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Push and Pull Strategies by Component Suppliers When OEMs can Produce the Component In-house: The Roles of Branding in a Supply Chain

Abstract

In the supply chains that consist of component suppliers (CSs), original equipment manufacturers (OEMs) and industrial customers (ICs), CS managers must manage the relationships with both their direct customers (OEMs) and indirect customers (ICs). In this research, we explore the effects of CSs' push and pull strategies on OEMs' component adoption decision in situations where OEMs can produce the components in-house. We hypothesize on how CS branding and OEM branding moderate the effects of push and pull strategies and on a boundary condition for the moderating effects. Survey measures from 195 Chinese mining-equipment companies and their actual component adoption data support our hypotheses. Our analysis shows that both push and pull strategies induce OEMs' adoption of the CS's components (instead of the ones made in-house). A strong CS brand image promotes the adoption, but a strong OEM brand image curbs it. Both of the brand images strengthen (weaken) the effectiveness of push (pull) strategies. Moreover, an IC's loyalty to an OEM weakens (strengthens) the positive moderating effects of CS (OEM) brand image on the relationship between push strategies and the adoption of the CS's components. Our findings are new to the literature and make implications for both marketing academics and practitioners.

Keywords: B2B branding; Push strategy; Pull strategy; Component supplier branding; OEM branding; Ingredient branding; Component adoption decision; Customer loyalty to OEM.

1. Introduction

Along the supply chain hierarchy that is often made up of component suppliers (CS), original equipment manufacturers (OEM) and their common pool of industrial customers (IC), it has become crucial for CS managers to effectively manage the relationships with both their direct customers (OEMs) and indirect customers (ICs) so they can obtain valuable insights about the downstream markets and provide added values to their customers (Dahlquist & Griffith, 2014; Homburg, Klarmann & Schmitt, 2011; Homburg, Wilczek & Hahn, 2014; Worm & Srivastava, 2014). To ensure the sustainability of their business, CS managers employ both push and pull strategies to influence their customers' buying decisions. Push strategies are used to create superior value for OEMs through building strong partnerships proactively and providing them with additional benefits and cost savings (Homburg, Wilczek & Hahn, 2014; Worm & Srivastava, 2014), whereas pull strategies rely on gaining strong brand awareness (Homburg, Klarmann, & Schmitt, 2011; Hutton, 1997), building brand differentiation and strong brand image among ICs (Chiou, Wu & Chuang, 2010; Frazier, 1999). Pull strategies can be impactful as they help to stimulate ICs' liking on the CS's components and to request the OEMs to use only certain CS's components, which in turn can increase OEMs' demands for the CS's components (Dahlquist & Griffith, 2014; Wuyts, Verhoef & Prins, 2009).

Although the notions of push and pull are well understood and these strategies have been practiced in the business world for a long time, research on their impact in the B2B market context is still lacking. In this research, we intend to explore how a CS can use its push and pull strategies more effectively to encourage OEMs' adoption of its components when the OEMs have the option of producing the components in-house or outsourcing. Although such "plural sourcing" by OEMs is widespread in practice and has attracted much research attention (Krzeminska, Hoetker & Mellewigt, 2013; Parmigiani, 2007; Puranam, Gulati & Bhattacharya, 2013; Sako, Chondrakis & Vaaler, 2016), studies from the marketing's perspective have been scarce. To the best of our knowledge, there has been no B2B marketing research that examines such situations. This is surprising because OEMs' ability to manufacture the components in-house and to buy from others poses severe challenges to CSs' businesses. When OEMs can produce the component in-house, CSs can suffer from reduced bargaining power in the relationships with OEMs and weakened influence on ICs (Emerson, 1962). Due to the lack of research in this context, it is unclear how a CS should develop marketing strategy to induce an OEM to adopt the CS's components. Which strategy is more effective for the CS, push strategies or pull strategies? What are the contingencies and how can a CS use push and pull more efficiently?

In addition, the branding of CSs and OEMs should be taken into consideration because the strength of their branding also plays a crucial role in the OEMs' component adoption decision. It is well accepted that branding is one of the most important supply chain strategies for both CSs and OEMs. Many studies have examined ingredient branding in B2C markets in the past (Desai & Keller, 2002; Rao, Qu & Ruekert, 1999; Simon & Ruth, 1998). Others have demonstrated that CS branding can assist brand differentiation and build strong CS brand image, which is then leveraged (possibly by both CS and OEMs) to increase profitability (Dahlquist & Griffith, 2014; Ghosh & John, 2009; Worm & Srivastava, 2014). Furthermore, extant research has also investigated the marketing strategies that a CS can use to approach its ICs (Homburg, Wilczek & Hahn, 2014), the effects of CS branding on performance (e.g., Dahlquist & Griffith, 2014; Homburg, Klarmann & Schmitt, 2011; Homburg, Wilczek & Hahn, 2014; Worm & Srivastava, 2014), OEMs' response behaviors such as aligning and opposing behaviors (Dahlquist & Griffith, 2014), and selection of a white box contract or a branded component contract (Ghosh & John, 2009).

Despite the research effort and fast-growing body of literature on B2B branding (Leek & Christodoulides, 2011; Seyedghorban, Matanda & LaPlaca, 2016), empirical studies on CS branding in a supply chain context (and from the CS's perspective) remain limited, and very few studies have incorporated both CS branding and OEM branding in their research framework. It is important to note that the role of OEM branding in supply chains should not be neglected, because OEM branding can change supply chain members' decisions and strategies. Previous studies have proven that a strong OEM brand can favorably affect an ICs' buying decision (Hutton, 1997; Wuyts, Verhoef & Prins, 2009; Zablah, Brwon & Donthu, 2010), and such a brand could empower the OEM with greater bargaining power against the CS and at the same time mitigate the CS's effort in brand differentiation. With the lack of research studies that incorporate both OEM and CS branding in the context of push and pull strategies in supply chains, the literature is yet to assist marketing managers to make informed decisions. Do CS branding and OEM

branding influence the OEM's component adoption strategy in different ways? More importantly, how do CS branding and OEM branding change the effects of CSs' push and pull strategies on the OEM's component adoption decision? Are there boundary conditions for the moderating effects of CS and OEM branding on the effectiveness of push and pull strategies?

In this research, we aim to explore a CS's push and pull strategies when OEMs can choose to buy or to manufacture the components in-house. Our focus is to examine how CS branding and OEM branding moderate the effects of the CS's push and pull strategies on an OEM's component adoption decision, and establish a boundary condition for the moderating effects. The empirical part of our study examines the supply chain of mining scraper conveyors in China and in this industry, the OEMs (i.e., producers of mining scraper conveyors) are featured with the ability to produce a critical component (i.e., high-strength chain) internally or to buy from component suppliers (i.e., producers of high-strength chains) externally. Survey measures from 195 mining equipment companies and their actual component adoption data generally support our hypotheses. Our analysis shows that both push and pull strategies have positive impact on an OEM's adoption of the CS's components (instead of producing in-house). A strong CS brand image helps promote the OEM's adoption of the CS's components, and a strong OEM brand image hampers that adoption. Moreover, a strong CS brand image strengthens the effect of the CS's push strategy and weakens the effect of its pull strategy. Similarly, a strong OEM brand image also strengthens the effect of CS's push strategy and weakens the effect of its pull strategy.

As for the boundary condition of the moderating effects of branding on the relationships between push/pull strategies and an OEM's use of the CS's components, we are concerned with customer loyalty as it plays an important role in B2B marketing (Davis-Sramek, Droge, Mentzer & Myers, 2009; Palmatier, Scheer & Steenkamp, 2007). Our analysis shows that an IC's loyalty to an OEM weakens the positive moderating effect of a CS's brand image on the relationship between the CS's push strategy and the OEM's adoption of the CS's component, but strengthens the positive moderating effect of the OEM's brand image on the relationship between the CS's push strategy and the OEM's adoption of the CS's component. Our findings are new to the literature and provide significant implications for both marketing academics and practitioners.

In the following sections, we first provide the rationales underlying our research framework and develop theoretical arguments supporting each of the hypotheses. Section 3 describes the methodology and Section 4 discusses the empirical results. Section 5 concludes the article with theoretical and managerial implications and directions for further research.

2. Theory and hypothesis

2.1 Branding in B2B markets

Traditionally, branding has been viewed as being irrelevant to B2B and industrial markets (Saunders & Watt, 1979). Associated mostly with emotional value, branding was thought to be of limited significance to formal and rational decision-making processes, in which trained professionals are responsible for decision making (Keller & Kotler, 2012; Lynch & de Chernatony, 2007). However, recent empirical research has not only acknowledged the importance of branding (Bendixen, Bukasa & Abratt, 2004; Kotler & Pfoerrtsch, 2007; Mudambi, 2002; Sheth & Sinha, 2015; Zablah, Brown & Donthu, 2010), but also demonstrated its influence on decision-making processes in B2B markets (Low & Blois, 2002; Wise & Zednickova, 2009).

Brands can provide a number of values to industrial buyers. They can enhance their perceived quality of products or services (Cretu & Brodie, 2007) and their confidence in decision making process (Michell, et al., 2001; Low & Blois, 2002), increase their level of satisfaction on the purchase decision (Low & Blois, 2002), and provide them with "feel good" factor and comfort (Mudambi, 2002). In addition, brands can reduce buyers' perceived risk and uncertainty in the buying decision process (Bengtsson & Servais, 2005; Mudambi, 2002), and assist decision-making units to reach consensus (Wise & Zednickova, 2009).

Because of these values, branded products and services are more easily placed on the bid list and often demand premium prices (Michell, et al., 2001; Low & Blois, 2002; Wuyts, et al., 2009), and buyers are generally more willing to pay extra (Hutton, 1997). Branded products and services can also facilitate communications between sellers and buyers (Michell, et al., 2001; Ohnemus, 2009) and are more likely to get referrals in business markets (Bedixen, et al., 2004; Hutton, 1997). In general, a strong brand enables

industrial marketers to gain higher customer satisfaction and loyalty (McQuiston, 2004), and better financial performance (Aaker & Jacobson, 2001; Dahlquist & Griffith, 2014; Homburg, et al., 2011; Worm & Srivastava, 2014) and relational outcomes (Cretu & Brodie, 2007; Gosh & John, 2009).

