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Corporate governance and innovation: a theoretical review

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Abstract

Purpose – The purpose of this paper is to present a review of the literature on two lines of research, corporate governance and innovation, explaining how different internal corporate governance mechanisms may be determinants of business innovation.

Design/methodology/approach – It explores the theoretical background and the empirical evidence regarding the influence of both ownership structure and the board of directors on company innovation. Then, conclusions are drawn and possible future research lines are presented.

Findings – No consensus was observed regarding the relation between corporate governance and innovation, with both positive and negative arguments being found, and with empirical evidence not always pointing in the same direction. Thus, new studies trying to clarify this relationship are needed.

Originality/value – Over recent years, interest has grown in the influence of governance mechanisms on innovation decisions taken by the management. Innovation efforts and results depend on factors that are influenced by corporate governance, such as ownership structure or the functioning of the board of directors. Thus, the paper shows an updated state of the art in this field proposing future lines for empirical research.

Keywords Corporate governance, Innovation, Ownership structure, Board of directors

Paper type Research paper

Introduction

Separation between ownership (shareholders) and control (management) and its relevance for company value and decisions makes it necessary to draw up management control mechanisms. This idea led to the appearance of the corporate governance concept, which has attracted great interest among academic researchers, especially as a result of certain financial scandals over recent years (Enron, Parmalat, WorldCom, etc.). According to Shleifer and Vishny (1997), corporate governance can be understood as the set of mechanisms that align objectives and interests between the providers of finance and company managers so that the former have a degree of certainty against the risk they take by making their funds available to managers, and can try to avoid opportunistic behavior by the latter.

Governance mechanisms can be separated into internal ones (set up by the company itself) and external ones (linked to the different markets in which the company may be present). This study focuses on the former which are the most developed in Spain and have most often been linked to innovation. They include, on the one hand, ownership structure (degree of concentration and large shareholder identity) and, on the other, the board of directors and its functioning in association with certain characteristics

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(size, composition, etc.) such as the most important measures for overseeing the management (Salas, 2002) and, as a result, for overseeing the decisions taken by the company regarding its performance and competitiveness.

In his two best-known books, Schumpeter (1934, 1942) claims that innovation is the main force for economic development. According to the Oslo Manual, the concept of innovation can be defined as “the introduction of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations” (OECD, 2005, p. 56). Most of the literature focuses on two methods for measuring innovation, the most common being to consider inputs (any efforts made by the company to be more competitive and more innovative, which are usually represented either by expenditure on Research and Development (R&D) as a percentage of the company’s total sales, or by the number of people involved in R&D activities as a percentage of the company’s total employees) and outputs (the result of the innovative activity measured as the number of patents registered or in process of registration by the company).

Although most of the prior studies have tried to analyze the influence of governance on company performance and value, others (some recently) have shown that corporate governance is one of the main determinants for innovation and technological change (Tylecote and Visintin, 2007). Over recent years, interest has grown in the influence of governance mechanisms on innovation decisions taken by the management (Tribo *et al.*, 2007; Wu, 2008; Latham and Braun, 2009; Belloc, 2012[1]; Block, 2012; Balsmeier *et al.*, 2014; Zhang *et al.*, 2014; Tsao *et al.*, 2015). Amongst others, these authors argue that innovation efforts and results depend on factors that are influenced by corporate governance, such as ownership structure, shareholder identity or the functioning of the board of directors.

In this context, the purpose of this study is to link these two fields of research by reviewing the literature (from the late 1980s until today, and including both Spanish and international journals). The ultimate aim is to find out the state of the art in this field and thus to propose future lines for empirical research. The paper is therefore organized as follows: second and third sections present the relation between ownership structure and the board of directors and business innovation, respectively, adding theory on the influence of one on the other and providing empirical evidence to corroborate the relations described. Finally, the fourth section draws conclusions from the review, points out some limitations and suggests possible lines for future research.

Ownership structure and innovation

Ownership structure is one of the main mechanisms for corporate governance (Shleifer and Vishny, 1997; La Porta *et al.*, 1998, 2000) so we review its influence on innovation, distinguishing between two aspects – ownership concentration, and the identity of the main owners[2].

Ownership concentration and innovation

The prior literature includes arguments supporting both a positive and a negative relation between ownership concentration and R&D activities[3]. An initial argument on a negative relation lies in greater risk aversion. Ownership concentration and combined ownership and management may reduce the pressure that external investors or other supervisors exert on managers in their control of financial statements, information transparency and strategic renewal (Carney, 2005). Agency theory (Jensen and Meckling, 1976; Fama and Jensen, 1983) claims that owners or managers become more risk averse as their share in the company capital grows (Beatty and Zajac, 1994; Denis *et al.*, 1997). This is because it is often difficult for them to diversify their risk so they become more conservative and carry out fewer R&D

activities. In addition, concentrated ownership can lead not only to risk aversion but also to a lack of willingness to participate in activities for strategic change, such as innovation, because this involves short-term expenditure on R&D while any possible returns would only appear in the long term (Hill and Snell, 1988; George *et al.*, 2005).

