



Foreign ownership and novelty of product innovations in China

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Abstract

This paper examines a relationship between foreign ownership and innovation novelty in the context of host advanced developing economies. The analysis is focused on two dimensions of product innovation novelty, the novelty of introduced innovations and the economic benefits from introduced novelty. We find that foreign affiliates do not have higher odds than domestic firms to introduce product innovations of higher novelty. Indeed, the findings indicate that the higher odds of foreign firms of introducing innovations of higher novelty are moderated by exploitation of ownership advantages and by a host market orientation. However, we find that foreign affiliates have higher odds to capture higher economic benefits from product innovations of higher novelty than domestic firms. Hence, although foreign affiliates are not higher up on an innovation novelty ladder than domestic firms, they replenish their product and innovation portfolio with innovations of higher novelty at a faster rate than domestic firms.

1. Introduction

Research on the relationship of foreign ownership and novelty of product innovations is recent and relatively limited. The conceptual studies typically make a distinction between two levels of novelty, innovations new to the firm and innovations new to the market, consistent with the distinctions in the Community innovation survey (CIS) (see Kleinknecht, van Monfort and Brouwer, 2002; Arundel, Smith, Patel and Sirilli, 1998). The focus of the empirical literature has been on the direct impact of foreign ownership on new to the market innovations, and exceptionally on both levels of novelty. For example, Sadowsky and Sadowsky-Rasers (2006) report a positive impact of foreign ownership on innovations of both low and high novelty (relative to no innovation) among Dutch firms that include innovators and non-innovators but, among innovators only, no impact of foreign ownership on new to the market innovations, and a negative impact when controlling for sources of innovation among innovators only. Similarly,

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Dachs, Ebersberger and Lööf (2007), in a group of five small European countries, detect a positive impact of at least one category of foreign firms in three countries, and no impact on the introduction of new to the market innovations in two in a sample of innovators only. With regard to (advanced) developing countries there is limited evidence, with an exception of a study on Brazil that finds that export-oriented foreign affiliates have a higher propensity than export-oriented domestic firms to introduce product innovations new to the market, among innovators only (Kannebley, Porto and Toldo Pazello, 2005).

In contrast to prior studies, the objective of the paper is to examine the impact of foreign ownership on the *novelty* of product innovations, rather than its impact on *individual levels* of innovation novelty. It examines this relationship by focusing on two dimensions of success in product innovation novelty, namely *the introduction of product innovation novelty* and the *economic benefits from product innovation novelty*. Unlike the literature that has focused on direct effects on novelty levels of introduced innovations, it is argued that foreign ownership is unlikely to have a direct positive impact on introduction of product innovation novelty but that its impact is likely to be moderated by innovations sources and market orientation. Different from prior studies, the paper also examines the impact of foreign ownership on the economic benefits from product innovation novelty, based on an argument that foreign affiliates and domestic firms have different access to complementary assets of relevance for the appropriation of economic returns from introduced innovations.

The paper contributes to the empirical literature in several ways. First, it follows a categorisation of innovation novelty levels from the Oslo manual, which is implemented only in the Canadian innovation survey. Unlike the CIS dichotomous categorisation, which is based on the firm and market criteria of novelty, it is based on the firm and geographic criteria of novelty. It distinguishes between four levels of novelty, new to the firm innovations and new to the region, (in case of large countries), new to the country and new to the world innovations. The geographic criteria of novelty is particularly relevant for the examination of the role of foreign ownership in the innovation in the host countries, associated with innovations crossing national borders. In addition, unlike prior studies that are based on innovation propensity indicators, the indicators of novelty are based on both propensity and intensity innovation indicators. The relationship between foreign ownership and the levels of innovation novelty is examined in the context of advanced developing countries as host economies.

The empirical analysis is based on data from China, which represents a suitable research context for two main reasons. First, in the last decades China has achieved a remarkable progress in building of innovation capabilities in the enterprise sector but despite this patent performance of domestic firms remains low both relative to its share in R&D as well as in comparison to foreign firms (OECD, 2007). Second, up to recently foreign affiliates have been primarily established as low cost manufacturing operations, but China currently has the highest inward foreign direct and R&D investments in the world (European Commission, 2004). These conditions provide a suitable setting to examine the relationship between foreign ownership and innovations of high novelty, and to assess the moderating effect of R&D internationalisation and market orientation on propensity of innovations of high novelty.

The remainder of the paper is organised as follows. The next section provides a conceptual background and develops hypotheses about the relationship between foreign ownership and the

novelty of product innovations. Section 3 describes the data, variables and the method of analysis. The results are presented in section 4 and discussed in section 5. The last section contains conclusions.

2. Conceptual background and hypotheses

Uncertainty and success in innovation

While product innovations represent an important factor of firm performance and a potential source of sustainable competitive advantage (Geroski, Machin and Van Reenen, 1993), the innovation process is characterised by higher uncertainty than is typically associated with economic activities (Dosi, 1988; Freeman, 1982). It is difficult for firms to predict both potential technical outcomes of their innovations as well as their market performance. Moreover, the market uncertainty is typically higher than technological uncertainty (Mansfield, 1981). Even when an innovating firm succeeds in coupling technological possibilities with the market, the additional uncertainty is associated with the economic benefits that it will be able to capture from innovations. Even though the degree of uncertainty and risk varies among innovations and is considerably higher for radical than for incremental innovations, still even the lower degrees of uncertainty associated with an innovation imply low predictability of innovation success (Freeman, 1982).