Although the literature of B2B branding has been expanding fast since 2000s (Seyedghorban, et al., 2016), only limited attention has been paid to CS branding in the supply chain context. As the literature on ingredient branding in B2C markets grows (Desai & Keller, 2002; Simon & Ruth, 1998; Swaminathan, Reddy & Dommer, 2012), scholars began to investigate the issues of CS branding in B2B markets (Kotler & Pfoertsch, 2010). They have demonstrated that a strong ingredient brand can increase customers' product perceptions (Desai & Keller, 2002; Park, Jun & Shocker, 1996; Rao, Qu & Ruekert, 1999; Simon & Ruth, 1998). This principle has been extended to B2B markets where CS branding can enhance the differentiation between OEMs in the eyes of ICs, which in turn affects the ICs' selection of OEMs (Ghosh & John, 2009). From the perspective of CSs, component branding can contribute to their financial performance (Dahlquist & Griffith, 2014; Homburg, et al., 2011; Worm & Srivastava, 2014). Nonetheless, research of CS branding is still in an early stage, and more attention is needed in this research area.

2.2 The effects of CS's push and pull strategies on OEM's component adoption

According to Dahlquist and Griffith (2014), in order to increase market performance, CS marketing managers must wisely allocate marketing investments onto their direct customers (i.e., OEMs) and indirect customers (i.e., ICs) so that their components can be adopted by OEMs. A CS can allocate marketing investment to OEMs to motivate their desirable behaviors (push strategy, Frazier, 1999). In the meantime, it can also devote its marketing resources to promote its own brand and gain preference among end customers (pull strategy, Frazier, 1999; Gerstner & Hess, 1995). These two kinds of marketing efforts have different working mechanisms and goals.

As highlighted in the relationship marketing studies (Palmatier, Dant, Grewal & Evans, 2006), a push strategy, or direct customer downstream support strategy in industrial supply chains (Homburg, Wilczek & Hahn, 2014), strengthens OEM-CS relationships. It represents CSs' relational and value-added activities to improve OEMs' products and profits and reduce their costs and risks. For instance, together with trade promotions, a good understanding of OEMs' market environment and needs enables CSs to extend better solutions such as component customization, on-time delivery and high quality services (Homburg, Wilczek, & Hahn, 2014; Joshi, 2009; Ulaga & Eggert, 2006), assist OEMs to operate more efficiently and effectively (Frazier, Speckman & O'Neal, 1988; Hallén, Johanson & Seyed-Mohamed, 1991), and avoid unnecessary and costly corrections after delivery is made (Cannon & Homburg, 2001). Such activities enable CSs to attract and persuade OEMs to adopt their components. Thus,

H1: A CS's push strategy has a positive effect on an OEM's adoption of the CS's component.

A pull strategy, or independent indirect customer marketing in industrial supply chains (Homburg, Wilczek, & Hahn, 2014), aims to build strong CS brand awareness and gain preference among ICs (Homburg, et al., 2011), which in turn boosts the demand and prompts OEMs to adopt the CS's components (Desai, 2000; Worm & Srivastava, 2014). Perhaps more importantly, a CS's pull strategy can encourage ICs to indicate and express their preferences to OEMs. To the extent that a particular CS's component is "solely specified" by ICs (Dahlquist & Griffith, 2014), OEMs are forced to follow the request and adopt that CS's components to avoid the possibility of losing the business. Thus,

H2: A CS's pull strategy has a positive effect on an OEM's adoption of the CS's component.

2.3 The moderating effect of CS's brand image

Brand image is defined as "perceptions about a brand as reflected by the brand associations held in consumer memory" (Keller, 1993), or as consumers' mental picture of a product or service (Dobni & Zinkhan, 1990). In B2C markets, brand image is about the symbolic meaning that consumers associate with the offerings, which influences consumers' response to marketing activities of the brand (Keller, 1993). It is mainly a perceptual factor that is "formed through consumer interpretation, whether reasoned

or emotional" (Dobni & Zinkhan, 1990). In B2B markets, brand image also plays an important role (Cretu & Brodie, 2007; Mudambi, Doyle & Wong, 1997). In this research, we define CS/OEM brand image as the end customers' (i.e., ICs') perception of the CS/OEM brand (Keller, 1993; Worm & Srivastava, 2014). Prior research has shown that a strong brand image has a positive effect on customers' perception of quality of the products or services (Cretu & Brodie, 2007), and that a CS's brand image positively affects the firm's profitability when product differentiation is strong and technology is highly intensive (Worm and Srivastava, 2014).

We propose that a CS's brand image positively moderates the effect of a CS's push strategy on an OEM's adoption of the CS's components. Push strategy focuses on building strong CS-OEM relationships through value-added activities and reduction of costs and risks of the OEMs (Cannon & Homburg, 2001; Worm & Srivastava, 2014). A strong brand image increases customers' perceived quality (Cretu & Brodie, 2007) and provides the products or services with a consistent, unique identity (Michell, et al., 2001). Thus, when a CS has a strong brand, its value-added, and cost and risk reduction activities associated with its push strategies are likely to be perceived to be more valuable for OEMs. In addition, its communication is perceived to be more credible and acceptable by customers (Low & Blois, 2002; Ohnemus, 2009). Because a strong CS brand enhances the effectiveness of its push strategies, we propose,

H3a: A CS's brand image strengthens the effect of its push strategy on an OEM's adoption of the CS's component.

Research on ingredient branding in B2C markets has demonstrated that a strong ingredient brand can enhance consumers' perception of product quality (Desai & Keller, 2002; Park, et al., 1996; Simonin & Ruth, 1998). Similarly, a strong CS brand can help increase the perceived differentiation of an OEM's offering in the eyes of ICs (Ghosh & John, 2009). It can also facilitate ICs' buying decision by reducing their information costs and perceived purchase risk (Homburg, et al., 2011; Zablah, et al., 2010). When a CS brand is strong enough, ICs may request an OEM to purchase the components from that specific CS.

When ICs specifies a component supplier, the OEM may face a lock-in situation and have restricted choices of component supply. The CS, on the other hand, can use its pull strategies and leverage its brand to increase its own profit at the expense of the OEM (Dahlquist & Griffith, 2014). Being pressured by both CSs and ICs, the OEM may experience a threat of losing autonomy and it is in its own interest to fight to maintain its position in the supply chain and to protect its business and profit. Under such situations, the greater the CS branding, the severer the threat the OEM feels about the CS's pull strategies, and thus the stronger the resistance. Thus,

H3b: A CS's brand image weakens the effect of its pull strategy on an OEM's adoption of the CS's component.

2.4 The impact of IC's loyalty to OEM on the moderating effects of CS brand image

Customer loyalty refers to "a deeply held commitment to rebuy or re-patronize a preferred product/service consistently in the future, ... despite situational influences and marketing efforts having the potential to cause switching behavior" (Oliver 1999). It is central to firms' strategies and performance (Palmatier, et al., 2007; Reichheld, 1996). Extant literature has demonstrated that a customer can be loyal to a product/service, a brand, a salesperson, or a firm (Palmatier, et al., 2007). Although research on customer loyalty has covered both B2C and B2B domains, studies in B2B context are significantly less (Davis-Sramek, et al., 2009; Palmatier, et al., 2007).

In this study, we focus on an IC's loyalty to an OEM. According to the literature, an IC's loyalty to an OEM embodies two distinct intentions, namely, the intention to repeat purchase from the OEM, and the intention to recommend the OEM to other ICs (Lam, Shankar, Erramilli & Murthy, 2004). In B2B relationships, customers' loyalty is built through value-add activities and cost benefits offered by the supplier (Cannon & Homburg, 2001; Palmatier, et al., 2007), high level of customers' satisfaction (Lam, et al., 2004; Chandrashekaran, Rotte, Tax & Grewal, 2007) and mutual trust (Chiou, et al., 2010; Doney &

Cannon, 1997). In general, loyal customers focus more on long-term benefits of both partners in B2B relationships (Doney & Cannon, 1997; Ganesan, 1994), tend to be more engaged in cooperative actions such as willing to pay more for the product/service (Reichheld, 1996), and have greater resistance to competing offerings (Dick & Basu, 1994).

We propose two three-way interaction effects of an IC's loyalty to an OEM, a CS's brand image, and the CS's push and pull strategies on the OEM's adoption of the CS's component. Specifically, we suggest that a strong IC's loyalty to an OEM weakens the positive moderating effect of a CS's brand image on the relationship between the CS's push strategy and the OEM's adoption of the CS's component. Given the importance of an IC's loyalty to an OEM (Anderson & Mittal, 2000; Palmatier, et al., 2007), maintaining good rapport with ICs is vital (Davis-Sramek, et al., 2009). To ensure a cooperative and stable relationship with the ICs who are highly loyal, an OEM is like to choose the components that are best fits for the ICs. In essence, when ICs loyalty to the OEM is high, the OEM focuses more on the CS's component quality and functions as well as the perceived value provided by the CS's push strategy (rather than the CS's brand image), and as a result, the positive moderating effect of the CS's brand image on the relationship between the CS's push strategy and the OEM's adoption of the CS's component is expected to be weakened. Thus,

H4a: The greater the IC's loyalty to an OEM, the weaker the strengthening effect of a CS's brand image on the relationship between the CS's push strategy and the OEM's adoption of the CS's component.

Similarly, we posit that a strong IC's loyalty to an OEM weakens the negative moderating effects of a CS's brand image on the relationship between the CS's pull strategy and the OEM's adoption of the CS's component. An IC's loyalty to an OEM can alleviate the OEM's perceived pressure caused by a CS's brand image. In the presence of the loyalty and trust, the IC is more willing to support and engage in a cooperative relationship with the OEM, rather than insisting on a specific CS's components (Doney & Cannon 1997; Ganesan 1994; Lam, et al., 2004). So, when the IC's loyalty to an OEM is high, the OEM is able to maintain a higher autonomy in choosing a suitable CS component on behalf of the IC, thereby mitigating the moderation effect of the CS brand on the OEM's component adoption decision. Thus,

H4b: The greater the IC's loyalty to an OEM, the weaker the weakening effect of the CS's brand image on the relationship between the CS's pull strategy and OEM's adoption of CS's component.

