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Political tie hot potato: The contingent effect of China's anti-corruption policy on cash and innovation

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ABSTRACT

In this study, we combine the resource-based view (RBV) with institutional theory to examine how a firm's cash holding affects its innovation investments and outcomes and explore the contingent roles of political ties and the national anti-corruption policy. Using 18,125 firm-year observations of Chinese firms from 2007 to 2016, we reveal a three-way interactive effect of cash holding, political ties, and the anti-corruption policy on innovation. Before the policy is implemented, cash holding has the greatest positive effect on R&D investment for politically connected firms, and after the implementation this positive effect for these firms is strongest for R&D outcomes. We propose that the logic of resource utilization efficiency implied by the anti-corruption policy strongly motivates politically connected firms to convert their R&D investment into actual output. The theoretical and practical implications are discussed.

1. Introduction

Innovation is the key driver of economic growth (Basile, 2001) and competitive advantage (Porter, 1990). Factors that are unique to emerging markets can affect innovation and are thus drawing increasing attention (Gao et al., 2021; Krammer and Jiménez, 2020; Zhou et al., 2017). Political ties in emerging economies such as China's are found to affect firm innovation behavior due to the power of the government and underdeveloped market institutions (Lin et al., 2014; Zhang et al., 2015). Although the motivations behind innovation have been extensively explored (e.g., Zhou and Li, 2008), most studies focus on either innovation investment (e.g., Zhang et al., 2020) or outcomes (e.g., Qian, 2007). However, the key question of how efficiently firms can transform resources into actual innovation outcomes has not been fully addressed. In this study, we address this question by examining the key antecedents and external political factors that help determine how a firm can use and allocate investment resources efficiently in an emerging market context.

Adequate resources are essential for the development of innovative projects, and can be tangible or intangible (Teece et al., 1997), internal or external (Park and Luo, 2001). Central to the resource-based view (RBV) is the notion that various resources and capabilities should be developed or obtained (Peteraf, 1993); however, the types of resources that best contribute to the innovation process have not been identified in the literature. Unlike the absorbed slack within an organization, cash holding is fully fungible and readily convertible, and thus provide invaluable flexibility and a safety net for firms faced with the uncertainty of innovative projects (Mishina et al., 2004). Thus, firms with more cash holding are likely to be better prepared for the potential failures of R&D endeavors (Jeffrey et al., 2010).

Institutional theory (North, 2005) suggests that in emerging economies, the ability to efficiently utilize resources and achieve optimal innovation outcomes can be severely constrained by the relationships firms have with the government (Nee and Opper, 2012; Zhou et al., 2017). Many studies suggest that political ties support firms through financing, policy information, relational-based contracts, and even technical assistance (e.g., Faccio, 2006; Musacchio et al., 2015). However, whether such connections help firms engaged in innovative activities (e.g., Kotabe et al., 2017) address the challenges of weak legal institutions, which cannot be resolved by tangible financial resources (e.g., cash holding), is unclear. From a dynamic resource-based view (Foss and Ishikawa, 2007), the ability of a firm to integrate, build, and reconfigure internal and external resources can help ensure its

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competitive advantage. However, no clear conceptual model has been developed to explain how various types of resources can be combined (e.g., Helfat and Peteraf, 2003) in the innovation process. In our study, we regard political ties as a type of external, intangible resource (Nee and Opper, 2010) and examine their moderating role in the relationship between cash holding and R&D investment and outcomes.

The cost and benefits of building political connections have also been extensively explored. Strong evidence has been provided that firms can use their political ties to improve their legitimacy and overcome the constraints imposed by weak institutions (Guo et al., 2014; Zhu et al., 2017), but some studies find that political ties can be counterproductive (Boubakri et al., 2008; Fan et al., 2007; Hadani and Schuler, 2013). We suggest that these mixed results (Wang et al., 2019) may be due to the political environment in which firms are embedded or to systematic environmental changes caused by significant national events (Yu et al., 2019), and this political context leads to a double-edged effect of political connections (Ge et al., 2019; Sun et al., 2012). Various theoretical frameworks have been used to identify the effects of national political institutions on political ties (Ge et al., 2019; Sun et al., 2012), and the contingent value of political connections when regimes change has also been acknowledged (e.g. Dieleman and Boddewyn, 2012; Siegel, 2007). We specifically examine how firms in an emerging economy reallocate resources to protect themselves from the risks associated with political ties when a national anti-corruption campaign is implemented. The value of political ties has typically been examined at the organizational level (e.g., Dieleman and Boddewyn, 2012; Sun et al., 2012; Siegel, 2007), while the effects of policy changes at the national level have not been fully explored. Major political events (e.g., anti-corruption campaigns) can disrupt the status quo of political resources and may limit the "gray zone" of benefits exchange through political ties.

In this study, we examine the conditions under which a firm's political capital improves the efficiency of their innovation activities by exploring the moderating effect of the anti-corruption policy in China. The 18th National Congress of the Communist Party of China in 2012 introduced a nationwide anti-corruption campaign. This event had long lasting and significant effects on businesses in China and thus provides an invaluable opportunity to explore how firms respond to it and change their allocation of political and financial capital to innovation. We suggest that although freedom from political accountability motivates entrepreneurs to invest more in innovation, such freedom will be restricted by an anti-corruption policy that emphasizes resource utilization efficiency. Our study explores the three-way interaction effects of cash holding, political ties, and the anti-corruption policy on R&D investment and R&D outcomes independently.

Our study makes several contributions to the literature. First, we develop a framework to identify the role of diverse resources in the innovation process and consider both innovation investment and outcomes. This framework enables us to examine the details of the relationship between investment and outcomes, and to establish how a firm can efficiently translate innovation investment into outcomes, which has not been previously considered. Second, we combine the dynamic RBV and an institutional perspective to reveal how the cash holding of a firm affects its R&D decisions in an emerging market (e.g., Pinkowitz et al., 2013). We suggest that cash holding represents flexible internal financial slack and can serve as a buffer against environmental uncertainty in R&D activities. In addition, as both internal and external resources are important in determining strategy (Dieleman and Sachs, 2008; Park and Luo, 2001), we suggest that innovation investment and outcomes can be jointly affected by internal capabilities such as a firm's cash holding and its political connections, which represents a complementary source of valuable external resources. Furthermore, we clarify the theoretical and empirical inconsistencies of political connection's influence on firms' innovation efficiency by testing the contingent effect of anti-corruption policy on political ties. The benefits derived from political ties can be affected by shifts in the political climate (Gulati and Higgins, 2003; Siegel, 2007), but the underlying motivations behind such policy changes are not always clear. The RBV and institutional theory focus on the uniqueness of resources and their allocation (Zhou et al., 2017) rather than the efficiency of resource utilization, which is implicit in anti-corruption policies. Thus, by taking these perspectives our findings reveal how political ties can help encourage innovation spending, and also the double-edged effects of such ties on innovation efficiency following a change in the institutional environment.

2. Theoretical framework and hypotheses development

2.1. RBV, institutional environment, and R&D

We conduct a thorough review of the innovation literature and identify the constructs that form the basis for our theoretical model. We integrate the RBV (Barney, 2001) and institutional theory to explain how various resources in transition economies interact and contribute to firm innovation. RBV focuses on how strategies are associated with specific characteristics of a firm's internal resources, i.e., that they are valuable, rare, unique, and organized (Barney, 2001). Resources can be physical (e.g., land, buildings, cash equivalents) or virtual (e.g., brand reputation, trademarks, knowledge, social networks) but all provide competitive benefits (Wernerfelt, 1984). However, not all resources are equally important to a firm's innovative activities. Valuable resources can be integrated to achieve innovation (Duran et al., 2016; Terziovski, 2010), but how these are prioritized and efficiently managed requires further investigation. To address this gap, we focus on the effect of cash holding on innovation.

The association between a firm's resources and innovation is generally context-specific, and the institutional characteristics of transition economies are likely to influence the role of political resources in innovation (Krammer and Jiménez, 2020; Zhou et al., 2017). Many scholars of RBV suggest that a holistic perspective (Oliver, 1997) should be taken, and that any analysis should consider both the internal resources of firms and the external environment (Barney, 2001; Priem and Butler, 2001). A dynamic RBV (Foss and Ishikawa, 2007; Helfat and Peteraf, 2003) can also be taken, which highlights that judgment and resources are complementary in the process of value creation. Political resources are more important for innovation (Gao et al., 2017; Wu, 2011) in transition economies, due to the lack of well-established legal frameworks for defining intellectual property rights (Hoskisson et al., 2000). Building good relationships with government officials is a strategy widely adopted to reduce environmental uncertainty (Hillman and Wan, 2005) and to mitigate the threat of imitation by rivals (Sheng et al., 2011). Thus, we suggest that political connections serve as an important context in which to investigate Chinese firms' strategic motives for allocating financial resources to innovation.

Unlike stable growth strategies, innovation involves high levels of investment, uncertainty, and risk, and are thus heavily dependent on a firm's available resources. We combine RBV and institutional theory and argue that political ties can provide flexible intangible resources in an environment where factor mobility is severely constrained by governmental interference (Luo, 2003) and can be complementary to the tangible financial resources (such as cash holding) required for innovation (e.g., Kotabe et al., 2017). Although political connections can complement cash holding when addressing the uncertainties of weak legal systems (Sun et al., 2012), their effectiveness depends on firms' institutional environments (Gao et al., 2017; Shi et al., 2014). Macro-level institutional shocks have rarely been considered in investigations into the effects of political ties on innovation (e.g., Gao et al., 2017), so we address this by focusing on the moderating effect the Chinese anti-corruption campaign may have on the joint influences of political and financial resources on innovation. The value of political connections may be severely reduced by the campaign (Hung et al., 2015) and it may also reshape the strategic norms in Chinese corporate culture (Griffin et al., 2017). To better understand the interplay between various resources, the institutional environment, and innovation, we

develop a research framework to test the combined effects of political connections and cash holding on innovation and also examine the contingent value of such connections (see Fig. 1). Thus, we examine the three-way interactive effect of cash holding, political ties, and the anti-corruption policy on R&D investment and R&D outcomes, respectively.

2.2. Cash holding and R&D

From a resource-based perspective, a firm is considered a historically determined collection of various resources (Wernerfelt, 1984) which are semi-permanently tied to its innovation strategies. In the RBV, fully appropriable resources such as physical assets are distinguished from cash reserves, which are more financially flexible (Gamba and Triantis, 2008). Cash held in excess of a firm's transactional needs represents a form of organizational slack, and although this can benefit innovation, it depends on the types of resources made available. Absorbed types of slack such as excess capacity or personnel are not easily converted into useful resources without significant friction (for example, a requirement for software engineers cannot be quickly addressed by transferring underutilized hardware engineers). However, slack in the form of cash is fully fungible and readily convertible, and thus cash holding is particularly relevant when analyzing how firms' innovation choices may be related to slack. Intangible capital cannot typically be pledged as collateral, so large firms prefer to finance innovation through internal funds (Falato et al., 2013) as cash can be used without delay. Thus, firms with sufficient cash holding are more likely to make R&D investments as securing external funds may not always be successful (Brown and Petersen, 2011).

Cash represents a unique type of financial slack and thus can help address latent conflicts between internal political coalitions and provide relief in control mechanisms (Cyert and March 1963). The level of slack within a firm and the R&D costs will likely be assessed when making R&D investment decisions, commensurate with the extent of the investment and whether internal or external resources are required (Lyandres and Palazzo, 2016). Firms that hold slack are protected from the uncertainty of innovation and are thus more likely to pursue innovative projects in general (Bourgeois, 1981). They can also take on risky R&D projects that cannot be easily justified in terms of explicit returns (Levinthal and March 1981), and managers will be more willing to take risks if a firm has some slack and is relatively wealthy (Bromiley, 1991). However, if there is no slack, failure will have extremely damaging consequences, and managers will be more risk-averse and make more conservative decisions (March and Shapira, 1987).

The motivation to hold corporate cash as a precaution is greater in an emerging market such as China as cash becomes an important buffer against the adverse cash flow shocks that can arise in a weak institutional environment (Duchin, 2010). Firms may choose to forgo promising innovation projects when faced with cash flow shortfalls because they are more sensitive to investment expenditure under weak legal institutions and a lack of intellectual property protection (Kusnadi and Wei, 2011). Slack therefore provides a cushion for R&D failure and the impact of the external environment, thus stimulating innovative activity (Jeffrey et al., 2010). We argue that as cash holding is immediately available and completely fungible, it provides a greater safety net and make managers more likely to invest in risky innovation projects.

