# Intangible Assets and Foreign Ownership in International Joint Ventures: the Moderating Role of Related and Unrelated Industrial Agglomeration

Tiancheng Hu [a]

[a] School of Business and Management, Francis Bancroft Building, Queen Mary University of London, Mile End Road, London, E1 4NS, UK.

Email: t.hu@qmul.ac.uk

Rui Guo *[b, a]

Corresponding author

[b] School of Public Policy and Management, University of Chinese Academy of Sciences, Beijing, 100049, PR China. Email: rui.guo@qmul.ac.uk

[a] School of Business and Management, Francis Bancroft Building, Queen Mary, University of London, Mile End Road, London, E1 4NS, UK.

Email: guorui@ucas.ac.cn

Lutao Ning [a]

[a] School of Business and Management, Francis Bancroft Building, Queen Mary University of London, Mile End Road, London, E1 4NS, UK.

Email: l.ning@qmul.ac.uk

# Intangible Assets and Foreign Ownership in International Joint Ventures: the Moderating Role of Related and Unrelated Industrial Agglomeration

**Abstract**: When multinational enterprises form international joint ventures (IJVs) with local firms, the knowledge exchange between the two can expose foreign firms' intangible assets to local competitors. We study how foreign ownership is used to manage knowledge leakage and how local industrial structures moderate the relationship between intangible assets and foreign ownership. Using a dataset of 25,447 IJVs in China, our results reveal that foreign ownership rises with the increase in intangible assets in IJVs. Related variety further enhances this relationship, whereas unrelated variety has a positive moderating effect only when foreign ownership is within a certain range.

**Keywords:** Intangible asset, knowledge leakage, foreign ownership, joint venture, industrial structure

JEL: F23, L16, G32, O33, O53

## 1. Introduction

When multinational enterprises (MNEs) enter the foreign domestic market, they generally rely on their intangible assets to maintain technological advantages over local competitors (Chang, 2019). Intangible assets, such as patents, designs, human capital, and management skills, contain the knowledge and technology that enables MNEs to accelerate their internationalization processes (Brennan & Garvey, 2009; Contractor, Yang, & Gaur, 2016). Because some degree of localization of products and services is required, MNEs generally establish international joint ventures (IJVs) to involve local partners (Kabiraj & Sengupta, 2018). Traditional international business theories predict that such localization creates positive knowledge spillovers for local firms [see Perri and Peruffo (2016)]. However, recent literature recognizes knowledge leakage as the negative effect of knowledge spillovers. It occurs when local competitors can imitate the core knowledge and technologies derived from foreign firms' intangible assets and threaten foreign firms' positions in the local market (Frishammar, Ericsson, & Patel, 2015). To manage potential knowledge leakage, foreign firms generally consider an ownership share in the IJVs as a protective measure to control resources, make decisions, and interact with local partners (Zhang, Li, Hitt, & Cui, 2007).

Although past empirical studies attempted to explore the relationship between intangible assets and foreign ownership strategies, they yielded mixed and inconclusive results. Some scholars, such as Chang, Chung, and Moon (2013) and Wooster, Blanco, and Sawyer (2016), find that foreign firms with more intangible assets tend to choose wholly owned subsidiaries (WOSs) instead of IJVs because they reduce the coordination and monitoring costs in dealing with local partners. By contrast, other researchers contend that MNEs have no preferences for a higher ownership share because they must provide incentives for local partners to cope with the uncertainty in exploiting intangible assets (Driffield, Mickiewicz, & Temouri, 2014). They

find a negative or insignificant effect of intangible assets on a foreign ownership share (Driffield et al., 2014; Sanchez-Peinado & Pla-Barber, 2006). Most empirical studies have treated ownership decisions as dichotomous choices between 0 (IJVs) and 1 (WOSs). Recently, scholars have argued that this method risks relegating various ownership modes to one category and may yield less accurate results (Driffield et al., 2014; Malhotra, Sivakumar, & Zhu, 2011). They argue that using a continuous measure for ownership may help solve this problem.

Moreover, prior research has further suggested that the local environment has a contingent role and can further affect the extent of knowledge spillovers, such as local institutions, local firms' absorptive capacity, and mobility of local human capital (Guo, Ning, & Chen, 2021; Lu, Tao, & Zhu, 2017; Xiao & Park, 2018). However, our understanding is still limited regarding how the local industrial structure can be an important environmental setting. The roles of various industrial structures on knowledge spillovers have been debated. An increasing amount of research has revealed that local industrial diversity facilitates learning among firms and induces knowledge spillovers (Boschma, 2017; Boschma & Iammarino, 2009; Castaldi, Frenken, & Los, 2015; Frenken, Van Oort, & Verburg, 2007). Therefore, industrial diversity is likely to interfere with the knowledge leakage in local regions and affect foreign firms' ownership decisions. Recently, scholars have proposed that industrial variety should be divided as variety between technologically related industries and between unrelated industries. No literature addresses whether and how different types of industrial varieties affect foreign ownership in IJVs.

To fill the research gaps, we study the continuous relationship of foreign firms' intangible assets and their shares in IJVs alongside the role of local industrial structures. We make two crucial contributions. First, the previous literature investigating intangible assets and foreign ownership primairly treats the ownership strategies as dichotomous choices, such as between WOSs and IJVs or between majority and minority ownership, which may be arbitrary and may

not offer detailed suggestions for foreign firms because different levels of ownership require different levels of resource commitment from foreign firms and has different power allocation between partners (Boubakri, Guedhami, Kwok, & Saffar, 2016; Driffield et al., 2014; Malhotra & Gaur, 2014). Therefore, we propose a continuous relationship between the level of intangible assets and foreign ownership because foreign firms intend to adjust their ownership gradually in IJVs to achieve a balance between the abilities to control knowledge leakage and resource commitments.

Second, we incorporate a contingent role of the local industrial structures in explaining the foreign ownership shares in IJVs. Previous literature has primairly investigated foreign ownership decisions and local industrial structures separately (Aarstad, Kvitastein, & Jakobsen, 2016; Castaldi et al., 2015; Frenken et al., 2007). We move beyond these perspectives and argue that because the local industrial structures may exacerbate the knowledge leakage, they may increase foreign firms' inclinations to gain more ownership in IJVs as ways of knowledge protection (Boschma, Eriksson, & Lindgren, 2009; Ning, Wang, & Li, 2016). In particular, we investigate two industrial structures: related industrial variety, that is, the agglomeration of firms in industries with high knowledge similarity; and unrelated variety, that is, the agglomeration of firms in industries with unrelated knowledge (Aarstad et al., 2016; Frenken et al., 2007). We find empirical support for the positive moderating role of related and unrelated varieties between intangible assets and foreign ownership; however, these roles can vary when foreign firms take different initial ownership positions in IJVs. The moderating roles these two types of varieties tend to be weakened when the ownership share in IJVs is too low or too high. To the best of our knowledge, this paper is the first to provide an integrated perspective and empirical evidence on the effect of the local industrial structures in the relationship between intangible assets and foreign ownership.