2.5 The moderating effect of OEM's brand image

An OEM's brand image perceived by ICs represents their reasoned or emotional perceptions of the OEM's brand (Keller, 1993; Low & Lamb, 2000) that affects their purchase decision. A branded OEM has strong bargaining power and advantage in the relationships with CSs (Worm & Srivastava, 2014). Meanwhile, faced with a strong OEM brand, ICs are more likely to follow the OEM's choice instead of requesting a different component supplier. Therefore, a strong brand enables the OEM to make the component adoption decision in its own interest and benefit from its power advantage in the relationships (Emerson, 1962). In this situation, if the CS's push strategy provides good value, the OEM is more likely to adopt the CS's component to obtain additional benefits and profit. Thus,

H5a: An OEM's brand image strengthens the effect of a CS's push strategy on the OEM's adoption of the CS's component.

A strong OEM brand can reduce ICs' information cost and perceived risk in purchasing decisions. In this case, ICs' purchasing decisions may rely mainly on (quality signal of) the OEM's brand, and as a result, the effect of the CS's brand becomes secondary. In addition, according to the research on ingredient branding in B2C markets, compared with a weak host brand, a strong host (i.e., OEM) brand benefits less from an ingredient (i.e., CS) brand (Simonin & Ruth, 1998). This suggests that a strong OEM brand can offset the effect of a CS's pull strategies on ICs' attitudes. Furthermore, ICs trust that an OEM with a strong brand will use suitable components in its offerings and take responsibility for problems arising from

the components (Cannon & Homburg, 2001; Ulaga & Eggert, 2006). As a result, the OEM has more choices in deciding whose components (CS's *vs* own) to adopt and likely, it is going to use its own components to maximize sales and profit. Therefore, to protect its interest, an OEM with a strong brand can respond to a CS's pull strategy with opposing behaviors (Dahlquist & Griffith, 2014; Ghosh & John, 2009). Thus,

H5b: An OEM's brand image weakens the effect of a CS's pull strategy on the OEM's adoption of the CS's component.

2.6 The impact of IC's loyalty to OEM on the moderating effects of OEM brand image

Customers' loyalty is built on consistent satisfaction with the supplier, which leads to their trust in the supplier and strong repeat purchase intention in the future (Chiou, et al., 2010; Webster, 2000). When ICs are loyal to an OEM, they trust that the OEM adopts suitable components according to their needs (Cannon & Homburg, 2001), and thus grant the OEM more autonomy when making the component adoption decision.

We propose two three-way interaction effects of an IC's loyalty to an OEM, the OEM's brand image, and a CS's push and pull strategies on the OEM's adoption of the CS's component. When ICs are highly loyal to an OEM, the OEM can benefit from its strong brand to better negotiate and maximize its profit (Worm & Srivastava, 2014). As a result, we expect that a high IC's loyalty to an OEM strengthens the positive moderating effects of the OEM's brand image on the relationship between the CS's push strategy and the OEM's adoption of the CS's component. Thus,

H6a: The greater the IC's loyalty to an OEM, the stronger the strengthening effect of the OEM's brand image on the relationship between a CS's push strategy and the OEM's adoption of the CS's component.

Similarly, when ICs are highly loyal to an OEM, the OEM can better take advantage of its strong brand image to offset the effect of a CS's pull strategy on the IC's attitude towards the CS's component. According to the literature on customer loyalty, a loyal customer has greater resistance to competitive strategies (Dick & Basu 1994). In our research context, the more loyal the IC is to an OEM, the more reluctant the IC is to a CS's pull strategy. Therefore, a high IC loyalty to an OEM strengthens the negative moderating effect of the OEM's brand image on the relationship between a CS's pull strategy and the OEM's adoption of the CS's component.

H6b: The greater the IC's loyalty to an OEM, the stronger the weakening effect of the OEM's brand image on the relationship between a CS's pull strategy and the OEM's adoption of the CS's component.

The conceptual model framework and hypotheses are illustrated in Figure 1.

[Please Insert Figure 1 about Here]

3. Methods

3.1 Data and sample

Our target population was the purchasing staff from major coal mining equipment operators (i.e., mining companies that use mining scraper conveyors; the ICs) in China who are the customers of OEMs (i.e., producers of mining scraper conveyors) and component suppliers (i.e., producers of high-strength chains that are critical components of the conveyors; the CSs). We selected 245 coal mining companies from 17 major (group) operators in the Chinese coal mining industry (all of them are state-owned enterprises). Each mining company has an independent purchasing department, and is responsible for its own mining

equipment purchases. Our interviewees were either the department managers or officers in charge. Our data was representative, as these 17 (group) operators produced 1.74 billion tons of coal in total, accounting for 53.7% of the national production in 2010.

Our survey questionnaire was developed in English first and then translated into Chinese and was checked for accuracy using the conventional back-translation process. The final questionnaire used in the survey was in Chinese. All the data were collected through face-to-face on-site or remote video conferencing interviews. Our interviewers were present during the interview sessions to ensure that any questions by the interviewees were addressed timely, and that misinterpretation and errors were minimized.

Among the 245 distributed questionnaires, 236 were collected. To ensure the reliability of the survey data, any questionnaire that had more than ten percent missing values were discarded, and any questionnaire that was related to an OEM who was unable to produce the component in-house were eliminated. Based on these criteria, only 195 questionnaires were accepted for this study. Among the 195 questionnaires, three OEMs (i.e., ZMM, XBBN and SXMJ) and five components suppliers (i.e., Parsons, XBBN, SXMJ, THIELE, FASING, and notes that Parsons is a subsidiary of ZMM) were identified. Table 1 below shows the use frequency of components among the three OEMs.

[Please Insert Table 1 about Here]

3.2 Measures

3.2.1 Dependent variable

Adoption is referred as the OEM's adoption of an independent CS's component while noting that all the OEMs in our sample can also use their internally produced components instead. Hence, adoption is a binomial variable, based on the OEM's *actual* component adoption decision: it is 0 if the OEM used the component made in-house, or 1 if the OEM outsourced it.

3.2.2 Independent variables

We developed scales of pull and push strategy based on extant literature and adapted other multi-item measures from existing scales. All the constructs in this study were measured by a self-reported questionnaire using a 7-point scale ranging from "highly disagree" (1) to "highly agree" (7). Appendix I presents the questionnaire questions we used for the five independent variables: brand image of the component supplier (*Brand_CS*), brand image of the OEM (*Brand_OEM*), pull strategy of the CS to ICs (Pull), push strategy of the CS to OEMs (Push), and an industrial customer's loyalty to the OEM (*Loyalty*).

Brand_CS, i.e., the CS's brand image, is defined as the end customers' (ICs') perception of the CS brand (Keller, 1993; Worm & Srivastava, 2014). To conceptualize a CS's brand image, respondents reported on the CS's product offering with a three-item, seven-point scale. These three items that are used to assess the CS's products include (1) good quality products and services, (2) good reputation in the industry, (3) improve OEM's product quality. Our measurement of CS's brand image was adapted from Worm and Srivastava (2014).

Brand_OEM, i.e., the OEM's brand image, is defined as the end customers' (ICs') perception of the OEM brand (Keller, 1993; Worm & Srivastava, 2014). To conceptualize an OEM's brand image, respondents reported on the OEM's product offering with a five-item, seven-point scale. These five items that are used to assess the OEM's products include (1) long business history, (2) good reputation in the industry, (3) not affected by quality issues yet, (4) achieved multiple good results in the industry, (5) recognized as a high end quality OEM. Our measurement of OEM's brand image was also adapted from Worm and Srivastava (2014).

Pull is the degree to which the selected CS's marketing activities (pull strategy) are perceived by the IC. To conceptualize *Pull*, respondents reported on the CS's pull strategy offering with a four-item, seven-point scale. These four items that are used to assess the CS's pull strategy include (1) IC has informed the OEM the IC preferred component brand, (2) IC has demanded the OEM to use the IC preferred component brand to ensure good product quality, (3) IC has informed the OEM that the OEM will get more business in future if the IC preferred component brand is used, (4) IC and the OEM agree to include the IC preferred component brand in the business contract. This scale of pull strategy was developed only for this study

because no appropriate scales were found in the supply chain literature.

Push is the degree of difference between the selected CS's marketing activities and other CS's marketing activities (push strategy) to OEM perceived by the IC. Such difference is required by the logit regression when we develop the utility function for the OEM, as detailed in section 4.3. OEM's decision can be depended on the various push strategies from different component suppliers. To conceptualize *Push*, we first conceptualize a *Push_S* (push strategy of selected CS to OEM), respondents reported on the *Push_S* offering with a four-item, seven-point scale. These four items include (1) the CS has provided plenty product and technical information and promotion to the OEM, (2) the CS demands the OEM to use his components, (3) Price discount is offered if the OEM agrees to use the CS's component, (4) CS promises and guarantees the OEM with unlimited component replacements and cost control. We define *Push* as the difference between *Push_S* and weighted average push of all other CS, as detailed in section 4.3. This scale of push strategy was developed only for this study because no appropriate scales were found in the supply chain literature.

Loyalty is an industrial customer's loyalty to an OEM. To conceptualize *Loyalty*, respondents reported their attitudes toward an OEM with a four-item, seven-point scale. These four items include (1) respondent's firm plans to make purchase from this OEM in future project, (2) respondent's firm will benefit from cooperation with this OEM in the future, (3) respondent's firm is most likely to choose this OEM for next purchase, even with a higher price, (4) respondent's firm is willing to recommend this OEM to other industry fellows. Our measurement of loyalty was adapted from Palmatier, Scheer & Steenkamp (2007).

3.2.3 Control variables

Five control variables were included in this study: firm size, respondents' education (*Edu*) and experience in the industry (*Experience*), product cost reduction (*Cost_P*) and operation cost reduction (*Cost_O*). Firm size was measured by the annual output (Million tons of coal production) of the respondents' firm. Respondents' education referred to respondents' education level and experience referred to the number of years the respondents have worked in the industry.

We use *Cost_P* and *Cost_O* to control the OEM's benefits from its ability to produce the component in-house. Product cost reduction referred to the reduction of product cost if the supplier can produce the component in-house. Operation cost reduction referred to the reduction of operation cost if the supplier can produce component in-house. Both *Cost_P* and *Cost_O* were single item measurement using a 7-point scale. The following items were used respectively to assess respondents' relative agreement. *Cost_P*: when producing the component in-house, OEM can reduce the product cost of the coal mining equipment; and *Cost_O*: when producing the component in-house, OEM can make better use of labor and machines. Table 2 below details the profile of the respondents and their firms.