Hypothesis 1a. *A larger cash holding enables more R&D investment.*

A firm's cash holding may positively affect its R&D investment and capacity to produce new and superior products. Himmelberg and Petersen (1994) suggest that due to "capital market imperfections, the flow of internal finance is the principal determinant of the rate at which small, high-tech firms acquire technology through R&D." Sufficient internal financial slack enables more R&D investment and a greater absorptive capacity, which is associated with R&D outcomes (Cohen and Levinthal, 1989). Firms holding more cash are also more likely to have access to the latest technologies and assimilate novel ideas into their own R&D activities. As innovation is a knowledge-intensive process, we can therefore expect that the higher levels of external knowledge acquisition resulting from cash R&D investment will be associated with more effective R&D outcomes.

Investment in R&D is strongly correlated with positive R&D outcomes (Cumming and MacIntosh, 2000), and Pandit et al. (2011) find a positive relationship between R&D investment and outcomes (in the form of patent counts and citations), although not all firms producing innovative output apply for patents. Schroth and Szalay (2010) demonstrate that firms holding more cash than other firms are more likely to win patent races. In addition, firms with sufficient cash do not need to release propriety information about their innovative projects to raise public funds for R&D investment, and thus do not risk revealing valuable information to their competitors (Bhattacharya and Ritter, 1983). We therefore suggest that a firm's cash holding encourages investment in R&D, provides more opportunities to develop knowledge associated with innovation, and reduces the risks of patent competition, all of which lead to superior R&D outcomes.

Hypothesis 1b. *A larger cash holding enables better R&D outcomes.*

2.3. The moderating role of political ties

Political connections can be considered as essential and flexible resources (Nee and Opper, 2010), and in China, unlike in other more developed economies, they have for many years played a unique role in corporate operations (Gao et al., 2017; Peng and Luo, 2000). In China's transitioning economy, political connections can make up for institutional inadequacies (Xin and Pearce, 1996), a lack of support for innovation, and moral hazards (e.g., contract breaking, violation of intellectual property rights), and can provide access to favorable resources and enable beneficial policies to be discussed (Musacchio et al.,

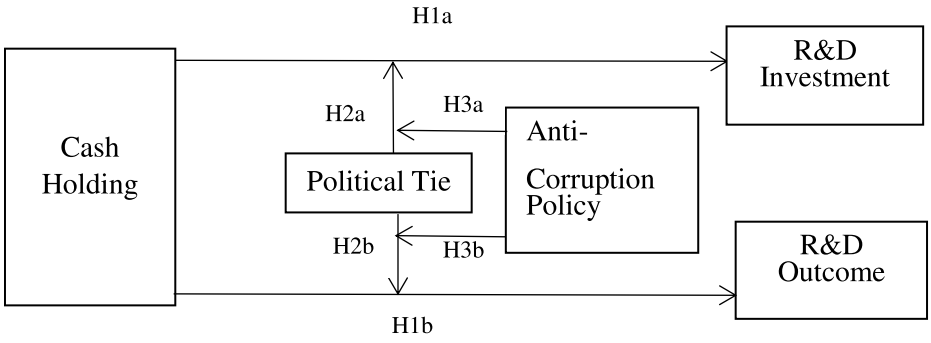

Fig. 1. Research framework.

2015). Chinese firms must depend on the government for important information and resources (Shi et al., 2014, 2017), and in terms of innovation, institutional voids in the capital markets severely constrain a firm's motivation and ability to invest in risky projects (Chen et al., 2014). Building political ties is thus often necessary for addressing the institutional uncertainties during the firm innovation process (Zhou et al., 2017).

Given the importance of political capital in transitional economies, managers may be motivated to establish connections with government officials via gift-giving, favors, or other methods that are legal but fall into a "gray area," or even through bribery (Shirokova and McDougall-Covin, 2012). Wealthy business managers are more likely to be targets of corruption because they frequently interact with government officials (Rose and Peiffer, 2013). However, a potential drawback of relying on political ties is that firms often use resources such as cash to bribe valuable members within their political network (Xu et al., 2019). The competitive environments and inefficient resource allocation in emerging economies (Venard, 2009) can lead business owners to resort to such non-market actions (including corruption, bribery, and lobbying) through their political connections, with the aim of improving their competitive position in innovation compared with their rivals (Capron and Chatain, 2008).

Although such unethical practices drain firm resources and also create unbalanced power dynamics within the external business environment, political ties still have significant value in emerging economies (Peng and Luo, 2000). The navigating of fragmented and often incomplete institutions and the government's preference for innovative activities (Chen et al., 2014) lead us to argue that the benefits of political ties in the Chinese context far outstrip the potential negative issues. These benefits include preferential treatment in incentive programs, the acquisition of unique resources, obtaining rich and reliable information, and the legitimization of investments, and thus it is well worth the risks of unethical behavior to ensure that firms retain their favorable status among key players in their network.

Thus, political ties contribute to the positive effects cash holding has on innovation in several ways. First, favorable treatment from the government can include the provision of timely and in-depth information regarding beneficial innovation policies, financial subsidies, tax preference, and cheaper government-controlled bank loans (Hillman, 2005; Peng and Luo, 2000; Yu et al., 2016), which reduce the cost of holding cash and the risks of investing cash in R&D. Second, politically connected firms are more capable of reducing the environmental uncertainties in China (Xin and Pearce, 1996), and thus more equipped to deal with the uncertainties of innovation projects and more confident about the returns on the cash investment. In an emerging market context, political ties reduce the dampening effect of policy uncertainty on cash investment and innovative activities. For example, the interpretation and application of laws regarding innovation activities are often unclear, and some firms have reported that the complexity and ambiguity of regulations is one of the biggest roadblocks to innovation in China (Zhu et al., 2012). Without such ties, simple permit applications or patent filings can be rejected after years of waiting, which increases the time cost of innovative projects. Politically connected firms will thus be more confident about the security of their R&D cash spending as they will face fewer barriers created by arbitrary government interventions concerning innovation (Peng and Luo, 2000; Shi et al., 2014). Political ties also enable firms to overcome malpractice problems and institutional obstacles during innovation processes (e.g., Wu, 2011), thus providing a more stable environment for cash investment on R&D. We therefore argue that politically connected firms with financial slack are more likely to invest in R&D with greater confidence and less concerns than those with few or no political ties.

Hypothesis 2a. *A firm's political ties positively moderate the relationship between cash holding and R&D investment.*

As mentioned above, political ties can improve a firm's financial standing, promote knowledge exchange, and increase access to new technologies (Guan and Liu, 2016), which leads to better innovation performance (Wang et al., 2018). Political ties also enable firms to absorb and exploit innovation-related resources from other external networks more effectively (Li et al., 2018), such as complementary technological resources (Walsh et al., 2009), through collaborative relationships with other organizations (e.g., public universities and research institutes). We therefore suggest that political ties are essential social capital that can positively influence firms' innovation capabilities and facilitate the conversion of cash to R&D outcomes (Gao et al., 2017). They can also help firms protect their R&D output by discouraging imitation and unfair competition (Sheng et al., 2011; Zhao, 2006). Thus, we propose that:

Hypothesis 2b. *A firm's political ties positively moderate the relationship between cash holding and R&D outcomes.*

2.4. Politically well-connected or political hot potato? The effect of anti-corruption efforts

2.4.1. Institutional pressure: the efficiency motivation behind anti-corruption policy

Management scholars have long argued that institutions significantly shape all types of firm behavior (Shi et al., 2017). To survive and prosper, firms must react and adapt to the pressures of the institutional constraints that surround them (Dacin et al., 2007). Although firms with political ties are typically more likely to reduce the level of institutional uncertainty surrounding their innovation activities, it is unclear how such ties will affect their innovation decisions when major political events change the institutional environment. We follow the literature on the mixed effects of political capital and the contingent effect of political ties (Wang and Chung, 2013; Wu and Chen, 2012), and argue that aspects of the nonmarket environment, such as the institutional environment and national systems, play a key role in clarifying the effect of political ties during the innovation process. Although exogenous shocks (e.g., the sudden death of an associated politician, regime change) have been used to explore this issue from a firm's perspective (Fung et al., 2015; Siegel, 2007), changes to the institutional environment at the national level have not been fully considered.

Corruption has been a central political and social issue for many decades in China (Wedeman, 2004). When Xi Jinping came to power in 2012, a systematic nationwide campaign against corruption came into effect. This was viewed as a major policy shift and a strong signal of long-term government commitment against corruption (Qian and Wen, 2015). As the campaign progresses, businesses adapt to the changing institutional environment and adjust their behaviors accordingly. Although firms have long enjoyed the benefits of political resources and have engaged in more innovation investment in response (Stilgoe et al., 2013), such benefits are undoubtedly impacted by the anti-corruption policy, especially when a key focus of the campaign is resource utilization efficiency.

2.4.2. Three-way interaction effects on R&D investment

Under the political climate of the anti-corruption campaign, political connections are suddenly in the spotlight, and thus the accompanying improvement in the legal system diminishes the value of political connections (Shi et al., 2014). The anti-corruption campaign in China also requires full compliance and has led to the sudden dissolving of many political ties. Over 182,000 party officials at all levels of government were investigated and/or arrested by the end of 2013, including 43 at the vice-minister level or above (Pan and Tian, 2017). Bribes are typically viewed as a quick way to establish political connections in transitional economies (Boubakri et al., 2008; Faccio et al., 2006; Fan et al., 2007). Firms engaging in corrupt behavior may lose their target politicians after the crackdown, thus losing the benefits of their political resource (Hung et al., 2015). Johnson and Mitton (2003) find that the

stock prices of companies with political connections fall significantly when the government's ability to provide privileges and subsidies is affected by external shocks. The ongoing anti-corruption campaign significantly reduces the price subsidies that politically connected firms receive when purchasing land from local government (Chen and Kung, 2019). We therefore argue that the economic benefits of political connections such as reduced taxation, the lower cost of government-controlled bank loans, and government subsidies may suddenly terminate (Hao et al., 2020), which in turn increase the financial pressure on R&D investment.

Well-connected firms also become more sensitive about their cash investments because their political connections become a "hot potato" when the anti-corruption campaign is in full force. Corrupt dealings between government officials and business executives have been primary targets of the anti-corruption campaign (Hao et al., 2020). Unlike firms without political connections, those with political connections are intrinsically at risk because the politicians that they are deeply involved with can be investigated at any moment and charged with corruption, which then leads the investigations back to the businesses. Politically connected firms thus become more risk-averse in terms of R&D investment and more likely to hold onto cash after the anti-corruption campaign. Studies indicate that firms entangled in corruption scandals drastically reduce their cash investment expenditures immediately after corrupt government officials are ousted (Pan and Tian, 2017). Smith (2016) also finds that firms located in more corrupt areas hold less cash than those in less corrupt areas. Firms involved in corruption scandals are also more sensitive about their cash expenditure, including R&D investment (Pan and Tian, 2017). Politically connected firms tend to decrease their cash spending on R&D investment to reduce the risks of being investigated under the anti-corruption campaign. Thus, we argue that the anti-corruption policy significantly weakens the financial benefits of political ties and makes managers more risk-averse in terms of cash investment in R&D, which in turn reduces the positive moderating effects of political connections.

Hypothesis 3a. *Anti-corruption policy reduces the positive moderating effect of political ties on the relationship between cash holding and R&D investment.*

2.4.2. Three-way interaction effects on R&D outcome

The 18th National Congress of the Communist Party of China in 2020 submitted an agenda to achieve the dual goals of government integrity and efficiency (Krammer and Jiménez, 2020), thus indicating the efficiency-seeking logic behind the anti-corruption campaign. The political ties of Chinese firms are widely held to change the flow of government financial subsidies and reduce their efficiency (Guo and Du, 2011). Before the anti-corruption campaign, politically connected firms often lacked incentives to pursue efficiency-based innovative activities and instead simply fulfilled administrative tasks (e.g., establishing the investment ratio of R&D) (Ramamurti, 2000). Chen and Wu (2011) also argue that when a firm depends on its political connections to achieve its competitive goals, it no longer has a strong motivation to focus on improving innovation efficiency. Although the anti-corruption campaign does not target firms' specific connections, it ties the hands of government officials and strips them of the discretionary political power that benefits the connected firms (Wang et al., 2018). Politically connected firms under the scrutiny and pressure of the anti-corruption campaign are particularly motivated to turn R&D investment into actual outcomes because they are more obliged to meet the government' expectations and objectives (Pan and Tian, 2017; Sun et al., 2010). Consistent with the institutional view, if they are to survive and prosper, well-connected firms must comply with the efficiency-driven motivation behind the anti-corruption campaign (Dacin et al., 2007). The efficiency logic of resource utilization refers to the degree to which resource input is transformed into product output (Megginson and Netter, 2001; Shleifer, 1998), and thus we suggest that managers in politically connected firms have shifted their focus from simple investment ratios to producing actual innovation outcomes.