Another argument that may explain the negative relation between ownership concentration and innovation is the conflict between minority and large shareholders which results from limited legal shareholder protection in some countries (Young *et al.*, 2008). High concentration may allow owners to use the company's resources to maximize their own private benefits (Su *et al.*, 2007), at the expense of the minority shareholders, instead of performing profitable activities, such as innovation, that would benefit everyone.

In line with the above arguments, there are studies that support this negative relation for Italy (Battaglion and Tajoli, 2000), Spain (Ortega-Argilés *et al.*, 2005; Ortega-Argilés and Moreno, 2009), Switzerland (Brunninge *et al.*, 2007) and Germany (Czarnitzki and Kraft, 2009). Outside Europe, other results also back this idea for Canada (Di Vito *et al.*, 2008) and China (Chang *et al.*, 2010; Zeng and Lin, 2011). Moreover, as suggested by Ortega-Argilés and Moreno (2009), not only ownership concentration but also the inclusion of owners in management tasks and decision-making could lead to a drop in risky projects because they are less specialized in the patent system and have fewer technical skills.

On the other hand, a positive relation between ownership concentration and innovation is suggested because large owners are likely to be more concerned about the market value of the company and more motivated to invest in projects that are expected to generate value (Baysinger *et al.*, 1991; Lee, 2005; Belloc, 2012). When ownership is concentrated in just a few hands, it is likely to prevent incorrect use of investment funds by the management (Ortega-Argilés *et al.*, 2006). A small number of large shareholders may prefer to make long-term investments in R&D in order to increase company stability instead of focusing on their own profits. Some empirical studies show that ownership concentration has a positive effect on innovation (Hill and Snell, 1988; Baysinger *et al.*, 1991; Lacetera, 2001, for the USA; Di Vito *et al.*, 2008 for Canada; Munari *et al.*, 2010, for Europe).

There have also been some studies supporting a two-way relation between ownership concentration and innovation, depending on the countries studied. For example, Lee and O'Neill (2003) conclude that an increase in ownership concentration is positively related to R&D expenditure in US companies, but not in Japanese companies. On the other hand, in a study on companies in France, Germany, Italy (all countries with high ownership concentration) and the USA and UK (where ownership is more dispersed), Hall and Oriani (2006) found that in France, Germany, UK and US investment in R&D is positively related to market value, and that in Italy and France only companies with no large shareholders were positively valued in the market for their R&D expenditure.

In addition, some empirical studies show that the relation between concentration and innovation might not be linear. Denison and Mishra (1995) argue that large shareholders have a vision that strengthens long-term success but, since they have a large share in the capital they are more risk averse, which causes a negative effect on R&D investment. So, if the risk aversion of large shareholders predominates, ownership concentration will have a negative effect on innovation but if a long-term vision predominates, the effect will be positive. Shapiro *et al.* (2015) explain this non-linear relation between the two variables by the hypotheses of alignment of interests and of entrenchment or opportunism, which results in an inverted U-shape relation, as found by Chen *et al.* (2014). Alignment of incentives may mean that at low levels of concentration, shareholders are more concerned about decisions that will create value in the company, such as innovation. Concentrated ownership dominated by large shareholders, on the other hand, may encourage the latter to divert resources at the cost of minority shareholders, especially when the latter's rights are not well

protected (La Porta *et al.*, 2000; Hess *et al.*, 2010), and this self-interested behavior may have a negative effect on R&D expenditure (La Porta *et al.*, 2000).

Cho (1998), however, states that the relation between corporate ownership and innovation activity may work both ways. He argues that ownership structure affects R&D expenditure, which affects company value, which in turn affects ownership structure. Other studies do not analyze a direct relation between ownership concentration and innovation but consider that the former may moderate another existing relation. For example, Tsao and Chen (2012) find that cash flow control by owners positively moderates the relation between internationalization and innovation in the company, while the entrenchment effect that arises from the diverging interests between control and cash flow rights may negatively moderate this relation. Other studies propose that R&D expenditure may mediate in the relation between ownership concentration and business performance (Zhang *et al.*, 2014).

In summary, regarding ownership concentration, although the empirical evidence is not conclusive, from a theoretical point of view and in line with what has been found in other prior studies, it seems reasonable to expect an inverted U relation between concentration and innovation. For low levels of ownership, what predominates is the incentive alignment effect and the fact that innovation may help create value. On the other hand, at greater levels of concentration and especially in countries with less protection for minority shareholders, risk aversion and the incentive to obtain private benefits from control may result in a negative relation. Moreover, the fact that the causality in the relation is not clear makes it necessary to control for endogeneity in any estimation.

