Learning from institutional diversity to innovate: a study of Chinese exporters in digital industries

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Abstract: While Chinese digital exporters such as Huawei and Lenovo are well known for their broad overseas markets, it is less explored how the markets' institutional diversity influences their innovation performance. We propose that the institutional diversity of an exporter's overseas markets tends to facilitate the exporter's deliberate learning and adaptation, building a diverse knowledge pool that gives rise to innovation. The exporter's capabilities and incentives for learning strengthen that positive relationship. We examined the argument with data of 14,701 Chinese digital exporters covering 2000–2007. We found that Chinese firms exporting to more institutionally–diverse markets sold more new products than those whose markets were less institutionally diverse. The benefits accrue more to the exporters with more carry-along trade business but less state-ownership. Managerial implications and future research directions are discussed.

Keywords: institutional diversity; innovation; learning by exporting; absorptive capacity; emerging economies; China.

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1 Introduction

Like many other emerging market (EM) firms, Huawei's early expansion overseas was largely limited to other EMs rather than into developed countries where Western giants like Cisco dominated (Peng, 2009). In 2001 Huawei sold its products in about 39 countries across five continents, with Thailand, Russia, Uzbekistan, Egypt, Iran, and Brazil as its most important markets[1]. By the end of 2006 Huawei had expanded its overseas markets to 156 countries, but with more than 80% of the overseas revenue still coming from other EMs. Though largely blocked out of advanced markets, Huawei hasn't stayed away from innovation spending. From 2001 to 2006 the firm maintained a high proportion of new products (with a mean of 28%) in its total output[2]. As for technological innovation, from 2000 to 2020 Huawei always led among all Chinese firms in terms of invention patents granted[3]. That could not be explained by the traditional 'learning by exporting' arguments (Salomon, 2006; Salomon and Shaver, 2005b), which assert that exporting to more advanced economies benefit a firm's innovation by providing access to advanced knowledge (Salomon, 2006; Salomon and Jin, 2008, 2010;

Salomon and Shaver, 2005b). Did exporting to other EMs contribute to Huawei's innovativeness? If so, How?

As recent literature taking a demand-side perspective has directed academic attention to the institutional environments of the markets where firms sell their products (Priem, 2007; Priem et al., 2012; Xie and Li, 2015, 2018), it is natural to believe that the institutional environments into which digital goods exporters sell their products influence their innovation activities. Researchers in this area have so far just classified destination countries as developed or less-developed based on the state of development of their institutions and then compared the institutional development in exporters' home and destination markets (Salomon, 2006; Xie and Li, 2013, 2018). No analysis using the overall composition of an exporter's destination markets in terms of institutional development has yet been published.

Such analysis was the objective of this study. It was designed to take into account the institutional diversity among all of an exporter's destination countries along with the exporter's ability and incentives to learn from its exporting experience. The study tested the proposition that diversity in the institutions of a firm's overseas markets exposes it more diverse knowledge about how to do business overseas, engaging managers' attention and helping them avoid inappropriate generalisation. That further stimulates deliberate learning and development of the organisation's dynamic capabilities (Zollo and Winter, 2002). Moreover, exporters exporting to diverse markets learn to adapt in complex situations, and that usually involves novel combinations of the diverse knowledge they have obtained from different markets. This is a major source of innovation from a recombinatory point of view (Fleming, 2001; Nelson and Winter, 1982; Schumpeter, 1934).

Exposure to diverse institutional environments increases the likelihood of successful learning, but doesn't guarantee it. Extensive previous research has shown that firms have difficulty in transferring, sharing and integrating the diverse knowledge they obtain from different markets (Barkema and Vermeulen, 1998; Li and Kozhikode, 2011; Mahmood and Zheng, 2009; Singh, 2008). The effectiveness of learning also relies on exporters' capabilities and their incentives to overcome such difficulties. We expect that institutional diversity inside a firm may capture the firm's capabilities of learning from diverse institutions, i.e. absorptive capacity specific for institutions. Firms that can manage to deal with institutional diversity among their internal stakeholders are also likely to be able to cope with institutional diversity in their external environments.

The outcome of an exporter's attempts to exploit diverse institutional knowledge will depend to some extent on its incentives to learn. Incentives to take action are subject to cost-benefit analysis (Chen, 1996). Exporters have better incentives to learn when they are well aware of the benefits of learning and at the same time the cost is relatively low. Firms engaged in carry-along trade (CAT) are more likely to be in that situation. In CAT an exporter doesn't produce all the products it exports (Bernard et al., 2019). Carrying other manufacturers' products overseas, a CAT exporter usually knows a lot about overseas demand and has existing distribution channels. It just doesn't have the production capability for that type of product. That gives the firm incentives to learn actively so that it can either consolidate its marketing advantage or rebalance its production capabilities. State ownership may be another determinant of an exporter's incentive to learn. State-owned enterprises (SOEs) often have serious agency problems and may feel less pressure from market competition. Either would weaken the incentives to exploit learned institutional knowledge for commercial ends.

An unbalanced panel of data describing 14,701 Chinese exporters covering 2000–2007 was used to examine these arguments. The institutional diversity of an exporter's foreign markets was quantified using the weighted variance of the institutional distance between each target country and China. Fixed-effects regressions were evaluated. The results show that institutional diversity significantly predicted increases in new product output among Chinese exporters. Institutional diversity within a firm was operationalised in this research in terms of mixed ownership, but the empirical tests didn't support our hypothesis. It may be that the measure used was not fine-grained enough due to the limitations of the data. CAT exporters are able to observe more commercial opportunities outside their business scope than other exporters, and the profit potential gives them an incentive to learn. So they tend to better exploit the benefits from institutional diversity. State ownership weakens firms' incentives to commercialise innovative ideas, perhaps due to agency problems or because they feel less competitive pressure.

This study's findings demonstrate a new benefit of exporting: learning from institutional diversity. Previous research has regarded exporting as a way to expand markets (Luo and Tung, 2007; Salomon and Shaver, 2005a), to spread risks (Hirsh and Lev, 1971; Kim et al., 1993), and to learn from more technologically-advanced markets (Salomon, 2006; Salomon and Jin, 2008, 2010; Salomon and Shaver, 2005b). The findings here show that engaging with diverse commercial environments also provides advantages for innovation. EM firms typically lack modern managerial skills and advanced technological knowledge. Exporting is for them usually their first step in entering foreign markets. While exporting to advanced markets might be difficult for them at the beginning, the findings from Chinese digital exporters suggest that exporting to institutionally-diverse markets helps to improve innovation performance in the long run. Previous research has confirmed that exporters differ in how effectively they learn from diverse institutional environments, but it failed to explain such firm-level heterogeneity (Xie and Li, 2018). The findings of this research suggest that the incentives to learning are an important contingency.

