

**The logic of spillover interception:
The impact of global supply chains in China**

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Abstract

Drawing on the global value chain analysis and institutional views, this paper explains the mechanism of ‘spillover interception,’ a structural obstacle to technology spillovers in emerging economies. Contrary to the widely accepted perception that FDI is expected to generate spillover of intermediate technology in particular, the findings indicate that excess inward FDI could structurally inhibit technology spillovers even at the lower tiers of the supply hierarchy within the emerging economy context. Based on an exploratory case study of the Chinese automotive industry, the paper analyses the net impact of global supply chains, and calls for a more comprehensive policy coordination.

Keywords: FDI; Global value chains; Emerging markets; Technology spillover

1. Introduction

Foreign direct investment (FDI) is expected to generate technology spillovers to local firms in developing countries, notably in rapidly growing middle-income developing countries, or so-called emerging economies. However, spillovers from multinational enterprises (MNEs) to domestic firms in host countries are not an automatic occurrence (Wang & Blomström, 1992; Kokko, 1996), and spillovers from foreign affiliates to local industries in developing countries have different outcomes across countries and sectors (McIntyre, Narula, & Trevino, 1996; Grether, 1999; Görg & Strobl, 2001).

Although neoclassical theories and endogenous models of economic development seem to have converged on the fact that technology is the engine of economic growth, many developing countries have confronted the reality that attaining technological advantage in the global market is extremely difficult. The issue at stake in emerging economies, especially given the progressive globalisation of international business, is the likelihood that the rapid entry of global players creates substantial entry barriers to local firms (Kogut, 1983; Nolan & Zhang, 2002). Despite a number of empirical studies on spillover effects, however, the sequential linkages of MNEs and their motives remain inadequately identified. The effect of FDI in technology spillovers needs to be analysed in greater depth, focusing on the mechanism of global supply chains¹ and the responses of MNEs to institutional constraints.

The objective of this paper is to explain the logic of ‘spillover interception,’ a structural obstacle to technology spillovers resulting from substantial FDI in emerging economies. Drawing on the global value chain framework and institutional views, this study provides one perspective on spillover effects. The study contributes to disentangling the ambiguous causality concerning technology spillovers, using the automotive industry in China as a case study.

The Chinese automotive industry offers a relevant example in the examination of the impact of MNEs and the degree of technology spillovers from them for two reasons. First, China is a rapidly growing car market and a great many MNEs are operating there. Second, the automotive industry is one of the largest sectors in the global market, and the automobile is an increasingly technology-intensive product (Barnes & Kaplinsky, 2000). The industry-specific case study based around the Chinese automotive industry is a good example of spillover interception caused by the alignment of global players. The study articulates how global supply chains could structurally marginalise less competitive local firms, thereby limiting technology spillovers through vertical linkages. By doing so, the paper draws the attention of researchers and policy makers to the net impact of global supply chains on the industrial structure of emerging economies.

The paper is organised as follows. The following section reviews the literature on spillover effects. Section 3 describes the background of the research. Section 4 outlines the research method. Section 5 explains the logic of spillover interception using the findings from the case research to exemplify the concept. Section 6 provides implications and generalisations. Section 7 provides conclusions.

2. Technology spillovers through FDI

Technology spillover is defined as a geographical diffusion of technology that may raise the level of human capital in the host country and increase productivity in local firms (Blomström, 1989). MNEs from industrialised countries are the major source of advanced technology in the global market, and their technologies are expected to be transferred to local firms through: (1) demonstration effects as a result of MNEs' local operation, (2) backward and forward linkages between MNEs and their local firms, (3) training of local employees and technical assistance provided by MNEs, and (4) competition between MNEs' affiliates and

local firms in the markets (Blomström, Kokko, & Zejan, 2000). To analyse the industry-level impact of FDI, this study focuses on the second channel of technology spillover, particularly vertical backward linkages, through which spillovers are most likely to take place (Javorcik, 2004).

To facilitate technology spillovers, close and continuous interactions with foreign firms are essential for local firms in emerging economies (Giuliani, Pietrobelli, & Rabellotti, 2005). If local firms can participate in the supply chains of MNEs, it will encourage technology spillovers to local firms through vertical linkages, and accordingly contribute to the development of the local supplying industry (Brannon, Dilmus, & Lucker, 1994; Buckley, Clegg, & Wang, 2002). Given this situation, the linkages between MNEs and local firms in developing countries will increase over time (Blomström & Kokko, 1997).

