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Foreign Direct Investment (FDI) and Indigenous Firms' Innovation: The Moderating Effect of Environmental Dynamism

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Introduction

Strategy, international business and economics literatures have explored whether foreign presence has an impact on innovation and productivity in a host country. A commonly shared argument is that when MNEs conduct FDI, host country firms are exposed to greater technological opportunities, with positive impact (Zhang et al., 2010). These positive externalities are known as FDI spillovers. Recent empirical work has advanced knowledge about FDI spillovers by suggesting various antecedents and moderators, such as strategies of senders (foreign MNE subsidiaries), absorptive capacity of recipients (host country firms), and modes of interaction between MNEs and local industry stakeholders through formal or informal collaborative linkages (Crespo and Fontura, 2007; Smeets, 2008). Despite sophistication of conceptual modelling and fineness of methodology, empirical evidence has delivered mixed results about the impact of foreign presence on a host country (Havranek and Irsova, 2011; Irsova and Havranek, 2013). The lack of consensus in the empirical literature intimates that the impact of foreign presence is subject to a number of unobserved contingency factors (Eapen, 2012).

This study investigates the extent to which the impact of FDI on indigenous firms' innovation is contingent on levels of environmental dynamism in the local market. Environmental dynamism refers to the degree of variation in the market and technological change (Eisenhardt, 1989; Sidhu et al., 2007). High levels of environmental dynamism mean a firm's competitive advantage rapidly becomes obsolete. This will influence a firm's strategy for gaining and protecting maximum returns from innovation. Nevertheless, existing analysis

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of FDI's impact on indigenous firms has neglected the dynamic aspect of task environments. This research gap prevents understanding of FDI impact in industries marked by dynamic change and hyper-competition, as seen in the case of FDI inflows in the UK pharmaceutical industry.

Our empirical analysis uses firm-level panel data for the South Korean manufacturing sector, drawn from three waves of innovation survey conducted in 2005, 2008 and 2010. We use South Korea as a case which has comparative advantages in both fast-changing and moderately changing industries, with a national innovation system known for its high adaptability to global competition (Dodgson, 2009). To investigate the impact of foreign presence from the perspectives of various industry stakeholders, this chapter divides technology spillovers from FDI into two types – horizontal spillovers on competitors and backward spillovers on upstream suppliers.

This chapter makes several contributions. First, our findings show that FDI at different levels of environmental dynamism has varying effects on the innovation performance of indigenous firms. Previous studies have focused on the moderating effects of static levels of external resources in indigenous firms' task environments, but paid little attention to environmental dynamics. We also conceptualise how levels of environmental dynamism interact with horizontal and backward channels which transfer technology spillovers from foreign MNEs to local competitors and suppliers differently. While previous studies have proposed differential potentials for each channel, few have scrutinised whether the two types of FDI spillover are differently sensitive to contextual factors. Furthermore, our study brings the literature of innovation in a dynamic environment to the new context, and has implications for the likelihood of inter-firm technology spillovers in fast-moving industries in the global context, compared with a single firm–level knowledge management strategy in the domestic context.

The remainder of the chapter is organised as follows. The next section reviews previous literature, conceptualises the moderating effect of environmental dynamism on the impact of FDI on indigenous firms' innovation, and develops hypotheses. The methodology section follows, presenting model specification and estimation strategy. After a discussion of test results and new findings, the chapter ends with conclusions and suggestions for future studies.

Literature review

MNEs operate in multiple foreign locations based on organisational capabilities to create, retain and transfer knowledge through social and technical knowledge management mechanisms across subunits across foreign subsidiaries (Argote et al., 2003; Gupta and Govindarajan, 2000). On that basis, existing studies have postulated that the entry of foreign firms presents local firms with

opportunities to observe and learn from advanced benchmark technological and managerial knowledge, known as FDI spillover (Zhang et al., 2010).

