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Disentangling the Effects of Business Groups in the Innovation-Export Relationship

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Abstract

This paper examines the role of business groups (BGs) in the relationship between innovation and exports. In the light of the divergent theoretical predictions on the role of BGs, we develop hypotheses that are explicitly based on the institutional context of emerging economies. By analyzing the institutional pressures under which BGs shape their strategies and operations, we formulate hypotheses on the effect of BG affiliation on exports, and the impact of innovation on exports. Empirical results, based on a large sample of Chinese manufacturing firms during the period of 1998-2007, show that both innovation and BG affiliation have a positive effect on exports, although BG affiliation weakens the positive value of innovation to exports. These findings are robust in different specifications. This paper highlights the complex role played by BGs, which needs to be understood in the context of institutions.

Key words: Innovation, Firm export performance, Business group (BG), China

JEL classification: F23, O31, D22

1. Introduction

As widely recognized growth strategies, innovation and exporting have been two major topics of research. There is a considerable body of work assessing the impact of innovation on firm exports (see a summary of studies in Table A1). Much of the literature has been anchored in the resource-based view (RBV) which regards the firm as an idiosyncratic bundle of resources that confer an enduring competitive advantage (Chabowski et al., 2018). Innovation contributes to firm exports directly through the provision of new or improved goods and services, and indirectly through altering a firm's existing set of resources and capabilities (Love and Roper, 2015). Despite theoretical consensus on the positive impact of innovation on firm exports, empirical findings are mixed. In particular, most studies focus on developed countries and only a few account for the firm heterogeneity associated with the institutional setting of a country (see Table A1). This is an important research gap because emerging economy firms (EMFs) have become important players in international markets, despite experiencing weak resource bases and institutional voids at home, which challenges "the conventional views on the weak competitiveness of EMFs" (Jormanainen and Koveshnikov, 2012, p. 692). This paper aims to advance this research stream by paying particular attention to the role of business groups (BGs).

BGs typically consist of legally independent firms, usually operating in multiproduct and multiple markets, which are bound together by persistent formal and informal ties (Khanna and Rivkin, 2001). They exist in both advanced and emerging economies and have received extensive attention in the fields of business history, development studies, economics, finance, strategy and management (Carney et al., 2018; Carney et al., 2017; Zhang et al., 2016). However, investigations into their internationalization, which include exporting as well as foreign direct investment (FDI) and international strategic alliances, are more recent. As noted by Holmes et al. (2018), "whether the business group form provides advantages or disadvantages in increasingly dynamic and innovative international markets, however, remains an open question" (p. 135). This paper aims to respond to this question by examining the direct effect of BG affiliation on firm exports and its moderating effect in the innovation-exporting relationship.

The core thesis of the paper is that firms require innovation to leverage their resources and capabilities for exporting and the value of innovation to exporting depends on whether they are affiliated with BGs. BGs can generate opposing forces, and therefore have offsetting influences (Carney et al., 2018; Holmes et al., 2018). Ex ante, the effects of BGs would be inconclusive without explicitly accounting for the institutional context (Khanna and Palepu, 1997). Under state capitalism, which is a key feature of emerging economies (Carney et al., 2018; Hu et al., 2019; Shinkle and Kriauciunas, 2010; Tajeddin and Carney, 2019), BG-affiliated firms (GAFs) seek legitimacy by complying with government mandates. Therefore, the interplay between the BGs, institutional pressures and a firm's strategies in response to institutional pressures is critical for understanding the role of BGs (Carney et al., 2018). Integrating RBV and the institutional perspective, we hypothesize positive effects of BG affiliation on firm export performance, but the negative moderating effects on the innovation-export relationship.

The empirical testing of the hypotheses is based on a large sample of Chinese manufacturing firms from 1998-2007. Relative to other countries' business groups such as Japan's *keiretsus* and *zaibatsu*, South Korea's *chaebols*, India's *business houses*, Russia's *oligarchs* and Latin America's *grupos*, the examination of BGs in China is more recent (e.g. Carney et al., 2015; Choi et al., 2011; He et al., 2013; Hu et al., 2019; Keister, 1998; Lee and Jin, 2009; Lee and Kang, 2010; White et al., 2008; Yiu et al., 2005). Appendix A presents an overview of BGs in China. Although Chinese BGs have only emerged since the late 1980s, their significance in the socio-economic landscape has been well established and a substantial number have succeeded in becoming major players in the global economy (Lee and Kang, 2010; Zhang et al., 2016). Chinese BGs are unique, as their formation and evolution reflect China's own institutional changes since opening up in 1978 (Carney et al., 2015; Keister, 1998; Lee and Jin, 2009; White et al., 2008). They also share similarities with other countries' BGs in terms of their governance structure and complexities. China, therefore, is an interesting research setting in which to study the interface between BGs, innovation and exports.

This paper seeks to make two contributions to the literature on innovation, exports and BGs. To the best of our knowledge, it is one of the first to document and explicitly conceptualize the relationship between BGs, innovation and firm exports. We challenge the premise in prior innovation-export literature that innovation is of equal value to firms with different institutional traits. In the light of divergent theoretical predictions on the role of BGs (Holmes et al., 2018; Khanna and Yafeh, 2007; Yaprak and Karademir, 2010), we develop hypotheses that are explicitly based on the institutional context of emerging economies. By analyzing the institutional pressures under which BGs shape their strategies and operations, we are able to formulate dominant hypotheses on the direct and the moderating impact of BG affiliation on firm exports. This paper's second contribution is context-specific. Given that China is a leading exporter and innovator, and that it aims to base international competitiveness on innovation, it is surprising that so few studies have examined the innovation-export linkage in China, let alone the role of BGs in this linkage. In view of the economic dominance of BGs in China, this research should be of scholarly and practical value to researchers and practitioners who have an interest in China's BGs and their role in innovation and export. More broadly, given the prevalence of business groups in other countries, we expect the evidence revealed for China to be of relevance to other emerging economies.

The rest of the paper is organized as follows. Section 2 provides a literature review and hypothesis development. We start with a review of the relationship between innovation and exports, which has been widely investigated in the literature. We then take stock of the empirical studies through a systematic literature search process (see Appendix B). Empirical evidence is dispersed and discordant, which calls for further consideration of the firm heterogeneity associated with the institutional setting of the country, e.g. BG. We will develop hypotheses on BGs explicitly keeping the emerging economy context in view. Section 3 discusses data and methodology. Section 4 presents empirical findings. Section 5 concludes.

2. Literature Review and Hypothesis Development

2.1. Innovation and Exports

Much of the export literature has been anchored in RBV which views resources as the cornerstone to sustaining a firm's competitive advantage (Barney, 1991; Boso et al., 2013; Chabowski et al., 2018; Saridakis et al., 2019; Singh, 2009; Wang and Ma, 2018). Emphasizing a firm's capability to accumulate, combine and deploy resources, RBV explains how heterogeneity in resources can lead to inter-firm differences in exporting. In a changing environment that defines export markets, firms must continuously develop and upgrade their resources and capabilities, which makes innovation a strategic priority.

The benefits of innovation for exporting are recognized as including the development of differentiated products and services, improving quality, reducing costs and adjusting internal structures to respond to technological changes and environmental uncertainty, thereby giving rise to competitive advantages and market power, and facilitating a firm's entry into, and expansion within, export markets (Azar and Ciabuschi, 2017; Caldera, 2010; Cassiman et al., 2010; Damijan et al., 2010; Filipescu et al., 2013; Golovko and Valentini, 2011; Yi et al., 2013). Additionally, innovating firms have stronger incentives to explore export markets than non-innovating firms (Pla-Barber and Alegre, 2007). Innovation is costly and risky, and the desired output is not always guaranteed. However, once innovation results in new or modified outputs, or in improved product quality, their use in more than one market is of little or no marginal cost. Therefore, innovators can be motivated to spread the fixed costs of innovation over increased sales in export markets.

From the RBV perspective, innovation is a cumulative process through which a firm's internal resources and capabilities can be developed and improved (Filatotchev et al., 2009; Filipescu et al., 2013; Golovko and Valentini, 2011). Exporting entails significant costs and risks, including the costs of developing suitable products and packaging for export markets, establishing export channels, transportation, dealing with export-specific administrative functions and accumulating information on export-market demand (Golovko and Valentini, 2011; Manova et al., 2015). As a result of innovation, stronger capabilities and valuable knowledge can help firms to manage export costs and to respond to rapid changes in the global marketplace (Guan and Ma, 2003). The above theoretical discussions point to the following hypothesis:

H1: There is a positive association between innovation and exports.

Despite the theoretical consensus on the positive impact of innovation on a firm's exports, empirical evidence is mixed. We systematically review the literature and present the literature search processes in Appendix B. Table A1 summaries the empirical findings. Overall, many studies report evidence of positive effects of innovation on exports, despite the use of different measures for innovation and export performance, and sample firms in different countries. But a number of studies have found a statistically insignificant relationship between innovation and firm exports (e.g. Ayllon and Radicic, 2019; Castellacci and Fevolden, 2014; Damijan et al., 2010; Faustino and Matos, 2015; Lefebvre et al., 1998; Van Beveren and Vandenbussche, 2010; Willmore, 1992) and some have revealed a negative relationship (e.g. Papalia et al., 2018; Rialp-Criado and Komochkoya, 2017; Roper and Love, 2002; Tavassoli, 2018; Wakelin, 1998). Specific to China, findings vary in the seven studies identified in Table A1 (Filatotchev et al., 2009; Fu, 2011; Guan and Ma, 2003; Rialp-Criado and Komochkoya, 2017; Yi et al., 2013; Yuan et al., 2015; Zhang and Zhu, 2016). A possible reason for the

inconclusive evidence is that firm heterogeneity associated with the institutional setting of the country, e.g. BG affiliation, matters.

A growing body of literature has recognized the systematic differences between GAFs and stand-alone firms (SAFs), but what role BG affiliation plays in the impact of innovation on firm exports is an under-researched topic (Carney et al., 2011; Holmes et al., 2018; Yaprak and Karademir, 2010). Table A1 reveals that only a small proportion of the empirical studies (7 out of 108) have explicitly considered BG, and there is only one study (Yi et al., 2013) on China. Extending the research stream on BGs, we will discuss below how BG affiliation affects firm exports, both directly and indirectly, through its conditioning effect on the relationship between innovation and firm exports.

Before we proceed further, it is worth mentioning that the direction of causality between exports and innovation is an issue of debate in the extant literature (e.g. Cassiman and Golovko, 2011; Filipescu et al., 2013; Golovko and Valentini, 2011; Lachenmaier and Wößmann, 2006; Monreal-Pérez et al., 2012). The so-called "learning-by-exporting" hypothesis remarks on the expected positive impact of exports on innovation (Caldera, 2010; Ganotakis and Love, 2011; Golovko and Valentini, 2011; Mancusi et al., 2018; Papalia et al., 2018). Exporting provides firms with a channel to access a new, and often a better stock of knowledge and ideas, that can enhance innovation and provide new experiential learning encounters. Additionally, exporters are exposed to more intense competition which gives them the incentive to innovate more than non-exporters. Despite the centrality of endogeneity in the nexus of the innovation-exports relationship, as shown in Table A1, less than half of the empirical studies (50 out of 108 papers included in our review) explicitly account for the potential endogeneity of innovation. The inadequacy of appreciating and addressing endogeneity is likely to result in inconsistent estimates and incorrect inferences, leading to inappropriate interpretations and misleading conclusions which eventually could seriously affect the outcomes of strategic decisions (Bascle, 2008). In the empirical section, we will explain our strategies for addressing the endogeneity concern.

2.2. BG Affiliation, Innovation and Exports in an Emerging-Economy Context

A commonly accepted definition provided by Khanna and Rivkin (2001) describes a business group as "a set of firms which, though legally independent, are bound together by a constellation of formal and informal ties and are accustomed to taking coordinated actions" (p. 47). BGs are prevalent in both developed and emerging economies and remain the dominant form of enterprises in emerging economies as a response to institutional voids (Carney et al., 2018; Holmes et al., 2018; Khanna and Yafeh, 2007; Yaprak and Karademir, 2010; Yiu et al., 2005).

The extant literature has linked BGs to both positives and negatives (Carney et al., 2018; Holmes et al., 2018; Khanna and Yafeh, 2007; Yaprak and Karademir, 2010). On the positive side, BGs serve a gap-filling function (i.e. filling the institutional voids through internal markets) and a coalition function (i.e. collectively coordinating activities to enhance economic welfare) (Holmes et al., 2018). GAFs can utilize the internal market within the business group for business transactions and network building, which allows them access to scarce

resources including capital, labor and raw materials, better coordination of production factors, development and utilization of group-specific human capital and knowledge collectively (which can be used across affiliated firms) and economies of scope in terms of R&D, marketing and other functional areas in the case of related business (Chang et al., 2006; Gaur and Kumar, 2009; Khanna and Yafeh, 2007; Mahmood and Mitchell, 2004).

