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CORPORATE GOVERNANCE AND INNOVATION: A SURVEY

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Abstract. The traditional economics of innovation, inspired by Schumpeter and more recent advances on his work, seem unable to explain why firms with similar external conditions may show greatly different performance in innovation. Contrastingly, the literature on corporate governance provides some useful insights for understanding corporate innovation activity, to the extent that such literature examines the economic effects of different modes of coordination between firm members. The process through which individuals integrate their human and physical resources within the firm is central to the dynamics of corporate innovation. This paper provides the first survey of the literature on this issue. We start by discussing how various theoretical approaches to the analysis of the firm deal with technological innovation. We then describe three main channels – corporate ownership, corporate finance and labour – through which a system of corporate governance shapes a firm's innovation activity. Finally, we examine the relationship between country-level institutional settings, national patterns of corporate governance and the aggregate innovation activity of corporations. We conclude by suggesting that future research should focus more deeply on the interrelation between the various dimensions of corporate governance and on their joint effect on firm innovation.

Keywords. Corporate governance; Incomplete contracts; Innovation; Specific investments

1. Introduction

What makes a firm innovative? For a long time, the traditional economics of innovation, inspired by Schumpeter (1934, 1942), dominated the ways through which economists approached this question and focused on the relationship between firms' innovation activity and market structure. According to Schumpeter's early work (Schumpeter, 1934), which is sometimes called 'Schumpeter Mark I', the key innovative actors are the individual entrepreneurs, with the new and small firms leading the process of 'creative destruction'. Small, new firms, in this view, have the flexibility to overcome organizational inertia and can easily introduce breakthroughs, so challenging the incumbent firms. This first hypothesis of Schumpeter's was reviewed by Schumpeter himself later on, giving rise to a different perspective – called 'Schumpeter Mark II' (Schumpeter, 1942). The Schumpeter Mark II model is characterized by a 'creative accumulation' pattern, in which established firms with monopolistic power are the driving forces of innovation processes. In this later view, large incumbent firms become the central innovative players, given their higher capability to exploit well equipped research and development (R&D) laboratories and to appropriate the returns from successful innovation.[1] The two perspectives raise opposing hypotheses on the relationship between competition and innovation: a positive relationship according to the first view, a negative relationship according to the second. Following these two lines of research, a flood of studies investigated how market structure relates to innovation (for comprehensive surveys see Kamien and Schwartz, 1975; Cohen and Levin, 1989;

Van Cayseele, 1998). Despite such work, this strand of literature did not yield clear-cut results, and it reached quite varied – and often contrasting – conclusions. As Aghion *et al*. (2005) pointed out, predominantly based on cross-section industry data, empirical research on the Schumpeterian hypotheses foundered because it overlooked the fact that the degree of competition changes as a result of successful innovation, which changes the competitive pressure to innovate. That is, there is an endogeneity problem.

In an effort to develop dynamic models accounting for the two-way relationship between market structure and firms' innovation activity, since the mid-1970s the game-theoretical approach was largely used in the economic literature in order to model explicitly the strategic interaction between incumbents and potential entrants. This research shows a high variety of theoretical developments, which can be roughly classified into the auction model (Gilbert and Newbery, 1982) and the patent race model (Loury, 1979; Dasgupta and Stiglitz, 1980; Reinganum, 1983). In the auction model, R&D competition is seen as a lump-sum bidding process for obtaining a patent, in which incumbent firms have more incentive to bid higher than potential entrants because of pre-emption motives. In the patent race model, conversely, there is a 'winner takes all' competition, and the incumbent has less incentive to innovate than the challengers because the profits from innovation would partially replace its existing profits, so reducing the marginal incentive to invest in R&D, according to the so-called Arrow (1962)'s replacement effect.[2] Hence, the game-theoretical approach too leads to mixed predictions. A more integrated perspective, trying to unify the different game-theoretical developments in a general framework, has been proposed by Sutton (1991, 1996, 1998). Sutton's 'bounds' approach does not impose a 'true model' that determines a unique equilibrium outcome; rather it establishes a set of boundaries to the possible games representing various industry settings. Within this theory, the relationship between market structure and innovation depends on the technological trajectory that a firm chooses and on the productivity of R&D investment along each trajectory. As Sutton (1996) argues, this approach should help to explain the mixed results found in the empirical literature. The fact that the nature of competition differs between sectors' technological trajectories has then also been explored using the distinction between competition *in* the market and competition *for* the market (see, for example, Ahn, 2002; Evans and Schmalensee, 2002, while specifically on sectoral systems of innovation see Malerba, 2005).