[Insert Table 2 about Here]

4. Analysis and results

We computed the means, standard deviations, and bivariate correlations for all of the variables. To ensure that the instruments of this study are reliable and valid, we conducted exploratory factor analysis and confirmatory factor analysis of the constructs. Since the dependent variable is binomial, we use logit rather than OLS regressions to test the hypotheses (Zavoina & McElvey, 1975). Logit models have been used extensively in different fields to study preferences and choices. Maximum likelihood estimation method is used (Greene, 1993).

4.1 Reliability and validity

Reliability is defined as the degree to which a construct is free from errors and provides consistent results. We performed exploratory factor analysis with SPSS 21 and used Cronbach's alpha to measure the internal consistency of the multi-item scales. As shown in Appendix I, the Cronbach's alphas of all constructs in this study exceeded 0.7. This shows that the sets of items correlated well with each other, and therefore, all

of them are deemed reliable.

To further ensure our constructs' reliability and validity, we also performed confirmatory factor analysis with Amos 7.0. We restricted each measurement item to load on its hypothesized factor. All items revealed significant ($p<0.001$) loadings on their expected constructs are all confirmed convergent validity. As shown in Appendix I, the factor loadings and model fit index ($\chi2(92) =175.16$, GFI=0.90, IFI=0.95, TLI=0.93, CFI=0.95, RMSEA=0.068) indicate that our model fits the data well. As shown in Appendix I, the average variance extracted (AVE) of all the constructs is higher than the widely accepted threshold of 0.50 except for the OEM's brand image (at 0.41). We believe that this relatively low AVE is driven by the relatively low factor loadings of some items of OEM's brand image. We keep these items because they are very important for the concept of OEM brand image and because they are all adapted from previous studies (Flynn et al., 2010); Zhao et al., 2011). We compared the variance-extracted estimates for each pair of constructs with the square of the correlations between the two constructs and found that both variance-extracted estimates for each pair of constructs were greater than their squared correlations. Hence, the discriminant validity of all the constructs are considered acceptable. In addition, the composite reliabilities (CR) of all of the constructs are greater than 0.70, which confirm our construct's reliability.

4.2 Common method bias

Because this survey was conducted through self-reported questionnaire and the data was self-reported, it is imperative to address the issue of common method bias. To test for common method bias, we applied Harman's single factor test (Podsakoff, et al., 1986). The results for the total variance obtained from the exploratory factor analysis of the essential variables include the independent variables, dependent variable, and control variables. We found that all the variables were loading on different factors, with a dominant value of 35.00% accounting for most of the variance. Thus, there is no general factor that accounts for the majority of the covariance across our measures. It suggests that the threat of common method bias is not significant and therefore not a big concern in this study.

We also performed a test with a confirmatory factor analysis (CFA) (Craighead, Ketchen, Dunn and Hult, 2011). Specifically, we compared a one-factor model and a four-factor model with all the latent variables. The results showed that the four-factor model ($\chi2(92) =175.16$, GFI=0.90, IFI=0.95, TLI=0.93, CFI=0.95, RMSEA=0.068) was considerably better than the one-factor model ($\chi2(119) =596.91$, GFI=0.69, IFI=0.74, TLI=0.70, CFI=0.73, RMSEA=0.14), which again suggests that the effect of common method bias is minimal.

Last, we employed the marker variable assessment technique approach recommended by Lindell and Whitney (2001). Specifically, we added an item *Industry_Tech* (it measures IC's perception of CS's industry manufacture technology level, range from very low to very high) as our marker variable. This marker variable meets Lindell and Whitney's criterion of being unrelated to our main variables theoretically. The results of a partial correlation analysis after we controlled for the influence of *Industry_Tech* showed that only 4 out of 27 significant correlations (*Exp* and *Push, Exp* and *Brand_CS, Cost_P* and *Brand_OEM,* and *Cost_P* and *Loyalty*) became insignificant, and no insignificant correlations became significant (see Table 3). Overall, these assessments suggest that the effect of common method bias is minimal. The mean and standard deviation of the variables are reported in Table 3.

[Insert Table 3 about Here]

4.3 Logit regression

To understand the economic rationale of OEMs' choice between producing the component in-house and outsourcing, we assume that an OEM considers factors such as its own brand image, the CS brand image, Pull and Push by CSs, and others (control variables). Recall that there are three OEMs and six CSs in our sample. So, for OEM i, its utility function is u_{ii} (i=1,2,3) if it adopts the component made in-house, or u_{ij} ($\mathrm{i} = 1,2,3; \mathrm{j} = 1,2, \ldots ,6$ and $\mathrm{j} \neq \mathrm{i}$) if the OEM outsources the component from an independent CS.

When OEM i chooses a component from supplier i, its utility function is:

$$u_{ii} = \mathrm{Brand\_OEM_i} + \mathrm{Brand\_CS}_i + \mathrm{Pull}_{ii} + \mathrm{Push}_{ii} + \varepsilon_{ii}, \mathrm{i} = 1,2,3.$$

When OEM i chooses a component from supplier j, its utility function is:

$$u_{ij} = \text{Brand\_OEM}_\text{i} + \text{Brand\_CS}_j + \text{Pull}_{ij} + \text{Push}_{ij} + \varepsilon_{ij}, \text{i} = 1,2,3; \text{j} = 1,2,\dots,6 \text{ and j} \neq \text{i}.$$

The logit model in our study is based on the following latent utility index model:

$$y_i^* = u_{ij} - u_{ii} = X_i\beta + \varepsilon_i$$

OEM i will outsource the components from an independent CS if $y_i^* > 0$, or use the components made in-house if $y_i^* \leq 0$. Thus, the probability of adoption=1 (i.e., using outsourced components) is:

$$Y_i^* = Prob(y_i^* > 0) = \text{Prob}\big(u_{ij} > u_{ii}\big) = \text{Prob}(X_i\beta + \varepsilon_i),$$

where Y_i^* is the probability of $u_{ij} > u_{ii}$, $X_i = X_{ij} - X_{ii} = \begin{pmatrix} 0 \\ \text{Brand\_CS}_j - \text{Brand\_CS}_i \\ \text{Pull}_{ij} - \text{Pull}_{ii} \\ \text{Push}_{ij} - \text{Push}_{ii} \end{pmatrix}$, and 0 is the eliminated effect of OEM's brand image. We assume that $\varepsilon_i = \varepsilon_{ij} - \varepsilon_{ii}$ and ε_i follows logistic distribution.

We use *CS's brand image*, *Pull* and *Push* in difference (i.e., $\text{Brand\_CS}_j - \text{Brand\_CS}_i$, $\text{Pull}_{ij} - \text{Pull}_{ii}$ and $\text{Push}_{ij} - \text{Push}_{ii}$) to calculate the probability of adoption. For $\text{Brand\_CS}_j - \text{Brand\_CS}_i$ and $\text{Pull}_{ij} - \text{Pull}_{ii}$, we assume that $\text{Brand\_CS}_i = 0$ in OEM i's decision when the OEM considers using its own CS brand. Similarly, we assume that $\text{Pull}_{ii} = 0$, as the OEM is unable to distinguish Pull_{ii}'s contribution from $\text{Brand\_OEM}_\text{i}$'s, when IC expresses its requirements for the OEM to use the components made in-house. As for $\text{Push}_{ij} - \text{Push}_{ii}$, we assume that OEM i must receive a Push_{ij} from the selected CS brand when it adopts an outsourced component. A weighted average based on all the other cases is used to calculate Push_{ii}, whereas $\text{Push}_{ij} = Push\_S$ are measured directly. Thus, *Push* is a measurement of push effect in difference and defined as $\text{Push}_{ij} - \text{Push}_{ii}$, and $X_i = \begin{pmatrix} 0 \\ \text{Brand\_CS}_j \\ \text{Pull}_{ij} \\ \text{Push}_{ij} - \text{Push}_{ii} \end{pmatrix}$. We include Brand_OEM in the model to capture its effect.

4.4 Endogeneity Tests

IC managers might be exposed to pull and push strategies by many CS and OEM brands, but they were only required to report their perception of the CS brand and OEM brand in the deal. This indicates that an OEM's adoption decision may be affected by unobserved factors other than Pull, Push, OEM's brand image, CS's brand image, and IC's loyalty to OEM. The omitted variables can cause endogeneity problems that produce biased and inconsistent coefficient estimators (Wooldridge, 2003). To address this concern, we follow Yang, Su & Fam (2012) and adopt Hausman's approach. We introduced an instrument variable, CS industry's qualification and measured it with a single item using a 7-point scale ranging from "low" (1) to "high" (7).

CS industry's qualification meets the two requirements of a valid instrument variable (Wooldridge 2003). First, it is correlated with all main independent variables (the correlation between instrument variable and Pull, Push, OEM brand image, CS brand image, and IC's brand loyalty are -.245, .502, .473, .490, and .558 respectively and all significant at $p<0.01$). Second, it is not correlated with the error terms in the model. We follow Hausman's (1987) approach and compare the OLS and two-stage least square estimates of adoption. We first use each of the five independent variables as dependent variable and run a regression for all other independent variables and the instrument variable. This gives us five groups of residuals in relation to the five independent variables. Then we run five logit regressions to check the endogeneity

problem, with each regression model using one of the five groups of residuals, respectively. The results show that all of the parameters for the residuals are insignificant, indicating that the endogeneity issue is not detected in our model.

4.5 Results

We use moderated regression to test our hypotheses because our model contains interaction effects. To reduce potential multicollinearity problems, we mean-centered the relevant variables. We then created the interaction terms by multiplying these mean-centered variables (Jaccard, Wan, & Turrisi, 1990). The variance inflation factors range from 1 to 2, which indicate that there is no significant multicollinearity problem. Table 4 reports the regression results and shows that CS's push strategy has a positive effect on the OEM's adoption of the CS's component (Model 2; β=0.787, $p<0.01$). Hence, H1 is supported. H2 is also supported because CS's pull strategy shows a positive effect on the OEM's adoption of the CS's component (Model 2; β=0.738, $p<0.05$).

