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ABSTRACT

China's 'Market for Technology' policy has attracted much interest over the past decade. In light of a relative emphasis on the spillover effects of joint ventures, this study examines the transferring effects of Multinationals' (MNCs) outbound open innovation in such a context. A survey of 2071 research and development (R&D) contract transactions between Chinese entities and MNCs indicates both internal factors (e.g. organisational capabilities) and external factors (e.g. the role of Intellectual Property protection) affect the transferring effects, which reformulate the focus of the Policy from the relational dimension of 'Government vs. MNCs' to the transactional dimension of 'Domestic entities vs. MNCs'. We thus conclude that MNCs' active initiative in the involvement of technology transfer and the success of domestic transaction partners combine to contribute to the technology progress within China's 'Market for Technology' policy.

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Market for Technology; outbound open innovation; R&D contract transaction

1. Introduction

'Market for Technology' (the Policy) is an important policy related to trade and foreign direct investment (FDI) that was launched by the Chinese government in the 1980s. However, research on the Policy finds that its emphasis is mainly on the spillover effects of Multinationals (MNCs), in particular those taking the form of JOVs (Li 2014), which seems different from the experience of Japan or South Korea. The practices of the latter are based on importing patents from Western countries and through secondary development and innovation in order to upgrade the capabilities of domestic enterprises (inbound activities and explorative capabilities, Subramaniam and Youndt 2005). Previous research also finds that Chinese enterprises seldom benefit directly from technological spillover by MNCs, and that the promotion effects of MNCs are closely related to Chinese enterprises' inputs of human capital and independent innovation capabilities (Li 2014).

Still, the current literature limits its focus to the closed innovation by MNCs in China and lacks awareness of such facts about the Chinese government's undertaking within the Policy in the process. Ever since the 1980s, the Chinese government has adopted the Policy with the aim of opening the domestic market through an administrative approach to attract FDI inflows and realise technology transfer (Government vs. MNCs).The issue of 'the Foreign Equity Joint Venture Law' in 1979 observed the confirmation of the Policy legally. In the following decades, great changes have occurred in China's economic system reform (i.e. China's joining the WTO), which reasonably gave rise to China's opening transition from 'policy-orientated openness' to 'institutional openness'[1]. These changes in the domestic environment (the transition from regulation to

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deregulation, the active role from government to domestic entities) could be regarded as the macro context for the FDI inflow.

However, with the development of the Chinese market, more MNCs rushed to China not only to outsource their production facilities and business activities but also to become actively involved in China's technology market, including by relocating their R&D sites and by conducting R&D contract transactions (Quan and Chesbrough 2010). Such trends not only conform to Chesbrough's (2003, 2006a) new discovery of the transition from closed innovation to open innovation by MNCs in the late twentieth century but also show the specific features of MNCs' outbound open innovation in China's technology market. These phenomena put forth an interesting research question: what is the basic role played by MNCs' innovation in the process of opening China's intermediate product market? At this point, when we review China's Policy, we become more interested not only in the macro institutions' changes themselves but also in their impacts on the micro innovation modes by MNCs, a phenomenon motivated by the context dependency of open innovation(Cheng and Huizingh 2014).

The above features of outbound open innovation by MNCs and the obvious transition of China's openness orientation provide another perspective for the evaluation of open innovation within China's Policy in the new context. Wu, Lin, and Chen (2013) illustrate the power of openness in terms of value creation that is largely supported by innovation capabilities, which underlines the importance to relate the openness policy's influence to the variation of the micro behaviours. We thus focus on the real performers behind the Policy from the traditional roles played by 'Government vs. MNCs' to the real roles played by 'Domestic entities vs. MNCs'. Accordingly, our research questions evolve into the following: To what extent do MNCs' active behaviours contribute to technology progress among domestic entities, and what are the necessary conditions for the improvement?

To answer these questions, this study adopts a quantitative approach to investigate the outbound open innovation from the perspective of MNCs' R&D contract transactions (activities related to the intermediate product market) in China. We configure a micro analytical framework under the variance of domestic policies and international environment to obtain a better understanding of the micro level performance of firms/individual projects, including R&D contracts and transactional motivations and behaviours of partners, thus providing a new dimension for exploring the nature of outbound open innovation within the context of China's Policy (Figure 1).

The paper is organised as follows. Section 2 reviews the literature and gives the concept development. Section 3 introduces the method. Section 4 discusses the analysis and presents the results of an empirical analysis. In section 5, we conclude by discussing the implications of our findings for future research.

