beneficial for the supplier and the customer, but it may also bring substantially higher profits for the manufacturer itself. In other words, we posit that the manufacturer that uses the structural hole only for its particular interest tends to achieve a lower value of rent, as compared to the manufacturer that uses the structural hole not only for its own benefits, but also in favor of its supplier and customer. To investigate this issue, the study is complemented by the underpinnings of the relational posture theory, which was first proposed by Kim and Choi (2015) to investigate the extended buyer-supplier relationship typology. Through the lenses of the relational posture theory, the paper conceptualizes the basic characteristics of dyadic relationships that determine different structural hole states in a triad (Choi and Wu, 2009b). Consequently, as the manufacturer is capable of forming the relationships between its supplier and customer, which then affect the interplay between the relational performance of two dyads, we posit that the value of the network rent yielded by the manufacturer is dependent upon the state of structural hole arrangement.

The paper begins with a brief review of the relevant theoretical underpinnings, followed by the development of specific research hypotheses. For this research, an exploratory study with a survey method has been used. Firstly, the basic assumptions considered when collecting data within a triadic context were demonstrated. Following the analysis of scale measurement validation, a multiple regression model with interaction effects has been developed and cluster analysis has been performed. The study then presents and discusses the empirical findings derived from the statistical analysis in relation to the research hypotheses. Finally, we draw conclusions and demonstrate the contribution of the study.

2. Literature review and hypothesis development

A structural hole is a type of arrangement, often contrasted with closure, where actors who are tightly linked to one another, develop numerous contacts, establish intense communication and exchange

information often obtained from multiple sources (Uzzi, 1996; Polidoroet al., 2011). On the other hand, the structural hole arrangement refers to the social capital theory and underscores the network benefits gained from bridging two disconnected actors (Burt, 1997). In other words, social actors positioned on top of the structural hole can enjoy brokerage opportunities (Li and Choi, 2009). Following the study of Xiao and Tsui (2007), the manufacturer sitting on the structural hole is particularly capable of gaining two major advantages: information and control. This was confirmed within the supply chain setting by Li and Choi (2009) who described an example of a manufacturer – a major computer company that was positioned on the structural hole between its suppliers and customers, and as such, it enjoyed information and control benefits. Accordingly, the manufacturer in the structural hole arrangement is capable of exploiting, manipulating and arbitraging information flow between disconnected parties for its own benefits (Brass, 1995; Baum and Ingram, 2002; Shipilov and Li, 2008; Yang *et al.*, 2010). In some situations, these benefits may take the form of network rent, being determined by structural variables, covering a wide range of enduring relationships among interacting social actors (Wasserman and Faust, 1994). Drawing upon the concept of network embeddedness rooted in Granovetter's original conceptualization (Granovetter, 1992), two dimensions of the network rent can be distinguished, namely structural and relational. The structural aspect concerns the configuration of network and covers the presence or absence of network ties between actors, along with other structural features like connectivity, centrality and hierarchy (Moran, 2005; Dyer and Singh, 1998). Dollinger *et al.* (2010) emphasized that in case of the network rent, the fundamental unit of analysis becomes the network, consisting of the collection of actors and their connecting ties. Considering the structural aspect of network rent, this study deals with a triad forming a basic unit of network, composed of two dyadic relationships with the central role of the manufacturer. On the other hand, the relational aspect highlights the quality of relationships (Nahapiet and Ghoshal, 1998) and suggests that yielding the network rent is dependent upon the following factors: trustworthiness, overlapping identities, feelings of closeness and interpersonal solidarity (Moran, 2005). In line with the relational aspect of network rent, establishing relationships of high quality is necessary to combine, exchange and invest in idiosyncratic assets, knowledge and capabilities. Accordingly, following the study of Dyer and Singh (1998), the network rent is defined as a super-added value jointly yielded through idiosyncratic contributions of all actors involved in an exchange relationship. This definition suggests that the network rent cannot be generated by certain companies in isolation. This is confirmed by Davis and Thomas (1993) who suggested that the rent occurs when dyad (a) and (b) both generate a value greater than the sum of their standalone values. Similarly, Choi and Wu (2009b) maintained that although structurally triads are built upon dyads, yet when the outcome of reciprocal interactions is considered, triads are more than a collection of two dyads. Therefore, in order to investigate the network benefits reaped by the manufacturer from the structural hole, one should focus on the reciprocal influence of both dyads in a triad (i.e. supplier – manufacturer and manufacturer – customer), being a specific unit of a supply chain (Dubois, 2009). In other words, one should capture how a link in one dyad affects another link in another dyad (Choi and Wu, 2009b). The outcome of interplay among dyads enables to yield a rent. In general, the concept of network rent is related to synergy which underscores an increase in the value of assets as a result of their combination (Luukkanen *et al.*, 2012). In the same vein, synergy is defined as an interaction among parties, that creates an enhanced combined effect (The American Heritage Dictionary of the English Language, 2018). This definition makes the concept of synergy related to statistical interaction (Corno *et al*., 2002). To reiterate, the network rent demonstrates a super-added value jointly produced through idiosyncratic contributions of all actors involved in an exchange relationship (Dyer and Singh, 1998).