## 2. Literature review and hypotheses development

### *2.1 Intangible assets and foreign ownership*

One of the most challenging issues for firms entering overseas markets is determining the level of ownership in host country subsidiaries (Dunning, Pak, & Beldona, 2007; Hennart & Slangen, 2015). Different ownership strategies can have serious implications for the control, commitment, and risks of the foreign ventures and affect their financial returns and technological competitiveness (Chang, 2019; Nisar, Boateng, & Wu, 2018). An extensive body of literature is primairly developed around the following major theories. The first stream primarily rests on Dunning's "OLI" paradigm, which indicates ownership advantages of specific assets, location advantages of a market, and internalization advantages of integrating transactions inside the firm as three determinants of firms' ownership choice (Agarwal & Ramaswami, 1992; Dunning et al., 2007). The second insight is derived from transaction cost theory. It perceives firms' ownership choice as a trade-off between the gains from exploiting crucial assets and costs related to negotiations with and monitoring partners (Maekelburger, Schwens, & Kabst, 2012). This insight suggests that market-based entry modes, such as IJVs, are more superior because firms could gain from the scale economies of the marketplace (Chang et al., 2013; Nguyen & Almodóvar, 2018). Such market benefits would only give way to a more integrated entry mode if transactions involve high asset specificity or market uncertainty (Maekelburger et al., 2012; Puck, Holtbrügge, & Mohr, 2009). However, the literature has been criticized for underestimating the role of contextual factors, such as the local institutions, local degree of marketization, and competition (Li & Li, 2010; Puck et al., 2009; Xie, 2017).

Ownership strategies regarding the degree of the ownership share are generally embedded under the broader study of entry mode strategies. Therefore, most literature has focused on

choices among a limited number of ownership structures. For example, choices between contract joint ventures and ownership joint ventures, between WOSs and IJVs (Chang, 2019; Wooster et al., 2016); or between majority and minority ownerships (Driffield et al., 2014; Li & Li, 2010). However, the selected dividing points are usually arbitrary (Malhotra et al., 2011). Therefore, foreign firms do not have sufficient insights on exactly how much ownership they should take because different levels of ownership in an IJV require different amounts of resources (Kabiraj & Sengupta, 2018; Nisar et al., 2018). Different levels of ownership may further bring foreign firms with different power over the IJVs and affect their cooperation with local partners (Boubakri et al., 2016). Therefore, selecting a suitable level of ownership along a continuous span allows foreign firms to take sufficient control with the least amount of resource commitments. Recently, scholars, such as Boubakri et al. (2016), Malhotra and Gaur (2014), and Yang (2015), have used continuous measures of ownership in studies on emerging markets. They argue that a continuous measure of foreign ownership is better than arbitrarily divided choices because it can show a more fine-grained pattern of how foreign ownership varies.

Many MNEs select IJVs as the entry mode into foreign domestic markets (Jiang, Li, Gao, Bao, & Jiang, 2013; Xie, 2017). Combination with local ownership can help foreign firms get adapted to the local market, access local resources and funding (Ryu, McCann, & Reuer, 2018; Toh & Jia, 2021; Zhang et al., 2007). Local partners can further receive advanced knowledge through IJVs and upgrade their technology becoming capable cooperators of foreign firms (He, Gan, & Xiao, 2021; Kabiraj & Sengupta, 2018). However, some scholars contend that through such frequent interactions with local partners, foreign firms may leak the core knowledge within their intangible assets (Inkpen, Minbaeva, & Tsang, 2019; Sun, Hong, Ma, & Wang, 2017). Therefore, local partners and competitors may absorb the leaked knowledge and later compete with foreign firms. Foreign firms generally take protective measures, such as discreet

communication and increased technological complexity, to manage knowledge leakages (Frishammar et al., 2015; Sofka, Shehu, & de Faria, 2014).

A suitable ownership structure may help foreign firms overcome knowledge leakage because increased ownership offers foreign firms more authority, control, and decision-making power over the IJVs (Agnihotri & Bhattacharya, 2019; Ryu et al., 2018). It further helps foreign firms monitor and safeguard their crucial assets, such as research and development resources (Kabiraj & Sengupta, 2018; Zhang et al., 2007). However, the empirical findings on the relationship between intangible assets and foreign ownership are mixed (Chang et al., 2013; Claver & Quer, 2005; Sanchez-Peinado & Pla-Barber, 2006). Some literature suggests that foreign firms with more intangible assets should enter the market as WOSs than IJVs. For example, Javorcik and Saggi (2010) analyze the foreign investments in Eastern European countries and find that foreign firms with more intangible assets are more likely to enter the market through WOSs because local partners may free ride on the foreign firms' efforts in exploiting intangible assets. Wooster et al. (2016) find that the U.S. firms generally select WOSs to prevent local partners from using intangible assets outside the scope of IJV contracts. Chang (2019) employs data on IJVs in China and finds that in industries with more intangible assets, the contributions of foreign firms to IJVs are generally larger, and thus, foreign firms are more likely to convert IJVs to WOSs and achieve maximum efficiency. By contrast, other scholars do not find a significantly positive connection between intangible assets and foreign ownership. For example, Sanchez-Peinado and Pla-Barber (2006) investigate foreign firms in Spain and find that the role of intangible assets in foreign ownership is not evident. Driffield et al. (2014) investigate the IJVs in Central and Eastern Europe and find that because the value of intangible assets is less measurable than tangible assets, foreign firms generally offer local partners with more ownership as a compensation for the uncertainty in exploiting intangible

assets. To the best of our knowledge, literature has seldom applied the continuous measure of ownership to explore intangible assets and ownership strategies.

One reason for the mixed findings may be that most existing research has considered ownership decisions relative to the dichotomy between IJVs and WOSs. Although some studies confirm that foreign firms prefer WOSs when they have more intangible assets, other studies may not draw the same results because IJVs are the priority choices of foreign firms. The dichotomy is unsuitable, particularly in emerging markets because many emerging markets set a very high standard for foreign firms to achieve majority ownership or WOSs (Bao, Wang, & Xie, 2019; Kabiraj & Sengupta, 2018). A more appropriate method is to conduct in-depth research on the relationship between intangible assets and foreign ownership in IJVs along with a continuous range.

### *2.2 Intangible assets and foreign ownership in China's IJVs*

Knowledge protection is a major concern for foreign firms in China. Local Chinese firms generally have less advanced technology (Inkpen et al., 2019; Kong, Guo, Wang, Sui, & Zhou, 2020). Moreover, because emerging markets are usually characterized by weak knowledge protection institutions, local firms are more encouraged to misappropriate the knowledge of foreign firms without compensation, thereby further increasing the risks of knowledge leakage (Sun et al., 2017; Zhang et al., 2007). Thus, foreign firms tend to rely more on internal control to compensate for the lack of external institutions. Therefore, we propose that the foreign ownership share in IJVs should be positively related to the level of intangible assets because it helps foreign firms control knowledge leakage in the following ways.

First, higher ownership may help foreign firms monitor and control the knowledge leakage in local partners. With more ownership, foreign firms can exert more management control over the IJVs and influence members to meet the objectives of protecting intangible assets (He et

al., 2021). For example, with more ownership, foreign firms can send more representatives to the board of IJVs (Kabiraj & Sengupta, 2018; Ryu et al., 2018). The representative managers can oversee the deployment of intangible assets and detect whether local partners possess intangible assets without that are not authorized from the foreign firm. Foreign firms with a higher ownership share in IJVs can thus discover the leakage earlier and quickly take measures to stop it (Frishammar et al., 2015; Ryu et al., 2018). With the growth in intangible assets, foreign firms require more monitoring and control and prefer higher ownership.