FDI spillovers have implications for the innovation performance of indigenous firms. Foreign entry extends the overall set of advanced technology in a host country, as foreign subsidiaries of MNEs have access to superior firm-specific assets from their home country or enjoy greater access to advanced technologies from other overseas sources (Veugelers and Cassiman, 2004). Foreign presence also adds technological heterogeneity in terms of the geographic origin of technology, and increases the scope of technological opportunities for firms in the host country to search, integrate with existing internal technology, and harness new values (Zhang et al., 2010). Therefore, innovation performance in an indigenous firm improves if the intensity of foreign activities increases in the local firm's industry or in industries where its upstream suppliers or downstream customers operate (García et al., 2013; Liu and Buck, 2007; Liu et al., 2009).

The effect of FDI spillovers is not automatic and this means foreign technological opportunities are realised contingent on unobserved factors, such as the characteristics of the task environments where a firm's innovation activities are organised. Indigenous firms' sensitivity to technological opportunities from foreign subsidiaries of MNEs varies depending on different levels of external munificence, competition and catch-up motivation. Current external information and resources in the host country are required for successful acquisition and learning of technologies of foreign origin (Judge and Miller, 1991; Tan and Litschert, 1994). A local firm is more likely to benefit from technology spillovers from FDI if it operates in industries of high technological intensity than otherwise (Buckley et al., 2007; Haskel et al., 2007; Keller and Yeaple, 2009; Sembenelli and Siotis, 2008). The effect of FDI spillovers is also greater in industries where the performance gap between local technology laggards and foreign technology leaders is wide than otherwise (Findlay, 1978; Kokko, 1994). Furthermore, the higher the competitive pressures within the market, the greater FDI spillovers that local rivals enjoy (Hallin and Holmström-Lind, 2012; Kokko, 1994; Perri et al., 2013).

While studies so far have focused on static environmental features as a contingency, existing studies do not inquire into the moderating effects of levels of environmental dynamism. There has been an implicit assumption that the impact of FDI is invariant across levels of environmental dynamism, or that FDI spillovers occur in a stable environment in terms of technological and market changes. However, this is not the case. In recent years an MNE's locational decision tends to be related to the anticipation of a positive cascading effect of the high rate of technological and market change in the host country on its global production network. This means that location advantages for FDI amid dynamic change are determined by the extent to which an MNE can

leverage technological opportunities in the host country for rapid renewal of its competitive advantages. Locations such as newly industrialised economies in East Asia with a resilient manufacturing base provide task environments that meet MNEs' demands for adaptability and technological entrepreneurship amid global competition (Dodgson, 2009; McKinsey and Company, 2010). Studies assuming a stable environment cannot fully explain variation in FDI spillovers in a dynamic setting in terms of technological and market changes.

Overall, the moderating effect of environmental dynamism should improve understanding of the impact of FDI on indigenous firms in a host country which has locational advantages in industries undergoing both stable and dynamic changes. Dynamism in a firm's task environments has received less attention in empirical studies of FDI spillovers, although the Strategy and International Business literatures have suggested environmental dynamism as a motivation of innovation and variation in knowledge exchanges through inter-firm linkages in a dynamic environment (Baum and Wally, 2003). The next section develops hypotheses about the moderating effect of environmental dynamism on the impact of FDI on indigenous firms. We consider two types of FDI spillovers, horizontal and backward spillovers.

Hypothesis development

Environmental dynamism and horizontal spillovers from FDI

FDI spillovers horizontally influence indigenous firms competing with foreign MNEs in the same industry. MNEs' globally competitive technology and practices can support local firms' strategies to improve performance through imitation (Haunschild and Miner, 1997). MNE technology and practices are also diffused when workers trained by MNEs move to domestic firms, passing on not only knowledge and know-how, but also norms and values acquired from their MNE training (Lipsey and Sjöholm, 2005; Markusen, 2005). Former MNE employees may establish start-ups as virtual spin-offs from MNEs. Nevertheless, empirical evidence has returned mixed verdicts (Havranek and Irsova, 2011; Irsova and Havranek, 2013) because, depending on the country and industry context, the positive effects of foreign technological opportunities can often be discounted in research by the negative effect of foreign competition and market crowding-out (Aitken and Harrison, 1999). In other words, only under specific contexts might indigenous firms benefit from horizontal spillovers from FDI.