When considering the network rent, we refer to the concept of 'ego network' of a particular firm. Within the examined triadic arrangement, an ego network is comprised of an ego (i.e. a social unit

such as a manufacturer), and the ego's immediate ties (first-degree connections), established by the supplier and the customer (Carnovale and Yeniyurt, 2015). The 'ego network' view enabled us to consider the network rent from the perspective of manufacturer, who looks for the opportunity to derive benefits by filling the gap between two other actors (Burt, 1992). Accordingly, the sum of relational performances generated in two dyads together with the added value of the network rent defines manufacturer's performance and may be depicted as follows:

Manufacturer's Performance = Value (a) + Value (b) + Value (a, b)

To put it more precisely, apart from simply capturing the relational performance in a bilateral arrangement, there is also a need to simultaneously grasp how one dyad, established between the manufacturer and its supplier in a triad, affects another dyad, formed by the manufacturer and its customer. This will provide us with understanding of the interplay and relational dynamics of supplier–manufacturer–customer relationships (Wu and Choi, 2005). Consequently, the network rent derived from the structural hole arrangement is generated by the additional value produced by the relational performance of two dyads. In this perspective, triads may be perceived as complex entities that can be characterized by nonlinearity. The collective behavior of a triad can never be grasped by the linear sum of dyads (Choi and Wu, 2009c). Accordingly, based on these arguments, the following hypothesis is offered:

H_1: The joint effect of the relational performance of two dyads contributes to yielding the network rent for the manufacturer positioned on the structural hole.

Based on Burt (1992), the paper argues that the manufacturer may reap substantial rent from brokering the relationships in its upstream and downstream dyads. These relationships are characterized by different states of the structural hole arrangement. Following the study of Choi and Wu (2009b), we distinguish between three states of triads. Each dyad in a triad may be either positive or negative. It is positive (*sign* +) when a relationship between the manufacturer and its supplier or the manufacturer and its customer is based on trust, reciprocity and commitment. In other words, it represents a voice-based relationship when both parties are willing to work together, as they are able to reap certain benefits (Nair *et al.*, 2009). While the supply chain concept emphasizes the significance of collaboration among the companies, one cannot ignore the fact that supply chain partners do not always establish collaborative relationships. At times, companies are not willing to extend the contract and want to exit the existing relationship (Nair *et al.*, 2009). This is a negative (*sign* -), adversarial and exit-based relationship, when both parties act opportunistically and antagonistically (Choi and Wu, 2009b). In order to characterize structural hole states, the concept of relational posture has been employed. It covers a continuum of relationships from adversarial (negative) to cooperative (positive); therefore, different base states of the structural hole arrangements can be characterized by relationship commitment, trust, information sharing, relational norms and conflict resolution (Kim and Choi, 2015).

In the light of the aforementioned, the cooperative (positive) relational posture of both dyads is more characteristic for structural hole state 1, as it requires a higher level of commitment, deeper trust, more intense information sharing, relational-based conflict resolution and higher adherence to relational norms. On the other hand, it is more likely that the adversarial (negative) relational posture of both dyads is more characteristic for structural hole state 3, as it demonstrates a lower degree of commitment, mutual distrust, reluctance of sharing information among companies, contract-based conflict resolution and lesser adherence to relational norms. Structural hole state 2 represents a hybrid type of arrangement, in which one dyad demonstrates a more cooperative relational posture, while the other one is more characteristic for the adversarial relational posture. To sum up, we argue that structural hole states can be determined by the relational posture of both dyads, characterizing an array

of relationships from adversarial to cooperative. The manufacturer positioned on the top of the structural hole holds a key to shaping such relationships. Prior studies showed that establishing cooperative relationships between actors (supplier and manufacturer, or manufacturer and customer) contributes to the higher performance gains of dyads (Devaraj *et al.*; 2007; Germain and Iyer, 2006). Other studies investigated the importance of relationships with a supplier or customer in improving manufacturer's performance in various areas (Lempke *et al.*, 2003; Chu *et al.*, 2012; Ndubisi *et al.*, 2005; Sukresna *et al.*, 2016; Huo *et al.*, 2014; Larso *et al.*, 2009; Hernández-Espallardo *et al.*, 2010). However, manufacturer's performance within a triadic context can only be examined more extensively when both dyads are considered together. Consequently, as the quality of relationships in both dyads affects the network rent indirectly, we argue that the type of structural hole state in a triad determines its value. Therefore, we posit that the cooperative relational posture of both dyads will magnify the positive impact on the network rent yielded by the manufacturer sitting on the top of the structural hole. And reversely, the adversarial relational posture of at least one dyad in a triad will contribute to lowering the value of network rent produced by the manufacturer in the structural hole arrangement. In extreme circumstances, when both dyads are characterized by the adversarial relational posture, we assume that no rent is actually produced. Therefore, although the manufacturer positioned on the structural hole will always be a beneficiary to some extent, nevertheless, the value of network rent will be highly dependent upon the state of structural hole arrangement. Based on the above theoretical considerations, we offer the following hypotheses:

H_2: Among three structural hole states, the highest significant network rent is generated by the manufacturer in the triadic supply chain consisting of the cooperative posture of both dyads;

H_3: Among three structural hole states, the lowest significant network rent is generated by the manufacturer in the triadic supply chain consisting of the adversarial posture of both dyads.

3. Methodology

3.1. Triadic sampling context

The study was embedded within the triadic sampling context. It is applied when data are gathered in a sample of companies establishing triads – the smallest unit of network (Choi and Wu, 2009a). In this study, triadic supply chains, comprised of three subsequent actors (supplier-manufacturer-customer), have been investigated. The selected target company - manufacturer, acting as the focal node in its triad, provided detailed contact information on its first-tier supplier and first-tier customer. The major business partners of the focal company were selected on the basis of two criteria: (1) supply components are parts that go into the end item, received by a customer (Wu *et al.*, 2010), and (2) the end item concerns the highest value product line for the focal company. The first criterion was intended to provide context for collaboration in a triad, while the second one stems from the fact that not all of the relationships are equally significant in the network, and they differ in terms of pivotal features such as closeness, interdependence, and rent-generating function (Leek *et al.*, 2002). Therefore, one should consider only such relationships that are strategically important for supply chains (Tan *et al.*, 1998; Cooper *et al.*, 1997). In addition, the sample was checked for redundancy by cohesion, in order to make sure that the manufacturer is actually positioned on the structural hole in the examined triads (Burt, 1992), and both the supplier and the customer do not establish a strong tie.