Consistent with the above uncertainties of innovation, Mansfield and Wagner (1975) distinguish three dimensions of success in industrial R&D: the probability of technical completion, the probability of commercialisation (given technical completion), and the probability of economic success (given commercialisation). The latter two dimensions can be considered as associated with an innovation. The first (commercial) dimension reveals whether an innovating firm is able to introduce an innovation to the market, and the second (economic) dimension demonstrates whether it is able to capture economic benefits from introduced innovations. It is taken here that the firm's ability to introduce to the market innovations of different levels of novelty primarily reflects innovation capabilities of the firm, while the firm's ability to appropriate economic outcome of innovations of different levels of novelty is primarily associated with the access to complementary assets and capabilities of a firm (Teece, 1986).

Given the differences between the two dimensions of innovation output, it is likely that that the same organisational and strategic factors have a different impact on the two outcomes of innovation (for an early empirical evidence see Mansfield and Wagner, 1975). Taking into account a potential asymmetry in the impact of foreign ownership on the two dimensions of innovation output, the relationship between the foreign ownership and novelty of product innovations in host economies will be examined for each dimension separately.

Foreign ownership and introduction of innovations of different level of novelty

In the studies of the impact of foreign ownership on innovation in host countries it is commonly argued that foreign affiliates will be more innovative than domestic firms because of (existing)

ownership advantages of multinational corporations. Starting with Hymer (1976) it has been widely accepted that due to advantages of domestic firms in own national environment, the internalised ownership advantages represent a precondition for the entry into production in foreign countries (see Dunning, 1993, 1988). Consequently, intra-firm transfer of technology developed in home countries has been seen as a basis for international production. Recently it has been argued that MNEs tend to transfer internally tacit knowledge that cannot be more efficiently transferred externally (Kogut and Zander, 1993). Assuming that a higher extent of tacit knowledge is associated with a higher novelty, this implies that on the basis of internal technology transfer foreign affiliates are more likely to introduce innovations of higher novelty in host countries than domestic firms that rely on international inter-firm technology transfer or imitation. However, taking into account that innovations are crossing national borders, internal international technology transfer is likely to have a positive impact primarily on the introduction of new to the country innovations by foreign affiliates. Since new to the world innovations cannot be introduced on the basis of intra-firm technology transfer, it is important to examine next the potential innovation role of foreign affiliates in host countries.

Traditional theories have assumed that development of new products and processes will take place in home countries of MNEs, while foreign affiliates will primarily engage in production activities (Vernon, 1966). However, recent trends of increasing internationalisation of R&D by multinational corporations suggest that foreign subsidiaries are likely to also engage in development of improved or new products and processes. Foreign affiliates tend to recombine the knowledge from home countries with learning in foreign markets through the evolutionary process of knowledge accumulation (Kogut and Zander, 1993). The increasing involvement of foreign affiliates in the process of innovation generation is associated with the creation of a variety of innovation networks within the multinational corporations (Zander, 1999). Related to this there are also changes in the technology and knowledge flows within the corporation. In addition to the traditional parent-affiliate technology and knowledge flows, reverse flows from affiliates to the parent, as well as lateral flows among affiliates are gaining on importance.

Associated with the changes in the location of generation of innovations and knowledge within the corporation, the eventual responsibility within the multinational, assigned to the affiliate by the headquarters, tends to reflect its specific accumulated capabilities (Birkinshaw and Hood, 1998; Pearce, 1992). This suggests that foreign affiliates may have different innovation capabilities and, associated with this, different roles (e.g. Ghoshal and Bartlett, 1988; Ronstadt, 1978). Different roles of subsidiaries in the generation of innovations have been often associated with its value added scope, in particular its R&D activities, and with its market scope, that is its geographic markets (White and Poynter, 1984). Consequently, the potential moderating effects of formal R&D activities and geographic market orientation on the relationship between foreign ownership and the novelty of introduced product innovation will be examined next.

Foreign affiliates, R&D and product innovation novelty

Traditional theories have assumed a centralised development of new products and processes in home countries of multinational corporations (Vernon, 1966). The empirical evidence on recent trends of internationalisation of generation of innovation by multinational corporations suggests first, that R&D investments are still largely concentrated in home countries of multinationals, and

second, that the foreign R&D investments are primarily located in developed countries although recently increasing also in advanced developing countries, in particular South East Asia and China (UNCTAD, 2005). These findings are consistent with arguments that there are both centripetal as well as centrifugal forces influencing the location of R&D by multinationals (Hirschey and Caves, 1981). The main centralising forces include the protection of firm-specific technology, home-market conditions as a basis for firm-specific technological advantages, economies of scale in R&D and minimisation of costs of coordination and control (Granstrand, Håkanson and Sjölander, 1992). The decentralising forces include both demand-oriented factors, such as an adaptation of products and processes to local conditions and government regulations, as well as supply-oriented factors, including scientific infrastructure, cost of R&D and R&D subsidies (Granstrand et al., 1992). Regarding foreign R&D investments in developing countries it has been argued that they are primarily driven by the availability of local science and technology resources and their lower costs (Reddy, 1997)

Specifically, the decentralisation of generation of innovations to foreign affiliates in host countries can be driven by two motives. The asset exploiting (Dunning and Narula, 1995) or home-base exploiting (Kuemmerle, 1999a) motive is associated with generation of innovations in response to the local conditions either by adapting parent's innovation or by creating new innovations for the local market. In contrast, the asset-seeking (Dunning and Narula, 1995) or home-base augmenting (Kuemmerle, 1999a) motive drives generation of innovations for the global market. The nature of the motives for internationalisation of innovation generation by multinationals imply that foreign affiliates that engage in R&D are unlikely to remain passive recipients of the technology transfer from the parent (Pearce and Tavares, 2002). This implies that the increasing importance of internal R&D relative to intra-firm innovation sources in foreign affiliates is likely to have a positive impact on their innovativeness. Foreign R&D motivated by asset exploitation is expected to have a positive impact primarily on introduction of innovations new to the country by foreign affiliates. Foreign R&D motivated by asset seeking is expected to have a positive impact primarily on introduction of innovations new to the world by foreign affiliates. Consistent with dual motives for internationalisation of R&D, it is hypothesised:

Hypothesis 1: Foreign affiliates with formal R&D are more likely to introduce product innovations of higher novelty than other firms.