Large shareholder identity

We describe below the different identities of large shareholders (institutional investors, bank owners, state ownership, non-financial entities, foreign investors, individual investors, family ownership and manager ownership) and how they relate to innovation.

Institutional investors. Institutional investors may lead to a lower level of innovation, because they tend to be short-sighted, looking only for short-term profits. They value these more than long-term profits (Kochhar and David, 1996) because access to specific company information is not readily available to them, which in turn makes it difficult for them to evaluate the company's value in the long term (Porter, 1992). They may prefer to benefit only from share price rises and drops even if such changes are only short-lived (Loescher, 1984). A consequence of this preference for investing in the short term is that managers may also set this time line when taking decisions (Kochhar and David, 1996). Also, since managers want to minimize threats of acquisition, which would leave them without a job (Walsh, 1989), they may have incentives to reduce the risk of long-term investments in, for example, innovation activities (Hayes and Abernathy, 1980). Institutional ownership may also pressure managers to report profits in the short term, especially in loss-making companies (Graves and Waddock, 1990). This reduces their interest in entrepreneurial activities, especially R&D investment and the development of new internal products, which involve a high level of risk and only bring returns in the long term (Hill *et al.*, 1988).

In line with these ideas, Graves (1988) showed a negative relation between institutional ownership and R&D expenditure. David *et al.* (2001) argued that institutional investors are not positively associated with R&D inputs, and Kochhar and David (1996) suggest that institutional ownership is negatively associated with the new product ratio, even though the relation is not statistically significant.

There may also be a positive relation between the two variables. Because of their wealth, institutional investors can obtain economies of scale in investment projects, so they have more market knowledge than individual investors (Black, 1992). They may therefore have the necessary incentives for carefully evaluating the possible benefits of long-term

investments rather than short-term gains from price fluctuations (Kochhar and David, 1996). And, since it is not easy for them to diversify their investment in the short term, they might encourage managers to make long-term investments (Kochhar and David, 1996). Another argument in support of a positive relation was made by Aghion *et al.* (2009). Institutional owners have greater incentives and supervisory capacities than other owners. This increased oversight protects managers from the consequences of a failed R&D project which might affect their reputation so institutional ownership can be said to reassure managers about their future job stability. In line with the above arguments Baysinger *et al.* (1991) and Hansen and Hill (1991) find that institutional investors have a positive effect on R&D expenditure by companies. Similarly, Aghion *et al.* (2009) for the USA and Choi *et al.* (2011) for China conclude that the presence of institutional ownership increases the number of registered patents.

Bank ownership. Banking entities maintain trade relations with the companies in which they invest, often providing loans and credits (Kroszner and Strahan, 2001). This exposes banks to uncertainty on the returns on R&D investments. In addition, the presence of banks encourages companies to increase their capital by borrowing (Petersen and Rajan, 1994). The greater the debt, the greater the risk and the greater the importance of distortions generated by debt in investment decisions. One of them is short-term investment (Grinblatt and Titman, 1998), which may hold back investments in R&D which are mainly for the long term (Hoskisson *et al.*, 1993).

However, the empirical evidence is not conclusive because some studies support a negative relation (Tribo *et al.*, 2007; Xiao and Zhao, 2012), some find the opposite (Sherman *et al.*, 1998; Miozzo and Dewick, 2002; Lee, 2005) and some find no significant relation (Kochhar and David, 1996).

State ownership. A positive relation might be expected between state ownership and innovation. Governments have an important role to play in developing innovation because they provide resources for creating new technologies (Amsden, 1992; Haggard, 1994). Some authors argue that they have positive effects on company performance in both advanced countries (Kole and Mulherin, 1997) and countries that are in an economic transition (Sun *et al.*, 2002). State-run companies have significant incentives and access to important infrastructure that facilitates innovation (Chang *et al.*, 2006). In some studies, however, the influence of state ownership on performance and business decisions is found to be negative (e.g. Vickers and Yarrow, 1991; Dewenter and Malatesta, 2001). A double agency relationship or the existence of political objectives going beyond profit maximization are possible explanations.

The empirical evidence, therefore, is not conclusive. Miozzo and Dewick (2002) conclude that, in the case of Denmark, the government plays an important role in stimulating innovative projects through collaboration. For China, Chen *et al.* (2014), Choi *et al.* (2011) and Zeng and Lin (2011) maintain that the State is positively related to innovation outputs or inputs. However, in an international study, Xiao and Zhao (2012) conclude that state-controlled banks have a negative effect on business innovation, especially in small companies. But neither Choi *et al.* (2012) nor Munari *et al.* (2010) find a significant relation.

