Reverse innovations bridging the gap between entrepreneurial orientation and international performance

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Abstract

Purpose – This paper aims to elucidate the relationship between entrepreneurial orientation, reverse innovation and international performance of emerging economy multinational enterprises (EMNEs).

Design/methodology/approach – The authors analyze archival data of Chinese limited companies between 2010 and 2016, including 11,230 firm-year observations about 1708 firms. In order to test the study's mediation hypotheses, the authors apply an ordinary least square (OLS) regression.

Findings – The authors find evidence that the entrepreneurial orientation of EMNEs has a positive effect on reverse innovations. Furthermore, the authors find positive effects of reverse innovation on the international performance of EMNEs. This pattern of results suggests that the relationship between entrepreneurial orientation and international performance is partially mediated by reverse innovation.

Practical implications – The study's findings help managers in EMNEs to promote reverse innovation by building and using their entrepreneurial orientation. It also helps them to set out and gauge the chances of success of their internationalization strategies. The findings also hold relevance for firms in developed economies as well, as they may understand which emerging economy competitors stand to threaten their positions.

Originality/value – The strategic role of reverse innovations – i.e. clean slate, super value and technologically advanced products originating from emerging markets – has generated considerable research attention. It is clear that reverse innovations impact the international performance of EMNEs. Yet how entrepreneurial orientation influences international performance is still underexplored. Thus, the current study clarifies the mechanism by examining and testing the mediating role of reverse innovation among the entrepreneurial orientation–international performance link.

Keywords Emerging markets, Entrepreneurial orientation, International performance, Emerging market multinationals, Reverse innovation

Paper type Research paper

1. Introduction

Several studies document the entrepreneurial orientation–international performance relationship (Brouthers *et al.*, 2015; Deligianni *et al.*, 2016; Karami and Tang, 2019;

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Knight and Cavusgil, 2004; Kuivalainen *et al.*, 2010; Şhin and Gürbüz, 2017; Wach *et al.*, 2018; Martin and Javalgi, 2016; Javalgi and Todd, 2011). These studies have reported that entrepreneurial orientation is an important driver of international performance. The rationale is that firms with a strong entrepreneurial orientation follow creative processes, are prepared to take chances in new projects and aim to predict future wants (Kollmann and Stöckmann, 2014; Zhang *et al.*, 2014). In turn, this makes them more successful in internationalization. Research in this area has made a considerable additional advances. It has offered insights on several relevant contingencies to this relationship (e.g. Şahin and Gürbüz, 2017), as well as attempted to understand the mechanisms by which entrepreneurial orientation leads to international performance, considering the role of several mediators, e.g. knowledge utilization and capabilities in learning and networking (e.g. Karami and Tang, 2019; Wach *et al.*, 2018).

In most studies, any assumptions about a role of innovation in the relationship between entrepreneurial orientation and international performance are at best implicit, as these studies consider capabilities required for innovation and/or learning effects that are linked only in part to firms' ability to develop new products that meet needs of local markets (e.g. Karami and Tang, 2019). Recently few scholars have paid attention to innovation as a mediator, for example, by detailing the role of business model innovation (Asemokha *et al.*, 2019).

In the present study, we want to underline the importance of innovations and specifically stress the key role of reverse innovations. Reverse innovation has changed the dynamism of global competition during the past two decades (Aulakh *et al.*, 2016). Increasingly, emerging economy multinational enterprises (EMNEs) are exploiting their local embeddedness, which helps them understand market demands, to seize control of reverse knowledge and innovation flows (Govindarajan and Ramamurti, 2011; Tseng, 2010). Via their advantages, EMNEs can become the first mover in exporting innovations to developed markets (Guillén and García-Canal, 2009; Lessard and Lucea, 2009; Williamson and Zeng, 2009). Therefore, investigating reverse innovation may help us understand how entrepreneurial orientation leads to successful internationalization, especially for emerging economy enterprises. Having established that entrepreneurial orientation may trigger innovation (Kollmann and Stöckmann, 2014; Zhang *et al.*, 2014), we argue that it should also benefit reverse innovation and in turn improve EMNEs' international performance. Practically, it is difficult to determine if an innovation is reverse or not without knowing its particular details. The purpose of our study is therefore not to measure reverse innovation *per se*, but instead, we want to raise awareness that reverse innovation fulfills a crucial role in the relationship between entrepreneurial orientation and international performance. In our analysis, we show how innovation fulfills a mediating role. Although it is hard to establish exactly, a substantial part of these innovations is likely to be conceived of as a reverse innovation. For instance, the Chinese company BYD has invented the first rechargeable lithium batteries that are cost-effective and can be developed in humid and ambient temperatures. As a result, the EMNE BYD is giving tough competition to international players due to its unique and cost-efficient method of manufacturing lithium batteries (Zeschky *et al.*, 2014; Quan *et al.*, 2018). Another reverse innovation is the WeChat app, introduced by Chinese company Tencent in 2011. Currently, the app has over 250 million active users with 78 million outside of China. After successful entry to the global market, Tencent opened its offices in the USA to promote its services and compete in developed markets.

Hence, in this study, we aim to examine how entrepreneurial orientation of EMNEs influences international performance and to investigate to what extent this relationship is mediated by reverse innovation. To this end we examine the following research question: *What is the effect of entrepreneurial orientation on international performance of EMNEs and to what extent is this relationship mediated by reverse innovation?*

This study contributes to the existing literature in the following ways. Regarding reverse innovation, we focus on entrepreneurial orientation as an antecedent, which is relevant considering the lack of research on reverse innovation drivers (Hussler and Burger-Helmchen, 2020). We also contribute to this literature by going beyond mapping examples of the phenomenon to examine whether firms stand to gain from engaging in reverse innovation (Malodia *et al.*, 2020) by looking at international performance effects. Regarding entrepreneurial orientation, current studies show limited understanding of how it can help emerging economy firms internationalize to other emerging and developed economies (Şahin and Gürbüz, 2017; Wach *et al.*, 2018), because the majority of studies have considered internationalization by firms from developed economies (Deligianni *et al.*, 2016; Huang and Li, 2019; Karami and Tang, 2019; Knight and Cavusgil, 2004). This is problematic, as evidence increasingly shows that EMNEs' drivers of successful internationalization differ from those of developed economy multinational enterprises (DMNEs) (He *et al.*, 2019; Surdu and Narula, 2021). Our study elucidates how emerging economy firms may internationalize and places these relevant insights against a backdrop of increasing practitioner and scholarly interest in this phenomenon (Banerjee *et al.*, 2015; Fu *et al.*, 2017).

This study also offers several implications for policy makers and managers. First, this study helps managers in EMNEs to identify strategies related to entrepreneurial orientation to encourage reverse innovation. Second, the ability to develop clean state, superior and technologically advanced innovations helps firms improve both domestic performance and international performance. Hence, both managers and policy makers can reconsider their internationalization strategies by embracing reverse innovations as a strategic tool to attain competitive advantage and improved performance at the international level. Due to the global need for low-cost superior inventions, EMNEs target both emerging and established markets. Therefore, the findings from our study are also informative to managers in DMNEs who may stand to lose out on more than just new business opportunities in emerging markets (Govindarajan and Trimble, 2012). In reality, corporations in rich economies aim to tap into EMNEs' reverse innovation to offer these technologies in emerging and developed markets (Borini *et al.*, 2016; Huang and Li, 2019), thus well aware of the threat to their market positions.