However, empirical studies show that backward linkages between MNEs and local firms are very limited (e.g. Turok, 1993; Belderbos, Capannelli, & Fukao, 2001; Giuliani, et al., 2005). Previous studies have emphasised the importance of the recipient firm's ability to absorb new knowledge, i.e. 'absorptive capacity' (Cohen & Levinthal, 1990) for technology spillovers. The reason for the negative result of linkages between MNEs and local firms is also attributable to the low absorptive capacity of regions (Crespo & Fontoura, 2007). Local contexts of host countries are an important factor because the firm-level absorptive capacity exists in the institutional milieu where firms interact with one another (Lorentzen, 2005).

Inter-firm interactions and intensive knowledge sharing are particularly important in supply chains in the automotive industry, because the automotive industry operates based on large supply chains and technologies used in the final products are incorporated with the functions of other various components. It is also the industry, which many developing countries regard as one of the key industries that lead national industries and propel economic development.

3. Background of the research

3.1. Policy environment

As with other developing countries, China has viewed the automotive industry as a key sector for economic development. Since the open-door policy was launched in 1979, the Chinese government strongly encouraged tie-ups between local firms and foreign firms in the automotive industry. In the Seventh Five-Year Plan (1986-90), the Chinese government defined the automotive industry as a pillar industry and introduced the ‘swapping market for technology’ strategy aiming to promote technology transfer. In 1994, the Chinese government introduced new regulations that restricted foreign carmakers’ equity share to 50%. In the meantime, FDI by foreign auto parts suppliers was encouraged, with the aim of developing the local component industry.

China’s overall development until the early 1990s can be characterised by a ‘go-slow’ policy. Afterwards, however, its FDI policy became more open, particularly in the automotive sector. The FDI policy eagerly invited both global car giants and their suppliers to the local market. In 2001, the regulations for the technical licensing of foreign firms were relaxed, while a substantial import tariff reduction—including one on auto and auto parts—was agreed upon when China entered the World Trade Organisation (WTO). In 2002, moreover, the Chinese government began allowing the formation of holding companies partly owned by foreign firms. China’s enthusiasm in inducing MNEs to enter the local automotive industry since the 1990s is in stark contrast with the policy that industrialised nations in Asia, notably Japan and South Korea, adopted in their development plans several decades ago.

3.2. Major players in the global market

It has been more than two decades since the Chinese government implemented the development policy for the local automotive industry. China's FDI stocks reached US\$ 501,471 million in 2003 (UNCTAD, 2004), the largest among developing countries. Alongside the vast bulk of FDI, the global supply chain is rapidly penetrating the Chinese automotive industry and expanding at every tier of the production hierarchy. However, despite active tie-ups with foreign firms, local carmakers seem to continue to struggle to obtain independent technological competitiveness. The development of local suppliers is even more sluggish. Although fostering the local components industry is an important factor for the development of China's automotive industry as a whole, as of 2005, no Chinese supplier was listed in the Top 100 in global auto parts original equipment manufacturers (OEM) suppliers' ranking. As Table 1 shows, the global auto parts markets are largely dominated by firms from North America, Japan, and Germany.

***** *Table 1 about here* *****

Considering the fierce competition in the global automotive market, the hurdle for Chinese local auto parts suppliers appears insurmountable. Does the significant presence of MNEs in the local market help the Chinese manufacturers reach a global-level of technological competitiveness? If any obstacle exists in the local context, what logic is underling the difficulty? The following sections analyse these issues.

4. Methodology

A standard approach for analysing spillover effects involves aggregate data of local industries. However, to trace the supply linkages of specific products precisely with the aim of determining the precondition for technology spillover through vertical linkages, this study adopts a qualitative case study. The case study approach can interpret reality, particularly complex interactions between firms in emerging markets (Hoskisson, Eden, Lau, & Wright,

2000). In order to investigate spillover effects through supply linkages in the emerging market context, the global value chain approach is useful, because it concerns the inter-firm relationships of global buyers and institutional mechanisms in their value chains, with special attention to the position of developing country firms (Humphrey & Schmitz, 2002; Nolan, Zhang, & Liu, 2007).

The field research was carried out between January and April 2003 as part of broader research on the evolution of global value chains. Japanese auto parts suppliers were selected as samples in the Chinese context because their inter-firm linkages are a representative case in global supply chains, and because they have been rapidly increasing their presence in China.

I conducted semi-structured interviews to identify supply channels since sample firms hesitated to write down suppliers' names on a survey sheet in order to maintain confidentiality of their businesses. The number of interviewees totalled 37. Initially, the headquarters of seven major auto parts suppliers were visited in Japan, where 17 interviews were conducted with senior personnel (general manager or managing directors) who are in charge of the Chinese business. Afterwards, their Chinese subsidiaries were interviewed. Principal interviewees were directors or presidents of 13 production units operating in China. Each interview entailed a plant tour. At 7 out of the 13 units, a manager who is responsible for production control or a purchasing manager guided the plant tour alongside the principal interviewee, and provided me with additional explanation about the characteristics of their products.