We predict that increased environmental dynamism in a host country will strengthen the positive effect of horizontal FDI spillovers on the innovation of indigenous firms. In a dynamic context, competition is about speedier introduction of new products than that by competitors. It is difficult for managers to predict the consequences of new product and process development or adoption

of managerial practices. Increased environmental uncertainty promotes the importance of external benchmarks in a firm's strategy in place of a firm's own private information (Lieberman and Asaba, 2006). Thus, in a dynamic rather than stable environment indigenous firms are likely to benefit from the presence of MNE subsidiaries which act as sources of information about globally competitive products, process technology and managerial practices (Haunschild and Miner, 1997).

Another reason for stronger positive effects from horizontal FDI spillovers in dynamic rather than stable environments is that foreign MNEs are concerned less about the risk of imitation. In a stable environment, the adaptation of new technology from the home country or other centres of excellence may raise for the MNE issues of protection of intangible assets from local competitors (Alcácer and Chung, 2007; de Faria and Sofka, 2010). However, in a dynamic environment the speed at which current technology loses value is greater in a fast-paced industry than in a slow-paced one (D'Aveni et al., 2010). This characteristic of the fast-cycle market reduces threats arising from unwanted leakage of technology to partners, and foreign MNEs are likely to overlook technology spillovers to indigenous firms in the same industry. On that basis, we postulate that environmental dynamism enhances the potential for positive effects of horizontal FDI spillovers on indigenous firms.

> *Hypothesis 1:* The impact of horizontal spillovers from FDI on indigenous firms' innovation increases as levels of environmental dynamism increase.

Environmental dynamism and backward spillovers from FDI

FDI spillovers can be generated through vertical transactional linkages among local suppliers of intermediate inputs and foreign MNE customers (Driffield et al., 2002). While advanced technology is difficult to transfer due to tacitness, complexity and specificity, a diffusion process can be facilitated when two firms share common organisational ground (Spencer, 2008). Transactional linkages foster persistent organisational interactions to facilitate transfer of technology between MNEs and local firms (Liu et al., 2009). Nevertheless, literature also reports opposing evidence. There could be limited use of supplier-assistance programs for foreign MNEs to support local suppliers (Dries and Swinnen, 2004). An MNE may design a global production network to transfer cost-reduction pressures from downstream to upstream external suppliers in the first place, while blocking unwanted technology spillovers (Driffield et al., 2002; Motohashi and Yuan, 2010). In other words, only under specific contexts might indigenous firms benefit from backward spillovers from FDI. .

We predict that high environmental dynamism will strengthen transactional linkages between foreign MNEs and indigenous firms, and thereby result in greater positive effects from backward FDI spillovers (Spencer, 2008).

Unlike in a stable environment, a turbulent environment poses for downstream customers' greater uncertainty and risk of product development arising from increased speed and discontinuity in technological and market changes. In response, there can be strong motivation for more frequent and intimate collaboration between customers and suppliers on production and development in a dynamic environment (Zhao and Cavusgil, 2006). Persistent organisational contacts in a dynamic environment facilitate trust-building between downstream customers and upstream suppliers (Zhao and Cavusgil, 2006), followed by greater commitment and assistance from customers (Vilkamo and Keil, 2003), leading to increased opportunities for suppliers to capture backward technology spillovers from customers (Jones, 2003). On that basis, we postulate that environmental dynamism enhances the potential for positive effects from backward FDI spillovers on indigenous firms.

Hypothesis 2: The impact of backward spillovers from FDI on indigenous firms' innovation increases as levels of environmental dynamism increase.

Methodology

Data

To test our hypotheses, we use data from three waves of the Korean Innovation Survey, provided by Korea's Science and Technology Policy Institute (STEPI). This survey series is equivalent to innovation surveys by other governments, including the EU's Community Innovation Survey, conducted under the direction of the OECD Oslo Manual. Innovation survey data has been employed for various recent publications exploring innovation activities within firms and FDI spillover research (Crescenzi et al., 2015; Ha and Giroud, 2015; Sofka et al., 2014). Across three waves of survey, in 2005, 2008 and 2010, a total of 9,753 firms participated. Our data consists of 5,032 observations of indigenous firms which responded to at least one of the surveys and provided full information for variables of our interest.