On the negative side, BGs often have complex ownership arrangements which pose unique governance challenges (Choi et al., 2011; Hu et al., 2019; Morck et al., 2005). GAFs may face principal-principal agency problems that arise because of conflicts of interest between controlling shareholders and minority shareholders. Controlling shareholders may also engage in tunneling, i.e. moving profits from firms in which they have low cash-flow rights to those in which they have high cash-flow rights. Certain GAFs may have to absorb the losses of non-performing members of the group. Second, inequity and nepotism in BGs can have detrimental effects on managerial and scientific talents, not only in terms of their development but also in terms of retention (Chittoor et al., 2009). Third, the close ties between BGs and their home-country government could lead to rent-seeking (Khanna and Yafeh, 2007). Finally, GAFs may be locked in their organizational routines and bureaucratic constraints. BG affiliation can make managers complacent and as a result, suboptimal decisions may be made, reflecting organizational inertia, leading GAFs to operate less efficiently (Chittoor et al., 2009; Khanna and Rivkin, 2001).

Collectively, the points above, and the paucity of evidence, emphasize the need for further theoretical and empirical analysis on the role of BGs in firm innovation and internationalization (Carney et al., 2018; Carney et al., 2011; Holmes et al., 2018; Yaprak and Karademir, 2010). The growth and internationalization of BGs has given rise to a recent set of studies. Our systematic review of the literature on the relationship between BGs and internationalization (which includes not only exports but also other entry modes such as FDI) shows mixed empirical evidence (see a summary of empirical findings in Table A2). This calls for a conceptualization of the relationship between BG affiliation and export performance by explicitly taking into account the institutional context. Based on the integration of RBV and the institutional perspective, we will consider how BG affiliation affects firm export performance in the context of emerging economies. The economic rationality of RBV focuses on value-maximization strategies (Oliver, 1997). However, such strategies are constrained by institutional voids and state intervention. To gain legitimacy, organizations often need to behave in line with institutional expectations and norms irrespective of economic rationality (Chabowski et al., 2018; Shinkle and Kriauciunas, 2010). Therefore, the interplay between the BGs, institutional pressures and firms' strategies in response to institutional pressures is critical for understanding the role of BGs (Carney et al., 2018).

2.2.1. The Impact of BG Affiliation on Firm Exports

From the perspective of RBV, GAFs are, in general, in a better position than SAFs with regard to accessing a variety of resources, therefore, are more able to capture growth opportunities. However, this may be a mixed blessing when it comes to their export strategy. First, by leveraging the resources of a BG, GAFs can alleviate resource deficiencies at the firm level (Carney et al., 2011; Holmes et al., 2018; Tan and Meyer, 2020; Yiu, 2011). This provides them with greater opportunities for exporting than SAFs. GAFs may also exploit the export

channels and international marketing skills of other firms in their BG (Tajeddin and Carney, 2019). Second, BGs formalize and stabilize channels for information exchange and experience sharing (Lamin, 2013; Lamin and Dunlap, 2011; Yiu, 2011). GAFs have better access to knowledge and information about export markets and distribution networks, and in this way reduce the high sunk costs that exporters typically face (Borda et al., 2017; Manova et al., 2015). They also benefit from other members' recommendations and standings in export markets, altering their opportunity sets accordingly (Purkayastha et al., 2018). Given their resource pools, established competitive positions in the domestic market and government support, BGs are popular targets by MNEs for business and research collaboration (Lu and Ma, 2008; Yiu, 2011). Linkages with MNEs offer GAFs another channel to secure foreign market opportunities for exporting and learning opportunities that can be subsequently transformed to their competitive advantage. Third, BGs enjoy superior visibility and reputational benefits (Lamin, 2013; Mukherjee et al., 2018) and tend to have lower bankruptcy risks. Their political connections with governments and their large size often give financial institutions the impression that governments may step in to prevent group bankruptcy (Mahmood and Mitchell, 2004). When legal institutions and contract-enforcing mechanisms are weak, as is often the case in emerging economies, GAFs can signal their credibility in honoring contracts on the basis of the group's reputation, which is often greater than that of their own individually (Khanna and Yafeh, 2007; Lamin, 2013).

On the other hand, the resource advantages of GAFs may encourage them to focus on growth opportunities at home rather than engaging in exporting. First, resource advantages give BGs strong market power. This, on top of their strong political connections, may shield GAFs from competition in the domestic market, giving them less incentive to operate in more competitive export markets (Carney et al., 2011; Holmes et al., 2018; Khanna and Yafeh, 2007). Second, many potential benefits associated with BG affiliation mentioned above, which provide remedies for domestic institutional voids, may be more useful for domestic activities (Carney et al., 2011; Chittoor et al., 2009; Gaur and Kumar, 2009). For example, because of the internal markets associated with BGs, which can minimize transaction costs due to information asymmetry and institutional voids, GAFs may favor supplying other group-member firms over international opportunities that SAFs may view as profitable. Furthermore, formal and informal ties promote group collaboration and social cohesion, but at the same time, impose on group members the responsibility to satisfy other group members first, which may lead to less exporting (Carney et al., 2011; Holmes et al., 2018). Third, as Tan and Meyer (2020) have argued "managerial experience is key for explaining how business groups prioritize different directions of growth". From the GAF managers' perspective, they are deeply embedded in the domestic environment and have developed and invested in knowledge and relationships at home, therefore may be less incentivized to undertake exporting given its associated costs and uncertainty (Carney et al., 2011; Tan and Meyer, 2020). This is consistent with the view that organizational inertia can limit GAFs' desire to explore new export markets (Chittoor et al., 2009; Gubbi et al., 2015; Shinkle and Kriauciunas, 2010).

The stark contrast in the theoretical explanations on the impact of BG affiliation on firm exports is reflected in the empirical findings. As shown in Table A2, among studies on exporting as an internationalization strategy, the positive effects of BG affiliation are found in Basile (2001) (Italy), Chung and Dahms (2016) (Taiwan), Singh (2009) (India), Sterlacchini (2001) (Italy) and Tajeddin and Carney (2019) (33 African countries). Negative

evidence is revealed by Chakrabarti and Mondal (2017) (India), Gubbi et al. (2015) (India) and Yi et al. (2013) (China). Gubbi et al. (2015) (India) and Sterlacchini (1999) (Italy) contain statistically insignificant findings. A recent survey article by Carney et al. (2018), in view of the conflicting theoretical arguments and empirical findings on the broad economic outcomes of BGs, concludes that the simple stylization of BG into "a dichotomy of paragons or parasites is too coarse" (p. 503) and advocates a finer-grained conceptual framework on the role of BG by explicitly bringing the institutional context into the analysis.

Institutions influence an organization's strategic decisions. Value-maximizing strategies associated with the economic rationality of RBV need to account for normative rationality. Emerging economies face institutional voids and their institutions are in transition with various reforms adopted and with changes intended to create conditions supportive of firms demonstrating international competitiveness through exporting and FDI (Borda et al., 2017; Chakrabarti and Mondal, 2017; Chittoor et al., 2009; Gaur et al., 2014; Gubbi et al., 2015; Hu et al., 2019; Khanna and Yafeh, 2007; Oura et al., 2016; Stucchi et al., 2015; Yiu, 2011). BGs receive extensive institutional support, in particular, support from the state, e.g. low interest rate finance, access to foreign currency, direct and indirect subsidies, domestic tax breaks and access to research institutions (Gaur and Delios, 2015; Khanna and Yafeh, 2007; Stucchi et al., 2015; Yiu et al., 2005; Yiu, 2011). In return, they must adhere to state signals and often act as pioneers in implementing the recommended policies (Hu et al., 2019; Khanna and Yafeh, 2007; Zhang et al., 2016). In emerging economies, institutional changes have been made to encourage and support firm exports, including exchange rate system reform, processing trade policy, tax rebates, the removal or reduction of trade and non-trade barriers and participation in regional economic integration or the WTO. GAFs, thus, have a strong incentive to operate in export markets, not only because of the resource advantages they possess for exporting, but also because of their need to gain institutional legitimacy by acting in line with the state's export promotion policy.

In addition, such an institutional context can mitigate the negative impact of BG affiliation on firm exports. The institutional transition in emerging economies gradually improves market functions, reduces agency problems, resource misallocation and rent-seeking, and stimulates competition, which diminishes some of the advantages that BGs hold (Borda et al., 2017; Carney et al., 2017; Chittoor et al., 2009; Holmes et al., 2018; Khanna and Yafeh, 2007). While their home market status is challenged, GAFs can leverage home market power for foreign market growth opportunities (Kim et al., 2010). The network effects have a dual role to play (Gaur et al., 2014; Singh, 2009). They may keep GAFs at home, but they may also pull GAFs together to export due to their business interdependence and their legitimacy need which is evidenced by taking similar actions. As BG's governance structure may make them more beholden to a particular interest, from the GAF managers' perspective, their deep embeddedness in the domestic institutional environment means that they undertake exporting activities, whenever possible, irrespective of whether they are economically sound. By taking action, managers maintain their legitimacy in the eyes of the government, which helps them protect their own interests and achieve their personal and organizational goals (White et al., 2008). The peculiarities of the institutional setting in emerging economies therefore suggest GAFs have higher export performance than SAFs.

H2: BG affiliation has a positive impact on export performance.

2.2.2. The Impact of BG affiliation on the Innovation-Export Relationship

In the absence of the consideration of institutional context, BGs can be expected to strengthen or weaken the positive impact of innovation on exports. As noted by Deng et al. (2014), the value of innovation to exports is contingent on firm resources. Innovation and export, as two growth strategies, depend on the concurrent utilization of resources (Golovko and Valentini, 2011; Roper and Love, 2002). Resource-rich firms can better match resources to enhance export competitiveness through innovation than resource-scarce firms that also lack the ability to address such challenges as appropriating innovation for exporting (Deng et al., 2014; Golovko and Valentini, 2011). BGs can act as de facto venture capitalists by allowing GAFs to access internal capital markets to finance risky innovation projects that benefit export performance (Chang et al., 2006; Purkayastha et al., 2018). Furthermore, internal capital markets in BGs can be more favorable because external finance is more costly in a world with asymmetric information, and asymmetric information can be mitigated within BGs (Belenzon and Berkovitz, 2010). From the perspective of the human capital needed for both innovation and export activities, BGs can act as incubators for scientific and managerial talent and can use trained personnel across GAFs, substituting for an inefficient external labor market (Chang et al., 2006; Khanna and Yafeh, 2007; Mahmood and Mitchell, 2004). Furthermore, GAFs can leverage the reputation and credibility of their BGs so as to acquire external capital and to attract and retain talent (Mahmood and Mitchell, 2004). In comparison to SAFs, GAFs therefore have the resources to engage in both growth strategies and also enjoy greater value of innovation for exports. In other words, BG affiliation is expected to strengthen the positive impact of innovation on exporting.

Yet the associated costs to BG affiliation may undermine the value of innovation to exports. Resource misallocation, organizational inertia and managerial complacency hinder not only exports but also innovation (Belenzon and Berkovitz, 2010; Mahmood and Mitchell, 2004) and limit the value of innovation to exports in GAFs. Strong market power and strong embeddedness in the domestic environment mean that GAFs often prefer domestic projects (Carney et al., 2011). Additionally, an important feature of BGs is diversification and GAFs engage in more unrelated diversification than SAFs (Carney et al., 2011; Khanna and Yafeh, 2007). Innovation that focuses on domestic markets or product diversity that may not be directly relevant to the export market can still be of benefit to exports through lifting the overall capability of the firm, but the degree of impact may be limited in scale and scope. Finally, a BG's close ties with the government could lead to deviation from economic objectives, which would decrease a firm's incentive to maximize utility from innovation for exports. In contrast, SAFs, although they have fewer routines, fewer bureaucratic processes and stronger governance, face a higher level of resource constraint and operating volatility. They have a strong incentive to maximize returns on innovation for exports. They are also sensitive to environmental changes and aim to adapt quickly. It is therefore plausible to expect the impact of innovation on exports to be stronger in SAFs than in GAFs. In other words, BG affiliation is unlikely to strengthen the positive impact of innovation on exporting. It may even weaken the positive effects.

The opposing theoretical account on the moderating effects of BG affiliation emphasizes the need to take into account the institutional context to formulate a dominant hypothesis. In emerging economies, the emergence and the evolution of BGs is often the direct result of state support and government nurturing (Khanna and Yafeh, 2007). In return for the institutional backing, BGs not only play the role of economic agent, seeking economic outcomes, but also have a social function (Carney et al., 2011). For example, in China, GAFs face the task of providing employment in order to ensure social stability, at the same time improving innovation and firm performance in order to fuel economic growth (Hu et al., 2019; White et al., 2008). Providing employment would mean keeping redundant human resources on the payroll and spending on non-productive resources. This phenomenon is not unique to China, but common among emerging economies (Bruton et al., 2015). Despite the ability to mobilize internal markets for resources, no BGs have unlimited resources. Balancing the conflicting institutional pressures and economical objectives is, from the resource perspective, a challenging task as firms have to assign resource portfolios to meet both economic and normative rationality, which often result in economic suboptimal decisions (Oliver, 1997). In the context of the innovation-exporting nexus, diverting resources from productive, value-adding activities undermines GAFs' ability to optimize the utilization of resources to capture the positive effects of innovation on exports. In other words, the positive value of innovation to exports in GAFs may not be as high as that in SAFs whose focus is more on economic rationality and efficient use of resources.