The rest of the paper is structured in the following way. In Section 2 previous literature on learning from exporting and the effect of diversity are reviewed, building on which we developed conceptual framework and hypotheses. Then, in Section 3 we unfolded the development of theoretical framework and hypotheses, while in Section 4 we described the design of the empirical study we used to examine the conceptual framework as proposed, consisting of a detailed introduction to data collection, operational measure construction and regression model specification. The empirical results and interpretation are presented in Section 5, followed by a discussion and conclusion in the end.

2 Research background

2.1 Learning by exporting

The positive relationship between exporting and firm innovation has been extensively discussed in the international business literature. There are several main explanations. The first is competition-based, arguing that exporting firms have to innovate to meet the more rigorous technological requirements they find overseas and to withstand more

intense competition in overseas markets (Braga and Willmore, 1991; Pamukçu, 2000). That argument is persuasive when the home country is relatively underdeveloped or isolated from global competition. In general, though, the level of competition in the overseas market is the same as or even weaker than that in an open and well-developed domestic market. The second explanation is related to economies of scale. The cost of innovation is regarded as a fixed cost that can be spread over different markets. Since exporters have access to both domestic and foreign markets, they tend to have higher rates of return to innovation spending and that gives them more motivation to innovate (Pugel, 1978; Tan and Hwang, 2002). Here the latent construct is market size rather than competition intensity. This explanation applies well to exporters with a small domestic market, but for many exporters their overseas markets are not necessarily larger than their domestic ones, especially for exporters located in large markets like China's, America's, or Germany's.

A third argument for the positive relationship between exporting and innovation is knowledge-based. It argues that exporters gain intangible knowledge as they exchange tangible goods with overseas customers (Grossman and Helpman, 1993). That enriches the exporter's internal knowledge pool and increases its likelihood of innovating successfully. Such a positive effect should be stronger for direct exporters than for indirect exporters, as the former have better access to overseas knowledge (Salomon, 2006). A series of empirical studies of Spanish manufacturing exporters applying this knowledge-based view found that exporting to countries with better-developed technology gave rise to better innovation performance than exporting to other countries (Salomon and Jin, 2008, 2010). But more recent studies of EM exporters have shown instead that EM exporters that sell only to overseas markets are less innovative than those that also sell in their less-developed domestic markets (Navas-Alemán, 2011; Xie and Li, 2015; Yao, 2012). And EM exporters that export a larger proportion of their products to other EMs tend to be more innovative than those exporting more to countries with advanced technology (Xie and Li, 2018). The scholarly efforts to reconcile these divergent findings have gone in three different directions. One attributes the differences to firms' different levels of absorptive capacity, arguing that EM firms' absorptive capacity is too limited to learn advanced technology effectively (Li et al., 2010; Salomon and Jin, 2008, 2010). A second explanation regards the difference in institutional development between exporters' home and destination countries as an obstacle to knowledge transfer and integration. So it too emphasises absorptive capacity (Xie and Li, 2018). Then there is the suggestion that it is not overseas knowledge per se, but a knowledge gap with the destination markets from which a firm obtains its knowledge that explains the positive relationship between exporting and innovation (Xie and Li, 2015). This study attempted to argue that it is the diversity of the institutional environments of a firm's markets which is critical, together with the firm's absorptive capacity specific to institutional factors and its incentives to learn. They jointly promote innovation.

2.2 Diversity and innovation

Research about organisational learning has found that diversity benefits innovation. Firms that can access diverse knowledge sources are able to pursue more recombination activities, and they are also more likely to achieve valuable innovation outcomes (Baum et al., 2000; Bonner and Walker, 2004; Faems et al., 2010; Frenz and Ietto-Gillies, 2009; Wang et al., 2011). Following that insight, scholars began to explore the effects of the

diversity of the knowledge accessed from different sources. Within an organisation, scholars have found that diverse technologies benefit the ability to innovate. They benefit exploratory research more than exploitative searching (Quintana-García and Benavides-Velasco, 2008). Another source of knowledge diversity is inter-organisational alliances. Firms in alliances with different kinds of stakeholders have been shown to be better equipped with complementary knowledge, thus are more likely to be effective and efficient in their innovation activities (Faems et al., 2010; Faems et al., 2005). And there has also been research exploring the effect of knowledge diversity from the demand side. It has shown that serving diverse market sectors or customer demands also improves firms' innovation outcomes by stimulating their deliberate learning and improving their dynamic capabilities (Xie and Li, 2015; Zhang et al., 2019; Zollo and Winter, 2002). However, how the diversity of the knowledge gained from different institutional environments influence innovation has remained underexplored, especially in the international context where institutions exert an important influence on firms' activities (Peng et al., 2009, 2008).

Access to diverse knowledge is particularly important for EM firms. They tend to lag in terms of technological capability, and their capacity to absorb new ideas is often limited. That leaves them unable to take full advantage of diversity in the technical knowledge they are exposed to in their foreign markets. EM firms do though usually have experience in dealing with unstable and varied institutional environments (Banalieva et al., 2015; Hoskisson et al., 2000; Kim et al., 2010). They may be good at comprehending, assimilating, and integrating diverse institutional knowledge, and can easily exploit any advantages available from institutional diversity. Thus some scholars have begun to notice the importance of institutional diversity for EM firms' innovation activities (Wu, 2013; Wu et al., 2015), but the empirical findings are still rudimentary where more exploration of firm-level heterogeneity is needed.

3 Hypothesis development

3.1 Destination countries' institutional diversity and innovation

Institutional diversity is defined as the variance in the institutional environments of the markets where a firm sells its products (Lundan and Li, 2019). Economies differ substantially in terms of both their formal and informal institutions. Two firms selling to the same number of countries may be dealing with very different levels of institutional diversity. Think, for example, of exporting to the USA and Canada as compared to selling to the USA and Germany. Although the two groups of market composition have very similar economic development levels, the institutional diversity between the USA and Canada is smaller than the institutional diversity between the USA and German.

Firms interacting with institutionally diversified markets would be influenced by institutional diversity in two ways. First, their knowledge pool for recombination activities would be enlarged and diversified. When firms enter markets with a different institutional environment they have an opportunity to learn novel ideas and practices from local customers, partners and even competitors (Savino et al., 2017; Sofka and Grimpe, 2010). The local institution such as national regulations, culture and norms give those they deal with different habits and preferences (North, 1990; Scott, 1995). For example, the local customers may have different functional requirements for the same

product. Such special demands provide firms with cues and directions for product development and technology improvement (Adner and Levinthal, 2001; Priem, 2007; Priem et al., 2012; Xie and Li, 2015). The more different kinds of knowledge a firm can access, the more numerous valuable and novel recombination outcomes it may be able to generate (Garcia-Vega, 2006; Quintana-Garcia and Benavides-Velasco, 2008; Srivastava and Gnyawali, 2011). It widens the scope of the firm's searches for effective solutions to new problems (Levinthal and March, 1982), improving the likelihood of successful innovation.