Second, higher ownership helps foreign firms reduce the knowledge leakage to other local firms through interactions with them (Sofka et al., 2014). Emerging markets have more informal rules, thereby requiring foreign firms to have frequent informal interactions with local suppliers and competitors (Zhang et al., 2007). Higher ownership offers foreign firms more power and authority to strengthen organizational control in IJVs (Sofka et al., 2014). Therefore, foreign firms can more efficiently control the interactions among their IJVs and other firms. For example, foreign firms with more ownership in IJVs can more easily establish rules to keep their intangible assets isolated from the external environment (Inkpen et al., 2019). Foreign firms can restrain managers and employees from disclosing information and can prevent knowledge leakage by reducing employee turnover to local firms (Frishammar et al., 2015; Sofka et al., 2014). Hence, we propose:

***Hypothesis 1.*** *The intangible assets in an IJV are positively associated with the level of foreign ownership.*

### *2.3 Moderating roles of industrial structures*

When firms from different industries colocate in different approaches, they form different types of industrial structures (Howell, He, Yang, & Fan, 2018). Previous literature has investigated how different dimensions, such as industrial specialization, industrial variety, and urbanization, influence the knowledge exchange among firms, thereby leading to different levels of knowledge spillovers (Boschma et al., 2009; Ng, 2007; Ning et al., 2016). Therefore, foreign firms located in regions with different industrial structures are likely to experience different levels of knowledge leakage, which influences their ownership shares in IJVs. Industrial variety, in particular, increases the knowledge sources for firms and generates a high level of knowledge spillovers (Boschma, 2017; Cainelli & Ganau, 2019). Firms can obtain fresh and better knowledge through learning from local firms in other industries (Boschma & Iammarino, 2009). Recent literature has found that knowledge spillovers can be maximized if regions have a portfolio of industries with high knowledge relatedness (Aarstad et al., 2016; Cainelli & Ganau, 2019; Frenken et al., 2007). However, others find that knowledge spillovers are more likely among many unrelated industries (Castaldi et al., 2015; Grillitsch, Asheim, & Trippl, 2018; Ng, 2007). In the following paragraphs, we discuss the industrial variety among related and unrelated industries as well as the contingent roles of industrial variety in the relationship between intangible assets and foreign ownership in IJVs.

### 2.3.1 Impact of related variety

The previous literature generally holds that agglomeration of different but related industries leads to more knowledge spillovers. Scholars argue that firms with similar prior experience and knowledge base can rapidly understand and utilize the new knowledge from different but similar industries (Boschma & Iammarino, 2009; Miguelez & Moreno, 2018). Most studies have reported the positive role of related variety in regional economic growth, firm productivity, and innovation. For example, Frenken et al. (2007) argue that related variety

brings more knowledge spillovers, thereby promoting economic growth and employment. Antonietti and Cainelli (2011) discover the roles of related variety in the creation of ideas among Italian manufacturing firms. Aarstad et al. (2016) find that related variety stimulates firm innovation in Norway because it maintains a small cognitive distance for firms to interact and learn from each other. Naldi, Criaco, and Patel (2020) discover that industrial variety provides Swedish firms with more diversified sources of knowledge, thereby increasing their willingness to export. Tavassoli and Carbonara (2014) contend that related variety strikes a perfect balance between knowledge proximity and distance among firms, thereby producing the optimal amount of knowledge spillovers.

As for the direct role of related variety in foreign ownership decisions, high relatedness reduces the barrier for firms to absorb and assimilate other knowledge (Castaldi et al., 2015). Thus, foreign firms can easily tap into a large pool of complementary local knowledge (Boschma et al., 2009; Frenken et al., 2007). Therefore, related variety reduces the difficulties for foreign firms to find local knowledge, thereby reducing their dependence on local partners (Boschma, 2017). When a high related variety provides sufficient complementary resources and reduces the costs of knowledge searching, foreign firms may be more inclined to commit more resources and increase ownership in IJVs to take more initiatives in business operations (Speckbacher, Neumann, & Hoffmann, 2015). Therefore, we contend that related variety itself plays a positively direct role in foreign ownership in IJVs.

Apart from the direct effect of related variety on foreign ownership, we contend a positive moderating role of related variety between intangible assets and foreign ownership for the following reasons: First, in regions with higher related variety, local firms can more easily spread the knowledge leaked from IJVs (Boschma et al., 2009). Local firms can collectively access and absorb external knowledge through mutual learning (Antonelli, Patrucco, & Quatraro, 2011). Local firms operating in similar industries as IJVs can more conveniently

develop relationships with employees from IJVs and absorb the knowledge leaked from foreign firms (Aarstad et al., 2016; Castaldi et al., 2015). Therefore, foreign firms have higher knowledge protection intensity because frequent communications with local firms can cause higher risks of unintended knowledge leakage (Sofka et al., 2014). Furthermore, because local firms share a similar knowledge base but operate in different businesses, they are more likely to form symbiotic relationships and become motivated to share knowledge with one another (Kijkasiwat, Wellalage, & Locke, 2021). Once foreign firms' knowledge is leaked, it can be quickly spread to firms in other industries highly related to the IJVs. This condition further increases the harms of knowledge leakage and creates more potential competitors (Boschma, 2017). Therefore, foreign firms may be more inclined to increase ownership in IJVs with the increasing intangible assets.

Second, related variety helps local competitors combine complementary resources with the leaked knowledge from intangible assets, thereby increasing the adverse effects of knowledge leakage on foreign firms. Speckbacher et al. (2015) argue that firms can realize synergies and improve their technology by combining the existing resources with those in other industries. To fully absorb and apply the advanced knowledge from foreign firms' intangible assets, local firms need a large number of complementary resourcesincluding equipment, infrastructures, and production materials (Chang et al., 2013; Sun et al., 2017). In regions with high related variety, finding complementary resources to the leaked knowledge is easier for the local firm (Castaldi et al., 2015; Ng, 2007). Therefore, local firms can more conveniently draw on these complementary resources directly to replicate the foreign firms' technology or invent a techonology based on it (Sofka et al., 2014). Hence, in such regions, foreign firms with more intangible assets experience more threats to their technology positions and are more inclined to select higher ownership in IJVs.

We, therefore, propose these hypotheses:

***Hypothesis 2a***. *Related industrial variety is positively associated with foreign ownership in IJVs.*

***Hypothesis 2b***. *Related industrial variety positively moderates the relationship between intangible assets and foreign ownership in IJVs.*

### 2.3.2 Impact of unrelated variety

The previous literature has debated on whether unrelated variety facilitates or reduces the knowledge spillovers. Existing studies primarily conclude that unrelated variety enlarges the knowledge and technological distances among different industry firms. Thus, the market structure becomes more fractured and incoherent (Frenken et al., 2007; Fritsch & Kublina, 2018). More current studies have found that unrelated variety can contribute to knowledge spillovers and technological innovation. For example, Frenken et al. (2007) find that unrelated variety reduces the interdependences among industries and makes regions more resilient against unemployment risks. It further prevents firms from exiting the market and enables them to absorb external knowledge more consistently (Fritsch & Kublina, 2018). In addition, Castaldi et al. (2015) and Grillitsch et al. (2018) find that knowledge spillovers across unrelated industries may not be as frequent as across related ones; however, unrelated variety usually generates more radical technological innovations. Moreover, Antonietti and Gambarotto (2020) find that regions with unrelated variety provide a fertile environment for combining different knowledge, thereby fostering more innovative start-ups.

We contend that unrelated variety has a negative direct effect on foreign ownership in IJVs. Because of a more fractured and incoherent market structure, unrelated variety increases the difficulties for foreign firms to find local knowledge and resources complementing their requirements (Aarstad et al., 2016; Castaldi et al., 2015). Shi, Sun, Pinkham, and Peng (2014)

have emphasized that local experience and networks are critical for firms in emerging markets. Compared with foreign firms, local partners have more experience with operations in the local market and have sufficient experience and networks to obtain local knowledge. Foreign firms thus tend to rely on local partners. To avoid spending excessive time and effort in searching for complementary local knowledge under an unrelated variety environment, foreign firms prefer to take lower ownership in IJVs and delegate more power to local partners. Therefore, we posit that unrelated variety has a negative direct effect on foreign ownership in IJVs.