Our dataset is pooled cross-sectional rather than panel data. While our data include observations that feature in more than one survey, most are observed only once or twice. This means panel estimation is not possible (Sofka et al., 2014).

Variable specification

Innovation performance

Innovation performance in a firm is measured by counts of product patent application. A patent of a firm indicates the level of new-to-the-market knowledge that is open to the public and contributes to the public knowledge pool in a national innovation system (Furman et al., 2002; Salomon and Shaver,

2005). We consider product count application rather than those that are already granted in order to approximate potential innovation outputs resulting from innovation activities during the period covered by this study (García et al., 2013). We focus on product patents excluding process patents to capture innovation output that leads to significant changes in new products and competence creation, rather than incremental changes in existing products and competence exploitation.

Horizontal and backward spillovers from FDI

As proxy for horizontal spillovers, we use the ratio of MNE subsidiaries in an industry's total R&D expenditures. A firm is classified as an MNE subsidiary if it identifies itself as such. While percentage ratio of foreign ownership is often used as an identifier of a firm's foreignness (Haskel et al., 2007), it does not necessarily show that any single foreign MNE is participating in meaningful governance activities in the local firm. Due to this difficulty, this study depends on a respondent's subjective judgement to determine whether it is a domestic firm or a subsidiary of a foreign MNE. The industry is identified by the two-digit NACE industry classification. We focus on a three-year lagged effect of FDI, that is, an indigenous firm's innovation performance is determined by FDI that took place three years before. This is to reduce endogeneity bias that could be caused by the use of non-lagged FDI effect.

As a proxy for backward spillovers, we compute the weighted sum of foreign R&D expenditure ratios in all downstream industries of a local firm, excluding the firm's own industry. The weighted sum is computed based on backward linkage coefficients from OECD's input–output table (Blalock and Gertler, 2008; Javorcik, 2004).

Environmental dynamism

To measure levels of environmental dynamism each firm faces, we use self-reported responses by firm managers about the number of years the firm's most important product survives in the market before replacement by a new product. Strategists' perception is essential, as ultimately the impact of environments depends on the extent to which managers perceive environmental dynamism (Carillo, 2005; Chen et al., 2010; Duncan, 1972). Previous studies have suggested cut-off points for fast, medium and slow rates of new-product introduction within an industry (Fine, 2000; Nadkarni and Narayanan, 2007). Following their definition, we assign ratings of 5 (product life < 3 years), 4 ($3 \leq$ product life < 10 years), 3 ($10 \leq$ product life < 40 years), 2 (40 years $\leq$ product life) and 1 (Permanent product life). In other words, 5 is the most dynamic environment, while 1 is the least dynamic (most stable). We acknowledge that our measurement is based on a single dominant product rather than all product lines within a firm.

Control variables

We incorporate several other factors into the model as control variables that may influence an indigenous firm's innovation performance. R&D expenditures (with log), R&D capacity measured as the ratio of R&D staff in a firm, and R&D centre as a dummy variable for the presence of permanent or temporary R&D teams in the organisational structure are related to the firm's absorptive capacity to identify, transform and exploit external technology and organisational capabilities for innovation activities. Age (with log) captures the amount of accumulated knowledge through all past learnings. To capture alternative sources of external technologies in the domestic setting, we enter Business group, a dummy variable indicating whether a firm is part of a large business group or not, and External search, another dummy variable, capturing whether a firm has engaged in R&D cooperation with any industry or non-industry partners.

Estimation method

Our model follows the knowledge production function (KPF). As a modified version of the production function, KPF considers innovation, organisational capabilities and commercial success in development as dependent variables (Liu and Buck, 2007; Wang and Yu, 2007), instead of overall performance. Our baseline model regresses a firm's innovation performance (the dependent variable) on proxies for horizontal and backward FDI spillovers and environmental dynamism (key independent variables). Thereby, this research explores the link between FDI spillovers and indigenous firm innovation performance (Salomon and Shaver, 2005) not yet translated into commercial success and overall productivity changes (Motohashi and Yuan, 2010). We estimate the model by the negative binomial model and use robust standard errors to deal with potential heteroscedasticity issues. We also control for time effects and unobserved factors at the industry level by including dummy variables for observations from each year and each industry.