Non-financial entities. Unlike banks, non-financial companies rarely have credit relations with the companies they control (Kroszner and Strahan, 2001; La Porta *et al.*, 2006). This reduces the degree of risk in debt, avoids investment inefficiencies such as the above-mentioned short-term investment bias, and encourages investment in R&D. Also, non-financial companies are more likely to recognize the importance of R&D in market success. Reciprocal trade relations and synergies between the company and its owner can be expected to encourage investment in R&D (Jaffe, 1986). By investing in R&D, controlled companies can improve their absorption capacity (Cohen and Levinthal, 1990). Sometimes,

owners invest strategically in R&D-intensive companies with the intention of delegating to them some of their own investments in R&D, which would thus become more efficient. Large companies invest in starting up others, give them incentives to invest in R&D and, if such new companies are then successful, the large companies include them in their own division to improve their own investments in R&D (Gompers *et al.*, 2008). Tribo *et al.* (2007) corroborate these ideas for Spain because their results suggest that non-financial companies have a positive impact on R&D investments.

Foreign investors. Foreign partners provide companies with advanced techniques, knowledge and management resources in addition to funding. According to Choi *et al.* (2011) there are three reasons for a positive relation between foreign ownership and innovation. First, foreign investment by multinationals tends to focus on the domestic market for their main business. This requires a competitive technological advantage over other domestic companies (Johanson and Vahlne, 1977; Chang, 1995) and the foreign companies are taken as the model for developing technological and innovation capacity. Second, foreign partners can help companies step up their R&D efforts by means of advanced transfer of technological resources. Finally, foreign investors also encourage their domestic partners to invest in technological development by using their own shares (Chang *et al.*, 2006).

The empirical evidence corroborates the positive relation in the European context (Love *et al.*, 1996 for Scotland, Kostyuk, 2005 for Ukraine), in China (Chen *et al.*, 2014; Choi *et al.*, 2011, 2012) and Korea (Lee, 2012). Similarly, for the USA Francis and Smith (1995) argue that foreign ownership reports a significantly larger number of patents granted than companies with dispersed ownership.

Individual investors. There can be both a positive and a negative relation between individual investors and R&D. On the one hand, supervision is enhanced when the main individual shareholders are present because they offer more points of view. Also, the stakes of large individual shareholders represent a significant proportion of their wealth so they have incentives to supervise and this may have a positive effect on R&D. On the other hand, agreements on long-term investment projects are more difficult to reach when there are numerous large investors (Hoskisson *et al.*, 2002). The empirical study performed by Tribo *et al.* (2007) for Spain did not find a significant relation, whereas Baysinger *et al.* (1991) conclude that the positive effect of ownership concentration on R&D expenditure can be attributed more to the impact of institutional rather than individual investors.

Family ownership. Families have better access to information and focus more on longer time frames than non-family shareholders (Anderson and Reeb, 2003; Brenes *et al.*, 2011). Family owners have an information advantage over minority shareholders and are better able to understand the value and risks involved in R&D projects. With their longer-term horizon, families see their company as an asset to be passed on to their descendants rather than as wealth to be consumed during their lifetime. Also, this longer time horizon allows family owners to tolerate an increased deficit if it encourages the managers and directors to participate in R&D investment strategies. On the other hand, family owners tend to be large shareholders whose wealth is tied up in their companies, so it is difficult for them to diversify their risks (Tsao *et al.*, 2015). So, since R&D projects are intrinsically risky, family enterprises may prefer to invest less in R&D (Anderson *et al.*, 2012).

The empirical evidence is not conclusive. For the USA, Francis and Smith (1995) reach the conclusion that family-owned enterprises hold significantly more patents than companies with multiple owners. For Korea, Yoo and Sung (2015) find that family control is positively related to R&D intensity, especially when there are few opportunities for growth. Along the same line, for Taiwan Tsao *et al.* (2015) conclude that family companies invest more in R&D. In European countries, Munari *et al.* (2010) argue that family ownership is negatively and significantly related to R&D investment. Similarly, for China, Choi *et al.* (2011) suggest that

family ownership leads to a smaller number of registered patents, and Chrisman and Patel (2012) find that families generally invest less in R&D than non-family companies adding that, when performance is worse than expected, their views change and they increase their investments in R&D more than non-family companies.

Other studies suggest that the effect is different depending on whether the company is in the hands of the founder or of the descendants. For the USA, Block (2012) finds that founder-led companies have a positive effect on both R&D expenditure intensity and productivity, but that when they are in the hands of descendants, the effect changes to neutral or even negative. In their analysis of Korean companies, Choi *et al.* (2015) find that the relation is positively moderated by growth in opportunities. Their results indicate that a family-run company generally invests less in R&D but, when performance drops below what was expected, prospects change to the extent that family-run companies increase their investments in R&D more than non-family companies. The relation is not the same for all companies, being weaker in large family-run business groups where family control is more secure.