Each interview initially addressed the firm's strategy for the Chinese market in relation to its global strategy in general, and then gradually focused on supply linkages. The following three questions were asked of all interviewees for verification purposes: (a) who is your main customer(s) in China? (b) who is your main supplier(s) for basic input and/or intermediate products? and (c) why do you use that supply channel? Most of the sample firms answered

these questions sufficiently. In several cases, however, the information was provided on the condition that the companies' names be kept anonymous. The linkages among the sample firms in the Chinese market is summarised in Fig. 1.

***** *Fig. 1 about here* *****

This study discusses four intermediate auto parts among other various products that the sample firms are manufacturing: (a) iron-casting parts (multinational supplier 'A', hereafter MN-S #A), (b) forged parts (MN-S #B), (c) steel sheets (MN-S #C), and (d) seatbelt webbings (MN-S #D). The MN-S #A, B, C, and D are all large multinational firms. Yet, none of them is in the Top 100 global auto parts suppliers' list. In addition, these four segments are relatively standardised products. Given this situation, Chinese local suppliers may have a greater opportunity to tap into these segments in the supply chains of global car giants, and then technology spillovers could occur through interaction with foreign buyers. However, contrary to the widely accepted perception there are more possibilities that technology of intermediate products can be transferred to local firms in the host country, the findings indicate it is still difficult for local firms to participate in the supply chains, even for these intermediate products. Based on the anecdotal evidence from the case study, the logic of spillover interception is discussed below.

5. The logic of spillover interception

5.1. The context of emerging markets

Emerging economies have increasingly attracted FDI by MNEs. Once the domestic markets of emerging economies were opened to the outside, MNEs have rapidly entered these economies because of the low labour costs and market potential in those countries. Compared to the growth momentum of the local markets, however, various institutions for business activities are still underdeveloped in emerging markets.

According to North (1990), institutions can be defined as ‘rules of the game in society,’ which include formal and informal conventions. In addition to this common mainstream specification of institutions, Edquist & Johnson (1997, p. 46) define institutions as ‘sets of common habits, routines, established practices, rules, or laws that regulate the relations and interactions between individuals and groups.’ To recognise problems in economic development of developing countries, it is essential to understand that institutions governing the behaviour of economic agents in developing countries are fundamentally different from those in advanced countries (Chang, 1998).

Underdeveloped institutions—in terms of not only changeable regulations and the weak protection of intellectual property rights, but also within an institutional context for production in emerging economies, including fragmented supply chains and disorganised inter-industry linkages—discourage MNEs from close interactions with local firms. Fig. 2 classifies different business environments in view of the causality between the market potential and institutional development of the country, although not all countries can be neatly categorised by this typology.

***** *Fig. 2 about here* *****

The vertical axis is the potentiality of the local market. The horizontal axis indicates the level of institutional development. The countries in quadrant 1 are those that have advanced institutions and sizeable domestic markets with a large pool of consumers possessing substantial purchasing power. The G-7 nations (Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States) fall within this group, although there are significant institutional differences among them. It should be emphasised that advanced institutions do not mean freer market systems. The important aspect of institutional development is the existence of coherent and effective regulations to coordinate complex economic activities

within the home context (Chang, 2002). In this context, MNEs may be more inclined to interact with local firms, which also tend to be global players.

Quadrant 2 includes countries with advanced institutions but whose local markets are relatively small, such as Singapore, Switzerland and the Nordic countries. The countries in this group are likely to become business hubs and/or Research and Development (R&D) bases, if the countries successfully lure knowledge-based FDI or develop such capacity locally.

Quadrant 3 is the characteristic of emerging economies. They possess great potential as markets as well as low-cost production bases, but their institutions are weak and in flux. Underdeveloped institutions are related to incoherent arrangements and biased regulations in economic activities, which increase risks and intensify uncertainty in the local business environment. Although MNEs tend to rush into those countries, they may be reluctant to interact with local firms in knowledge sharing. In the course of foreign entry, MNEs draw boundaries to avoid unintended spillover from their affiliates to local firms (Dunning, 1988). Meanwhile, a MNEs' strong local presence can inhibit local learning (Lall, 1981). Under these conditions, there is a strong likelihood that local firms experience the problem of spillover interception as a result of limited inter-firm linkages.

Other developing countries, in particular the least developed countries such as sub-Saharan Africa, are categorised into quadrant 4. Their market potential and institutional development are both low. Technology spillovers are limited, not because of excess FDI, but because of the lack of FDI.