Foreign affiliates, geographic market and product innovation novelty

Geographic market orientation is commonly viewed as a factor of influence on innovative behaviour of firms. In the national context it is commonly argued that export orientation is likely to have a positive impact on innovation among national firms, primarily because of higher competitive pressure and customers with higher innovation capabilities than in domestic market. This argument is largely supported by the empirical evidence (Becheikh, Landry and Amara, 2006).

In contrast, with regard to market orientation of foreign multinationals the early literature has suggested that host market oriented multinationals are likely to be more innovative than export

oriented multinationals in developing countries (Caves, 1982). Traditional export oriented foreign affiliates, associated with efficiency seeking foreign direct investments, aiming at low cost manufacturing operations without higher value added functions, have been considered likely to have lower innovativeness than host market oriented foreign affiliates (White and Poynter, 1984; Behrman and Fischer, 1980). However, in the recent literature it has been suggested that among export oriented foreign affiliates a new type of exporting affiliates can be distinguished, which has a world product mandate (Pearce, 1992). Such affiliates are internationally responsible for a particular product, with a right to produce and market the respective product and perform related R&D activities. In contrast to traditional export oriented foreign affiliates, foreign affiliates with the world product mandate are likely to be associated with higher innovativeness relative to host market oriented foreign affiliates (Pearce and Tavares, 2002).

Despite a recent increase in inward foreign R&D in advanced developing countries (UNCTAD, 2005), majority of export-oriented foreign affiliates are still predominantly of a traditional efficiency-seeking type rather than with a world product mandate. Therefore, consistent with the traditional argument, it is hypothesised:

Hypothesis 2: Foreign affiliates with host market orientation are likely to introduce product innovations of higher novelty than other firms.

Foreign ownership and economic benefits from innovations of different levels of novelty

The impact of product innovations on the firm performance depends on the extent to which an innovating firm is able to capture economic benefits from innovation. Since the regimes for appropriation of innovation are commonly weak (in terms of legal protection, and ease of imitation) it has been argued that the innovator's ability to capture returns from innovation primarily depends on the access to needed complementary assets, primarily those in manufacturing and marketing, at the time when an innovation is introduced to the market (Teece, 1986). Consistent with this argument, the empirical evidence suggests that sales and service efforts represent the most important mechanisms for appropriation of returns from product innovations (Levin et al., 1987). Due to transactional difficulties associated with contractual relations, innovating firms that own complementary assets, or can access them easily through inter-firm partnering are the most likely to appropriate returns from an innovation (Teece, 1986).

Foreign affiliates are likely to have an easier access to complementary assets than domestic firms due to several reasons. First, in order to compensate for the liability of foreignness, it is often argued that foreign affiliates entering a host country must have internalised ownership advantages over domestic firms (Dunning, 1993; Caves, 1982). These advantages include both intangible assets advantages and advantages of common governance of intangible assets with complementary assets, associated with multi-plant and multi-country operations (Dunning, 1993). These advantages, thus, include a wide range of internalised complementary assets advantages over domestic firms related to input sourcing, marketing and management knowledge, knowledge of international markets, financial resources and other advantages. Moreover, due to the network structure of modern multinational corporations (Hedlund, 1986; Ghoshal and Bartlett, 1988), foreign affiliates have an access to the assets and knowledge of the whole corporation.

Next, due to a developed network of inter-firm partnerships of multinational companies the advantages of foreign affiliates over domestic firms in host countries are likely to be also based on advantages of extensive inter-firm interactions (Dunning, 1995). While large multinational companies dominate international strategic technology partnerships, the participation of firms from developing countries is marginal, also in the case of firms from more advanced developing countries (Narula and Sadowski, 1998; Freeman and Hagedoorn, 1994). This suggests that majority of domestic firms in advanced developing countries lack technological capabilities needed for international technology partnering. Consistent with a gap in resource endowments of firms from developed and developing countries, the empirical evidence suggests that firms from developed countries primarily use alliances to access complementary assets needed to exploit own resources while in contrast firms from emerging economies use alliances with foreign multinationals to acquire resources needed to develop own capabilities (Hitt, Dacin, Levitas, Arregle and Borza, 2000:451). Due to a developed network and extensive experience of international inter-firm partnerships of the corporation, foreign affiliates are likely to have an easier access to complementary assets through inter-firm partnering than domestic firms.