What also does not help is the inherently complex governance arrangements in BGs. Both exporting and innovation are subject to dynamic environments and require systems in place to identify opportunities and respond to them (Cassiman and Golovko, 2011; Golovko and Valentini, 2011; Roper and Love, 2002). Innovation and exporting are often conducted by separate units of an organization. Responding to changes in the external environment for innovation alone, or for exporting alone, may not generally be hard. However, facilitating innovation to stimulate exports places additional requirements on organizational systems. Firms need to have enough strategic and operational flexibility to promptly allocate resources so as to modify existing activities or embark on new courses of action in response to changes. The opaque governance of BGs may undermine GAF's ability to effectively take advantage of innovation for exporting. GAFs may benefit from buffering effects against the uncertainties and risks they face in international markets (Alcantara and Mitsuhashi, 2012; Stucchi et al., 2015), and thus engage in exporting. However, superior export performance may not be innovation-based, but in line with the vent-for-surplus model which argues that export growth is the result of using surplus resources that would have remained idle in the absence of exports (Fu and Balasubramanyam, 2005). In view of the institutional pressures of providing employment and accommodating the growing workforce in emerging economies, GAFs therefore follow the export promotion path as is advocated by the state, but the governance constraints present them with a challenge to maximize the value of innovation for exporting.

H3: BG affiliation weakens the positive impact of innovation on export performance.

3. Data and Methodology

3.1. Data

This paper uses patent-granted data from China National Intellectual Property Administration (CNIPA), formerly known as the State Intellectual Property Office of China (SIPO), and the Annual Census on Industrial Enterprises (ACIE) dataset from the National Bureau of Statistics (NBS) for all firm-level variables. Both datasets have been widely used in existing studies published in leading journals including *Economic Journal* (e.g. Cai and Liu, 2009), *Journal of Development Economics* (e.g. Hu et al., 2017), *Journal of International Business Studies* (e.g. Liu et al., 2009; Wei and Liu, 2006; Xie and Li, 2018), *Journal of International Economics* (e.g. Liu and Qiu, 2016; Wang and Ma, 2018), *Journal of Management* (e.g. Tse et al., 2017) and *Research Policy* (e.g. Choi et al., 2011; Guo et al., 2016; Piperopoulos et al., 2018)). Provincial-level data are obtained from the CEIC database[1]. Data quality has been shown to be reasonably accurate and reliable ((e.g. Cai and Liu, 2009)).

As summarized by Choi et al. (2011), Chinese patent data have been managed and maintained through a uniform and rigorous process by CNIPA and constitute the most detailed and systematically compiled data about innovation in China. China formally enacted the Patent Law in 1984 and has enhanced its enforcement of patent law over time. China has also ratified all major international conventions on intellectual property rights, including the World Intellectual Property Organization (WIPO) (1980), the Paris Convention (1985), the Madrid Agreement (1989), and has signed the Integrated Circuits Treaty (1989) and also signed up to the agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) in 2001. Therefore, using Chinese patents to measure the innovation performance of firms in China is appropriate. Additionally, we choose not to use internationally granted patent data, such as those from the USPTO or PCT, to measure a firm's overall innovation output. This is because the share of foreign patents by firms in China remains small (see Figure 2) and the high cost of different patent processes internationally favors large firms engaging in foreign patenting (Choi et al., 2011). CNIPA provides detailed information on patents (Dang and Motohashi, 2015), including application number, application date, IPC classification, applicants' names and addresses, inventors' names and patent attorneys' names and addresses. A drawback is the lack of citation information, a widely used patent-quality indicator.

The ACIE database compiled by NBS covers all Chinese manufacturing firms with an annual turnover of more than RMB 5 million during the period 1998-2007. It includes detailed information on firms, including name, ownership, location, industry, assets, revenue, investments, profits, exports, employment and cash flow. The data covers 31 provinces in China. Shares of covered firms in each province are proportional to their shares in GDP. Thus, the data do not have a severe regional bias. Due to entry and exit and to ownership restructuring, the number of firms in operation changes over time. Following Cai and Liu (2009), we clean the data via extensive checks for nonsense observations, outliers, coding mistakes and the like. In particular, we dropped all observations if they had missing values for key financial variables (such as total assets, fixed assets and

[1] https://www.ceicdata.com/en

industrial output) or if the number of employees was reported to be less than ten. This finally produced an unbalanced panel dataset.

3.2. Empirical Model, Measures and Methods

To examine the innovation-export relationship, the basic model is as follows:

$$Export_{it} = \beta_0 Innovation_{it} + \beta_1 BGA_{it} + \beta_2 BGA_{it} \text{ x } Innovation_{it} + \gamma_i \boldsymbol{X}_{it} + T_t + F_i + \varepsilon_{it}$$

where $Export_{it}$ is export performance of firm i in year t. F_i is firm-fixed-effects, T_t is year-fixed-effects, ε_{it} is error term. Two main explanatory variables are *Innovation* and *BGA*. $\boldsymbol{X}_{it}$ is a vector of control variables that explain firm export performance. They include firm-level variables: *Productivity*, *Capital intensity*, *Human capital, SOE, Firm size* (*Size*), *External finance dependence* (*EFD*) (captured by two variables – *Inventory* and *Tangibility*) and *Government Subsidy* (*Subsidy*) and a business-group-level variable: *Assets in the rest of the business group* (*Assets_BG*). Variable definition and measurement are provided in Table 1.

The econometric assessment of the impact of innovation and BGA on export performance poses a number of methodological challenges from measurement issues to endogeneity concerns. As noted in Table A1, there is no agreement on measures for export performance and innovation. In the main analysis, we measure export performance using export intensity with respect to employment (*EIE*). In robustness analysis, we employ two commonly used measures: export propensity (*EP*) and export intensity with respect to sales (*EIS*), i.e. the share of exports in total sales. The sample size becomes much smaller when EIS is used. Nevertheless, the results are qualitatively similar, as will be shown in Section 4.

In terms of measuring *Innovation*, existing studies often use dummy variables or input indicators such as R&D expenditure (see Table A1). There are a number of issues associated with these measures. First, they do not measure the "efficiency" of knowledge development. Undertaking innovation or increasing innovation inputs does not necessarily imply outputs (Roper and Love, 2002; Tavassoli, 2018). Second, firms not only rely on internal R&D activities for acquiring knowledge, but also utilize technologies embodied in equipment or other external resources. Additionally, R&D investment reflects firms' investment in resource base which, though linked to innovation activities, is a more general indicator of the overall level of a firm's sophistication in absorbing external knowledge and information and managing and coordinating the interplay of internal and external R&D projects (Roper and Love, 2002). Thus, inputs may represent innovative activities realized at the firm level only weakly (Lachenmaier and Wößmann, 2006). In terms of the impact of innovation on exports, what really matters for firms is likely to be actual outputs rather than innovation activities *per se* (Ganotakis and Love, 2011; Roper and Love, 2002; Wakelin, 1998; Yi et al., 2013). Additionally, in the context of China, not all firms have separate R&D departments, or even R&D budgets. Using dummy or input variables could under-estimate the impact of innovation. On the other hand, corruption and serious misallocation of resources result in the loss of R&D efficiency (Yi et al., 2013). Using these variables is likely to over-estimate the effects of innovation.

Patents, an output indicator of innovation, are used in this study. For robustness checks, we employ both absolute term and relative term of patents adjusted by firm size (measured by employment). Because there is a time-lag of 18 months between the filing and the publishing of granted patent applications, the innovation variable is therefore effectively a lagged variable. We choose to use contemporary patent data for the measurement of innovation variables, but for robustness checks, we use lagged patent measures. The use of patents is not without shortcomings. Most notably, not all innovative outputs are patented, patent quality varies and patented innovation outputs may not always lead to commercial success (Choi et al., 2011; Dang and Motohashi, 2015; Roper and Love, 2002). Therefore, as an additional robustness check, we also use the share of new product sales in total sales (*NPS*) to measure innovation. Unfortunately, data for new product sales are unavailable for 2001 and 2004.

Given the potential reverse causality between innovation and exports, we adopt the following strategy to mitigate the concerns. First, we manage the problem of common confounding using a range of firm-level control variables that are expected to impact on both innovation and exports, and fixed-effects models. The confounding factors in the innovation-export relationship that are often considered include *Productivity* (e.g. Alarcón and Sánchez, 2016; Altomonte et al., 2016; Bravo-Ortega et al., 2014; Braymen et al., 2011; Cassiman and Golovko, 2011; Esteve-Perez and Rodriguez, 2013; Ganotakis and Love, 2011; Monreal-Pérez et al., 2012), *Capital intensity* (e.g. Alarcón and Sánchez, 2016; Golovko and Valentini, 2011; Yang and Chen, 2012; Yang et al., 2004), *Human capital* (e.g. Amadu and Danquah, 2019; Ayllon and Radicic, 2019; Braymen et al., 2011; Yang et al., 2004), *Size* (e.g. Alarcón and Sánchez, 2016; Altomonte et al., 2016; Ayllon and Radicic, 2019; Braymen et al., 2011; Carboni and Medda, 2018; Esteve-Perez and Rodriguez, 2013; Filipescu et al., 2013; Lachenmaier and Wößmann, 2006) and *EFD* (e.g. Altomonte et al., 2016; Carboni and Medda, 2018; Mancusi et al., 2018). Additionally, the fixed-effects estimator addresses confounding of the relationship by controlling time-invariant unobserved heterogeneity, e.g. organizational structure, managerial capabilities, unobservable changes in a firm's operating environment, or in the business cycle, that may be correlated with strategic decisions relating to export and innovation (Golovko and Valentini, 2011).

In view of the research context of China, we also include *SOE* and *Subsidy* as control variables. In China, the BG as an organizational structure was first introduced in SOEs, and large Chinese BGs are likely to be state-controlled. Following Hu et al. (2019), we include *SOE* to tease out this effect. Particularly relevant for Chinese firms is also government subsidy as a source of external capital which can be used to finance innovation and exports (Yuan et al., 2015). *Subsidy* is therefore included as a control variable. Similar to BGs in other countries, Chinese BGs are also diversified, with businesses covering a number of industries, and they benefit from economies of scale and scope at the group level (Zhang et al., 2016); we therefore include a control variable at the group level, *Assets_BG*.

Next, we employ an instrumental-variable (IV) approach for estimation to address the endogeneity issue associated with both *Innovation* and *Productivity* variables. To check the validity of IVs, we report Kleibergen-Paap rank LM test for under-identification, Kleibergen-Paap rank Wald F test for weak-identification and

Hansen-J statistics for over-identification. When *EIE* and EP are used as a dependent variable, we employ the following three IVs: government expenditure on education in a province (*Education*), government expenditure on R&D in a province (*Expenditure*) and the number of researchers in a province. The above tests confirm the validity of the instruments. When *EIS* is used, we follow Ganotakis and Love (2011) and Yi et al. (2013), using R&D intensity (measured by the ratio of R&D expenditure to sales), *Education* and *Expenditure* as IVs.

Third, after recognizing the endogeneity problem, many studies choose to use lagged variables instead of the IV approach (e.g. Becchetti and Rossi, 2000; Caldera, 2010; Ito and Lechevalier, 2010; Monreal-Pérez et al., 2012; Sterlacchini, 2001; Tavassoli, 2018; Van Beveren and Vandenbussche, 2010; Yi et al., 2013). We therefore also follow this practice and use lagged *Innovation* and *Productivity* variables to check for robustness. In summary, through disposing a rich set of control variables and fixed-effects, and employing a combination of IV approach and lagged variables, we are able to make plausible causal inferences on the impact of *Innovation* and *BGA* on *Export*.

4. Results

The number of BGs in our sample ranges from 1,072 in 1998 to 3,496 in 2004 (see Figure 1) and the number of GAFs varies from 2,401 in 1998 to 9,638 in 2004 (see Table 2). Table 2 provides a comparison of GAFs and SAFs. Over the sample period, both GAFs and SAFs experienced an increasing trend in innovation and exports. However, GAFs outperformed SAFs on both fronts. On average, GAFs were larger than SAFs but there was more variation among GAFs than among SAFs.

Table 3 presents summary statistics and correlation coefficients for all variables. Correlation coefficients are low with the maximum magnitude being 0.340. The variance-inflation factors are well below the threshold level of 10. Both indicate that multicollinearity is not an issue of concern. Table 4 presents the results with *EIE* as a dependent variable and using the IV fixed-effects approach. The bottom of the table reports a battery of diagnostic tests related to the validity of the instruments. The Kleibergen-Paap LM statistics and the Kleibergen-Paap F statistics suggest the rejection of the null of under-identification and weak-identification, respectively. Additionally, the Hansen test of overidentifying restrictions indicates that the orthogonality of conditions cannot be rejected at the 10% level in all specifications. Together, these tests give us confidence regarding the results of the IV fixed-effects estimation.

Specifications (1)-(6) employ different measures of *Innovation* with (1) and (2) using the absolute term of Patents and its lagged variable, respectively; (3) and (4) using the relative term of Patents and its lagged variable, respectively and (5) and (6) using NPS and its lagged variable, respectively. In keeping with the *Innovation* variable, *Productivity* is also lagged when lagged *Innovation* is used. In all specifications, the coefficients on *Innovation* are positive and statistically significant, revealing the positive link between innovation and exports in Chinese manufacturing firms, supporting H1. The coefficients on *BGA* are all positive and statistically significant except in specification (3), suggesting that, on average, GAFs export more than SAFs, supporting H2. The interaction term (*BGA* x *Innovation*) shows a negative and statistically significant effect, indicating that

SAFs are better at utilizing innovation to facilitate exports than are GAFs. H3 is thus supported. The impact of innovation on exports is clearly positive for all firms, but the degree is higher for SAFs than for GAFs.