To achieve the study's objectives, we follow an archival research design. We collected data from the China Stock Market and Accounting Research (CSMAR) to measure entrepreneurial orientation, reverse innovation and international performance. The patent information was used as a proxy to assess reverse innovation activities of the firms. We selected the period between 2010 and 2016 to examine important predictors of international performance. Finally, we applied ordinary least square (OLS) to test the hypotheses with the help of Stata 14.

2. Theoretical background

2.1 Entrepreneurial orientation

Entrepreneurial orientation embodies a "firm's strategic orientation, capturing specific entrepreneurial aspects of innovativeness, proactiveness and risk-taking" (Tang *et al.*, 2008, p. 220). Innovativeness reflects "a firm's tendency to engage in and support the new idea, novelty, experimentation and creative process" (Lumpkin and Dess, 1996, p. 144) to explore and capture new business opportunities. Proactiveness refers to the firm's orientation to introduce new products based on its forward-looking perspective and anticipatory ability (Miller and Friesen, 1982). Risk-taking refers to the firm's ability to handle uncertainties during an entrepreneurial strategic process. The risk-taking orientation requires firms to commit a lot of resources to entrepreneurial endeavors where the rate of failure may be high and the outputs are unknown (Miller and Friesen, 1978). In general, entrepreneurial orientation is linked with firms' decision-making styles, practices and methods associated

with entrepreneurial activities (Lumpkin and Dess, 1996). Entrepreneurial firms are more inclined to innovate, take risks and foresee future needs (Ferreira *et al.*, 2018; Kollmann and Stöckmann, 2014; Zhang *et al.*, 2014).

2.2 Entrepreneurial orientation and international performance

Internationalization helps businesses achieve long-term growth and compete globally (Alayo *et al.*, 2019). Several studies found a favorable relationship between entrepreneurial orientation and international performance. (e.g. Jantunen *et al.*, 2005; Alayo *et al.*, 2019). Entrepreneurial orientation allows firms to evaluate, exploit, identify and capture opportunities from global markets (Banalieva *et al.*, 2018; Ferreira *et al.*, 2018; Lisboa *et al.*, 2011). For instance, Lisboa *et al.* (2011) determined that entrepreneurial orientation is a significant predictor of firms' overseas market capabilities.

Emerging market firms are compelled to identify and capture opportunities in foreign markets due to strong competition in their domestic markets (Luo and Tung, 2007). Exploring opportunities abroad will help them to secure a better performance overall. International performance refers to achieving corporate goals in overseas markets (Knight and Cavusgil, 2004). Specifically, international performance equates to businesses' operational success across several international functions, such as foreign joint ventures, export operations and subsidiary operations. For emerging market firms, entrepreneurial orientation is a particularly important force driving their explorations of and performance in international markets (Yamakawa *et al.*, 2008; Zhou, 2007). Emerging market firms with an orientation that reflects innovation, vision and proactiveness are equipped to pursue international opportunities despite their limited resources (Bonaglia *et al.*, 2007; Yamakawa *et al.*, 2008). The entrepreneurial orientation makes these firms more willing to accept risks and uncertainties that come with exploring foreign markets. Some studies reported the link between entrepreneurial orientation and international performance for emerging market firms in particular. For instance, Javalgi and Todd (2011) e reported that entrepreneurial orientation and commitment to internationalize of Indian SMEs positively influence international success. Moreover, Zhang *et al.* (2012) conducted research in China and revealed that entrepreneurial orientation and social capital of entrepreneurs are important determinants of international performance.

The different aspects of entrepreneurial orientation all contribute to emerging market firms' success in internalization. First, innovativeness allows firms to develop creative solutions in the face of market challenges (Park *et al.*, 2017).Innovativeness is a valuable company specific-resource that may not easily transfer or be imitated (Ratten and Tajeddini, 2017). Innovativeness is a strategic resource that allows firms to reach international markets (Kim and Park, 2010) and to gain a competitive advantage by offering value-adding products or providing a totally new source of value in relation to competitors (Schilke, 2014). Entrepreneurs with innovative and valuable products can access foreign marketplaces early (Cavusgil and Knight, 2015). According to Child *et al.* (2017), innovativeness is what firms who face barriers and challenges when competing in foreign markets (e.g. lack of reputation and networking, lack of resources) will resort to in order to attain international successes.

Second, proactive firms will be better able to gain a first mover advantage that helps them charge higher prices and target foreign markets (Brege, 2020). Proactive firms will be more ready to internationalize and have invested in the necessary strategic competences to circumvent international market entry barriers. s (Kuivalainen *et al.*, 2010). According to Jantunen *et al.* (2005), proactive enterprises may find and create technologies that fit their goods with foreign client demands and wants, enhancing legitimacy and international performance.

Lastly, risk-taking firms have the orientation to invest large amount of resources in ventures that are highly risky or have uncertain outcomes (Morgan *et al.*, 2016). In the foreign

context, risk-taking is closely associated with proactiveness and innovativeness (Brouthers *et al.*, 2015). To reduce liabilities of foreignness, companies must be ready to develop and implement innovative strategies and models that may enable them to achieve international performance (Zahra *et al.*, 2000). Besides, being proactive in the international markets means being able to identify and pursue new markets without certainty about future performance. Hence, emerging market enterprises must make early, bold and risky efforts to overcome foreignness liabilities and gain legitimacy and competitive advantage in international markets (Brouthers *et al.*, 2015). In conclusion, risk-taking is inherent to venturing into unfamiliar markets and thus firms who are more likely to take risks may also be more likely to perform well in their internationalization attempts (Yiu *et al.*, 2007) [1]. Accordingly, we hypothesize that:

H1. EMNEs' entrepreneurial orientation in terms of innovativeness, proactiveness and risk-taking ability has a positive influence on international performance.

2.3 Reverse innovation

Reverse innovations are defined as "clean slate, super value products that are technologically advanced created to meet the unique needs of relevant segments, initially adopted in the emerging markets followed by the developed countries" (Malodia *et al.*, 2020, p. 1010). The adjective "reverse" means the flow of innovation is from developing to developed economies. This direction is opposite to predominant technology flow in recent times (Govindarajan and Ramamurti, 2011). Although emerging economies are less involved in technology breakthroughs, they are aggressively exploring fresh and inventive solutions to meet pressing local challenges (e.g. Burger-Helmchen *et al.*, 2013; Hussler and Burger-Helmchen, 2020). Reverse innovation is gaining momentum as it can draw on technology, ideas and talents from several parts of the world due to globalization and integration of the world's economies (Archibugi and Filippetti, 2015).