Finally, family ownership may be a moderating variable for other relations. For example, Kim *et al.* (2008) find that family ownership has a positive moderating effect on the relation between financial slack and R&D investment, and Tsao *et al.* (2015) conclude that it positively moderates the relation between R&D investment and CEO remuneration.

Management ownership. Management ownership helps reduce agency problems between shareholders and managers and the fact that managers have greater voting power guarantees their job stability so also reduces their risk aversion (Cho, 1992). When managers hold shares in the company they are more likely to take decisions that will maximize shareholder profit, such as R&D investment (Hill and Snell, 1988; Latham and Braun, 2009).

However, the empirical evidence on the one hand suggests the relation may be both positive (Hill and Snell, 1988; Francis and Smith, 1995) and negative. Latham and Braun (2009) argue that the relation between organizational decline and innovation is moderated by management ownership. That is, when managers face a loss of their wealth or job security, they cut back any risky actions, which leads to a drop in innovation activities. Greater ownership leads managers to adopt behavior that is more in line with the rigidity model, significantly holding back investment. However, in some cases, no statistically significant relation is found (Lacetera, 2001; Choi *et al.*, 2012).

So, regarding the influence of the main shareholder's identity on business innovation, it seems that, in line with the theory, a company is more likely to carry out innovation activities if the largest shareholder is a long-term institutional investor, a non-financial entity or a foreign investor. In companies run by a family or individuals, if they have sufficient resources or a situation in which they can afford to carry out risky activities (such as innovation) without placing their future at risk, innovation activity can be expected to be more intense. This is also the case if the company is under the control of its founder rather than descendants, in which case business performance is usually worse and there is greater conflict over decisions (Blumentritt *et al.*, 2013). In the case of companies in which the State has a significant stake, the problems of State-Owned companies may predominate (such as a double agency relation, soft budgetary restrictions, distorted objectives, etc.), which may affect decisions to create value. Along these lines, some studies suggest that product and service innovation increases after privatization (Antoncic and Hisrich, 2003). Finally, when managers hold a stake in the capital, they will align their interests with those of the owners, thus encouraging value-creating decisions on, for example, innovation.

Boards of directors and innovation

The board of directors provides a formal link between the owners and those in charge of the day-to-day running of the company, and is described as the top body for control decisions

within corporate governance (Fama and Jensen, 1983; Adams *et al.*, 2008). Although the literature, especially in the fields of finance and business management, shows that the board plays a crucial role in the relation between corporate governance and strategy, the evidence on the relation between the board and innovation by companies is limited (Balsmeier *et al.*, 2014). As far as we know, Baysinger *et al.* (1991) were the first to analyze the link between certain board characteristics and innovation, and concluded that there is a positive link between the proportion of internal board members and R&D expenditure per employee. Since then, the literature has gradually shown how other board characteristics may also influence companies' innovation activities. These include composition (Baysinger *et al.*, 1991; Hoskisson *et al.*, 2002; Kor, 2006; Brunninge *et al.*, 2007; Balsmeier *et al.*, 2014), size (Lacetera, 2001; Adams *et al.*, 2008; Driver and Guedes, 2012), directors' educational level (Escribá-Esteve *et al.*, 2009; Barroso *et al.*, 2011; Dalziel *et al.*, 2011), board meeting frequency (Chen and Hsu, 2009; Wincent *et al.*, 2010) and CEO duality (Lhuillery, 2011).

An essential aspect of boards is their composition. On the one hand, external directors can reconcile differences on the board, evaluate whether independent agendas fit in corporate routines and reduce potential agency conflicts (Yoo and Sung, 2015). This type of director plays two important roles in a firm. First, their independence places them in a better position to supervise management (Rosenstein and Wyatt, 1990; Peng, 2004; Brunninge *et al.*, 2007). Second, external directors, such as bankers or politicians, have different assets to offer or represent important interest groups (Adams *et al.*, 2008).

This type of director also plays an essential role in the acquisition of specialist knowledge, as do their networks for speeding up knowledge transfer (Westphal, 1999). Company expansion through external directors can help to attract funds and to improve its learning experience for innovation activities (Fried *et al.*, 1998). So external directors can be expected to help promote strategies that will boost shareholder wealth, including R&D investments (Kosnik, 1987, 1990). And when external directors work in close collaboration with companies, they can give not only new strategic guidelines but can also provide information and advice during a process of change because of their personal contacts linking the company with important elements in its environment (Borch and Huse, 1993). They can be agents for the acquisition of resources (Goodstein and Boeker, 1991; Kim and Kim, 2015) and can improve the organization's reputation (Hung, 1998; Johannisson and Huse, 2000), facilitating external conditions for change or innovation actions.

