Demand Heterogeneity, Learning Diversity and Innovation in an Emerging Economy

Zhenzhen Xie a,1,2, Jiatao Li b,*

a Department of Innovation, Entrepreneurship and Strategy, School of Economics and Management, Tsinghua University, Beijing, China
b Department of Management, School of Business and Management, Hong Kong University of Science & Technology, Clear Water Bay, Kowloon, Hong Kong

Abstract

Prior research has shown mixed findings about the relationship between exporting and a firm's innovation performance. This study applied organizational learning theory with a demand-side perspective to explore whether the mixed findings could be due to confounding a positive effect of knowledge variety with a negative effect arising from market separation. Compared with firms with only domestic or foreign customers, firms with both types of customers have more opportunities to acquire diverse knowledge and form innovative combinations, but serving disparate customers tends to inhibit knowledge transfer, sharing and integration. Data on 8529 Chinese automobile and component manufacturers were analyzed to test these arguments, and firms competing in less separated domestic and overseas markets were found to demonstrate the best innovation performance. Firms with greater absorptive capacity were found better able to overcome the difficulties caused by market separation and enjoy more benefits from market variety.

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1. Introduction

Does demand heterogeneity influence firms' innovativeness? The organizational learning literature suggests that firms can learn from their customers (De Loecker, 2011; Lederman, 2010; Liu et al., 2009; Salomon, 2006; Salomon and Jin, 2008; Salomon and Shaver, 2005) and that knowledge acquired from diverse geographic locations can be a richer resource for generating novel knowledge combinations and can lead to more innovation (Hitt et al., 1997; Lahiri, 2010; Penner-Hahn and Shaver, 2005; Singh, 2008; Wang et al., 2011; Wilson and Doz, 2011). This is consistent with the demand-side perspective, which suggests that, "Strategies based on consumer heterogeneity can result in competitive advantage even if the firm holds only obsolete or mundane resources. …successful innovations can be consumer driven rather than resource or technology driven, and consumer knowledge can play a key role in entrepreneurial idea discovery" (Priem et al., 2012: 346). However, no consistent relationship between customer location heterogeneity and innovation has been found in previous empirical studies. Some found positive effects (e.g. Li et al., 2010; Salomon and Jin, 2008, 2010; Salomon and Shaver, 2005), while some others found negative ones (e.g. Navas-Aleman, 2011).

Combining theories of organizational learning with a demand-side perspective, this study addressed this inconsistency by proposing three factors that may jointly influence a firm's effectiveness in learning from customers in heterogeneous geographic markets: market variety, market separation, and the firm's absorptive capacity. Market variety is defined by the composition of qualitatively different geographical markets, such as domestic and overseas markets. Firms with both domestic and overseas customers have
greater market variety than firms selling only domestically or overseas. They tend to be exposed to a variety of knowledge, to build a more diverse knowledge base and to be more innovative. Geographic markets are dissimilar to different degrees. The degree of dissimilarity will be termed market separation. When a firm’s domestic and overseas markets are widely separated it is exposed to highly dissimilar knowledge, but it then may suffer from difficulties in knowledge transfer, sharing and integration (Anderson and Gatignon, 1986; Lavie and Miller, 2008). Greater absorptive capacity, defined as “the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends” (Cohen and Levinthal, 1990: 128), may help a firm overcome the difficulties arising from separation and enjoy more benefits from market variety.

Empirical work on 8529 manufacturers in the automobile and component industries in China during 2005–2007 supports the above arguments. Compared with Chinese manufacturers selling only domestically or only overseas, those with both domestic and overseas customers file more patent applications, and make more new product introductions and sales. In the industry sectors where domestic and overseas markets are less separated, the positive effect of learning from market variety is further enhanced. Firms’ absorptive capacity enhances the positive effect of market variety and weakens the negative moderating effect of market separation.

These results make three contributions to the literature. First, they extend the research on “learning diversity” by drawing on the demand-side perspective. In recent years organizational learning scholars have started to investigate the effect of diversity in external knowledge sources (e.g. network dispersion, alliance portfolios) and internal knowledge bases (e.g. technological diversity, R&D dispersion) on the innovativeness of organizations (Frenz and Ietoo-Gillies, 2009; Lahiri, 2010; Quintana-Garcia and Benavides-Velasco, 2008; Singh, 2008; Srivastava and Gnyawali, 2011). The demand-side perspective, emphasizing the benefits of consumer heterogeneity and consumer-driven innovations, can further add to this work (Priem et al., 2012). In this paper we argue that 1) variety in a firm’s customer groups (i.e. the geographic distribution of customers) is good for innovation as they can provide diverse information and knowledge benefits, but 2) separation between the customer groups may reduce the benefits of variety, as knowledge gained from highly separated customers may be too difficult to transfer or integrate.

This paper also aims to make contributions to the international strategy literature. Prior research on international diversification has focused primarily on predicting firms’ overall performance (e.g. Delios and Beamish, 1999; Wan and Hoskisson, 2003). A few studies have examined the relationship between international diversification and innovation (Hitt et al., 1997; Wang et al., 2011), but they focused on the geographic dispersion of foreign direct investment, not on geographic diversification of customers through exporting. This study has shown the value of knowledge held by both domestic and overseas customers, and the results may help to disentangle the mixed findings about the relationship between exporting and innovation.

This analysis of Chinese data also contributes to development economics. The substantial difference between domestic and overseas markets makes it difficult for firms to take the first step in international expansion (Pederson and Shaver, 2011). This is especially true for firms from emerging economies, as they typically lack global experience, managerial competence, and professional expertise (Luo and Tung, 2007). Compared with foreign direct investment, exporting to an overseas market usually involves a lot less commitment and risk (Cassiman and Golovko, 2011), and is a key first step in the international expansion of emerging economy firms. Such firms typically lag global technology leaders, so they may need to leverage the knowledge that they gain through exporting to develop indigenous technological capabilities (Li and Kozhikode, 2009; Pack and Saggi, 1997). A few emerging economy governments have adopted more open-door policies hoping that trade and foreign direct investment (FDI) can promote indigenous technological progress (Chittoor et al., 2008; Pack and Saggi, 1997; Pamukcu, 2000). The results of this study suggest that 1) having both domestic and overseas customers helps firms build their own innovative capabilities, 2) governments can facilitate that by decreasing the separation between domestic and overseas markets, but 3) emerging economy firms must also build up their absorptive capacity to make the best use of learning from a diverse set of customers.