In order to conduct the study, a quantitative survey as a method of data collection was developed. The questionnaire used for this study contained a number of variables examining operational performance of the manufacturer, as well as the relational posture and performance of two dyads: supplier-manufacturer and manufacturer-customer in a triad. The structure of the survey questionnaire was adjusted to certain groups of respondents, serving different functions in a triad. Generally, the questionnaire mailed out to the manufacturer as a focal link in its triad was standardized, while the items included in the

questionnaire that was sent out to suppliers and customers were customized. Depending on the role served in a triad, each responding company answered a specific set of questions. Accordingly, the manufacturer answered the questions concerning the relational posture separately for both dyads – one formed with its supplier and the other one established with its customer. Then, due to its middle location, the manufacturer also answered the questions concerning the relational performance of both dyads: upstream and downstream, and finally rated its operational performance. The remaining two groups of actors in a triad, suppliers and customers, answered the questions concerning the relational posture of a dyad formed with the manufacturer. Ultimately, both suppliers and customers expressed their opinion on the relational performance of a dyad. This group of actors did not answer the questions concerning operational performance.

3.2. Data gathering process and study setting

The process of data gathering spanned over 8 months in 2017 and 2018, and covered several stages. In order to collect data from all three links forming a triadic structure of supplier-manufacturer-customer, the methodology recommended by Wu *et al.* (2010) was employed. In the first stage of data gathering process, the companies solicited for this study were formal leaders or focal links with a strong position in their triads, as they can effectively control the interaction between their suppliers and their customers (Li and Choi, 2009; Rossetti and Choi, 2005; Ross, 2005). The survey instrument was sent out via mail or fax to 340 respondent companies operating in Europe (Poland, Germany, Czech Republic, Slovakia, Italy, Hungary and the Netherlands). Together with the survey, a letter covering the major goal of the study was attached, ensuring full confidentiality of the collected data. After the survey had been initially mailed or faxed, a number of follow-up reminder emails (every three weeks, on average) were sent out.

The informants were the logistics or supply chain managers that are familiar with operations performed in their triadic supply chains, established with the suppliers and the customers. These managers provided responses to the measurement from the perspective of the manufacturer as the focal company in its triad. The surveyed informants were also encouraged to suggest contact information to the persons on the part of the supplier and the customer, selected on the basis of the criteria mentioned earlier. The obtained response rate was roughly 38 percent (129 companies). Such response rates are typical for mailed surveys and comparable to other studies (Ling *et al*., 2008). The relatively high response rate was partly secured by the letter that had been mailed out along with the survey questionnaire. The letter was certified by the University and National Science Center. It ensured the informants that the findings of the study would be used for the academic purpose only.

However, only a portion of the raw data might be used for further analysis, as the number of 117 companies (more than 90 percent of the initial sample) provided detailed, complete and true information on the first-tier supplier and the first-tier customer. After receiving feedback from the focal company, we emailed a survey questionnaire to its two informants – the supplier and the customer. 117 responses from the focal companies provided us with a total of 234 potential matching suppliers and customers. In order to demonstrate the relational setting to the informants, each survey questionnaire was customized to clearly specify the names and part numbers of specific components, as well as the names of the end products in which these components were used. The selected informants (supplier and customer) were mostly logisticians, operation managers and firm owners, and they provided responses to the items concerning the network properties from the perspective of their companies. If the informants did not return the questionnaire within three weeks, we contacted them again by fax or email in order to encourage a response. Finally, out of the 234 surveys sent to suppliers and customers, a number of 175 survey responses were received (93 and 82 came from suppliers and customers, respectively). They supplied to or purchased from 103 focal companies, in total. Among

this group are single supplier (10) and single customer (21) responses that demonstrate the findings for dyads. The remaining portion of this group are 72 triads that establish a simultaneous relationship both with the supplier and the customer. These two actors bring non redundant benefits (redundancy by cohesion), as in most of the cases they do not know each other. Additionally, suppliers and customers do not establish strong relationships with each other in any investigated triad. The subsample including triadic supply chains relationships has been employed in this study for further analysis.

3.3. Measures

In order to test the research hypotheses, our study encompasses two construct groups – measures for performance and measures for relational posture.

Measures for performance capture the operational performance of the manufacturer and the relational performance of dyads. There are several ways to conceptualize manufacturer's performance (Flynn *et al.*, 2010; Swink *et al.*, 2007; Gligor and Holcomb, 2012; Mackelprang *et al.*, 2014). In order to capture the interorganizational perspective, the analysis of manufacturer's performance within the supply chain context was conducted. Thus, forming relationships among manufacturing companies and their partners enhances knowledge sharing (Rosenzweig *et al.*, 2003; Devaraj *et al*., 2007; Narasimhan and Kim, 2002), and brings better coordination that improves manufacturing flexibility, manufacturing efficiency (Saeed *et al.*, 2005; Ward and Duray, 2000), product quality (Swink *et al*., 2007; Boyer and Lewis, 2002), product development cycle time and responsiveness (Dröge *et al.*, 2004). It is difficult to compare the performance of manufacturers operating in different industries; therefore, perceptual measures were used, as in Flynn *et al*. (1995). We used six indicators of operational performance that were inquired only from the investigated manufacturers, sitting on the top of the structural hole in their triads. The measures for relational performance were used to assess the extent to which both parties in a dyad generated reciprocal effects. For instance, Kim and Choi (2015) argued that relational performance demonstrates the extent to which both companies have mutually produced surplus in returns and capabilities when compared with the sum of those of particular individuals. In other words, relational performance is associated with concerted efforts to create surplus benefits and their fair distribution. In the opinion of Whipple *et al*. (2015), the relational performance between partners ought to lead to improved benefits for all involved actors. Accordingly, Selnes and Sallis (2003) proposed to measure it by three items: two of them – better product quality and development of new markets - are connected with enhancing the competitive position of a dyad, derived through the relational performance, while the third one refers to cost reduction. This last item should be of particular interest when relational performance is considered, as its benefits ought to transcend the cost of coordination. In other words, relational performance should, at least, leverage the cost of administrative coordination associated with establishing a dyad (Govindarajan and Fisher, 1990). The studies also evidence that relational performance is indicated by the extent to which differing viewpoints of the companies in a dyad lead to better problem solving, and thus to higher profits (Kim and Choi, 2015). This is specifically important when the difference is task-related and serves as a means for the companies to express their multiple options for task completion. In other way, firms possess a variety of viewpoints, opinions or solutions that may be chosen in the decision making process. This is of crucial importance, especially when problem-solving tasks require innovation and creativity (Salas *et al*., 2015). We used five indicators that were inquired from respondents separately for two dyads. Based on the responses obtained from both actors (supplier-manufacturer and manufacturer-customer), the average scores for a certain dyad, forming a triad, were calculated. As a result, two constructs were formed – one for the upstream dyad established between