5.1.1. Technology gaps

The background of spillover interception in emerging markets lies in a significant expansion of global supply chains. Large global firms, which are the 'core' in production

networks, are rapidly widening their supply chains across the borders to increase scale economies (Nolan, 2001). As a result, they can use their established supply chains, which are now globally available. One indication that global buyers are in favour of multinational suppliers relates to the gaps between technological capabilities of MNEs and those of local firms. As Blomström & Sjöholm (1999) point out, technology spillovers may not occur if the technology gap between foreign investors and local firms is too large. It is necessary here to distinguish technology spillovers from productivity spillovers, although these two effects are construed to be either as a cause and result or as complementary. An increase in productivity does not necessarily imply that local firms acquired technological knowledge from MNEs (Bell & Marin, 2004), because local firms may increase productivity by changing production processes and improving routines.

It is also possible for MNEs to increase productivity at their local units by purchasing sophisticated machinery, even though local staff has no expertise in the technologies used for production. For example, MN-S #A has a joint venture (JV) in China, which has won local awards for its high productivity. The production lines at the JV, which manufactures cast-iron parts such as cylinder blocks and manifolds, are highly automated. When MN-S #A established the JV in China, the firm imported most of the production facilities and equipment from Germany, Japan, and the United States, in order to maintain an international product standard for multinational customer firms. In this regard, the JV is a typical ‘full-set type’ transplant, in which production technologies are kept in a ‘black box’ in the form of machinery.

Although it is widely held that standardised components can be outsourced to unspecific suppliers, even simple parts are often produced with specific technologies. For MNEs, technology is a vital factor in building brand reputation, particularly for products such as automobiles whose technological excellence could affect the user’s life (Nolan, 2001). For

these reasons, global car giants prefer to purchase certain intermediate parts and materials from globally recognisable suppliers who have sufficient expertise and technological advantage. In fact, because of the difficulty of manufacturing high quality of cylinder blocks at competitive price, MN-S #A has the lion's share in the Chinese cylinder block market. Unless local firms deliberately create their own knowledge bases to internalise external technology, the establishment of positive linkages with MNEs can be difficult (Narula & Marin, 2003). Given the existence of technology gaps, the incentive to use local firms appears to be limited in the presence of a large number of global suppliers.

5.1.2. High velocity of competition

The rapid entry of global suppliers into emerging markets is also associated with increasing global competition in the local context. In emerging markets, MNEs need to establish their supply chains quickly since local supply chains are significantly underdeveloped or often non-existent. Speedy capacity building is the key factor to gaining a major share in the rapidly changing local competition, because rival MNEs are also entering the market. In such a high-velocity context, selection is a crucial aspect for firms (Eisenhardt & Martin, 2000). Customer firms are likely to implement selective strategies in favour of well-known specialist suppliers. In the case of MN-S #A, the JV is purchasing materials from 40 firms in China, but all of them are JVs of, or wholly owned by, foreign firms. While some of those material suppliers entered China before MN-S #A, many others quickly set up their operation units when MN-S #A launched the JV, which enabled #A to achieve above 95% of the local content ratio.

On the operation side, Ono (1992) reports that although some Chinese manufacturers have the ability to produce certain sophisticated components, they are reluctant to meet Japanese buyers' exacting requirements of quality and delivery. This attitude on the part of

local firms also discourages MNEs from using them in the highly competitive market. Since the most effective learning of technologies and refinement of operational techniques are achieved through close interactions between firms, slow responses could frustrate the development of inter-firm linkages. As Jones and Womack (1985) foresaw, organisational techniques overall are moving ahead so rapidly that it is increasingly difficult for firms in emerging economies to catch up with MNEs from advanced countries.

5.2. Global linkages of MNEs

To compete effectively in emerging markets, existing inter-firm linkages within a certain business group are important for MNEs in order to fill the institutional voids in the business environment (Khanna & Rivkin, 2001). Through business linkages with familiar group members, MNEs can obtain information on foreign markets (Delios & Henisz, 2000). The entry of various types of MNE that already have global linkages can be seen as the redeployment of global supply chains in the transitional industrial structure of emerging economies. Backed by their international competitiveness and global linkages, large first-tier suppliers internationalise to keep pace with their customer MNEs' expansion. The internationalisation of global suppliers also encourages lower-tier suppliers to enter new markets by investing the sectors that their customer firms have entered and/or by boosting exports to the location in order to maintain the existing linkages, as well as to exploit new businesses as in the case of MN-S #A. This 'crowding-in' of MNEs is, in effect, what is happening in China.

5.2.1. Global reach

Since leading suppliers usually supply their products to several global customers, the first-tier of global supply chains has a largely oligopolistic nature (Nolan & Zhang, 2002).