Again, however, even when focusing on an individual sector, both theoretical and empirical studies were unable to explain why firms with similar *external* conditions could show – as they often do – greatly differing innovation performances (see Fagerberg *et al*., 2005).

This persistent ambiguity of both the various theoretical predictions and empirical outcomes raised the suspicion that to see firms simply as players in a multi-actor economic game was not sufficient to completely understand firms' innovation performance. This concern stimulated economists to look inside firms, at their structure. As a result, new strands of research tried to relate firms' innovation activity to their organizational characteristics according to an evolutionary theory, and to their managements' strategies and corporate governance. Although the evolutionary view of innovative firms presents a rather strong cohesiveness (see Nelson and Winter, 1982; Dosi *et al*., 1988; Nelson, 1991; Teece and Pisano, 1994; and, for a survey, Teece *et al*., 1997), studies that link a firm's innovation to its corporate governance arise in very different veins of the literature, such as corporate ownership, management, finance and labour (see for instance Lacetera, 2001; Casper and Matraves, 2003; Michie and Sheehan, 2003; Shipton *et al*., 2005; Lerner *et al*., 2008; Aghion *et al*., 2009; Sapra *et al*., 2009; Ughetto, 2010).

Given its heterogeneity, the literature on corporate governance and innovation explores various dimensions of a firm, and it offers a large set of research tools to investigate the innovation performance of individual corporations. The tendency of previous economic research to ignore differences between firms in corporate structure and governance in part explains why the research is unable to provide conclusive answers on what the determinants of firm innovation are. Conversely, in the light of the

corporate governance literature, differences in corporate governance do exist and matter significantly for innovation performance. This line of research builds on an idea that dates back to Coase's (1937) contribution: the firm is not a black box, rather it is an institution that organizes the relationships between those who contribute labour and capital inputs to the production, so providing a mode of coordination alternative to the market. From this point of view, the system of corporate governance becomes central to an analysis of innovation, because it affects the ways through which individuals integrate their human and physical resources within the firm and because it affects how these individuals take their investment decisions.

Surprisingly, unlike the other strands of study on the economics of innovation, this field of research has not benefited so far from a systematic discussion and review of its major contributions. This paper aims to fill this gap.

Before presenting such literature, it is useful to provide definitions of what is meant by innovation and corporate governance. We define innovation as the first attempt to bring an invention (i.e. the first occurrence of an idea for a new product or process) to market.[3] We define corporate governance as the set of devices – both institutional and market based – by which corporations are governed. To put it in another way, in our view, a system of corporate governance specifies the distribution of rights and responsibilities among different actors inside the corporation (through, for example, internal mechanisms such as the corporate ownership structure, or external mechanism such as the market for corporate control).[4]

Studies that link corporate governance to innovation form a corpus of research that is difficult to disentangle for two interrelated reasons. First, as Lazonick (2003) notes, a well received theory of the innovative enterprise is still missing, which implies the absence of a single coherent conceptual framework for understanding the phenomenon of corporate technological innovation at the firm level. Second, lacking such a theory, contributions to this issue have remained separate and relate to various and different aspects of corporate governance.