the manufacturer and its supplier, and the other one for the downstream dyad formed by the manufacturer and its customer.

The following group of constructs covered the relational posture that represents the quality of relationships in dyads, and is characterized by relationship commitment, trust, information sharing, relational norms and conflict resolution. Relationship commitment is defined as a mutual partner's belief that the relationship is worth the effort required to ensure its survival (Morgan and Hunt, 1994). Accordingly, commitment within the triadic context denotes a long-term, purposeful arrangement among individual but interrelated organizations that enable gaining and sustaining competitive advantages *vis-a-vis* their competitors outside the triad (Jarillo, 1998). The essence of relationship commitment is trust (LaLonde and Cooper, 1989), defined as the willingness to rely on an exchange partner (Moorman *et al.*, 1993). Trust encourages partners to believe in positive outcomes of relationship performance, and thus, it deteriorates the feeling of insecurity and opportunism (Krishnan *et al.*, 2006). Trust reduces the fear of information disclosure and enhances the belief in the content of the information that is received (Chen *et. al.*, 2011). Some previous studies evidenced that the presence of trust results in higher information sharing (Li and Lin, 2006), while others suggested that information sharing leads to higher levels of trust (Ghosh and Fedorowicz, 2008; Nyaga *et al.*, 2010). As highlighted by Zhao *et al.* (2008), communication is a crucial component of information sharing. In other words, communication between supply chain partners is essential when disseminating and sharing strategically significant information for mutual aims (Paulraj *et al.*, 2008). Sharing of information enables developing conflict resolution mechanisms (Kwon and Suh, 2004; Nyaga *et al.*, 2010). Methods of resolving conflict range along a continuum from the use of cooperation to the use of force (Fisher, 1997).

Accordingly, these methods might be characteristic either for the relational or contractual type of conflict resolution, respectively. The first group includes joint resolution leading to a mutual solution or persuasion, which occurs when one actor persuades the other that a particular solution brings the best outcome. On the other hand, the contractual type of conflict resolution contains sanctions leading to the expulsion of an actor from the arrangement, or introduction of a third party to obtain recourse to arbitration (Mohr and Spekman, 1994). The ability of information sharing (exchange) along with flexibility and solidarity define a construct of relational norms. Drawing upon the study of Heide and John (1992), Lai *et al.* (2013) described information sharing as a bilateral expectation that both actors in a dyad will proactively provide information that is useful to them. On the other hand, flexibility refers to a bilateral expectation that both actors in a dyad will make necessary adaptations when conditions change. Finally, solidarity denotes a bilateral expectation that both actors place a high value on the relationship. The indicators were inquired from respondents separately for two dyads. Based on the responses obtained from both actors (supplier-manufacturer and manufacturer-customer), the average scores for particular dyads were calculated. As a result, two constructs were formed – one for the upstream dyad, established between the manufacturer and its supplier, and the other one for the downstream dyad, formed by the manufacturer and its customer. All three constructs (operational performance, relational performance and relational posture of dyads) were operationalized on a five-point Likert-type scale.

3.4. Measurement Assessment

The assessment process investigates the adequacy between a construct and procedure used to measure or manipulate that construct (O'Leary-Kelly and Vokurka, 1998). The newly developed indicators of operational performance of the manufacturer and the relational performance of dyads were rigorously anchored in the literature to ensure high content validity. In order to verify the construct validity, we assessed unidimensionality, reliability and validity.

Unidimensionality was established through the Exploratory Factor Analysis (*EFA*) using the Principal Component Analysis (*PCA*). The Factor Analysis was performed to summarize the information manifested by many variables by compressing them into a smaller set of constructs, and verify if the variables load sufficiently on their hypothesized factors (Hair *et al.*, 1998). There were three constructs examined in our study. Two constructs manifested the relational performance of upstream and downstream dyad, whereas the third one demonstrated operational performance of the manufacturer.

The first and second construct contained four variables each, and generated the value of variance equal to 68 and 62 percent, respectively. One variable was dropped in each factor due to low loadings below the value of 0.5. The third factor included six variables and produced 76 percent of variance. The analysis produced a clear pattern of constructs with minimal cross-loadings and loadings exceeding .5 on one construct (Nunnally, 1988). Based on the values of *anti-image* correlation *matrix* diagonals, the individual sampling adequacy score (*MSA*) was close or above .70, which is considered to be a middling result (Schmidt and Hollensen, 2006). For the assessment of reliability, we calculated internal consistency and composite reliability (*CR*). In order to verify the internal consistency, we calculated Cronbach's alpha for each construct. Their values in all instances were above .70, and thus may be considered to be highly reliable (George and Mallery, 2003). The coefficients of *CR* estimated for the underlying constructs were close or above the value of .70, which is considered to be a satisfactory result (Nunnally and Bernstein, 1994). In order to determine validity, we calculated both convergent and discriminant validity (Straub *et al*., 2004; Sezen, 2008). An average variance extracted (*AVE*) measuring the convergent validity was close or above .50 for all constructs. It indicated that all constructs are capable of explaining, on average, at least 50 percent of the variance of their indicators (Chin, 1998). Thus, a set of variables reflect one and the same major factor that may be depicted through unidimensionality (Fornell and Larcker, 1981). The constructs also have the appropriate discriminant validity, as their value of *AVE* is larger than the squared correlations between the construct and any other considered construct. In aggregate, the results suggest acceptable unidimensionality, reliability and validity.