Results

Baseline model

Descriptive and correlation matrices are as reported in Table 7.1. The correlation matrix does not reveal any multicollnearity issues. This is complemented by a mean variance inflation factor (VIF) of 1.23 and a condition number of 15.41.

Table 7.2 shows the result of the negative binomial regression. Model 1 is the baseline model including control variables only. R&D expenditures, R&D capacity, and R&D centre are all positively related to indigenous firms' innovation performance. This is consistent with past studies' predictions based on the importance of a firm's absorptive capacity for innovation performance (Cohen

Table 7.1 Correlation matrices and descriptive statistics

	Variables	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1	Innovation performance	1.000									
2	R&D expenditures	0.102	1.000								
3	R&D capacity	0.103	0.286	1.000							
4	R&D centre	0.130	0.499	0.496	1.000						
5	Age	0.061	0.104	−0.068	0.242	1.000					
6	Business group	0.108	0.065	−0.011	0.135	0.114	1.000				
7	External search	0.073	0.251	0.123	0.253	0.091	0.117	1.000			
8	Horizontal FDI spillovers	0.030	0.117	0.107	0.136	0.016	−0.006	0.076	1.000		
9	Backward FDI spillovers	−0.011	−0.023	−0.085	−0.062	0.055	0.038	−0.019	−0.157	1.000	
10	Environmental dynamism	0.049	0.233	0.222	0.316	0.019	0.001	0.156	0.164	−0.214	1.000
	Observations	5032	5032	5032	5032	5032	5032	5032	5032	5032	5032
	Mean	3.507	2.634	0.071	0.563	2.733	0.079	0.119	0.021	0.035	2.689
	Standard deviation	22.403	2.821	0.114	0.496	0.638	0.270	0.324	0.053	0.059	1.332

Table 7.2 FDI spillovers and the moderating effect of environment velocity

	Model 1	Model 2	Model 3	Model 4	Model 5
<*Control variables*>					
R&D expenditures	0.177***	0.179***	0.180***	0.179***	0.180***
	(0.0234)	(0.0221)	(0.0220)	(0.0221)	(0.0220)
R&D capacity	3.554***	3.574***	3.563***	3.582***	3.573***
	(0.582)	(0.566)	(0.565)	(0.566)	(0.566)
R&D centre	2.028***	2.074***	2.078***	2.088***	2.089***
	(0.155)	(0.146)	(0.145)	(0.144)	(0.144)
Age	0.436***	0.424***	0.427***	0.437***	0.438***
	(0.0958)	(0.0947)	(0.0947)	(0.0942)	(0.0943)
Business group	0.920***	0.971***	0.942***	0.962***	0.938***
	(0.194)	(0.196)	(0.195)	(0.191)	(0.192)
External search	0.439**	0.433**	0.439**	0.431**	0.436**
	(0.163)	(0.160)	(0.159)	(0.159)	(0.158)
Year effect	Included	Included	Included	Included	Included
Industry effect	Included	Included	Included	Included	Included
<*Environmental dynamism, FDI spillovers*>					
Environmental dynamism	0.233***	0.214***	0.249***	0.149*	0.189***
	(0.0647)	(0.0594)	(0.0621)	(0.0667)	(0.071)
Horizontal FDI spillovers		−2.265	4.450	−2.046	3.768
		(1.419)	(3.148)	(1.411)	(3.188)
Backward FDI spillovers		−6.778†	−6.345†	−9.263*	−8.537*
		(3.687)	(3.640)	(3.835)	(3.830)
<*Moderating effects*>					
Horizontal FDI spillovers × Environmental dynamism			−1.873*		−1.628†
			(0.835)		(0.846)
Backward FDI spillovers × Environmental dynamism				1.955*	1.679
				(0.995)	(1.021)
Constant	−4.536***	−4.535***	−4.630***	−4.359***	−4.467***
	(0.527)	(0.524)	(0.526)	(0.536)	(0.542)
Observations	5032	5032	5032	5032	5032
Log likelihood	−6908.462	−6899.227	−6896.121	−6896.300	−6894.009
Chi square	1108.05***	1210.70***	1221.56***	1232.55***	1240.86***