Reverse innovation can be conceptualized according to its three dimensions: (1) clean slate, (2) super value and (3) technologically advanced products (Malodia *et al.*, 2020). Reverse innovations are *clean state* in nature because they follow a ground-up or bottom-up approach to design and develop a product to solve existing problems (Govindarajan and Trimble, 2012; Leavy, 2011). The characteristic of a clean state is well-supported by value innovation theory that requires firms to make a fresh start by looking beyond their existing capabilities and assets (Kim and Mauborgne, 1997). For example, firms designed a blanket called the "Embrace Baby Warmer", using a wax-like material that retains heat longer than a traditional photo-therapy bassinet (Malodia *et al.*, 2020). Clean state reverse innovations are more likely to succeed during adoption and diffusion phase (Borini *et al.*, 2012; Leavy, 2011). Clean slate is an effective way to serve underserved or unserved markets by using existing or new technology (Ali, 1994; Lee and Na, 1994). Therefore, clean slate innovations are perfect solutions for emerging markets and later appear in developed economies as reverse innovations (Govindarajan and Ramamurti, 2011; Leavy, 2011). Reverse innovations are considered *super value products* because these products provide superior benefits at a very low cost. Affordability is the central concern of innovations targeted at or originating from emerging markets (Angeli and Jaiswal, 2016; Gupta, 2020; Hossain *et al.*, 2016). In emerging markets, customers prefer and require affordable products that are adequate in meeting their basic needs (Bower and Christensen, 1995). According to Chan Kim and Mauborgne (2005), reverse innovations can lower client operational costs, offer greater functionality, or replace consumables with reusable components. Reverse innovations are technologically advanced because they leverage cutting-edge technology to make high-quality items at a cheaper cost than existing alternatives (Zeschky *et al.*, 2014). Reverse innovations are originally intended for emerging markets, stressing ease-of-use and operation. These solutions or products are

original, but they are well-supported by advanced technologies (Radjou *et al.*, 2012). It has been observed that most existing reverse innovations are based on disruptive or radical technologies (Archibugi and Filippetti, 2015). Furthermore, reverse innovations create novelty by developing advanced, affordable and standardized modular designs. Reverse innovations differ from mere cost innovations, due to their high performance and high-quality character, while still coming at low cost.

2.3.1 Link between entrepreneurial orientation and reverse innovation. Baker and Nelson (2005) proposed that When entrepreneurs face a challenging environment with limited resources and new opportunities, they (1) seek external resources, (2) avoid new challenges and remain inert and (3) combine resources to solve new problems and take advantage of opportunities. Those who choose the third option create super-value innovations by using limited resources creatively (Baker and Nelson, 2005; Ernst *et al.*, 2015; Halme *et al.*, 2012). For example, Singla *et al.* (2018) have argued that firms with limited resources may take risks and innovate to benefit their organization and community. From this argument, entrepreneurial enterprises may turn limited resources into cost-effective and innovative solutions. Entrepreneurial firms are more likely to employ resources creatively to reap prospective profits rather than do nothing and lose (Tversky and Kahneman, 1979). However, firms that have excessive resources take fewer risks (Cheng and Kesner, 1997) and maintain the status quo (Nohria and Gulati, 1996). Under these circumstances, managers have a higher propensity to avoid innovation.

It is also observed that EMNEs often face a situation of limited resources (Hobdari *et al.*, 2017). However, their entrepreneurial orientation may nonetheless help them to create breakthrough innovations. Entrepreneurial enterprises demonstrate ambition in competitive marketplaces and seek novel routes (Singla *et al.*, 2018). Hence, firms with higher entrepreneurial orientation can build competencies to successfully employ scarce resources, delivering innovative and efficient solutions (Wiklund and Shepherd, 2003). Also, to ease their resource constraints, they are more risk-taking and innovative. Consequently, they may be more able to exploit their seeking abilities to get new resources and opportunities, hence achieving a first-mover advantage (Alvarez and Busenitz, 2001; Zahra and Covin, 1995).

Based on the above arguments, this study proposes the following hypothesis:

H2. EMNEs with higher entrepreneurial orientation are more likely to be involved in reverse innovations, which are clean slate, super value and technologically advanced products.

2.3.2 Reverse innovation and international performance. Following up on our definition of international performance, we expect reverse innovation to drive international performance. At the more general level, firm performance refers to business achievements or success in terms of shareholder value, profitability and market share (Hult *et al.*, 2004) and the positive relationship between innovation and firm performance is well-documented in the literature (de Zubielqui *et al.*, 2019; Hamelink and Opdenakker, 2019).

Some observers have contended that EMNEs show many dependencies on the home country's advantages to gain international competitiveness (He *et al.*, 2019; Rugman, 2009). Others have argued that EMNEs only have "ordinary resources" (Madhok and Keyhani, 2012) with few intangible assets, like cutting-edge technology and brands, that may sustain long-term performance. In contrast, several authors have argued that EMNEs have a deep understanding of local customers' latent needs, expertise in manufacturing low-cost designs and a stronghold on distribution channels in their home markets (Guillen and Garcia-Canal, 2009; Lessard and Lucea, 2009; Williamson and Zeng, 2009; Ramamurti, 2012). All of these may be potential sources of competitive advantage in several "mid-tech" industries, both in local and international markets (Ramamurti, 2009; He *et al.*, 2019; Surdu and Narula, 2021).

Likewise, companies in China are motivated to do well internationally, so they are coming up with completely new ways to make products that are hard to copy both locally and internationally (Zeng and Williamson, 2007). Furthermore, He *et al.* (2019) reported that Chinese EMNEs with their innovation based on technological knowledge have contributed significantly to successful internationalization.

Sometimes, EMNEs at the forefront of an emerging industry may even be global first movers (Hobdari *et al.*, 2017; Ramamurti and Singh, 2009; Tan, 2017). Following either of the strategies, EMNEs are likely to trigger the reverse innovation process, which is followed by the international diffusion of these innovations. EMNEs can optimally adapt foreign technology for local markets, resulting in ultralow-cost products and services (Ramamurti, 2009). EMNEs have fewer market positions or assets to safeguard while innovating for the domestic market. Concerning DMNEs, EMNEs are quicker to make strategic decisions, allowing them to catalyze the diffusion of innovations (Surdu and Narula, 2021).