Unrelated variety affects MNEs' ability to spread knowledge across industries and find complementary resources from local markets. However, the information exchange between foreign firms and local partners is not interrupted. Compared with foreign firms, local partners have built suitable experience and networks to obtain local knowledge. Therefore, unrelated variety may not reduce the firms' abilities to absorb and apply the knowledge from foreign firms. Moreover, unrelated variety has some characteristics beneficial for knowledge leakage, and thus, unrelated variety may play a positive moderating role in the relationship between intangible assets and foreign ownership.

First, in regions with higher unrelated variety, risks of knowledge leakage for foreign firms increase because local firms have more opportunities to exchange knowledge with completely different industries (Castaldi et al., 2015). Combinations of unrelated knowledge are rare but may lead to the development of new markets and growth paths (Grillitsch et al., 2018). In particular, more diverse demands for products and services encourage firms from different industries to cooperate with others and explore unexploited market opportunities under unrelated industrial structures (Antonietti & Gambarotto, 2020; Ng, 2007). These unrelated knowledge combinations can lead to radical innovations, generate new technology paths, and bring radical industry changes (Aarstad et al., 2016; Castaldi et al., 2015). Moreover, if these radical innovations are based on the knowledge leaked from foreign firms, local firms

embracing these innovations can threaten foreign firms' competitive advantages (Perri & Peruffo, 2016). Therefore, in regions with unrelated variety, foreign firms with intangible assets may perceive more danger from knowledge leakage and may select higher ownership in IJVs.

Second, unrelated variety helps create a more stable regional economy, thereby allowing local competitors to continuously absorb foreign firms' knowledge leakage. In regions with higher unrelated variety, different industries are less connected, and thus, external shocks to only a few industries do not affect the region's overall economic stability. Therefore, unrelated variety can harm the growth of unemployment and help stabilize the regional economy (Frenken et al., 2007). Meanwhile, the interactions among firms within identical or similar industries become more stable, thereby facilitating more continuous interactions among firms (Fritsch & Kublina, 2018; Inkpen et al., 2019). These continuous interactions help local firms maintain close contact with IJVs, thereby gradually absorbing knowledge from foreign firms (Zhang, Li, & Li, 2014). Therefore, in regions with high unrelated variety, foreign firms with more intangible assets are more likely to be caught up by local firms. Therefore, they are more inclined to increase ownership in IJVs for protection.

Based on these arguments, we hypothesize the following:

***Hypothesis 3a.*** *Unrelated industrial variety is negatively associated with foreign ownership in IJVs.*

***Hypothesis 3b.*** *Unrelated industrial variety positively moderates the relationship between intangible assets and foreign ownership in IJVs.*

## 3. Data and methodology

### *3.1 Data source and sample*

We select China as an empirical setting for three reasons: First, IJVs are the most common form of market entry and have been crucial to the development of China's economy because they bring new and advanced knowledge and help local firms upgrade (Chang et al., 2013). Second, the institutions for knowledge protection in China are still underdeveloped, thereby allowing Chinese firms to take advantage of leaked knowledge and increase their competitiveness by replicating foreign firms' technology (Jiang et al., 2013; Zhang et al., 2007). Third, China has a huge heterogeneity among industrial structures of different regions, which creates substantial variations in the intensity of knowledge spillovers or risks of leakage across regions (Ning et al., 2016; Wang & Wu, 2016). Therefore, China provides us with a suitable context to explore the relationship between intangible assets and the foreign ownership share from the perspective of knowledge leakage and comprehensively understand the roles of the industrial structures in the ownership share.

To conduct an empirical analysis, we employ the Annual Industrial Survey Database from China's National Bureau of Statistics, which comprises the financial information of all local and foreign-invested firms with total firm assets of over 5 million RMB (Bao et al., 2019; Chang, 2019). We collect annual data across 1998–2007. We include all foreign firms that initially operated as IJVs and then adjusted their ownership share during the sample period. Following Bao et al. (2019), we define IJVs as firms with foreign ownership higher than 0% and less than 100%. Furthermore, we include the sample wherein IJVs' foreign ownership finally increased to 100%. After excluding missing values, we obtain a sample data with 106,512 firm-level observations from 25,447 IJVs.

### *3.2 Variables*

#### 3.2.1 Dependent variable

To measure the foreign ownership in the IJVs, we follow Xie (2017) and Agnihotri and Bhattacharya (2019) in defining the dependent variable as the ratio of ownership held by a foreign firm in an IJV's total equity. This measure can precisely reflect the foreign firms' control over the IJVs. As mentioned previously, the distinction between continuous and dichotomous measures is subtle but important because the continuous measure of ownership provides a more fine-grained perspective on the differences between joint ventures with varying levels of equity (Mani, Antia, & Rindfleisch, 2007).

### 3.2.2 Independent variable

We follow Xie (2017) and Chang (2019) in measuring the independent variable as the ratio of intangible assets, available in the balance sheet, over the total assets of an IJV. In our sample, intangible assets in IJVs are good proxies of the intangible assets transferred from foreign firms. During the sample period, the local firms in China still fall largely behind MNEs in terms of technology development, and many of them depend on foreign firms' advanced technology. Furthermore, scholars, such as Chang et al. (2013) and Chang (2019), recognize that foreign firms are the primary contributors of intangible assets in China's IJVs.

### 3.2.3 Moderating variables

Related and unrelated varietes are both measured using Jacquemin and Berry (1979) entropy index. It is commonly used to measure the variety of industries in a region and was first applied by Frenken et al. (2007) to explore the roles of related and unrelated varieties in the growth of employment and productivity in the Netherlands. Afterward, it has been applied by different scholars, such as Castaldi et al. (2015), Aarstad et al. (2016), and Cainelli and Ganau (2019), to examine the roles of the industrial variety in innovation and productivity. Furthermore, numerous scholars have applied an entropy measure when investigating the roles

of related and unrelated varieties in regional knowledge spillovers. For example, when Antonelli et al. (2011) investigate the effects of related variety on the creation of new ideas by Italian firms, they use entropy to measure the industrial variety at the broader two-digit industries and the five-digit subsectors. Antonietti and Gambarotto (2020) use the same approach to explore the roles of unrelated variety in the growth of innovative start-ups in Italy. Similarly, Naldi et al. (2020) use the entropy measure to study how the industrial variety enables Swedish firms to gain external knowledge and enter international markets. Overall, we consider entropy as an effective measure because it can decompose the industrial variety into different levels, thereby helping us distinguish between related and unrelated industries.

Previous studies have defined that subsectors within a broader industry (e.g., the two-digit level industry) generally possess a similar knowledge base, whereas the broader industries are usually unrelated (Antonietti & Cainelli, 2011; Frenken et al., 2007; Naldi et al., 2020). Following their methods, we define industries at the two-digit SIC code level as unrelated because they depend on distinctly different sets of knowledge and technology, whereas the four-digit industries within a two-digit industry are related because they primarily employ the same set of knowledge and technology. We measure unrelated variety (UV) as the summed entropy of employment in all two-digit industries within a region. Formally, it can be written as follows:

$$UV = \sum_{g=1}^{G} P_g \, log_2\left(1/P_g\right) \tag{1}$$

where $P_g$ measures the share of employment in the two-digit industries $G(1,2,\dots g)$ over the employment of all the industries in the same city. Employment is the sum of employment at all firms belonging to the same industry. When all the employment is concentrated in one industry, $UV$ equals 0. When the employment is equally distributed in all the two-digit industries, $UV$ has the maximum value $log_2(G)$.