Another example in addition to MN-S #A is MN-S #B. The customers of MN-S #B in China include transplants of major carmakers such as Volkswagen (VW), General Motors (GM), Isuzu, Mitsubishi, Suzuki and a British auto parts maker, GKN.

MN-S #B also demonstrates the strength in its own production network. MN-S #B set up the first JV in 2002 to supply forged parts such as crankshafts and connecting rods. In the following year, MN-S #B constructed its second plant in Shanghai to produce and export crankshafts to Southeast Asia. Once the second plant begins full operation, #B's production capacity in China will be nearly doubled, from 14,000 metric tons in 2003 to 27,000 metric tons within few years.

Meanwhile, MN-S #B increased its equity share in its joint forging venture in Thailand to 90%, and established a wholly-owned company in Indonesia. These two local units in Southeast Asia are engaged in quality checks of forged parts produced in MN-S #B's JVs in China and the Philippines. By functionally linking its operation units in these four countries, MN-S #B has established a regional supply network for forged parts in Asia. Large economies of scale are crucial to supply high-quality forged parts at a competitive price, which requires not only technology but also cross-border coordination. Global reach is the essential ability that supplier firms should possess in order to meet the global needs of the multinational customer firms (Barnes & Kaplinsky, 2000).

5.2.2. Global alliance

The locational and industrial spread of MNEs in the same sector has led to greater competitive interactions between them (Cantwell, 1989). MNEs are expanding their scope for partnership with competitive global players, and creating global alliances is an increasing trend among MNEs as a means to upgrade technology and improve efficiency. In the emerging market context, the MNE may also form a horizontal partnership with another MNE

not only to diversify their customer channels in the new market but also to attain stronger bargaining power vis-à-vis local firms.

The alliance between MNEs implies that not only their offshore units are concerned with the tie-up but also their other supply bases as well as other firms in their supply chains will be involved in shaping their vertical linkages in the local context. The case of the steel sheets supply chain in China illustrates two global alliances. One is MN-S #C's JV, which #C established with its car manufacturer customer for cutting and processing steel sheets for automotive bodies in China. MN-S #C owns 70% ownership in the JV and the carmaker owns the remaining 30%. The primary local supplier of basic material is a Chinese state-run steel maker. However, the material purchased from the local steel maker is used not for car bodies but for car interior parts, which can be manufactured with lower quality steel. Steel sheets for automotive bodies are imported from Japan. These sheets are a special type of steel, which is highly durable and easily manufactured, and developed in collaboration with Nippon Steel Corporation (NSC), one of the world's largest steel producers.

NSC presents another global alliance in China. In 2004, NSC set up a JV in Shanghai, with China's leading steel firm, Baoshan Iron & Steel, and Arcelor, a European allied steel group. Although Baoshan Steel has a 50% equity share in the JV, the degree of technology transfer from the two global steel giants will depend on which operational process Baoshan will be involved in and how, because the entire steel-making process is a sequence of procedures involving highly complex operations and many stages of raw material preparation (Nolan, 2001). In fact, NSC has another JV with a foreign firm to produce blast furnace coke in North China. The plant has a production capacity of 1 million tons of coke per year (Nihon Keizai Shimbun, 2004). NSC is reinforcing its supply capacity in China in three ways: (a) importing high value-added steel sheet from a plant in the home country, (b) processing steels for general use at the JV in China with large firms to maximise sales channel, and (c)

producing raw materials to supply them locally. Tapping into this self-reinforcing linkage is a big challenge for local firms.

5.2.3. Intra-firm sourcing

Nohria and Garcia-Pont (1991) labelled inter-firm grouping and global interactions in specific business areas in the automobile industry ‘strategic blocks.’ In these strategic blocks or ‘cliques’ of alliances, each player is ‘locked in’ to cooperate with the others in the block, but ‘lock out’ others (Gulati, Nohria, & Zaheer, 2000). This locking-out is also possible at the lower tier by MNEs’ intra-firm sourcing. MN-S #D may offer evidence of this practice, as well as other responses of MNEs to the emerging market.

MN-S #D is a specialist supplier of safety auto parts and components. The firm entered the Chinese market as a second-tier supplier by establishing a wholly-owned plant to manufacture seatbelt webbings. Its direct customer in China is another multinational auto parts supplier. MN-S #D’s webbings are assembled to seatbelts at the first-tier supplier’s place and then delivered to major multinational carmakers operating in China. Since seatbelt webbings are key components for seatbelts, carmakers’ quality requirements are particularly high. To meet the customers’ high quality standards, MN-S #D’s JV imports 50% of fibre materials from #D’s own affiliate in Thailand. The remaining half of fibre materials are imported from the world’s leading manufacturer of synthetic materials, which has more than 200 subsidiaries and affiliates around the world.