Compared to DMNEs, the EMNEs generally have products and services that are more suitable for emerging markets due to a closer relationship with client demands and preferences. Moreover, they feel comparatively more comfortable working in the challenging environment that usually prevails in emerging markets (Cuervo-Cazurra and Genc, 2008). Consequently, transferring innovation from one emerging market to another is not surprising because customers share needs and preferences like price-sensitivity and a desire for rugged, portable and easy-to-use products (Bang *et al.*, 2016). However, the diffusion of innovation from emerging markets to developed markets is perplexing at first glance. Yet, Govindarajan and Ramamurti (2011) have proposed five reasons behind the possible diffusion of innovation from emerging to developed markets. First, customers in developed markets cannot afford products at standard prices. Therefore, they may look for alternatives at ultralow prices (Hang *et al.*, 2010). Consequently, innovations in low-cost medical care, housing, or banking products and services may appeal to customers living in inner-city or rural areas of the developed countries. Second, products which have been developed as the ultralow cost for emerging markets can expand whole market demand in developed markets. The demand would be expanded because of the price elasticity effect when new versions are launched in developed markets at ultralow cost. Third, augmenting products for emerging markets requires the addition of new functionalities, like the ease-of-use or portability which can also create new applications in developed markets. For example, optimizing home appliances in terms of portability can appeal to at-home customers in developed markets. Consequently, improving existing products for emerging markets can boost sales in developed markets (Banerjee *et al.*, 2015; Govindarajan and Trimble, 2012). Fourth, some scholars contend that the technology of low-cost products may be enhanced over time until these products satisfy the high-end applications in developed markets (Christensen and Bower, 1996). Finally, EMNEs can also lead global innovations by adopting frontier technologies to leave behind legacy technologies (Surdu and Narula, 2021). For example, EMNEs like Suzlon Energy Limited and Goldwind Science and Technology Co., Ltd., among the global first movers in the energy sector, have revolutionized the energy sector by creatively utilizing non-conventional energy sources.

Therefore, reverse innovations which are carefully designed can open new growth opportunities by allowing firms to target emerging markets and then move innovation into developed economies (Borini *et al.*, 2012; Leavy, 2011; Zeschky *et al.*, 2014). Reverse innovations may enable firms to get a competitive advantage not only in their domestic markets in which these innovations are first introduced, but also in foreign markets, including other emerging markets and developed markets. Consequently, this study proposes a third and fourth hypothesis below. Figure 1 provides a conceptual model with the study.

H3. Reverse innovations have a positive effect on the international performance of EMNEs.

H4. Reverse innovation mediates the relationship between entrepreneurial orientation and international performance of EMNEs.

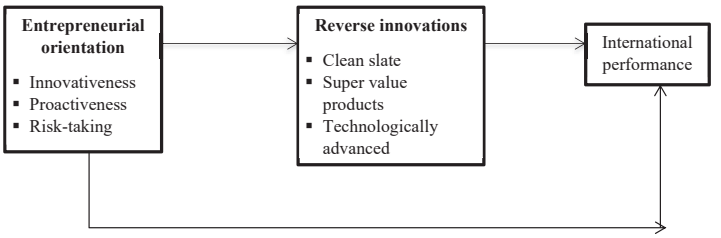

Figure 1.
Reverse innovation in the entrepreneurial orientation–international performance nexus

3. Methodology

3.1 Sample and data collection

We set out to test our hypotheses using an archival research design. Data was collected from the CSMAR to measure entrepreneurial orientation, reverse innovation and international performance. The CSMAR provides information on firms listed on Shanghai and Shenzhen stock markets. Shanghai stock exchange is the largest stock exchange in China where mostly listed companies are state-owned and larger firms. However, Shenzhen stock exchange is the smaller stock exchange including individual investors and private entrepreneurs. Due to our focus on both larger and smaller firms, we were able to reduce the bias towards large enterprises in the sample. The CSMAR database includes all industries, ranging from manufacturing to services and the agriculture industry. However, we focus on manufacturing industry data, because firms in the other industries (e.g. banking, retail) have limited patenting activities (Boeing *et al.*, 2016), and we use patenting activities as a proxy for reverse innovation. Hence, data on firms in the agricultural and service industry were not included. Furthermore, the database included a few firms which do not release the number of patents in their financial report, and these firms were therefore excluded from the analysis. We selected the period between 2010 and 2016 to determine the essential predictors of firm performance, including international performance, of Chinese firms. China's exports expanded throughout this time, although global economic downturns effected international performance before and after this period. After excluding the missing information, a final sample of 11,230 firm-year observations was obtained across seven years, pertaining to 1,708 firms.

3.2 Variables measurement

3.2.1 Entrepreneurial orientation. We measure entrepreneurial orientation by taking the sum of the standardized scores for innovativeness, proactiveness and risk-taking, an approach adopted from Miller and Le Breton–Miller (2011). In this regard, we reasoned that companies that engage extensively in product development and research are more innovative (Hall and Bagchi-Sen, 2002; Lee and O'neill, 2003). Hence, we measure innovativeness by dividing research and development (R&D) with total sales. Proactiveness displays firms' capacity to participate in proactive growth plans rather than retreat (Miller, 1983). This ability is best represented by firms' aggregate investment practices. Hence, proactiveness is measured by using the percentage of profits reinvested

by the firms each year. The percentage of annual earnings reinvested within the company or retained earnings is a common proxy used by several studies (Miller and Le Breton–Miller, 2011; Purkayastha and Gupta, 2022). The aggregated investment is a proportion of annual retained earnings. We chose retained earnings over investment practices in available capital or other expense categories because our study focuses on multiple industries where different strategies and investment patterns apply (Helfat, 2007). Also, taking only a measure of investment expenditures may rule out a company's building up resources to make bolder moves soon (Kaplan and Zingales, 1997). Specifically, proactiveness is measured using the retention ratio, which shows the percentage of retained net-income, i.e. not paid as dividends. Risk-taking will be measured by taking the standard deviation (SD) of the return on assets (ROA) (Wright *et al.*, 2007).

3.2.2 Reverse innovations. The proxy for the amount of reverse innovations is patent information, which will be assessed through the CSMAR database. The patent information is relatively new at CSMAR, and various studies use it to measure Chinese enterprises' innovativeness. There are three kinds of patents in China: design, utility and invention patents. According to Article 22 of the Chinese Patent law, an invention patent should have notable features and innovations. Invention patents are subject to extensive scrutiny and examination, whereas the other two are only registered instead of examined and granted (Lei *et al.*, 2012). Invention patents are perceived or judged as having higher standards than utility and design patents and are therefore treated as independent intellectual property in the literature (Lei *et al.*, 2012). Besides, Chinese firms are motivated to invent products and services to gain local competitive advantage and compete in international markets (Zeng and Williamson, 2007). Consequently, reverse innovations in this study will be measured by using exclusively invention patents. Generally, patent applications show only the beginning of the innovation process (i.e. invention), but they are still a proxy for innovative activity and an important indicator (Dziallas and Blind, 2019; Ervits, 2018).

Invention patent data has the advantage of safeguarding that some of the important criteria for reverse innovation are met in our measures. One of these is that the reverse innovation should be (potentially) of super value. Firms use patenting activities strategically to improve their competitive position, and hence, to (potentially) appropriate value from invention for a firm (Dziallas and Blind, 2019). The literature points out that particularly in high tech industries, patents may enable firms to evaluate their present and future competitiveness (Frietsch and Schmoch, 2006). Also, Invention patents represent major innovations that benefit the economy (Naughton, 2007). Another important aspect of a reverse innovation is that it should be technologically advanced, and several studies point out this quality in invention patent data, e.g.: "patents represent new technology" (Dziallas and Blind, 2019, p. 11). Furthermore, patents are considered among the most important innovation determinants that assess the technological capabilities of innovation systems (Freeman, 1982; Frietsch and Schmoch, 2006). An additional quality of the patent from the perspective of measuring reverse innovation, is that patents provide information is generally related to geographical location, i.e. it captures "where the novelty creation occurred" (Laurens *et al.*, 2015, p. 22). Patent statistics for EMNEs provide good evidence of competence-creating innovation activities originating from the home and for meeting international standards (Ervits, 2018). Notwithstanding the merits of patent data in measuring reverse innovation, in our analysis, we show how innovation fulfills a mediating role, because it is hard to establish exactly the nature of each patent. Yet a substantial part of these innovations is likely to be conceived of as a reverse innovation.