The anti-corruption campaign enhances information transparency and helps to ensure that rules are enforced, enabling the investment decisions and actions of politically connected leaders (e.g., members of the party) to be tracked (Bertot et al., 2010). Government officials who have the power to allocate valuable political resources (e.g., subsidies, preferential tax, and government contracts) no longer enjoy the conditions necessary for rent-seeking and are under pressure to make policies more transparent. They should thus allocate political resources based on corporate efficiency or social welfare rather than personal contacts. Thus, the anti-corruption policy blocks rent-seeking channels, which in turn motivates connected firms to use their existing resources more efficiently. The levels of information disclosure and procedural transparency increase, so business leaders with political ties must consider how every innovation dollar is spent instead of simply spending a specified amount (Pan and Tian, 2017).

The anti-corruption policy encourages politically connected firms to legally and efficiently access new technologies and increase their innovative capabilities via political networks (Guan and Liu, 2016; Wang et al., 2018). It also reduces the incentives of managers of politically connected firms (e.g., state-owned firms) to misuse R&D investment for personal gain, which leads to spending inefficiencies (Zhou et al., 2017). The anti-corruption campaign may therefore make political ties more effective in terms of the relationship between cash holding and R&D outcomes.

Hypothesis 3b. *The anti-corruption policy enhances the positive moderating effect of political ties on the relationship between cash holding and R&D outcomes.*

3. Methods

3.1. Sample and data

To test our hypotheses, we constructed a longitudinal data set of Chinese listed firms from the period between 2007 and 2016. The final sample of 18,125 firm-year observations comprises all firms listed on the Shanghai and Shenzhen Stock Exchanges. These firms are located in 22 provinces of 4 municipalities within 5 autonomous regions of mainland China, excluding the Special Administrative Regions (i.e., Hong Kong and Macau). Our data are obtained from the CSMAR database, which is the primary source of information on Chinese stock markets and the financial statements of China's exchange-listed firms. The primary data source for identifying firms' innovation investment and cash holding is CSMAR's China Stock Market Financial Information database. Data on firms' political ties are retrieved from China Listed Firm's Corporate Governance Research database. In addition, we hand-coded data on the anti-corruption campaign from the website of the Central Commission for Discipline Inspection and the Procuratorial Yearbooks of China, published by the Supreme People's Procuratorate of China. All these databases are commonly used in other research on Chinese firms (e.g., Sun et al., 2016; Wang and Qian, 2011).

Table 1 provides the sample distribution information. In our sample, 18.108% of companies belong to high-technology industries (e.g., Pharmaceuticals, Computing machinery, Radio, TV, and Communications equipment) (OECD, 2003). As Table 1 shows, firms in high-tech industries invest more money on R&D and obtain more patents than those in low-tech industries. Approximately 14.946% of the firms engage in regulated industries in China. A large proportion of our sample (41.043%) consists of firms located in the East China Region (i.e., Shanghai, Jiangsu, Zhejiang, Anhui, Fujian, Jiangxi, and Shandong provinces) whereas only 5.997% of the firms are located in the Northwest China Region (i.e., Shanxi, Gansu, Qinghai, Ningxia, and Xinjiang provinces). The East remains China's economic powerhouse and accounts for more than half of the country's GDP. The average age of firms

Table 1
Sample distribution.

A. Industry distribution of the sample firms	Firm size	Firm age	R&D input	R&D output	Freq	%
Companies belong to high-tech industries	7.518	14.360	0.027	23.839	3282	18.108
Companies belong to low-tech industries	7.567	15.103	0.009	7.614	14,843	81.892
Companies belong to regulated industries	7.479	14.942	0.017	11.790	2709	14.946
Companies belong to unregulated industries	7.569	14.974	0.011	10.334	15,416	85.054
B. Year distribution of the sample firms						
2007	7.295	11.718	0.003	6.493	1334	7.360
2008	7.333	12.277	0.006	6.951	1449	7.994
2009	7.355	12.924	0.009	8.891	1527	8.425
2010	7.393	13.689	0.010	10.134	1587	8.756
2011	7.435	13.875	0.016	11.324	1813	10.002
2012	7.532	14.571	0.025	12.752	1963	10.830
2013	7.656	15.476	0.017	13.638	2042	11.266
2014	7.736	16.477	0.017	13.554	2044	11.277
2015	7.758	17.341	0.018	10.795	2117	11.680
2016	7.774	18.088	5.04e-13	8.404	2249	12.140
C. Region distribution of the sample firms						
North China Region	7.875	14.006	0.012	20.341	2517	13.887
Northeastern China Region	7.482	16.220	0.011	3.554	1107	6.108
East China Region	7.489	14.736	0.0134	5.853	7439	41.043
Central China Region	7.525	15.368	0.016	18.065	4468	24.651
Southwest China Region	7.535	15.855	0.008	6.554	1507	8.314
Northwest China Region	7.494	14.661	0.006	1.839	1087	5.997

(North China Region: Beijing, Tianjin, Hebei, Shanxi, Neimenggu; Northeastern Region: Liaoning, Jilin, Heilongjiang; East China Region: Shanghai, Jiangsu, Zhejiang, Anhui, Fujian, Jiangxi, Shandong; Central China Region: Henan, Hubei, Hunan, Guangdong, Guangxi, Hainan; Southwest Region: Chongqing, Sichuan, Guizhou, Yunnan, Xizang; Northwest Region: Shanxi, Gansu, Qinghai, Ningxia, Xinjiang. The regional categories are based on the resource of China Bureau of Statistics.).

in our sample is around 14 years.

3.2. Measurements

3.2.1. Dependent variables

The two dependent variables in our research framework are R&D investment and R&D outcome. Following the literature (Chrisman and Patel, 2012; Hillier et al., 2011), R&D investment is the ratio of a firm's R&D expenditure to total assets in year *t* adjusted by subtracting median industry-level R&D expenditures to size in the same year. Following other studies (Tan et al., 2014; Tong et al., 2014), we use the number of invention patent applications to measure R&D outcome.

3.2.2. Independent variable

Following Dittmar et al. (2003) and Harford et al. (2008), we use firms' cash ratio, defined as the amount of cash and cash equivalents scaled by total assets net of cash and cash equivalents, as our independent variable.

3.2.3. Moderating variables

3.2.3.1. Political ties. Following other studies on firm-level political ties (Haveman et al., 2017), we use two methods to measure political embeddedness: (1) a binary indicator variable set to one in years when an executive or director of the focal firm has served as the chief officer or deputy chief officer at the division level or above, and zero otherwise (Faccio, 2006; Hillman, 2005); and (2) a variable that measures the proportion of executives and directors who have political experience. The first measurement takes a value of 1 if a director on the board or an executive has current or former political experience, and 0 otherwise. A director is deemed to have political experience if she or he is a current member of a Chinese legislative body (i.e., the National People's Congress or the Chinese People's Political Consultative Conference) or was a government official before joining the company (Sun et al., 2016). For the second measurement, we measure a company's political ties using the percentage of all directors on the board who have political experience (Sun et al., 2016).

3.2.3.2. Anti-corruption policy. The nationwide anti-corruption campaign in China was implemented at the 18th National Congress of the Communist Party when President Xi Jinping came to power in late 2012. In 2013, the Commissions for Discipline Inspection (CDIs) investigated more than 30,000 Party officials nationwide for violations of the Eight Provisions and applied disciplinary sanctions to 7600 (Li, 2019). For example, Zhou Yongkang, a former member of the Politburo Standing Committee and head of China's security agencies, was placed under investigation by the Central Commission for Discipline Inspection (CCDI) for abuse of power and corruption in late 2013. The CDIs were established by the government to enforce the internal rules of the Communist Party of China (CPC) and to combat the corruption and malfeasance of government officials. The CCDI represents the highest internal control institution of the CPC and is considered the main anti-corruption body in China. Local CDI levels were established in provinces, cities, and towns.

The CDI's anti-corruption process consists of the following steps (Nie and Wang, 2016). First, the CDI acts to discover and investigate any government officials that have committed malfeasance and then implements formal investigative procedures; second, it determines the penalties according to the disciplinary rules of the CPC and if necessary, forwards the evidence gathered to the procuratorates (Xu and Yano, 2017). The suspects are then charged, and the criminal cases of corruption and bribery are moved to court. Finally, sentences are pronounced by the court. To target a wider range of conduct that involves the abuse of state power for private gain, such as bribery and embezzlement, the government has increased the number of CDI offices in the provinces. More than 230 offices of the CDI have been established in mainland China, an increase of 35.9% since the start of the anti-corruption campaign at the end of 2012. Table 2 shows the number of CDI offices in 31 provinces of China before and after the campaign's inception.

We use two methods to measure the changes to the political environment caused by the anti-corruption campaign: (1) the increase in the number of provincial CDIs since the anti-corruption policy was announced at the end of 2012, and (2) the number of government officials investigated in cases of corruption in the provinces each year. The CDI is central to the anti-corruption campaign (Li, 2019), so we suggest that the increased number of CDI offices in provinces reflects the government's anti-corruption efforts and intensity at the provincial level, which gives a direct and appropriate measurement of political environment change in China. Meanwhile, to measure the overall extent of

Table 2
Increased number of offices of CDI since anti-corruption policy at the provincial level.

Provinces	Number of offices of CDI before anti-corruption campaign	Number of offices of CDI after anti-corruption campaign	Increase rate of CDI offices	Number of investigated officials (above provincial-level) after anti-corruption campaign
Beijing	6	9	50.0%	3
Tianjin	6	7	16.7%	5
Hebei	7	8	14.3%	9
Shanxi	5	8	60.0%	9
Neimenggu	5	7	40.0%	8
Liaoning	6	8	33.3%	7
Jilin	6	8	33.3%	5
Heilongjiang	6	7	16.7%	4
Shanghai	6	8	33.3%	3
Jiangsu	6	8	33.3%	6
Zhejiang	6	9	50.0%	2
Anhui	6	7	16.7%	6
Fujian	5	7	40.0%	3
Jiangxi	5	7	40.0%	6
Shandong	6	8	33.3%	3
Henan	7	11	57.1%	6
Hubei	7	8	14.3%	5
Hunan	5	7	40.0%	4
Guangdong	6	8	33.3%	5
Guangxi	6	7	16.7%	5
Hainan	4	6	50.0%	5
Chongqing	5	8	60.0%	5
Sichuang	6	9	50.0%	8
Guizhou	5	7	40.0%	4
Yunan	5	8	60.0%	6
Xizang	4	5	25.0%	1
Shanxi*	5	7	40.0%	6
Gansu	5	7	40.0%	4
Qinghai	4	6	50.0%	1
Ningxia	3	4	33.3%	1
Xinjiang	6	7	16.7%	3
Total	170	231	35.9%	147

(Data source: the official website of China's Central Commission for Discipline Inspection).

corruption at the provincial level, our variable captures the number of government officials investigated in cases of corruption filed per 100,000 population in a province in a given year. These data are obtained from the Procuratorial Yearbooks of China (e.g., Huang et al., 2017; Jiang and Nie, 2014). We also link the annual increase in CDI offices to the provinces where the firms are headquartered. First, we confirm the increase in the number of CDI offices in 31 provinces in China based on official government reports (see Table 2) and then, based on the registered headquarter locations of the companies in our sample, we manually match these with the number of CDI offices added in each province.