Nonetheless, in this stream of work, it is possible to identify three main dimensions of corporate governance that are relevant to innovation. A first dimension concerns the distribution of control rights and residual profit rights within the corporation, essentially the corporate ownership structure. How these rights are allocated shapes the control power of a firm's decision makers over resource allocation and these decision-makers' incentives to invest in the innovation process (see, for example, Lacetera, 2001; Miozzo and Dewick, 2002; Aghion *et al*., 2009). A second dimension relates to the ways through which corporations finance innovative production. Alternative financial instruments imply alternative mechanisms for governing production, and this can strongly affect the corporation's capabilities to commit financial resources to irreversible investment strategies (for example, Lazonick, 2007; Lerner *et al*., 2008; Sapra *et al*., 2009; Ughetto, 2010). A third dimension is that of labour. This dimension has been somewhat neglected by the traditional corporate governance research, but it is a central concern for corporate government and performance (Blair, 1999). In knowledge-intensive production, human capital is as important as physical and financial assets in creating innovation, while various employer-employee relationships provide different incentives for workers to develop human capital and technological innovation (for example, Laursen and Foss, 2003; Michie and Sheehan, 2003; Shipton *et al*., 2005). Some studies, moreover, show that corporations develop their organizational structure interdependently with the broader institutional context in which they operate, generating dominant patterns of corporate governance at the national level, and this shapes the various trajectories of technological development observed in market economies (for example, Hall and Soskice, 2001; Casper and Matraves, 2003). Table 1 presents a summary of the links between corporate governance and innovation, and the main related research. In particular, column 1 of Table 1 lists the various corporate governance dimensions, column 2 shows the possible channels through which each dimension of corporate governance relates to innovation and column 3 reports the main references in the literature. As it appears from Table 1, this stream of research is extremely heterogeneous and often entails mixed

Table 1. Summary Table.

Corporate governance dimension	Effects on innovation	Main related works
Corporate ownership		
Ownership structure *(concentrated versus dispersed ownership)*	Concentrated ownership positively affects innovation because it reduces agency costs and disciplines managers' behaviour	Hill and Snell (1988), Holmstrom (1989), Baysinger *et al*. (1991), Francis and Smith (1995)
	Concentrated ownership positively affects innovation because it favours financial commitments and organizational integration	Lacetera (2001)
	Concentrated ownership positively affects innovation because it makes reputation constraints tighter and favours long-term relations	Mayer (1997), Miozzo and Dewick (2002)
	Concentrated ownership negatively affects innovation because it exacerbates asymmetric bargaining power problems	Battaggion and Tajoli (2001)
	Dispersed ownership positively affects innovation because it favours managers' flexibility and specialization	Ortega-Argilés *et al*. (2005)
	Concentrated ownership affects innovation according to a nonlinear relationship depending on country characteristics	Lee (2005)

Owners' identity *(institutional investors versus others)*	Institutional investors positively affect innovation because they cannot exit from ownership in the short run without depressing the price of their other stocks	Hansen and Hill (1991), Kochhar and David (1996)
	Institutional investors positively affect innovation because they increase monitoring	Aghion *et al*. (2009)
	Institutional investors negatively affect innovation because they have short-term interests	Hill *et al*. (1988), Graves (1988)
	Pension funds positively affect innovation because they have long-term interests	Sherman *et al*. (1998), Hoskisson *et al*. (2002)
	Mutual funds negatively affect innovation because they have short-term interests	Sherman *et al*. (1998)
	Bank ownership positively affects innovation because banks are able to monitor managers' actively	Lee (2005)
Corporate finance		
Financial structure *(equity versus debt)*	Equity finance positively affects innovation because it helps risk management and financial commitments, and reduces asymmetric information problems	Bradley *et al*. (1984), Long and Malitz (1985), Williamson (1988), Gugler (2001), Carpenter and Petersen (2002), Lazonick (2007)
Takeovers *(easy versus difficult replacement of management)*	Takeovers negatively affect innovation *ex ante* because they discourage specific and/or long-term investments	Shleifer and Summers (1988), Stein (1988), Johnston and Rao (1997), Pugh *et al*. (1999)
	Takeovers negatively affect innovation *ex post* because the restructuring process absorbs managerial energy	Smith (1990), Hitt *et al*. (1991), Long and Ravenscraft (1993)
	Takeovers positively affect innovation *ex post* because they provide superior management	Zahra (1995), Wright *et al*. (2001), Lerner *et al*. (2008), Ughetto (2010)