2. Theoretical background and hypotheses

2.1. Organizational learning diversity and demand-side knowledge

Firms have become increasingly active in organizing complex knowledge-seeking activities in recent years (Chesbrough, 2003; Faems et al., 2010), and the organizational learning literature has paid more attention to the effect of diverse knowledge sources on a firm’s innovation performance. Innovation scholars suggest that innovation often arises from novel combinations of existing knowledge (Cohen and Malerba, 2001; Fleming et al., 2007; Hargadon and Sutton, 1997; Schumpeter, 1934). Firms with access to a diverse set of knowledge sources tend to have more opportunities for innovation involving combining and recombining their knowledge, and tend to generate higher quality and more valuable innovations (Bonner and Walker, 2004; Faems et al., 2010; Frenz and Ietoo-Gillies, 2009; Wang et al., 2011). But exploiting diverse knowledge sources effectively requires explicit cognitive investment from management to avoid inappropriate generalization. That effort stimulates deliberate learning and the development of dynamic capabilities (Zollo and Winter, 2002). This is how a firm can enhance its innovative capability by learning from diverse knowledge sources.

One important way of tapping into diverse sources of knowledge is international diversification (e.g. Bonner and Walker, 2004; Faems et al., 2010; Frenz and Ietoo-Gillies, 2009; Singh, 2008; Wang et al., 2011). Unfortunately, prior research has focused on the geographic dispersion of foreign direct investment rather than on diversity in the customer groups involved (Hitt et al., 1997; Lahiri, 2010; Wang et al., 2011). Research from the demand-side perspective shows the importance of customer knowledge in cultivating a firm’s competitive advantages (Priem et al., 2013). As one form of international diversification (Shaver, 2011), exporting to overseas markets exposes firms to multiple customer groups with diverse market knowledge (e.g. customer preferences, demand and
environments tend to recombine the knowledge to generate innovations (Breschi et al., 2003; Leten et al., 2007). While diverse task environments help to build a diverse internal knowledge base, failure to integrate the knowledge properly may prevent a firm from making good use of it (Oxley and Sampson, 2004; Schoenmakers and Duysters, 2006). Empirical research on the relationship between the diversity of a firm’s knowledge base and its innovativeness has found mixed results, and whether or not the difficulties in knowledge integration should be attributed to the extent of diversity remains unclear (Lahiri, 2010; Leten et al., 2007; Srivastava and Gnyawali, 2011).

2.2. Variety of customer groups and innovation

Market variety captures the extent to which a firm’s customers are spread over different markets. Firms with customers in only one market have the least market variety. Customers in different markets hold rich but localized knowledge (Wilson and Doz, 2011), so market variety usually helps a firm tap into those diverse sources of knowledge and build a diverse knowledge base (Hitt et al., 1997; Lahiri, 2010; Singh, 2008). It may positively contribute to the firm’s innovativeness by offering better opportunities to create new, innovative combinations (Taylor and Greve, 2006).

Exporting diversifies the geographic distribution of a firm’s customer groups. Firms with both domestic and overseas customers are exposed to greater market variety, and more diverse customer needs and requirements. In response they may be required to develop specialized technological capabilities and adapt to disparate institutional environments (Adner and Levinthal, 2001; Singh et al., 2011; Zander, 1999). This gives them better opportunities to build a rich and diverse knowledge base, and better opportunities to innovate by making novel combinations of the knowledge to which they are exposed (Cohen and Levinthal, 1990).

This demand variety argument is consistent with and builds on the mechanisms of exploration and exploitation as put forth by March (1991). Exploitation refers to the processes of refinement, production, and focused attention through which firms create reliability and efficiency; exploration includes searching, experimenting and trialing processes through which firms look for new possibilities (Andriopoulos and Lewis, 2009; Holmqvist, 2004; March, 1991). Exploration produces more distant (i.e., longer-term) benefits which may be quite uncertain, while exploitation produces nearer-term, more certain results. Exploration is a search for innovation, while exploitation gets the most that it can out of previous successful innovation activities. Since the two processes conflict in terms of the organizational structures and strategies that they require, it has been found that a proper balance between exploitation and exploration is vital for effective innovation and good long-term performance (Sheremata, 2000; Tushman and O’Reilly, 1996).

For emerging economy firms, the knowledge acquired in overseas markets is likely to be more advanced than that which they can acquire from domestic customers. The overseas markets provide firms with new technologies and market opportunities while the domestic market is less developed, mainly requiring efficiency and consistency. Chinese manufacturers competing mainly domestically, and focusing on exploiting existing groups of customers, may fail to pay adequate attention to exploring advanced taking place overseas. Lacking exploration activities, such firms may lag behind in developing their innovative capabilities. On the other hand, Chinese manufacturers exporting most of their products overseas may find their capabilities and resources too limited to support extensive exploration in overseas markets. Without the support of domestic exploitation, intensive exporters can be overwhelmed by the highly competitive and dynamic international markets. They might have upgraded their product lines with knowledge transferred from overseas clients (such as through OEM business), but may not have developed their own innovative capabilities which require extensive and persistent R&D investment. Firms with both domestic and overseas sales are able to support their overseas exploration with domestic exploitation. The resources and capabilities that they have developed in the domestic market, combined with advanced technology and market opportunities found overseas, may improve their innovation performance.

March’s (1991) fundamental arguments about the exploitation–exploration balance are therefore consistent with and supportive of our own arguments about the learning benefits of demand variety. Indeed, March (1991) concluded that some personnel turnover is a good thing in organizations, because it helps bring in new ideas and assist the firms in achieving the balance between exploration and exploitation required for success. This seems to be a fruitful parallel with our demand variety theory, helping clarify the mechanisms underlying our ideas. Therefore, we propose the following hypothesis:

Hypothesis 1. Ceteris paribus, firms competing in both domestic and overseas markets are more innovative than those competing in only one or the other.

2.3. Separation of customer groups and innovation

Market separation tends to reduce the coherence and relatedness of the knowledge acquired from customer groups located in different markets. It decreases the commonalities of the knowledge and limits the logical relatedness which tends to arise through cross-border knowledge spillovers. Firms with little coherence and relatedness in their knowledge base may find it difficult to successfully recombine the knowledge to generate innovations (Breschi et al., 2003; Leten et al., 2007). Groups that work in widely separated task environments tend to find little similarity in their knowledge bases, share less and gain less from sharing. This may lead to dysfunctional conflict and hinder communication, coordination and social integration, impeding knowledge transfer, sharing and integration within the firm (De Dreu, 2006; Harrison and Klein, 2007; Jehn, 1995; Li and Hambrick, 2005). Separation between a firm’s markets may tend similarly to reduce the relatedness and coherence of its knowledge, again impeding knowledge sharing, transfer and integration within the firm. So while market variety brings a diverse knowledge base, it may impede synergy if market separation is great.
Published research has confirmed that it is easier to achieve knowledge synergies when the diverse knowledge involved shares some similarities (Leten et al., 2007; Markides and Williamson, 1994; Van Looy et al., 2005). The concepts of market variety and market separation mirror the concepts of product diversification and industry relatedness. Research on product diversification has shown that related diversification tends to generate greater synergy than diversification which is unrelated (Ansoff, 1965; Markides and Williamson, 1994; Rumelt, 1974). At the same time as product diversification increases the variety of a knowledge base, any relatedness between industries or product lines tends to reduce the difficulties in knowledge integration.