Exposure to diverse institutions also helps to improve a firm's adaptability and flexibility. Firms may have to implement very different solutions and practices to best adapt to the local institutional environments they face. Their managers have to collect more information about how to do business under different conditions and then ensure that the know-how they acquire in one market isn't inappropriately generalised to another. Those processes not only mandate cognitive investment from the managers and deliberate learning from the organisation, they also make the exporting firm more flexible and better able to adapt (Cuervo-Cazurra and Genc, 2008; Gaur and Lu, 2007; Zhang et al., 2019). All of these processes improve firms' general problem-solving ability, and thus their likelihood of successful innovation.

To sum up, what firms gain from the diverse institutional environment can be divided into two aspects. The first includes the diversified institutional knowledge like practice and solutions of competitors with different institutional backgrounds, and the directions or cues of product improvement fit in different market demands. This constitutes a more diverse knowledge pool that is beneficial for recombination activities and gives rise to innovation (Fleming, 2001; Nelson and Winter, 1982; Schumpeter, 1934). The second aspect is the improvement of firms' capabilities in recombination activities. Exporters that entered institutionally diversified markets tend to invest more in learning, and their efforts in adjustment and integration activities improved their overall flexibility and adaptability. This is also very important for novel and valuable recombination activities.

Hypothesis 1 Greater institutional diversity in an exporter's overseas markets predicts better innovation performance.

3.2 Moderating effect of institutional absorptive capacity

It is not easy to identify the most useful pieces of information, nor to combine them cleverly for successful commercial ends (Xie and Li, 2018). Some firms are good at it, while some others fail. A specific type of absorptive capacity may help explain the differences. Following Xie and Li's suggestion (2018), institutional absorptive capacity can be defined as a firm's ability to recognise valuable institutional knowledge, assimilate it, and apply it to commercial ends (cf. Cohen and Levinthal, 1990). Institutional absorptive capacity helps a firm build a diverse internal knowledge base by learning from diverse institutional environments, and then make good use of the knowledge acquired. This is somewhat similar to the technological absorptive capability which has already been extensively studied, but institutional absorptive capacity is mainly a function of a firm's storage of institutions-related knowledge and its related knowledge processing activities (Volberda et al., 2010).

The institutional diversity within a firm contributes to the firm's institutional absorptive capacity. A firm's owners, managers, and other employees may come from

different institutional environments bringing different norms, ethics, and cultures. Together that constitutes diversity in the firm's internal institutions. Lack of shared values can create obstacles to communication and building mutual trust (Li and Hambrick, 2005), but internal institutional diversity can be an advantage when the firm has to deal with very different external institutional environments. Compared with firms with unified internal institutions, internally institutionally-diversified firms tend to accumulate more experience of compromise, adaptation to, and integration with diverse institutions. It comes to be built into their organisational culture and routines. That improves their institutional absorptive capacity and helps them to be more alert to the different institutional environments outside the firm, more confident and more capable of dealing with dissimilarities. They can then make better use of the diverse knowledge they encounter.

Hypothesis 2 Internal institutional diversity strengthens any positive relationship between external institutional diversity and a firm's innovation performance.

3.3 Moderating effect of incentives to learn

In addition to an ability to learn, incentives to learn should also influence the effectiveness of a firm's learning. The motivation for competitive behaviour is usually the result of a cost-revenue calculation (Chen, 1996; Cyert and March, 1963). Compared with simply copying, innovation is a riskier, longer-term investment with a very uncertain payoff (Kathuria, 2008; Lall, 1992). While learning to innovate effectively is generally regarded as beneficial for long-term performance and sustainability, firms may not be well aware of such benefits due to bounded rationality among the management. In addition, managers' interests are not always aligned with those of the firm (Jensen and Meckling, 1976; Ross, 1973). They tend to underinvest in long-term and risky projects to help ensure good short-term returns during their term of office to further their job security and pay (Ireland et al., 2013). Such agency problems may limit a firm's incentives to learn from institutional diversity.

3.3.1 CAT intensity

Sometimes firms are not motivated to learn because they are not aware of the potential opportunities as a result of limited attention to the markets beyond their current customers (Christensen and Bower, 1996). In the context of exporting, CAT is a specific type of trade that can help to minimise that problem. There are some manufacturers whose products are ready for the overseas market but are not direct exporters. They may lack a relevant license, distribution channels, or marketing capabilities. Or they may simply not bother to do so because they want to focus on the other stages of their value chains. To sell their products overseas, such firms might hire professional international trading agencies. Or they might authorise another manufacturer with the relevant exporting qualifications or well- developed distribution channels to carry their products overseas. The manufacturers that undertake such distribution are said to engage in CAT (Bernard et al., 2019).

Compared with the firms that only export their own products, those carry-along exporters may have stronger incentive to innovate and that incentive improves their

performance in learning from diverse institutional arrangements. Carrying others' products, CAT exporters are more likely to be dealing with product and market knowledge outside their own business scope, which should tend to increase their awareness of novel and promising opportunities (Bernard et al., 2019). More importantly, CAT exporters have already established their distribution channels and market presence. Those would be valuable ready-prepared complementary assets (Teece, 1986) that could easily be useful when a CAT firm seeks to commercialise their new ideas. An active CAT suggests an abundance of already-existing complementary assets ready to be further exploited. In that situation cost-benefit analyses are likely to predict attractive marginal profits from developing new products (Chen, 1996; Chen and Miller, 1994). That can be an excellent incentive for innovation. Any positive relationship between institutional diversity and innovation should thus be stronger for active CAT exporters.

Hypothesis 3 A greater proportion of CAT in a firm's operations strengthens any positive relationship between institutional diversity and the firm's innovation performance.

3.3.2 State ownership

While all firms with separate ownership and management tend to have agency problems to some degree, state-owned firms tend to be particularly afflicted due to the double layer of delegation (Megginson, 2005; Shleifer and Vishny, 1994). Taxpayers dispersed all over the country first delegate the control of state-owned firms to bureaucrats who have no residual claim on the business's profits. The bureaucrats then delegate the management to professional managers who are usually public employees who also cannot benefit much from the firm's profitability. State-owned firms often bear substantial unusual costs and unprofitable obligations. Thus the managers have limited incentives to improve long-term commercial performance and the bureaucrats have inadequate incentives to monitor the managers' behaviour. The taxpayers, who have the most interest in state-owned firms' profitability and who have incentives to monitor the management have no ability to do so because of their dispersion. So even if learning from institutional diversity is beneficial for such firms, the managers of state-owned firms may not be motivated to reap such benefits.