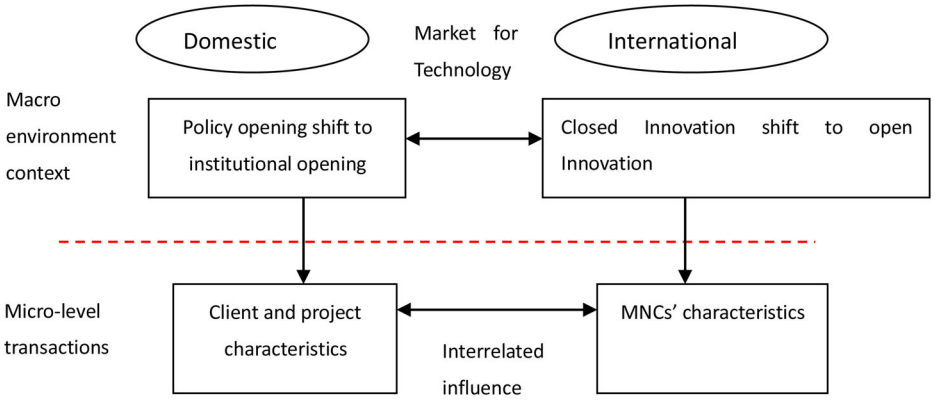

Figure 1. The micro analytic framework within the policy.

2. Literature review and concept development

2.1. Active technology transfers related to outbound open innovation

The paradigm of open innovation has attracted wide attention among scholars and practitioners. According to Chesbrough (2003, 2006a), most of the companies conducted every aspect of their business internally in the early twentieth century. This do-it-all-yourself approach meant that MNCs limited any active technology transfers. Those outside of the MNCs could only gain technology transfers by the spillover of MNCs (Outside-in, West and Bogers 2014).

Ever since the latter part of the 1990s, with changes in the knowledge landscape, a new shift from a closed system of innovation based on tight control to an open mode based on 'the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively' (Chesbrough 2006b) has appeared. Considering nearly 40% of many MNCs' patents were kept in house and neither used in their own business nor licensed to any other business, there lies much room for the improvement of Intellectual Property Rights (IPR) Management; for example, through the 'inside-out process of transferring knowledge' (outbound open innovation), MNCs will not only actively participate in the intermediate product market by chartering, technology transfer, and so on, but also benefit the recipients in absorption, digestion and re-innovation to gain more returns[2]. While in so doing, open innovation in general and outbound open innovation in particular may have had both positive and negative effects on performance (Kline 2003; Laursen and Salter 2006; Enkel 2010). In addition, such an approach can help to overcome two dilemmas that the traditional Policy may face in the context of closed innovation in China: (1) MNCs will not enter into the intermediate product market, and (2) they will take strict control of technology spillover.

2.2. Two different modes of technology transfers by MNCs in China

Outbound open innovation encompasses activities involved in the exploitation of internal ideas, such as through licensing out or outright selling of knowledge, as well as the divestment of parts of the firm (Lichtenthaler 2009). It is agreed that core technologies will be strictly protected under either innovation mode because core knowledge resources can build competitive advantages (Barney 1991) only if they are strictly protected. Based on the paradigm of outbound open innovation, MNCs may transfer the following two technologies outside of their boundary and form the following two types of technology transactions:

(1) Transfer of MNCs' internal mature technology. Based on the product life cycle, such technologies, although they have lost their superior positions in developed countries and global markets, still play the role of advanced technologies in developing countries. Meanwhile, these technologies have been standardised and adapted to be quickly digested and absorbed by host-country firms, MNCs can directly use them to improve existing products and service configurations. As such activities are not a totally different solution, there is no need for the strict control by MNCs. Instead, MNCs can execute a number of R&D transactions to quickly meet the expectations of various clients, such as developing technology platforms, providing technology services, and even transferring the technologies to Chinese firms.

H1a: Upon decreasing control in organization, the involvement of MNCs' transactions with domestic enterprises increases.
H1b: Upon increasing the adaptation of technology to the Chinese market, the involvement of MNCs' transactions with domestic enterprises increases.

(2) Transfer of MNCs' internal, unused technology. Based on open innovation, such technologies originate from MNCs' internal R&D and are located in the first or second phase of a product's life cycle. However, in the process of development, these technologies are not regarded as necessary for the core business of MNCs; therefore they are usually kept on the shelf or in 'stock'. Additionally,

patents that MNCs hold but never used also fall into this concept. To reduce the costs of keeping unused technologies, MNCs would like to obtain access to external sources of markets where different business models can be profitable, or MNCs may transfer them to enterprises at a similar level of technological development to benefit from the inter-organisational networking (Van de Vrande et al. 2009). With regard to the Chinese market, it may be ideal for MNCs to choose to reach transactions with other foreign subsidiaries in China. Foreign subsidiaries, as shared by the similar values (attitudes for IPR etc.) and behaviours (transparent payment and purchasing practices, etc.), may be preferred by MNCs. While doing so, MNCs can cooperate with these clients and further develop these unused technologies (outbound activities and explorative capabilities), which can both improve the application of unused technologies as well as produce more market rewards through cutting-edge idea inspired by the unused technologies. Thus, we come to the following hypotheses:

H2a: As the uncertainty in the payment modes decreases, the involvement of MNCs' transactions with foreign subsidiaries in China increases.
H2b: As the demand for the IPR levels increases, the involvement of MNCs' transactions with foreign subsidiaries in China increases.