(*Continued*)

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Table 1. *Continued.*

Corporate governance dimension	Effects on innovation	Main related works
	Takeover pressure affects innovation non-monotonically, depending on the relative effect of the expected takeover premium and the loss of control benefits	Sapra *et al*. (2009)
Labour		
Collective bargaining *(strong versus weak workers' bargaining power)*	Strong workers' bargaining power positively affects innovation because it allows workers to benefit from human capital investments	Daniel (1987), Machin and Wadhwani (1991), Michie and Sheehan (2003), Rogers (2004)
	Strong workers' bargaining power negatively affects innovation because workers rent-seek	Hirsch and Link (1987), Acs and Audretsch (1988), Drago and Wooden (1994), Menezes-Filho *et al*. (1998)
Worker participation *(large versus low worker participation)*	High worker participation positively affects innovation because it corrects organizational failures and encourages skills development	McCain (1980), Smith (1991), Scott and Bruce (1994), Michie and Sheehan (1999a, 1999b, 2003), Searle and Ball (2003), Laursen and Foss (2003), Shipton *et al*. (2005)
	Low worker participation may cause employee resistance to innovation because it causes employees to expect not to reap the benefits of their investment in human capital	Bemmels and Reshef (1991), Zwick (2002)
National settings and business systems		
Modes of coordination *(spot transactions versus long-term relationships)*	Non-market forms of coordination positively affect incremental innovation because they sustain long-term commitments and specific skills development	Lazonick and O'Sullivan (1996), Soskice (1997), Tylecote and Conesa (1999), Whitley (1999), Hall and Soskice (2001), Casper and Matraves (2003)
	Market forms of coordination positively affect radical innovation because they encourage the use of the exit option and redeployable assets	

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results. In this paper, we try to provide an organic and systematic review of the contributions on these aspects of corporate government and innovation.

The motivation for this survey stems from the fact that how institutions of corporate governance affect technological development is increasingly recognized as a crucial question for both legal and economic policymakers (see O'Sullivan, 2000). Furthermore, technological innovation is central for long-run economic growth, while it has its own peculiarities that keep it distinct from traditional indicators of economic performance (Krugman, 1979).

Having clarified what we do discuss in this paper, it is worth emphasizing what we do not do. Because many comprehensive surveys of the literature on the relationship between corporate governance and corporate performance have been written over the years,[5] we do not review that literature here, while we focus on those studies that explicitly address firms' innovation activity. In the following section, we do, however, briefly review some different approaches to the analysis of the firm, which are directly or indirectly used as the reference theoretical frameworks in the studies discussed in the paper.

We also explicitly restrict our discussion to the literature referring to business corporations' production of innovation, and exclude from the survey the literature focusing on innovation performance of other forms of economic organization (such as cooperatives or public institutions).

Finally, the usual caveat for survey papers applies to this one as well. Although we try to cover a representative spectrum of the papers on corporate governance and innovation, it would be impossible to give due consideration to all the many works written on this theme.

The paper proceeds as follows. In Section 2, we briefly discuss how the main theories of the firm deal with technological innovation. We then review the main contributions on the ways through which corporate governance can affect innovation, developing our discussion along the three dimensions of corporate governance mentioned above: corporate ownership (Section 3), corporate finance (Section 4) and labour (Section 5). Section 6 examines national structures of governance and provides some macro-evidence. Section 7 concludes.