In line with the above arguments, Brunninge *et al.* (2007) and Shapiro *et al.* (2015) find that the presence of external directors has a positive effect on strategic changes, including innovation. Similarly, for Germany Balsmeier *et al.* (2014) find that external directors with experience who sit on the boards of technological companies have a positive and significant effect on applications for patents in the companies which they advise and supervise.

However, the monitoring and advice that can be expected from external directors is not always positive for R&D investment (Yoo and Sung, 2015). These authors state that the main role of such directors is not to promote R&D activities but to discipline the strategic decisions taken by main shareholders. They thus become cautious and, as a result, may unwittingly affect long-term performance and discourage certain business strategies because they do not have access to all the information available on strategic decisions so base their approval on the available financial information (Lorsch and Young, 1990).

Internal directors, on the other hand, may be more likely to adopt new strategies for new product development because they know more about such products so do not perceive so much uncertainty (Hill and Snell, 1988; Hoskisson *et al.*, 2002). Baysinger *et al.* (1991) conclude that senior executives may be more prepared to invest in risky R&D projects if they are well represented on the boards because they are less dependent on the opinions and evaluations of external directors and because the proportion of internal directors has a positive effect on the R&D expenditure of large enterprises. On the other hand, Hayes and

Abernathy (1980) and Baysinger and Hoskisson (1989) argue that when companies emphasize financial goals instead of strategic control for evaluating managerial performance, they tend to prefer short-term strategies instead of long-term projects. Also, if senior executives are penalized for adopting strategies involving poor returns, they will be more reluctant to invest in risky R&D projects[4].

Regarding the type of innovation and in comparison with external directors, internal directors may prefer internal innovation (new product development) to external innovation (acquisition) because of the uncertainty inherent in the latter. Also, external directors may find it difficult to evaluate the efficiency of strategic decisions (Mizruchi, 1983; Lorsch and Young, 1990), including product development. Holmstrom (1989) argues that external directors may favor the external acquisition of innovation, in which case evaluation may be based on financial criteria because decisions do not require full understanding by the companies involved. In fact, the empirical evidence suggests that companies that carry out control based on financial information tend to favor external innovation (Hitt *et al.*, 1996; Hoskisson *et al.*, 2002).

For another board characteristic, that of size, both a positive and a negative relation with innovation are possible. On the one hand, a larger number of directors increases the overall experience, information and advice that the company can resort to (Goodstein *et al.*, 1994; Haynes and Hillman, 2010). It also offers more links with the external environment and, probably, more resources (Jackling and Johl, 2009), because more directors increase the company's access to a greater number of external resources, including the technological and financial ones that are essential for innovation (Shapiro *et al.*, 2015). Therefore, a large board of directors can improve a company's capacity to deal with uncertainty in the environment and can increase links with other partners (Pfeffer and Salancik, 2003).

An alternative view suggests that a larger board may prevent it from being effective in its strategic decisions because, for example, there is greater diversity of opinions which may lead to conflict and mistrust among directors (Amason and Sapienza, 1997), and to difficulties for meeting frequently or for coordinating different points of view (Goodstein *et al.*, 1994; Yermack, 1996; Ruigrok *et al.*, 2006).

Regarding the empirical evidence, for Taiwan, Chen (2012) finds that R&D investment is negatively related to board size. But for the UK, Driver and Guedes (2012) do not find evidence of a significant impact of board size on R&D expenditure. Similarly, for China, Shapiro *et al.* (2015) obtain results indicating the board size has no impact on the introduction of new patents.

The educational level of board members determines their abilities and level of knowledge (Barroso *et al.*, 2011). The highest educational levels are characterized by greater cognitive complexity (Wally and Baum, 1994), leading to a greater capacity for grasping new ideas (Barker and Mueller, 2002), adopting new behavior, defining problems better and searching for creative solutions to complicated problems (Bantel and Jackson, 1989). Bearing in mind that R&D projects are complex, directors with a higher educational level may be more receptive to innovation (Barroso *et al.*, 2011; Dalziel *et al.*, 2011). They may be able to take new technologies on board (Lin *et al.*, 2011), acquiring new knowledge and processes, analyzing information much more precisely (Escribá-Esteve *et al.*, 2009) and developing new methods for solving problems (Wincent *et al.*, 2010). So, companies whose board members have a higher educational level will have a more thorough understanding of R&D processes and of external environments, so will be better equipped to implement R&D activities, in line with the findings of Chen (2012) and Lacetera (2001).