The above arguments and empirical evidence suggests that on the basis of both internalised ownership advantages and advantages of inter-firm partnering foreign affiliates are likely to have an easier access to specialised complementary assets than domestic firms. Since the access to complementary assets is significant for appropriation of returns from innovations when the needed assets are specialised to innovation rather than generic, the more radical and novel are the introduced innovations, the more likely it is that the appropriation of returns will depend on the specialised innovation assets. The superior access to specialised complementary assets of the foreign affiliates is thus expected to be primarily relevant for capturing economic benefits from innovations of higher levels of novelty than innovations of lower levels of novelty. Therefore it is hypothesised:

Hypothesis 3: Foreign affiliates are more likely to capture higher economic benefits from product innovations of higher novelty than domestic firms.

3. Data and method

Data

The empirical analysis is based on data from Jiangsu province of China. The province, located on the East coast, is one of the most developed provinces, and has the characteristics of an advanced developing economy of relevance for the research in this study. First, it has significant domestic innovation capabilities, ranking third by the share of its R&D in the countries total, fourth by the R&D intensity, sixth by the composite regional innovation system score, and second (after Guandong) by its share of high-tech trade (OECD, 2007). Next, it has considerable inflow of foreign direct investments, the second largest after Guandong (Invest in China, 2006), with important presence of foreign R&D too (23% share of industrial R&D) (OECD 2007). Lastly, within the innovation system of the province multinationals and small and medium size enterprises are more important than state-owned enterprises or public research organisations (OECD 2007).

The data have been collected by an innovation survey conducted in 2003. Since the official business register of the firms in Jiangsu province was not available, the sampling frame was based on telephone directories of the capitals of 13 province's municipal counties. In contrast to typical official Chinese surveys, that cover only medium and large firms, it includes firms of all sizes (from 10 or more employees). The inclusion of small firms is relevant because of their important role in the provincial system of innovation and because in the context of transition economies the majority of newly created private firms are typically small firms. Firms were randomly sampled from a population of urban manufacturing firms. The sample was restricted to one fifth of the estimated population of 12,000 firms. The data collection started with a postal survey, with follow-up visits to non-responding firms, resulting in the response rate of 15%. The innovation survey was single-respondent, subject-based and consistent with the Oslo manual, with several modifications: it covered incremental and significant innovations; it included sales-based output measurement of product innovations of all levels of novelty; and it covered the innovation in one year (2002).⁴

Since the paper is focused on the relationship between foreign ownership and the novelty of product innovations, the analysis is based on a sample of innovators only, similar to prior studies (Sadowsky and Sadowsky-Rasers, 2006; Dachs et al., 2007; Kannebley et al., 2005). The sample includes 130 innovating firms that have introduced product innovations (defined as the commercial adoption of a new product).

Variables

Dependent variables

There are two dependent variables. The *novelty of introduced product innovations* measures the firm's ability to introduce to the market product innovations of different levels of novelty. The variable *economic benefits from product innovation novelty*, measures the firm's ability to capture economic benefits of product innovations of different levels of novelty.

4 For a description of the main results of the survey see Alcorta, Urem and Tongliang (2008).

Consistent with the Oslo manual it is distinguished between four levels of innovation novelty (reference). Apart from new to the firm innovations, as the lowest level of novelty (considered in other classifications in the literature as well), the Oslo manual distinguishes, on the basis of the geographical criteria, new to the region (in case of large countries), new to the country and new to the world innovations, in increasing order of novelty.⁵ Consistent with the manual, the innovation survey distinguished between first to the firm, first to Jiangsu, first to China and first to the world innovations.⁶

The dependent variables are constructed in two steps. First, the product innovation novelty is analysed on the basis of two indicators, innovation propensity and innovation intensity. Definition and measurement of propensity and intensity variables is consistent with the prior innovation literature (see Arundel, Smith, Patel and Sirilli, 1998). Four indicators of innovation propensity and four indicators of innovation intensity are calculated, one per each level of novelty. The *innovation propensity* variable for a given level of novelty is a dichotomous with value one if the firm reported sales of innovations of a given level of novelty in 2002 and value zero if the firm did not report sales of innovations of a given level novelty. Reporting sales of innovations of a given level of novelty is interpreted as their successful introduction to the market. The *innovation intensity* of a product innovation of a given level of novelty is measured by the ratio of sales of product innovations of a given level of novelty in total sales in 2002.

In the second step, based on propensity and intensity indicators of individual levels of innovation novelty, two dependent ordinal variables have been defined. The *novelty of introduced product innovations* is a dependent variable based on individual propensity indicators, and *economic benefits from product innovation novelty* is a dependent variable based on individual intensity indicators. In the definition of the ordinal variables the two lowest levels of novelty (first to the firm and first to Jiangsu) have been combined into one category to reduce the problem of empty or small cells. The *novelty of introduced product innovations* (NOVELTY) is an ordinal variable with value 1 if first to the firm or first to Jiangsu product innovations are the highest level of novelty introduced in the firm, value 2 if first to China product innovations are the highest level of novelty introduced, and value 3 if first to the world product innovations are the highest level of novelty introduced. The second dependent variable is *economic benefits from product innovation novelty* (BENEFITS), an ordinal variable with value 1 if the highest intensity of product innovation sales in the firm are generated by first to the firm and first to Jiangsu product innovations, value 2 if the highest intensity of product innovation sales in the firm is generated by first to China product innovations, and value 3 if the highest intensity of product innovation sales in the firm is generated by first to the world product innovations.

5 Canada is the only country that is implementing geographical criteria of innovation novelty in its official survey. However, there are three differences in comparison to the Jiangsu innovation survey: 1) the novelty is considered only for the firm's most significant innovation; 2) the questionnaire considers only whether firms introduced innovations of different levels of novelty, not innovation sales generated by such innovations, and 3) the new to the region innovations are not included among innovation novelty categories.