When an exporter operates in a sector where the domestic and overseas markets are highly separated, it may find the two markets quite different in terms of formal regulations, informal norms, technological standards, and customer preferences (Marquis, 2003; Marquis and Lounsbury, 2007; Singh et al., 2011). In that case, the knowledge acquired from domestic and overseas customers can seem incoherent and unrelated, which can lead to difficulties in within-firm knowledge transfer, sharing and recombination (Breschi et al., 2003; Leten et al., 2007). Therefore, we propose that:

**Hypothesis 2.** When a firm’s domestic sector is separated more widely from its overseas markets, any innovation benefits of competing in both domestic and overseas markets will be reduced.

### 2.4. Market variety, market separation and absorptive capacity

It is generally difficult to integrate diverse knowledge acquired from highly separated markets, but some firms can integrate better than others. This is an important manifestation of absorptive capacity (AC). Defined as “the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends” (Cohen and Levinthal, 1990: 128), absorptive capacity can be seen having internal and external aspects (Lewin and Massini, 2003). External AC includes skill in identifying and learning valuable knowledge from the external environment. Internal AC refers to the ability to manage internal variation, knowledge sharing, combining and updating (Lewin and Massini, 2003; Lewin et al., 2011). The two elements of AC may help firms build innovative capabilities by learning from diverse customers in two different ways.

Good external AC enables a firm to recognize and acquire valuable knowledge held by customers in different markets, enhancing the information benefits of market variety. As discussed above, compared with firms focused on only one market, those with customers in both domestic and overseas markets get access to more diverse knowledge held by their customers in different locations. Firms with good external AC can better recognize and acquire diverse useful knowledge and internalize it into their own knowledge pool, ready to be used for internal transfer, sharing and recombination. At the same time, good internal AC facilitates internal knowledge transfer, sharing and integration within the firm. When a firm’s internal knowledge pool consists of less related knowledge acquired from highly separated customer groups, internal AC mitigates the difficulties of integrating this diverse knowledge. If the benefits of competing both domestically and overseas depend on market separation as Hypothesis 2 proposes, a firm’s absorptive capacity may help it avoid the negative effects of separation between the domestic and overseas markets. This is how absorptive capacity with strong internal and external elements may enhance the positive effect of market variety and weaken any negative effect of market separation.

**Hypothesis 3.** Greater absorptive capacity enhances any positive relationship between market variety and innovation.

**Hypothesis 4.** Greater absorptive capacity weakens any innovation penalty arising from market separation.

Fig. 1 illustrates the inter-relationship among these hypotheses.
3. Methods

3.1. Empirical context

China’s automobile and auto component industries during 2005–2007 were chosen as the empirical context in part because of the increased global integration and FDI in the industry during that period. The Chinese government issued a new policy for the automotive industry in 1994 which encouraged FDI and showed a clear preference for investments by global automakers and their suppliers. The expectation was presumably that they might help nurture the development of auto manufacturing in China. As a result, the automobile industry in China has experienced substantial progress in both market size and technology over the past two decades, with many local firms beginning to export and even invest directly overseas (Chin, 2010).

However, the indigenous technological capabilities of China’s auto and component industries remain rather weak (Chin, 2010), despite the many links with multinational corporations (MNCs) from developed economies (China Automotive Industry Yearbook, 2008). The local manufacturers which have achieved some degree of international competitiveness generally were cultivated by, or have had close relationships with multinational assemblers or first-tier foreign suppliers (Chin, 2010).

Overall, the effect of China’s 1994 automotive industrial policy has been to separate China’s automobile industry from the international market (Chin, 2010). Different sectors of the industry have been constrained in their FDI and international trade to different degrees, so the separation in technology level and market demands between domestic and international markets has been maintained differently in different sectors. In 2004 the policy was adjusted, and the relatively stable and liberal macro environment which resulted encouraged increasing inward FDI and international trade (Chin, 2010). But even today trade barriers and FDI constraints persist in certain sectors of the industry. For example, import tariffs on cars are significantly higher than those on parts and components. These developments make the Chinese auto industry a good context for testing the hypotheses of this study.

3.2. Sample

The sample for testing the hypotheses came from the Annual Industrial Survey database (2005–2007) of China’s National Bureau of Statistics (NBS). The NBS collects financial and other information on industrial firms and publishes aggregated information in the official China Statistics Yearbooks. Firms in China with annual sales of at least ¥5 million (roughly US$600,000 at the 2006 average exchange rate) are required to submit financial and other information annually. Several prior studies have used the NBS databases, including those of Pan (Pan et al., 1999), Buckley (Buckley et al., 2002), Park (Park et al., 2006) and Chang and Xu (2008).

The database divides the automobile industry into six, four-digit SIC (standard industry classification) sectors: automobile assembling, recreational vehicle manufacturing, electronic vehicle manufacturing, automobile bodies and trailers, automobile parts and accessories, and automobile repairing. However, no firm was categorized as an electronic vehicle manufacturer during the study period. Automobile repairing was excluded as it is fundamentally a service.

A panel database was assembled by matching yearly data with unique company identifiers. The final sample consisted of 8529 firms and 19,057 firm-year observations. There were 5423 observations for 2005, 6251 for 2006, and 7383 for 2007. Among the automobile manufacturers in the 2005 sample, 76.0% of the firms did not export, 3.1% of them exported all of their production, and 20.9% of them sold in both domestic and overseas markets. In 2006 the three proportions were 76.4%, 2.8% and 20.8% respectively, and in 2007 they were 76.6%, 2.8% and 20.5%.

3.3. Measurements

3.3.1. Dependent variable

Innovation, especially technical innovation, was quantified using patent data from the website of China’s State Intellectual Property Office (see http://search.cnipr.com/). Following the lead of, for example, Salomon and Jin (2008, 2010), each firm’s patent applications in each year from 2006 to 2011 were counted and the count variables patent application, patent application, patent application, and patent application were created, where the subscript i indexes firms, and t + 1, t + 2, t + 3 and t + 4 index years.