To understand the degree of impact of innovation on exports, we need to read together the coefficients on *Innovation* and the interaction term (*BGA* x *Innovation*). In specification (1)-(4), the coefficients on Patents measures (in absolute, relative and lagged terms) represent elasticity. Controlling for other variables, for example, specification (1) reveals that a 1% increase in Patents leads to a 4.032% increase in EIE in SAFs, but 1.077% (= 4.032% - 2.955%) increase in GAFs. However, these elasticities are not directly comparable to the coefficients in specifications (5) and (6) as NPS and Lagged-NPS are measured in ratio. To facilitate understanding and comparison of effect sizes, we computed standardized regression coefficients which allow meaningful comparison of estimated coefficients across samples or variables (Thompson, 1999).

For specification (1), a 1 standard deviation (henceforth, SD) increase in Patents is associated with a 0.513 SD increase in EIE for SAFs and a 0.137 SD increases for GAFs. These are economically meaningful results, representing an 89.4 percent increase of the EIE sample mean in SAFs and a 23.9 per cent increase in GAFs. The standardized coefficients in specification (2) are 0.346 and 0.087 on Lagged-Patents for SAFs and GAFs, respectively. Both are lower than the corresponding coefficients in specification (1). The reduction in the effect sizes may reflect diminishing returns in innovation over time as the product life cycle evolves.

The standardized coefficients take the values of 0.010 and 0.003 on Patents/Employment for SAFs and GAFs, respectively, in specification (3) and 0.005 and 0.003, respectively in specification (4). These effect sizes are smaller than the corresponding ones in specifications (1)-(2). Our tentative explanation is that what matters more to firm exports is the cumulative nature of innovation at the aggregate level than innovation intensity measured by Patents/Employment. Innovation intensity tends to be smaller in larger firms (Roper and Love, 2002). Innovation is often positively associated with organizational size, as revealed by a meta-analysis of Camisón-Zornoza et al. (2004), i.e. the larger the size, the more innovative outputs may be generated. But this does not necessarily mean higher innovation intensity. Our findings indicate the absolute volume of innovation is a more economically significant antecedent factor for firm export performance than the intensity, although innovation intensity is statistically significant. As a side note, this reinforces Thompson (1999)'s point on improving research clarity and usefulness with effect size indices as supplements to statistically significant tests.

For specification (5), a 1 SD increase in NPS is associated with a 0.379 SD increase in EIE for SAFs and a 0.251 SD increase for GAFs. Specification (6) reveals that a 0.150 SD increase in EIE for SAFs and a 0.095 SD increase for GAFs are associated with a 1 SD increase in Lagged-NPS. Again, the observation made above, i.e. the effect sizes become smaller with the use of the lagged variable, stands. NPS is also an innovation intensity measure, being the ratio of new product sales to total sales. However, comparing the coefficients on NPS measures and those on Patents/Employment measures shows that the effect sizes are larger in the former than in the latter. This may reflect the fact that new product sales better capture innovation's commercial success than patent and can directly feed into firm exports. Hence it may be unsurprising that, between the relative measures, the effect sizes are larger for NPS than for Patents/Employment.

To understand the degree of impact of BGA on exports, we undertake the evaluation at the mean level of Innovation measures. GAFs, on average, have higher EIE than SAFs. The difference ranges between 0.129 (specification 5) and 0.637 (specification 2), representing a 10.9 to 53.7 percent increase of the EIE sample mean. We note that the level of statistical significance on BGA is lower in specifications (3) and (4) when Patent/Employment measures are used. We attribute this to innovation intensity (Patent/Employment) which only weakly captures the economic effects of innovation on firm export performance, and which may influence the results of other variables including BGA whose effects and those of innovation are closely intertwined, as argued in the present paper.

We compare our findings with studies in Table A1that have taken into account endogeneity and used innovation output measures. Only 7 out of 108 studies meet these criteria. Our findings on the innovation variable are consistent with Fu (2011) (China), Gkypali et al. (2015) (Greece), Tavassoli (2018) (Sweden) and Yi et al. (2013) (China), but different from Filipescu et al. (2013) (Spain), Ganotakis and Love (2011) (UK) and Wang et al. (2013) (China) which find statistically insignificant effects of innovation on export sales (in absolute or relative terms). The different findings could be attributable to different research contexts. However, examining the same country, i.e. China, our results are in line with two out of three studies. This is likely to be due to the sample setting. The present study, Fu (2011) and Yi et al. (2013) are all large sample panel-data studies, covering a broad range of firms. Fu (2011) contains 53,981 firms over the period 2000-2007 and Yi et al. (2013) 359,874 firms from 2005-2007. However, Wang et al. (2013) employ a very small sample, covering only 153 observations for 141 firms that were involved in technology licensing activities. As the authors acknowledged their "New product sales" variable is "substantially skewed" (p. 1084), therefore the estimated coefficients are likely to be biased.

We further contrast our results with studies that have simultaneously considered BG affiliation and innovation in internationalization. Out of 24 studies in Table A2, only three have done so. In two studies on India, Gaur et al. (2014) and Purkayastha et al. (2018) find that BGs not only positively impact on firms' internationalization strategy of shifting from exports to FDI and the degree of internationalization (which includes both exporting and FDI activities), but also strengthen the positive effects of innovation. Although exporting is one of the internationalization strategies, as is widely recognized in the literature, the antecedents for exports and FDI may be different because FDI often involves more risks, complexity and resource commitments than exports (Gaur et al., 2014; Wei et al., 2014). Our results are therefore not directly comparable to those of Gaur et al. (2014) and Purkayastha et al. (2018). A study by Yi et al. (2013) into the export performance of Chinese firms finds negative coefficients on BG affiliation but positive coefficients on the interaction between innovation and BG affiliation. These are in complete contrast to our findings. Research setting and estimation strategy may explain the difference. Our sample covers ten years, which is much longer than the three years in Yi et al. (2013). Our estimations also control for firm productivity, an important variable in the innovation-export study which has been omitted in Yi et al. (2013). As extensively discussed in the literature, exporting may be the result of self-selection where highly productive firms are systematically more likely to be exporters than their less productive

counterparts (Aw et al., 2011; Falk and de Lemos, 2019; Ganotakis and Love, 2011; Golovko and Valentini, 2011), so omitting the productivity variable, therefore, may contaminate the results.

With respect to control variables, *Capital intensity*, *Human capital*, *Inventory* and *Tangibility* behave consistently across specifications, confirming that capital intensity and human capital are positively related to firm export performance, and *EFD* (captured by *Inventory* that signals the liquidity needed to meet demand and *Tangibility* that reveals a firm's ability to pledge collateral in order to raise finance) negatively affects firm export performance. These findings are consistent with what the innovation-export literature predicts, i.e. firms that have more physical and human capital resources perform better in the export market. Other control variables, though not being consistently statistically significant, have consistent signs. *Productivity*, *SOE*, *Subsidy* and *Assets_BG* are positively related, and *Size* is negatively related to *Export*. These results confirm productivity, state-ownership, government subsidy and BG's assets are important factors that enhance a firm's competitive edge. *Size* is an interesting case. It is probably the most debated determinant of firm exports (Nassimbeni, 2001). On the one hand, it reflects a firm's resources, with larger firms having more resources to manage uncertainties and to support innovation and export, thereby realizing the commercial value of innovative outputs in export markets (Basile, 2001). On the other hand, it is an indicator of a firm's overall organizational structure, with larger firms having layers of bureaucracy and being more prone to bureaucratic inertia (Lee and Chen, 2009). This could lead to resistance to changes which are often required for both innovation and exports, or delayed responses to changes in the markets. It is therefore not a straightforward matter as to whether size as a variable captures the resource or bureaucracy effects. Our results here show the net effects of *Size*.

We further conduct a set of robustness tests by using different measures of export performance and including additional control variables at the BG level. They are reported in Table 5. As shown in Table A1, the extant literature on exports has used alternative measures for export performance. The common ones are EP and EIS. The top panel of Table 5 present the results for EP. The results are qualitatively similar to those in Table 4. The coefficients on *Innovation* are consistently positive and statistically significant, while those on the interaction term (*BGA x Innovation*) are consistently negative and statistically significant. When Patents measures are used, the estimates range between an elasticity of 0.218 (or standardized coefficient of 0.004) in specification 4 and 0.944 (or 0.554) in specification 1 for SAFs and between 0.004 (or 0.002) in specification 2 and 0.287 (or 0.168) in specification 1 for GAFs. When NPS measures are employed, the degree of impact of 1 SD increase in NPS is associated with 0.210 (specification 5) and 0.088 (specification 6) SD increases of log odds ratio in SAFs and 0.115 (specification 5) and 0.027 (specification 6) SD increases of log odds ratio in GAFs. These findings again support H1 and H3. The comparison across different specifications again broadly confirms our previous observations that the effect sizes are smaller when innovation is measured in lags, when patent measure is used in a relative term, and when Patents/Employment rather than NPS is used as a relative measure. The coefficients on *BGA* are positive and statistically significant. Evaluated at the means, the degree of impact ranges between 0.279 (specification 4) and 0.641 (specification 1), providing backing for H2.

For the middle panel, the dependent variable is EIS. The results for *Innovation* and the interaction term (*BGA x Innovation*) are again in line with those in Table 4, clearly supporting H1 and H3. The effect sizes are also

economically meaningful, particularly for specification (1) and (2). The impact of 1 SD increase in innovation is associated with 0.513 and 0.346 SD increases in EIS for SAFs and 0.137 and 0.087 SD increases for GAFs, respectively. However, though the coefficients for BGA are positive across different specifications, they are only statistically significant in specifications (1) and (2). Thus, H3 is only supported when innovation is measured using Patents in absolute terms.

The extant literature on BGs has recognized the potential knowledge spillovers in BGs (Belenzon and Berkovitz, 2010). To control for the BG-level innovation effects, we add a new variable, *Innovation_BG* and the results are presented in the bottom panel of Table 5. The qualitative findings for innovation and BGA again remain unchanged. Interestingly, *Innovation_BG* negatively affects exports. This may indicate that firms in the same BG are different in terms of their strategic focus and unlikely to benefit from each other's innovation for exporting purposes. Taking together the results in Tables 4 and 5, our findings are robust.

5. Discussion and Conclusions

Innovation is believed to be an important driver behind economic development at the macro-level, and the survival and growth of firms at the micro-level. This has attracted a lot of academic interest, and much has been done in terms of investigating the innovation-export relationship. In the light of the theoretical consensus, but inconclusive empirical findings, our conceptual framework examines the moderating role of BGs and their associated opposing forces, and the offsetting effects on firm exports. Recognition of the BG-innovation-export linkage contributes to our understanding of the value of innovation to firms' exports in general. Combining two unique longitudinal, comprehensive datasets on Chinese manufacturing firms, we empirically test the hypotheses and find that both innovation and BG affiliation have a positive impact on exports, but that BG affiliation plays a negative role in the innovation-export relationship. These findings are fairly robust in different specifications. The paper provides support for both the positive and negative narratives surrounding the role of BGs and highlights the complex role played by BGs which needs to be understood in the context of institutions.

This study has important implications for research and practice. First, with regard to academic literature, only a few studies on the impact of innovation on firm exports have investigated the role of BG affiliation, and the limited evidence available is mixed. This research contributes to our understanding of variation in the innovation-export relationship among firms in an emerging economy institutional context, and provides explanations on why and how some firms are more export-oriented and benefit more from innovation in exporting than others. Second, research on BGs has largely focused on financial performance and the conceptualization of BGs in their gap-filling function and coalition function (for a review, see Holmes et al., 2018). In hypotheses development, we take a balanced view by studying BGs under the conjoint lens of RBV and the institutional perspective, showing how BG's role in firm exports is moderated by BG affiliation. This paper therefore offers validation regarding the need to study the role of BGs in the emerging economy context. Third, the paucity of literature on the interplay of innovation and exporting in EMFs, and the unique institutional context of emerging economies, makes this study an important contribution. Though there is an emerging trend of research on BGs in emerging economies, we know little about how BG affiliation affects firm export

performance in the presence of institutional pressures. Given the economic dominance of BGs in these countries which is likely to persist as market failure and institutional void challenges will not be resolved any time soon, we need to understand more about how, why and when BG affiliation adds economic value to firms and the economy.