Hypothesis 4 State ownership weakens any relationship between institutional diversity and a firm's innovation performance.

4 Empirical methods

4.1 Sample and data

The data used to test these hypotheses was sampled from the Chinese Industrial Enterprise database, which covers Chinese manufacturing firms with annual sales revenue of ¥5million or more. In each year between 2000 and 2007, China's National Bureau of Statistics (NBS) published data describing those firms in its annual Statistical Yearbooks. Basic information about each firm's size, financial status and operating conditions are included. The Chinese Industrial Enterprise data have previously been used in much business research (e.g. Buckley et al., 2002; Chang and Xu, 2008; Pan

et al., 1999; Park et al., 2006; Xie and Li, 2018). Meanwhile, China's General Administration of Customs records export trade information and since 2000 has published those records in the China Import and Export Trade dataset (termed the Chinese customs data). Both datasets can be obtained from the RESSET data platform (available at http://www.resset.com/).

Firms in three industry categories – communications equipment, computers and other electronic equipment; electrical machinery and equipment manufacturing; and instrumentations and culture, office machinery manufacturing – were selected to compose the study's sample. Innovation is prevalent in these technology-intensive sectors. Customs records show that from 2001 to 2009 the proportion of exporters in these digital-related industries increased from 16.7% to 27.4% of the firms, with about one-quarter of them having sold into more than 10 countries in each year. At the same time, those digital exporters had also been innovating actively. Each year from 2000 to 2010, about 19.5% of the digital exporters introduced new products, with the production of new products composing around 46% (on average) of their total output[4].

From 2000 to 2007, about 67,827 firms in the three industries appeared in the NBS dataset, with 188,176 annual records about their basic information and financial indicators. Using the firms' full names as unique identifiers, their exporting records were extracted from the customs database. That provided detailed information about their overseas markets and the exact value of their exports to each market each year. Firms that could not be matched with exporting records were deemed not to have engaged in exporting, and they were dropped from the analyses. That left 20,879 exporters with 60,684 yearly exporting records. Following the lead of previous studies which used the NBS data (Brandt et al., 2012, 2014; Elliott et al., 2019), firms with missing records or which had negative values for firm age, registered capital, assets, number of employees, total wages, output, value-added, new product output or sales revenues were excluded. Any of the following situations were also grounds for exclusion: total assets smaller than current assets or fixed assets, total liabilities smaller than current liabilities or long-term liabilities, current depreciation larger than accumulated depreciation, or total liabilities larger than total assets. Firms with fewer than 8 employees were also excluded because in China they fall under a different legal regime (Brandt et al., 2012; Elliott et al., 2019; Upward et al., 2013). After also excluding outliers with extreme values of the main variables, that left an unbalanced panel of 36,996 firm-year observations of 14,701 exporters.

4.2 Variables

4.2.1 Innovation

We captured the outcome of a firm's innovation with its product innovation. It was quantified using the New Product Output indicator reported in the NBS survey, with the unit of thousands of US dollars. The NBS values included both new-to-the-market products and those improved with new technology or new designs, reflecting a firm's success in knowledge recombination (Schumpeter, 1934) and commercial integration (Dodgson et al., 2015). Chinese firms are penalised if they misreport their financial ratios in the NBS survey, making the data reasonably reliable. The NBS data have been used in previous research (Li et al., 2010; Zhou and Li, 2008; Xie and Li, 2018).

Unfortunately, the New Product Output indicators for 2004 observations are missing from the NBS dataset. To correct this, if a firm had records in both 2003 and 2005, the average of those two values was used to represent 2004. About 43% of the 2004 observations could be imputed in this way. For those firms with no record in 2003 or 2005 or both, a 0 value was used representing no new products. The proportion of firms with non-zero new product output in 2004 as a result of this procedure was approximately the same as in other years. In order to reduce the skew in the original value of new product output and to exclude any time and industry effects, the values were mean-centred using the values for firms with the same 4-digit Chinese industry code in each year. Finally, to ensure that all of the variables were scaled similarly and for convenience in interpreting the results, the centred value was divided by 1,000, so that this variable was expressed in millions.

4.2.2 Institutional diversity

Institutional diversity represents the heterogeneity among the institutional environments of a firm's international markets in a given year. It was quantified as a weighted variance of the institutional environments of a firm's destination countries in a particular year. Berry's formulation for institutional distance (Berry et al., 2010) was used. It takes in political, economic, and cultural dimensions of international distance to compose a comprehensive indicator as

$$\text{Institutional diversity}_{it} = \sum\nolimits_{k=1}^{3}\left(\sum\nolimits_{j=1}^{J}\alpha_{jit}\left(D_{jt}^{k}-D_{jit}^{k}\right)^{2}\right)$$

where i index firms, t indexes years, j indexes firm i's export destinations, and k ranges from 1 to 3 and represents economic distance, political distance, and cultural distance. α_{jit} represents the proportion of its total exports that firm i exported to country j in year t, and D_{jt}^{k} represents the k^{th} dimension of institutional distance between China and country j in year t. D_{jit}^{k} is a weighted average value of the total institutional distance in terms of dimension k for firm i in year t, which is calculated as

$$D_{jit}^{k}=\sum\nolimits_{j=1}^{J}\alpha_{jit}D_{jt}^{k} \tag{2}$$

D_{jt}^{k} then represents the distance between China and country j in terms of the k^{th} institutional dimension in year t. The institutional diversity values calculated using equation (1) were adjusted by deducting the industry mean of the observations in each year to exclude any time and industry effects, as well as to reduce the variable's skew. In order to maintain similar scales among all the regressors, the centred value of institutional diversity was divided by 100.

4.2.3 Internal institutional diversity

A firm's internal institutional diversity represents the variance of its internal institutional environments. Such inside diversity may bond together diverse knowledge, foster knowledge transfer, and improve a firm's ability to assimilate external knowledge (Lane et al., 2001). One common diversification of internal institution is when a firm embraces different types of ownership in forming joint ventures. Previous research has found that

international joint ventures learn efficiently because their diverse internal sources of knowledge increase their ability to understand, assimilate and apply external knowledge (Kogut, 1988; Lane et al., 2001; Lyles, 1988). In this research a firm's internal institutional diversity was quantified using the number of different ownership types in which it was involved. The types of ownership considered were domestic Chinese owners, owners from Hong Kong, Macao, or Taiwan (HMT owners), and those from foreign countries. The data were extracted from the NBS data. They were used to create an indicator variable given the value 0 if a firm was entirely domestically owned. If a firm was partially owned by either of the other two types, a value of 1 was assigned. A firm with both HMT investors and foreign investors was given the value 2[5].