For MNCs, the above two different types of technology transfers involve two different domestic entities: one is the technology transaction between MNCs and Chinese domestic enterprises/units, and the other is the technology transaction between MNCs and foreign subsidiaries in China. Given the different demands from clients and the complexity of R&D contracts, different amounts of money are transferred into the R&D contract activities (which conforms to Williamson's concept of specific assets, 1985) between these two types. Thus, we come to the following hypothesis:

H3: The specific assets involved in transactions between MNCs and domestic enterprises are lower than those between MNCs and foreign subsidiaries in China.

In the end, we propose in this paper that the verification of the above hypotheses depends on the following factors: the technology that MNCs actively bring to transact with domestic entities, active demand from domestic entities, and the integration of the domestic market structure by the host government (Fransman 1995).

The technology factor reveals the supplying influence related to the transition context of MNCs' closed innovation to open innovation, whereby more feasibility of MNCs' technology transfers to the outside world, be it the 'R&D Tech' contracts vs. 'Tech. consulting and Tech. service' contracts, are now guaranteed. Such influences are also demonstrated in the initiatives by MNCs (i.e. ambidexterity capabilities and organisation control). The demand factor appears as the dragging strength, which is indicative of the size of host country and the appealing structure of the host market. Requirements for items with different IPR levels and the avoidance of uncertainty in the transactions are parts of the demand initiatives from domestic entities. The above two points concern the firm/individual projects-level factors, which conform to the initiatives variables of MNCs and domestic entities in Section 4. The third factor probes the micro influence produced by the design of institutions and policies at the macro level, which reveals the context dependency of open innovation (Cheng and Huizingh 2014).

3. Data and methods

3.1. Sample and data collection

Our data[3] are from the Beijing technology and market office (BTMO), which covers all R&D transactions registered with the BTMO since 2001 by those MNCs that have invested in IT or other industries in Beijing. During the period covered by our sample (January 2001–June 2011), 2071 IT R&D outsourcing contracts were registered by more than 90 MNCs-owned subsidiaries and JOVs. These MNCs include IBM, MS, Motorola, Nokia, SIEMENS, LG, and Toshiba, among others. Most MNC-owned R&D institutions in China act as technology contractors. We have 1843 items for 'reverse

Table 1. Yearly distribution of R&D transactions unit: items.

FTLO	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
0	0	17	10	4	21	53	32	14	28	32	17	228
1	22	50	42	74	52	129	124	306	352	485	207	1843
Total	22	67	52	78	73	182	156	320	380	517	224	2071

Source: BTMO; FTLO means foreign-to-local outsourcing. Transaction between foreign subsidiaries and MNCs is defined as 0, while those between domestic enterprises and MNCs is defined as 1. Here, foreign subsidiaries in China and domestic enterprises are both called domestic entities.

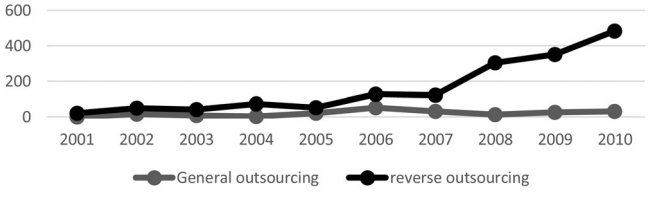

Figure 2. Distribution graphics of the two main types of outsourcing in the samples. Source: BTMO; unit of horizontal axis is time, unit of vertical axis is contract items.

outsourcing' (i.e. from Chinese enterprises to MNCs)[4] and 228 items for 'general outsourcing' (i.e. from Foreign subsidiaries in China to MNCs). Details are presented in Table 1 and Figure 2.

3.2. Measures

3.2.1. Measures of transaction modes within China's policy

This study develops a dummy dependent variable to measure the different transaction modes of outbound open innovation within China's Policy. Contrary to the former focus of the Policy on the role of 'Government vs. MNCs', we turn our attention to the transaction modes between 'Domestic entities vs. MNCs'. Thus, we obtain two types of transactions modes around R&D projects in China's ITO markets: FTLO (foreign-to-local outsourcing) is defined as 1, which explains the 'reversed outsourcing' of R&D contract transactions between domestic firms (the client) and MNCs (the contractor); FTLO (foreign-to-local outsourcing) is defined as 0, which explains the 'general outsourcing' of R&D contract transactions between foreign subsidiaries in China (the client) and MNCs (the contractor).