In addition, more frequent board meeting allow directors to devote more time and effort to the company strategy and to business operations, sharing their experience, knowledge and judgment. This would provide more critical information and valuable resources (Forbes and Milliken, 1999) for advising the management team on important matters for the company while reviewing the main strategic actions (Haynes and Hillman, 2010). More

frequent meetings are likely to result in a more efficient board (Vafeas, 1999) and better governance (Chiang and He, 2010) and are likely to be valuable for building and developing a network of relations among members (Gabrielsson and Winlund, 2000). Such relations among directors may facilitate access to necessary resources (capital, information, talent, etc.), thus reducing the risk of a shortage of resources for R&D (Chen and Hsu, 2009).

Also, frequent board meetings may give members a better understanding of R&D activities. In meetings they can develop alternative strategies, reducing uncertainty and therefore leading to a greater probability of success in innovative activities (Wincent *et al.*, 2010). However, the results found by Chen (2012) do not support this positive relation between meetings and innovation.

Finally, the distinction between the roles of directors and of managers is clearest when the positions of President of the Board and CEO are separate (Fama and Jensen, 1983), this being known as the absence of duality. Supervision by the board may clearly influence the impact of risk-taking by the CEO (Hambrick and Finkelstein, 1987; Crossland and Hambrick, 2007). When a single person holds several positions (President of the Board and CEO), agency problems arise because of information asymmetries between the CEO and the board. Prior studies suggest that duality leads to unfavorable results for shareholders (Hambrick and D'Aveni, 1992; Boyd, 1994; Webb, 2004; Petra and Dorata, 2008) or may lead to decisions to protect the wealth of all the stakeholders in the company being set aside (Sahin *et al.*, 2011). On the other hand, the separation of these positions may reduce tension between the management and the board, and it is more likely that the President will adopt decisions with long-term potential and within economic and social benefits such as R&D investments (De Villiers *et al.*, 2011). In line with this, Zhang (2012) also argues that separation of these positions may mean that not only shareholders' interests are taken into account but also those of other stakeholders.

Against these arguments, for France, Lhuillery (2011) indicates that certain board practices that address shareholders, such as duality, may individually have a positive influence on R&D investments in line with the results also found by Driver and Guedes (2012) for the UK.

In summary, the relation between a company's innovation and certain characteristics of its board seems clear from a theoretical point of view, with a positive effect expected the higher the educational level of board members, the number of board meetings and the lack of duality or accumulation of positions. However, in the case of board composition and size, the final influence on the degree of innovation will depend on compliance by the company with recommendations in codes of good governance.

Conclusions

This paper first carried out a theoretical review of the influence of ownership concentration and of different types of owner on innovation. It was noted that neither the theory nor the empirical evidence are conclusive for establishing a relation between these variables, because different authors find different results depending on the sample, country or firms studied. Second, no consensus was observed regarding the relation between board composition and innovation, with both positive and negative arguments being found, and with empirical evidence not always pointing in the same direction.

Although in recent years many researchers have been focusing on this field of study, a more consistent explanation still needs to be found for these relations. Also, since the empirical evidence is not extensive, most prior studies have analyzed the influence on innovation of the degree of ownership concentration (Cho, 1998; Ortega-Argilés *et al.*, 2005; Brunninge *et al.*, 2007; Czarnitzki and Kraft, 2009; Shapiro *et al.*, 2015) or the identity of the main shareholders (Hill and Snell, 1988; Kochhar and David, 1996; Lacetera, 2001; Xiao and Zhao, 2012; Yoo and Sung, 2015; Tsao *et al.*, 2015). But there have been fewer studies considering how one of the main governance mechanisms, that is, the board of directors, relates to innovation actions (Wu, 2008; Driver and Guedes, 2012; Balsmeier *et al.*, 2014).

For these reasons, future research could focus on the influence of the board of directors on innovation for Spanish firms, a subject not yet studied in depth because, while Tribo *et al.* (2007), Ortega-Argilés *et al.* (2005) and Ortega-Argilés and Moreno (2009) use samples of Spanish firms, they only consider ownership structure as a determinant of innovation. In addition, Hernández *et al.* (2010), using a sample of 86 Spanish quoted companies in technology companies, show how the ownership structure can moderate the relationship between board composition and R&D investments. Thus, it might be of interest to analyze how board characteristics and functioning may delimit innovation at both input and output level, focusing on the board characteristics that have traditionally been considered (composition, size, meetings, duality). 98.5 percent of Spanish listed firms have a majority of external directors on their boards (CNMV, 2016) to comply with the code of good governance. Thus, if they see innovation as a strategic tool and also receive advice from internal members, they can be expected to carry out more innovation, especially by means of external acquisition. Similarly, in line with the Spanish good governance code, the average size of the board in Spanish firms is 9.8 members (CNMV, 2016). This is not very large and is likely to reduce conflicts between board members and minimize problems of coordination, so there may be a positive effect according to innovation theory. Considering that the theory supports a positive effect, and the fact that the average number of meetings per year of Spanish listed firms is 10.6 (higher than the recommended figure), it can also be expected that during such frequent meetings, decisions on innovation will be taken. 54.7 percent of Board Presidents are also CEOs of their companies (CNMV, 2016) so, since the positions are combined in almost one half of Spanish companies, a negative effect on innovation can be expected in Spain. However, other newer variables could be considered such as diversity within the board (gender, educational background, nationality, tenure, etc.), with analysis of the role played by another of the bodies with great influence, the management team (socio-demographic and psychological characteristics, type of management style, culture, values, etc.) on business innovation.