3.2.4. Control variables

Following studies that use R&D as the dependent variable (e.g., Chen and Hsu, 2009), we first control for conventional firm-level characteristics including firm size, age, orientation toward production and marketing, and performance. Larger companies tend to be more active than smaller companies in R&D as they typically have more managerial and financial resources to develop new products and technology. To control for possible firm size effects, we use the logarithms of firms' total number of employees, as suggested by Qian et al. (2013). We also compute the number of years a firm has been established in its current field. In addition, we control for the effect of a firm's orientation toward investments in production and marketing on its R&D by using the natural logs of capital expenditures and advertising expenditures divided by sales (Chrisman and Patel, 2012). We then calculate Altman's z-score and Tobin's Q, which represent the likelihood of bankruptcy and the market value of a firm, respectively, to control for the possible relationship between a firm's overall performance and R&D (Chrisman and Patel, 2012). Other studies find that state ownership has a negative influence on new product innovation and sales, patent application, and the profits from innovation projects in China (Guan et al., 2009; Xu and Zhang, 2008). Managers in state-owned enterprises (SOEs) have fewer incentives to enhance their firms' competitiveness through innovation, as public employees cannot gain major benefits but must still bear the high risks of R&D (Rong et al., 2017). We rule out the influences of SOEs on R&D and their inherent political power by controlling for the effects of state ownership. Following Zhou et al. (2017), we treat ownership as a continuous variable and measure the percentage owned by the government.

In addition, we control for board-level governance effects on R&D, including CEO duality and blockholder ownership. According to He and Wang (2009), CEO duality affects R&D spending because a unified leadership can better enable CEOs to utilize firm resources. To measure CEO duality, we use a dummy variable equal to 1 if the CEO is also the chairperson on the board, and 0 otherwise. An ownership structure such as blockholder ownership provides a mechanism through which firms can assemble and direct the resources necessary for innovation, particularly in emerging markets with inadequate external institutions (Chen et al., 2013). Thus, we control for the effect of blockholder ownership by calculating the percentage of ownership stakes held by the largest shareholder of the firm. To rule out the influences of natural disasters on firm investment (e.g., Hosono et al., 2016), we add the number of earthquakes in the region in which the company is located as a control. We also control for the effects of GDP by using the logarithms of regional GDP. Detailed definitions of all variables are given in Table 8.

3.3. Statistical approach

We analyze our panel data using Stata 14.1. We use a fixed-effects regression model because this can control for all factors that vary across entities but are constant over time, and for those that vary over time but are constant across entities (Wooldridge, 2002). Thus, this approach significantly alleviates any potential endogeneity of the explanatory variables. In addition, following Xu et al. (2019), we lag our dependent variables (R&D investment and outcome) by one year to minimize reverse causality. We then control for a set of board-, company-, and region-level variables that may simultaneously affect R&D investment and outcome. Third, we include year and industry (9 year-dummies and 72 industry dummies using the two-digit SIC code) in our regression models to account for within-group variation over time and limit the potential bias caused by omitted variables. This empirical approach enables the predicted mean of the dependent variable to vary across groups and thus controls for unobserved heterogeneity (Gormley and Matsa, 2014).

We examine the potential direct causal effects between cash holding and political ties using a fixed-effect regression model. We find that the effect of cash holding on political ties is positive but insignificant ($\beta = 0.016$, n.s.). We further test these effects in economically developed regions and in undeveloped regions where corruption activities are more prevalent. We divide the sample into two sub-samples based on the NERI index of marketization of China's provinces, which is a widely applied measure of China's institutional environment (Liu et al., 2019; Shi et al., 2014). The results show that cash holding has positive but insignificant effects on political ties in both developed ($\beta = 0.015$, n.s.) and undeveloped regions ($\beta = 0.013$, n.s.). This suggests that no significant endogeneity problems are caused by the relationship between cash holding and political ties in our case. We suggest that political ties can be considered as an appropriate moderating variable for the relationship between cash holding and R&D in our research model.

4. Results

Table 3 presents the means, standard deviations, and correlations for the full sample. The average firm is 14 years old, has 5645 employees, and reports 5558.44 million yuan in sales. As expected, a firm's cash holding has a positive relationship with R&D investment ($r = 0.057$, $p < 0.01$). Anti-corruption policy has a negative relationship with cash holding ($r = -0.046$, $p < 0.01$). Following the rule of thumb that severe multicollinearity requires a correlation greater than 0.8 (e.g., Farrar and Glauber, 1967: 98), we find no severe multicollinearity among our variables.

Table 4 presents our fixed-effects hierarchical regression results from measuring political ties as a dummy variable and anti-corruption policy as the increase in the number of CDI offices at the provincial level. Model 1 is the baseline model that includes only the control variables, while Models 2–4 include our explanatory variables. The increasing values of adjusted R-squared and significant F tests for Models 2–4 together suggest that adding our explanatory variables improves the model fit over the baseline Model 1.

Hypothesis 1a predicts that a firm's cash holding positively affects its R&D investment. As Model 1a in Table 4 shows, firms' cash holding has a positive and significant effect on R&D investment ($\beta = 0.067$, $p < 0.001$). Thus, Hypothesis 1a is supported. Hypothesis 1b predicts that firms' cash holding positively affects R&D outcome. Model 1b in Table 4 shows that firms' cash holding has a positive but insignificant effect on R&D outcome ($\beta = 9.051$, n.s.) Thus, Hypothesis 1b is not supported.

Hypothesis 2a proposes that a firm's political ties positively moderate the positive relationship between cash holding and R&D investment. As Model 3a in Table 4 shows, the interaction effect between cash holding and political ties is positive and significant ($\beta = 0.155$, $p < 0.001$). Hypothesis 2b proposes that a firm's political ties positively moderate the relationship between cash holding and R&D outcome. Model 3b in Table 4 shows that the interaction effect between cash holding and political ties is positive and significant ($\beta = 22.419$, $p < 0.05$). To further understand the moderating effects of political ties, we plot a two-way interaction in Fig. 2. Thus, Hypothesis 2a and 2b are supported.

Hypothesis 3a predicts a three-way interaction of cash holding, political ties, and anti-corruption policy on R&D investment. As Model 4a in Table 4 shows, the three-way interaction term is negative and significantly related to R&D investment ($\beta = -0.210$, $p < 0.05$). We then conduct simple slope tests to further confirm our findings. We find that cash holding is positively related to R&D investment for firms that have political ties before the anti-corruption policy's implementation. Thus, the positive effect of cash holding on R&D investment is strongest when firms have political ties in a more corrupt environment. The graph of the three-way interaction (Fig. 3a) further confirms this finding. Therefore, Hypothesis 3a is supported.

Hypothesis 3b predicts a three-way interaction of cash holding, political ties, and anti-corruption policy on R&D outcome. Model 2b in Table 4 shows that cash holding is positively related to R&D outcome ($\beta = 9.051$, n.s.). Compared with its effect on R&D investment ($\beta = 0.067$, $p < 0.001$) (see Model 2a in Table 4), cash holding may have a less significant influence on R&D outcomes. The three-way interaction term is positive and significantly related to R&D outcome ($\beta = 185.077$, $p < 0.001$) (see Model 4b in Table 4). We then conduct simple slope tests to further confirm our findings. The graph of the three-way interaction (Fig. 3b) shows that the positive effect of cash holding is strongest when a firm is politically connected and when the anti-corruption policy is in place. Therefore, Hypothesis 3b is supported.

Table 5 presents the results of our fixed-effects hierarchical regression, in which political ties are measured as a dummy variable and anti-corruption policy is measured as the number of government officials investigated in cases of corruption filed per 100,000 population in different provinces in a given year. Model 4a in Table 5 shows that the three-way interaction term of cash holding, political ties, and anti-corruption policy is negative and significantly related to R&D investment ($\beta = -0.028$, $p < 0.001$), which is consistent with the results in Model 4a in Table 4 ($\beta = -0.210$, $p < 0.05$). Therefore, Hypothesis 3a is further supported. As Model 4b in Table 5 shows, the three-way interaction term of cash holding, political ties, and anti-corruption policy is positive and significantly related to R&D outcome ($\beta = 8.600$, $p < 0.05$), which is consistent with the results in Model 4b in Table 4 ($\beta = 185.077$, $p < 0.001$). Therefore, Hypothesis 3b is further supported.

Table 6 describes our fixed-effects hierarchical regression results where we measure political ties as the proportion of directors who have political experience instead of the binary variable, and anti-corruption policy using the first measurement (the increase in the number of CDI offices after the 18th National Congress). Model 3a in Table 6 shows that the two-way interaction term of cash holding and political ties is positive and significantly related to R&D investment ($\beta = 0.570$, $p < 0.001$), which is consistent with the results in Model 3a in Table 4 ($\beta = 0.155$, $p < 0.001$). Thus, Hypothesis 2a is further supported. In addition, as Model 4a in Table 6 shows, the coefficient of the three-way interaction term of cash holding, political ties, and anti-corruption policy on R&D investment is negative and marginally significant ($\beta = -0.592$, $p < 0.1$), which confirms the previous results in Tables 4 and 5, and thus Hypothesis 3a is further supported. Additionally, the three-way interaction effect of cash holding, political ties, and anti-corruption policy on R&D outcome is significantly positive ($\beta = 846.195$, $p < 0.001$), which confirms the results in Tables 4 and 5. Therefore, Hypothesis 3b is further confirmed.

Table 7 describes our fixed-effects hierarchical regression results when political ties are measured as the proportion of executives and directors who have political experience instead of the binary variable, and the anti-corruption policy is measured as the number of government officials investigated in cases of corruption filed per 100,000 population in different provinces each year. As seen in Model 4a in Table 7, the coefficient of the three-way interaction term of cash holding, political ties, and anti-corruption policy on R&D investment is significantly negative ($\beta = -0.081$, $p < 0.001$), which further confirms the results in Tables 4, 5, and 6. Furthermore, as Model 4a in Table 7 shows, the same three-way interaction effect on R&D outcome is significantly positive ($\beta = 26.982$, $p < 0.05$). Thus, Hypothesis 3b is further supported.

4.1. Robustness test

To further confirm the findings in our empirical tests, we conduct several robustness tests including alternative estimation procedures, instrument sets, and specifications. First, following other studies (e.g., Liu et al., 2016), we use a dummy variable to capture the anti-corruption campaign that started in 2012 to test the robustness of the constraining effects of the policy on firms' political ties. The coefficient of the three-way interaction term of cash holding, political ties, and anti-corruption is significantly positive on R&D investment ($\beta = -0.208$, $p < 0.001$) and on R&D outcome ($\beta = 52.503$, $p < 0.01$). These results are consistent with our previous estimates.

Second, we re-run the analysis with a random-effects regression model and obtain a qualitatively similar pattern. Cash holding has significantly positive effects on R&D investment ($\beta = 0.043$, $p < 0.010$). The moderating effect of political ties on the influence of cash holding is significantly positive ($\beta = 0.113$, $p < 0.001$). The coefficient of the three-way interaction term is still significantly negative on R&D investment ($\beta = -0.208$, $p < 0.001$). The coefficient of the three-way interaction effects of cash holding, political ties, and anti-corruption policy on R&D outcome is still marginally significant ($\beta = 52.503$, $p < 0.1$). Therefore, there is no difference in the estimates between the fixed-effects and random-effects models.

Third, we use the propensity score matching technique to generate a sample of comparable firms with and without political ties. We first estimate a probit model using 5744 politically connected firms and 1238 non-politically connected firms, with the variables of firm size, age,

Table 3
Means, standard deviations, and correlation.