MN-S #D also imports dyestuffs and finishing paint from Japan. According to MN-S #D, the quality of seatbelt webbings hinges upon the quality of the resin used in their manufacture. In fact, the competition in the seatbelts market focuses now on R&D activities dealing with resin, supported by a huge amount of R&D expenditure and high technology. Although there are a number of local resin manufacturers in China, the special resin for

finishing seatbelt webbings is, for the moment, not available locally. Some local firms are trying to obtain a share in the lower tiers of global supply chains, making use of their cost competitiveness. However, even in relatively low unit-price intermediate products such as seatbelt webbings, low price per se is not the determinant to winning business. The major players in the safety components competition in China are predominantly foreign makers, with little involvement from local firms.

***** *Fig. 3 about here* *****

Taking into account the points argued above, the logic of spillover interception is summarised in Fig. 3. Based on findings from case studies, there appear to be four patterns of MNEs' response to the idiosyncratic context of emerging markets. The first is full-set investment, whereby MNEs outsource a large proportion of facilities and key equipment from their home countries. Second, while MNEs buyers favour well-known global suppliers, those multinational suppliers are deliberately expanding their global reach to increase their economies of scale internationally. Third, some MNEs also resort to horizontal collaboration with other MNEs to diversify sales channels. Last, MNEs can reinforce their intra-firm sourcing by purchasing key components and materials from their own operation units elsewhere.

As the anecdotal evidence indicates, even intermediate parts require high technology and specific techniques. Since most local firms in China have not developed those technologies to the international level, the insertion in supply chains of MNEs is not so straightforward despite, or because of, the vast bulk of MNEs in the country. The expanding global supply chains of MNEs can limit the creation of new linkages between local firms and MNEs, and consequently intercept technology spillover to local industries.

6. Implications

6.1. Generalisability of the concept

The logic of spillover interception described above presents the challenge for local firms in emerging markets. Although there may be various ways of upgrading technology, as long as technology spillovers through vertical linkages are concerned, the effect can be constrained even at the lower tiers of the supply hierarchy due to limited interactions between local firms and MNEs.

This trend is not only within the automotive industry in China. The study by Nolan et al. (2007) suggests a similar phenomenon. Their sectoral study demonstrates that MNEs have increasingly dominated the local supply chains of the aerospace, beverages, and retail industries in China. Regarding key components for consumer products, a cross-border study reports more than 56% of television tubes for colour televisions and more than 90% of compressors for air conditioners made in China are produced by foreign firms (NNA Singapore ed., 2005). Moreover, foreign JVs produce nearly 85% of China's high-tech exports, and 61% of them come from wholly foreign-owned enterprises (Kroeber, 2004).

Although China may be a distinctive case because of its strong market potential, there is evidence of a similar trend in other emerging economies. Leite's (2002) study on the ABC region in Brazil, an area with a high concentration of MNEs, indicates the difficulties of developing new inter-firm linkages in a sector with strong global linkages. Giuliani et al. (2005) also report, in their research on Latin America, that local firms' functional upgrading in value chains was inhibited by their main U.S. buyers. In Central Europe, since VW and Fiat entered the region, they have increasingly switched their outsourcing suppliers from local firms to the wholly-owned firms or JVs set up by Western suppliers (Havas, 1997). In South Africa, although to a lesser extent because of its smaller market size and present FDI volume, a similar marginalisation is occurring; Barnes and Kaplinsky (2000) note that local components firms are increasingly being relegated to niche segments.

These cases may imply that chances of technology spillovers through vertical backward linkages could reduce rather than increase as MNEs grow in the local industry. In other words, the degree of spillover interception could increase over time, if local firms in emerging economies fail to engage appropriately in global systems. This could lead to ‘immiserising growth’ (Kaplinsky, 2000), involving increasing economic activities but falling economic returns. The great challenge for local manufacturers in China as well as other emerging economies is how they can participate in global supply chains in a sustainable way.

6.2. Policy recommendation

China’s FDI policy has worked well in terms of securing significant FDI. However, it does not seem to have been very successful in the creation of linkages between MNEs and local firms, and in developing local firms’ independent technological competence. China has been widely viewed as an emerging ‘world factory’ and the growing presence of the ‘made in China’ label offers visible facts in several product markets. Nevertheless, ‘made *in* China’ does not mean ‘made *by* China’ (Kwan, 2002). As long as local firms depend heavily on foreign investors’ technologies, China’s competitiveness is not real.