In order to assess the relational posture, we followed the approach applied in the study of Vestag and Whybark (2005). In line with this research, we first computed the average scores of responses for 17 questions manifesting the relational posture obtained from both partners in a dyad, and then, summed these scores for each dyad. This provided us with necessary input data to calculate the relational posture index. Accordingly, the total score for each dyad both upstream and downstream was compared to the maximum possible score for each index of 85 (17*5). The percentage of the maximum possible score is used as the index. For instance, a dyad whose total score on 17 questions manifesting the relational posture was 51 would have an index value of 60 (51/85). This results in the relational posture indices that may theoretically range from 0 to 100; however, their actual value is between 20 and 100.

In addition, a number of variables may have an impact on the operational performance of the manufacturer. As the structural hole requires from the manufacturer to hold a strong position relative to the supplier and the customer, the control variables ought to be included in the model. In particular, two control variables are manufacturer's size (estimated by a number of full-time employees) and age of the manufacturer (in years). Clearly, when investigating the triadic arrangement, it is very likely that the actor settled on the structural hole will be a larger company, having a long term experience in an industry. Another set of variables controlled for the actual strength of the manufacturer in the triadic arrangement. Specifically, two variables can be used, namely: the share of the customer's revenue that is generated by the product supplied by the manufacturer (SCR), and the share of the manufacturer's cost of goods sold that is generated by the product supplied by the supplier (COGS) – both measured as a percentage.

4. Research Analysis

4.1. Multiple Regression Analysis with Interaction Effects

In order to capture the network rent, we followed the study of Peng *et al.* (2016) who used the multiple regression model with interaction effects to demonstrate synergy between two independent variables. In the similar vein, Luukkanen *et al.* (2012), drawing on the study of (Southwood, 1978) argue that the concept of synergy is related to the statistical interaction that it is the product of two independent variables X_i and X_j, i.e. X_iX_j. The analysis of interaction provides information on the sign and statistical significance of the interaction.

To conduct the multiple regression analysis with interaction effects, we used the approach recommended by Aiken and West (1991). Our study is based on moderately correlated bivariate predictors manifesting the relational performance of two dyads and their interaction. The network rent pertains to the non-additivity of the effects of independent variables – the relational performance generated by two dyads that exists in a population of triads for a particular dependent variable – the operational performance of the manufacturer (Burt, 1992; Kraemer and Blasey, 2004).

The scores of factors, derived from the Factor Analysis when assessing unidimensionality, were used to demonstrate the operational performance of the manufacturer and the relational performance of dyads (main terms in the model). The cross-product (interaction term) manifests the network rent that was generated from the factor scores of both relational performances. In addition four control variables were induced in the model: manufacturer's size, age of the manufacturer, the share of the customer's revenue that is generated by the product supplied by the manufacturer (SCR), and the share of the manufacturer's cost of goods sold that is generated by the product supplied by the supplier (COGS). Table 1 shows the detailed results of regression analysis with interaction effects.

Table 1. Multiple Regression Model with Interaction Effects

Variables	Model	β	t	*p*-value	*VIF*	*adj.* R_{square}
Independent variables	Relational performance of upstream dyad	.357	5.14	.000	1.06	.293
	Relational performance of downstream dyad	.684	8.21	.000	1.14	
	Network rent	.205	2.13	.036	1.17	
Control variables	# employees	.424	3.81	.000	1.15	
	Age	.084	.766	ns.	1.10	
	SCR	.341	2.17	.033	1.19	
	COGS	.211	1.96	.054	1.07	

ns. – not significant

The values of *VIFs* in the obtained model range from 1.00 – 1.20, which is a commonly accepted level for detecting multicollinearity, suggesting a moderate (not problematic) correlation between variables (Akinwande *et al*., 2015). A Durbin-Watson statistic estimated for the model is 1.82 and does not demonstrate a very low level of autocorrelation between the variables (Field, 2009). The regression analysis for operational performance of the manufacturer showed that the adjusted coefficient of determination (R^2_{adjusted}) is .293. It suggests that the predictors explain roughly 30 percent of the variance in operational performance. As depicted in Table 1, all three predictors are significant in the model. The model has *F*-ratio value of 5.42 percent, which indicates that the null hypothesis of no relationship or a negative relationship between independent variables and operational performance can be rejected at the level of $p < .01$, as demonstrated by the positive regression coefficients for independent variables. The standardized regression coefficients indicate the relative strength of each of the significant independent variables, as demonstrated by (beta, *p*) at the end of each variable. There is a positive influence of the relational performance generated by upstream dyad (.357, .000), downstream dyad (.684, .000), and network rent (.205, .036) on operational performance. It is also worth noting that both factors of relational performance quite similarly contributed to operational performance. In other words, the higher the relational performance generated by upstream and downstream dyads, the greater the overall operational performance. Interestingly, the network rent, interpreted as the additional effect of the reciprocal influence of relational performance generated by two dyads, is significant in the model at $p < .05$. This finding suggests that network rent actually exists in the examined triads. Moreover, it has a positive influence on the operational performance of the manufacturer. This clearly evidences that an increase of network rent significantly contributes to the higher level of operational performance. Furthermore, the findings revealed that three out of four control variables have a positive and significant impact on the operational performance (.424, .000). Specifically, empirical results indicated that the effects of manufacturer's size on the operational performance increase. Thus, larger manufacturers occupying the structural hole have more power, than smaller ones, to shape the relationships both with the supplier and the customer, to generate benefits. In addition, both control variables: the share of the customer's revenue that is generated by the product supplied by the manufacturer (.341, 033), and the share of the manufacturer's cost of goods sold that is generated by the product supplied by the supplier (.211, .054) have a positive and significant impact on the operational performance. The obtained results suggest that the higher operational performance is obtained when the manufacturer positioned on the structural hole is a more important business partner for the supplier and the customer. Finally, the age of the manufacturer appeared to be insignificant for the operational performance. This may demonstrate that regardless of the manufacturer's age, the company is capable of sitting on top of the structural hole and derive benefits.