Extending the idea of unrelated variety, we follow Frenken et al. (2007) and define related variety (RV) as the weighted sum of entropy at the four-digit industry level within each two-digit industry. Formally, related variety is as follows:

$$RV = \sum_{g=1}^{G} P_g H_g \tag{2}$$

where

$$H_g = \sum_{i \in S_g} (p_i / P_g) log_2 \big(1/(p_i/P_g)\big) \tag{3}$$

where $p_i$ is the share of employment in the four-digit industry $i$ over a city's total employment.

3.2.4 Control variables

We refer to the previous literature and control for several factors that may affect the foreign ownership share in the IJVs. We control for the firm size because larger firms have more resources to draw and may rely less on their local partners (Xie, 2017). We include the firm age as a proxy for learning or resources acquired from a joint venture's experience, which may increase local knowledge and lead to higher foreign ownership (Chang, 2019; Xie, 2017). Because Bao et al. (2019) suggest that foreign ownership tends to be high in IJVs with higher financial leverage since foreign firms have more financial resources than local partners, we include the ratio of total debts to total assets for measuring an IJV's financial leverage. Moreover, we use the ratio of export sales in total sales to measure IJVs' overseas market orientation and capture the influence of overseas markets (Chang, 2019). We further control for the ratio of inventory to total assets for measuring ownership adjustment costs because clearing costs can delay foreign firms' decisions to select higher ownership (Axarloglou & Kouvelis, 2007). Apart from firm-specific variables, we include the Herfindahl–Hirschman Index at the industry level to measure the industrial competition because foreign firms

experiencing more competition have more inclinations to protect their resources and increase control over IJVs (Li & Li, 2010; Puck et al., 2009). As the adjustment of ownership is a lengthy process, we measure the foreign ownership at year t, while the other variables at year t − 1.

### *3.3 Methodology*

We first use the Tobit model as the baseline model to estimate the foreign ownership because it can help examine the linear relationship between intangible assets and foreign ownership. The Tobit model is a widely used statistical tool to manage continuous dependent variables between 0 and 1 (Wulff & Villadsen, 2020). However, we take a step further and adopt Papke and Wooldridge (1996) fractional probit model because the model holds no assumption of the conditional distribution and yields more consistent estimations (Wulff & Villadsen, 2020). Therefore, the fractional probit model is a more suitable choice for our research. According to Papke and Wooldridge (1996), the conditional expectation of the fractional dependent variable is defined as follows:

$$E(y_i|x_i) = G(x_i\beta) \tag{4}$$

where $i$ denotes the firm. $0 \leq y_i \leq 1$ is the foreign ownership of an IJV. $G(\cdot)$ is a probit distribution function that leads to computationally simple estimators when unobserved heterogeneity emerges (Papke & Wooldridge, 1996).

## 4. Results

### *4.1 Main results*

Table 1 reports the descriptive statistics and Pearson's correlation coefficients for the variables. On average, the foreign firms take an ownership of 56.1% in the IJVs. The IJVs in our sample have an average age of 8.21 years. The average level of intangible assets ratio is 27.9%.

Table 2 presents the regression results of the complete sample. Models 1–4 are estimated using the Tobit model, whereas Models 5–8 are estimated using the fractional probit model. We add control and independent variables subsequently with our complete models in Models 4 and 8. Overall, the statistical tests were conducted using Wald Chi-squared support with the Tobit and fractional probit models because both models reject the null hypothesis that all coefficients in the model are simultaneously zero (Papke & Wooldridge, 1996). We primairly interpret our results based on the full model of fractional probit estimation (Model 8). As shown in Model 8, a significantly positive relationship is observed between intangible assets and foreign ownership in IJVs ($\beta = 0.256$, p<0.01), that is, a one-unit increase in the level of intangible assets leads to a 0.256-unit increase in foreign ownership. This result supports Hypothesis 1. Related variety has a positively direct effect on foreign ownership ($\beta = 0.289, p < 0.01$), thereby supporting Hypothesis 2a. By contrast, the coefficient of unrelated variety is negative ($\beta = -0.562, p < 0.01$), thereby supporting Hypothesis 3a.

For moderating variables, the coefficient of the interaction term of the intangible assets and related variety is positive, which supports Hypothesis 2b ($\beta = 0.225, p < 0.01$). However, the coefficient of the interaction term of the intangible assets and unrelated variety is insignificant ($\beta = 0.008, p > 0.1$), thereby failing to support Hypothesis 3b. We illustrate the moderating effects of related and unrelated varieties (Figure 1). In Figure 1a, the solid and dashed lines represent the relationship between intangible assets and foreign ownership in the presence of low and high related variety, respectively. The slope of the line increases with the level of related variety, thereby suggesting that related variety has a positive moderating role in the relationship between intangible assets and foreign ownership. However, as Figure 1b presents two parallel lines, it shows no evident differences in the relationship between intangible assets and foreign ownership under lower or higher unrelated variety. This finding corresponds with the insignificant moderating role of unrelated variety in Model 8.

**Table 1.** Descriptive statistics and correlation coefficients of variables

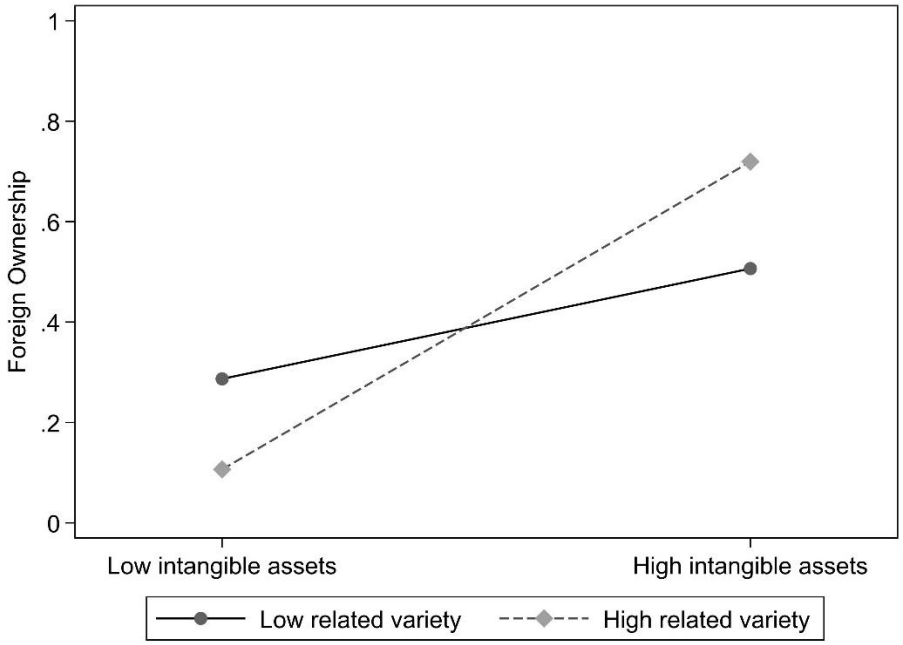
| | Variables | Mean | S.D. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Foreign ownership | 0.561 | 0.314 | 1.000 | | | | | | | | | |
| 2 | Intangible assets | 0.279 | 0.401 | 0.007 | 1.000 | | | | | | | | |
| 3 | Related variety | 2.222 | 0.549 | 0.105 | −0.079 | 1.000 | | | | | | | |
| 4 | Unrelated variety | 4.145 | 0.368 | 0.036 | −0.018 | 0.153 | 1.000 | | | | | | |
| 5 | Size | 21.809 | 45.264 | 0.065 | 0.131 | −0.019 | −0.003 | 1.000 | | | | | |
| 6 | Age | 8.209 | 7.033 | −0.155 | −0.062 | 0.002 | −0.020 | −0.202 | 1.000 | | | | |
| 7 | Leverage | 0.547 | 0.276 | −0.121 | −0.050 | −0.026 | −0.020 | −0.042 | 0.070 | 1.000 | | | |
| 8 | Export ratio | 0.360 | 0.489 | 0.121 | −0.025 | 0.052 | −0.057 | 0.193 | −0.033 | −0.014 | 1.000 | | |
| 9 | Adjustment costs | 0.211 | 0.147 | −0.030 | 0.090 | −0.017 | −0.013 | −0.161 | −0.026 | −0.164 | −0.057 | 1.000 | |
| 10 | Industrial competition | 0.888 | 0.153 | 0.095 | −0.014 | 0.421 | 0.175 | 0.179 | −0.055 | −0.030 | 0.145 | −0.051 | 1.000 |

Notes: (1) Firm size is measured by 1 million RMB. (2) All absolute correlation coefficients greater than 0.006 are significant at $p < 0.05$. N=106,512.