[Insert Table 4 about Here]

We argue that a CS's brand image positively moderates the relationship between the CS's push strategy and the OEM's adoption of the CS's component (H3a) and negatively moderates the relationship between the CS's pull strategy and the OEM's adoption of the CS's component (H3b). Table 4 shows that the interaction of CS's brand image and the CS's push strategy is positive and significantly related to the OEM's adoption of the CS's component (Model 4; β=2.159, $p<0.001$), and that the interaction of CS's brand image and the CS's pull strategy is negative and significantly related to the OEM's adoption of the CS's component (Model 4; β=-1.293, $p<0.05$). Hence, both H3a and H3b are supported.

[Insert Fig 2a and 2b about Here]

To illustrate the moderating effects more clearly, we decomposed the interaction terms and compared the impact of the CS's push strategy and the CS's pull strategy on the OEM's adoption of the CS's component at low and high levels of CS's brand image (Aiken and West, 1991). Specifically, we set the low level of moderator as one standard deviation below its mean and the high level as one standard deviation above the mean. As Figure 2a shows, the CS's push strategy has a positive effect on the OEM's adoption of the CS's component at high levels of CS's brand image, but a negative effect on the OEM's adoption of the CS's component at low levels of CS's brand image. As shown in Figure 2b, the CS's pull strategy has a negative effect on the OEM's adoption of the CS's component at high levels of CS's brand image, but a positive effect on the OEM's adoption of the CS's component at low levels of CS's brand image.

We argue that an IC's loyalty to the OEM negatively moderates the strengthening effect of the CS's brand image on the relationship between push strategy and the OEM's adoption of the CS's component (H4a) and negatively moderates the strengthening effect of the CS's brand image on the relationship between pull strategy and the OEM's adoption of the CS's component (H4b). We introduced a three-way interaction to test the hypotheses (Wang, Gu & Dong 2013). Table 5 shows that the three-way interaction of IC's loyalty to the OEM, the CS brand image and the CS's push strategy is negative and significantly related to the OEM's adoption of the CS's component (Model 6: β=-1.275, $p<0.10$; Model 8: β=-1.721, $p<0.10$). In contrast, the three-way interaction of IC's loyalty to the OEM, the CS brand image and the CS's pull strategy is positive but insignificantly related to the OEM's adoption of the CS's component (Model 6: β=0.824, $p>0.10$; Model 8: β=0.940, $p>0.10$). Hence, only H4a is supported and H4b is rejected.

[Insert Fig 3 about Here]

Figure 3 depicts the three-way effect of an IC's loyalty to an OEM, the CS's brand image and the CS's

push strategy on the OEM's adoption of CS's component. The figure illustrates the effect of the CS's push strategy on the OEM's adoption of the CS's component decision under four conditions: (1) High CS brand image and High loyalty, (2) High CS brand image and Low loyalty, (3) Low CS brand image and High loyalty, and (4) Low CS brand image and Low loyalty. H4a suggests that the strengthening effect of the CS's brand image on the relationship between push strategy and the OEM's adoption of the CS's component is weaker when the IC's loyalty to the OEM is high rather than low. As Figure 3 shows, when the IC's loyalty to the OEM is high (Line 1 and 3), the push effect on OEM's adoption of CS's component increases under high CS brand image but decreases under low CS brand image. When the IC's loyalty to the OEM is low (Line 2 and 4), the push effect on the OEM's adoption of the CS's component increases under either high or low CS brand image. In short, a comparison of the moderation effect of the CS's brand image under both high and low IC's loyalty to the OEM conditions confirms that the strengthening effect is weaker when the IC's loyalty to the OEM is high, in support of H4a.

We hypothesize that an OEM's brand image positively moderates the relationship between a CS's push strategy and an OEM's adoption of the CS's component (H5a) but negatively moderates the relationship between the CS's pull strategy and the OEM's adoption of the CS's component (H5b). Table 4 shows that the interaction of OEM's brand image and the CS's push strategy is positive and significantly related to the OEM's adoption of the CS's component (Model 3; $\beta=1.592$, $p<0.01$), and that the interaction of OEM's brand image and the CS's pull strategy is negative and significantly related to the OEM's adoption of the CS's component (Model 3; $\beta=-0.838$, $p<0.05$). Therefore, both H5a and H5b are supported.

[Insert Fig 4a and 4b about Here]

To illustrate the moderating effects more clearly, we applied the same method as before, decomposing the interaction terms and comparing the impact of the CS's push and pull strategy on the OEM's adoption of the CS's component at low and high levels of OEM's brand image. We set the low level of moderator as one standard deviation below its mean and the high level as above. As Figure 3a shows, the CS's push strategy has a positive effect on the OEM's adoption of the CS's component at high levels of OEM's brand image, but a negative effect on the OEM's adoption of the CS's component at low levels of OEM's brand image. As shown in Figure 3b, the CS's pull strategy has a negative effect on the OEM's adoption of the CS's component at high levels of OEM's brand image, but a positive effect on the OEM's adoption of the CS's component at low levels of OEM's brand image. Thus, both H5a and H5b are further confirmed.

We argue that an IC's loyalty to the OEM positively moderates the strengthening effect of the OEM's brand image on the relationship between the CS's push strategy and the OEM's adoption of the CS's component (H6a) and positively moderates the strengthening effect of the OEM's brand image on the relationship between the CS's pull strategy and the OEM's adoption of the CS's component (H6b). Table 5 shows that the three-way interaction of IC's loyalty to the OEM, the OEM's brand image and the CS's push strategy is positive and significantly related to the OEM's adoption of the CS's component (Model 7: $\beta=1.437$, $p<0.10$; Model 8: $\beta=2.007$, $p<0.05$). However, the three-way interaction of IC's loyalty to the OEM, the OEM's brand image and the CS's pull strategy is positive but insignificantly related to the OEM's adoption of the CS's component (Model 7: $\beta=0.866$, $p>0.10$; Model 8: $\beta=0.317$, $p>0.10$). Hence, only H6a is supported and H6b is rejected.

[Insert Fig 5 about Here]

Figure 5 depicts the three-way interaction effect of an IC's loyalty to the OEM, an OEM's brand image and the CS's push strategy on the OEM's adoption of the CS's component. It illustrates the effect of the CS's push strategy on the OEM's adoption of the CS's component under four conditions: (1) High OEM brand image and High loyalty, (2) High OEM brand image and Low loyalty, (3) Low OEM brand image and High loyalty, (4) Low OEM brand image and Low loyalty. H6a suggests that the strengthening effect of the OEM's brand image on the relationship between the CS's push strategy and the OEM's adoption of the CS's component is stronger when IC's loyalty to the OEM is high rather than low. As Figure 5 shows, when an IC's loyalty to the OEM is high (Line 1 and 3), the push effect on the OEM's adoption of the CS's component increases under either high or low OEM's brand image. When an IC's loyalty to the OEM is

low (Line 2 and 4), the push effect on the OEM's adoption of the CS's component decreases under either high or low OEM brand image. A comparison of the moderation effect of the OEM's brand image under high and low IC loyalty conditions shows that its strengthening effect is stronger when the IC's loyalty to the OEM is high, in support of H6a.

Finally, regardless the effect of *Pull* and *Push,* both of the CS and OEM brand images affect an OEM's adoption of the CS's component. We find that the OEM's brand image has a negative effect on the OEM's adoption of the CS's component (β=-1.008, $p<0.001$), and that CS's brand image has a positive effect on the OEM's adoption of the CS's component (β=0.382, $p<0.1$). This suggests that an OEM is more likely to use the components made in-house when its brand image is strong, and that it is more likely to outsource them when the CS brand image is weak.

5. Discussion

Being an important research topic in business marketing, B2B branding has attracted great research attention and the literature has been expanding fast in recent years (Leek & Christodoulides, 2011; Seyedghorban, et al., 2016). Nonetheless, research on CS branding in a supply chain context is still limited especially when it comes to the situations where OEMs can concurrently produce a component in-house and outsource from CSs (Krzeminska, et al., 2013; Parmigiani, 2007; Puranam, et al., 2013; Sako, et al., 2016). In response to the calls for additional research attention on CS branding in a supply chain network (Dahlquist & Griffith, 2014; Homburg, et al., 2014), this research integrates the literature on B2B branding in business marketing and the literature on push and pull strategies in marketing channels into one research framework. With data from the mining equipment industry in China, this study examines the effects of a CS's push and pull strategies on an OEM's adoption of the CS's component and the moderating effects of both the CS' and the OEM's brand images. The empirical results support most of our hypotheses. Both push and pull strategies positively affect an OEM's adoption of the CS's component. A CS's brand image perceived by ICs strengthens the effect of push strategy but weakens the effect of pull strategy. And an OEM's brand image perceived by ICs strengthens the effect of the CS's push strategy, but weakens the effect of its pull strategy.

The results further show a boundary effect of the CS's and OEM's brand images. Specifically, when ICs are highly loyal to an OEM, the positive moderating effects of the CS's brand image on the relationship between the CS's push strategy and the OEM's adoption of the CS's component is weakened, but the positive moderating effects of the OEM's brand image on the relationship between the CS's push strategy and the OEM's adoption of the CS's component is strengthened. However, the results do not support the hypotheses involving the three-way interaction effects of CS's pull strategy, CS/OEM brand image, IC's loyalty to OEM on the OEM's adoption of the CS's component (H4b and H6b). The reason might be that the OEM feels the pressure from both the CS and IC because a CS's pull strategy aims to affect an IC's attitude and behavior, regardless of how loyal the IC is to the OEM. Further research is called for to explore if this possibility is valid. In addition, only a strong CS's brand image promotes the OEM to use outsourced components, whereas a strong OEM's brand image discourages the use of outsourced components. These findings provide implications for both marketing academics and practitioners.

5.1 Theoretical contributions

The present research contributes to the literature in three ways. First, we extend the extant research on CS branding (e.g., Dahlquist & Griffith, 2014; Ghosh & John, 2009; Worm & Srivastava, 2014) by advancing the understanding of how CS branding can promote an OEM to adopt the CS's components when that OEM can produce the component in-house. Although it is rather common that an OEM can both produce in-house and buy a component from component suppliers (Krzeminska, et al., 2013; Parmigiani, 2007; Puranam, et al., 2013; Sako, et al., 2016), marketing studies in this context have been surprisingly scant. Obviously, when an OEM can produce the component in-house, its governance strategy with a branded CS (Ghosh & John, 2009), or response behaviors to a CS's brand differentiation strategies (Dahlquist & Griffith, 2014) are likely to be different. This poses a great challenge for CSs to sustain their business and remain competitive (Worm & Srivastava, 2014). The current research focuses on this interesting situation. Our findings not only extend and enrich the literature of CS branding in a supply chain network, but also add to the B2B branding literature in general.