2. Innovation in the Theory of the Firm

As we have mentioned in the introduction, the traditional economics of innovation treats firms as if they were alike and considers innovation as a direct consequence of profit-maximizing behaviour (see Nelson, 1991, for an exhaustive critical discussion). Conversely, the literature on corporate governance and innovation recognizes that firms differ in their internal governments' structure and organization, and affirms that these differences do matter for a firm's economic performance. However, different approaches to the analysis of the firm propose various (and, in some cases, contrasting) interpretations of the firm-internal context that enables innovation to be generated. Such different approaches, then, are at the base of the large variety of existing studies on corporate governance and innovation. Before presenting this body of studies, therefore, in this section we briefly discuss how the most influential theories of the firm deal with technological innovation, in order to outline the theoretical ground on which the debate on this issue develops.

Let us start by describing the main features of technological innovation. Technological innovation is the development of an original product or process, through the utilization of productive resources and the embodiment, combination or synthesis of knowledge in a new object or method. It follows that innovation is generated through a collective and cumulative process of learning (R&D programs are the first driving force in this respect), which requires the commitment of resources for a prolonged period of time. By definition, technological innovation involves three elements: (1) specificity of the investments, (2) uncertainty about the result and (3) impossibility of anticipating future returns.

1. Investment specificity relates to the cumulative and collective character of the innovation process. The development of a new technology needs the interaction of knowledge and experiences by

those individuals that are collectively attempting to innovate, so as to generate specialized skills specific to a certain relation. The coordination and integration of these skills in response to technological problems then generates new knowledge and innovation.
2. Innovation production is highly uncertain. Underlying the innovation production there is a process of discovery that may or may not succeed in generating new technology. As a consequence, individuals cannot describe *ex ante* every possible situation they will face and their future actions, while they must adapt to new information as it becomes available.
3. Even if the innovation process generates new knowledge, the new technology or product may not be an improvement of the existing knowledge sufficient to guarantee commercial success. Thus, final returns and their distribution among those who have taken part (and invested) in the innovation process cannot be predicted when the process starts.

These three elements imply the impossibility of writing complete contracts that specify each party's obligations in every possible state of the world. Individuals that engage in collective innovation processes are simply not able to foresee all contingencies, and contracting for details of every conceivable eventuality may be too costly. In a context of incomplete contracting, the need for specific investments causes the so-called hold-up problem, which relates to the possibility that a given party may threaten opportunistically to withdraw some of the resources from the relationship (after the specific investments of the other project participants are made) unless his share of the final returns is increased. The consequence of the hold-up problem is a distortion in the initial investment decision; in particular, parties that are required to undertake specific investments may anticipate this opportunistic behaviour of the counterpart and may refrain from investing *ex ante*. As a result, on the one hand, short-run specific investments generate the risk of an opportunistic behaviour by one (or more) of the investors; on the other hand, long-run returns, even in the case of the project's success, are uncertain *ex ante* and cannot be anticipated by those who participate in the innovation process.

The firm, as an *ex post* mechanism of governance, provides a partial solution to this problem. The firm can be described as a structure of vertical integration in which the ownership of the assets involved in the production process is concentrated in the hands of a single party, so that the incentives for opportunism are removed (Williamson, 1985; Grossman and Hart, 1986; Hart and Moore, 1990). Because only one party has both the right to make residual management decisions (i.e. the right to control how the assets are used under contingencies that are not specified in the contract) and the right to claim the residual profits of the production, the remaining parties lose the capabilities to make opportunistic threats. Yet the firm as a centralized structure of governance is only a second-best solution, to the extent that, under a one-party-owner regime, the non-owner firm members lose the ability to hold up as well as the incentive to invest.[6] This deeply affects innovation activity, because innovation is a process of collective and specific investing. It follows that one of the crucial problems of a firm's innovation production is to devise institutional arrangements for governing the relationships among those who contribute firm-specific assets, in the presence of multiple investors, uncertainty and self-interest; and that understanding firm innovation requires an analysis of how, and under what governance structures, corporations innovate.