3.2.2 Measures of MNC's outbound open innovation

Consistent with Lichtenthaler (2015), which states that outbound open innovation is related to both internal factors and external factors, we hereby adopted the following three factors: exploitation (exploitative capability), exploration (explorative capability) and organisation control.

MNCs' *exploitative* capability, as one of MNCs' ambidextrous capabilities (March 1991), focuses on improving existing products and service configurations, but not necessarily a totally different solution. Hereby, it is measured by the total number of R&D transactions MNCs executed to quickly meet the expectations of various clients, which reveals the scope MNCs can reach with the application of technologies to clients. In so doing, the standardised technologies can be easily adapted to the host country, which facilitate the absorption by domestic enterprises (H1b). MNCs' *explorative* capability is expected to create innovation that changes the rules of the game, create new market space and result in superior innovation performance (Cheng and Shiu 2015). Herein, it is measured by the ratio of R&D contacts worth more than 10 million RMB to all the signed contracts, revealing the extent to which MNCs can explore the development of technology for the clients.[5] We also use *Sellerform* (wholly owned or joint venture) as the variable for organisation control to capture MNCs' willingness and readiness to pursue different technologies under host countries' IPR protection levels, which is a binary dummy variable. Subsidiaries wholly owned by MNCs are defined as 1, while joint ventures (JOVs) are defined as 0. H1a is the hypothesis concerning the degree of

control in the process of transaction with different clients (negative, which means less control in organisation with more transactions with domestic enterprises-reverse outsourcing).

3.2.3 Measures of project and client characteristics

To measure the complexity of R&D contracts, this study uses the item of asset specificity from Williamson (1985). Consistent with the sunk cost in the different measures of asset specificity (Stanko and Calantone 2011), the item of *Log value* represents the amount of money targeted into R&D contract activity. Such amount of inputs cannot be easily transferred to other usage, which is highly related to the complexity of R&D projects. It is expected that specific assets involved in 'reversed outsourcing' are lower than those in 'general outsourcing' (H3).

In the process of open innovation, the client's use of purposive inflows of knowledge is one of the major motivations. A dummy variable is used to stress varied client's demands for MNCs' technologies. We specifically clarify three different forms of IPR by MNCs that are traded in the R&D contracts areas, such as *Local patents* (R&D contracts in the form of domestic patents), *knowhow* (R&D contracts in the form of technology secrets) and *noIPR* (R&D contracts with non-IPR involved, or usage of public knowledge). Moreover, the first two types of IPR are closely related to unused technology, and the *noIPR* item is related to mature technology. It is expected that 'general outsourcing' involves more IPR-related technology transactions (H2b), which may be indicative of initiatives and demands for advanced technology by the clients.

For the clients in outsourcing, how to avoid uncertainty, particularly the behavioural uncertainty (Williamson 1991) is very important. Such uncertainties are related to the moral risks of the contractor, such as opportunity risks (Steensma and Corley 2001) and contractor experience (Pisano 1990). Consistent with the work of Gopal et al. (2003), the item of *paymodes* is used to indicate the behavioural uncertainty (H2a). It is a dummy variable, for which 1 indicates down-payment, and 0 represents lump-sum payment. It is expected that clients in 'reversed outsourcing' face more uncertainty with MNCs and consequently need a more flexible payment mode.

3.2.4 Control variables

We also include such control variables as the project duration (*Log contract time*), which measure the time span from the beginning of contract signing to the end of contract execution. Such a variable can control for the related influence on asset specificity, payment mode and the execution of technology service or consulting contracts, which conforms to the work of Croisier (1998).

The average *project size* reveals the fixed effect of sub industries. It measures the average amount of all the projects obtained by MNCs, which is calculated by the total value of all the projects divided by the total sum during 2001–2011. As the sample firms come from the different components of IT industry (including mobile communication, computer software, communication equipment manufacture, etc.), this variable can be used to control for those sub-industrial impacts.

The *Year* variable is usually considered when the pooled cross-section data are used. With the development of China's economy and the improvement of the IPR system, the two modes of R&D contract outsourcing are also changing in the process; thus, we introduce the time trend variable of *Year* to exclude its impact.

Frequency is a relevant dimension used to recover the cost of specialised governance structures (Williamson 1985). It measures the repeated transaction numbers through the same pair of parties during our research period. In the explanatory variables, the behavioural uncertainty may be endogenous, that is, if there is more cooperation experience between parties and more trust is being set up, the payment mode will be influenced. *Frequency* can be used to control for such a phenomenon.