Note: Robust standard errors are in parentheses; † $p<0.10$, * $p<0.05$, ** $p<0.01$, *** $p<0.001$.

and Levinthal, 1989). Age also has a positive effect on a firm's innovation performance, reflecting on the prediction that cumulative firm-level learning from past years matters (Levitt and March, 1988). Also in line with the literature's prediction is the positive effect of Business group and External search, meaning the importance of R&D collaboration, either locally within business

groups or widely with external alliance partners (Hagedoorn and Wang, 2012; Mahmood et al., 2011).

Model 2 includes the main effects of two types of FDI spillover and environmental dynamism. The coefficients for both horizontal and backward spillovers are negative and not significant. While this result is not consistent with the theoretical prediction of positive horizontal and forward effects from FDI, empirical literature has reported mixed results. In other words, depending on the contingency of industry- and firm-level context, the impact of FDI on indigenous firms may vary.

The coefficient of environmental dynamism is positive and statistically significant. This means that as environmental dynamism increases, indigenous firms increase innovation activities and innovation performance improves accordingly. This result is in line with theoretical predictions and findings in existing studies (Sidhu et al., 2007).

The moderating effect of environment dynamism

Models 3, 4 and 5 provide regression results to test Hypotheses 1 and 2. The coefficients of the interaction terms between FDI spillovers and environmental dynamism indicate changes in FDI spillover effects as environmental dynamism increases. Furthermore, the regression results are complemented by further graphical scrutiny (Hagedoorn and Wang, 2012). This allows us to examine interaction effects more carefully, as magnitude, statistical significance and the sign of the marginal effect may vary across different levels of environmental dynamism in a non-linear negative binomial model.

Our Hypothesis 1 concerned the positive moderating effect of environmental dynamism on the relationship between horizontal FDI spillovers and the innovation performance of an indigenous firm. In both Models 3 and 5, coefficients of the interaction term Horizontal FDI spillovers x Environmental dynamism are negative and statistically significant. This indicates that in a dynamic environment there are fewer positive horizontal spillovers than in a stable environment. As a further scrutiny of the interaction term, Figure 7.1 represents the marginal effect of horizontal FDI spillovers and innovation performance of indigenous firms at different levels of environmental dynamism. It shows that the marginal effect of horizontal spillovers is positive when environmental dynamism is low, that is, in a relatively stable environment, but the positive effect diminishes as levels of environmental dynamism rise. This means that indigenous firms may experience positive horizontal spillovers, but this is likely to be cancelled out by negative competition effects as the level of environmental dynamism increases. In other words, there is a negative moderating effect of environmental dynamism on the association between horizontal FDI spillovers and innovation performance of indigenous firms. Thus, Hypothesis 1 is not accepted.