4.2. Cluster Analysis

Having confirmed the existence of network rent, we employed the cluster analysis to group the business units using relationships as a clustering criterion (Humphries *et al.*, 2007; Kannan and Tan, 2010; Khan *et al.*, 2009). Based on the quality of relationships, we determined clusters that symbolized the structural hole states of triads. We then used the ANOVA analysis to test whether the obtained structural hole states differ significantly with respect to the factorial value of the network rent.

4.2.1 Characteristics of the clusters

Based on the relational posture scores of both dyads (supplier-manufacturer, and manufacturer-customer), *K-means* cluster analysis was applied. We used the *a priori* theory approach to determine the number of clusters (Hair *et al.*, 1992) and provide a benchmark for assessing the findings of the

theory-testing inquiry. As each cluster was to represent one out of four types of the structural hole state, the number of four clusters were used to perform the cluster analysis. The criterion for cluster membership was the minimal Euclidean distance between each case and classification center represented by centroid – cluster center (Ketchen and Shook, 1996).

The *F*-values computed for the relational posture indices of upstream and downstream dyads are 57.14 and 74.12, respectively, and show that the scores significantly differentiate clusters at $p <= .05$. The first cluster contains 12 percent of the research sample and indicates a negative opinion on the relational posture of upstream dyad, as well as a slightly positive view on the relational posture of downstream dyad. In the light of the findings, we argue that the first cluster represents structural hole state 2 with negative (adversarial) and positive (cooperative) relational posture of upstream and downstream dyad, respectively. On the other hand, cluster 2, including the largest fraction of 36 percent of the sample, demonstrates a positive relational posture of both dyads. Therefore, we acknowledge cluster 2 to be referred to as structural hole state 1. Cluster 3 includes the share of 19 percent of the sample that reports positive relational posture of upstream dyad and extremely adversarial relational posture of downstream dyad. Accordingly, we posit cluster 3 to exemplify structural hole state 2 with positive and negative relational posture of upstream and downstream dyad, respectively. Finally, cluster 4 contains 33 percent of triads in the sample. This group is the most restrained to the investigated phenomenon, as it indicates negative relational posture of both dyads. Therefore, we suggest cluster 4 to be referred to as structural hole state 3.

4.2.2. Relationship between the structural hole states and the network rent

In order to draw a richer picture within the quantitative data, we selected the network rent as the external variable to be used for linking with the obtained clusters. In order to recognize whether the network rent is significant across all four clusters, we performed the ANOVA analysis and test for means. Due to a relatively small number of cases (72 in total), we first performed the Levene's test in order to check if there is homogeneity amongst variances of the obtained groups. As the outcome of Levene's test is insignificant at $p <= .05$, the hypothesis of homogeneity of variances can be accepted. The obtained findings were additionally confirmed by *F*-test for homogeneity of variances, which demonstrated that none of the six test values is less than .05. The results suggest that running the ANOVA analysis is justified from the methodological point of view, as empirical data manifesting the network rent are not too heterogeneous and belong to the same universe of variation phenomena (Schmidt and Hollensen, 2006). Table 2 depicts the ANOVA analysis of the network rent across clusters. It shows that the *F*-value is relatively high and the average network rent differs across the four clusters at $p <= .05$.

Table 2. ANOVA of the network rent across four clusters

Source of variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	79.727	3	26.575	207.62	.00000	2.739
Within Groups	8.703	68	.1279			
Total	88.430	71				

While the ANOVA analysis demonstrates that an overall difference between the structural hole states exists, it does not inform about the directional specifics concerning the detected differences (i.e. between two specific structural hole states). Therefore, in order to obtain a fuller picture of the direction of the relationship between the particular cluster and the rent, we performed test that investigated the differences in average rents between each pair of clusters. Table 3 depicts the results of test for means.

Table 3. Factorial value of network rent – differences in means across structural hole states

Test: Two Sample for Means	Pair 1		Pair 2		Pair 3		Pair 4		Pair 5		Pair 6	
	Cluster 1	Cluster 2	Cluster 1	Cluster 3	Cluster 1	Cluster 4	Cluster 2	Cluster 3	Cluster 2	Cluster 4	Cluster 3	Cluster 4
Mean	-0.9078	1.4758	-0.9078	-1.1802	-0.9078	0.2674	1.4758	-1.1802	1.4758	0.2674	-1.1802	0.2674
Known Variance	0.1201	0.0844	0.1201	0.3727	0.1201	0.0357	0.0845	0.3771	0.0845	0.0357	0.3727	0.0357
Observations	9	26	9	14	9	23	26	14	26	23	14	23
Hypothesized Mean Difference	0.0000		0.0000		0.0000		0.0000		0.0000		0.0000	
Z	-18.5052		1.3628		-9.6279		15.2876		17.4378		-8.6240	
P(Z<=z) one-tail	0.0000		0.0865		0.0000		0.0000		0.0000		0.0000	
z Critical one-tail	1.6449		1.6449		1.6449		1.6449		1.6449		1.6449	
P(Z<=z) two-tail	0.0000		0.1730		0.0000		0.0000		0.0000		0.0000	
z Critical two-tail	1.9600		1.9600		1.9600		1.9600		1.9600		1.9600	

Since the difference between the average network rent in certain structural hole states can go both ways, a two-tailed test applies. Based on the comparison of the average factorial values of network rent, we argue that excluding cluster 1 and 3 (pair 2), for which no significant differences were detected, the comparison of the remaining five pairs indicated significant differences at $p <= .05$. In particular, significant differences arose in the comparison between cluster 2, representing structural hole state 1, and all other groups. Moreover, cluster 1, representing structural hole state 2, is significantly different from cluster 4 (pair 3). The latter one, demonstrating structural hole state 3, significantly differs from cluster 3. Accordingly, the results of test for means suggest that, except for pair 2, there is a significant difference between the network rent demonstrated by the remaining pairs of structural hole states.