In addition, it might be possible to include moderating variables in the existing models. For example, in line with the study by Choi *et al.* (2015) (in the case of family firms), it might be of interest to consider whether growth opportunities moderate the relation between board characteristics and innovation.

Another possible line of research would involve a set of analyses to establish differences by country, depending on the type of legal system to which they are subject. Various studies have shown that a country's legal origin and its impact on investor protection and financial development influence a variety of economic aspects including financial markets, labor and competitiveness, and therefore allocation of resources (La Porta *et al.*, 2008). For example, Common Law countries afford greater protection for shareholders than Civil Law countries, which affects the development of governance mechanisms and might determine the innovation strategy. Such greater protection in the case of Common Law countries might reduce one of the negative effects of concentration on innovation. On the other hand, Spain has traditionally been classified as having a bank-based financial system because of the importance traditionally placed on the stakes held by banks in business capital. Spanish listed companies are characterized by high shareholder concentration and high levels of borrowing, mostly from banks. Regarding ownership structure, control is usually exerted by families, followed in importance by financial entities (Sacristán and Cabeza, 2008). On the other hand, in systems based on capital markets, it is the latter that mostly allocate funds because firms request long-term funding from them while the banking system usually supplies short-term funds. Moreover, in this model, usually associated with countries such as the UK and the USA, ownership is dispersed (Sacristán and Cabeza, 2008). While banks can paralyze innovation by extracting informational income and protecting established firms (Rajan, 1992), markets are more likely to promote innovative, R&D-based industries (Allen, 1993). It is for this reason that higher levels of innovation can be expected in countries with a market-oriented governance model.

In order to achieve the above-mentioned objectives in our country, a sample of Spanish non-financial listed companies over recent years could be used. The data could be taken from the SABI database and from companies' annual corporate governance reports and annual reports which have to be filed with the National Stock Exchange Commission and posted on their websites. Information on management teams can be found on the internet, in documentation provided by companies, the "Who's Who" directory, etc.

For Europe, the Amadeus (Bureau van Dijk) database could be used. This contains business and financial information on the 510,000 largest European enterprises, and searches can follow different criteria. It contains data on ownership structure, the stakes held by the different shareholders, direct or indirect ownership, and information on the ultimate owner. It also provides financial data (such as annual accounts), from which it would be possible to extract information on R&D expenditure.

The methodology to be used could be panel data analysis and, more specifically, the generalized method of moments, which affords two advantages. First, since information is available for various time periods, it is possible to control the individual effect or the unobservable heterogeneity of the firms by first differences. Second, it helps to mitigate endogeneity by avoiding bias in the ordinary least square regression coefficient when the error term is correlated with any of the explanatory variables by means of instrumental variables (lags).

Finally, regarding the limitations of this study, although the literature review is as thorough as possible, it is possible that some studies may have been omitted. Also this study does not have an empirical part allowing for the relations considered to be tested in future lines of research. Similarly, we are aware that for future research, performing empirical studies related not so much to the amount but more to the quality of corporate governance would face the added difficulty of how to obtain such information.

Notes

1. As far as we aware, Belloc (2012) is the only review of the literature that adopts a similar approach to this one although its presentation of prior empirical studies is less extensive than ours. More specifically, we give a more detailed review of the influence of ownership on innovation, making an explicit distinction according to the different identities of the main or largest shareholder. Also, unlike Belloc (2012), who focuses on ownership structure and on some of the external control mechanisms, we analyze the relation between another of the main internal governance mechanisms, the board of directors with its different characteristics and firms' innovation activity.
2. Some studies consider a corporate governance index rather than specific ownership measures as an explanatory variable. For example, Chiang *et al.* (2011) conclude that high levels of corporate governance control (a single construct made up of board size, independent directors, owner identity or the difference between control rights and cash flow) are positively linked to the technical and economic success of R&D activities but have no significant influence on commercial success.
3. Some studies, however, do not support a significant relation between ownership concentration and innovation (Choi *et al.*, 2011).
4. Other studies do not find that the presence of managers on the board has a significant effect on R&D intensity (Lacetera, 2001).

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