3.3.2. Explanatory variables

Following the lead of prior research, the count of a firm’s geographically defined markets was used as a measure of the variety of its markets (Delios and Beamish, 1999; Lu and Beamish, 2001, 2004). Since only the domestic and overseas markets as a whole were considered, a dummy variable market variety, was defined as equal to “1” if the firm competed in both the domestic and overseas markets in that year, and “0”, otherwise.

The distance measures commonly used in international business research—cultural, geographical, institutional, political, and economic national distances—or a combination of several of them can serve as a measure of dyadic national market separation. But no information was available about the national destinations of the products exported by the firms so no such measures could be formally defined. A different sample might allow such treatment, but this study relied on a sector-level measure of market separation based on the openness of each four-digit SIC sector.

Sector-level market separation has been neither studied nor measured in prior management research, but it can have advantages over distance-based measures of market separation in two respects. First, the knowledge relevant to innovation is very broad and the separation between knowledge acquired in different markets is difficult to capture by simply using one or several descriptors of
distance between markets. It is the overall dissimilarity between the two markets that matters. Second, the knowledge spillovers relevant to firm-level catch-up are usually industry-specific (Chang and Xu, 2008), but dyadic national distance measures fail to capture the variation between sectors. The sector-level variation is especially important in emerging economies like China, where the differences between sectors can be large. In highly protected sectors the knowledge relevant for innovation in the domestic market can be quite different from that useful in overseas markets; in open sectors the difference can be much smaller.

Before China’s economic reforms in the late 1970s, all sectors were strictly separated from the rest of the world. Since then, economic openness can be quantified using international capital inflows and international trade volumes (Finger, 2011). International capital inflows can be captured by the FDI intensity of each sector. Following Javorick’s lead (Javorcik, 2004), sectoral FDI intensity was quantified using the output-weighted percentage of equity owned by foreign investors in each four-digit SIC sector in year $t$. A sector’s openness to international trade is reflected in its export intensity and import intensity (Bureau and Salvatici, 2004). The sector-level export and import values came from the China Customs Statistics Yearbook (China Customs Statistics Yearbook, 2005–2007). When sectoral FDI intensity, sectoral export intensity and sectoral import intensity were all low, the sector’s market separation was assumed to be high. A composite measure of market separation was therefore constructed from those three indicators. They were centered, reverse coded, and then summed to generate the variable market separation$_k$ for firm $i$ in year $t$. Firms in the same sector have the same level of market separation in the same year.

Most empirical studies have quantified absorptive capacity by assuming that it is based on prior related knowledge, which in turn can be operationalized using prior R&D expenditures (for a review, see Volberda et al., 2010). But prior market knowledge is also an important component of absorptive capacity (Li et al., 2010). In this study a composite measure of absorptive capacity$_i$ was constructed by summing each firm’s R&D and advertising spending in year $t$, each normalized using the firm’s sales in year $t$.

### 3.3.3. Control variables

Market openness introduces foreign competition into the domestic market, tending to make domestic and overseas markets more similar over time. In order to tease out any potential competition effect, it is important to measure and control for it. A sectoral concentration$_k$ variable served this purpose. It was calculated as each sector’s Hirschman–Herfindahl index. For each firm $i$ in sector $k$,

$$HHI_k = \sum_{h=1}^{n_k} \left( \frac{sales_{hi}}{\sum_{j=1}^{n_k} sales_{ji}} \right) ^ 2,$$

where $sales_{hi}$ refers to the annual sales of firm $h$ in sector $k$ and year $t$, and $n_k$ refers to the number of firms in sector $k$ and year $t$. Firms in the same sector have the same level of market concentration in the same year.

Because of the large fixed investments involved in the automobile industry, the scale of production is very important. Therefore, highly concentrated sectors tend to be more competitive. Pitcher and Smith (2001) found that variety tends to be more important in more competitive environments, and this was taken into account by including a term representing the interaction between market variety and market competition, $market\ variety_i \times sectoral\ concentration_i$, in the models.

Several other control variables were also included in the analyses. Economic research suggests a positive and monotonic relationship between firm size and innovation activity (Braga and Willmore, 1991; Cohen and Levinthal, 1989) because larger firms are better able to spread the fixed cost of innovation over a larger sales volume and to hedge risk by undertaking a variety of R&D projects simultaneously (Cohen and Levinthal, 1989; Sasidharan and Kathuria, 2011). On the other hand, organization scholars make the counter-argument that larger firms tend to be less affected by market competition, which limits their incentive to make technological improvements (Kathuria, 2008; Katrak, 1990). Empirical studies have usually found any effect to be non-linear, either U-shaped (Siddharthan, 2008), inverted U-shaped (Kumar and Saqib, 1996), or horizontal S-shaped (Kumar and Aggarwal, 2005). Applying the results of recent empirical research to the innovative activities of Chinese firms (Li et al., 2010; Tan and Hwang, 2002), $firm\ size_i$ was defined as the natural logarithm of a firm’s sales in year $t$ to allow for the possibility of non-linearity.

The impact of a firm’s age on its product innovation is also ambiguous. On one hand, older firms are better able to earn satisfactory returns on their innovation investments due to their accumulated knowledge and other specific assets (Iansiti, 2000; Sasidharan and Kathuria, 2011). On the other hand, older firms suffer more organizational inertia (Hannan and Freeman, 1984) and are less able to connect new products with their existing resources, processes, and strategy (Dougherty and Hardy, 1996). In China, since older auto firms are “likely to [have inherited] more central planning legacies of the pre-reform Chinese economy” (Li et al., 2010: 254), so a negative effect of firm age might be expected. The $firm\ age_i$ variable was defined as the difference between year $t$ and the year that the firm had been established.