5. Research Findings and Discussion

By applying a Multiple Regression Model with Interaction Effects, we generally found that the joint effect between the relational performances of two dyads contributes to yielding additional rent for the manufacturer sitting on the structural hole. Therefore, following Burt (1992), the manufacturer indeed holds the position of *tertius*, the third one that profits – more specifically – the third that yields the network rent. This research finding lends a support to H_1. Clearly, the structural hole enables the manufacturer to establish relationships to derive a supernormal profit as the outcome of mutual interplay between the relational performances of two dyads. The quality of bilateral relationships in dyads determines the relational performance which, in turn, affects the network rent. Depending on the relational posture of both dyads shaped by the manufacturer positioned on the structural hole, the interplay between the relational performance of upstream and downstream dyads will yield a different network rent. Figure 1 depicts the relationship between the structural hole states and the average the network rent (‘bubble’ size equates to the number of triads contained in each cluster). The findings suggest that there is a significant difference between the mean values of network rent across the

structural hole states. In particular, the following findings from the analysis of variance may be derived:

- the highest average value of rent that equates 1.475 and is generated in structural hole state 1;
- no rent is generated in structural hole state 3, as the value of rent is close to 0 (exactly .267);
- no rent is generated in structural hole state 2, as the average rent indicates the lowest value and equates -.907 (cluster 1) and -1.180 (cluster 3).

The rent in structural hole state 1 is the highest, as manufacturers take full advantage of their privileged position in favor of themselves and the remaining actors in a triad. This is evidenced by the consistent and highly-rated responses of both actors (supplier-manufacturer or manufacturer-customer) when investigating the relational performance of dyads. Moreover, we argue that both actors collaborating with the manufacturer and located on the extreme positions in their triads also enjoy additional benefits offered by the network rent.

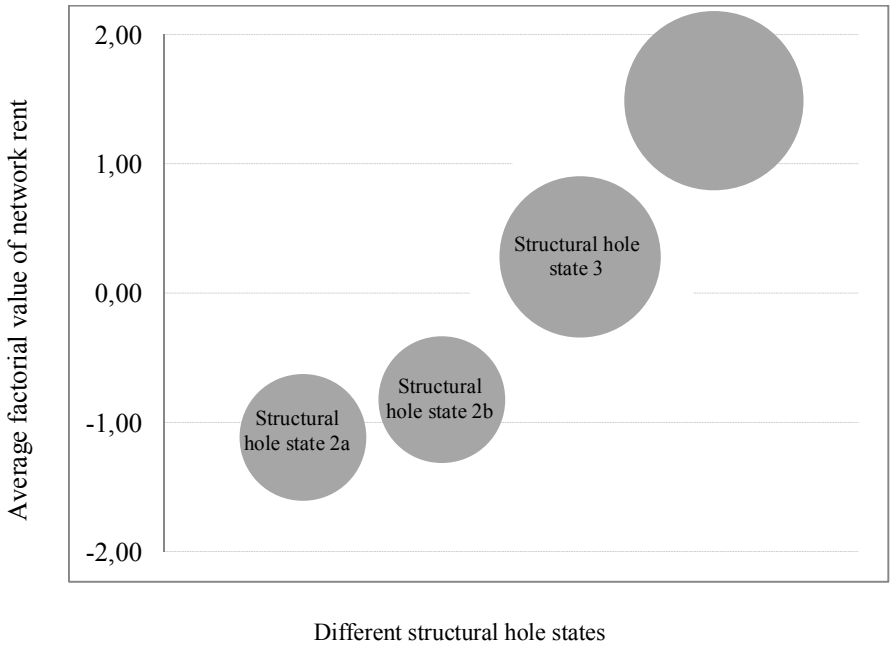

Fig. 1. Clusters of triads ordered by increasing mean average factorial value of the network rent

The research findings suggest that positive relational postures maintained by manufacturers with actors in an upstream and downstream dyad contribute to yielding the network rent. However, following the study of Gammelgaard and Larson (2001), we acknowledge that manufacturers need to learn how to communicate, coordinate, and cooperate with supply chain partners to fill in the structural hole properly. Information sharing and joint planning help better understand customer requirements and enhance demand forecasting, thus allowing manufacturers to match upstream and downstream activities in a triad. As the result, manufacturers will be capable of providing better quality products at a lower cost and in a more flexible way. Cohen and Roussel (2005) posit that this will lead to better operational performance of manufacturers and their collaborators in a triad. In the light of the findings, among the three structural hole states, the highest significant network rent is generated by the manufacturer in the triadic supply chains consisting of the cooperative posture of both dyads. This finding lends a support to H_2.