4. Analysis and results

4.1 Model design and regression

To test our hypotheses, binary logit regression was used. For a logistic regression, the predicted dependent variable is a function of the probability that a particular event occurs (Greene 1993). Thus, the predictor model for this study can be specified as follows:

$$\mathrm{P}(Y_i = 1) = \frac{e^{Zi}}{1 + e^{Zi}} = \frac{1}{1 + e^{-Zi}}, \tag{1}$$

$$\text{with } Z_i = \beta_0 + \beta X_j + \gamma H_k + \mu. \tag{2}$$

Here $X_j(j = 1 - 8)$ is a vector of explanatory variables (including variables related to firms and project characteristics), which corresponds to asset specificity, organisation forms, ambidexterity capabilities, uncertainty and dummy variables that are used for different forms of IPR included in contracts. $H_k(k = 1 - 4)$ represents all the control variables such as year trend, fixed effect of sub industries, frequency and project duration; μ is a random disturbance term.

Figure 2 shows that 'reverse outsourcing' has increased considerably since 2006 (black curve), which is closely related to the transition and development of the Chinese economy (from 1996 to 2006, the compound annual growth rate of China's GDP was nearly 9.5%; an OECD report also shows that from 2002 to 2006, Chinese firms' annual R&D expenditure rate was listed as the highest in the world). Factors contributing to this large change include an improvement in domestic IPR protection (the Chinese government has revised its Trademark Law since 2001; moreover, ever since 2004, China has held National IPR Protection Week every year from 20 to 26 April). As there appear to be no fundamental changes in the motivation and nature of the two outsourcing activities, we believe that such a change in the sample structure will not obviously influence our empirical results. We also take the year 2006 as the dividing line and designed the following two models: a long-term model (Model 1) that focuses on population data from 2001 to 2011, and a short-term model (Model 2) that studies the hypotheses for the 2006–2011 period after the great changes in the sample structure.

We have two major types of R&D contracts in our sample. Type 1 is 'R&D Tech.' Contracts (here Tech. is an abbreviation for Technology), totalling 1128 items and accounting for 54% of the sample. Type 2 is 'Tech. consulting and Tech. service' contracts, totalling 848 items and accounting for 41% of the sample (the remaining 5% are 'Tech. transaction' contracts). There may exist some differences in these two main types, which may influence our econometric results.[6] Moreover, after 2006, with the rapid development of 'reverse outsourcing', 'Tech. consulting and Tech. service' contracts account for the major portion (89% of these transactions are of the 'reverse outsourcing' type). Thus, we need to give separate consideration to these two main types of contracts. Model 3 is a regression that only considers 'R&D Tech.' contracts, and Model 4 is a regression for 'Tech. consulting and Tech. service' contracts.

$$\text{Model 1 } (2001 - 2011): Z_i = \beta_0 + \beta X_j + \gamma H_k + \mu \quad X_j(j = 1 - 8). \tag{3}$$

$$\text{Model 2 } (2006 - 2011): \quad Z_i = \beta_0 + \beta X_j + \gamma H_k + \mu \quad X_j(j = 1 - 8). \tag{4}$$

$$\text{Model 3: } \quad Z_i = \beta_0 + \beta X_j + \gamma H_k + \mu \quad X_j(j = 1 - 8). \tag{5}$$

$$\text{Model 4: } \quad Z_i = \beta_0 + \beta X_j + \gamma H_k + \mu \quad X_j(j = 1, 2, 4, 6, 8). \tag{6}$$

The results of our analysis are presented in Table 2.

Table 2. Regression results for different periods and different contract types.