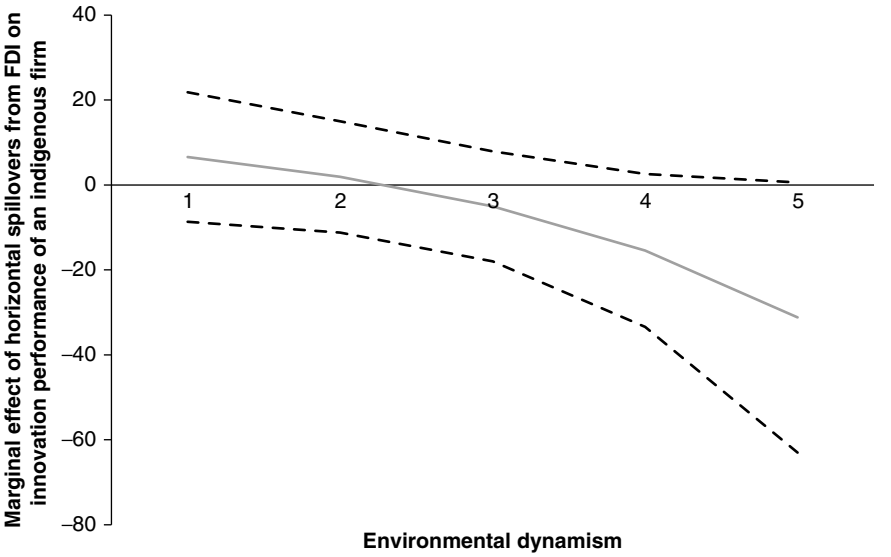

Figure 7.1 The moderating effect of environmental dynamism on the relationship between horizontal spillovers from FDI and innovation performance of indigenous firms
Note: The dotted lines are 95% Confidence Interval.

Our Hypothesis 2 proposed the positive moderating effect of environmental dynamism on the relationship between backward FDI spillovers and the innovation performance of an indigenous firm. The coefficient of the interaction term Backward FDI spillovers x Environmental dynamism is positive and significant in Model 4. However, the positive effect is not significant in Model 5, although the sign is positive consistently. We turn to Figure 7.2 to further examine the marginal effect of backward FDI spillovers and innovation performance of indigenous firms at different levels of environmental dynamism. It shows that the marginal effect of backward spillovers is negative in stable environments. However, the negative marginal effect is replaced by a positive effect as environmental dynamism comes closer to the highest level, that is, the most dynamic environment. This indicates a positive moderating effect of environmental dynamism on the association between backward FDI spillovers and the innovation performance of indigenous firms. Thus, Hypothesis 2 is partially accepted.

Conclusion

Main findings and contributions

This chapter has explored the moderating effect of environmental dynamism on the relationship between horizontal and backward FDI spillovers and

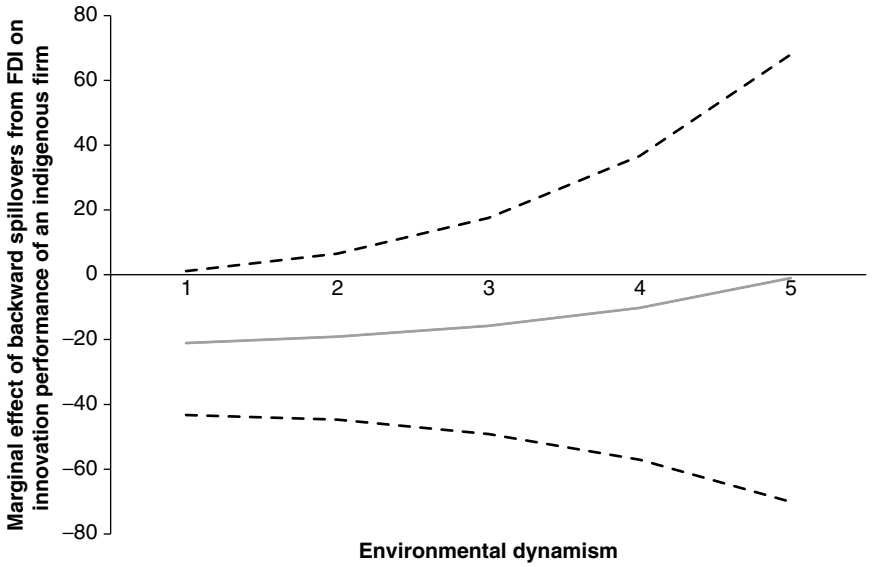

Figure 7.2 The moderating effect of environmental dynamism on the relationship between backward spillovers from FDI and innovation performance of indigenous firms
Note: The dotted lines are 95% Confidence Interval.

the innovation performance of indigenous firms in the host country. Our empirical analysis shows that high environmental dynamism weakens the positive effect of horizontal spillovers from FDI. In a dynamic environment, indigenous firms may benefit from a positive demonstration effect due to foreign presence, but are also likely to experience challenges due to intense competition with foreign MNEs with advantages accruing from HQ's assets and intra-MNE knowledge integration systems. We also find partial evidence for a positive effect that backward FDI spillovers are strengthened in a dynamic environment. This means that upstream suppliers in the host country are likely to capture positive externalities to strengthen their innovation performance when they have transactional linkages with foreign MNEs in a dynamic environment.