The paper has important policy and managerial implications. Our empirical context is China. After 40 years of economic reform, China's position as a leading trading nation has been well-established. China has also become a serious contender in the world of innovation. R&D expenditure (a measure of innovation input) in 2017 was RMB 1.76 trillion, up 43-fold since 1996[2]. Patent applications in the domestic market (a measure of innovation output) saw a growth of 43-fold (up from 96,233 in 1998 to 4,146,772 in 2018) and patents granted a growth of 38-fold (up from 61,378 in 1998 to 2,335,411 in 2018)[3]. These achievements are in contrast to another prevalent belief that China's international competitiveness is mainly fueled by low labor costs and high levels of investment in physical capital. From the policy perspective, our findings highlight the need to take a joined-up approach and work across departments in policy making. Our evidence of institutional pressure on BGs helping with exports, but working against effectively utilizing innovation for exports, complements the findings of White et al. (2008) that show institutional pressure on BGs helps achieve the political goal of maintaining employment, but works against innovation. Therefore, the impact of policies is complex. Merely stimulating exporting is an ineffective approach when the country is moving away from cost-leadership to competitiveness based on knowledge and innovation. Policymakers need to be cognizant of BGs as a micro-institutional tool which can be used to achieve political and economic goals. More concerted, coordinated efforts by policy makers in different departments may be a way forward promoting the positive role of BGs in both export promotion and the effective utilization of innovation for exporting.

For managers, the finding that innovation significantly affects firm export performance suggests that firms need to strategically engage in innovation, and leverage innovative outputs to improve export performance. Innovation provides an avenue for Chinese firm to catch up. The innovation strategy of a firm should be planned in conjunction with their foreign market strategy. This study points to the benefits and costs they can derive from BG affiliation. BG affiliation, a success driver behind exports in the past, could become a liability if firms want to become innovation-led exporters. Finally, business strategies should pay attention to the target specificities and credibility of the national institutional system (Bruton et al., 2015; Carney et al., 2011) and be aware of conflicting institutional pressures when leveraging innovation for exports.

Although our research is promising, we acknowledge the limitations. First, this empirical setting is based on a single country context, China. Although the hypotheses are developed by taking account of the institutional features of emerging economies, the empirical findings may vary by country. The generalizability of findings therefore needs to be further established through future studies in different country contexts. Second, the concern of reverse causality between innovation and exports is mitigated in our study, as we employ the IV approach and adjust model specifications and variable measurements. Despite this, we accept that we may not have completely

[2] http://data.uis.unesco.org/ (accessed on 17 December 2019).
[3] http://www.sipo.gov.cn/tjxx/ (accessed on 17 December 2019).

ruled out this concern; for example, the typical caveat related to the most suitable instrumentation of variables remains. Third, the present study is based on a sample that ends in 2007, the year of the onset of the global financial crisis which significantly changed the global economic landscape. Potentially, the crisis has affected firms' innovation and exporting paths. Future research could utilize more recent data to test our hypotheses and verify the results.

Appendix A: Business Groups in China – An Overview

BGs are an important form of business organization in China. According to the State Administration for Industry and Commerce of China (SAIC), a BG consists of at least five legally independent firms partly or wholly owned by a parent company. The parent company should have registered capital of more than 50 million yuan (US$6 million) and the total registered capital of the parent and affiliated companies within a BG should be more than 100 million yuan (US$12 million). BGs in China emerged under China's economic restructuring in the 1980s and have thrived due to policy inducements, institutional voids and market forces (Lee and Jin, 2009). Lee and Jin (2009) and Zhang et al. (2016) provide an excellent summary of the development of BGs. This section only intends to provide a brief overview to establish the research context.

China's policy regime towards BGs has evolved through four stages over the past four decades. Table A3 presents the reforms related to Chinese BGs. In the 1980s, making the transition from a planned economic system to a market economy, the Chinese government started encouraging BGs (Keister, 1998). The concept of a "business group" first appeared in the State Council's official documents (Lee and Kang, 2010) in 1986. BGs were mainly formed through horizontal co-operation between enterprises. Some of the successful SOEs were asked to absorb non-performing SOEs.

From 1987 to 1992, the formation of BGs was driven by the government and by the enterprises themselves, although the government remained the dominant force. During this stage, the government's approach to BGs was continuously refined. Enterprises had incentives to build BGs so as to enjoy preferential policies and the benefits of economies of scale/scope and specialization (Lee and Kang, 2010). By 1993, more than 7,000 known BGs had been formed (Keister, 1998). There were three major paths through which firms formed BGs: spill-offs, merger and acquisitions, and joint ventures (Lee and Jin, 2009).

Following the formal establishment of the country's "socialist market economy" status in November 1993 and the national industrial policy in 1994, many non-state-owned firms emerged, and some built their own BGs. Between 1993 and 2003, the government also encouraged the creation of big BGs with the intention of improving Chinese firms' international competitiveness. In 1997, the State Council chose 120 BGs as national pilot BGs (the so-called "national champions") and they were granted various privileges (Lee and Kang, 2010). They were also at the forefront of the move to list Chinese firms on stock markets. By the end of the 1990s, nearly all were listed on China's domestic stock markets and many were listed on international stock markets (Brødsgaard, 2012). Additionally, Zhu Rongji's 1998 administrative reform, reducing the number of ministerial-

level departments, unexpectedly reduced the state's influence over BGs and strengthened the power of BGs themselves (Brødsgaard, 2012).

The year 2003 marked the beginning of the fourth phase in the evolution of China's BGs. The Chinese government established the Assets Supervision and Administration Commission (SASAC) to regulate SOEs and this has since played a crucial role in the reform of state-owned BGs. Nevertheless, the landscape of BGs in China is not dominated by state-controlled BGs. In terms of ownership, as summarized by Zhang et al. (2016), there are both state-controlled or privately-controlled BGs. Figures in 2008 reveal that out of 2,971 BGs in China, 44% (1,293) were state-controlled and 43% (1,290) were privately-controlled. Over time, BGs have become more market-oriented, possessing significant economic clout. In 2007, BGs hired 32.4 million people, accounting for 11% of urban workers (Lee and Kang, 2010). Their sales revenues were as high as 93.2% of GDP. Data for the top 500 BGs in 2006 revealed that 70% were in the manufacturing sector.

Appendix B: Systematic Literature Review Methodology

To comprehensively evaluate and summarize the current state of the literature, we followed systematic literature review methodology (Tranfield et al., 2003) and comprehensively searched the Web of Science (WOS) database, formerly ISI Web of Knowledge, for research articles. WOS is a widely used database for systematic literature reviews, e.g. Beugelsdijk et al. (2018); Chabowski et al. (2018); Holmes et al. (2018) and Ipek (2019).

First, to deal with the literature on the impact of innovation on firm exports. we conducted a search process using a combination of "export" and "firms" with one of the terms: "innovation", "patent", "R and D" or "research and development". This resulted in 1472 papers. Because the present research is about BGs, to ensure the inclusion of studies that may not include "firms" in the keywords, we performed another search process using a combination of "export" and "BG" with one of the following terms: "innovation", "patent", "R and D" or "research and development". This resulted in 114 papers. Combining the papers from the two separate search processes amounts to a total of 1,545 papers.

In order to determine relevant, quality, empirical studies to be included in a summary of findings, we applied four criteria: (a) papers analyze the impact of innovation on firm exports; (b) papers focus on exporting rather than other specific internationalization modes (e.g., licensing, franchising, foreign direct investment or merger and acquisition) or internationalization in general; (c) papers are quantitative and empirical in nature; and (d) papers are published in peer-reviewed academic journals that are accessible. We screened 1,545 papers. After excluding conference proceedings, book chapters, book reviews, conceptual articles, case studies and all research about the impact of export on innovation, we identified 108 quantitative, empirical studies that have been published in reputable journals and that examine the impact of innovation on exports using firm-level data. Table A1 presents a summary of findings; 7 out of 108 journal articles consider BG as an explanatory variable or a control variable. A total 78 articles study developed countries, and 9 examine China.

Second, to review the literature on the role of BGs in internationalization broadly and exports specifically, we conducted a search of the Web of Science database using a combination of "business group" and "firms" with one of the terms: "export", "internationalisation", "internationalization", "international diversification", "international diversity", "foreign direct investment", "merger and acquisition", "merger and acquisitions" or "mergers and acquisitions". This resulted in 90 papers. Applying the criteria for inclusion, i.e. (a) papers analyze the role of BGs on firm internationalization; (b) papers are quantitative, empirical in nature; and (c) papers are published in referred academic journals that can be accessible, we identified 24 studies. They are summarized in Table A2.

Empirical studies disclose mixed influences of BGA on firm internationalization which is captured by a range of measures. However, it is worth noting that exports and FDI are two different entry modes with different characteristics. FDI often involves more risks, complexity and resource commitments than exports (Gaur et al., 2014; Wei et al., 2014). Therefore, they may have different antecedents. Measures, such as those using foreign sales, whether in absolute terms or in relative terms (e.g. the ratio of foreign sales to total sales), mix export sales with foreign subsidiary sales, and may be problematic.

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Table 1: Variable Definition and Measurement

Variable	Measurement
EIE	log(Export/Employment + 1), adjusted by inflation with 1998 as the base year. Export is export volume
EP	Export propensity = 1 if firm is an exporter; 0 if a non-exporter
EIS	log(Export/Sales + 1)
Patents	log(Number of patent granted + 1)
Patents/Employment	log(Number of patent granted/Employment + 1)
NPS	(New products sales)/Sales
BGA	Business group affiliation (BGA) = 1 if a firm is affiliated with a business group; 0 otherwise
Productivity	Following previous research, we measure productivity using firm total factor productivity (TFP). The methodology is described by Olley and Pakes (1996). The method takes into account of simultaneity biases (that arises because productivity level is known to a firm but unobservable to the econometrician) and employs a semi-parametric estimation that deals with correlation between idiosyncratic firm level productivity and input quantities.
Capital intensity	log(Capital/Employment), adjusted by inflation with 1998 as the base year
Human capital	log(Wages/Employment), adjusted by inflation with 1998 as the base year
Size	log(Employment)
Inventory	Inventory/Sales
Tangibility	(Fixed assets)/(Total assets)
Subsidy	log(Government subsidy + 1), adjusted by inflation with 1998 as the base year
SOE	State-owned enterprises (SOE) = 1 if a firm has state ownership; 0 otherwise
Assets in the rest of the business group (Assets_BG)	log(Total assets at the business-group level minus the assets of the GAF + 1), adjusted by inflation with 1998 as the base year; 0 for SAF
Patents in the rest of the business group (Innovation_BG)	log(Number of patent granted at the business-group level minus that of the GAF + 1); 0 for SAF

Note: The unit is thousands of RMB for sales, new product sales, export sales, inventory, fixed assets, total assets, government subsidy, capital and wages.

Table 2: Summary statistics: Business group affiliated firms (GAFs) vs. stand-alone firms (SAFs)

	Number of firms		Patents		Export		Employment		NPS (%)	
	GAFs	SAFs	GAFs	SAFs	GAFs	SAFs	GAFs	SAFs	GAFs	SAFs
1998	2,401	70,887	0.44	0.05	36,876.45	8,924.1	1,961.43	328.48	7.12	1.98
1999	3,048	77,998	0.55	0.07	37,034.93	9,875.53	1,831.44	335.14	7.14	1.99
2000	3,390	79,995	0.52	0.09	52,017.19	12,470.89	1,593.64	320.01	7.25	2.05
2001	4,275	93,586	0.58	0.10	45,843.73	11,808.16	1,414.59	284.53	-	-
2002	5,029	107,307	0.82	0.13	49,554.84	13,326.68	1,445.49	274.55	7.21	1.81
2003	5,859	123,908	1.09	0.12	54,223.92	15,953.96	1,444.43	263.34	7.41	1.84
2004	9,638	179,999	0.89	0.13	53,636.25	15,437.29	1,500.55	303.48	-	-
2005	7,872	194,623	1.45	0.16	77,676.80	18,267.48	1,318.67	222.37	7.83	2.25
2006	7,535	226,094	2.05	0.21	100,989.50	20,416.08	1,356.73	212.83	8.54	2.51
2007	4,668	184,223	1.59	0.21	123,269.90	20,251.08	1,526.25	189.54	9.81	2.55

Notes: Patents = Number of patent granted; Export = Export sales (in thousands of RMB); Employment = number of employees; NPS = (New products sales)/Sales

Table 3: Descriptive and summary statistics

	Mean	SD	4	5	6	7	8	9	10	11	12	13	14	15	16
1. EIE	1.186	2.068													
2. EP	0.277	0.448													
3. EIS	0.123	0.241													
4. Patents	0.039	0.263													
5. Patents/Employment	0.001	0.011	0.494												
6. NPS	0.023	0.111	0.126	0.040											
7. BGA	0.039	0.193	0.101	0.009	0.072										
8. Productivity	3.523	0.885	0.076	0.024	0.043	0.058									
9. Capital intensity	3.702	1.259	0.060	0.023	0.047	0.103	0.043								
10. Human capital	2.531	0.625	0.098	0.046	0.077	0.078	0.294	0.283							
11. Size	4.850	1.124	0.160	-0.006	0.086	0.204	0.023	-0.059	-0.079						
12. Inventory	0.147	0.234	0.042	0.014	0.072	0.049	-0.231	0.045	-0.037	0.117					
13. Tangibility	0.447	0.215	0.018	0.005	0.031	0.036	-0.181	0.120	-0.012	0.075	0.315				
14. Subsidy	0.113	0.316	0.110	0.031	0.095	0.089	0.041	0.090	0.095	0.151	0.032	0.034			
15. SOE	0.072	0.258	0.029	-0.006	0.029	0.124	-0.086	0.106	-0.028	0.232	0.096	0.101	0.031		
16. Assets_BG	0.198	1.598	0.111	0.026	0.082	-0.303	0.130	0.218	0.202	0.340	0.174	0.118	0.139	0.083	
17. Innovation_BG[#]	0.034	0.244	0.077	0.035	0.105	0.007	0.064	0.049	0.087	0.123	0.038	0.015	0.094	0.016	0.151

SD = standard deviation. [#] Correlation between *Innovation* and *Innovation_BG* is calculated based on the sample of GAFs only as for SAFs, *Innovation_BG=0*.