Variables	Mean	S.D.	1	2	3	4	5	6	7	8	9
1. Firm size (log employees)	7.56	1.43	1.000								
2. Sales(log sales)	8.64	1.82	0.347***	1.000							
3. Firm age	14.12	36.63	−0.048***	−0.221***	1.000						
4. Capital	32.24	1137.74	0.014*	−0.011	−0.023***	1.000					
5. Advertising	0.01	0.02	0.042***	−0.010	0.070***	0.000	1.000				
6. Tobin's Q	5.41	379.26	−0.037***	−0.017**	−0.001	0.000	−0.001	1.000			
7. Altman's Z	10.70	546.20	−0.039***	−0.034***	−0.003	0.000	0.000	−0.115***	1.000		
8. Duality	0.19	0.42	−0.072***	−0.053***	−0.051***	−0.004	0.024***	−0.003	−0.001	1.000	
9. Blockholder ownership	35.67	15.59	0.189***	0.122***	−0.187***	0.015*	−0.010	−0.007	−0.004	−0.069***	1.000
10.SOE	26.42	41.12	0.120***	0.119***	−0.095***	0.015**	−0.068***	−0.005	−0.008	−0.131***	0.192***
11. Earthquake	0.10	0.30	−0.009	−0.042***	0.034***	−0.002	−0.012	−0.003	−0.004	−0.042***	−0.036***
12. GDP	4.29	0.37	0.065***	−0.028***	0.094***	−0.001	0.081***	−0.010	−0.008	0.108***	−0.010
13.R&D outcome	21.39	168.37	0.145***	0.068***	−0.006	−0.002	0.004	−0.001	−0.001	0.005	0.022***
14. R&D investment	0.01	0.10	−0.028***	−0.006	−0.017**	−0.003	0.002	0.000	0.000	0.009	−0.005
15. Cash holding	0.15	0.13	−0.120***	−0.037***	−0.106***	0.028***	0.053***	0.054***	0.032***	0.059***	−0.001
16. Political tie	0.08	0.14	0.052***	−0.007	−0.009	0.044***	−0.015**	−0.005	−0.005	0.071***	0.019**
17. Anti-corruption	1.62	2.54	0.073***	−0.099***	0.188***	0.007	0.091***	−0.008	0.008	0.022***	−0.042***
	Mean	**S.D.**	10	11	12	13	14	15	16	17	
10.SOE	26.42	41.12	1.000								
11. Earthquake	26.42	41.12	0.038***	1							
12. GDP	0.10	0.30	−0.245***	−0.333***	1						
13.R&D outcome	21.39	168.37	0.000	−0.018**	0.035***	1.000					
14. R&D investment	0.01	0.10	−0.011	−0.004	0.016**	0.012	1.000				
15. Cash holding	0.15	0.13	−0.054***	−0.026***	0.030***	−0.011	0.057***	1.000			
16. Political tie	0.08	0.14	−0.034***	0.030***	0.064***	0.007	−0.003	0.027***	1.000		
17. Anti-corruption	1.62	2.54	−0.102***	0.015**	0.199***	0.004	0.000	−0.046***	0.031***	1.000	

Superscripts indicate significance at the $^{+}$ $p < 0.10$ * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$ level.

industry, Tobin's Q, blockholder ownership, and advertising expenditures. We then use the propensity score to perform a one-to-one matching, resulting in 4051 pairs of matched firms. Such a matched sample removes any differences between the two groups of firms other than political capital and ensures comparability between them. We then re-run the analysis and the results are highly consistent with the findings for the whole sample.

In addition, a concern regarding the causal effect of cash holding is that unobserved or omitted variables may correlate with both cash holding and firm innovation. This positive association may also be driven by reverse causality, in which a larger level of innovation investment may result in a greater demand for holding cash. We address these concerns by adopting the Generalized Method of Moments (GMM) system (Arellano and Bover, 1995). This technique has the advantages of addressing both endogeneity problems and fixed effects in addition to removing dynamic panel bias (Nickell, 1981). Thus, the approach enables us to consider the dynamic effect of cash holding on innovation by including the effect of past innovation activities, and also to control for firm-level unobservable heterogeneity by including firm fixed effects. We test the relationship between cash holding, political ties, the anti-corruption policy, and innovation activities over the period of 2007–2016 using the GMM technique. The results show that the effect of cash holding on R&D investment is positive and significant ($\beta = 0.192$, $p < 0.001$). The interaction effect of political ties and cash holding on R&D investment is also positive and significant ($\beta = 0.348$, $p < 0.001$), while the three-way interaction effect of cash holding, political ties, and anti-corruption policy is negative and significant on R&D investment ($\beta = -0.503$, $p < 0.001$), and positive and significant on R&D outcome ($\beta = 128.935$, $p < 0.05$). The main results of the previous section are again supported.

We also conduct several additional tests to check the different effects of cash holding, political ties, and anti-corruption policy on innovation in regulated versus unregulated industries. We run fixed-effect models using a split-sample approach to examine the variance in results between these industries. Following the literature (e.g., Hadani and Schuler, 2013; Hillman, 2005; Sun et al., 2016), we measure the significance of government regulation for the sample firms based on their two-digit sector categorization. If a firm belongs to Petrochemical, Pharmaceutical, Metallurgical, or Machinery industries, we consider it a regulated company. The results of the fixed-effects regression models are consistent. We find that the moderating effect of political ties on the positive relationship between cash holding and R&D investment is more significant in regulated industries with more asymmetrical information, and when the government has control over key resources. This finding is consistent with our argument that political ties help firms deal with environmental uncertainties and supplement their existing internal resources (e.g., cash holding), and in turn their confidence regarding their R&D investment decisions is enhanced.

We then run regressions using two randomly selected subsamples (85%) from the total observations, as suggested by Li et al. (2010), and find that our results remain consistent with those using the full sample. We then examine the relationship between cash holding and R&D investment and outcome with and without political connections, respectively. The relationship between cash holding and R&D investment ($\beta = 0.250$, $p < 0.001$) is significant and positive when firms are politically connected. We then examine the moderating effect of firms' political connections on the relationship between cash holding and R&D investment/outcome before and after the implementation of the anti-corruption policy. The relationship between cash holding and R&D investment ($\beta = 0.363$, $p < 0.001$) is significant and positive before the implementation of the policy. Again, these results confirm our hypotheses.[1]

5. Discussion

Innovation has become increasingly important for businesses in emerging markets, and thus any firm capabilities and managerial behaviors that influence R&D activities deserve attention. Thus, we examine how a firm's cash holding affects its level of innovation, and the contingent roles of political ties and the anti-corruption policy. Our results confirm that cash holding as a fungible type of financial slack has a positive relationship with innovation investment, which suggest that

[1] All regression results for the additional robustness checks are available upon request.

Table 4
Fixed-effects regression model of cashing holding and R&D (Political tie=measurement 1; Anti-corruption=measurement 1).

	DV: Innovation Investment				DV: Innovation Outcome			
Variable	**Model 1a**	**Model 2a**	**Model 3a**	**Model 4a**	**Model 1b**	**Model 2b**	**Model 3b**	**Model 4b**
Control Variables								
Firm size	−0.010***	−0.009***	−0.009***	−0.009***	1.970*	2.126*	2.177*	2.109*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.849)	(0.855)	(0.856)	(0.856)
Firm age	−0.010	0.006	0.008	0.009	−1.823	0.377	0.261	−1.777
	(0.015)	(0.015)	(0.015)	(0.015)	(9.029)	(9.135)	(9.138)	(9.151)
Capital	−0.034	−0.023	−0.012	−0.001	−94.484	−92.929	−88.861	−95.215
	(0.291)	(0.290)	(0.289)	(0.289)	(175.586)	(175.580)	(175.570)	(175.459)
Advertising	−0.059	−0.062	−0.057	−0.055	6.714	6.278	6.846	5.870
	(0.041)	(0.041)	(0.041)	(0.041)	(24.755)	(24.755)	(24.754)	(24.745)
Tobin's Q	0.001	0.000	0.002	0.001	1.119	1.010	1.123	1.255
	(0.022)	(0.022)	(0.022)	(0.022)	(13.553)	(13.553)	(13.551)	(13.545)
Altman's Z	−0.000	0.003	0.001	0.001	0.306	0.822	0.479	0.352
	(0.016)	(0.016)	(0.016)	(0.016)	(9.566)	(9.571)	(9.571)	(9.564)
Duality	0.002	0.002	0.001	0.001	3.247^{+}	3.176^{+}	3.206^{+}	3.406^{+}
	(0.003)	(0.003)	(0.003)	(0.003)	(1.861)	(1.862)	(1.863)	(1.862)
Blockholder Ownership	−4.582***	−4.244***	−4.137**	−4.092**	−720.965	−675.166	−651.180	−672.125
	(1.287)	(1.285)	(1.282)	(1.282)	(777.368)	(777.871)	(777.840)	(777.330)
State ownership	−0.001	−0.001	−0.001	−0.001	−2.063	−2.091	−2.055	−1.904
	(0.003)	(0.003)	(0.003)	(0.003)	(1.775)	(1.775)	(1.775)	(1.775)
Natural disaster	0.006	0.006	0.006	0.006	0.624	0.631	0.669	0.876
	(0.005)	(0.005)	(0.005)	(0.005)	(2.833)	(2.833)	(2.833)	(2.840)
GDP	0.007	0.002	0.001	0.003	−32.689	−33.266	−33.579	−35.706^{+}
	(0.034)	(0.034)	(0.034)	(0.034)	(20.479)	(20.481)	(20.479)	(20.512)
Main effects								
Cash holding		0.067***	0.068***	0.066***		9.051	9.413	11.200^{+}
		(0.009)	(0.009)	(0.009)		(5.732)	(5.734)	(5.741)
Political tie			0.005^{+}	0.004			−1.685	−1.514
			(0.003)	(0.003)			(1.664)	(1.672)
Anti-corruption policy				0.002				−7.448
				(0.015)				(9.168)
Two-way Interactions								
Cash holding*Political Tie			0.155***	0.150***			22.419*	29.219**
			(0.016)	(0.017)			(9.979)	(10.076)
Cash holding*Anti-corruption				−0.104*				92.066***
				(0.041)				(24.898)
Political tie*Anti-corruption				0.006				8.391
				(0.010)				(6.303)
Three-way Interactions								
Cash holding* Political tie*				−0.210*				185.077***
Anti-corruption policy				(0.088)				(53.168)
Year, industry, and province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
constant	0.087	0.055	0.057	0.045	126.672	122.340	122.750	136.105
	(0.141)	(0.141)	(0.140)	(0.141)	(85.233)	(85.273)	(85.262)	(85.308)
R2	0.006	0.009	0.015	0.015	0.005	0.006	0.006	0.008
F-value	1.715	2.662	4.341	4.259	1.692	1.708	1.755	2.124

$n = 18{,}125$; Standard errors are shown in parentheses.
Superscripts indicate significance at the $^{+}$ $p < 0.10$ * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$ level.
(Note: Political ties measurement 1 is a dummy variable coded "1″ if a director on the board has current or former political experience and "0″ otherwise; Anti-corruption policy measurement 1 is the increased ratio of the number of offices in the Commission for Discipline Inspection in different provinces post 2013.

firms in the emerging market context initiate or intensify their innovation efforts when they hold enough cash. Our results are consistent with studies of the role of financial slack in a firm's pursuit of risky strategies (e.g., Bromiley, 1991; Cyert and March 1963; March and Shapira, 1987), in which financial slack occupies a push role.

In addition, as we hypothesized, political ties were found to act as a boundary condition of the cash holding–R&D investment relationship. Our findings also suggest that the implementation of the anti-corruption policy reduces the positive moderating effect of political ties on the relationship between cash holding and R&D investment. Thus, under normal circumstances, firms with political connections are more likely to use their cash to pursue R&D activities because political ties help to decrease the uncertainties associated with innovation in an emerging market economy like China, which lacks institutional infrastructure, and where bureaucratic red tape is a hindrance and moral hazards such as contract breaching and intellectual property theft are commonplace. However, under a dramatic institutional change such as the nationwide anti-corruption campaign, the value of political connections is diluted as the legal system becomes more transparent (Shi et al., 2014). Our findings also show that politically connected firms are more likely to spend their cash on innovation under normal circumstances, and that the positive moderating effect of political connections will be reduced by the anti-corruption campaign. In observing this phenomenon regarding politically connected firms' R&D investment behavior, we can conclude that the anti-corruption campaign has to some extent disrupted the status quo of political networks and introduced more uncertainty into the external environment. We also find that the anti-corruption policy enables politically connected firms to shift their focus from R&D investment to R&D outcome. The efficiency-seeking logic behind the anti-corruption campaign (Krammer and Jiménez, 2020) motivates politically connected firms to improve the efficiency of their R&D investment and thus meet government expectations.