Organizational slack is known to be an important determinant of firms’ innovation decisions (Cyert and March, 1963). It enables a firm to afford risky and long-term investments, to absorb failure, and to bear the costs of exploring and experimenting with new ideas. At the same time, it may diminish the incentives to innovate or promote undisciplined R&D investments. Previous studies have shown positive, negative, and inverted U-shaped relationships between slack and inventiveness (Greve, 2003; Nohria and Gulati, 1996; Rosner, 1968). Two variables were created to capture organizational slack in this study. $Adjusted\ asset-liability\ ratio_i$ and $adjusted\ gross\ profit\ ratio_i$ were calculated by subtracting the sector average value from each firm’s asset–liability ratio and gross profit percentage. Firms with a relatively low ratio of liabilities to assets or a high gross profit ratio for their sector are likely to have more organizational slack.
In addition to these firm-level and industry-level factors, a manufacturer's location also tends to influence its innovativeness in China. For example, strong protection of intellectual property rights (IPR) motivates firms to innovate by protecting the potential returns on any success (Feinberg and Majumdar, 2001; Park and Ginarte, 1997). However, a strong IPR protection also increases the difficulty of imitating, and this has been shown to generate resource wastage and imitation disincentive effects that reduce innovation activities (Glass and Saggi, 2002). Since institutional development in China tends to vary regionally or even locally, regional IPR protection was represented in the analyses by a provincial index adapted from the marketization indices developed by China's National Economic Research Institute (Fan et al., 2010). "The indices reflect the development status of market trading mechanisms and other institutions in achieving more efficient market functioning" (Gao et al., 2010: 386). The institute reports a level of IPR protection for each province annually, calculated using data from the reports of China’s State Administration for Industry and Commerce, survey data, and the China Statistical Yearbooks published by the National Bureau of Statistics. The indices have been used in economics, management and finance studies on China (Chen et al., 2006; Gao et al., 2010).

Finally, since foreign-owned and state-owned manufacturers may have divergent strategic or social purposes influencing their decisions about innovation, foreign ownership and state ownership percentages for each firm were also included in the analyses. Year dummies and sector dummies were included in all of the models in order to capture any year or sector effect.

3.4. Analytical methods

Since the dependent variable is a count measure that can take only non-negative integer values, a Poisson regression model suggests itself (Greene, 2003; Kennedy, 1998). However, a likelihood-ratio test showed that patent application+1, patent application+2, patent application+3 and patent application+4 were over-dispersed—the variance was much larger than the mean. Negative binomial regression was therefore considered more appropriate. Moreover, more than 90% of the observations were bunched close to zero. A Vuong test against standard negative binomial regression showed that zero-inflated negative binomial regressions would do a better job with those, though zero-inflated negative binomial regressions cannot take the panel nature of the data into account. Panel negative binomial regressions with random or fixed effects correct for any within-firm covariance, but fail to deal with the zero-inflated condition. In the end, both zero-inflated negative binomial regressions and panel negative binomial regressions were evaluated with the dependent variables patent application+1, patent application+2, patent application+3 and patent application+4.

In the first stage of evaluating the zero-inflated negative binomial regressions, a firm’s total number of patent applications from its setup to year t was used to model the possibility of a patent application in year t. Due to organizational inertia, a firm which has never patented before is less likely to begin now. To deal with the potential endogeneity problem, the second stage models were made dynamic by including the 1-year lagged values of the patent data, i.e. patent application−1.

Hausman’s test was used to decide whether to use random effects or fixed effects panel negative binomial regression. The resulting chi-squared was 295.98, and was significant at the p > 0.001 level of confidence. This indicates that the null hypothesis of no systematic difference between the coefficients of the random- and fixed-effect negative binomial formulations was rejected. Therefore, the fixed effect formulation was employed. Except for the dummy variables and the lagged dependent variables, all the other variables were mean-centered before the regressions in order to deal with any multicollinearity among them.

4. Results

The regression results modeling the data on these 8529 manufacturers generally supported the hypotheses. Table 1 presents the relevant descriptive statistics and correlations. The strong correlations among patent application, patent application+1, patent application+2, patent application+3 and patent application+4 indicate strong persistence in filing patent applications. The interaction term market variety × sectoral concentration was dropped for two reasons: 1) its coefficient is never significant, and 2) the inclusion of such an interaction term increases multicollinearity concerns. Variance inflation factors (VIFs) were calculated to assess the potential multicollinearity problem. The maximum VIF obtained in any of the models was 2.31 (market separation), and the mean VIF was around 1.61, substantially below the rule-of-thumb cutoff of 10 for regression models (Ryan, 1997). Therefore, multicollinearity was not considered an important issue for these analyses.

Since the explanatory variables were found to explain the variance in patent application+3 best, the regression results for the other years have not been reported. This result indicates that it generally took three years for the effect of learning diversity to manifest itself in patent applications. Table 2 reports the results of the zero-inflated negative binomial regressions with patent application+3 as the dependent variable. The control variables were included in all these models. The independent variables and interaction terms were added sequentially. Model 1 was the baseline formulation. Model 2 tested Hypothesis 1. Model 3 tested Hypothesis 2. Model 4 is the complete model which tested all four hypotheses. The zero-inflated negative binomial regression is based on a sample of 8529 firms and 19,057 firm-year observations. Wald’s chi-squared statistic was significant at the 0.1% level of confidence for all of the specifications, indicating that the explanatory variables explained a significant portion of the variation in new patent filings.

Hypothesis 1 predicts a positive relationship between market variety and patent application. The coefficient of market variety was positive and significant (p ≤ 0.1) in all of the models so Hypothesis 1 was well supported. Firms selling only part of their production in overseas markets tended to apply for more patents each year. Hypothesis 2 proposes that when the sectoral market separation is great, the positive relationship between market variety and patent application should be weaker. The coefficient of the interaction
Table 1
Summary statistics and correlation matrix.