Table 4: The role of BGA in the innovation-export relationship (Dependent variable = EIE)

	(1)	(2)	(3)	(4)	(5)	(6)
Innovation measurement	Patents	Lagged-Patents	Patents/Employment	Lagged-Patents/Employment	NPS	Lagged-NPS
Main Variables						
Innovation	4.032***	2.614***	1.951***	1.208***	7.068***	2.747***
	(0.669)	(0.464)	(0.574)	(0.186)	(1.121)	(0.677)
BGA	0.675***	0.721***	0.160	0.469*	0.184**	0.456***
	(0.096)	(0.116)	(0.123)	(0.278)	(0.080)	(0.122)
Interactions						
BGA x Innovation	-2.955***	-1.957***	-1.358***	-0.510***	-2.399***	-1.011***
	(0.514)	(0.370)	(0.404)	(0.083)	(0.409)	(0.254)
Control Variables						
Productivity	0.022*		0.061*		0.088***	
	(0.012)		(0.036)		(0.026)	
Lagged-Productivity		0.052***		0.098***		0.022
		(0.020)		(0.021)		(0.040)
Capital intensity	0.045***	0.059***	0.072***	0.045***	0.075***	0.065***
	(0.013)	(0.006)	(0.015)	(0.007)	(0.008)	(0.007)
Human capital	0.107***	0.116***	0.083***	0.109***	0.106***	0.135***
	(0.010)	(0.008)	(0.014)	(0.009)	(0.009)	(0.010)
Size	-0.059***	-0.029**	-0.119***	-0.082***	-0.003	-0.031**
	(0.023)	(0.013)	(0.017)	(0.015)	(0.013)	(0.014)
Inventory	-0.157***	-0.149***	-0.107***	-0.159***	-0.199***	-0.183***
	(0.025)	(0.022)	(0.030)	(0.032)	(0.028)	(0.028)
Tangibility	-0.046***	-0.086***	-0.041***	-0.079***	-0.035***	-0.061***
	(0.009)	(0.009)	(0.013)	(0.012)	(0.007)	(0.011)
Subsidy	0.049***	0.038***	0.068***	0.019	0.043***	0.060***
	(0.011)	(0.010)	(0.014)	(0.012)	(0.011)	(0.012)
SOE	0.104***	0.057*	0.023	0.025	0.016	0.080*
	(0.032)	(0.032)	(0.034)	(0.044)	(0.024)	(0.042)
Assets_BG	0.004	0.006*	0.004	0.002	0.002	0.006*
	(0.003)	(0.003)	(0.005)	(0.004)	(0.003)	(0.003)
Kleibergen-Paap rank LM statistic	76.472***	113.188***	25.796***	23.456***	89.579***	131.533***
Kleibergen-Paap rank Wald F statistic	25.495***	37.747***	15.266***	14.493***	29.866***	43.894***
Hansen-J statistic	0.192	1.123	3.488	2.681	1.598	1.865
Number of firms	233,123	137,622	233,123	137,622	233,123	137,622
Number of observations	588,243	351,247	588,243	351,247	588,243	351,247

Notes: Robust standard errors in parentheses. Fixed effects included. *, **, *** significance at 10%, 5% and 1%, respectively.

Table 5: Robustness analysis

Innovation measurement	Patents	Lagged-Patents	Patents/Employment	Lagged-Patents/Employment	NPS	Lagged-NPS
Dependent variable = EP						
Innovation	0.944***	0.443***	0.435***	0.218***	0.846***	0.347***
	(0.121)	(0.093)	(0.062)	(0.046)	(0.100)	(0.122)
BGA	0.667***	0.302***	0.608***	0.279***	0.602***	0.450***
	(0.037)	(0.019)	(0.035)	(0.019)	(0.035)	(0.035)
BGA x Innovation	-0.657***	-0.439***	-0.393***	-0.114***	-0.382***	-0.239***
	(0.093)	(0.078)	(0.050)	(0.031)	(0.085)	(0.101)
Number of firms	239,131	143,830	239,131	143,830	239,131	143,830
Number of observations	603,263	369,383	603,263	369,383	603,263	369,383
Dependent variable = EIS						
Innovation	0.226***	0.167***	0.205***	0.156**	0.195***	0.178*
	(0.057)	(0.026)	(0.028)	(0.073)	(0.060)	(0.107)
BGA	0.049**	0.017***	0.019	0.016	0.015	0.020
	(0.024)	(0.006)	(0.026)	(0.026)	(0.020)	(0.045)
BGA x Innovation	-0.158***	-0.054**	-0.117***	-0.099***	-0.060***	-0.023**
	(0.040)	(0.026)	(0.036)	(0.024)	(0.014)	(0.012)
Number of firms	202,740	106,239	202,740	106,239	202,740	106,239
Number of observations	499,212	282,216	499,212	282,216	499,212	282,216
Dependent variable = EIE, including Innovation_BG as an additional explanatory variable						
Innovation	4.031***	2.609***	1.962***	1.209***	7.001***	2.736***
	(0.670)	(0.464)	(0.574)	(0.185)	(1.112)	(0.677)
BGA	0.675***	0.709***	0.167	0.471*	0.184**	0.465***
	(0.096)	(0.115)	(0.122)	(0.278)	(0.079)	(0.123)
BGA x Innovation	-2.951***	-1.952***	-1.361***	-0.519***	-2.350***	-0.982***
	(0.514)	(0.370)	(0.404)	(0.084)	(0.401)	(0.250)
Innovation_BG	-0.120**	-0.012	-0.514***	-0.361***	-0.033	-0.072
	(0.052)	(0.049)	(0.167)	(0.090)	(0.046)	(0.056)
Number of firms	233,123	137,622	233,123	137,622	233,123	137,622
Number of observations	588,243	351,247	588,243	351,247	588,243	351,247

Notes: Robust standard errors in parentheses. Control variables and fixed effects are included in all specifications but not reported for brevity. *, **, *** significance at 10%, 5% and 1%, respectively.

Table A1: A summary of selective firm-level studies on the effects of innovation on exports

	Study	Sample	Innovation measures	Export performance measures	Endogeneity of innovation considered	Business group (BG) considered	Key findings on the effects of innovation, and BG if it is considered, on exports
1.	Alarcón and Sánchez (2016)	Spanish food and agricultural firms	R&D expenditure PD_dummy PS_dummy	EP	Yes	No	• In agricultural firms, positive effects (+ve hereafter) of PD and insignificant effects of PS on EP • In food firms, insignificant PD and +ve PS on EP • +ve R&D expenditure in both samples
2.	Alegre et al. (2012)	Italian and Spanish ceramic tile producers	Product innovation performance based on two dimensions: innovation effectiveness and innovation efficiency	EIS	No	No	+ve
3.	Altomonte et al. (2016)	Manufacturing firms located in 7 European countries (Austria, France, Germany, Hungary, Italy, Spain and UK)	R&D_dummy	EP	Yes	No	+ve
4.	Amadu and Danquah (2019)	Ghanaian firms	Innovation_dummy R&D_dummy	EP	Yes	No	+ve
5.	Aristei et al. (2013)	Manufacturing firms from 27 Eastern European and Central Asian countries	PD_dummy	EP EIS	Yes	No	+ve
6.	Aw et al. (2011)	Taiwanese electronics manufacturing firms	R&D_dummy	EP	Yes	No	Mutually positive effects of innovation and export
7.	Ayllon and Radicic (2019)	Spanish manufacturing firms	Internal RDI External RDI % of R&D personnel PD_dummy	EP	Yes	No	Insignificant

			PS_dummy				
8.	Azar and Ciabuschi (2017)	Swedish firms	Subjective measures of technological innovation and organizational innovation	Export performance measured using six items within two dimensions of financial performance and strategic effectiveness	No	No	+ve
9.	Azar and Drogendijk (2016)	Swedish firms	Subjective measures of technological innovation and organizational innovation	Export performance measured using six items within two dimensions of financial performance and strategic effectiveness	No	No	+ve
10.	Azari et al. (2017)	Norwegian exporting SMEs	Subjective measures of product innovation focus, process innovation focus, business model innovation focus and service innovation focus	Subjective measures of EI Export breadth = the number of foreign markets within different international geographical areas defined by the firm	No	No	• +ve PD on EI and export breadth • Insignificant PS and service innovation on EI and export breadth • -ve business model innovation on EI and export breadth
11.	Barrios et al. (2003)	Spanish manufacturing firms	RDI	EP EIS	No	No	+ve
12.	Basile (2001)	Italian manufacturing firms in 1991, 1994 and 1997	PD_dummy PS_dummy	EP EIS	No	Yes	• +ve PD & PS on EP • +ve PD on EIS in 1994 and 1997 • +ve PS on EIS in 1997 • insignificant PD in 1991 and PS in 1991 and 1994 • +ve BG
13.	Becchetti and Rossi (2000)	Italian firms	RDE Innovation_dummy	EP EIS	Yes	No	• Insignificant RDE on both EP and EIS • +ve Innovation_dummy on both EP and EIS
14.	Becker and Egger (2013)	German firms	PD_dummy PS_dummy	EP EIS	Yes	No	• +ve PD on EP

							• +ve PS on EP if it is accompanied by PD • Significant bias of the impact of PD & PS on EIS when ignoring endogeneity issue
15.	Bleaney and Wakelin (2002)	UK manufacturing firms	Number of innovations	EP	No	No	+ve only in innovators group
16.	Blyde et al. (2018)	Chilean manufacturing firms	Innovation_dummy	Export sales	Yes	No	+ve
17.	Bortoluzzi et al. (2018)	4 Southeastern European countries (Albania, Bosnia and Herzegovina, Serbia and Montenegro)	Subjective measures of product innovation, organizational innovation and marketing innovation	Export breadth	No	No	Curvilinear effects
18.	Boso et al. (2019)	Ghanaian firms	Subjective product innovativeness	Export sales	No	No	+ve innovativeness conditional on dysfunctional competition and market responsiveness
19.	Boso et al. (2013)	Exporting firms in Ghana, Bosnia and Herzegovina	Subjective product/service innovativeness	Export sales Subjective export performance	No	No	+ve innovativeness conditional on export market environment
20.	Bravo-Ortega et al. (2014)	Chilean firms	RDE	EP	Yes	No	+ve
21.	Braymen et al. (2011)	New firms founded in the US in 2004	R&D expenditure	EP	Yes	No	+ve
22.	Caldera (2010)	Spanish firms	R&D_dummy RDI PD_dummy PS_dummy	EP	Yes	No	+ve
23.	Carboni and Medda (2018)	Manufacturing firms from 7 European countries (Austria, France, Germany, Hungary, Italy, Spain and UK)	R&D_dummy RDI	EP	Yes	No	+ve
24.	Cassiman and Golovko (2011)	Spanish manufacturing firms	PD_dummy PS_dummy	EP	Yes	No	• +ve PD • Insignificant PS

25.	Cassiman et al. (2010)	Spanish manufacturing firms	PD_dummy PS_dummy	EP	Yes	No	• +ve PD • Insignificant PS
26.	Castellacci and Fevolden (2014)	Norwegian defense firms	RDI	EI	No	No	Insignificant
27.	Chakrabarti and Mondal (2017)	Indian firms	RDI	EIS	No	Yes	• +ve innovation • -ve BG
28.	Damijan et al. (2010)	Slovenian firms	PD_dummy PS_dummy	EP	Yes	No	Insignificant PD & PS
29.	Di Cintio et al. (2017)	Italian manufacturing SMEs	RDI	EIS	Yes	No	+ve
30.	Dohse and Niebuhr (2018)	German firms	PD_dummy PS_dummy Radical innovation dummy Incremental innovation dummy	EP	Yes	No	• +ve PD and incremental innovation • Insignificant PS and radical innovation
31.	Esteve-Perez and Rodriguez (2013)	Spanish manufacturing SMEs	R&D_dummy	EP	Yes	No	+ve
32.	Falk and de Lemos (2019)	Austrian SMEs	RDI	EP EIS	No	No	+ve
33.	Faustino and Matos (2015)	Portuguese manufacturing firms	R&D expenditure	Export sales	Yes	No	Insignificant
34.	Fernandez-Mesa and Alegre (2015)	Italian and Spanish ceramic tile producers (SMEs)	Innovation performance based on three dimensions: product and process innovation effectiveness and innovation efficiency	EIS	No	No	+ve
35.	Filatotchev et al. (2009)	Chinese SMEs in high-tech industry	RDE	EP Export orientation (Export sales as a categorical variable) Subjective export performance	No	No	• +ve innovation on EP only in returnee-owned firms • +ve innovation on export orientation and subjective export performance variables
36.	Filatotchev and Piesse (2009)	IPO firms in France, Germany, Italy and UK	RDI	EIS	No	No	+ve