6 Regarding the comparability of the novelty levels used here and the Community innovation survey distinctions, following Mohnen and Therrien (2001) it is taken that all innovations that are new beyond the firm (i.e. except new to the firm innovations) correspond to new to the market innovations (as nearest concepts).

Independent variables

In the first regression model, explaining the *novelty of introduced product innovations*, there is one focal independent variable. The focal independent variable is foreign firm (FOR), a dichotomous variable with value 1 if the firm is foreign and value 0 if it is not. Foreign firms are defined here as firms in majority foreign ownership and in majority Hong Kong, Macao and Taiwan (i.e. overseas Chinese) ownership. This definition is consistent with the ownership categories of foreign invested enterprises and Hong Kong, Macao and Taiwan invested enterprises in the Chinese official statistics. Foreign firm is the only independent variable in the second regression model, explaining the *economic benefits of product innovation novelty*.

One of the two moderator variables in the first regression, on the *novelty of introduced product innovations*, is formal R&D (R&D), which measures whether a firm is engaged in formal R&D activities. It is a dichotomous variable with value 1 if the firm has a separate R&D department and value 0 if it does not. In case of foreign firms it indicates whether a decentralisation of R&D to the affiliates of foreign multinationals located in Jiangsu has taken place. Because of high collinearity of the product term of this and foreign ownership variable, with its component variable foreign ownership, this moderator variable is replaced by its inverse variable, no formal R&D (NOR&D).⁷

The second moderator variable in the first regression on the *novelty of introduced product innovations* is host market (HOSTMKT), which measures a domestic market orientation of the firm. To avoid a problem of endogeneity, it is defined as a dichotomous variable with value 1 if the firm was selling products only on domestic market in 2000, 2001 and 2002 and value 0 if it was not. Value 1 on this variable means that the firm was not an exporter in any of the three considered years.

The effect of moderator variables is tested by inclusion of product interaction terms between the focal independent variable foreign ownership and the moderator variables. To test the moderating effect of formal R&D the interaction term *foreign firm x formal R&D* (FOR*R&D) is calculated. To solve the problem of collinearity between the focal independent variable and the interaction terms, formal R&D variable is replaced by an inverse variable and an interaction term *foreign firm x no formal R&D* (FOR*NOR&D) is calculated with an inverse variable. To test the moderating effect of host market orientation, an interaction term *foreign firm x host market* (FOR*HOSTMKT) is calculated.

Control variables

In the first model, explaining the *novelty of introduced product innovations*, there are three control variables, firm size, sector and age, consistent with the innovation literature (for a review of empirical studies see Becheikh, Landry and Amara, 2006). Size of the firms is defined in terms of sales, rather than employment because of the transition context of China. Traditional state firms from centrally planned economies have been characterised by labour hoarding, thus in the context of China an indicator based on sales is likely to provide a more reliable measurement of

⁷ The replacement of the R&D variable by an inverse NOR&D variable has reduced the correlation between product interaction term and the foreign ownership variable below 0.8.

size. To avoid a bias due to outliers, the variable large firm (LARGE) is defined as dichotomous with value 1 if total sales of the firm in 2002 were above median value and value 0 if they were not.

The influence of industry is controlled by a dichotomous variable sector. The definition of the variable is based on a categorisation of sectors by Robson, Townsend and Pavitt (1988), who distinguish between core sectors, which are highly innovative and primarily characterised by product innovations, secondary sectors that are less innovative and have similar levels of both product and process innovations, and the sector other that is low innovative. The core and secondary sector are considered here ‘high innovative’ and the sector other ‘low innovative’. The empirical analysis of the significant innovations in the UK reveals that the high innovative sector include chemicals, plastics, metal products, non-electrical machinery, electrical machinery and vehicles, and the low innovative sector food, textile, wood and non-metal industries and other manufacturing. The UK classification of sectors is applied to the firms from the sample. The variable SECTOR has value 1 if the firm is from the high innovative sector and value 0 if it is not.

Related to the debate about the role of new and incumbent firms in (major) innovations, the control variable new firm measures whether the firm is a new entrant. Taking into account that China is a transition economy, it is defined relative to the reform process in China. Since a range of the legislative and other reforms leading towards the socialist market economy, and aiming at the stimulation of innovation and encouragement of foreign direct investments were initiated since 1992 (Huang, Amorin, Spinoglio, Gouveia and Medina, 2004), the variable new firm (NEW) is defined as dichotomous with value 1 if the firm was established in 1992 or later and value 0 if it was not.

The second model, explaining the *economic benefits from product innovation novelty*, contains the same control variables as the model one (for firm size, sector and entry), and in addition control variables formal R&D and export, that correspond to the moderator variable from the model one. Export (EXPORT) measures export market orientation of the firm, and is an inverse of the host market variable. To avoid a problem of endogeneity, it is defined as a dichotomous variable with value 1 if the firm was an exporter in 2000, 2001 or 2002 and value 0 if it was not.

Method

The analysis is based on Ordinal Logit regression model, estimated in SPSS. This is a cumulative ascending proportional odds model that estimates the probability of an outcome being *at or below* a particular category of the dependent variable, where the category of the ordinal dependent variable with the highest score is treated as the reference category, and is omitted (see more in O’Connell, 2006). The model assumes proportional or parallel odds. It estimates the effects of independent variables on the logits (or log odds) of lower scores relative to higher scores on the ordinal dependent variable:

$$\ln \left(\frac{p(Y \leq j)}{p(Y > j)} \right) = \alpha_j - \sum_{k=1}^K \beta_k X_k \quad \text{for } j = 1 \text{ to } J - 1$$

where Y presents the score, j number of categories of the ordinal variable and a_j the thresholds (one for each category of the dependent variable, except for the reference category). A positive coefficient indicates a lower cumulative logit for lower scores relative to higher scores, that is, a higher logit for larger scores.