| Variables                          | Mean  | S.D.  | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   | 11   | 12   | 13   | 14   | 15   |
|-----------------------------------|-------|-------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 1. Patent application_{it} + 1   | 0.63  | 11.24 |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| 2. Patent application_{it} + 2   | 0.81  | 10.71 | 0.86 |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| 3. Patent application_{it} + 3   | 1.06  | 12.46 | 0.72 | 0.86 |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| 4. Patent application_{it} + 4   | 1.23  | 12.90 | 0.63 | 0.75 | 0.84 |      |      |      |      |      |      |      |      |      |      |      |      |      |
| 5. Market variety_{it}           | 0.21  | 0.41  |      | 0.07 | 0.08 | 0.08 | 0.09 |      |      |      |      |      |      |      |      |      |      |      |
| 6. Market separation_{it}        | 0.00  | 2.60  |      |      |      |      |      | 0.00 | 0.00 |      |      |      |      |      |      |      |      |      |
| 7. Absorptive capacity_{it}      | 0.00  | 1.48  | 0.11 | 0.13 | 0.12 | 0.15 | 0.00 |      |      |      |      |      |      |      |      |      |      |      |
| 8. Patent application_{it}       | 0.51  | 10.17 | 0.80 | 0.70 | 0.62 | 0.50 | 0.07 |      |      |      |      |      |      |      |      |      |      |      |
| 9. Sectoral concentration_{it}   | 0.01  | 0.01  | 0.10 | 0.11 | 0.01 | 0.37 | 0.13 | 0.10 |      |      |      |      |      |      |      |      |      |      |
| 10. Firm size_{it}               | 10.23 | 1.54  | 0.15 | 0.18 | 0.18 | 0.30 | 0.02 | 0.23 | 0.15 | 0.15 | 0.24 |      |      |      |      |      |      |      |
| 11. Firm age_{it}                | 9.05  | 10.40 | 0.03 | 0.04 | 0.04 | 0.03 | 0.04 | 0.03 | 0.06 | 0.03 | 0.05 | 0.05 |      |      |      |      |      |      |
| 12. Adjusted asset–liability ratio_{it} | -21.81 | 56.22 | 0.00 | -0.01 | -0.01 | 0.00 | 0.00 | -0.46 | 0.00 | 0.00 | 0.05 | -0.03 | -0.01 |      |      |      |      |      |
| 13. Adjusted gross profit ratio_{it} | 0.00  | 0.89  | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | -0.02 | 0.01 | 0.01 | -0.02 | 0.00 | 0.01 | 0.01 |      |      |      |      |
| 14. Regional IPR protection_{it} | 9.90  | 7.92  | 0.01 | 0.01 | 0.01 | 0.18 | 0.29 | 0.01 | -0.17 | -0.01 | -0.01 | -0.06 | -0.12 | 0.02 |      |      |      |      |
| 15. Foreign ownership_{it}       | 0.17  | 0.34  | 0.01 | 0.01 | 0.02 | 0.01 | 0.30 | 0.05 | 0.02 | 0.01 | -0.08 | 0.31 | -0.14 | -0.01 | 0.01 | 0.14 |      |
| 16. State ownership_{it}         | 0.04  | 0.19  | 0.02 | 0.02 | 0.02 | 0.01 | -0.08 | 0.05 | 0.02 | 0.14 | 0.19 | 0.29 | 0.01 | -0.02 | -0.12 | -0.07 |      |

Note: N = 19,057.
* Indicates significance at the p ≤ 0.05 level of confidence.
term relating market variety and market separation was found to be significant and negative ($p \leq 0.1\%$ in model 3 and $p \leq 1\%$ in model 4). In combination this delivers support for Hypothesis 2. Hypothesis 3 predicts a positive interaction between market variety and absorptive capacity. The coefficient of the interaction term was positive and significant only at the $p \leq 0.1\%$ level of confidence, so Hypothesis 3 was not robustly supported. Hypothesis 4 argues for the importance of a three-way interaction between market variety, market separation and absorptive capacity. In model 4 the coefficient of the three-way interaction term was positive and significant at the 5% level, so Hypothesis 4 was supported.

The significant positive effect of the three year-lagged dependent variable patent application ($p \leq 1\%$ in model 1, and $p \leq 0.1\%$ in models 2–4) indicates strong persistence of innovative activities. As expected, firm size ($p \leq 0.1\%$ in all models) is a significant and positive predictor. The coefficients of adjusted asset–liability ratio were negative and significant in all of the models. State ownership had a significant negative effect, which may indicate the reduced incentives or the different strategy orientations of state-owned enterprises. Fig. 2 illustrates the three-way interaction between market variety, market separation, and absorptive capacity based on the coefficients of the zero-inflated negative binomial regression.

Table 3 reports the results of the fixed-effect negative binomial regressions. They are based on a sample of 977 firms and 2770 firm-year observations. The coefficient of market variety was positive and significant ($p \leq 5\%$ in all the models). Again, Hypothesis 1 was supported. The significant negative coefficient of the interaction between market variety and market separation ($p \leq 5\%$ in model 8, $p \leq 10\%$ in model 7) delivers support for Hypothesis 2. The coefficients of the two-way and three-way interaction terms with absorptive capacity are no longer significant. This may be due to the fewer degrees of freedom in fixed-effect models. Among the control variables, foreign ownership had a significant and negative effect, which may indicate that foreign subsidiaries were not as interested as local firms in applying for patents and introducing new products. MNCs may concentrate their innovation activities in their home countries or in countries with frontier technologies and strong institutions, rather than in an emerging economy like China’s with a large technology gap and weak IPR protection (Braga and Willmore, 1991; Fan and Hu, 2007; Kathuria, 2008). But we should note that this finding does not support those reported in a previous empirical study (Choi et al., 2011), and thus future research is needed to resolve this inconsistency.

### 4.1 Robustness check

To test whether or not the findings might be sensitive to the specific measures chosen for the dependent and explanatory variables, some supplementary analyses were conducted with different operational measures. The NSB database reports the value of new products sold by each firm annually. The NSB defines new products as those “new to the market that either (1) adopt completely new scientific principles, technologies, or designs, or (2) are substantially improved in comparison with existing products in terms of performance and functionality, through significant changes in structure, materials, design, or...
manufacturing processes\(^3\) \((\text{National Bureau of Statistics of China, 2006: 292; Zhou and Li, 2008: 1122}). All new products in the auto industry are subject to local government certification, which is valid for up to three years \((\text{Li et al., 2010; Zhou and Li, 2008}).\) Previous research such as that of Laursen and Salter \((2006)\) used similar definitions. Since new product certifications generally bring a tax reduction and/or a government subsidy, firms have an incentive to report their new product sales.

Following the lead of previous scholarly work on product innovation using the same database \((\text{Li et al., 2010; Zhou and Li, 2008}),\) a new product intensity \(\text{new product intensity}_{it} + 1\) variable was developed to quantify product innovation. It was a firm’s new product sales in year \(t\) expressed as a percentage of its total sales. Such a measure is continuous over a range of 0 to 100. Since less than 20\% of the firms reported a new product.

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\(^3\) Here “new to China” means that the product was never previously produced in China rather than never offered in the China market before. The “new product” might previously have been imported. China’s Ministry of Science and Technology awards certificates for new products which 1) are based on independent intellectual property rights, 2) have high market potential, 3) are internationally competitive (i.e. have high export potential), and 4) are assembled largely from domestic parts and components. Such a definition captures not only firms’ manufacturing technology, but also their R&D and marketing capabilities. Such product innovation comprehends successful commercialization of new products. Such a certified “new product” enjoys various policy benefits including tax reduction, loan support, import barriers against competitors and export subsidies. Export-oriented firms that produce a “new product” mainly for overseas markets thus have incentives to report their new product sales as long as the new product was never produced in China before.
product introduction every year, a dummy variable product innovationit + 1 was defined to roughly indicate each firm’s innovation performance. It was coded as “1” if the firm reported any sales of new products in year t, and “0” otherwise. Table 4 reports the correlations among the different operational measures of innovation. While the two dependent variables measuring product innovation were highly correlated (ρ = 0.73), their correlation with patent applications was low (ρ ≤ 0.11). All independent variables were lagged for one year to address causality concerns, which reduced the sample size to 11,674 firm-year observations. This time Hausman’s test recommended random effects models. Table 5 reports the results of dynamic, random-effect Probit regressions with product innovationit + 1 as the dependent variable, and dynamic, random-effect Tobit regressions with new product intensityit + 1 as the dependent variable. The results are more or less the same as those with the negative binomial formulation.