37.	Filipescu et al. (2013)	Spanish manufacturing firms	RDI Number of PDs PS_dummy	Export breadth Export depth = EIS	Yes	No	• +ve RDI and PS • Insignificant PD
38.	Flor and Oltra (2005)	Spanish ceramic tile manufacturing firms	Intensity of internal R&D Intensity of internal non-R&D innovation activities	Subjective export performance	No	No	• Insignificant intensity of internal R&D • +ve intensity of internal non-R&D innovation activities
39.	Fryges et al. (2015)	German business services firms	% of R&D personnel	EIS	Yes	No	+ve
40.	Fu (2011)	Chinese firms	NPS	EP Export sales	Yes	No	+ve
41.	Gajewski and Tchorek (2017)	Polish exporting manufacturing firms	PD_dummy PS_dummy	EIS	No	No	• +ve PD • Insignificant PS
42.	Ganotakis and Love (2011)	UK firms	PD_dummy NPS	EP EIS	Yes	No	• +ve PD and NPS on EP • Conditional on having entered export markets, insignificant innovation (PD and NPS) on EIS
43.	Gashi et al. (2014)	SMEs in 31 transition economies	R&D expenditure PD_dummy	EP EIS	Yes	No	• Insignificant R&D expenditure • +ve PD
44.	Geldres-Weiss et al. (2016)	Chilean exporting firms in La Araucania	New products the firm exports	Export sales	No	No	Insignificant
45.	Girma et al. (2008)	UK and Irish firms	R&D_dummy RDI	EP EIS	Yes	No	• In the sample of British domestic firms, insignificant R&D on EP • In the sample of Irish domestic firms, +ve R&D on EP • Insignificant RDI on EIS in both samples
46.	Gkypali et al. (2018)	Greek R&D active manufacturing firms	Innovation performance based on % of innovative sales in total sales and % of innovative products in total range of products	Export performance based on export intensity and 5-year export growth	No	No	Insignificant

47.	Gkypali et al. (2015)	Greek R&D active manufacturing firms	% of new or improved product sales in total sales	EIS	Yes	No	+ve in mature firms group, not in young firms group
48.	Golovko and Valentini (2011)	Spanish manufacturing firms	Innovation_dummy RDI	EP	Yes	No	Innovation and exports positively reinforcing each other in a dynamic virtuous circle
49.	Gourlay and Seaton (2004)	UK firms	RDI	EP	No	No	+ve
50.	Gourlay et al. (2005)	UK service firms	RDI	EP EIS	No	No	+ve
51.	Guan and Ma (2003)	Chinese firms	Supplementary innovation assets Core innovation assets	EIS	No	No	• +ve supplementary innovation assets • Insignificant core innovation assets
52.	Gubbi et al. (2015)	Indian pharmaceutical firm	RDI	EP EIS	No	Yes	• Insignificant innovation on EP • +ve innovation on EIS • Insignificant BG on EP during 1992-1997 and +ve BG during 1998-2007 • -ve BG on EIS
53.	Halilem et al. (2014)	Canadian SMEs	PD_dummy PS_dummy	EIS to the US market EP to non-US markets	Yes	No	• +ve PD and insignificant PS on EIS to the US markets • Insignificant PD and PS on EP to non-US markets
54.	Harris and Li (2009)	UK firms	R&D in 2010 dummy = 1 if the establishment undertook any R&D in 2000 Continuous R&D dummy = 1 if the establishment undertook R&D continuously during 1998-2000	EP EIS	Yes	No	• +ve innovation on EP • Conditional on having entered export markets, insignificant innovation on EIS
55.	Harris and Li (2011)	UK manufacturing firms	R&D_dummy	EP	Yes	No	+ve
56.	Añón Higón and Driffield (2011)	UK SMEs	PD_dummy PS_dummy	EP	Yes	No	• +ve PD • Taking into account PD, insignificant PS

57.	Imbriani et al. (2014)	Italian manufacturing SMEs	PD_dummy PS_dummy	EP	No	No	+ve
58.	Ito and Lechevalier (2010)	Japanese firms	R&D_dummy RDI	EP EIS	No	No	• +ve R&D_dummy on EP • Insignificant RDI on EIS
59.	Kirbach and Schmiedeberg (2008)	German manufacturing firms	PD_dummy PS_dummy RDI	EP EIS	Yes	No	• +ve PD • insignificant PS • +ve, non-linear RDI on EP and EIS
60.	Kiss et al. (2018)	Manufacturing firms in 7 European countries (Austria, France, Germany, Hungary, Italy, Spain and UK)	RDI	EIS	No	No	+ve
61.	Kumar and Siddharthan (1994)	Indian firms	RDI	EIS	No	No	+ve in 4 out of 13 industries
62.	Lachenmaier and Wößmann (2006)	German manufacturing firms	Innnovation_dummy RDI	EIS	Yes	No	+ve
63.	Laursen et al. (2012)	Italian manufacturing firms	Innovation_dummy % of R&D personnel	EIS	No	No	+ve
64.	Lefebvre et al. (1998)	Canadian SMEs	RDI	EP EIS	No	No	Insignificant
65.	Lo Turco and Maggioni (2015)	Turkish manufacturing firms	PD_dummy PS_dummy	EP	No	No	+ve
66.	López Rodríguez and García Rodríguez (2005)	Spanish manufacturing firms	RDI PD_dummy PS_dummy Number of PDs Patent_dummy Number of patents	EP EIS	No	No	• +ve of PD, PS and patent • RDI affecting EIS but not EP
67.	Lopez-Bazo and Motellon (2018)	Spanish manufacturing firms	PD_dummy PS_dummy Innovation_dummy	EP	Yes	No	+ve

68.	Love et al. (2016)	UK SMEs	Innovation_dummy Radical innovation_dummy	Export breadth = the number of exporting countries/regions EIS	No	No	• +ve on export breadth, • Insignificant on EIS
69.	Mancusi et al. (2018)	Italian manufacturing firms	Innovation_dummy	EP EIS	Yes	No	+ve
70.	Manez et al. (2015)	Spanish manufacturing firms	R&D_dummy	EP	Yes	No	+ve
71.	Monreal-Pérez et al. (2012)	Spanish manufacturing firms	RDI R&D_dummy PD_dummy PS_dummy	EP	Yes	No	• +ve innovation variables except RDI • Insignificant RDI
72.	Mulliqi et al. (2019)	Firms in 29 European and Central Asian transition economies	R&D_dummy PD_dummy PS_dummy	EIS	Yes	No	• +ve R&D • PD & PS insignificant in fractional logit model but +ve in Tobit model
73.	Nassimbeni (2001)	Italian SMEs	PD (1=low, ...,5=high) PS (1=low, ...,5=high) Amount of investment in innovation (1=low, ...,5=high)	EIS	No	No	+ve
74.	Ogasavara et al. (2016)	Brazilian exporters	Subjective measure of innovation resources	Subjective measures of export performance	No	No	+ve
75.	Ossorio (2018)	Italian listed firms	RDI	EIS	No	No	+ve
76.	Oura et al. (2016)	Brazilian industrial SMEs	Innovation capacity based on a set of questions	Export performance based on a set of questions	No	No	+ve
77.	Ozcelik and Taymaz (2004)	Turkish manufacturing firms	PD_dummy PS_dummy Innovation_dummy RDI	EIS	No	No	• +ve innovation variables except PD • Insignificant PD
78.	Papalia et al. (2018)	German manufacturing firms	PD_dummy PS_dummy	EP	Yes	No	• In small firms, +ve PD and -ve PS • In medium firms, +ve PD and insignificant PS • In large firms, insignificant PD and +ve PS

79.	Pla-Barber and Alegre (2007)	French biotechnology firms	Innovation outcome based on a set of questions	EIS	No	No	+ve
80.	Radicic and Djalilov (2019)	SMEs in 28 EU countries	Technological innovation_dummy Non-technological Innovation_dummy	EIS	Yes	No	• +ve technological innovation in all but large firms • Insigificant non-technological innovation
81.	Rasiah et al. (2016)	Taiwanese semiconductor firms	Innovation capabilities	EIS	No	No	+ve
82.	Rialp-Criado and Komochkoya (2017)	Chinese SMEs	Internal RDI PD_dummy PS_dummy	EIS	Yes	No	-ve
83.	Ribau et al. (2017)	Portugal plastics SMEs	Innovation capabilities	Export performance	No	No	+ve
84.	Rodil et al. (2016)	Spanish firms	R&D_dummy Variety of innovation dummy Marketing innovation dummy	EP EIS	No	No	• +ve on EP • Insignificant R&D_dummy, but +ve Variety of innovation dummy and marketing innovation dummy on EIS
85.	Rodriguez and Rodriguez (2005)	Spanish firms	RDI PD_dummy PS_dummy Number of PDs Number of patents	EP EIS	No	No	• +ve for all innovation variables except RDI on EP • Insignificant RDI on EP • +ve for all innovation variables on EIS
86.	Roper and Love (2002)	UK and German manufacturing plants	PD_dummy Innovation intensity = number of product changes made by the plant/number of employees Innovation “success” = the proportion of each plant’s sales derived from new products	EP EIS	No	No	• +ve PD on EP but not EIS • Innovation intensity having no bearing • +ve innovation “success” on EIS, but not on EP of UK plants, -ve on EP, but not on EIS of German plants
87.	Roper et al. (2006)	Manufacturing plants in Ireland and Northern Ireland	Dummy variable for in-house R&D department	EIS	No	No	+ve

88.	Saridakis et al. (2019)	UK SMEs	Innovation dummy for new or significantly improved goods Innovation dummy for new or significantly improved services PS_dummy Radical PD_dummy Incremental PD_dummy Radical PS_dummy Incremental PS_dummy	EP	No	No	+ve
89.	Shinkle and Kriauciunas (2010)	Non-financial firms in 4 transitional economies: Belarus, Bulgaria, Lithuania, and Ukraine	% R&D personnel	EP Export sales growth	No	No	• Insignificant on EP • +ve on export sales growth
90.	Silva et al. (2017)	Portuguese manufacturing exporting firms	Subjective tech-innovation	Subjective economic export performance Subjective strategic export performance	No	No	+ve
91.	Singh (2009)	Indian manufacturing firms	R&D expenditure	Export sales	No	Yes	• +ve innovation • +ve BG
92.	Sterlacchini (1999)	Italian manufacturing firms	Innovative content of capital stock Ratio of expenditure on design, engineering and trial production to sales Share of costs for acquiring innovative capital goods on sales Innovation_dummy	EP EIS	No	Yes	• +ve innovation, albeit not all innovation variables statistically significant • Insignificant BG
93.	Sterlacchini (2001)	Italian manufacturing firms	% of R&D personnel Product R&D (0=not significant, ...,3=very important) Process R&D (0=not significant, ...,3=very important)	EP EIS	No	Yes	• +ve Product R&D • +ve R&D personnel and introduction of innovative machinery, but the level of significance varying by firm size • Insignificant Process R&D

			Introduction of innovative machinery (0=not significant, ...,3=very important)				• +ve BG in large firms
94.	Stucki (2016)	Swiss firms	Innovation activities capturing innovation inputs and outputs in four aspects	EP Export sales	No	No	• +ve on EP • Insignificant on export sales
95.	Tavassoli (2018)	Swedish manufacturing firms	Innovation output = NPE Innovation input = RDE	EP EIE	Yes	No	• Accounting for endogeneity, ○ -ve RDE on EP ○ Insignificant RDE on EIE ○ +ve NPE in all specifications on EIE
96.	Tomiura (2007)	Japanese firms	RDI Patent/Sales	EP	No	No	+ve
97.	Van Beveren and Vandenbussche (2010)	Belgian firms	Internal R&D_dummy External R&D_dummy PD_dummy PS_dummy	EP	Yes	No	Insignificant
98.	Veganzones-Varoudakis and Plane (2019)	Indian firms	R&D_dummy The number of innovation types	EIO	Yes	No	R&D affects innovation which in turn affects exports
99.	Villar et al. (2012)	Spanish ceramic tile firms	Product innovation measured by the total amount of innovations as published in specialized journals	EIS divided into categories	No	No	+ve of innovation, conditional on size and experience
100.	Wakelin (1998)	UK firms	Innovation_dummy Number of innovations	EP EIS	No	No	• -ve innovation dummy on EP but +ve the number of innovations on EP • Insignificant on EIS
101.	Wang (2014)	Chinese manufacturing firms	R&D_dummy	EP	No	No	+ve
102.	Wang et al. (2013)	Chinese manufacturing firms	RDE New product sales	EIS Export sales	Yes	No	• +ve RDE • Insignificant New product sales
103.	Willmore (1992)	Brazilian firms	R&D_dummy	EP	No	No	Insignificant

				Log (exports)			
104.	Yang et al. (2004)	Taiwan manufacturing firms	R&D_dummy RDI	EP	Yes	No	+ve
105.	Yang and Chen (2012)	Indonesian manufacturing firms	R&D_dummy RDI	EIO	Yes	No	+ve
106.	Yi et al. (2013)	Chinese firms	NPS	EIS	Yes	Yes	• +ve innovation • -ve BG • +ve the interaction between innovation and BG when using hierarchical regression with lagged variables, but insignificant when using GMM
107.	Yuan et al. (2015)	Chinese firms	R&D expenditure	EIS Export sales	Yes	No	-ve
108.	Zhang and Zhu (2016)	Chinese manufacturing exporters	Subjective productive innovation performance	Subjective export performance	No	No	+ve