To promote intimate interactions with MNEs and improve the conditions for technology transfer, emerging economies need a more comprehensive policy design. A general policy recommendation, returning to Fig. 2, is to shift the country status from quadrant 3, in which spillover interception is most likely, to quadrant 1, by developing institutional infrastructures. In effect, the process of institutional development involves a range of institutions, not only ‘market-creating institutions’ (Rodrik & Subramanian, 2003) such as property rights and the rule of law, but also non-market institutions such as coordination of business corporations, links between the research and education institutions and industry (Chang, 1998; Stiglitz, 2003), as well as the system of the economy as a whole (Lall & Narula, 2004).

Without institutional and organisational competence to utilise incoming resources in local industrial complexities, FDI policy, which narrowly targets technology spillovers from MNEs, may not be effective enough to enhance the competitiveness of the nation. In order to mitigate the adverse consequence of spillover interception, upgrading institutional infrastructure should be the top priority for the governments of emerging economies.

7. Conclusion

This study investigated structural mechanisms of spillover interception focusing on the Chinese automotive industry. The hurdle for local firms is not only the existing technological disadvantage but also the structural force of global supply chains.

However, the possibility of spillover interception does not suggest the restriction of FDI by MNEs. FDI is a vital source for the development of emerging economies. Nevertheless, types of FDI need to be carefully selected (Lall, 1995; Narula & Dunning, 2000). Moreover, the government needs to focus on cross-sectional interrelationships within the local industry to promote technology spillovers in important areas (Cantwell, 1993). Without institutional conditions to create coherent inter-firm and cross-sectional linkages, FDI-led development policy may be insufficient to develop robust industrial structures.

The limitation of this study is in its range of application. Although we have observed the mechanism of spillover interception in the emerging market context, there are some examples of successful firms from developing countries. On the one hand, research into supply linkages of those firms will offer helpful guidance for other firms in developing countries; on the other hand, since MNEs' existing supply chains are not perfectly self-sufficient because of the heterogeneity of emerging markets, more industry-specific and country-specific research on MNEs' adaptation in different institutional settings will be required.

In addition, future research could deepen interactions at the micro-level. Although this study looks specifically at the constraints to technology transfer in supply linkages between firms, the firm's essential resource is ultimately individuals. Individuals create knowledge, and organisations can create a context for employees to increase their knowledge (Nonaka & Takeuchi, 1995). The top management of foreign affiliates has the pivotal role in building knowledge structures (von Krogh, Roos, & Slocum, 1994; Engelhard & Nägele, 2003). Foreign investors and local entities need more consideration with regard to cross-border management and in the development of effective linkages with each other to cope with market uncertainty. This will be the prime task that both parties should strive for in order to achieve mutual long-term gains.

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Table 1**Top 100 global OEM auto parts suppliers by country of origin**

	Top 1-50	Top 51- 100
North America (incl. Canada)	19	19
Japan	15	10
Germany	10	8
France	3	5
Others	3 ^a	8 ^b

^a. One supplier firm each from Italy, Sweden, and the U.K.

^b. Three from the U.K. and one each from Italy, South Korea, Spain, Sweden, and Switzerland.

Source: Automotive News Europe (2005).