Another robustness check involved measuring market variety in some other way such as with the Blau index (Harrison and Klein, 2007). Again, similar regression results were found, so the results are not reported in detail.

5. Discussion and conclusions

Customers are an important source of external knowledge (Priem, 2007; Priem et al., 2012), and customers in different geographically defined markets tend to act as diverse knowledge sources for internationalized firms. That helps such firms build a diverse knowledge base, though difficulties in knowledge integration may impede their taking advantage of it. So whether or not international diversification leads to greater innovativeness remains inconclusive (Duysters and Lokshin, 2011; Srivastava and Gnyawali, 2011; Wang et al., 2011). Drawing on the organizational learning literature and taking a demand-side perspective, these results suggest that variety and separation influence learning effectiveness in opposite directions.

Customer group variety helps to build a diverse knowledge base with multiple perspectives, skills and abilities, and rich information. This tends to promote innovation (Bonner and Walker, 2004; Faems et al., 2010; Frenz and Ietoo-Gillies, 2009; Wang et al., 2011).

Table 3

<p>| Coefficients of fixed-effects, negative binomial regressions predicting patent applicationit + 3. |</p>
<table>
<thead>
<tr>
<th>Model 5</th>
<th>Model 6</th>
<th>Model 7</th>
<th>Model 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1: Market varietyit × market separationit</td>
<td>0.22 (0.09)</td>
<td>0.21 (0.09)</td>
<td>0.20 (0.09)</td>
</tr>
<tr>
<td>H2: Market varietyit × absorptive capacityit</td>
<td>−0.09 (0.05)</td>
<td>−0.09 (0.04)</td>
<td></td>
</tr>
<tr>
<td>H3: Market varietyit × absorptive capacityit × market separationit</td>
<td>−0.02 (0.04)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H4: Market varietyit × absorptive capacityit × absorptive capacityit</td>
<td>0.00 (0.05)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Market separationit × absorptive capacityit</td>
<td>−0.03 (0.21)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Absorptive capacityit</td>
<td>0.05 (0.04)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sectoral concentrationit</td>
<td>−0.13 (0.07)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Firm sizeit</td>
<td>0.42 (0.06)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Firm ageit</td>
<td>−0.02 (0.04)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted asset–liability ratioit</td>
<td>−0.52 (0.08)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted gross profit ratioit</td>
<td>0.49 (0.26)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regional IPR protectionit</td>
<td>0.03 (0.05)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foreign ownershipit</td>
<td>−0.13 (0.05)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>State ownershipit</td>
<td>−0.05 (0.04)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>−1.42 (0.08)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Log likelihood</td>
<td>−3008.56</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wald’s chi-squared</td>
<td>192.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change in Wald’s chi-squared vs. baseline</td>
<td>5.67</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

N = 2770. Industry and year dummies were included in all models. Standard errors are in parentheses.
† Indicates significance at the p ≤ 0.10 level of confidence (two-tailed test).
* Indicates significance at the p ≤ 0.05 level of confidence (two-tailed test).
** Indicates significance at the p ≤ 0.01 level of confidence (two-tailed test).
*** Indicates significance at the p ≤ 0.001 level of confidence (two-tailed test).

Table 4

Summary statistics and correlation matrix for the alternative measures of innovation.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>S.D.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. New product intensityit + 1</td>
<td>6.38</td>
<td>18.91</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Patent applicationit + 1</td>
<td>0.17</td>
<td>0.38</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Patent applicationit + 2</td>
<td>0.62</td>
<td>12.20</td>
<td>0.10*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Patent applicationit + 3</td>
<td>0.69</td>
<td>10.66</td>
<td>0.11*</td>
<td>0.10*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Patent applicationit + 4</td>
<td>0.90</td>
<td>11.04</td>
<td>0.12*</td>
<td>0.11*</td>
<td>0.11*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Patent applicationit + 5</td>
<td>1.23</td>
<td>13.96</td>
<td>0.12*</td>
<td>0.11*</td>
<td>0.61*</td>
<td>0.74*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Patent applicationit + 6</td>
<td>1.30</td>
<td>13.93</td>
<td>0.11*</td>
<td>0.11*</td>
<td>0.60*</td>
<td>0.67*</td>
<td>0.79*</td>
<td>0.84*</td>
</tr>
</tbody>
</table>

Note: N = 11,674.
* Indicates a correlation significant at the p ≤ 0.05 level of confidence.
However, separation between customer groups, which usually implies little similarity in the knowledge acquired from them, reduces the likelihood of constructive communication and coordination and inhibits knowledge sharing and integration within a firm. This may reduce the positive effect of variety on innovation. We argue, therefore, that demand-side diversification may contribute to firms’ innovation performance. Considering customer groups influences demand-side utility (e.g., Ye et al., 2012), and how demand-side factors may influence firms’ innovation performance. Considering customer groups may reduce the positive effect of variety on innovation. We argue, therefore, that demand-side diversification may contribute to firms’ innovation performance. Considering customer groups may reduce the positive effect of variety on innovation. We argue, therefore, that demand-side diversification may contribute to firms’ innovation performance. Considering customer groups may reduce the positive effect of variety on innovation. We argue, therefore, that demand-side diversification may contribute to firms’ innovation performance. Considering customer groups may reduce the positive effect of variety on innovation. We argue, therefore, that demand-side diversification may contribute to firms’ innovation performance. Considering customer groups may reduce the positive effect of variety on innovation. We argue, therefore, that demand-side diversification may contribute to firms’ innovation performance.

The robustness check with market variety measured by the Blau index suggested that firms which manage to balance their domestic and overseas customer markets tend to be more innovative than intensive exporters and intensive domestic players. This finding may be a manifestation of the exploitation–exploration balance proposed by March (1991). Chinese manufacturers exploit the domestic market, developing consistency and efficiency. At the same time, they explore their overseas markets, looking for new technologies and in the sectors where the two markets are not widely separated tend to benefit most from learning diversity. In addition, firms with better absorptive capacity tend to overcome the difficulties caused by market separation and benefit more from market variety.