Two Ordinal Logit regression models are estimated, the first model explaining the *novelty of introduced product innovations* and the second model explaining *economic benefits from product innovation novelty*. All independent, moderator and control variables are dichotomous and treated as quantitative.

4. Results

Results of the Ordinal Logit regression for the *novelty of introduced product innovations* are presented in Table 1 and for the *economic benefits from product innovation novelty* in Table 2. Frequencies of main variables are given in the Table A1 and correlations among variables in Table A2 in the Appendix. Both Ordinal Regression models are statistically significant, satisfy the assumption of proportional odds and have a moderate level of Nagelkerke pseudo R^2 (.287 and .268, respectively), as can be seen from Table 1 and Table 2. The results provide full support for two and a partial support for one of the three formulated hypotheses.

Hypothesis 1 predicts that foreign affiliates with formal R&D are more likely to *introduce product innovations of higher novelty* than other firms. The findings from the estimation of the first model demonstrate that this contingency hypothesis is not fully supported, as can be seen in Table 1. Consistent with the hypothesis, the results confirm that the relationship between foreign ownership and introduction of innovations of higher novelty is contingent on a source of innovation. Moreover, the moderating effect is higher than the direct effects of other explanatory variables. However, contrary to the hypothesis, it is found that foreign affiliates without formal R&D have higher odds to introduce innovations of higher novelty relative to other firms and holding all other variables constant.

Hypothesis 2 predicts that foreign affiliates with host market orientation are more likely to *introduce product innovations of higher novelty* than other firms. As expected, on the basis of the estimation of the first model it is found that foreign affiliates with host market orientation have higher odds of introducing innovations of higher novelty relative to other firms and holding all other variables constant. Furthermore, the moderating effect of host market orientation is higher than the effects of other explanatory variables.

Regarding control variables in the first model, there are also some interesting results. Large firms, firms from high innovative sectors and new firms have higher odds to *introduce innovations of higher novelty* relative to other firms, and holding all other variables constant. Moreover, the effect of firm size is larger than the effect of sector and new firms. However, the direct effects of these control variables are much smaller than the effects of moderating variables.

Table 1. Novelty of introduced product innovations: Ordinal Logit regression model

		Estimate (β)	Std. Error	Wald	df	Sig.	95% Confidence Interval		Exp (β)
							Lower Bound	Upper Bound	
Threshold	NOVELTY = 1	-,688	,613	1,262	1	,261	-1,889	,513	0,503
	NOVELTY = 2	2,082	,633	10,811	1	,001	,841	3,324	8,020
Location	LARGE	1,239	,422	8,630	1	,003	,412	2,066	3,452
	HIGHINNOV	,905	,380	5,660	1	,017	,159	1,650	2,472
	FOR	-1,983	,889	4,972	1	,026	-3,725	-,240	0,138
	NOR&D	-,446	,414	1,157	1	,282	-1,257	,366	0,640
	DOMMKT	-1,450	,411	12,428	1	,000	-2,257	-,644	0,235
	NEW	,884	,411	4,620	1	,032	,078	1,691	2,421
	FOR * NOR&D	2,258	1,108	4,150	1	,042	,086	4,430	9,564
	FOR * HOSTMKT	2,603	1,028	6,415	1	,011	,589	4,617	13,504
	Model fit	Chi-square	37,501			8	,000		
G. of fit	Pearson Chi-sq.	61,870			64	,552			
	Deviance Chi-sq.	60,875			64	,588			
PseudoR ²	Nagelkerke	,287							
T.of prop.	Chi-square	9,808			8	,279			
	N	130							

Link function: Logit.

Hypothesis 3 predicts that foreign affiliates are more likely than domestic firms to capture higher economic benefits from innovations of higher novelty. Consistent with this direct hypothesis, by the estimation of the second model it is found that foreign affiliates have higher odds to appropriate *higher economic benefits from product innovations of higher novelty* than domestic firms and holding all other variables constant (see Table 2). Moreover, the effect of foreign ownership is much higher than the effect of control variables.

Regarding control variables in the second model⁸ it is interesting to note that firms from high innovative sector, and export oriented firms have higher odds to capture *higher economic benefits from innovations of higher novelty* relative to other firms and holding all other variables constant. In addition, the odds of capturing higher economic benefits from product innovations of higher novelty of firms with formal R&D do not differ statistically significantly from the odds of firms without formal R&D.

⁸ The control variable large firm had to be dropped from the second regression because of multicollinearity with R&D variable and because a model with the large firm variable could not converge even when the R&D variable was dropped from the regression.

Table 2. Economic benefits from product innovation novelty: Ordinal Logit regression model

		Estimate (B)	Std. Error	Wald	df	Sig.	95% Confidence Interval		Exp (B)
							Lower Bound	Upper Bound	
Threshold	BENEFITS = 1	2,891	,677	18,227	1	,000	1,564	4,218	18,011
	BENEFITS = 2	4,804	,774	38,551	1	,000	3,288	6,321	121,997
Location	HIGHINNOV	1,200	,470	6,530	1	,011	,280	2,120	3,320
	FOR	1,804	,509	12,545	1	,000	,806	2,802	6,074
	R&D	,114	,443	,066	1	,797	-,755	,983	1,121
	EXPORT	1,147	,405	8,015	1	,005	,353	1,940	3,149
	NEW	,779	,453	2,956	1	,086	-,109	1,668	2,179
Model fit	Chi-square	31,809			5	,000			
G. of fit	Pearson Chi-sq.	39,227			41	,550			
	Deviance Chi-sq.	39,201			41	,551			
PseudoR ²	Nagelkerke	,268							
T. of prop.	Chi-square	7,767			5	,170			
	N	130							

Link function: Logit.