The manufacturer in structural hole state 3 establishes adversarial relationships in both dyads. Understandably, as both relational postures are negative, they do not generate any relational benefits whose reciprocal interactions could be magnified in the form of network rent. This may partially explain no rent generated for the manufacturer in structural hole state 3. In case of structural hole state 2, the findings go even further to indicate the negative return (or loss) derived by the manufacturer in this group of triads. Interestingly, both clusters demonstrating structural hole state 2a and 2b indicate no significant difference between the mean values of network rent. This probably stems from the fact that both groups belong to the same structural hole state. However, it is interesting to observe that regardless which relationships in a triad are positive and which are negative, the rent is similarly low. In other words, the relational performance of upstream and downstream dyad appears to have similar importance for the network rent. This finding appears to be in line with the study of Hou (2012), where manufacturer's performance with customers carries similar weight in influencing financial performance directly, as does manufacturer's performance with suppliers.

In these triadic arrangements, the structural hole is not filled by the manufacturer to establish relationships that enable to yield the network rent. In other words, allying with one partner against the other one, as depicted by structural hole state 2, yields counter-productive effects from the perspective of the network rent. Interestingly, there is an imbalance in the trade-off relationship between relationships in both dyads. Clearly, the benefits reaped from the relational performance of one dyad are not balanced by the loss generated by the relational performance of the other dyad. On the contrary, in fact, the negative outcome of the relational performance of one dyad outweighs the positive results of the other. Choi and Wu (2009a) provided a description of detrimental process triggered by the coexistence of positive and negative relationships in a triad. Drawing upon this example, we argue that the structural hole loses its potential as the source of the network rent. As a consequence, the manufacturer progressively becomes less attractive for the actors in both dyads that irrevocably lose their opportunity to enjoy additional benefits offered by the network rent. As the manufacturer may use its position to play out the supplier and the customer (i.e. temporarily establishing cooperative relationship in one dyad and adversarial one in other dyad), both actors are more likely to make long-term losses. Accordingly, due to the existence of adversarial relationship in one dyad, both actors on the extreme positions in a triad are unable to take a full advantage of their complementary resources, and ultimately, they may lose interest in further collaboration within the existing arrangement. For that reason, the structural hole arrangement is much more likely doomed to decay. If the value of rent is significantly low (like in the case of structural hole states 2 and 3), the manufacturer presumably intends to exploit its position in favor of itself to increase only its own profit. Sometimes manufacturers are not willing or capable of exploiting the relationships to generate additional profits. If they are not willing to shape the relationships that enable to produce the network rent, they are probably satisfied with employing more adversarial relational posture in their triads. Although the manufacturer wastes the potential opportunities that come up when establishing relationships that provide the network rent, it is still able to capitalize on its *tertius* position in a different way. Admittedly, the findings of our study show that there is a positive and significant relationship between the rent and the manufacturer's operational performance, which suggests that a substantial decrease in the value of network rent determines a sharp decline in the manufacturer's operational performance. However, judging on the value of the adjusted coefficient of determination in the Multiple Regression Model for the network rent, we may envisage that other factors than the relational posture also contribute to operational performance of the manufacturer. In fact, the manufacturer may still reap substantial benefits from using the structural hole to establish an antagonistic relationship in its triad. An essential condition for yielding benefits other than the network rent though, is to keep both partners – the supplier and the customer – separated. In other words, the manufacturer, as the only actor in a triad that has direct relationships with both partners, can make use

of its advantage over the other two actors to impose additional financial burdens with no compensation for the supplier and the customer. Following the opinion of Choi and Wu (2009a), as the manufacturer places direct pressure on the supplier and the customer in structural hole states 2 and 3, it is more likely that strong-arm tactics creates animosity from both actors. At times, the manufacturer may also be unable to establish relationships providing the network rent. It might be too weak to leverage power and generate the network rent, especially when it loses its privileged position in favor of two other actors, who tend to establish positive relationships between each other (Choi and Wu, 2009a).
The obtained findings of the study do not fully support H_3, as interestingly, the lowest significant network rent (actually it is negative) is generated by the manufacturer in structural hole state 2 consisting of both cooperative and adversarial dyads. In case of the structural hole arrangements built on two adversarial dyads, no rent is generated. To conclude, the findings suggest that the lowest significant values of network rent are demonstrated by manufacturers in structural hole state 2, while moderate values of network rent are yielded by manufacturers in structural hole state 3.

6. Conclusions and implications of the study

Our study offers several contributions to the theory of triadic supply chains. First, the findings of our empirically-based study suggest that mostly conceptual conclusions drawn from the analysis of other triadic arrangements with the structural hole might also be applied for triads operating within a manufacturing setting. Moreover, while prior research concerning triads mostly focused on either upstream or downstream side of supply chains (Choi and Wu, 2009b; Storey *et al.*, 2006; Das *et al*., 2006; Koufteros *et al*., 2007), our study sought to merge the upstream and downstream perspective of a supply chain. It operationalized how dyads may affect one another in a triad with the manufacturer positioned on the structural hole. This study also shows that the structural hole may not only be used to build antagonistic relationships. Admittedly, the manufacturer sitting on the structural hole may be considered as *tertius* – the third that profits (Burt, 1992), which is capable of playing two actors against each other, or allying with one partner against the other one. However, our study also suggests that the manufacturer in a triad might also act as the third that yields the network rent and tends to simultaneously establish a positive relational posture to two other actors (as illustrated by structural hole state 1) in such a way that the joint effect of relational performance generated by both dyads contributes to reaping significantly higher profits for all actors involved. The findings of the study may also contribute to the theory of network rent that assumes establishing collaborative relationships based on mutual benefits (Coombs and Metcalfe, 2000). Our study empirically evidenced that the network rent appears to be preferably characterized by a non-zero sum relationship where all participants of certain arrangement can be winners *(win-win situation)* (Dyer and Nobeoka, 2000; Joshi and Campbell, 2003). Therefore, along with the highest rent derived by the manufacturer in structural hole state 1, two other actors (the supplier and the customer) are also more likely to reap substantial benefits in such a triadic arrangement. In other words, all three actors in a triad benefit to some extent from structural hole state 1, although total benefits are not, most presumably, evenly distributed among the actors.

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