4.2.4 CAT intensity

According to China's customs regulations, only firms with independent import and export rights are qualified to engage in cross-border trade without going through a qualified international trade agent. The NBS data included a self-reported variable called the delivery value of exports. It is the total value of exported goods manufactured substantially by the firm itself. Meanwhile, the customs data also report the value of each firm's aggregate exports including both its own products and any it exported for others. The CAT value used in the analyses was the difference between those two values. A firm's *CAT intensity* was then calculated as a firm's CAT value divided by the value of the firm's own exports.

4.2.5 State ownership

The NBS dataset provides detailed information about the composition of a firm's registered capital, so the exact amount of state capital is available. *State ownership* was measured by the percentage of state capital in a firm's total registered capital. This was intended to reflect the extent to which a firm would implement the orders or wishes of the government (Greve and Zhang, 2017; Zhou et al., 2016), and it is also an objective and enduring indicator because ownership structure does not change frequently.

4.2.6 Other variables

Many factors of course influence a firm's innovation performance. Larger firms normally have more resources, making them better able to bear the potential risks of innovation (Braga and Willmore, 1991; Sasidharan and Kathuria, 2011). *Firm size* was represented in the analyses by the logarithm of a firm's registered capital. Older firms tend to have accumulated more experience in international trade and technological activities, so they may perform better in those terms than younger firms. *Firm age* was therefore another variable included in the regressions, measured by deducting a firm's year of establishment from the observation year. And previous research has found that ownership type influences firms' behaviour. Firms with foreign ownership have better access to overseas technology and also tend to be more innovative themselves. Firms with Hong Kong, Macao or Taiwan participation may enjoy some policy advantages and thus perform better than domestic firms. Taking into accounts the influence of different ownership types, each type of capital was expressed as a proportion of each firm's total registered capital to create the variables *foreign ownership* and *HMT ownership*.

The abundance of a firm's slack resources might also be expected to influence their innovation activity (Cyert and March, 1963), because slack allows continuous investment in long-term, risky research and development activities (Greve, 2003; Rosner, 1968). Previous research has found that too much or too little slack both tend to hamper innovation success (Nohria and Gulati, 1996). The variable *slack resource* was quantified as a firm's assets-to-liabilities ratio (its total liabilities divided by its total assets and multiplied by 100). The industry means in each year were deducted to exclude industry effects and to reduce the skew in the variable's distribution.

There is much research which shows that firms exporting more intensively perform better in their innovative activities (Bratti and Felice, 2012; Damijan et al., 2010; Li et al., 2010; Salomon and Jin, 2008, 2010), so *exporting rate* was another variable in the analyses evaluated by expressing the value of a firm's exports in each year as a proportion of its total sales revenue. The export type also influences the innovation process. If most of a firm's exports are OEM products, its operations will be dominated by the clients' overseas designers and thus be isolated from the innovating process. That may hamper the firm's innovation performance (Kang, 2011; Zhang et al., 2008). An *OEM intensity* variable was therefore evaluated as the value of a firm's OEM shipments as a proportion of its total export value.

Firms that sell their products to many different markets or customer groups have more sources of diverse knowledge and are also more active in product adaptation activities (Hitt et al., 1997; Lahiri, 2010; Singh, 2008; Xie and Li, 2015). Following the lead of previous research that used a counting approach in depicting market variety (Delios and Beamish, 1999; Lu and Beamish, 2001, 2004), this study's *market variety* variable was evaluated as the number of different countries to which a firm exported in a given year.

The economic development level of the destination countries also influences firms' innovation activities and learning outcomes. On the one hand, better-developed economies may have higher quality standards to which exporters from EMs must adapt their products. They also have more advanced technologies, providing firms with abundant sources of technical knowledge to recombine. On the other hand, research has also found that it is difficult for EM exporters to assimilate the advanced technology available from more advanced economies (Li et al., 2010; Salomon and Jin, 2008, 2010; Xie and Li, 2018). In that case better development in the destination countries can negatively influence an EM exporter's innovation. Therefore, the variable *development* was also included in the analyses. It was the weighted average of GDP per capita[6] (in thousands of US dollars) of all of a firm's destination countries.

Intellectual property rights protection of course influences a firm's incentive to innovate (Khanna and Palepu, 2010; Zhang et al., 2007). An *IPR protection* variable was therefore defined to represent this effect. The values were those reported by China's National Economic Research Institute in its China marketisation index (Fan et al., 2010) for each firm's headquarters province each year.

A *performance* variable was also included in the models because a firm's financial performance influences its subsequent inclination to invest in innovation activities. Performance was measured in terms of return on equity (multiplied by 100). The values were centred it by deducting the industry-year mean to reduce any time and industry effects.

There was also a *patents* variable: a count of each firm's invention patents applied for in each year. Apart from technological absorptive capacity, patent applications reflect a

firm's willingness to invest in R&D activities. Previous research has found a positive relationship between R&D expenditure and the number of invention patents (Acs and Audretsch, 1988; Dosi, 1982).

The variables included in the models are summarised in Table 1.

Table 1 Overview of variable measures

Variable name	*Measurement*	*Sources*
Innovation	Within-industry centred value of new product output in each year	NBS firm-level data
Firm age	The year of establishment subtracted from the year of observation	NBS firm-level data
Firm size	The natural logarithm of a firm's total registered capital	NBS firm-level data
Foreign ownership	The percentage of foreign capital in the firm's total registered capital	NBS firm-level data
HMT ownership	The percentage of capital from Hong Kong, Macao and/or Taiwan in the firm's total registered capital	NBS firm-level data
Slack resources	Within-industry centred value of a firm's total liabilities divided by its total assets, multiplied by 100	NBS firm-level data
Exporting rate	The reported value of a firm's exports divided by its overall sales revenue, multiplied by 100	NBS firm-level data
OEM intensity	The percentage of OEM exports in a firm's total export value	Chinese custom data
Market variety	The number of a firm's different export markets	Chinese custom data
Development	Weighted average of GDP per capita of all the destination markets (in constant 2010 US dollars)	World Bank national accounts data
IPR Protection	NERI marketisation index for the firm's headquarters province	NERI China marketisation index
Patents	The number of invention patents a firm applied for in each year	The State Intellectual Property Office
Performance	Net profit divided by total assets, centred using the industry-year mean and multiplied by 100	NBS firm-level data
Institutional diversity	Weighted variance of the institutional distance between China and all the destination markets centred using the industry-year mean	Berry et al. (2010)
Internal institutional diversity	Number of different types of foreign capital among a firm's investors	NBS firm-level data
State ownership	The percentage of state-invested capital in the total registered capital in the observed year	NBS firm-level data
CAT intensity	(Customs recorded export value – NBS recoded export value)/NBS recoded export value	Chinese custom data