3.2.3 International performance. All behaviors covering firms' cross-border expansion can be used as criteria to measure firms' international performance and internationalization. These international activities include R&D and manufacturing in overseas markets (Hitt *et al.*, 1997). In this study, we will utilize overseas sales intensity (sales in overseas markets) as

a proxy for international performance, following previous studies (Hitt *et al.*, 1997; Lu and Beamish, 2004).

3.2.4 Control variables. Entrepreneurial orientation can be affected by a firm's age, size, board structure and specific financial variables. For instance, larger firms may have a different level of entrepreneurial orientation compared to smaller firms. Specifically, larger firms can easily access external resources and more slack resources (Zahra *et al.*, 2000). Therefore, we control for the effect of firm size by using the natural log of total assets (cf. Hashmi *et al.*, 2020). Besides, firm age is negatively related to valuation as we do not have much information about younger firms (Pástor and Pietro, 2003) and younger firms have greater tendency to grow (Evans, 1987). Moreover, corporate governance literature suggests that board size influences firm performance (Calabrò *et al.*, 2013). Hence, we control for the impacts of firm size and board size. Furthermore, profitability is usually a good determinant of organizations' ability to capture better rates of return (Connolly and Hirschey, 2005) and affects firm performance. Thus, we control for profitability indicators including Tobin's Q (TQ), a book to market ratio (BTMA), asset growth (AG), return on equity (ROE) and financial leverage. The study also controlled the effect of CEO duality because CEOs with dual positions may influence the decisions concerning identification, execution and negating the pursuit of entrepreneurial initiatives (Zahra *et al.*, 2000). We have also controlled for board independence, because independent directors are in a better position to govern management, influencing firm performance (Deb and Wiklund, 2017). Besides, we controlled for the effect of data year for its contemporaneous correlation which may be present, because of the use of panel data (Certo and Semadeni, 2006). Lastly, we use industry as a control variable in our model, because firms in different industries may represent different organizational characteristics, which can further affect their performance (Wiklund and Shepherd, 2005). Table 1 provides information about the variables used in our study.

Table 1. Operationalization of variables

Variables	Abbreviation	Measurement
Entrepreneurial orientation	–	The sum of the standardized scores for innovativeness, proactiveness, and risk-taking
Reverse innovations	–	The measurement of reverse innovations is done through patent information (i.e. number of patents)
International performance	–	Overseas revenue intensity = overseas sales revenue/total assets at year-end
Firm size	FS	Defined as the natural log of total assets
Firm age	Age	Number of years in industry
Board size	BS	The number of directors on the board
Independent director	ID	The firms will take at least 2 directors as independent directors
Tobin's Q	TQ	Tobin's Q is the percentage among a physical asset's market value and its additional value
Book to market ratio	BTMA	Book to market ratio of shareholders equity
Asset growth	AG	Asset Growth of the company is measured as the change in total assets
Return on assets	ROA	Total profit is a percentage of Total Assets
Return on equity	ROE	The ratio of total profit and percentage of equity
Board meeting	BM	The number of meetings in one-year time
CEO duality	DUAL	Dummy variable that equals to 1 if the CEO is working as an executive and 0 otherwise
Financial leverage	LEV	The ratio of total debt to the total asset
Year and industry	YI	To control the effect of year and industry, we included year and Industry dummies in all regressions

4. Findings

4.1 Descriptive statistics and correlation matrix

Table 2 provides information about the descriptive and correlation results. The mean value of entrepreneurial orientation is 0.04, for reverse innovation it is 17.4, and for international performance, it is 21.3. Also, the descriptive results related to firms' board structure show that on average, firms have nine board members, the number of independent directors is four, and the number of meetings held in a year is nine. 15% of the total Chinese A-share listed firms report CEO duality and the mean value of firm size is 23.192. Moreover, the mean values of the firms' specific financial features are as follows: TQ is 1.75, BTMA is 1.18, AG is 0.167, ROA is 0.043, ROE is 0.082, and financial leverage is 0.509. Besides descriptive statistics, Pearson correlation was calculated among the main and control variables to examine the initial relationship among variables and to identify the issue of multicollinearity. Table 2 reports that entrepreneurial orientation is positively correlated with both reverse innovations ($r = 0.079$, $p < 0.001$) and international performance ($r = 0.067$, $p < 0.001$). Also, reverse innovations are positively correlated with international performance ($r = 0.551$, $p < 0.001$). It can also be seen that there is no problem with multicollinearity as all correlations reported are less than 0.6 as recommended by Field (2013). To further examine the issue of multicollinearity, the variance inflation factor (VIF) is calculated. The value of VIF is 1.4, which is less than the recommended cutoff of 10 (Hair *et al.*, 2010).

4.2 Model estimation

This study followed the mediation methodology defined by Baron and Kenny (1986) to examine the hypotheses. In this regard, we performed the OLS regression on the following main econometric equations of this study.

$$International\ Performance_{i,t} = \beta_0 + \sum_{i=1}^{n} \beta_n F\_Control_{it} + \varepsilon_{it} \quad (1)$$

$$International\ Performance_{i,t} = \beta_0 + \beta_{1\text{entrepreneurial orientation}} + \sum_{i=1}^{n} \beta_n F\_Control_{it} + \varepsilon_{it} \quad (2)$$

$$Reverse\ Innovation_{i,t} = \beta_0 + \beta_{1\text{entrepreneurial orientation}} + \sum_{i=1}^{n} \beta_n F\_Control_{it} + \varepsilon_{it} \quad (3)$$

$$International\ Performance_{i,t} = \beta_0 + \beta_{1\text{entrepreneurial orientation}} + \beta_{2\text{Reverse innovation}} + \sum_{i=1}^{n} \beta_n F\_Control_{it} + \varepsilon_{it} \quad (4)$$

Three main conditions must hold to confirm the mediating role of reverse innovations (Baron and Kenny, 1986). First, the relationship between entrepreneurial orientation and international performance must be examined to assess the direct impact. Second, entrepreneurial orientation must influence reverse innovations. The third and final condition includes that reverse innovations should bring significant change within the international performance when international performance is regressed on both entrepreneurial orientation and reverse innovations. Table 3 provides results associated with our estimated models.

4.3 Hypothesis testing

Prior to the mediation analysis, we tested a model in which the control variables are related to international performance (Model 1).