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The China International Marine Containers Group (CIMC) is another example of successfully balancing domestic and overseas markets. By exploring overseas markets, it kept upgrading its product quality and technology. At the same time, it combined the technology and market knowledge acquired from overseas with its capabilities developed in the domestic market, innovating to further reduce its costs and to increase product variety (Zeng and Williamson, 2007).

Chinese automobile assemblers, however, faced more regulations and greater separation from their global markets due to high import tariffs. Chinese assemblers found it difficult to combine the knowledge acquired from overseas customers with that acquired domestically. Although there are assemblers with balanced domestic and overseas sales, such as Great Wall Auto, this sector has long been criticized for its lack of innovativeness (Chin, 2010).

This study was designed to link scholarly work on organizational learning with demand-side perspectives. Demand-side research studies how organizational diversification influences demand-side utility (e.g., Ye et al., 2012), and how demand–side factors may influence a firm’s innovation performance (e.g., Fontana and Guerzoni, 2008; Priem et al., 2012). Drawing on organizational learning theory, we argue that demand-side diversification may contribute to firms’ innovation performance. Considering customer groups
in different geographically-defined markets as diverse sources of external knowledge, this study has shown that firms with various and less separated customers tend to be more innovative.

A stream of research on “learning by exporting” has highlighted the importance of overseas knowledge acquired from exporting, but it has reported a mixed relationship between exporting and innovation (Navas-Aleman, 2011; Salomon, 2006; Salomon and Jin, 2008, 2010; Salomon and Shaver, 2005). These results complement that work by suggesting that while overseas knowledge is important, the value of domestic knowledge should not be overlooked, particularly the value of learning from diverse domestic and international markets. The innovation performance of emerging economy exporters illustrates the limitations of “learning by exporting”. They rely primarily on their low costs and tend to rely on their foreign customers for access to the latest technology and for market knowledge (Hobday, 1995). However, the most successful exporters from emerging economies tend not to be the most active introducers of new products, even though they tend to have the best access to foreign knowledge (Navas-Aleman, 2011). This seems to be a learning diversity effect. A firm with good access to overseas knowledge, especially very advanced knowledge as in the case of intensive emerging economy exporters, may not bother to profit from the knowledge available domestically and may have less opportunity to build a diverse knowledge base or to develop its own innovation competence (Fagerberg and Godinho, 2005; Mahmood and Zheng, 2009).

So these findings suggest that neither managers nor government should pursue high export intensity exclusively nor should they pay too much attention to it as a measure of technological progress. It is also important to pay attention to the domestic market as a knowledge source. The combination of domestic and overseas knowledge does a better job of promoting innovation. In addition, governments should recognize that economic openness in many sectors not only facilitates knowledge spillovers to indigenous firms, it can also reduce the difficulties that exporters face in making good use of the knowledge gained from diverse sources. Accordingly, local managers of firms operating in relatively open sectors should be more courageous in expanding their product markets abroad without ignoring the domestic market. Firms operating in less open sectors should be cautious when they try to expand abroad, as they may find it difficult to improve their innovation record by combining domestic and overseas knowledge. In either case, governments need to encourage exporters to invest in their absorptive capacity to better capture the benefits of market variety and to avoid the drawbacks of market separation and managers should of course pay attention to building absorptive capacity.

Due to data limitations, this research did not control for some variables which may influence firms’ incentives and capabilities in innovation, such as family and institutional ownership and international collaborations such as alliances and partnerships. The use of patent applications as a measure of innovation is also subject to criticism, especially in the China context (e.g. Hu, 2010; Oxley, 1997). In addition, there was no attempt to distinguish among different types of innovation. Firms competing in highly separated markets may build connections relating highly dissimilar knowledge and thus make it possible to generate radical innovations rather than just incremental ones. Future research might use more refined measures of innovation to explore the potential benefits of competing in widely separated markets.

The low level of significance of the moderating effect of absorptive capacity may be due to the mixture of external and internal elements of absorptive capacity. Due to data limitations, these two elements could not be analyzed separately. Future research might fruitfully take a closer look into the absorptive capacity concept by distinguishing between its internal and external aspects and proposing more refined hypotheses. The external aspect of absorptive capacity may facilitate knowledge acquisition, thus enhancing the positive effect of market variety. Its internal aspect may facilitate knowledge sharing and integration, weakening the negative effect of market separation.

As one of the first exploratory studies aiming to link demand-side perspectives with organizational learning research in an international context, the study has treated the distinction between domestic and overseas markets as the main source of knowledge variety. The design was then simplified by operationalizing the separation between the two markets using the degree to which the domestic market was closed to the rest of the world. Future research may choose to explore more refined measures of market variety and market separation. For example, sales in each country might be used to quantify the variety of a firm’s markets. Many kinds of distance constructs, such as institutional distance, geographical distance or economic distance might be used to capture the level of market separation. Table 6 illustrates a more general theoretical framework with a $2 \times 2$ matrix. Firms with customers in many geographical markets that are less separated from each other have access to a variety of knowledge yet may find the diverse knowledge easier to transfer and synthesize. They should tend to be the most innovative. When a firm has customers in many markets but the markets are highly separated from each other, it may not be easy to build the synthesis required for innovation. Firms with customers in fewer geographical markets that are widely separated from each other should tend to suffer from a lack of knowledge variety and difficulty in knowledge integration. They should tend to be the least innovative. When a firm has customers in fewer but less

---

**Table 6**
The interaction between market variety and market separation.

<table>
<thead>
<tr>
<th>Market variety</th>
<th>Low</th>
<th>Mixed results</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market separation</td>
<td>Low</td>
<td>Worst innovation performance</td>
<td>Mixed results</td>
</tr>
<tr>
<td>High</td>
<td>Intermediary performance</td>
<td>Intermediary performance</td>
<td></td>
</tr>
</tbody>
</table>

---

4 We would like to thank a reviewer for suggesting this insight.
separated markets, the firm may be able to make good use of the knowledge that it acquires from the customers, but there is not much variety in its knowledge pool for it to build on.

Besides the organizational learning perspective, scale arguments have also been used to explain the relationship between international diversification and innovation. A larger market tends to increase the potential returns to innovation, encouraging firms to innovate (Hitt et al., 1997; Wang et al., 2011). While this alternative explanation may also lead to Hypothesis 1, it cannot explain the moderating effects demonstrated in confirming Hypotheses 2 & 3. Alternative explanations remain for future research to explore. Future research might also profitably extend the empirical context to other industries and countries to test the generalizability of these findings.

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