			R&D Tech. Model 3		Tech. consulting and service Model 4	
	Model (1) Long-term	Model (2) Short-term	long-term	Short-term	Long-term	Short-term
Log value	−0.3107(−4.03)***	−0.2544(−2.49)**	−0.2854(−2.46)**	−0.2768(−1.67)*	−0.4912(−2.99)***	−0.2717(−1.49)
Pay modes	0.8071(3.36)***	1.3377(4.21)***	1.3265(4.25)***	1.4725(3.27)***	0.6870(1.25)	1.5190(2.38)**
LocalPatent	−2.9786(−7.75)***	−2.9799(−6.51)***	−1.8166(−3.30)***	−1.5766(−2.46)**		
Knowhow	−4.1357(−9.26)***	−4.4646(−8.22)***	−2.0647(−3.29)***	−1.7199(−1.95)*		
Exploration	−3.1336(−3.79)***	−4.3039(−4.77)***	−4.9802(−5.12)***	−7.4101(−5.77)***		
Sellerform	−0.9713(−3.81)***	−1.9437(−5.62)***	−0.9636(−2.81)***	−1.5377(−3.21)***	0.1679(0.07)	
Contract time	0.3041(3.06)***	0.1484(1.05)	0.0439(0.29)	0.2141(0.83)	0.5911(2.65)***	0.3117(1.23)
Project size	1.1155(7.78)***	0.9378(5.84)***	1.1749(5.35)***	1.4480(4.79)***	1.0203(3.24)***	−0.3881(−0.92)
Year	0.1102(2.53)**	0.4700(5.65)**	0.1489(2.69)***	0.4301(3.31)***	0.5993(5.75)***	1.0508(5.65)***
Frequency	−0.0247(−5.18)***	−0.0140(−2.32)**	−0.0110(−1.59)	−0.0053(−0.56)	−0.0685(−4.91)***	−0.0257(−1.59)
NoIPR					2.5962(2.94)***	0.3000(0.24)
Exploitation					0.0051(3.24)***	0.0052(2.52)**
_cons	−2.3e + 02(−2.61)***	−9.5e + 02(−5.68)***	−3.1e + 02(−2.74)***	−8.8e + 02(−3.34)***	−1.2e + 03(−5.78)***	−2.1e + 03(−5.66)***
N	2025	1737	1125	958	807	715

Note: *t*-statistics in parentheses; *$p < .05$, **$p < .01$, ***$p < .001$.

4.2 Main findings

As Table 2 shows, based on open innovation orientations, the main effects within China's Policy (demonstrated by the match of MNCs and clients' initiatives) are significant. The results of Model 1 and Model 2 suggest that most of the explanatory variables have significant effects on the transaction modes ($p < .001$). There is no substantial difference between the long-term Model 1 and the short-term Model 2. We learned that R&D contract transactions executed in China are supported by initiatives undertaken by MNCs as follows: the effects of *Sellerform* include less control of organisation ($\beta = -0.9713$, $p < .001$; $\beta = -1.9437$, $p < .001$) and are positively related to 'reversed outsourcing'; the effects of *exploitation* include a higher number of reactions to local expectations ($\beta = -3.1336$, $p < .001$; $\beta = -4.3039$, $p < .001$) that are positively related to the 'reversed outsourcing'. The above results strongly support H1a and H1b (MNCs' active outbound open innovation gives rise to more R&D outsourcing transactions with domestic enterprises in China)

H2a and H2b pertain to the effects of China's institutional arrangement, such as the deepening of openness and improvement of IPR protection, which can be revealed by domestic clients' motivations and behaviours. Given the significance of *pay modes* (measure of domestic entities' evasion of uncertainty ($\beta = 08071$, $p < .001$, Model 1; $\beta = 1.3377$, $p < .001$, Model 2, respectively), and the significance of demands for the different IPR forms of *Knowhow* and *Local Patent* (both have a significance of $p < .001$), H2a and H2b are both supported. The implications are that less uncertainty in the transactional behaviour and more demands for MNCs' IPR will promote more R&D outsourcing activities between foreign subsidiaries in China and MNCs.

Given the significance of *Log value* ($\beta = -0.3107$, $p < .001$, Model 1; $\beta = -0.2544$, $p < .001$, model2, respectively), H3 is strongly supported, which means that specific assets in 'reverse outsourcing' are lower than those in 'general outsourcing'.

We also give independent regression for the two different types of contracts in Table 2. For 'R&D tech.' contracts, most of the variables in Model 3 are significant. For 'Tech. consulting and Tech. service' contracts, when Model 4 applies to the long term, the variables of *paymodes* and *Sellerform* seem insignificant. Below we give explanations for the insignificance of these two variables.

Explanation for the variable *paymodes*: the value of 'Tech. consulting and Tech. service' contracts is far lower than that of 'Tech. R&D' contracts (the former's average amount is 520,000 RMB, and the latter is 1,700,000 RMB). On the one hand, the uncertainty in 'Tech. consulting and Tech service' contracts is lower than that in 'Tech. R&D' contracts, and more consideration is given to economic factors such as payment modes. On the other hand, a lower amount of the contract relieves the client with heavy economic burdens and risks. Thus, both 'reverse outsourcing' and 'general outsourcing' are prone to lump-sum payment, which causes the variable *paymodes* to be insignificant in the long-term model.

Explanation for the variable *Sellerform*: Our dataset notes a substantial difference in organisational form of 'Tech. R&D' contracts and 'Tech. consulting and Tech service' contracts (in the case of R&D institutions wholly owned by MNCs, 'Tech. R&D' contracts account for 72% of all transactions). The unbalanced allocation of these two main types of contracts to the two types of outsourcing activities produces obvious impacts on the organisational forms chosen by the two types of outsourcing activities. Thus, once we control for the contract types, the organisational form of contracts does not have any significant effect.