Table 2.
Descriptive statistics and correlation

	Mean	SD	Min	Max	Entrepreneurial orientation	International performance	Reverse innovation	FS	BS	ID	TQ	BTMA	AG	ROE	BM	LEV	DUAL	Age
Entrepreneurial orientation	0.042	1.85	−14.83	32.00	1													
International performance	17.4	1.49	5.09	25.03	0.067**													
Reverse innovation	21.3	1.61	9.04	28.70	0.079**	0.551**												
FS	23.2	1.75	18.27	30.81	−0.201**	0.496**	0.859**											
BS	9.48	2.28	4.00	22.00	−0.089**	0.086**	0.312**	0.424**										
ID	3.49	0.84	1.00	8.00	−0.066**	0.176**	0.354**	0.454**	0.828**									
TQ	1.75	1.81	0.10	33.27	0.317**	−0.209**	−0.440**	−0.493**	−0.165**	−0.152**								
BTMA	1.18	1.15	0.03	10.33	−0.299**	0.254**	0.516**	0.612**	0.101**	0.148**	−0.516**							
AG	0.167	0.34	−0.83	10.89	0.108**	0.003	−0.043*	−0.012	−0.024	−0.022	0.095**	−0.041**						
ROE	0.082	0.82	−18.57	43.61	0.151**	0.016	0.013	0.025	−0.003	−0.007	0.046**	−0.032*	0.021					
BM	10.2	4.79	1.00	57.00	−0.004	0.044*	0.110**	0.177**	−0.002	0.030*	−0.107**	0.195**	0.095**	−0.012				
LEV	0.509	0.215	0.01	1.34	−0.322**	0.209**	0.530**	0.610**	0.260**	0.269**	−0.507**	0.615**	−0.037*	−0.003	0.207**			
DUAL	0.156	0.36	0.00	1.00	0.129**	−0.002	−0.128**	−0.127**	−0.146**	−0.097**	0.134**	−0.103**	0.072**	0.006	0.008	−0.125**		
Age	2.62	0.46	−1.00	49.00	−0.148**	0.024**	0.087**	0.121**	0.067**	0.001	−0.087**	0.058**	−0.108**	0.000	0.103**	0.175**	−0.026	

Note(s): *, **, ***, significant at 10%, 5%, and 1%, respectively

Table 3. Influence of entrepreneurial orientation on international performance through reverse innovation

	Model 1 (International performance)		Model 2 (International performance)		Model 3 (reverse innovations)		Model 4 (International performance)	
	β	p-value	β	p-value	β	p-value	β	p-value
Entrepreneurial orientation	–	–	0.09 (3.21)	0.002	0.046 (5)	0.000	0.077 (2.99)	0.003
Reverse innovations	–	–	–	–	–	–	0.980 (12.2)	0.000
FS	0.81 (23.16)	0.00	0.87 (16.4)	0.000	1.02 (59.3)	0.000	−0.10 (−1.02)	0.30
BS	−0.09 (−3.06)	0.41	−0.03 (−0.92)	0.357	0.01 (0.591)	0.554	−0.03 (−0.70)	0.48
ID	0.16 (1.96)	0.56	0.07 (0.68)	0.493	−0.05 (−1.34)	0.207	0.07 (0.66)	0.50
TQ	0.03 (1.08)	0.59	0.014 (0.43)	0.662	−0.01 (−0.68)	0.495	0.04 (1.48)	0.13
BTMA	−0.22 (−4.34)	0.00	−0.28 (−3.45)	0.001	−0.13 (−5.71)	0.000	−0.22 (−2.86)	0.00
AG	0.05 (0.50)	0.88	0.01 (0.053)	0.958	−0.25 (−5.26)	0.000	0.22 (2.05)	0.04
ROE	−0.06 (−0.40)	0.34	−0.20 (−1.15)	0.249	−0.04 (−0.60)	0.544	−0.15 (−0.90)	0.36
BM	−0.03 (−3.00)	0.00	−0.04 (−3.52)	0.000	−0.02 (−6.53)	0.000	−0.03 (−2.44)	0.01
LEV	−0.18 (−0.72)	0.51	−0.10 (−0.283)	0.777	0.83 (7.30)	0.000	−0.62 (−1.82)	0.06
DUAL	0.28 (2.98)	0.02	0.32 (2.47)	0.014	−0.09 (−1.98)	0.048	0.36 (2.89)	0.00
Age	−0.04 (−5.03)	0.00	−0.44 (−3.27)	0.001	−0.23 (−4.67)	0.000	−0.49 (−3.54)	0.00
(Constant)	0.87		0.09 (0.085)	0.932	−0.44 (−1.26)	0.206	0.58 (0.54)	0.84
F-values	74.89		44.1		562.8		44.20	
Adj-R^2	0.300		0.306		0.82		0.40	

Note(s): t-statistics are reported in parentheses

4.3.1 Entrepreneurial orientation and international performance. Model 2 is employed to examine H1. The hypothesis is supported, as the coefficient of entrepreneurial orientation in Model 2 is positive and significant ($\beta = 0.09$, $t > 2$, $p < 0.01$). In the context of emerging markets, firms have greater propensity to take risks, remain vigilant about international opportunities, and creative while using the limited resources (Bonaglia *et al.*, 2007; Yamakawa *et al.*, 2008), influencing their international performance.

4.3.2 Entrepreneurial orientation and reverse innovation. Model 3 is used to examine H2. Hypothesis 2 is supported as the coefficient of entrepreneurial orientation in model 3 is positive and significant ($\beta = 0.046$, $t > 2$, $p < 0.01$). According to dynamic capability theory (Liao *et al.*, 2009), firms can innovate in a rapidly changing environment by integrating, building and reconfiguring internal and external competencies. Similarly, our finding suggests that innovative, proactive and risk-taking firms can engage in reverse innovation. Since the transition in the Chinese economy, firms have shown a greater tendency to take risks and are more motivated to engage in innovative projects (Li *et al.*, 2009). This characteristic is well-matched with the firms in emerging economies with a high entrepreneurial orientation level. Hence, firms with a higher entrepreneurial orientation are more likely to engage in breakthrough innovations (Tan, 2001).

4.3.3 Reverse innovation and international performance. Model 4 is developed to examine H3. It is supported as the coefficient of reverse innovations is positive and significant ($\beta = 0.98$, $t > 2$, $p < 0.01$). Findings show that firms involved in reverse innovations are in the best position to perform well globally. According to Govindarajan and Ramamurti (2011), reverse innovations are used to handle emerging customer needs, gain a competitive advantage and enter similar emerging and developed markets. Zeschky *et al.* (2014) argue that reverse innovations can help firms grow by allowing them to target emerging markets and then move into developed countries. Besides, we compare the effects of entrepreneurial orientation and reverse innovation on international performance. In this regard, we conducted variance decomposition analysis through EViews. A variance decomposition analysis indicated that in all periods entrepreneurial orientation is responsible for a larger part of the variance in international performance than reverse innovation.