4.3 Modelling

After its adjustment using the industry-year mean, the dependent variable *new product output* was linear and continuous. That allowed using generalised linear regression models that apply to panel data. According to the findings of research on firm-specific advantages, innovative firms tend to expand their markets to increase the return on their R&D investments (Cassiman and Glolovko, 2011). That challenges the causal direction between institutional diversity and innovation discussed so far. All the explanatory variables were lagged by 1 year to fix this problem. As a result, 14,105 observations that appeared only once between 2000 and 2007 were dropped from the regression analyses. Also, some unobserved firm-specific attributes such as managers' preferences may influence innovation and institutional diversity simultaneously. To address such potential endogeneity, fixed-effects models were evaluated which took all time-invariant firm-level factors into account (Wooldridge, 2005, 2010). Following a recommendation of Cameron and Miller (2015), the standard errors were clustered by firm to minimise the potential for heteroskedasticity or autocorrelation.

5 Results

5.1 Regression results

Descriptive statistics and pairwise correlations describing the data are displayed in Table 2. The pairwise correlations between *internal institutional diversity* and *foreign ownership* (ρ = 0.447), *HMT ownership* (ρ = 0.390) are relatively high because of the way *internal institutional diversity* was defined and measured. The correlation between *HMT ownership* and *foreign ownership* also has a high absolute value (ρ = –0.454) because most of the firms had only one ownership type.

Variance inflation factors (VIFs) for the variables were evaluated to check for multicollinearity. The maximum VIF was 1.71 (for *foreign ownership*), and the mean VIF for all of the variables was 1.20. Both of those values are substantially smaller than 10, indicating that multicollinearity was not a serious problem (Ryan, 1997).

The estimated coefficients of institutional diversity on innovation performance and the moderating effects are reported in Table 3. Model 1 is the null model with only the control variables and moderators. Model 2 tested the predictive power for innovation performance of the main variable institutional diversity. Model 3 includes the interaction term of internal institutional diversity and institutional diversity. The continuous moderators were centred before constructing the interaction terms. Model 4 tested for any moderating effect of CAT intensity. Model 5 reports the moderating effect of state ownership. And model 6 is the full model with all the moderators and interaction terms.

Hypothesis 1 proposed a positive relationship between institutional diversity and innovation. Model 2 in Table 3 supports this hypothesis by showing a positive and significant coefficient for the institutional diversity term ($b > 0$, $p \leq 0.001$). Institutional diversity in a firm's overseas market does indeed predict better innovation performance.

Table 2 Descriptive statistics and correlation matrix

		Mean	*Std. dev.*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*
1	Innovation	–29.54	46.22																
2	Firm age	8.51	7.71	0.102															
3	Firm size*	9.51	1.63	–0.119	0.157														
4	Foreign ownership	32.83	43.77	–0.072	–0.158	0.202													
5	HMT ownership	24.90	40.72	–0.051	–0.071	0.025	–0.454												
6	Slack resources	–0.28	22.68	0.012	0.029	–0.213	–0.128	–0.049											
7	Exporting rate	57.48	47.82	–0.020	–0.104	–0.019	0.091	0.192	–0.028										
8	OEM intensity	12.00	30.66	–0.059	–0.022	0.090	0.201	0.042	–0.100	0.113									
9	Market variety	11.26	12.67	–0.032	0.033	0.158	–0.093	0.037	0.084	0.170	–0.041								
10	Development	31.07	14.51	–0.009	–0.033	0.071	0.108	0.150	–0.056	0.184	0.059	–0.011							
11	IPR protection	14.53	8.95	–0.034	–0.027	–0.065	–0.069	0.092	0.016	0.092	0.159	0.141	0.108						
12	Performance	0.10	12.57	–0.002	–0.063	–0.067	0.079	–0.060	–0.198	–0.039	0.031	0.017	–0.012	–0.042					
13	Patents	0.50	10.09	–0.027	0.005	0.101	0.000	0.004	0.009	–0.007	0.013	0.074	0.009	0.038	0.006				
14	Institutional diversity	–0.57	1.19	–0.001	0.028	0.125	–0.007	0.016	0.024	0.055	–0.106	0.280	0.000	–0.236	0.005	0.009			
15	Internal institutional diversity	0.71	0.48	–0.090	–0.200	0.223	0.477	0.390	–0.141	0.202	0.168	–0.052	0.214	–0.034	0.030	0.007	0.042		
16	CAT exporting	0.42	8.63	0.006	0.006	0.009	0.003	–0.007	–0.001	–0.033	0.033	–0.008	–0.007	–0.022	–0.006	0.001	0.007	–0.001	
17	State ownership	3.37	15.39	0.020	0.300	0.138	–0.100	–0.107	0.029	–0.124	–0.050	–0.048	–0.031	–0.168	–0.043	0.000	0.047	–0.127	0.029

Notes: N = 31,747

All of the variance inflation factors were smaller than 1.7 and the mean VIF was 1.2.

Correlations with absolute values larger than 0.012 are significant at the $p \leq 0.05$ level of confidence.

*The variable firm size was the natural logarithm of a firm's registered capital, giving it a smaller mean and standard deviation.

Table 3 Estimated coefficients of the fixed-effect models with GLS estimates

	Innovation performance				
	Model 1	*Model 2*	*Model 3*	*Model 4*	*Model 5*
Firm age	–0.244	–0.231	–0.232	–0.226	–0.268
	(0.024)	(0.032)	(0.032)	(0.036)	(0.009)
Firm size	–0.538	–0.696	–0.695	–0.690	–0.438
	(0.386)	(0.293)	(0.293)	(0.296)	(0.516)
Foreign ownership	–0.006	–0.017	–0.017	–0.017	0.011
	(0.828)	(0.544)	(0.539)	(0.543)	(0.662)
HMT ownership	0.032	0.022	0.022	0.022	0.051
	(0.227)	(0.435)	(0.441)	(0.446)	(0.067)
Slack resources	0.031	0.033	0.033	0.033	0.025
	(0.143)	(0.143)	(0.143)	(0.143)	(0.274)
Exporting rate	–0.008	–0.006	–0.006	–0.005	–0.006
	(0.396)	(0.501)	(0.502)	(0.613)	(0.510)
OEM intensity	0.019	0.016	0.016	0.015	0.022
	(0.552)	(0.621)	(0.620)	(0.648)	(0.517)
Market variety	–0.072	–0.094	–0.093	–0.095	–0.077
	(0.272)	(0.164)	(0.166)	(0.156)	(0.277)
Development	0.067	0.091	0.091	0.090	0.076
	(0.136)	(0.056)	(0.056)	(0.057)	(0.105)
IPR protection	–0.368	–0.330	–0.330	–0.330	–0.331
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Performance	–0.028	–0.039	–0.039	–0.039	–0.036
	(0.257)	(0.147)	(0.148)	(0.145)	(0.192)
Patents	0.010	0.026	0.026	0.027	0.001
	(0.867)	(0.674)	(0.675)	(0.662)	(0.986)
Internal institutional diversity	–0.782	0.092	0.068	0.128	–2.338
	(0.707)	(0.968)	(0.977)	(0.955)	(0.278)
CAT intensity	0.111	0.115	0.115	0.332	0.176
	(0.283)	(0.276)	(0.276)	(0.019)	(0.121)
State ownership	0.036	0.031	0.031	0.029	0.315
	(0.260)	(0.360)	(0.361)	(0.379)	(0.330)