The above empirical results contribute to a different understanding of MNCs' outbound open innovation within China's Policy in the new context: with the systematic openness of the Chinese market and the orientation of MNCs towards outbound open innovation, R&D institutions owned by MNCs have rapidly increased their involvement in Chinese technology market. As contractors, MNCs present different capabilities for technology transfers (including 'exploitative capability' and 'explorative capability'), thus providing more transaction opportunities for domestic entities. Our data show that more domestic enterprises participate 'reverse outsourcing', while foreign subsidiaries in China make more deals in 'general outsourcing'. These results are related to the initiatives of

domestic clients, as reflected by the variable of *paymodes* (evasion of uncertainty) and the project attributes (measured by the variable of *Log value*), as well as influenced by MNCs' initiatives, as reflected by the variables of *Sellerform* (organisation form) and MNCs' ambidexterity capabilities, for example, *exploitation* and *exploration* variables.

5. Conclusion and discussion

Although China's Policy has received widespread attention in the past decade, its nature and the role of MNCs remain inconclusive. The main purpose of this study is to re-examine MNCs' transferring effects of outbound open innovation within China's Policy. This study distinguishes two types of R&D transactions in terms of MNCs' outbound open innovation (between MNCs and domestic entities) and explores the relative influencing factors. Based on a cross-section database of 2071 items of IT R&D contract transactions, the empirical analysis indicates some interesting results. Our study's findings suggest that the interaction of micro and macro openness in China has promoted the involvement of an increased number of MNCs in R&D contract transactions with domestic entities. Relative to those foreign subsidiaries in China, MNCs deal more with domestic enterprises under such circumstances (from MNCs, for example, less control in organisation, or more adaptation to the Chinese market); we also found MNCs deal more with foreign subsidiaries in China under such circumstance (from the clients, for example, less uncertainty in the payment modes, or more demands for the IPR levels). Considering the target of China's Policy, MNCs' above performance provide opportunities and incentives for the growth of Chinese domestic entities. If the technology gap between the two types of domestic entities can be narrowed in some fields in the future, China's Policy can really take effect.

5.1. Implications related to China's practice

Our research conclusions can be summarised in two points. One is that outbound open innovation creates new opportunities for the implementation of China's Policy in the sense that MNCs in the outbound open innovation context will actively make technology transfers to the outside world (pushing factor). This result can also be demonstrated by several successful 'Market for Technology' cases in China, such as hydroelectric generating set technology in the Three Gorges Project and locomotive manufacturing technology. These technologies appeared at the end of the twentieth century and at the beginning of the twenty-first century, when MNCs began the stage of open innovation. As many MNCs are willing to externalise their technology, such opportunity benefits Chinese enterprises from making full use of MNCs' R&D technology through the intermediate product market in terms of resource integration, technology absorption, technology consulting and technology services, and so on. Of course, such a trend from MNCs produces a great incentive to the persistent opening and improvement of China's institutional arrangement. It is the combination of the two trends, namely, the trend to the outbound open innovation by MNCs and the trend to the improvement of institutional arrangement by Chinese government that have contributed to the successful execution of the Policy in the ITO market. It cannot be imagined that such a process could have occurred under the traditional closed innovation context. It is for this reason, the automotive industry, which originated in the 1980s, and the high-speed railway industry, which did not begin to develop in earnest until the twenty-first century, demonstrated completely different effects with regard to the implementation of the Policy.

The other point is that the strong attraction of China as a host country is demonstrated by the existence of a variety of Chinese domestic entities interested in transacting with MNCs and in absorbing their mature or unused technology (dragging factor). MNCs with open innovation strategies will not only 'exploit' their mature technology but also 'explore' their redundant technology with outside partners, which put great pressure on the host country (China) to open and develop its market. In response to the transformation of MNCs' innovation modes, the Chinese government has been quickly adjusting its policy(including relaxing the control limits of equity of MNCs, as reflected in

H1a),further opening the economy along the final product market to the intermediate product market (which accelerates MNCs adaptation to the host market, as reflected in H1b). In addition, more attention is being paid not only to the institutional development of the domestic technology market (such as facilitating the payment modes, as reflected in H2a) but also to the diversity of trading partners and areas of collaboration. The latter includes collaboration on technology management, IPR protection (as reflected in H2b) and efforts to better coordinate firm cultures between Chinese entities and MNCs, which contributes to the upgrading of the absorption abilities of Chinese entities. Of course, our empirical results reveal that there still lies the technology gap between the two transactions modes with MNCs (as reflected in the inputs of specific assets), which demonstrate domestic enterprises should strive to increase their absorption capability (Cohen and Levinthal 1990) and independent innovative capability in the future.