The anti-corruption campaign also provides the advantage that firms without political ties will be more likely to succeed in innovation if an overall decrease in costs and uncertainties occurs in the institutional environment surrounding innovation. As Xu and Yano (2017) note, "Stronger anti-corruption efforts can better alleviate the expropriation problem since the probability of being exposed becomes higher and the

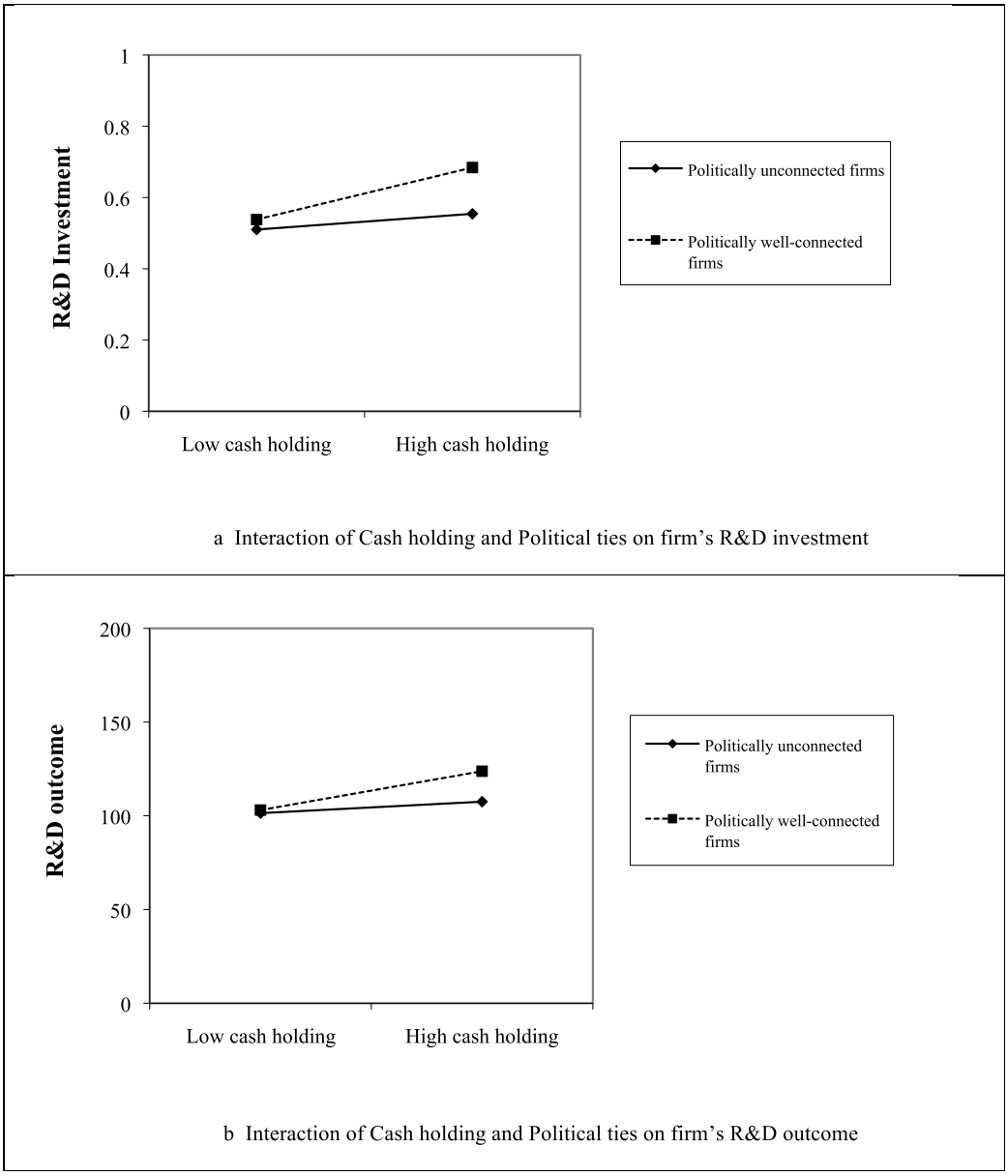

Fig. 2. Interaction of Cash holding and Political ties on firm's R&D.

punishment associated with corruption becomes more severe, which significantly reduces the returns of expropriation for corrupt bureaucrats. This in turn reduces the uncertainty and transaction costs associated with innovation. Anti-corruption efforts thus contribute to fostering the institutional trust that proves to be necessary for the development of innovation and entrepreneurial activities." The campaign can contribute to leveling the playing field in the long run and promote healthier competition, which will increase the speed at which emerging markets such as China transition to a market economy.

5.1. Theoretical implications

Our findings provide novel insights into the roles of cash holding, political ties, and the anti-corruption policy in firm innovation in an emerging market, and thus make several contributions to the literature. First, we integrate both innovation investment and outcomes as two distinct dependent variables into our research framework to examine the roles of financial and political resources during the innovation process, and thus offer new insights into the relationship between investment and outcomes. Although many studies have investigated the effects of various resources on innovation (e.g., Hoegl et al., 2008), their measurements of innovation either consider the R&D investment amount or R&D outcomes (e.g., Wu, 2011; Yu et al., 2016). We suggest this can lead to mixed findings on the relationship between resources and innovation. Distinguishing R&D investment from the outcome, and exploring the effects of various resources, can lead to a more comprehensive understanding of the innovation process and the relationship between resources and innovation.

Second, our findings highlight the unique characteristic of cash holding. This represents a powerful form of fungible internal resource that can be used to address the institutional voids associated with innovation in China, thus contributing to the literature on resource slack and firm behavior in emerging markets (e.g., Pinkowitz et al., 2013). Although some economists link cash holding with high-tech industries (e.g., Brown and Petersen, 2011), we extend their studies by incorporating management theories to explain the mechanisms underlying such relationships. From the RBV and institutional theory perspective, we argue that cash holding as financial slack has significant positive effects

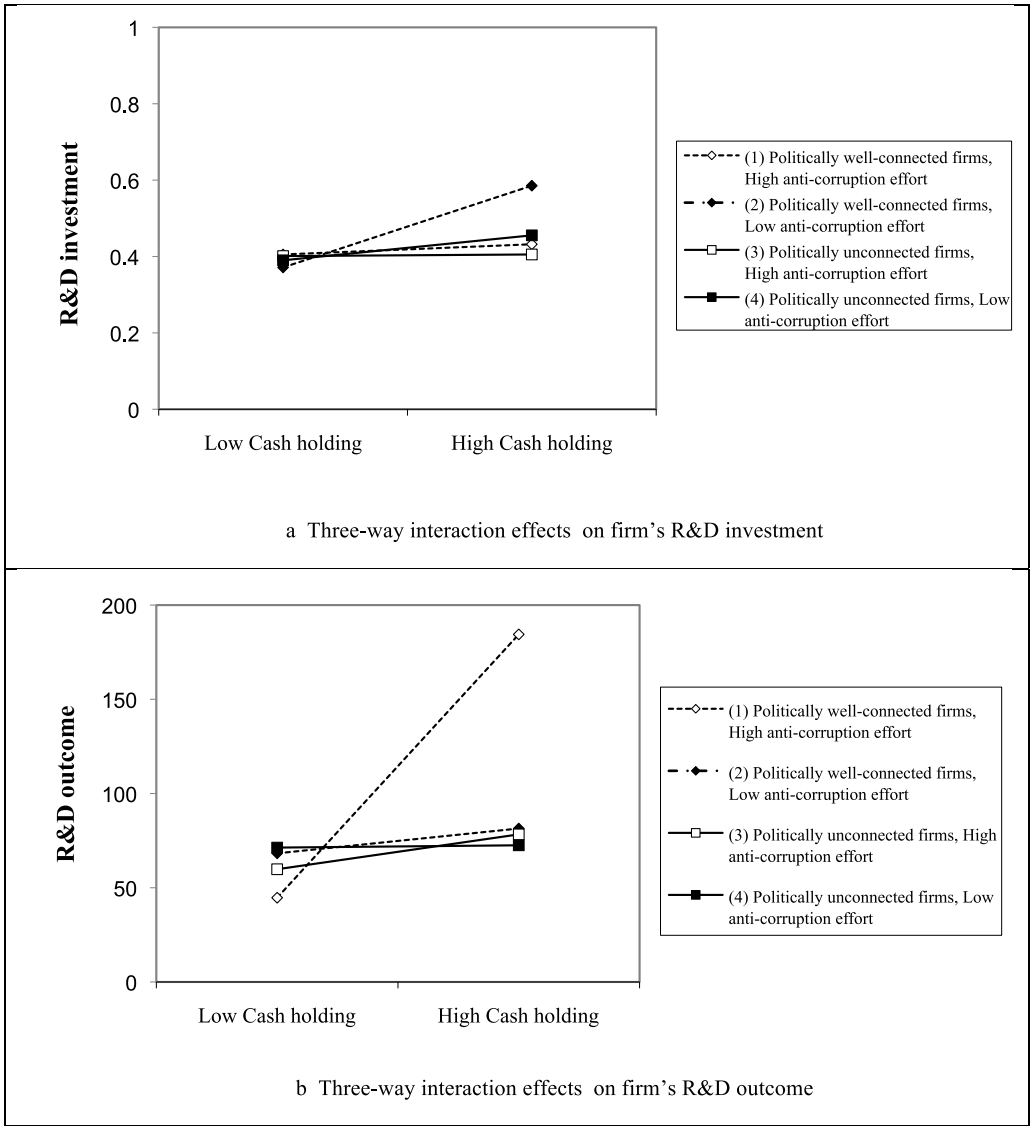

Fig. 3. Three-way Interaction Effects of Cash holding, Political ties, and Anti-corruption on Firm's R&D.

on R&D investment and outcomes in an emerging market like China, because it improves firms' abilities to shield against the risks inherent in R&D and a weak legal environment (e.g., Kusnadi and Wei, 2011). We stress that not all resources contribute equally to a firm's R&D, but that high cash reserves in particular increase the ability to undertake high-risk and potentially profitable investments and reduce the sensitivity of investment expenditure (Almeida et al., 2004). Firms in an emerging market are more likely to be financially constrained (due to greater exposure to capital market imperfections) and are expected to accumulate cash to safeguard against R&D investment requirements.

Third, by exploring the interaction effects of cash holding and political ties on R&D investment and outcomes, we argue that political ties in the emerging market context are an important external intangible resource, which supplement firms' internal financial resources and contribute to innovation. Thus, we extend the research framework of RBV by combining analyses of the internal resources of firms (e.g., cash holding) with the external institutional environment (e.g., Priem and Butler, 2001; Barney, 2001). By combining financial and political capital, firms can address both their potential financial constraints (Almeida et al., 2004) and the weaker legal protection of emerging economies (Musacchio et al., 2015), which in turn leads to increased investor confidence and motivation for R&D investment. We extend the traditional RBV perspective and argue that firms in emerging economies can leverage the value of their own resources by accessing complementary resources through political alliances. Our findings further confirm the dynamic resource-based view and emphasize the importance of combining resources to adapt to the institutional environment and address associated changes (e.g., Helfat and Peteraf, 2003).

We also provide empirical evidence of the effect political ties have on firm innovation behavior and how both innovation investment and outcomes are contingent on institutional environment change. By exploring the contingent effect of the anti-corruption policy on political ties, we reveal the double-edged effects of these ties on innovation and thus the key contingencies related to the associations among the anti-corruption campaign, political ties, resource allocation, and innovation efficiency in an emerging market. Although Sun and colleagues (2012) provide a theoretical framework of the contingent value of corporate political ties and emphasize the importance of the national political system, they do not examine how a change to the national political environment affects firms' integration of resources. Although

Table 5
Fixed-effects regression model of cashing holding and R&D (Political tie=measurement 1; Anti-corruption=measurement 2).