The various approaches to the analysis of within-firm relationships between multiple investors can be roughly classified into three main groups: the principal–agent paradigm (which inspired the 'shareholder primacy' view of the firm), the incomplete contracting framework (which is at the base of the 'stakeholder approach' to the firm) and the Organizational Control Theory (which proposes a more general perspective). These three approaches substantially define the basic theoretical ground for most of the studies on corporate governance and innovation.

The shareholder primacy view of the firm, built on the principal–agent paradigm, states that shareholders (the principals) engage managers (the agents) to run the firm on the shareholders' behalf (Jensen and Meckling, 1976).[7] Advocates of this theory argue that what enhances corporate

performance, broadly speaking, is the shareholder control power over management's behaviour and strategies. It is also assumed that shareholders are the only residual claimants because they are the only economic actors that invest in the corporation without a guaranteed return, whereas the other firm members are hired by the shareholders through arm's-length market transactions. Hence, from this perspective, specific investments by non-shareholder constituencies are absent and shareholders' investments are advocated as the only fundamental source of productive activities. As Lazonick (2003) noticed, this precludes an analysis of how business corporations might generate new knowledge.

Contrastingly, the so-called stakeholder approach envisions the firm as a wide constituency of stakeholders. Blair (1995) in particular defines stakeholders as those who contribute firm-specific assets. Proponents of this model argue that the physical assets in which shareholders invest are not the only assets necessary to innovation, while firm-specific human assets are as important as – and often more important than – physical capital in generating innovation. Moreover, both shareholders and employees with firm-specific skills have a 'stake' that is at risk in the corporation. Therefore, any assessment of firm innovation must consider the incentives and disincentives faced by all stakeholders who potentially contribute to the innovation process. In this context, the problem of finding mechanisms that lead to higher levels of investment by all firm-specific investors becomes central to a theory of innovation. Within the stakeholder approach, different interpretations have been proposed to tackle such a problem: endogenous allocation of property rights between financier and creator (Aghion and Tirole, 1994), allocation of property rights to third-party investors (Rajan and Zingales, 1998) and allocation of property rights to the corporation itself as a legal entity (Blair and Stout, 1999, 2006).

Aghion and Tirole (1994) analyse the allocation of property rights on innovation in an incomplete contract framework (similar to that of Grossman and Hart, 1986 and Hart and Moore, 1990) and propose a theoretical model in which a customer finances and commercializes the innovation, whereas a research unit performs the creative task. This model shows that a structure where customer and research unit are integrated reduces hold-up costs and sustains innovation only if capital inputs are substantial relative to intellectual inputs, or if the customer has more bargaining power *ex ante,* or if the customer has a deep pocket and so a higher willingness to pay; otherwise, it may be strictly optimal for the customer to give property rights to the research unit and to demand co-financing by an investor.

Rajan and Zingales (1998) show analytically that the optimal investment decisions cannot be achieved if only one party (among multiple specific investors) owns the assets necessary to the production. Optimal investment decisions can be achieved when the assets are owned by an otherwise passive third party that controls the use of the assets, so eliminating the risk of hold-up between the specific investors. The third-party owner, moreover, must be a generic input in the team who does not contribute something critical to the production. In Rajan and Zingales' (1998) interpretation this is exactly the role of passive outside shareholders. However, the interpretation that shareholders will not use control over the assets to extract an undue rent at the expense of the other investors has been argued to be implausible (Blair, 1999).

Blair and Stout (1999, 2006), two legal scholars, develop an alternative theory according to which the corporation itself, as a legal entity under the law separated from the investors, acts as the repository of all the property rights over the assets used in production. In their view, the corporate production is a team production where financial investors put up money and workers' human capital. Thus, in order for the production to succeed, all the resources must be locked in to the corporation and none of the team members should be able to withdraw his contribution from the firm. In this theory, managers and directors are not agents of the shareholders-owners but are 'mediating hierarchs' who protect firm-specific investments and distribute the returns. The board of directors, indeed, is not itself a residual claimant and wants the corporate investors to stay together, in order to assure the continuation of the board position of its members. As a consequence, the board has no incentive to behave opportunistically against corporate investors, while it has some incentive to keep specific investments locked in to the

corporation. Blair and Stout (2006) conclude that the lock-in function of the corporation promotes value-creating corporate productions.