Notes: N = 17,642.
Coefficients were reported with p-values in parentheses.
All of the standard errors were clustered at the firm level.
The industry-adjusted value of new product output in the following year was used as the dependent variable.

Table 3 Estimated coefficients of the fixed-effect models with GLS estimates (continued)

	Innovation performance				
	Model 1	*Model 2*	*Model 3*	*Model 4*	*Model 5*
H1: Institutional diversity		1.301	1.363	1.323	0.391
		(0.000)	(0.001)	(0.000)	(0.216)
H2: Internal institutional diversity			–0.094		
× institutional diversity			(0.840)		
H3: CAT intensity				0.370	
× institutional diversity				(0.010)	
H4: State ownership					–0.383
× institutional diversity					(0.024)
Constant	–18.247	–17.482	–17.455	–17.672	–19.305
	(0.003)	(0.007)	(0.007)	(0.006)	(0.003)
F	5.14	8.82	8.32	8.54	7.21
Prob > F	0.000	0.000	0.000	0.000	0.000

Notes: N = 17,642.
Coefficients were reported with p-values in parentheses.
All of the standard errors were clustered at the firm level.
The industry-adjusted value of new product output in the following year was used as the dependent variable.

Hypothesis 2 predicted that firms with greater internal institutional diversity should perform better when learning from complex institutional environments. That was tested by model 3 in Table 3. However, this hypothesis was not supported as the relevant coefficient was not significant. This may reflect an inadequate measure of internal institutional diversity. Since we could not capture the home country of the foreign ownership clearly, our counts of different type between HMT ownership and foreign ownership are not fine-grained enough to represent internal institutional diversity.

Model 4 in Table 3 tested for any moderating effect of CAT intensity on the relationship between institutional diversity and innovation, as proposed in Hypothesis 3. The coefficient of the interaction term in model 4 was positive and significant ($b = 0.37$, $p \leq 0.01$), indicating that the influence of institutional diversity on firms' innovation performance would be strengthened by their engaging in CAT. As we have predicted, firms that engage in CAT may be more incentive to learn from institutional diversity due to their awareness of potential profiting opportunities outside their own business scope.

Hypothesis 4 predicted that state ownership would weaken the positive relationship between institutional diversity and innovation. Model 5 in Table 3 was designed to test that hypothesis. The coefficient of the interaction term between state ownership and institutional diversity is significant and negative ($b < 0$, $p \leq 0.05$), showing that the positive influence of institutional diversity on a firm's innovation performance will tend to be weaker if the firm has a higher proportion of state ownership. This supports the general impression that state-owned exporters are less likely to transfer their innovation ideas to successful commercial ends (Ayyagari et al., 2011; Xu and Zhang, 2008).

To test the robustness of these findings, institutional diversity was re-calculated using more of Berry's dimensions (Berry et al., 2010). The political, economic, cultural, and global connectedness dimensions were used to re-compute the indicator in equation (1)

(where *k* was changed to 4). The regression results with the 4-dimension institutional diversity measure are reported in Table 4. The direction and significance of the coefficients for all the independent variables and interaction terms remained the same.

Table 4 Results with a 4-dimensional measure of institutional diversity

	Innovation performance				
	Model 6	*Model 7*	*Model 8*	*Model 9*	*Model 10*
Firm age	–0.244	–0.230	–0.230	–0.225	–0.267
	(0.024)	(0.033)	(0.033)	(0.037)	(0.009)
Firm size	–0.538	–0.681	–0.680	–0.676	–0.420
	(0.386)	(0.304)	(0.304)	(0.307)	(0.535)
Foreign ownership	–0.006	–0.017	–0.017	–0.017	0.012
	(0.828)	(0.545)	(0.542)	(0.545)	(0.659)
HMT ownership	0.032	0.022	0.022	0.022	0.051
	(0.227)	(0.434)	(0.438)	(0.445)	(0.066)
Slack resources	0.031	0.033	0.033	0.033	0.025
	(0.143)	(0.144)	(0.144)	(0.143)	(0.274)
Exporting rate	–0.008	–0.006	–0.006	–0.005	–0.006
	(0.396)	(0.500)	(0.501)	(0.613)	(0.508)
OEM intensity	0.019	0.014	0.014	0.013	0.020
	(0.552)	(0.662)	(0.661)	(0.691)	(0.558)
Market variety	–0.072	–0.097	–0.097	–0.099	–0.081
	(0.272)	(0.149)	(0.150)	(0.142)	(0.256)
Development	0.067	0.090	0.090	0.090	0.075
	(0.136)	(0.058)	(0.058)	(0.059)	(0.109)
IPR protection	–0.368	–0.330	–0.330	–0.330	–0.332
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Performance	–0.028	–0.039	–0.039	–0.040	–0.037
	(0.257)	(0.142)	(0.142)	(0.139)	(0.185)
Patents	0.010	0.030	0.030	0.030	0.004
	(0.867)	(0.648)	(0.649)	(0.647)	(0.931)
Internal institutional diversity	–0.782	0.087	0.070	0.124	–2.351
	(0.707)	(0.970)	(0.976)	(0.957)	(0.275)
CAT intensity	0.111	0.115	0.115	0.334	0.176
	(0.283)	(0.276)	(0.276)	(0.017)	(0.121)
State ownership	0.036	0.031	0.031	0.029	0.312
	(0.260)	(0.361)	(0.362)	(0.382)	(0.329)

Notes: N = 17,639.
Coefficients were reported with p-values in parentheses.
All of the standard errors were clustered at the firm level.
The industry-adjusted value of new product output in the following year was used as the dependent variable.