	DV: R&D investment				DV: R&D output			
Variable	**Model 1a**	**Model 2a**	**Model 3a**	**Model 4a**	**Model 1b**	**Model 2b**	**Model 3b**	**Model 4b**
Control Variables								
Firm size	−0.010***	−0.009***	−0.009***	−0.009***	2.311*	2.126*	2.177*	2.149*
	(0.001)	(0.001)	(0.001)	(0.001)	(1.069)	(0.855)	(0.856)	(0.856)
Firm age	−0.010	0.006	0.008	0.010	3.728	0.377	0.261	−1.276
	(0.015)	(0.015)	(0.015)	(0.015)	(11.293)	(9.135)	(9.138)	(9.144)
Capital	−0.034	−0.023	−0.012	0.005	−84.867	−92.929	−88.861	−100.261
	(0.291)	(0.290)	(0.289)	(0.289)	(223.508)	(175.580)	(175.570)	(175.487)
Advertising	−0.059	−0.062	−0.057	−0.054	−42.913	6.278	6.846	5.980
	(0.041)	(0.041)	(0.041)	(0.041)	(31.654)	(24.755)	(24.754)	(24.743)
Tobin's Q	0.001	0.000	0.002	0.001	0.990	1.010	1.123	1.075
	(0.022)	(0.022)	(0.022)	(0.022)	(17.156)	(13.553)	(13.551)	(13.545)
Altman's Z	−0.000	0.003	0.001	0.002	0.297	0.822	0.479	−0.825
	(0.016)	(0.016)	(0.016)	(0.016)	(11.959)	(9.571)	(9.571)	(9.603)
Duality	0.002	0.002	0.001	0.001	0.454	3.176+	3.206+	3.301+
	(0.003)	(0.003)	(0.003)	(0.003)	(2.363)	(1.862)	(1.863)	(1.862)
Blockholder Ownership	−4.582***	−4.244***	−4.137**	−4.049**	−667.162	−675.166	−651.180	−686.971
	(1.287)	(1.285)	(1.282)	(1.281)	(982.784)	(777.871)	(777.840)	(777.730)
State ownership	−0.001	−0.001	−0.001	−0.002	−1.313	−2.091	−2.055	−1.878
	(0.003)	(0.003)	(0.003)	(0.003)	(2.242)	(1.775)	(1.775)	(1.775)
Natural disaster	0.006	0.006	0.006	0.006	−0.063	0.631	0.669	0.757
	(0.005)	(0.005)	(0.005)	(0.005)	(3.605)	(2.833)	(2.833)	(2.832)
GDP	0.007	0.002	0.001	0.002	8.371	−33.266	−33.579	−29.759
	(0.034)	(0.034)	(0.034)	(0.034)	(25.429)	(20.481)	(20.479)	(20.568)
Main effects								
Cash holding		0.067***	0.068***	0.066***		9.051	9.413	10.747+
		(0.009)	(0.009)	(0.009)		(5.732)	(5.734)	(5.746)
Political tie			0.005+	0.004			−1.685	−1.505
			(0.003)	(0.003)			(1.664)	(1.673)
Anti-corruption policy				−0.000				0.785*
				(0.001)				(0.328)
Two-way Interactions								
Cash holding*Political Tie			0.155***	0.151***			22.419*	25.166*
			(0.016)	(0.017)			(9.979)	(10.051)
Cash holding*Anti-corruption				−0.010***				5.719***
				(0.003)				(1.730)
Political tie*Anti-corruption				0.000				0.581
				(0.001)				(0.442)
Three-way Interactions								
Cash holding* Political tie*				−0.028***				8.600*
Anti-corruption policy				(0.006)				(3.646)
Year, industry, and province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
constant	0.087	0.055	0.057	0.044	−51.733	122.340	122.750	112.523
	(0.141)	(0.141)	(0.140)	(0.141)	(105.922)	(85.273)	(85.262)	(85.556)
R2	0.006	0.009	0.015	0.017	0.003	0.006	0.006	0.007
F-value	1.715	2.662	4.341	4.651	1.021	1.708	1.755	2.017

$n = 18{,}125$; Standard errors are shown in parentheses.
Superscripts indicate significance at the $^{+}\ p < 0.10$ * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$ level.
(Note: Political ties measurement 1 is a dummy variable coded "1″ if a director on the board has current or former political experience and "0″ otherwise; Anti-corruption policy measurement 2 is the number of government officials investigated in graft cases on corruption filed per 100,000 population in a province in a given year).

many studies focus on the contingent effects of political ties from the perspective of regime change (e.g., Dieleman and Boddewyn, 2012; Siegel, 2007), few examine the underlying motivations and ideologies behind policy changes. We argue that the motivations for the national-level policy changes determine the values of various resources and guide firms to allocate and integrate them in a new way.

Our results reveal not only how political ties can help encourage innovation spending in a non-transparent institutional environment but also when and why political ties become a less-than-ideal resource for R&D investment after changes such as the anti-corruption campaign. When the political and institutional climate is disrupted, managers must conduct cost/benefit analyses to determine whether the benefit of tapping into political networks outweighs the possibility of being investigated by the government for corruption. Politically connected firms may then overcompensate by allocating cash elsewhere and choosing to drastically decrease their R&D investment to avoid risky situations. Therefore, our study clarifies the boundary of the effect of firms' political ties in emerging economies and emphasizes the important role of national-level political shocks in determining the allocation of political and financial resources simultaneously. We extend studies that focus on the contingent effect of a single type of resource (e.g., political ties) on a firm's behavior (Dieleman and Boddewyn, 2012), and argue that external shocks introduce comprehensive and far-reaching effects on the usage of multiple resources rather than a single resource. Thus, our research framework provides a holistic perspective through which we can examine the contingent effect of environmental factors on multiple valuable resources and explore the changes in their allocation.

Although the positive effect of political ties on innovation in emerging economies is widely acknowledged, they also can lead to the "inefficiency curse" (e.g., Zhou et al., 2017), in which politically connected firms are less likely to transform their R&D investment into actual R&D output. Our framework informs the inconsistent findings of studies exploring the functional role and unique advantages of political ties in terms of filling an institutional void, and the pooling of resources associated with innovation in emerging economies (Luo and Chung, 2013; Lux et al., 2011; Zhou et al., 2017). However, this approach only

Table 6
Fixed-effects regression model of cashing holding and firm's R&D (Political tie =Measurement 2; Anti-corruption policy =Measurement 1).

	DV: R&D investment				DV:R&D outcome			
Variable	**Model 1a**	**Model 2a**	**Model 3a**	**Model 4a**	**Model 1b**	**Model 2b**	**Model 3b**	**Model 4b**
Control Variables								
Firm size	−0.010***	−0.009***	−0.009***	−0.009***	1.970*	2.126*	2.143*	2.070*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.849)	(0.855)	(0.856)	(0.855)
Firm age	−0.010	0.006	0.008	0.009	−1.823	0.377	0.504	−1.473
	(0.015)	(0.015)	(0.015)	(0.015)	(9.029)	(9.135)	(9.136)	(9.144)
Capital	−0.034	−0.023	−0.008	−0.004	−94.484	−92.929	−89.922	−86.189
	(0.291)	(0.290)	(0.289)	(0.289)	(175.586)	(175.580)	(175.546)	(175.379)
Advertising	−0.059	−0.062	−0.058	−0.056	6.714	6.278	7.207	6.750
	(0.041)	(0.041)	(0.041)	(0.041)	(24.755)	(24.755)	(24.752)	(24.736)
Tobin's Q	0.001	0.000	0.001	0.001	1.119	1.010	1.157	1.234
	(0.022)	(0.022)	(0.022)	(0.022)	(13.553)	(13.553)	(13.550)	(13.539)
Altman's Z	−0.000	0.003	0.001	0.002	0.306	0.822	0.437	0.254
	(0.016)	(0.016)	(0.016)	(0.016)	(9.566)	(9.571)	(9.570)	(9.559)
Duality	0.002	0.002	0.001	0.001	3.247^{+}	3.176^{+}	3.116^{+}	3.312^{+}
	(0.003)	(0.003)	(0.003)	(0.003)	(1.861)	(1.862)	(1.862)	(1.860)
Blockholder Ownership	−4.582***	−4.244***	−4.013**	−3.984**	−720.965	−675.166	−627.339	−647.797
	(1.287)	(1.285)	(1.282)	(1.282)	(777.368)	(777.871)	(777.880)	(777.076)
State ownership	−0.001	−0.001	−0.002	−0.002	−2.063	−2.091	−2.118	−1.883
	(0.003)	(0.003)	(0.003)	(0.003)	(1.775)	(1.775)	(1.775)	(1.774)
Natural disaster	0.006	0.006	0.006	0.006	0.624	0.631	0.626	0.862
	(0.005)	(0.005)	(0.005)	(0.005)	(2.833)	(2.833)	(2.833)	(2.839)
GDP	0.007	0.002	0.001	0.002	−32.689	−33.266	−33.630	−36.139^{+}
	(0.034)	(0.034)	(0.034)	(0.034)	(20.479)	(20.481)	(20.477)	(20.503)
Main effects								
Cash holding		0.067***	0.071***	0.069***		9.051	9.979^{+}	12.209*
		(0.009)	(0.009)	(0.009)		(5.732)	(5.740)	(5.747)
Political tie			0.018^{+}	0.018^{+}			−2.968	−1.379
			(0.010)	(0.010)			(5.962)	(5.967)
Anti-corruption policy				0.004				−7.287
				(0.015)				(9.162)
Two-way Interactions								
Cash holding*Political Tie			0.570***	0.544***			106.738**	148.197***
			(0.061)	(0.062)			(37.117)	(37.750)
Cash holding* Anti-corruption				−0.102*				97.977***
				(0.041)				(24.919)
Political tie*Anti-corruption				0.021				49.449*
				(0.038)				(22.841)
Three-way Interactions								
Cash holding* Political tie* Anti-corruption policy				−0.592^{+}				846.195***
				(0.316)				(191.305)
Year, industry, and province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
constant	0.087	0.055	0.057	0.047	126.672	122.340	122.749	137.416
	(0.141)	(0.141)	(0.141)	(0.141)	(85.233)	(85.273)	(85.255)	(85.270)
R2	0.006	0.009	0.014	0.015	0.005	0.006	0.006	0.009
F-value	1.715	2.662	4.272	4.148	1.692	1.708	1.806	2.352

$n = 18{,}125$; Standard errors are shown in parentheses.
Superscripts indicate significance at the $^{+}$ $p < 0.10$ * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$ level.
(Note: Political ties measurement 2 is the percentage of all directors on the board who had political experience; Anti-corruption policy measurement 1 is the increased ratio of the number of offices in the Commission for Discipline Inspection in different provinces post 2013).

partially captures the impact of the institutional environment (e.g., Kotabe et al., 2017; Lin et al., 2014; Zhang et al., 2020). By considering the resource utilization efficiency strategy associated with the anti-corruption policy, our framework provides a more comprehensive understanding of the role of political ties in determining innovation efficiency and helps reconcile previous controversial perspectives (Ramaswamy, 2001; Shleifer and Vishny, 1994). Our results show that the implementation of anti-corruption policies in an emerging market like China's enhances the influence of political ties on innovation and reduces the excessive or even wasteful spending on R&D investment caused by the over-reliance on such ties. We highlight the functional role of anti-corruption policies in constraining the abuse of political resources, and thus contribute to the literature concerning the effectiveness of financial and political resources in terms of innovation.

5.2. Practical implications

This study also has managerial and policy implications. First, it provides important practical implications for managers in emerging economies like China's, where technological innovation has become increasingly important. Firms must therefore determine the appropriate level of effort required for developing and maintaining political ties under a variable national political climate: being politically connected can sometimes hinder innovation spending when the connections are under harsher scrutiny.

From a policy perspective, our study suggests that policy makers focused on encouraging companies to conduct innovation must design policies that consider the trends and variation in resource slack levels, be aware of political connections, and consider the innovation portfolios of non-connected firms, particularly when providing access to innovation funding, financial incentives, and subsidies. This can help level the playing field and increase the motivations of firms that would otherwise feel disadvantaged. Our study also suggests that policy makers should focus on improving intellectual property rights protection to provide a stable and safe environment for the innovative activities of non-politically connected firms.

The anti-corruption policy is also found to be effective in alleviating the expropriation problem–which can lead to arbitrary and wasteful

Table 7
Fixed-effects regression model of cashing holding and firm's R&D (Political tie =Measurement 2; Anti-corruption policy = Measurement 2).