4.3.4 Test of mediation. To test H4, in which we assume that reverse innovations mediate the relationship between entrepreneurial orientation and international performance, model 2 and model 4 from Table 3 are assessed. First, international performance is regressed on entrepreneurial orientation in model 2 to determine the direct impact of entrepreneurial orientation on international performance. The results indicate that entrepreneurial orientation has a positive and significant influence on international performance ($\beta = 0.09$, $t > 2$, $p < 0.01$). Furthermore, both entrepreneurial orientation and reverse innovations are regressed against international performance in model 4 to determine the mediating role of reverse innovations. The results identify that both entrepreneurial orientation ($\beta = 0.077$) and reverse innovations ($\beta = 0.98$) are positively and significantly related to international performance with $t > 2$ and $p < 0.01$. Hence, it satisfies H4 by confirming the partial mediation of reverse innovations among entrepreneurial orientation and international performance.

4.4 Endogeneity tests

Although this study has controlled for firms' age and size, variables associated with board structure and other important firm-specific variables, the problem of endogeneity can be raised if there is a significant correlation among the main independent variables and regression residuals. To address endogeneity, we follow the method of alternative models (Wooldridge, 2010). First, we used one-year lagged values of entrepreneurial orientation as firms take some time to translate its capabilities into outcomes. Table 4 shows that the β-coefficient from entrepreneurial orientation to international performance is positive and

Table 4. Endogeneity results

	Model 1 (International performance)		Model 2 (reverse innovations)		Model 3 (International performance)		Model 4 (International performance)		Model 5 (reverse innovation)		Model 6 (International performance)	
	β	p-value	β	p-value	β	p-value	β	p-value	β	p-value	β	p-value
Entrepreneurial orientation	1.76 (18.14)	0.000	0.429 (5.62)	0.000	1.59 (17.2)	0.000	2.02 (5.78)	0.000	0.115 (4.48)	0.000	1.72 (5.16)	0.000
Reverse innovations	–	–	–	–	0.382 (43.8)	0.000	–	–	–	–	2.67 (2.71)	0.007
FS	0.251(13.5)	0.000	0.213 (14.7)	0.000	0.169 (9.57)	0.000	0.988 (7.10)	0.000	1.01 (58.2)	0.000	−1.70 (−1.70)	0.089
BS	−0.393 (−3.94)	0.000	−0.533 (−6.81)	0.000	−0.189 (−1.99)	0.046	0.06 (0.58)	0.564	0.012 (0.88)	0.381	0.059 (0.60)	0.549
ID	0.036 (0.132)	0.895	0.418 (1.92)	0.055	−0.123 (−0.467)	0.641	0.002 (0.01)	0.999	−0.051 (−1.40)	0.162	0.025 (0.10)	0.924
TQ	0.388 (4.69)	0.000	−0.415 (−6.39)	0.000	0.547 (6.927)	0.000	−0.173 (1.94)	0.052	−0.017 (−1.49)	0.137	−0.085 (−0.99)	0.323
BTMA	0.514 (4.05)	0.000	0.609 (6.11)	0.000	0.281 (2.32)	0.020	0.232 (1.01)	0.310	−0.106 (−4.53)	0.000	0.383 (1.80)	0.072
AG	−0.289 (−0.715)	0.474	−1.23 (−3.90)	0.000	0.185 (0.479)	0.632	−0.145 (−0.49)	0.621	−0.238 (−5.25)	0.000	0.376 (1.15)	0.250
ROE	−0.042 (−0.141)	0.888	0.055 (0.236)	0.814	−0.062 (−0.222)	0.824	−0.379 (−0.84)	0.401	−0.034 (−0.45)	0.651	−0.197 (−0.48)	0.631
BM	−0.001 (−0.038)	0.970	−0.067 (−3.19)	0.001	0.025 (0.964)	0.335	−0.114 (−3.62)	0.000	−0.024 (−6.86)	0.000	−0.058 (−1.66)	0.096
LEV	−8.01 (−10.9)	0.000	0.548 (0.953)	0.341	−8.22 (−11.7)	0.000	−1.08 (−1.17)	0.241	0.853 (7.37)	0.000	−2.76 (−2.66)	0.008
DUAL	1.144 (3.07)	0.002	−0.020 (−0.067)	0.946	1.15 (3.23)	0.001	−0.237 (−0.68)	0.496	−0.101 (−2.23)	0.026	0.031 (0.09)	0.925
Age	1.84 (23.9)	0.000	4.275 (70.5)	0.000	0.211 (2.56)	0.010	−0.299 (−0.79)	0.428	−0.221 (−4.45)	0.000	−0.021 (−0.06)	0.925
(Constant)	5.571 (27.8)	0.932	7.44 (47.4)	0.000	2.72 (13.54)	0.000	−2.58 (−0.89)	0.375	−0.391 (−1.06)	0.000	−1.31 (−0.49)	0.621
F-values	114.3		489.6		254.1							
Adj-R^2	0.070		0.247		0.155							
WaldChi2							95.5		125.8		922	

Note(s): t-statistics are reported in parenthesis

significant in model 1($\beta = 1.76$, $p < 0.001$), model 2 ($\beta = 0.429$, $p < 0.001$) and in model 3 ($\beta = 1.59$, $p < 0.001$). In addition, the β-coefficient of reverse innovations in model 3 is positive and significant ($\beta = 0.382$, $p < 0.001$), which supports our main results. Also, the F-statistics in Table 4 show that F-value is greater than the threshold value of 10, confirming the relevance condition of good instrumental variable (Güntner *et al.*, 2020). Second, we employed two-stage least square (TSLS) method. In 2-SLS, the instrumental variable should be correlated with the independent variable but it must not be correlated with the dependent variable. We took the lag value of the entrepreneurial orientation as an instrument variable that is expected to meet the standard that it is not correlated with the international performance. Table 4 shows that β-coefficient of entrepreneurial orientation is positive and significant in model 4 ($\beta = 2.02$, $p < 0.001$), model 5 ($\beta = 1.15$, $p < 0.001$) and in model 6 ($\beta = 1.72$, $p < 0.001$). Furthermore, the coefficient of reverse innovations ($\beta = 2.76$) in model 6 is also significant with $t > 2$ and $p < 0.001$. Hence, these results confirm our main study findings.

5. Conclusion

The role of firms' entrepreneurial orientation as an important predictor of international performance is widely acknowledged (Child *et al.*, 2017; Knight and Cavusgil, 2004), but few studies have investigated the mechanisms via which entrepreneurial orientation leads to international performance. In fact, the literature has been criticized for its inadequacy and nascent theoretical explanation of performance implications of entrepreneurial orientation (Linton and Kask, 2017; Wales, 2016). Advocates of entrepreneurship research have stressed the need for further examination of the entrepreneurial orientation–international performance link by considering mediating elements (Li *et al.*, 2009; Wiklund and Shepherd, 2005). Our findings show that although the entrepreneurial orientation is indeed fundamental in enhancing international performance, and this relationship is mediated through the role of reverse innovations. Entrepreneurial orientation of firms in terms of innovativeness, proactiveness and risk-taking is positively associated with reverse innovation. Also, we could show that firms' involvement in reverse innovations in emerging markets enhances their international performance. In the end, the mediation results show that reverse innovations partially bridge the relationship between entrepreneurial orientation and international performance, as entrepreneurial orientation also has a positive direct effect on international performance.