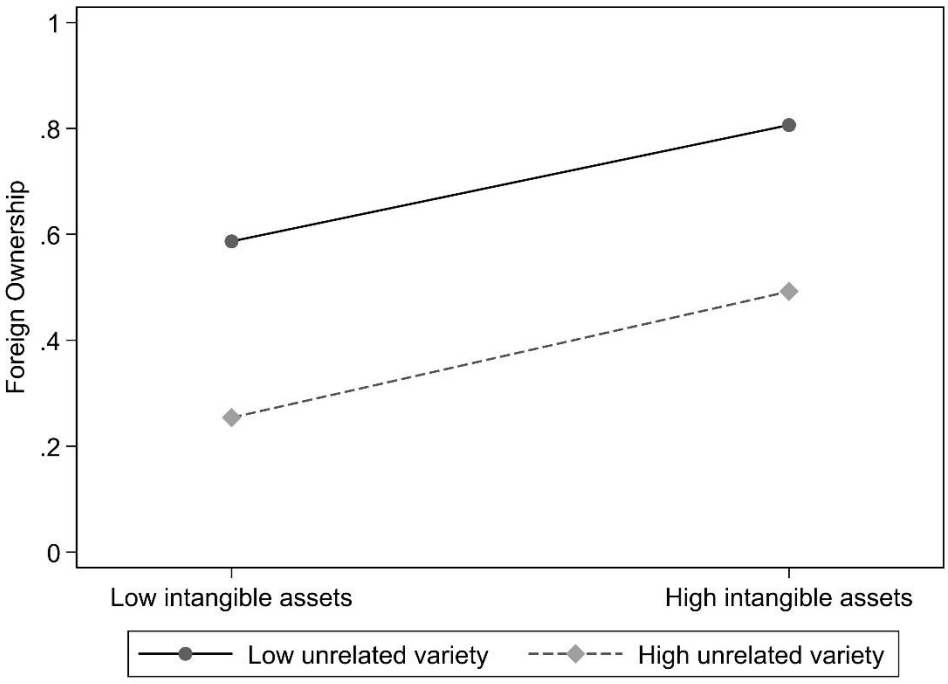
**Table 2.** Foreign ownership, intangible assets, and the roles of related and unrelated variety (Tobit and fractional probit estimations)

| | Tobit | Tobit | Tobit | Tobit | Fractional | Fractional | Fractional | Fractional |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Ln(size) | 0.049*** | 0.081*** | 0.017 | 0.115*** | 0.022 | 0.072*** | 0.005 | 0.122*** |
| | (0.018) | (0.018) | (0.017) | (0.017) | (0.026) | (0.026) | (0.026) | (0.026) |
| Age | −0.007*** | −0.007*** | −0.007*** | −0.007*** | −0.011*** | −0.012*** | −0.011*** | −0.011*** |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Leverage | 0.145*** | 0.142*** | 0.152*** | 0.138*** | 0.219*** | 0.216*** | 0.224*** | 0.217*** |
| | (0.004) | (0.004) | (0.004) | (0.004) | (0.009) | (0.009) | (0.009) | (0.009) |
| Export ratio | 0.091*** | 0.091*** | 0.070*** | 0.067*** | 0.131*** | 0.132*** | 0.109*** | 0.100*** |
| | (0.003) | (0.003) | (0.002) | (0.003) | (0.007) | (0.007) | (0.006) | (0.006) |
| Adjustment cost | −0.133*** | −0.133*** | −0.132*** | −0.135*** | −0.189*** | −0.191*** | −0.193*** | −0.202*** |
| | (0.008) | (0.008) | (0.008) | (0.008) | (0.012) | (0.012) | (0.012) | (0.012) |
| Industrial competition | 0.192*** | 0.074*** | 0.266*** | 0.057*** | 0.292*** | 0.111*** | 0.476*** | 0.089*** |
| | (0.009) | (0.010) | (0.008) | (0.009) | (0.012) | (0.013) | (0.013) | (0.014) |
| Intangible asset | 0.088*** | 0.154*** | 0.043 | 0.197*** | 0.086* | 0.184*** | 0.038*** | 0.256*** |
| | (0.030) | (0.031) | (0.029) | (0.029) | (0.045) | (0.046) | (0.014) | (0.047) |
| Related variety | | 0.072*** | | 0.190*** | | 0.111*** | | 0.289*** |
| | | (0.003) | | (0.003) | | (0.003) | | (0.004) |
| Intangible asset*Related variety | | 0.097* | | 0.158*** | | 0.134* | | 0.225** |
| | | (0.055) | | (0.058) | | (0.077) | | (0.093) |
| Unrelated variety | | | −0.273*** | −0.385*** | | | −0.386*** | −0.562*** |
| | | | (0.003) | (0.004) | | | (0.006) | (0.007) |
| Intangible asset*Unrelated variety | | | 0.167** | 0.010 | | | 0.233 | 0.008 |
| | | | (0.082) | (0.089) | | | (0.149) | (0.171) |
| Constant | 0.281 | 0.213 | 1.705*** | 1.655*** | −0.954*** | −1.058*** | 0.605*** | 1.046*** |
| | (0.186) | (0.185) | (0.018) | (0.176) | (0.133) | (0.133) | (0.136) | (0.136) |
| Year Dummy | yes | yes | yes | yes | yes | yes | yes | yes |
| Industry Dummy | yes | yes | yes | yes | yes | yes | yes | yes |
| Observations | 106,512 | 106,512 | 106,512 | 106,512 | 106,512 | 106,512 | 106,512 | 106,512 |
| Left Censored | 0.000 | 0.000 | 0.000 | 0.000 | | | | |
| Uncensored | 83,954 | 83,954 | 83,954 | 83,954 | | | | |
| Right Censored | 22,558 | 22,558 | 22,558 | 22,558 | | | | |
| Pseudo R-squared | 0.060 | 0.067 | 0.095 | 0.150 | 0.196 | 0.197 | 0.203 | 0.209 |
| F Test//Wald chi2 | 7645 | 8476 | 12044 | 19106 | 49524 | 43065 | 39134 | 40443 |
| Prob > chi2 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

Note: Robust standard errors in parentheses. Bonferroni-adjusted p-values: *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$




(a) Interaction between intangible assets and related variety




(b) Interaction between intangible assets and unrelated variety

**Figure 1.** Illustrations of hypothesized effects using the full sample in Table 2

*4.2 Further analysis on the role of unrelated variety*

In general, the full sample estimations confirm our Hypotheses H1, H2a, H2b, and H3a but not H3b. However, the previous discussions on how foreign ownership may be affected by their initial ownership states inspire further subsample analysis. As Bao et al. (2019) and Chang (2019) propose, the ownership share selected by the foreign firms when they enter local markets tend to have substantial impacts on the subsequent ownership strategies. If the more efficient foreign firm is not given an appropriate ownership share because of a weak initial controlling position, they are likely to pursue a higher ownership share afterward to increase the IJV's efficiency (Chang, 2019). If the foreign firms already possess sufficient ownership to protect their assets, then they are less likely to further increase ownership. Therefore, we divide the firms into four subsamples according to the initial level of foreign ownership. In Table 3, Models 1–4 are estimated using the Tobit model. Using fractional probit estimation, Models 5–8 estimate the full model on IJVs with initial foreign ownership lying between 0%–25%, 25%–50%, 50%–75%, 75%–100%, respectively.