Second, we respond to calls for additional research on push and pull strategies in B2B markets (Chiou, et

al., 2010; Frazier, 1999) by examining the effects of CS's push and pull strategies on OEMs' component adoption decisions. Chiou, et al. (2010) and Frazier (1999) stated that a firm's push and pull strategy is highly related to the issues of resource allocations in marketing channels, and further research on the relationship between resource allocations and supply chain performance are in need. Research on push and pull strategies in the supply chain context has just begun (e.g., Dahlquist & Griffith, 2014; Homburg, et al., 2014; Worm & Srivastava, 2014). And the effects of CS's push and pull strategies on OEM's component adoption decision have not been investigated. This study addresses this research gap by examining the direct effects of CS's push and pull strategies on OEM's outsourcing decisions. It has also extended to the literature on push and pull strategy from marketing channels (mainly based on consumer products) to supply chain contexts (based on industrial components and products). Our findings add to the literature of B2B branding, especially CS branding in a supply chain network, and provide useful implications for both CS and OEM firms to develop effective marketing strategies.

Finally, this research adds to the extant B2B branding literature by incorporating both CS and OEM branding into a single research framework and examining how they moderate the effects of a CS's push and pull strategies on an OEM's component adoption decision. It also establishes a boundary condition for the moderating effects. Products and services can be branded at any level of supply chains (Keller & Kotler, 2012). However, most B2B branding studies were not conducted in a supply chain network context, and they rarely differentiated the roles of branding at different supply chain levels. For those that focus on CS branding in a supply chain network, only the CS brand is considered (e.g., Dahlquist & Griffith, 2014; Ghosh & John, 2009; Homburg, et al., 2014; Worm & Srivastava, 2014). In this research, we fill this research gap by considering both CS and OEM branding in our research framework. Our findings demonstrate that they can not only strengthen or weaken the effects of pull and push strategies on OEMs' component adoption, but also serve as a direct offsetting mechanism that affects OEMs' decision. Furthermore, we also incorporate a crucial construct in the B2B context, namely, an IC's loyalty to an OEM to explore its weakening and strengthening effects on the moderating effects of CS and OEM branding. As a result, we are able to provide a more complete and comprehensive understanding of the roles of branding in supply chains.

5.2 Managerial implications

Our findings provide managerial implications for the managers in both CS and OEM firms. In general, CS managers apply both push and pull strategies to induce an OEM to adopt their components instead of using its own components made in-house. Although both push and pull strategies positively affect the OEM's adoption of their components, CS managers should realize that the effects of their strategies are contingent on the CS's and OEM's brand images perceived by ICs. When a CS uses push strategy, its strong brand can strengthen the effect of its push strategy on the OEM's adoption. However, CS managers should be aware that when ICs are highly loyal to the OEM, the effect of CS brand image is weakened. On a contrary, when a CS uses pull strategy, its strong brand may weaken that effect because the OEM may feel pressure and threat from the upstream supplier and thus become resistant. Thus, for CSs with a strong brand, push strategy is more effective than pull strategy to induce OEMs to adopt their components.

Meanwhile, CS managers should find new ways to persuade an OEM with a strong brand to adopt their components, as a strong OEM brand can weaken the effects of their pull strategy. Furthermore, an OEM with a strong brand is at a better position to take advantage of a CS's push strategy, as it can negotiate hard and squeeze the profit out of the CS. This is particularly the case when ICs are highly loyal to the OEM. Finally, it is important for a CS to build a stronger brand image among ICs so that the end customers can promote OEMs' adoption of the CS's components.

With regard to OEM managers, building a strong brand is crucial because a strong OEM brand can serve as an offsetting mechanism to maintain its decision autonomy when CSs employ push and pull strategies to influence its component adoption decision. Furthermore, an OEM with a strong brand can leverage more from a CS's push strategy to improve profitability through harsh negotiation with the CS. Overall, it is very important for OEMs to cultivate solid loyalty and maintain stable relationships with ICs, because that loyalty can weaken the effects of CS branding while strengthen the effects of OEM branding.

5.3. Limitations and future research

This study has several limitations that are noteworthy for further research. First, we focus on both CS and OEM branding as the moderators on the effects of push and pull strategies, future research can explore other industrial and environmental factors as contingent conditions to offer more new insights (e.g.,

Dahlquist & Griffith, 2014; Worm & Srivastava, 2014). Since several extant studies on CS branding have suggested the importance of CS's push and pull strategies, future research can further examine the boundary conditions of their effects on OEM's component adoption decision. Second, in a supply chain network, the relationship quality and interdependence structure of CS-OEM and OEM-IC relationships are expected to be important determinants of an OEM's component adoption strategy. Although we incorporate IC's loyalty in the framework as a boundary condition, further research can examine the role of relationship quality and interdependence structure in both CS-OEM and OEM-IC dyads. Third, although both actual adoption data and perception data were used, all data were collected from ICs. This has limitation since our research context was a triad network. Although our test demonstrates that common method bias is not serious, it is suggested that future empirical research should collect two-sided matched perception data to test the model. Fourth, our data were only collected from one industry which may constrain the generalizability of the research results. Data from different industries are desirable for further studies. Finally, caution is warranted in generalizing the findings to other contexts because China's social and institutional frame of reference might be unique. Empirical studies on both emerging and developed economies could address this research gap.

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Table 1. Use frequency of components by OEMs

Component Brand	OEMs	Use Frequency
PARSONS	ZMM	88
	XBBN	24
	SXMJ	13
	Total	125
XBBN	XBBN	41
	Total	41
SXMJ	SXMJ	17
	Total	17
THIELE	ZMM	7
	XBBN	3
	Total	10
FASING	XBBN	1
	Total	1
Others	SXMJ	1
	Total	1
Total	ZMM	95
	XBBN	69
	SXMJ	31
	Total	195

Table 2. Profile of firms and respondents

Characteristics of sample	Total
Firm size	
(1) <2	64
(2) 2-5	81
(3) 6-8	30
(4) 9-10	10
(5) Above 10	10
Education level	
(1) High school	12
(2) Diploma	67
(3) Bachelor	106
(4) Master or above	8
(5) Others	2
Experience	
(1) <1 year	0
(2) 1-3 years	13
(3) 3-5 years	57
(4) 5-8 years	77
(5) >8 years	48

Table 3. Descriptive Statistics and Correlations

	1	2	3	4	5	6	7	8	9	10	11
1. *Adoption*	1	.241**	0.056	0.031	-.150*	0.04	0.104	.309**	0.007	-.226**	-0.143**
2. *Firmsize*	.241**	1	0.119	.270**	-0.095	-.172*	0.002	0.048	0.065	0.07	-0.025
3. *Exp*	0.06	0.121	1	-0.015	-0.04	0.023	-0.064	-0.025	-0.005	-0.089*	-0.038**
4. *Edu*	0.029	.269**	-0.043	1	0.073	-.161*	-0.04	0.006	-0.036	0.029	0.034
5. *Cost_P*	-.146*	-0.092	0.008	0.048	1	-.129*	-.168**	0.033	-.114*	-0.061	-0.001
6. *Cost_O*	0.039	-.173*	0.009	-.151*	-.145*	1	0.079	-.198**	0.088	0.013	0.092*
7. *Pull*	0.085	-0.006	-.216**	0.057	-.325**	0.114	1	-0.087*	0.529**	.397**	.439**
8. *Push*	.297**	0.049	0.046	-0.035	0.097	-.213**	-.315**	1	-.167*	-.333**	-.254**
9. *Brand_CS*	-0.003	0.052	-0.13	0.047	-.239**	0.113	.619**	-.357**	1	.635**	.602**
10. *Brand_OEM*	-.212**	0.055	-.226**	0.106	-.196**	0.052	.586**	-.548**	.631**	1	.328**
11. *Loyalty*	-.143*	-0.031	-.191**	0.119	-.151*	0.125	.639**	-.500**	.647**	.684**	1
Marker Variable	0.112	-0.082	-.263**	-0.129	-.268**	.142*	.550**	-.217**	.411**	.343**	.316**
Mean	0.251	2.082	3.821	2.600	3.544	5.282	5.798	5.522	5.827	5.785	5.651
S.D.	0.435	1.071	0.881	0.735	1.808	0.924	0.793	1.054	0.677	0.580	0.697

Notes: N= 195; *p<0.05; **p<0.01; Zero-order correlations are below the diagonal; adjusted correlations for potential common method variance (Lindell and Whitney, 2001) are above the diagonal.