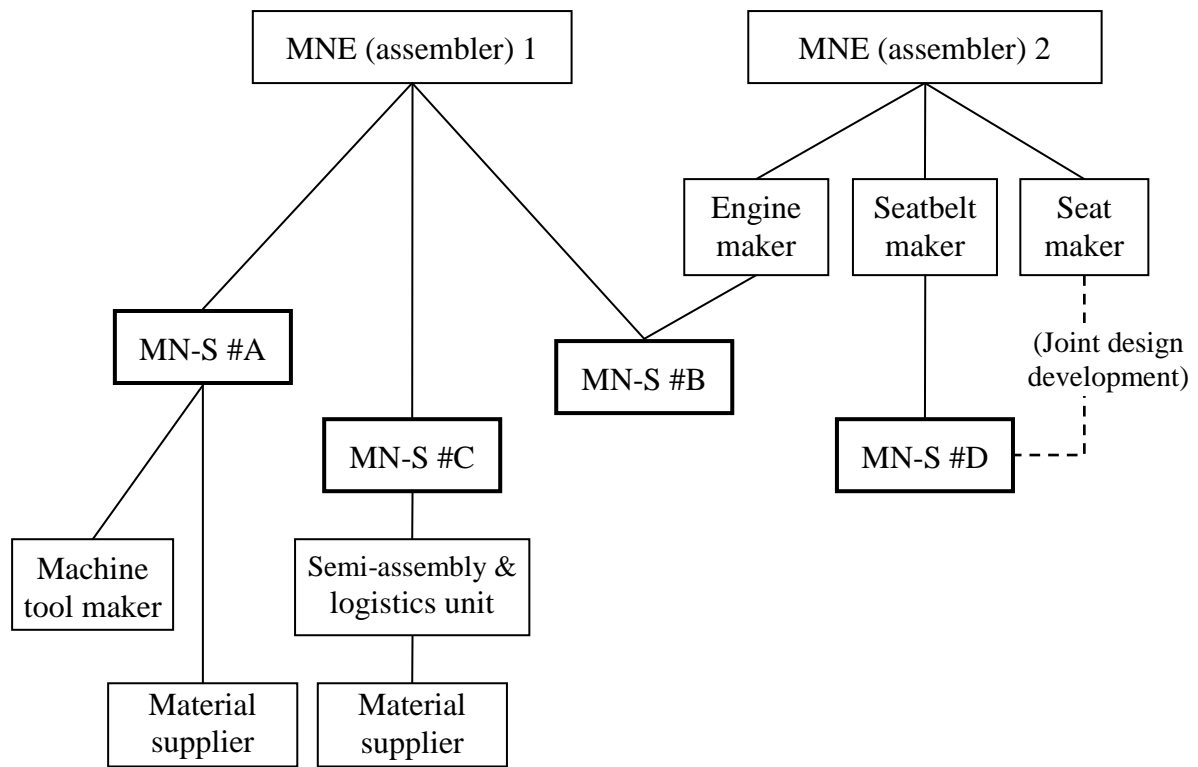


Fig. 1. Supply linkages of the sample firms in China.

		Institutional development	
		High	Low
Market potential	High	1.	3. <i>Spillover interception</i>
	Low	2.	4.

Fig. 2. The causality of spillover interception.

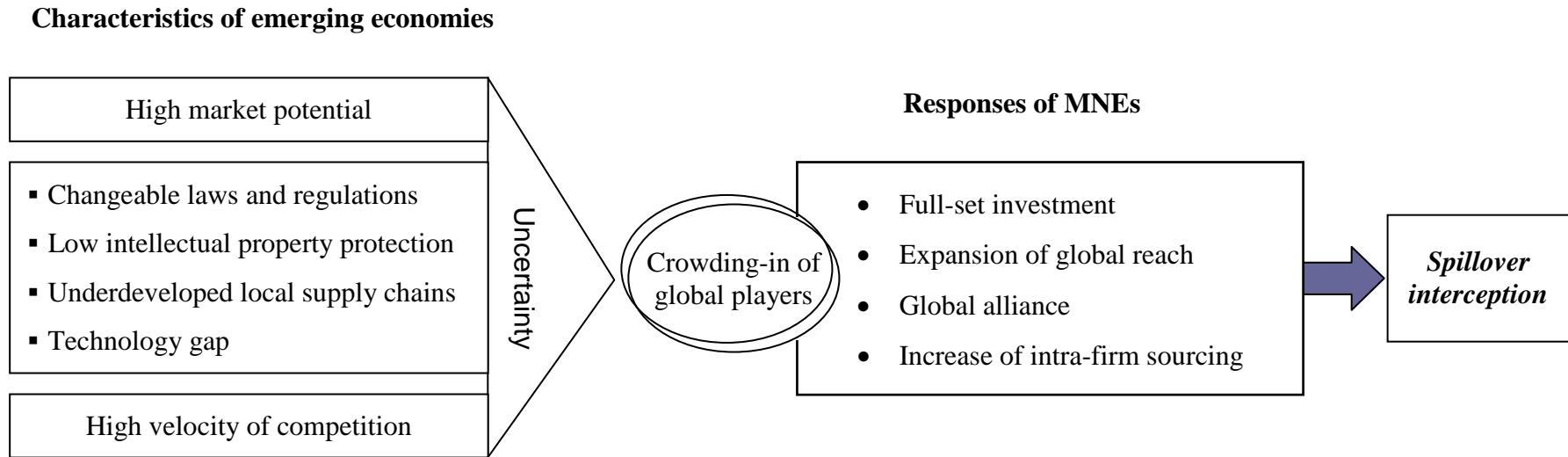


Fig. 3. The logic of spillover interception.

Notes

¹ The supply chain is defined as ‘the network of organizations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services in the hands of the ultimate consumer’ (Christopher, 1998, p.15). Looking at the full range of activities of global production networks, it is also referred to by the term ‘global value chains’ (Gereffi & Kaplinsky, 2001; Humphrey & Schmitz, 2002). These terms are interchangeable in many cases. In this paper, I use the term ‘global supply chains,’ focusing more on cross-border production linkages than on whole value chain activities which complex distribution systems, R&D and other operational management are involved.