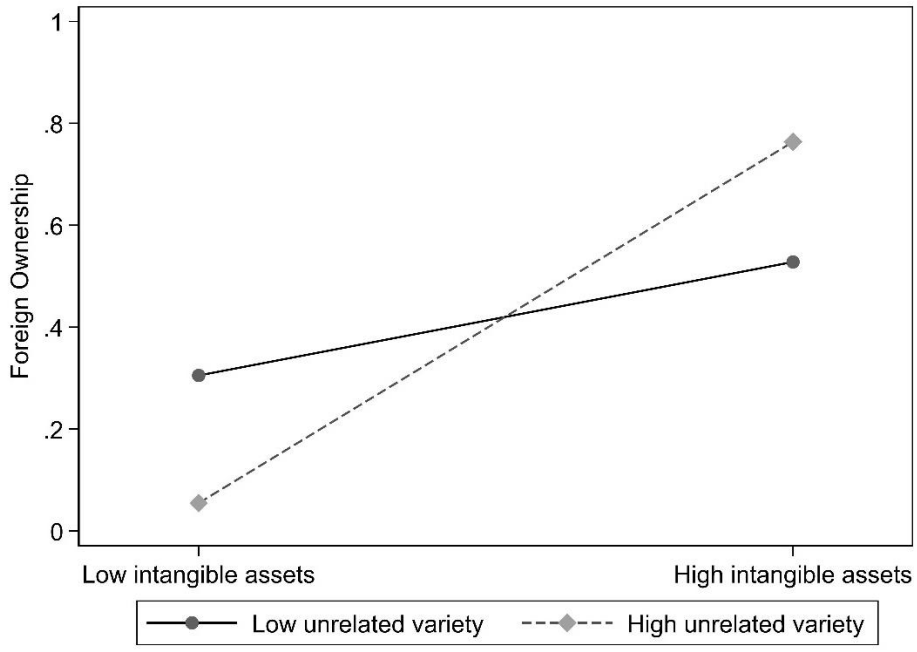
Model 5 shows that when the initial foreign ownership lies in the 0%–25% interval, the relationship between intangible assets and foreign ownership is significantly positive. The direct effects of related and unrelated varieties on foreign ownership are also significant. However, we do not observe any moderating effects of related or unrelated varieties because the coefficient of the interaction terms is not statistically significant. This finding may be attributed to the absence of preferential government policies in China for firms with less than 25% foreign ownership (Bao et al., 2019). Therefore, the inclinations of these foreign firms to select a higher ownership share in IJVs are likely to be similarly strong. This factor may buffer the positive moderating roles of related and unrelated varieties (Zhu, Wei, Bao, & Zou, 2019).

**Table 3.** Tobit and fractional probit estimations on subsamples divided by range of initial foreign ownership

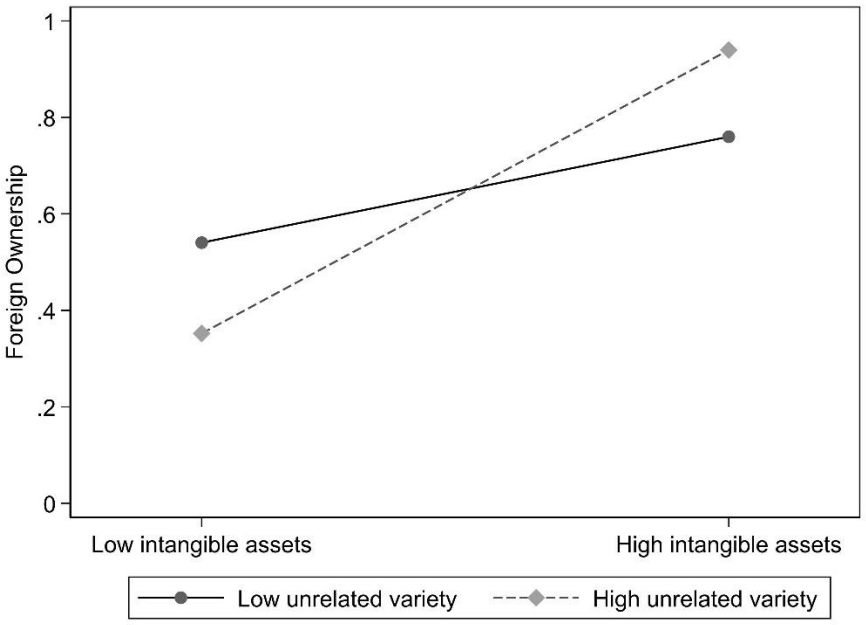
| | Tobit (1) | Tobit (2) | Tobit (3) | Tobit (4) | Fractional (5) | Fractional (6) | Fractional (7) | Fractional (8) |
|---|---|---|---|---|---|---|---|---|
| Initial Foreign Ownership (%) | (0,25) | [25,50) | [50,75) | [75–100) | (0,25) | [25,50) | [50,75) | [75–100) |
| Ln(size) | 0.167*** | 0.013* | 0.044*** | 0.208*** | 0.495*** | 0.013 | 0.077*** | 0.159*** |
| | (0.010) | (0.007) | (0.009) | (0.017) | (0.025) | (0.011) | (0.015) | (0.034) |
| Age | −0.029*** | −0.010*** | 0.003 | −0.049*** | −0.089*** | −0.017*** | 0.005 | −0.101*** |
| | (0.003) | (0.003) | (0.005) | (0.009) | (0.007) | (0.004) | (0.007) | (0.019) |
| Leverage | 0.001 | 0.016*** | 0.003 | 0.017** | −0.008 | 0.033*** | 0.005 | 0.091*** |
| | (0.006) | (0.003) | (0.004) | (0.007) | (0.017) | (0.006) | (0.009) | (0.016) |
| Export ratio | 0.026*** | 0.011*** | 0.019*** | 0.034*** | 0.063*** | 0.022*** | 0.031*** | 0.070*** |
| | (0.004) | (0.002) | (0.003) | (0.005) | (0.010) | (0.004) | (0.007) | (0.010) |
| Adjustment cost | −0.083*** | 0.007 | −0.042*** | −0.063*** | −0.185*** | 0.016 | −0.067*** | −0.158*** |
| | (0.012) | (0.007) | (0.009) | (0.014) | (0.028) | (0.011) | (0.015) | (0.031) |
| Industrial competition | −0.014 | 0.037*** | 0.029*** | 0.019 | −0.005 | 0.053*** | 0.044*** | 0.044 |
| | (0.011) | (0.007) | (0.010) | (0.018) | (0.026) | (0.010) | (0.015) | (0.034) |
| Intangible asset | 0.182*** | 0.129*** | 0.258*** | 0.227*** | 0.433*** | 0.223*** | 0.426*** | 0.404*** |
| | (0.041) | (0.024) | (0.033) | (0.058) | (0.093) | (0.040) | (0.056) | (0.128) |
| Related variety | 0.054*** | 0.068*** | 0.115*** | 0.089*** | 0.129*** | 0.109*** | 0.182*** | 0.263*** |
| | (0.004) | (0.002) | (0.004) | (0.006) | (0.008) | (0.003) | (0.006) | (0.013) |
| Intangible asset* related variety | 0.071 | 0.099** | 0.256*** | −0.020 | 0.012 | 0.144** | 0.408*** | −0.008 |
| | (0.081) | (0.048) | (0.095) | (0.132) | (0.184) | (0.070) | (0.143) | (0.322) |
| Unrelated variety | −0.043*** | −0.067*** | −0.133*** | −0.249*** | −0.088*** | −0.117*** | −0.225*** | −0.633*** |
| | (0.005) | (0.004) | (0.011) | (0.009) | (0.010) | (0.008) | (0.029) | (0.028) |
| Intangible asset* unrelated variety | −0.192* | 0.199* | 0.158*** | 0.053 | −0.443 | 0.344* | 0.270*** | 0.958 |
| | (0.114) | (0.111) | (0.049) | (0.121) | (0.338) | (0.189) | (0.091) | (0.696) |
| Constant | 0.310*** | 0.583*** | 0.865*** | 3.309 | −0.978*** | −0.455*** | 0.127 | 2.406*** |
| | (0.094) | (0.034) | (0.053) | (103.833) | (0.131) | (0.031) | (0.109) | (0.122) |
| Year Dummy | yes | yes | yes | Yes | yes | yes | Yes | yes |
| Industry Dummy | yes | yes | yes | Yes | yes | yes | Yes | yes |
| Observations | 15,953 | 35,325 | 23,023 | 32,211 | 15,953 | 35,325 | 23,023 | 32,211 |
| Left Censored | 0.000 | 0.000 | 0.000 | 0.000 | | | | |
| Uncensored | 15,578 | 34,075 | 21,105 | 13,196 | | | | |
| Right Censored | 375 | 1,250 | 1,918 | 19,015 | | | | |
| Pseudo R-squared | 0.038 | 0.049 | 0.041 | 0.056 | 0.113 | 0.058 | 0.059 | 0.179 |
| F Test//Wald chi2 | 1874 | 1726 | 1515 | 1706 | 5603 | 1716 | 2468 | 1217 |
| Prob > chi2 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |

Note: Robust standard errors in parentheses. Bonferroni-adjusted p-values: *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

However, in Models 6 and 7, when an IJV's initial foreign ownership is within 25–75%, we find positive moderating roles of both related and unrelated varieties as proposed in Hypotheses 2b and 3b. In the range of the initial ownership of 25–75%, IJVs no longer need to increase the ownership share for preferential policies, and moderating effects of the industrial structures become more significant. For foreign firms with over 25% ownership, their direct interactions with the local environment increase and the risks of knowledge leakage through employee mobility and local knowledge exchanges grow. Therefore, foreign firms in these IJVs are very sensitive to changes in the industrial structures. The moderating effects of industrial structures between their intangible assets and foreign ownership are thus significantly positive. Figures 2a and 2b illustrate the moderating roles of unrelated variety for IJVs with the initial ownership of 25–50% and 50–75%. In these two groups, the relationship between intangible assets and foreign ownership becomes stronger when unrelated variety increases.




(a) Interaction between intangible assets and unrelated variety (initial ownership of 25%–50%)




(b) Interaction between intangible assets and unrelated variety (initial ownership of 50%–75%)

**Figure 2.** Illustrations of hypothesized effects using the subsamples in Table 3

Model 8 (Table 3) shows that when the initial foreign ownership of an IJV exceeds 75%, the moderating effects of related and unrelated varieties become insignificant again. We explain the results as follows: more than 75% of the foreign ownership in IJVs largely reduces the risk of knowledge leakage through local partners. Foreign firms with more than 75% ownership in IJVs further have dominant power over the access to and use of intangible assets. The dominant ownership share helps foreign firms protect their intangible assets to ensure that knowledge leakage is less affected by related or unrelated varieties.

*4.3 Robustness tests*

For robustness tests, we first turn to alternative measures of variables, such as intangible assets measured using the ratio of intangible assets to total sales; firm size measured using total sales; adjustment costs measured using total inventory over total sales. Second, to include the effect of partner characteristics, we divide the complete sample into IJVs with local partners

that are state-owned enterprises (SOEs) and those that are non-SOEs. Finally, because the sample firms come from 30 two-digit industries that may exhibit some differences from one another for the importance of knowledge and technology, we divide the full sample according to industries' technology intensity. We further adopt Howell (2017) method and classify two-digit industries in China into four categories according to technology intensity, which includes high, medium-high, medium-low, and low technology intensity industries. Our estimates remain broadly consistent with the full sample.

## 5. Conclusion

Using a dataset on IJVs in China across 1998–2007, this paper explains the relationship between intangible assets and foreign ownership in IJVs. The empirical analysis supports our arguments that foreign ownership has a continuously positive relationship with intangible assets. Moreover, based on the arguments that the industrial structures can influence the interactions among firms and thus the intensity of knowledge leakage, we discover that related industrial variety has a positive direct effect on foreign ownership in IJVs and positively moderates intangible assets and foreign ownership. By contrast, unrelated industrial variety has a negative direct effect on foreign ownership, and its positive moderating effect is insignificant. A subsample analysis shows that the moderating roles of related and unrelated varieties are affected by the initial ownership share of foreign firms in IJVs. When the initial ownership share is lower than 25%, most foreign firms seek to increase ownership because the roles of the industrial structures are less pronounced, whereas an initial ownership share of higher than 75% provides sufficient control over the knowledge leakage risks, and thus, the impacts of the industrial structures decline.

Our analysis contributes to the research on knowledge protection by MNEs in two ways. First, we reveal a continuous relationship between intangible assets and foreign ownership in

China's IJVs. In China, knowledge leakage is a major concern for foreign firms depending on intangible assets. Although most of them have to form IJVs with partners in the local market, they tend to obtain a higher ownership share for more control over their core knowledge. Our results help solve the inconclusiveness of previous literature on intangible assets and the foreign ownership share in IJVs (Bao et al., 2019; Driffield et al., 2014). Second, we achieve a deeper understanding of foreign firms' ownership in IJVs by offering a contingent perspective from the local industrial structures. We discuss the roles of the industrial structures in knowledge leakage and argue that knowledge leakage from MNEs and domestic firms is more likely to occur in regions with high industrial variety where related and unrelated varieties can further strengthen foreign firms' inclinations to increase ownership when their intangible assets are exposed to knowledge leakage risks. We call for more efforts of integrating the industrial structures into the ownership structure research.

We draw several implications for foreign firms in emerging markets. First, before becoming WOSs, foreign firms should gradually increase their ownership share in IJVs for more intangible assets. Operating as WOSs is challenging because of local restrictions or heavy resource commitments, foreign firms can choose to enter with minority ownership and then gradually increase ownership as they bring more intangible assets to IJVs (Chang et al., 2013). Second, foreign firms should consider the role of the industrial structures when selecting their favored ownership structures; industrial structures vary substantially within emerging markets and determine the easiness of knowledge exchange among local firms and the risks of knowledge leakage (Boschma & Iammarino, 2009). In particularly, the industrial structures, such as related and unrelated varieties, may enlarge the risks of knowledge leakage, thereby making it necessary to escalate protective measures. Under this circumstance, foreign firms investing in emerging markets should opt for higher ownership than usual to safeguard against knowledge leakage.

This paper has several limitations which may offer opportunities for future research. First, we only conduct our empirical analysis for China, However, our results might be more pronounced in China than in other countries. Future research can test our hypothesized relationship in other emerging markets. Second, because of data limitation, we do not consider the impacts of local partners' previous characteristics on foreign ownership in IJVs, such as the local partners' storage of local knowledge and the relationship with the government, (Bao et al., 2019; Chang et al., 2013). Future research can include these characteristics as control variables.

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