Table 4. Regression results

Logistic Regression					
DV=Adoption	*Main effect*		*Moderation*		
Independent Variables	Model 1	Model 2	Model 3	Model 4	Model 5
Intercept	-1.309***	-1.448**	-0.979***	-1.487***	-1.417***
	(0.196)	(0.220)	(0.264)	(0.354)	(0.372)
Firmsize	0.616***	0.610**	0.487*	0.628**	0.629*
	(0.188)	(0.201)	(0.218)	(0.240)	(0.251)
Experience	-0.056	0.059	0.077	0.130	0.146
	(0.189)	(0.211)	(0.227)	(0.265)	(0.272)
Edu	0.042	0.064	0.025	0.162	0.211
	(0.201)	(0.210)	(0.230)	(0.251)	(0.260)
Cost_P	-0.461*	-0.353	-0.340	-0.357	-0.355
	(0.225)	(0.232)	(0.246)	(0.272)	(0.272)
Cost_O	0.119	0.222	0.042	-0.081	-0.012
	(0.189)	(0.201)	(0.232)	(0.254)	(0.260)
Brand_OEM	-1.008***	-0.896**	-1.717***	-1.324**	-1.693***
	(0.263)	(0.315)	(0.441)	(0.404)	(0.506)
Brand_CS	0.382†	0.161	0.157	-0.070	0.050
	(0.239)	(0.269)	(0.289)	(0.409)	(0.414)
Pull		0.738*	0.431	0.316	0.310
		(0.288)	(0.323)	(0.344)	(0.398)
Push		0.787**	0.736*	1.343**	1.310**
		(0.255)	(0.295)	(0.451)	(0.456)
*Brand_OEM*Pull*			-0.838*		-0.028
			(0.377)		(0.459)
*Brand_OEM*Push*			1.592**		0.857
			(0.532)		(0.648)
*Brand_CS*Pull*				-1.293*	-1.436*
				(0.524)	(0.600)
*Brand_CS*Push*				2.159***	2.064***
				(0.497)	(0.521)
Likelihood Ratio Chi-Square	32.958	50.802	74.972	99.888	101.782
DF	7	9	11	11	13
Pr > ChiSq	<.0001	<.0001	<.0001	<.0001	<.0001

†p<0.10; *p<0.05; **p<0.01; ***p<0.001

Table 5. Regression results of three-way moderation

Logistic Regression			
DV=Adoption	*Moderation (three-way)*		
Independent Variables	M 6	M7	M8
Intercept&Controls	…	…	…
Brand_OEM	-1.801**	-1.669**	-1.817**
	(0.583)	(0.554)	(0.609)
Brand_CS	-0.144	-0.100	-0.284
	(0.518)	(0.500)	(0.551)
Loyalty	0.106	-0.514	-0.104
	(0.481)	(0.478)	(0.557)
Pull	0.163	0.277	0.272
	(0.460)	(0.450)	(0.495)
Push	1.762**	1.472**	1.744**
	(0.590)	(0.580)	(0.618)
*BrandEq_OEM*Pull*	0.202	0.407	0.138
	(0.534)	(0.561)	(0.605)
*BrandEq_OEM*Push*	1.048	0.685	0.922
	(0.801)	(0.751)	(0.862)
*BrandEq_CS*Pull*	-1.209†	-1.236†	-0.995
	(0.668)	(0.659)	(0.719)
*BrandEq_CS*Push*	2.320***	2.022**	2.198**
	(0.655)	(0.593)	(0.674)
*Loyalty*Pull*	-0.283	-0.337	-0.438
	(0.436)	(0.472)	(0.535)
*Loyalty*Push*	-0.126	0.711	0.554
	(0.638)	(0.701)	(0.723)
*Loyalty*BrandEq_CS*Pull*	0.824		0.930
	(0.716)		(1.001)
*Loyalty*BrandEq_CS*Push*	-1.275†		-1.721†
	(0.746)		(1.000)
*Loyalty*BrandEq_OEM*Pull*		0.866	0.317
		(0.542)	(0.686)
*Loyalty*BrandEq_OEM*Push*		1.437†	2.007*
		(0.783)	(0.885)
Likelihood Ratio			
Chi-Square	106.874	110.690	114.155
DF	18	18	20
Pr > ChiSq	<.0001	<.0001	<.0001