5. Discussion

This study is focused on the relationship between foreign ownership and product innovation novelty rather than individual product innovation novelty levels as is common in the literature. The relationship is analysed with regard to two dimensions of the innovation output.

The results indicate that the odds of foreign affiliates to *introduce product innovations of higher novelty* are contingent on innovation source, providing a partial support for Hypothesis 1. Since prior studies have not accounted for the moderated effect of foreign ownership due to innovation sources used, they do not provide directly comparable results. However, the result about the direct negative impact of foreign ownership on novelty is consistent with a prior study on the introduction of new to the market innovation in a context of a developed host country, when controlling for innovation sources, including R&D within a foreign affiliate (Sadowsky and Sadowsky-Rasers, 2006).

Contrary to the Hypothesis 1, the findings suggests higher odds of introduction of product innovations of higher novelty by foreign affiliates without formal R&D relative to foreign affiliates with formal R&D and domestic firms. While unexpected, the finding is consistent, on one side, with the foreign R&D primarily driven by asset exploitation motive, that is characteristic for countries with relatively larger markets and weaker science base (Kuemmerle, 1999b), such as the case of China and other large advanced developing countries. This result is also consistent with the finding that foreign R&D units in China were initially relatively small and primarily established because of regulatory requirements (Walsh, 2003), and thus at the

outset not likely to be involved in significant development activities. Moreover, although China seems to attract some asset-seeking R&D units, it appears that there are large regional differences in the number and nature of foreign R&D units (von Zedwitz, 2004). The finding seems consistent with the evidence that Jiangsu province is not a primary location within China for foreign R&D either in terms of research oriented R&D units or in terms of a number of R&D units of major multinational corporations (see von Zedwitz, 2004, Table 5).

In addition, the finding that odds of *introduction of product innovations of higher novelty* are higher for foreign affiliates without formal R&D relative to foreign affiliates with formal R&D and domestic firms seem to suggest a separation of development from commercialisation of innovation, which allows for the introduction of new to the world innovations on the basis of exploitation of ownership advantages. The traditional theories have assumed that both development and first commercial application of new products and processes will take place in the home countries of MNEs (e.g. Vernon, 1966). However, taking into account a developed network of the incumbent foreign affiliates in host countries, in a reformulation of the product cycle theory Vernon (1979) argues that the core innovation activities are likely to remain centralised in the home countries, allowing for the first commercialisation of the new product in the home or developed host countries, but considering it unlikely in developing host countries due to a considerable innovation gap. Taking into account that in the context of advanced developing countries, including China, the innovation gap seems to be reducing (UNCTAD, 2005; Mahmood and Singh, 2003), the first commercialisation of corporate innovations in advanced developing countries seems likely and consistent with the findings.

Next, the findings indicate that foreign affiliates with host market orientation have higher odds of *introducing innovations of higher novelty* than other firms (as suggested by Hypothesis 2). While the moderating effect of geographic market has not been examined in prior studies, the result seems consistent with finding that export has a direct negative although not statistically significant effect on new to the market innovations in the Netherlands (Sadowsky and Sadowsky-Rasers, 2006). However, the result does not seem consistent with the finding that higher propensity of new to the market product innovations is associated with export market orientation and among exporters, with foreign ownership, in Brazil (Kannebley et al., 2005, based on the classification and regression tree method). Nevertheless, the finding is consistent with the traditional arguments that the host market orientation has a positive impact on innovative behaviour of foreign affiliates in developing countries (Caves, 1982). The finding is also consistent with the primarily traditional export-oriented foreign direct investments in China.

The results for the two contingency hypotheses suggest that the impact of foreign ownership on the *novelty of introduced product innovations* is moderated by innovation sources and market orientation of foreign affiliates. These findings are consistent with the findings of the model *without* interaction terms where the foreign ownership variable is not statistically significant. Taken together these results provide strong support for the proposition that the impact of foreign ownership on the novelty of introduced product innovations is contingent rather than direct.

Lastly, the findings suggest that *economic benefits from product innovations of higher novelty* are higher in foreign affiliates relative to domestic firms, as predicted by Hypothesis 3. While prior studies have not examined empirically similar effects of foreign ownership, the finding is consistent with the argument that foreign affiliates in advanced developing countries have

advantages over domestic firms in assets complementary to innovation, which are of relevance for capturing the economic benefits from the commercialisation of innovations of higher novelty. Moreover, it is consistent with the evidence about weaker resource endowments of domestic firms in developing and transition economies (Hitt et al., 2000). The evidence that the main motive of Chinese firms in international alliances is learning to develop own technological capabilities, as well as marketing expertise and managerial skills, seems to confirm relatively weaker endowments of domestic firms in China (Luo, 2002).