5.2. Implications related to other research

The contribution this paper seeks to make includes what follows. First, we provide a new perspective to re-examine MNCs' outbound open innovation within China's Policy through R&D contract transactions in the intermediate product market, a focus that appeared to be rare in previous studies. Contrary to the traditional simple dichotomy of the relationship of outbound activities with exploitative capabilities and the relationship of inbound activities with explorative capabilities (Lichtenthaler 2009; Cheng and Shiu 2015), our findings support such a logic: outbound activities not only encompass activities involved in the exploitation of internal ideas (such as mature technology) but also encompass activities involved in the exploration of new knowledge originating from the clients' demands for unused technology, for which MNCs will have to deploy more asset specificity and interact closely with clients to generate greater innovation performance (measured by IPR and specific assets, etc.). Such a view extends the extant research concerning the exploitative nature of outbound activities (Faems et al. 2010; Reed, Storrud-Barnes, and Jessup 2012) and addresses the potential effects of the new knowledge that can come from those outbound activities (Cheng and Shiu 2015).

Second, while recent research is turning from the industry and company perspective to the individual project level to tackle the understudied areas in open innovation research (Hsieh and Tidd 2012; Namkuk, Dong-Jae, and Sungjoo 2014), a lack of the combination of company and project level analyses in the open innovation exists. This research introduces both the characteristics of both factors and finds they are informed by each other, for example, in the process of R&D contract transactions, different R&D projects represent and reveal firms' different capabilities. Such a combined analysis also supports our first contribution. From the company perspective, it may seem difficult to manage the two different strategic choices requiring different organisational perspectives (March 1991); however, the project perspective presents an alternative for the reorganisation of the knowledge, skills and processes by such means as a task group, and so on, in a company, thus easing the situation of dilemma.

Third, to better understand the nature of outbound open innovation within China's Policy, the study makes an empirical analysis and finds that most of the influencing factors are closely related to the matching of partners in specific initiatives. It is the interaction of MNCs and domestic entities, both merged in the atmosphere of open innovation, that contribute to the varied R&D transactions and technology transfer behind China's miracle of the Policy. Given the specific development period and environment conditions, any single factor, for example, MNCs in closed innovation, or the Chinese government's policy oriented openness, is unlikely to contribute to the successful execution of the Policy.

5.3. Limitations and suggestions for future research

One limitation of this study is that we focused on only one industry, that is, the outsourcing of information technology in one specific location in China (Beijing). Future research covering a larger

number of industries and locations is needed to determine the 'generalisability' of the study findings across the country.

In addition, this study used a cross-sectional research design, which limits conclusions regarding causality between the initiatives and their impacts. Despite the procedural challenges involved, there is a need for longitudinal research to clearly establish these causal relationships.

Furthermore, an empirical analysis of the Policy could reveal a general trend underlying its mechanism and impacts. A deeper insight into the practices and rules in this area could be gained if a case study was conducted in the future to complement this quantitative analysis.

Notes

1. The Chinese government launched its open economy in 1995, but until 2001, after China joined the WTO, China's open economy was merely a normative institutional arrangement. The year 2006 not only saw the end of the transition period of WTO protection for China, but it also saw the start of the Chinese government's strategy of 'innovative country'. Thus, the year 2006 was regarded as the dividing line between China's two different but closely related opening stages, 'policy-orientated openness' and 'institutional openness'.
2. This mechanism is one of the mechanisms of outbound open innovation, which is also called formal collaboration, and requires a firm and its external partner to adhere to an agreed structure for the exchange (Laursen and Salter 2014).
3. This database comprises the entire first hand dataset. For those IT MNCs in Beijing, if they conduct R&D transactions with domestic entities and hope to obtain tax incentives for R&D, then they should register with BTMO for the necessary information disclosure including item, time, name of partners, amount, payment mode, IPR, and frequency, etc.
4. In line with different studies of outsourcing, we define outsourcing activities initiated by developed country firms (Clients) as 'general outsourcing', while those initiated by developing-country firms (Clients) are defined as 'reversed outsourcing'.
5. Barki, Rivard, and Talbot (1993) identify project size as a significant variable that characterises risk in a software project; thus, large projects pose greater risks and task uncertainty, which force MNCs to expend more time and energy to address the uncertainty. We hereby use the variable big project ratio to reveal the explorative capability of MNCs.
6. Compared with 'R&D Tech.' contracts, 'Tech. consulting and Tech. service' contracts need less asset specificity input, and the client faces less behavioural uncertainty; there are no items in the form of knowhow in transactions, and there are no items over 10 million RMB. It is for this reason why we test model 4 with only a few variables.

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