This chapter's key contribution is to confirm the moderating effect of environmental dynamism on technology spillovers from FDI. The suggestion of an environmental moderating effect explains a source of mixed evidence on FDI spillovers in past studies. So far, this mixed evidence has often been ascribed to insufficient specification of the external and internal contexts of FDI spillovers (Havranek and Irsova, 2011). Recent studies have partly responded to this call for research by suggesting that the intrinsic availability of information and resources in task environments influences the occurrence of technology

spillovers from FDI (Buckley et al., 2007; Haskel et al., 2007; Keller and Yeaple, 2009; Sembenelli and Siotis, 2008). Relatively less attention has been paid to the moderating effect of environmental dynamics of change. To fill this gap, we integrated the literature of environmental dynamism with FDI spillover literature. As a result, our study complements the literature on the moderating factors of FDI spillovers, conceptually and empirically.

Another contribution is to show differences between horizontal and backward FDI spillovers. Past studies have assumed that both types of spillover respond identically to changes in intra-firm or external settings, and any previous studies exploring suitable circumstances for positive effects on horizontal or backward spillovers, if performed, have been isolated from one another. This chapter shows that effects of horizontal and backward spillovers are likely to be maximised at different levels of environmental dynamism.

This research also contributes to the environmental dynamism literature. Strategy scholars have noted the interplay between rates of change at firm and industry levels. Firms' strategy, behaviour and organisational structure have been investigated extensively. However, the concept has been bounded in domestic economies. In reality, more and more firms operate in multiple locations, so that what environmental dynamism influences is not only a firm's strategy, behaviour and structure but also interactions between foreign MNEs and indigenous firms in the host country. Thus, we propose that environmental dynamism is a key contextual dimension explaining technology and knowledge spillovers in international business.

Practical implications

This research has practical implications for both MNE subsidiaries and domestic firms in a dynamic industry. Firms in a host country may access technological opportunities by participating in value chains led by foreign MNEs. High environmental dynamism creates a situation where foreign need to access the fast-changing technologies that a local supply network in a host country provides. Overall, there is a virtuous cycle wherein suppliers and customers of different country origins co-develop in a dynamic market and industry.

A policy implication is that policymakers may have to consider the varying impact of FDI spillovers under different task environments. So far, FDI policy effect is assessed according to the industry classification scheme, where industries are defined as clusters of products. However, this classification assumes common task environments within the product group, while firm-level strategy-making and performance cannot be homogeneous due to heterogeneous task environments within industries (Rumelt, 1991). Therefore, it is proposed that policymakers should pay more attention to the firm-level perspective of external environmental conditions under which foreign and local firms operate.

Research limitations and future research directions

This study has some limitations. First, we measure environmental dynamism based on firm-level responses about a single dimension focusing on a dominant product's life span. Environmental dynamism should have been measured in multiple dimensions and the effect needs to be examined holistically (McCarthy et al., 2010). This research also focuses on environmental dynamism in a host country. Although foreign operations in a host country are in response to local environmental dynamism, subsidiaries can be aligned with MNE strategy, which is a response to global environmental dynamism. Therefore, future research might consider multidimensionality of the original concept in a global context.

Furthermore, this chapter has a few methodological limitations. Our data is pooled cross-sectional data. While this is a decision constrained by inability to construct strong panel data, there are repeated observations remaining in the dataset. This means interpretation of coefficients may take this issue under consideration. Furthermore, our data does not include variables to control for MNE group-level strategy and organisational characteristics. Foreign subsidiaries are part of MNE-level knowledge production systems and this should be taken into account. Building on this chapter's empirical findings, future research may explore factors causing variance of FDI spillover effects at different levels of environmental dynamism, focusing on interaction of strategies between MNEs and indigenous firms.

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