The findings of the second model, explaining *economic benefits from product innovations of higher novelty*, have an additional interpretation. The innovation intensity indicator, used in the construction of the dependent variable *economic benefits of product innovation novelty*, have been interpreted by some as an indicator of ‘firm’s ability to replenish its stock of products’ (Barlet, Duguet, Encaoua and Pradel, 1998:458), that is, as ‘the rate at which firms replace their product mix’ (Smith, 1998:21). This implies that the findings from the second model also suggests higher odds of foreign affiliates to replace their mix of products and product innovations with more novel product innovations compared to domestic firms. This suggests a higher potential innovation-based competitiveness of foreign affiliates relative to domestic firms, consistent with traditional arguments about ownership advantages of foreign affiliates.

6. Conclusions

The paper contributes to the international business literature on the relationship between foreign ownership and innovation in host countries in three ways. First, while prior studies have examined the impact of foreign ownership on the *individual levels* of innovation novelty, this paper complements the literature by examining the relationship between foreign ownership and *innovation novelty*. Furthermore, the study provides evidence that the higher odds of foreign affiliates of introducing product innovations of higher novelty are not direct but are *contingent* on exploitation of ownership advantages, rather than on generation of innovation in a host country, and on a host market orientation. Moreover, the findings suggest that even though foreign affiliates do not have (directly) higher odds of being higher up on an innovation novelty ladder than domestic firms, they are likely to replenish their product and innovation portfolio with innovations of higher novelty at a faster rate than domestic firms, further highlighting a complex relationship between foreign ownership and innovation in host countries. Finally, the findings are also of relevance to the innovation literature, which predominantly focuses on a single dimension of innovation success. The study provides additional evidence, extending the findings of the early literature (Mansfield and Wagner, 1975), that the same firm characteristics, here the firm ownership, can have a different impact on different dimensions of success in product innovation.

The findings have important policy implications. Regarding the implementation of a strategy of an innovation-based growth in China, the findings warn about a relatively weak potential of domestic firms for innovation-based competition, consistent with findings of other studies. The weaker domestic firms’ potential innovation-based competitiveness is likely to be associated with weaknesses of the Chinese innovation system which seem to lie not only in lower innovation capabilities, as often emphasised (OECD, 2007), but also in lower complementary assets and capabilities. Indeed, an important policy challenge of China seems to be not only the

development of technological capabilities of domestic firms, but also the development of management, marketing, organisational and other firm capabilities as well.

Certain caveats concerning this research should be mentioned. First, the study is focused on urban enterprises only. Since rural firms (i.e. private firms in rural areas) are less innovative than urban firms in Jiangsu (Sun and Wang, 2004:28), the evidence presented here likely overestimates innovation level of firms in the province. Therefore, including rural firms in the analysis in further research would be important. Next, the moderator variable measures only the presence of formal R&D activities within the firm. Taking into account differences in motivation and role of R&D units, it would be useful in further research to consider the moderating role of formal R&D by accounting for the nature of R&D activities.

This study examines a relationship between foreign ownership and the commercial and economic success of product innovations novelty. Future research could examine the relationship between foreign ownership and product innovation novelty in a dynamic framework, taking into account evolutionary changes in the innovation activities of foreign subsidiaries, thus contributing to the literature on the role of foreign subsidiaries. Building on the findings of this study, future research could also examine the relationship between foreign ownership and economic success of innovations in host countries by accounting for innovation portfolio differences between foreign and domestic firms.

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Appendix.

Table A1. Frequencies

		N	Percentage
NOVELTY	1 firm & Jiangsu 1st	30	23,1%
	2 China 1st	65	50,0%
	3 world 1st	35	26,9%
BENEFITS	1 firm & Jiangsu 1st	87	66,9%
	2 China 1st	31	23,8%
	3 world 1st	12	9,2%
HIGHINNOV	1 high innovative	83	63,8%
	0 low innovative	47	36,2%
LARGE	1 above median	77	59,2%
	0 below median	53	40,8%
FOR	1 foreign	20	15,4%
	0 domestic	110	84,6%
RD	1 yes	77	59,2%
	0 no	53	40,8%
NORD	1 yes	53	40,8%
	0 no	77	59,2%
EXPORT	1 yes	54	41,5%
	0 no	76	58,5%
DOMMKT	1 yes	76	58,5%
	0 no	54	41,5%
NEW	1 yes	75	57,7%
	0 no	55	42,3%
Valid		130	100,0%
Missing		0	
Total		130	

Table A2. Correlations

	NOVELTY	BENEFITS	LARGE	HIGHINNOV	FOR	RD	NORD	EXPORT	DOMMKT	NEW
NOVELTY	1	,580**	,267**	,200*	,098	,156	-,156	,308**	-,308**	,047
BENEFITS	,580**	1	,010	,193*	,376**	,034	-,034	,242**	-,242**	,173*
LARGE	,267**	,010	1	,092	,093	,331**	-,331**	,159	-,159	-,394**
HIGHINNOV	,200*	,193*	,092	1	,055	,190*	-,190*	,049	-,049	-,093
FOR	,098	,376**	,093	,055	1	,093	-,093	,030	-,030	,149
RD	,156	,034	,331**	,190*	,093	1	-1**	,064	-,064	-,267**
NORD	-,156	-,034	-,331**	-,190*	-,093	-1**	1	-,064	,064	,267**
EXPORT	,308**	,242**	,159	,049	,030	,064	-,064	1	-1**	,027
DOMMKT	-,308**	-,242**	-,159	-,049	-,030	-,064	,064	-1**	1	-,027
NEW	,047	,173*	-,394**	-,093	,149	-,267**	,267**	,027	-,027	1
N	130	130	130	130	130	130	130	130	130	130

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).