	DV: R&D investment				DV: R&D outcome			
Variable	**Model 1a**	**Model 2a**	**Model 3a**	**Model 4a**	**Model 1b**	**Model 2b**	**Model 3b**	**Model 4b**
Control Variables								
Firm size	−0.010***	−0.009***	−0.009***	−0.009***	1.970*	2.126*	2.143*	2.118*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.849)	(0.855)	(0.856)	(0.855)
Firm age	−0.010	0.006	0.008	0.010	−1.823	0.377	0.504	−1.038
	(0.015)	(0.015)	(0.015)	(0.015)	(9.029)	(9.135)	(9.136)	(9.142)
Capital	−0.034	−0.023	−0.008	0.000	−94.484	−92.929	−89.922	−98.876
	(0.291)	(0.290)	(0.289)	(0.289)	(175.586)	(175.580)	(175.546)	(175.461)
Advertising	−0.059	−0.062	−0.058	−0.056	6.714	6.278	7.207	6.749
	(0.041)	(0.041)	(0.041)	(0.041)	(24.755)	(24.755)	(24.752)	(24.741)
Tobin's Q	0.001	0.000	0.001	0.001	1.119	1.010	1.157	1.162
	(0.022)	(0.022)	(0.022)	(0.022)	(13.553)	(13.553)	(13.550)	(13.544)
Altman's Z	−0.000	0.003	0.001	0.003	0.306	0.822	0.437	−1.154
	(0.016)	(0.016)	(0.016)	(0.016)	(9.566)	(9.571)	(9.570)	(9.599)
Duality	0.002	0.002	0.001	0.001	3.247^{+}	3.176^{+}	3.116^{+}	3.188^{+}
	(0.003)	(0.003)	(0.003)	(0.003)	(1.861)	(1.862)	(1.862)	(1.861)
Blockholder Ownership	−4.582***	−4.244***	−4.013**	−3.922**	−720.965	−675.166	−627.339	−672.398
	(1.287)	(1.285)	(1.282)	(1.281)	(777.368)	(777.871)	(777.880)	(777.689)
State ownership	−0.001	−0.001	−0.002	−0.002	−2.063	−2.091	−2.118	−1.929
	(0.003)	(0.003)	(0.003)	(0.003)	(1.775)	(1.775)	(1.775)	(1.775)
Natural disaster	0.006	0.006	0.006	0.006	0.624	0.631	0.626	0.717
	(0.005)	(0.005)	(0.005)	(0.005)	(2.833)	(2.833)	(2.833)	(2.832)
GDP	0.007	0.002	0.001	0.002	−32.689	−33.266	−33.630	−29.685
	(0.034)	(0.034)	(0.034)	(0.034)	(20.479)	(20.481)	(20.477)	(20.567)
Main effects								
Cash holding		0.067***	0.071***	0.069***		9.051	9.979^{+}	11.380*
		(0.009)	(0.009)	(0.009)		(5.732)	(5.740)	(5.751)
Political tie			0.018^{+}	0.016^{+}			−2.968	−2.203
			(0.010)	(0.010)			(5.962)	(5.965)
Anti-corruption policy				0.000				0.790*
				(0.001)				(0.328)
Two-way Interactions								
Cash holding*Political Tie			0.570***	0.555***			106.738**	117.915**
			(0.061)	(0.062)			(37.117)	(37.367)
Cash holding* Anti-corruption policy				−0.010***				5.789***
				(0.003)				(1.729)
Political tie*Anti-corruption policy				0.002				1.906
				(0.003)				(1.555)
Three-way Interactions								
Cash holding* Political tie*				−0.081***				26.982*
Anti-corruption policy				(0.021)				(12.542)
Year, industry, and province fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
constant	0.087	0.055	0.057	0.047	126.672	122.340	122.749	112.077
	(0.141)	(0.141)	(0.141)	(0.141)	(85.233)	(85.273)	(85.255)	(85.553)
R2	0.006	0.009	0.014	0.016	0.005	0.006	0.006	0.008
F-value	1.715	2.662	4.272	4.473	1.692	1.708	1.806	2.054

$n = 18{,}125$; Standard errors are shown in parentheses.
Superscripts indicate significance at the $^{+}$ $p < 0.10$ * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$ level.
(Note: Political ties measurement 2 is the percentage of all directors on the board who had political experience; Anti-corruption policy measure 2 is the number of government officials investigated in graft cases on corruption filed per 100,000 population in a province in a given year).

investment decisions–and thus enhances the overall effectiveness and efficiency of innovation. The institutional uncertainties in emerging markets generally hinder innovation and can even lead to capital flight (Shi et al., 2017), so by promoting anti-corruption policies policy makers can help to create a fairer competitive environment for firms without political ties, enabling them to access government resources for innovation, which encourages firms at all levels of political networking to pursue innovative activities.

5.3. Limitations and future directions

Our paper has some limitations. Although the Chinese context provides an invaluable opportunity to examine our proposed theoretical framework, our sample is necessarily limited to the Chinese market, which limits the generalizability of our results. Studies that examine other emerging economies such as South Africa, India, Vietnam, and Guyana would be of benefit, particularly when there is turbulence in the institutional environment or national level policy changes. The research framework provided in the current study is well suited to exploring the aftermath of nationwide policy change in rapidly changing economies, and the impact of underlying motivations of such policies on firm innovation efficiency and political resources. In addition, when a nationwide campaign takes effect in a large country such as China, numerous within-country differences in policy execution and implementation are likely between different regions. Future studies are encouraged to examine the specific effects of large-scale policy changes on each region with a scale designed to capture the degree of policy implementation and variance in enforcement strength. This will allow within-country differences to be identified and enable meaningful research into large economies that have diverse levels of economic, political, and institutional development among their cities. Studies show that higher levels of local government intervention increase cash holding, while anti-corruption policies decrease them (Xie and Zhang, 2020), so it is important to further examine the fluctuations of cash holding levels and explore how firms spend their cash in ways other than innovation activities. Future studies can thus observe the interaction effects between government intervention levels and cash spending, in terms of strategic behavior across risk levels before and after large-scale

Table 8
Definitions and measurements of the variables.

	Variable name	Measurement
Dependent Variables	**R&D Investment**	The ratio of a firm's R&D expenditures to total assets in year t adjusted by subtracting the median industry-level R&D expenditures to size in the same year (Hillier et al., 2011; Pindado et al., 2010; Chrisman and Patel, 2012).
	R&D Outcome	The number of invention patent applications (Tan et al., 2014; Tong et al., 2014).
Independent Variables	**Cash holding**	The amount of cash and cash equivalents scaled by total assets net of cash and cash equivalents (Dittmar et al., 2003; Harford et al., 2008).
Moderate Variables	**Political Ties**	**Measurement 1**: A dummy variable coded "1″ if a director on the board has current or former political experience and "0″ otherwise. A director is deemed to have political experience if she/he is a current member in the Chinese legislative bodies (i.e., the National People's Congress and the Chinese People's Political Consultative Conference) or was a government official before joining the company (Faccio, 2006; Hillman, 2005; Sun et al., 2016). **Measurement 2:** The percentage of all directors on the board who had political experience (Sun et al., 2016).
	Anti-corruption policy	**Measurement 1**: Increased ratio of the number of offices in the Commission for Discipline Inspection (CDI) in different provinces after the 18th Congress conference. **Measurement2**:The number of government officials investigated in graft cases on corruption filed per 100,000 population in a province in a given year. **Measurement3**: A dummy variable equal to 1 for observations falling after the 18th Congress conference and 0 otherwise.
Control Variables	**Firm size**	The logarithms of firm total number of employees (Qian et al., 2013).
	Firm age	The number of years a firm has been established in its current field.
	Capital expenditure	The natural logs of capital expenditures.
	Advertising expenditure	Advertising expenditures divided by sales.
	Tobin's Q	The ratio of the firm's market value to book value and is calculated as follows: (common shares outstanding * calendar year closing price) + (current liabilities - current assets)+(long term debt)+(the liquidating value of preferred stock) divided by (total assets). Source: CSMAR.
	Altman's Z	Altman's Z-score was used to measure the likelihood of a firm experiencing financial distress or bankruptcy (Miller and Reuer, 1996). It measures the probability of bankruptcy within the next two years, where a higher Z-score means better financial health. Data on Altman's Z-score are retrieved from Wind Database.
	CEO duality	A binary variable equal to "1″ if there was a combined role of CEO and chairperson on a board, and "0″ otherwise.
	Blockholder ownership	The percentage of ownership stakes held by the largest shareholder of the firm.
	State ownership	The percentage of minority equity stakes held by government.
	Natural disaster	The number of earthquakes in the region in which the company is located.
	GDP	The logarithms of GDP of the region in which the company is located.

Table 9
Sample distribution in industries by two-digit SIC Code.

SIC Code	Industry Description	Number of Firms	% Firms in Industry
A01	Agriculture	106	0.585
A02	Forestry	33	0.182
A03	Animal husbandry	67	0.370
A04	Fishery	64	0.353
A05	Agriculture, forestry, animal husbandry and fishing services	10	0.055
B06	Coal mining and washing	243	1.341
B07	Oil and gas extraction	49	0.270
B08	Ferrous metal mining and dressing	42	0.232
B09	Non-ferrous metal mining and dressing	199	1.098
B11	Mining auxiliary activities	62	0.342
C13	Agricultural and non-staple food processing	275	1.517
C14	Food manufacturing	211	1.164
C15	Wine, beverage, and refined tea manufacturing	329	1.815
C17	Textile	253	1.396
C18	Textile and clothing	175	0.966
C19	Leather, fur, feathers and their products and footwear	35	0.193
C20	Wood processing and wood, bamboo, rattan, brown, grass products	58	0.320
C21	Furniture manufacturing	39	0.215
C22	Paper and paper products	193	1.065
C23	Printing and recording media reproduction	65	0.359
C24	Manufacturing of cultural and educational, industrial and esthetic, sports and entertainment products	36	0.199
C25	Petroleum processing, coking and nuclear fuel processing	117	0.646
C26	Chemical raw materials and chemical products manufacturing	1101	6.074
C27	Pharmaceutical manufacturing	1090	6.014
C28	Chemical fiber manufacturing	177	0.977
C29	Rubber and plastic products	244	1.346
C30	Non-metallic mineral products	458	2.527
C31	Ferrous metal smelting and Calendering	288	1.589
C32	Non-ferrous metal smelting and Calendering	459	2.532
C33	Metal products	233	1.286
C34	General equipment manufacturing	547	3.018
C35	Special equipment manufacturing	654	3.608
C36	Automobile manufacturing	611	3.371
C37	Manufacturing of railways, ships, aerospace, and other transport equipment	307	1.694
C38	Electrical machinery and equipment manufacturing	977	5.390
C39	Manufacturing of computers, communications, and other electronic equipment	1360	7.503
C40	Instrument manufacturing	53	0.292
C41	Other manufacturing industries	77	0.425
C42	Comprehensive utilization of waste resources	40	0.221
D44	Electricity, heat production and supply	613	3.382
D45	Gas production and supply	139	0.767
D46	Water production and supply	112	0.618
E47	Housing construction	10	0.055
E48	Civil engineering and construction	386	2.130
E50	Architectural decoration and other construction industries.	126	0.695
F51	Wholesale	641	3.537
F52	Retail trade	627	3.459
G53	Railway transport	40	0.221
G54	Road transport	275	1.517
G55	Water transport	226	1.247
G56	Air transport	92	0.508
G58	Handling and transportation agency	32	0.177
G59	Storage	29	0.160
G60	Postal service	31	0.171
H61	Accommodation	59	0.326

(*continued on next page*)

Table 9 (*continued*)

SIC Code	Industry Description	Number of Firms	% Firms in Industry
H62	Catering	26	0.143
I63	Telecommunications, radio and television and satellite transmission services	79	0.436
I64	Internet and related services	280	1.545
I65	Agriculture, forestry, animal husbandry and fishing services	531	2.930
J67	Coal mining and washing	20	0.110
J69	Oil and gas extraction	36	0.199
K70	Ferrous metal mining and dressing	1202	6.632
L71	Non-ferrous metal mining and dressing	21	0.116
L72	Mining auxiliary activities	262	1.446
M73	Agricultural and non-staple food processing	20	0.110
M74	Food manufacturing	77	0.425
M75	Wine, beverage, and refined tea manufacturing	10	0.055
N77	Textile industry.	95	0.524
N78	Textile and clothing	122	0.673
P82	Leather, fur, feathers and their products and footwear	44	0.243
Q83	Wood processing and wood, bamboo, rattan, brown, grass products	65	0.359
R85	Furniture manufacturing	117	0.646
R86	Paper and paper products	99	0.546
R87	Printing and recording media reproduction	34	0.188
S90	Manufacturing of cultural and educational, industrial and esthetic, sports and entertainment products	210	1.159

institutional policies are implemented. The specific types of R&D output before and after large-scale policy changes can also be compared. Firms with political ties may be much more eager to produce quick and significant results after facing scrutiny in the changing institutional and political environment, but the long-term performance benefits of different types of R&D outcomes are not necessarily equal. Thus, changes in R&D direction and their impact on performance over time should be examined in more detail.

6. Conclusion

Political ties have been extremely beneficial in China but can have a double-edged effect on innovation efficiency. Changes in institutional sensitivity to corruption have a major influence on the usefulness of political ties when leveraging cash holding for innovation investment and output. We draw on the resource-based view and institutional theory to highlight the resource utilization efficiency logic of the anti-corruption policy and demonstrate that politically connected firms are strongly motivated to convert R&D investment into actual outcome. By developing a framework to examine the nuances of investment and outcome, while considering the inconsistencies in the benefits political ties have for innovation efficiency under a dynamic institutional landscape, we provide a new research direction through which the innovation process, political connections, and environmental conditions can be simultaneously explored.

CRediT authorship contribution statement

Feifei Lu: Conceptualization, Methodology, Data curation, Investigation, Writing – review & editing. **Zhu Zhu:** Conceptualization, Investigation, Writing – original draft, Writing – review & editing, Supervision. **Lina Zhu:** Data curation, Writing – review & editing, Data curation, Writing – review & editing. **Hao Gao:** Data curation, Data curation.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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