Notes on variable names:

- Innovation_dummy: Innovation dummy = 1 if firm realized either product or process innovation;
- Patent dummy = 1 if firm registered patent (Patent_dummy);
- PD_dummy: Product innovation (PD) dummy = 1 if firm innovating in products;
- PS_dummy: Process innovation (PS) dummy = 1 if firm innovating in processes;
- R&D_dummy: R&D dummy = 1 if firm reported R&D activities;
- Internal R&D_dummy: Internal R&D dummy = 1 if firm engaged in internal R&D activities;
- External R&D_dummy: External R&D dummy = 1 if firm engaged in external R&D activities;
- RDI: R&D intensity in terms of sales = (R&D expenditure)/Sales;
- RDE: R&D intensity in terms of employment = R&D expenditure per employee
- NPS: The share of new product sales in total sales = (New production sales)/Sales
- NPE: New product sales per employee
- EP: Export propensity = 1 if firm exports
- EIE: Export intensity in terms of employment = Export per employee
- EIO: Export intensity in terms of output = Export/Output
- EIS: Export intensity in terms of sales = Export/Sales

Table A2: A summary of selective firm-level studies on the effects of business group affiliation on internationalization

	Paper	Sample	Innovation measures	Internationalization measures	Findings on BG and innovation if considered
1.	Agnihotri and Bhattacharya (2019)	Indian firms	RDI	FITI	• -ve BG • +ve innovation
2.	Alcantara and Mitsuhashi (2012)	Firms in the Japanese automobile parts industry	Not included	FDI dummy	Firms generally take risk in choosing FDI destinations when not affiliated with BG. Nonetheless, small firms with BGA are more likely to enter host countries with high political instability than are large firms with such affiliation.
3.	Belderbos et al. (2012)	Japanese firms	Not included	The share of import from Japan in total capital good procurement of the focal affiliate in 1995	+ve
4.	Basile (2001)	Italian manufacturing firms in 1991, 1994 and 1997	PD_dummy PS_dummy	EP EIS	• +ve BG • +ve PD & PS on EP • +ve PD on EIS in 1994 and 1997, +ve PS on EIS in 1997 and insignificant PD in 1991 and PS in 1991 and 1994
5.	Chakrabarti and Mondal (2017)	Indian firms	RDI	EIS	• -ve BG • +ve innovation
6.	Chari (2013)	Indian firms	RDI	The ratio of foreign investments to total assets FDI dummy	• +ve BG • +ve innovation
7.	Chen and Jaw (2014)	Taiwanese firms	RDI	FSTS	• +ve BG • +ve innovation
8.	Chidambaran et al. (2018)	Indian firms	Not included	Cross-border acquisition dummy	Firms belonging to a BG are more likely to undertake acquisition, but there is no difference between whether an acquisition is domestic or cross-border.
9.	Chittoor et al. (2015)	Indian firm listed on the Bombay Stock Exchange	RDI	Overseas acquisition dummy	• +ve BG • +ve innovation
10.	Chittoor et al. (2009)	Indian firm	RDI	FSTS	• -ve BG • +ve innovation
11.	Chung and Dahms (2016)	Taiwanese firms	Not included	Relative sales percentage in foreign markets	+ve

12.	Duanmu (2015)	Chinese firms in Wuxi	R&D_dummy	FDI dummy	• Insignificant BG • +ve innovation
13.	Gaur and Delios (2015)	Indian firms	RDI	FSTS FATA	• -ve BG on FSTS • Insignificant BG on FATA in the full sample and subsamples except during 2001-2005 • During 2001-2005, +ve of BG on FATA • +ve innovation on FSTS in full sample but insignificant in subsamples • Insignificant innovation on FATA in the full sample and subsamples of 1996-2000 and 2001-2005 • -ve innovation on FATA in the sub-sample of 1991-1995
14.	Gaur et al. (2014)	Indian firms	R&D expenditure	Dummy variable to capture the shift from exports to FDI	• +ve BG • +ve innovation • +ve the interaction between BG and innovation
15.	Gubbi et al. (2015)	Indian pharmaceutical firm	RDI	EP EIS	• Insignificant BG on EP during 1992-1997 and -ve BG during 1998-2007 • -ve BG on EIS • Insignificant innovation on EP • +ve innovation on EIS
16.	Li et al. (2017)	Chinese listed firms	Not included	Number of new FDI entry	Insignificant effects of state-owned BG
17.	Purkayastha (2018)	Indian firms	RDI	FSTS	• +ve BG • +ve innovation
18.	Purkayastha et al. (2018)	Indian firms	RDI	Degree of internationalization calculated as summation of (a) FSTS, (b) FATA, (c) number of overseas subsidiaries to total number of subsidiaries (OSTS), and (d) proportion of the number of countries where a firm has subsidiaries to highest number of countries with subsidiaries represented in the sample in a particular year (Scope)	• +ve BG • +ve innovation • +ve the interaction between BG and innovation
19.	Singh (2009)	Indian manufacturing firm	R&D expenditure	Export sales	• +ve BG • +ve innovation

20.	Sterlacchini (1999)	Italian manufacturing firm	Innovative content of capital stock Ratio of expenditure on design, engineering and trial production to sales Share of costs for acquiring innovative capital goods on sales Innovation_dummy	EP EIS	• Insignificant BG • +ve innovation, albeit not all innovation variables statistically significant
21.	Sterlacchini (2001)	Italian manufacturing firm	% of R&D personnel Product R&D Process R&D Introduction of innovative machinery	EP EIS	• +ve BG in large firms • +ve Product R&D • +ve R&D personnel and introduction of innovative machinery, but the level of significance varying by firm size • Insignificant Process R&D
22.	Stucchi et al. (2015)	Indian firms	Not included	Number of foreign subsidiaries	-ve
23.	Tajeddin and Carney (2019)	SMEs in 33 African countries	Not included	EIS	+ve
24.	Yi et al. (2013)	Chinese firms	NPS	EIS	• -ve BG • +ve the interaction between innovation and BG when using hierarchical regression with lagged variables, but insignificant when using GMM • +ve innovation

See notes in Table A1. Notes on additional variable names:

- FITI: The ratio of foreign investments to total investment of the firm
- FSTS: The ratio of foreign sales to total sales
- FATA: The ratio of foreign assets to total assets

Table A3: Institutional Reforms and Key Policies Related to Business Groups in China

Timeline	Reforms and Key Policies
Phase 1: 1980-86	Chinese government starting to encourage the reorganization of SOEs to form business groups
Phase 2: 1987-92	
1987	State Council of China enacted the regulation "Several Suggestions on the Establishment and Development of Business Groups"
1989	National Development and Reform Commission issued "A Summary of the Symposium on Organization and Management of Business Groups"
1991-1992	State Council promulgated a series of guidelines and policies, including: • "The Instructions on the Selection of a Number of Large Business Groups to carry out a pilot" • "The Methods of Approval Procedure for National Pilot Business Groups" • "The Interim Measures for the Establishment and Development of Business Groups by Township Enterprises" • "The Measures for the Implementation of the Registration and Management of the National Pilot Business Groups"
Phase 3: 1993-2002	
1993	In November 1993, the third Plenary Session of the 14th CPC (Central Committee the Party) passed "The Decision on Several Issues Concerning the Establishment of the Socialist Market Economy"
1994	State Council issued "The Outline of the National Industrial Policy in the 1990s"
1994	Company Law was introduced
1997	State Council approved State Planning Commission, State Economic and Trade Commission and State Commission to issue "Notice on Deepening the Pilot Work of Large Business Groups"
1998	Securities Law was introduced to regulate capital markets and trading activities
1999	In September 1999, the 15th National Congress of the CPC passed "The Decision of CPC Central Committee on Major Issues concerning the Reform and Development of State-Owned Enterprises" which made BGs a pillar of the national economy and a major force in international competition
1999	1994 Company Law was amended
2002	Code of Corporate Governance for listed companies was released
Phase 4: 2003-	
2003	State-owned Assets Supervision and Administration Commission of the State Council (SASAC) was established, which played a crucial role in the reform of state-owned BGs
2008	Anti-monopoly Law was introduced and the Anti-monopoly Law Enforcement Authority (ALEA), an agency of the Ministry of Finance and Commerce (MOFCOM), was set up with the authority to review and rule on proposed mergers and acquisitions (M&A)

Figure 1: The number of business groups in the sample

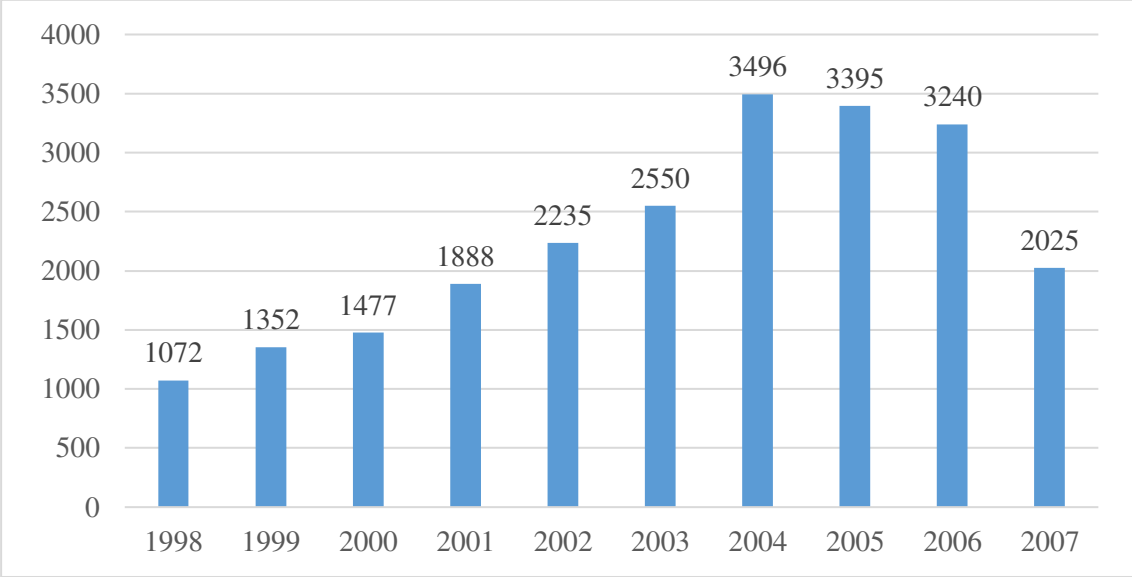
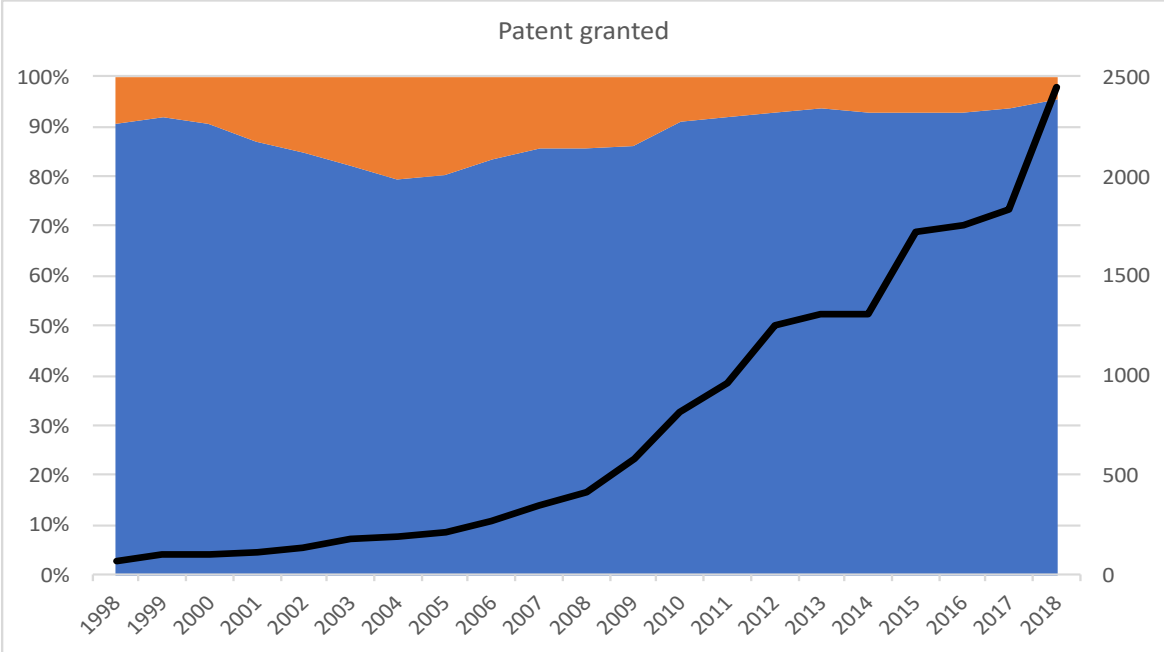


Figure 2: Patent granted by firms registered in China, 1998-2018



Note: Black sold line is the total number of patent granted in thousands and they follow the right-side y-axis. Orange area represents the share of foreign patent granted and blue area represents the share of domestic patent granted. They follow the left-side y-axis, adding to 100%.