Table 4 Results with a 4-dimensional measure of institutional diversity (continued)

	Innovation performance				
	Model 6	*Model 7*	*Model 8*	*Model 9*	*Model 10*
H1: Institutional diversity		1.316	1.361	1.338	0.421
		(0.000)	(0.001)	(0.000)	(0.181)
H2: Internal institutional diversity			–0.068		
× institutional diversity			(0.884)		
H3: CAT intensity				0.369	
× institutional diversity				(0.009)	
H4: State ownership					–0.374
× institutional diversity					(0.027)
Constant	–18.247	–17.547	–17.527	–17.735	–19.401
	(0.003)	(0.007)	(0.007)	(0.006)	(0.003)
F	5.14	8.90	8.41	8.64	7.29
Prob > F	0.000	0.000	0.000	0.000	0.000

Notes: N = 17,639.
Coefficients were reported with p-values in parentheses.
All of the standard errors were clustered at the firm level.
The industry-adjusted value of new product output in the following year was used as the dependent variable.

The relationships were also evaluated using the SOE and non-SOE data separately. The results are reported in Table 5, where model 11 was regressed with the non-SOE sample and model 12 was regressed with the SOE sample. The coefficient of the institutional diversity term is not significant in model 12, meaning that institutional diversity has no significant relationship with new product output among state-owned exporters. This is consistent with previous findings (Ayyagari et al., 2011; Xu and Zhang, 2008) that SOEs feel less market pressure transfer put their innovative ideas to commercial use.

Table 5 Comparison of the effects from institutional diversity between SOEs and non-SOEs

	Innovation performance	
	Model 11	*Model 12*
	Non-SOE	*SOE*
Firm age	–0.273	0.036
	(0.035)	(0.868)
Firm size	–0.492	–5.356
	(0.466)	(0.253)
Foreign ownership	–0.017	–0.001
	(0.423)	(0.996)

Notes: Coefficients were reported with p-values in parentheses.
All of the standard errors were clustered at the firm level.
The industry-adjusted value of new product output in the following year was used as the dependent variable.

Table 5 Comparison of the effects from institutional diversity between SOEs and non-SOEs (continued)

	Innovation performance	
	Model 11	*Model 12*
	Non-SOE	*SOE*
HMT ownership	0.025	0.003
	(0.244)	(0.987)
Slack resources	0.031	0.150
	(0.177)	(0.302)
Exporting rate	–0.006	–0.136
	(0.512)	(0.172)
OEM intensity	0.026	–0.002
	(0.421)	(0.987)
Market variety	–0.106	0.752
	(0.118)	(0.082)
Development	0.103	–0.041
	(0.034)	(0.879)
IPR protection	–0.335	–0.456
	(0.000)	(0.369)
Performance	–0.046	0.000
	(0.090)	(0.999)
Patents	0.023	1.746
	(0.694)	(0.003)
Institutional diversity	1.190	4.433
	(0.000)	(0.121)
Constant	–19.201	29.696
	(0.003)	(0.544)
N	16,773	869
F	10.36	2.63
Prob > F	0.000	0.002

Notes: Coefficients were reported with p-values in parentheses.
All of the standard errors were clustered at the firm level.
The industry-adjusted value of new product output in the following year was used as the dependent variable.

6 Discussion and conclusions

Exposure to markets with diverse institutional environments attracts exporters' attention to learning and enlarges their knowledge pool for recombinative activities, thus improving their innovation performance. This is what can be concluded from this study's analyses of the data on Chinese digital exporters during the 2000 to 2007 period. However, exports benefit unequally even if firms are faced with similar institutional

diversity in their markets. This is because their incentive to learn from institutional diversity also alters the effects of institutional diversity on innovation. Exporters that engage in CAT are more likely to know about existing demand they could reach but could not supply, which may increase their incentive to pursue commercial recombining activities to seize the profit opportunity. Exporters with state capital invested have less incentive to transfer the innovative ideas generated from diverse institutional knowledge to commercial ends, due to their feeling less pressure to increase sales or market share.

This research was designed to make several contributions to the scholarly understanding of these issues. First, it adds to the understanding of learning by exporting (Bratti and Felice, 2012; Salomon and Jin, 2010) by addressing additional dimensions of firm heterogeneity. Previous research has found that exporters innovate more effectively than non-exporters because they can recombine knowledge from local and destination markets, but the knowledge compositions of the destination markets, especially institutions-related knowledge, has been less rigorously explored. Using a composite indicator of institutional diversity, this study addressed the influence of variety in the institutional environments of an exporter's destination markets.

It also further developed the concept of institutional absorptive capacity (Xie and Li, 2018), which to some extent determines firms' efficiency in assimilating institutional knowledge. However, this construct showed no significant predictive power, perhaps because the operational measure of institutional absorptive capacity used (i.e. the internal institutional diversity) was not fine-grained enough due to the limitation of the original data. Future research might usefully retest the argument using more delicate measures. The findings of this research also highlight the effect of learning incentives in facilitating exporters' innovation. Effective learning by exporting apparently requires institutional diversity in a firm's export markets together with strong learning incentives.

These findings have some rich implications for practicing managers. For firms that have enough capacity and are able to engage in international trade, it is better to spread the firm's exports to markets with diverse institutions rather than markets with similar institutions. It is the diversity of market institutions, rather than how advanced those institutions are, that contributes to better innovation.

The findings provide specific implications for EM firms. In some situation EM firms are prevented from entering more advanced markets by local competitors. But spreading sales into more institutionally-diverse EMs is also a way to boost innovation. EMs are typically more divergent in terms of institutions in any case. The findings of this research accord well with those of Xie and Li (2018) who found that exporting intensity to other EMs benefits Chinese exporters' innovation performance.

Future research should examine the generalisability of this conceptual framework to other economies. And this study considered only national institutional heterogeneity. Local variations would probably be even more influential, but testing that would require more fine-grained measures of local institutions' influences. There may be many other ways of building institutional absorptive capacity beyond simply selling into institutionally-diverse markets. Allying with partners from diverse institutional environments, direct investment in countries with diverse institutions, or hiring top managers with diverse institutional backgrounds are obvious examples. Future research might usefully explore the relative effectiveness of these alternative techniques.

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Notes

1 Data source: China Import and Export Trade dataset (available at http://www.resset.com/).

2 Data source: Chinese industrial enterprise data (available at http://www.resset.com/).

3 Data source: China National Intellectual Property Administration (https://www.cnipa.gov.cn; https://www.wipo.int/ipstats/en/).

4 These statistical data were calculated from the Chinese Industrial Enterprise data published by the National Bureau of Statistics (available at http://www.resset.com/).

5 HMT firms or Chinese affiliates of foreign firms were assumed to have mastered Chinese institutional norms when they adapted to the local market, regardless of any partial Chinese ownership.

6 The data were obtained from World Bank national accounts data and OECD national accounts data files accessible at https://data.worldbank.org/indicator. Raw data are in constant 2010 US dollars.