5.1 Theoretical implications

Our findings have implications for theorizing about both the causes and consequences of reverse innovation. In general, the findings affirm that the role of innovation by EMNEs cannot be ignored, especially in the case of an emerging economy where companies either locally or internationally are doing several breakthrough projects that might turn out to be reverse innovations (Govindarajan and Ramamurti, 2011). Though reverse innovation is a relatively new concept, it is gaining much attention among researchers (Hadengue *et al.*, 2017; Malodia *et al.*, 2020; Govindarajan and Trimble, 2012). Yet prior to this study several questions about causes and consequences remained unaddressed.

5.1.1 Reverse innovation and international performance. Examples of reverse innovation are numerous. However, this study empirically examines the importance of reverse innovation to EMNEs' international performance. In other words, it answers in a more generalizable way than previous research the question of whether and what firms stand to gain from doing reverse innovation. Regarding the consequences of reverse innovation, our findings have been able to validate propositions in Malodia *et al.* (2020) related to the tangible outcomes of reverse innovation. Indeed, we can show that reverse innovation has effects on international

performance, and we infer that reverse innovation is therefore an impetus for global competitiveness of EMNEs. This finding supports the idea that reverse innovations give competitive advantages across global markets. That is, they give EMNEs a unique value proposition toward developed market consumers, that is of a high-quality and technologically advanced (Zeschky *et al.*, 2014), while at the same time more affordable than existing value propositions in the market (Angeli and Jaiswal, 2016; Gupta, 2020; Hossain *et al.*, 2016). In fact, this is the kind of value proposition that is highly sought after in developed markets, as these (too) face grand challenges that cannot be addressed by maintaining the status quo (George *et al.*, 2016). For instance, Malodia *et al.* (2020) discuss the example of developed market health care policies that call for more affordable ways to deliver high quality health care in the future and argue how reverse innovations are in a position to contribute to that goal.

5.1.2 Entrepreneurial orientation and reverse innovation. Many studies have shown examples of reverse innovation, but there is little understanding of reverse innovation drivers (Hussler and Burger-Helmchen, 2020). Having just established in this study that reverse innovation may indeed benefit international performance, only serves to underline the relevance of having knowledge on how to become successful at it. Regarding antecedents of reverse innovation, we were able to theorize about entrepreneurial orientation as a driver of reverse innovation and test related hypotheses. In doing so, we could rely on a well-established body of literature about entrepreneurial orientation effects on international performance. In this regard, this study contributes empirically and conceptually to the literature on reverse innovation by moving beyond recent advances that conceptualized reverse innovation antecedents (Hussler and Burger-Helmchen, 2020; Malodia *et al.*, 2020). These studies had already put forward several potential antecedents, such as customer-related (e.g. understanding unique customer needs) and firm-related (e.g. local responsiveness) antecedents. Entrepreneurial orientation has not been studied in this regard, but we believe it links to prior conceptualizations. Entrepreneurial orientation has firm- and customer-related benefits. For example, proactiveness may help firms understand local/emerging and developed market customers' needs, while innovativeness may capture firms' recombinant abilities to tailor emerging market solutions to developed markets. Our findings thus expand understanding of reverse innovation antecedents.

5.2 Managerial implications

This study contributes to practice and policy in three major ways. First, our findings emphasize that entrepreneurial orientation of firms and entrepreneurial culture within EMNEs can allow managers to reap benefits both in terms of reverse innovation and international performance. Entrepreneurial orientation helps firms become more responsive and agile while handling emerging customer needs, resulting in innovations they can export to developed countries. Second, given the evidence that reverse innovation positively affects international performance and acknowledge that now is the time that developed marker consumers are looking for super-efficient and low-cost products, is it advisable that EMNEs put to practice strategies for reverse innovation. Third, policy makers may devise of ways through which government can accommodate firms' innovations to reach global markets without facing export barriers like high customs and embargoes. In terms of softer policy measures, organizing international trade events may help EMNEs to promote and route their innovations to other emerging markets and developed markets.

5.3 Limitations

The study also has its limitations. First, our analysis uses 2010–2016 data, which may not reflect current reverse innovation tendencies. Relatedly, it uses exclusively secondary data, whereas primary data might help researchers capture the reverse nature of innovations.

Therefore, future studies may seek to test our model with another type of data, such as primary data and especially quantitative data, as research on reverse innovation has been mostly qualitative (e.g. Malodia *et al.*, 2020; Govindarajan and Trimble, 2012). Second, reverse innovation is a rather new concept and needs more research attention as far as its measurement is concerned. Although Malodia *et al.* (2020) have made a pioneer effort to conceptualize and identify some important dimensions that can be used for measurement, several validity issues remain. Future studies could focus on scale development for reverse innovation, which could be used to measure the concept using primary data. The invention patent data used in our study gives considerable confidence that ideation and development originated in an emerging market (e.g. Ervits, 2018; USPTO, 2021), yet primary data could help capture where these innovations were then introduced to markets to fully understand the flow of innovation (Von Zedtwitz *et al.*, 2015). Finally, the entrepreneurial orientation lag value only meets the relevance condition of a good instrumental variable. We need a variable that meets relevance, exogeneity and exclusion. However, finding a truly exogenous instrument was not feasible. Future studies should ensure that they include potential instrumental variables on board within their survey design to avoid this issue.

5.4 Future research directions

Theoretically, our study suggests several future research directions. This study focused on firm-level entrepreneurial orientation and did not examine individual- or team-level entrepreneurial orientation (e.g. Covin *et al.*, 2020), which leaves a theoretical gap in our understanding of the entrepreneurial orientation–reverse innovations relationship. Hence, future research is suggested to examine the relationship between individual and team-level entrepreneurial orientation and factors shaping reverse innovation. Also, our study reveals the partial mediation of reverse innovation between entrepreneurial orientation and international performance. Hence, it shows that some other potential mediators can be further explored while analyzing the link between entrepreneurial orientation and international performance (e.g. opportunity exploitation and exploration; Asemokha *et al.*, 2019). Furthermore, while our study sheds light on tangible consequences of doing reverse innovation, it leaves room to test propositions made in previous research about its effects on intangible outcomes, such as firm learning (Malodia *et al.*, 2020). Finally, the relationship between entrepreneurial orientation and reverse innovation is unlikely to be unconditional and universal. Different contexts may influence this relationship. For example, the institutional environment of a particular country may induce firms to explore their entrepreneurial abilities to get an advantage in their home country, as well as to position themselves abroad in a competitive way (Marano *et al.*, 2017).

Note

1. We thank an anonymous reviewer for pointing out that regarding the related dependent variable of international scope (i.e. the number of countries in which a firm serves markets), studies find an inverse U-shaped relationship (Dai *et al.*, 2014). This effect can be explained, because attaining scope calls for firms to at least spread risks to some degree, rather than put at stake everything to enter a limited amount of markets. The present study is focussed on international performance defined as firms' operational success at international levels (cf. Knight and Cavusgil, 2004). Therefore, we hypothesize a positive effect for risk-taking.

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