†p<0.10; *p<0.05; **p<0.01; ***p<0.001

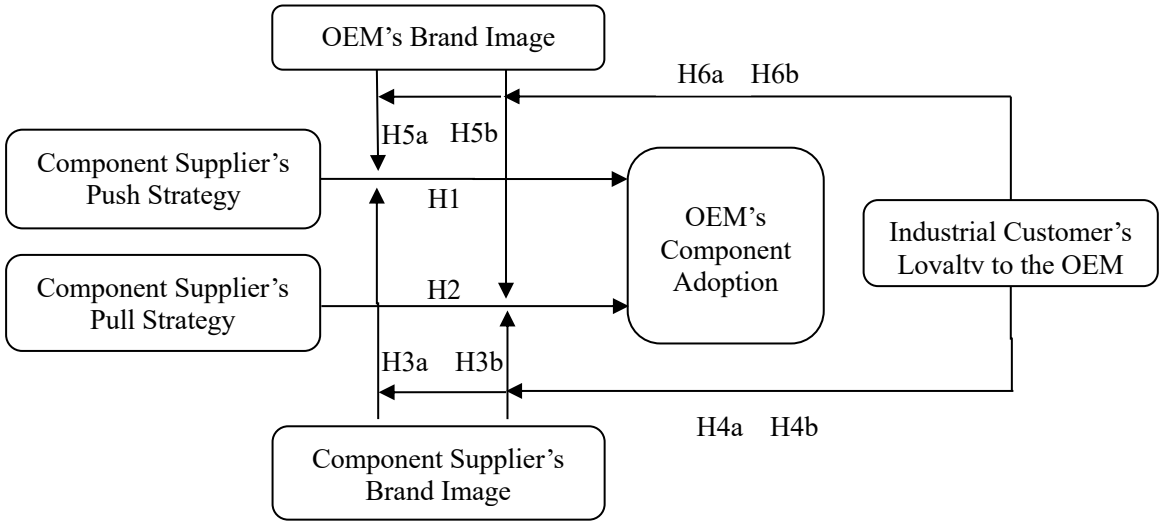

Figure 1. Conceptual Framework

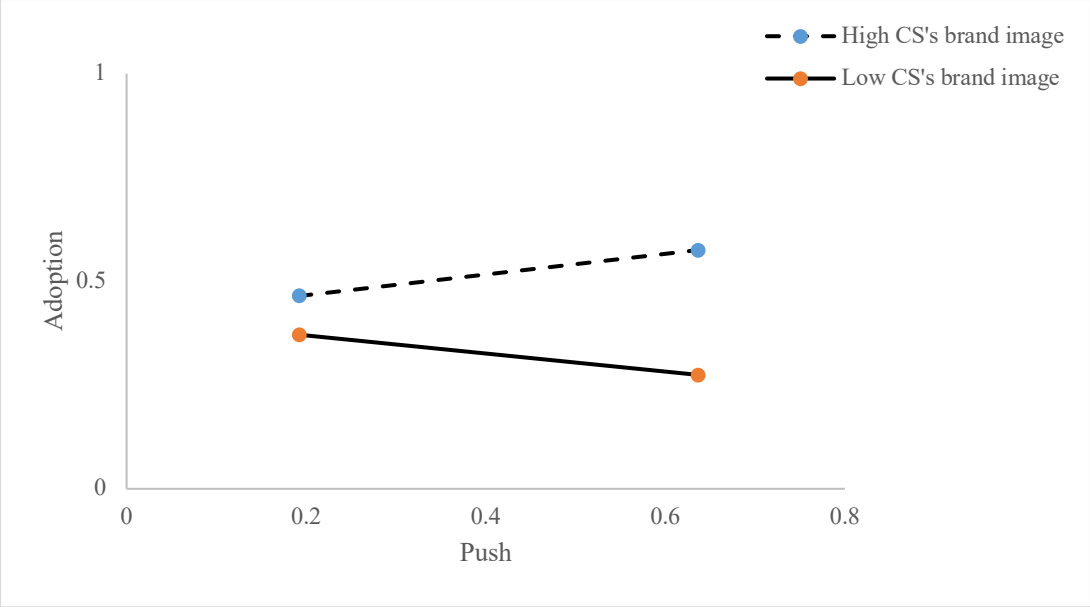

Figure 2a. Interaction between CS brand image and Push

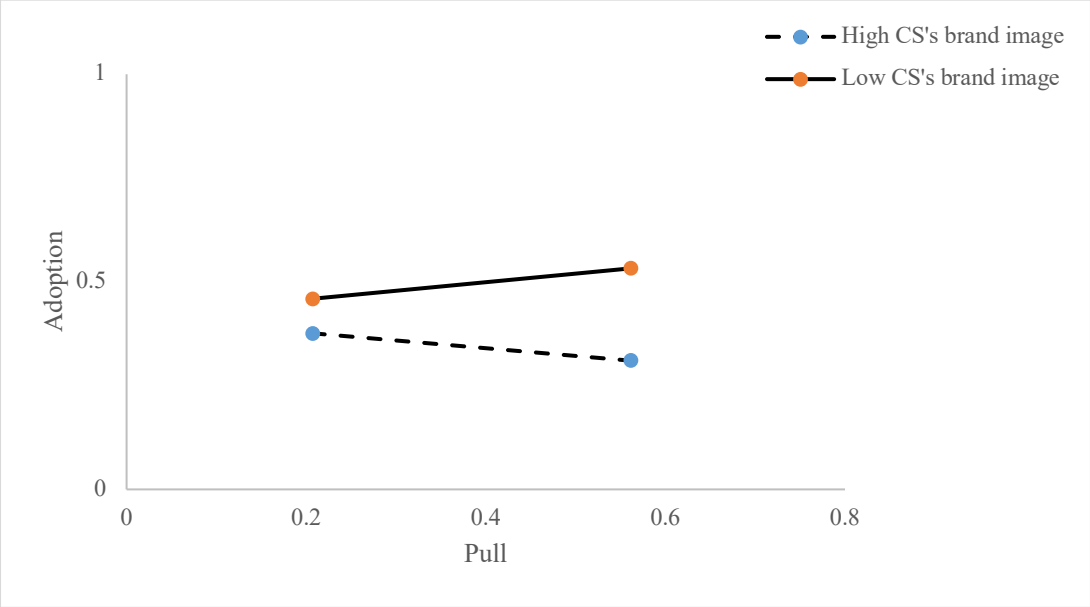

Figure 2b. Interaction between CS brand image and Pull

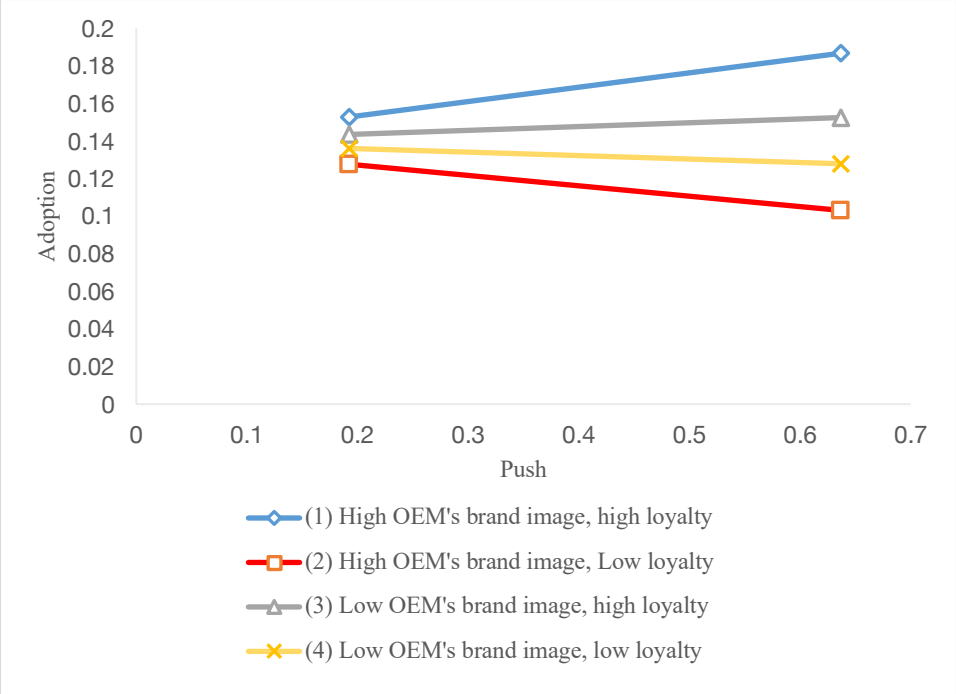

Figure 3. Three-way interaction between Loyalty, OEM brand image and Push

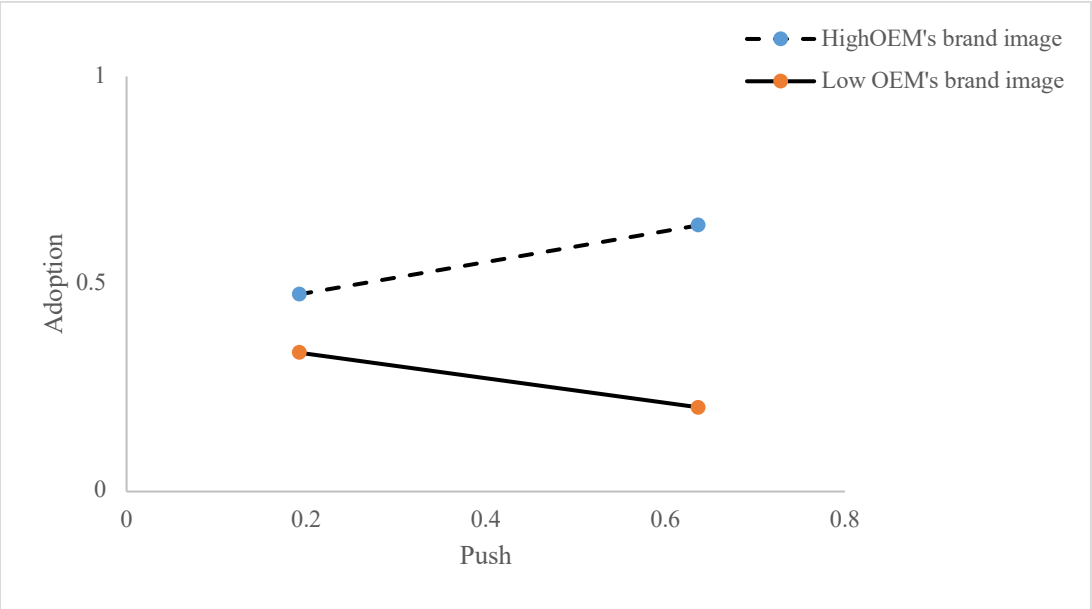

Figure 4a. Interaction between OEM brand image and Push

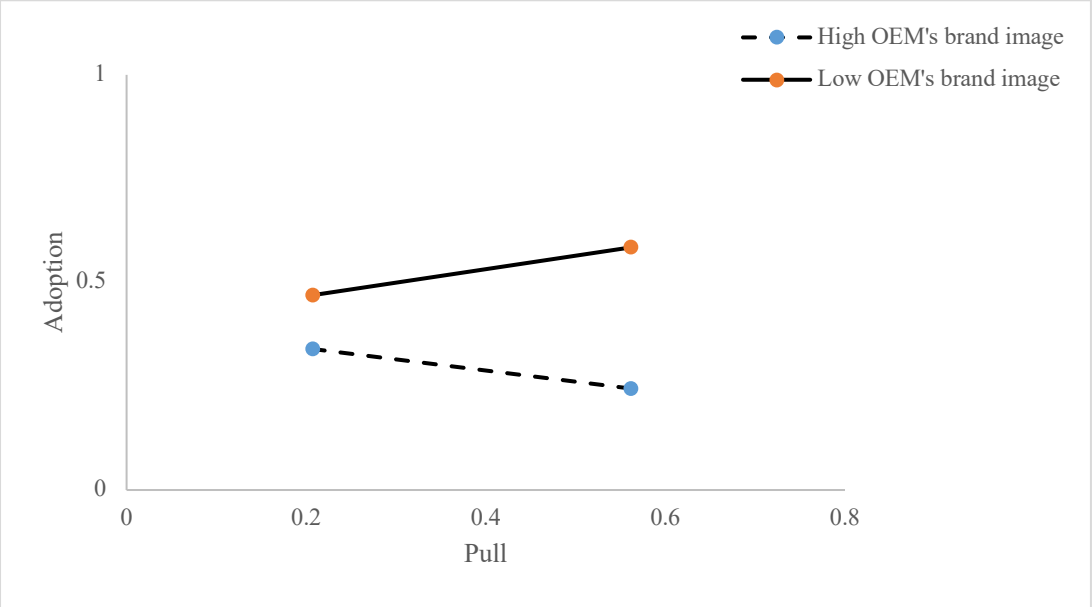

Figure 4b. Interaction between OEM brand image and Pull

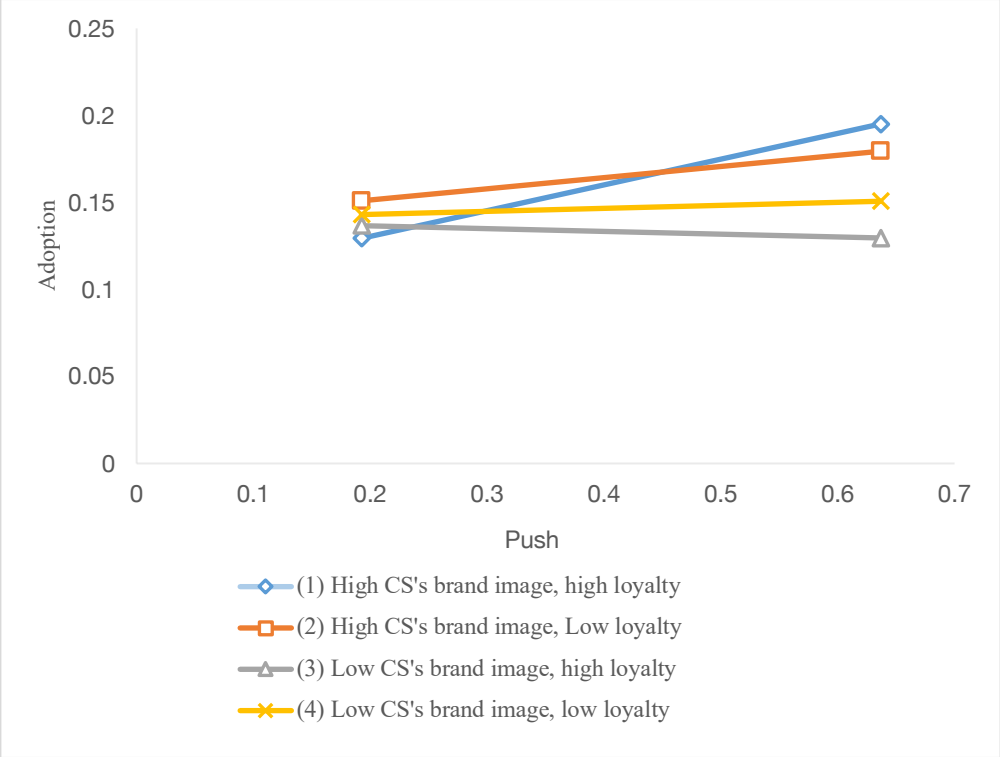

Figure 5. Three-way interaction between Loyalty, CS brand image and Push

Appendix I. Values of Component and Cronbach's Alpha of Independent Variables

Construct	Description	Factor Loading
Brand_CS CR=0.78 AVE=0.55 Cronbach's Alpha=0.77	This component supplier offers good quality products and services.	0.875*
	This component supplier has good reputation in the industry.	0.838*
	Reputation and product quality of OEMs would be improved if they use components from this supplier.	0.772*
Brand_OEM CR=0.78 AVE=0.41 Cronbach's Alpha=0.81	This OEM has long business history in the industry.	0.760*
	This OEM has good reputation in the industry.	0.755*
	Up to today, the reputation of this OEM has not been affected due to any quality issues.	0.699*
	Up to today, this OEM has achieved multiple good results in the industry.	0.720*
	This OEM is recognized as a high-end quality supplier in the industry.	0.716*
Loyalty CR=0.88 AVE=0.66 Cronbach's Alpha=0.82	My firm plans to make purchase from this OEM in our future project.	0.810*
	My firm will benefit from the cooperation with this OEM in the future.	0.826*
	My firm is most likely to choose this OEM for next purchase, even with a higher price.	0.827*
	My firm is willing to recommend this OEM to other industry fellows.	0.778*
Push CR=0.90 AVE=0.68 Cronbach's Alpha=0.89	The component supplier has provided plenty product and technical information and promotion to OEM.	0.797*
	The component supplier demands the OEM to use his components.	0.890*
	Price discount is offered if the OEM agrees to use the supplier's component.	0.896*
	The component supplier promises and guarantees the OEM with unlimited component replacements and cost control.	0.892*
Pull CR=0.84 AVE=0.57 Cronbach's Alpha=0.84	My firm has informed the OEM the component brand we prefer to use.	0.795*
	My firm has demanded the OEM the component brand we prefer to use to ensure good product quality.	0.836*
	My firm has informed the OEM if they use our preferred component brand, we will give the OEM more business in future.	0.787*
	My firm and the OEM agree to include the preferred component brand in the business contract.	0.866*

CR=composite reliability; AVE=average variance extracted;
* significant at the $p<0.001$ level.