The limits of a pure stakeholder perspective in explaining what makes a firm innovative are highlighted by O'Sullivan (2000). She argues that the firm-specific skills necessary to create innovation evolve throughout the innovation process. Hence, firm-specific assets that were once part of the process may be unnecessary in another part of the same process. For this reason, a stakeholder perspective encouraging the entrenchment of the claims of investors who have participated in the past, even when their assets are not longer necessary, may retard the production of the innovation.

In accordance with this view, Lazonick (2007) focuses on the organizational conditions at the base of the dynamics of the innovation process, and he argues further that incomplete contracts pervade the innovation process. The so-called Organizational Control Theory proposed by Lazonick and others (Lazonick and O'Sullivan, 1996; Carpenter *et al*., 2003; Lazonick, 2003, 2007; Lazonick and Prencipe, 2005) affirms that an enterprise must achieve three social conditions in order to innovate: first, strategic control, i.e. the firm must give decision makers the power to allocate physical and human resources to specific investment strategies; second, organizational integration, i.e. the firm must create incentives for team members to apply their skills and efforts to collective learning processes; third, financial commitment, the firm must ensure the allocation of money to the innovation process until it generates financial returns. Lazonick (2003), in particular, compares his theory of the innovative enterprise to the traditional theory of the market economy and argues that only firm-level organizational control (rather than market control) over the resource allocation can put in place these three social conditions. Specifically, it is the firm rather than the market that creates incentives that affect how individuals allocate their labour, that controls the allocation of money to alternative uses, and that shapes the type of investments in productive capabilities.[8] Yet, this approach too is subject to a limitation to the extent that it provides a description of the social conditions of innovative enterprise, while it does not investigate what enables firms to achieve these conditions.

3. Corporate Ownership

3.1 *Ownership Structure*

The corporate ownership structure is the mode through which ownership rights (i.e. control rights and residual profit rights) are distributed within the corporation. Traditionally, the degree of concentration of equity ownership is considered the main factor shaping the ownership structure of a corporation. Two different approaches deal with the relationship between ownership structure and innovation. The first approach affirms that a concentrated ownership entails more effective monitoring of management strategies and, in turn, reduces the high agency costs associated with innovation, according to a principal–agent framework. A second approach emphasizes that various ownership structures relate to different methods of enforcement in incomplete contractual relations concerning specific investments by firm-internal and firm-external investors.

The agency costs approach predicts that diffuse equity ownership negatively affects corporate innovation activity because it enables the managers to pursue their own objectives, such as increasing their personal wealth and prestige, to the detriment of projects that increase profits. Indeed, inasmuch as the costs of monitoring exceed the benefits, small dispersed shareholders do not have incentives to monitor management behaviour (Berle and Means, 1932; Alchian and Demsetz, 1972; Ross, 1973; Jensen and Meckling, 1976).[9]

This view is corroborated by Hill and Snell's (1988) findings, concerning 94 *Fortune 500* firms drawn from five research-intensive industries for the year 1980. Their findings show a positive relationship between the level of corporate R&D spending per employee and stock concentration. They explain this

empirical result by arguing that an innovation strategy may be attractive to investors, because they can switch out of a stock as soon as an investment project starts to show a low probability of success, while innovation is less attractive to managers, because they bear the costs of failure. Thus, firms in which stockholders dominate, by means of equity concentration, will undertake high-risk innovation strategies; conversely, firms in which managers dominate, because equity ownership is dispersed, will prefer low-risk imitation strategies. Similarly, Baysinger *et al*. (1991) examine the R&D investments (averaged over the period 1981–1983) in 176 *Fortune 500* companies and find a positive effect of concentration of equity ownership on corporate R&D spending. Baysinger *et al*. (1991) also find that the percentage of inside directors in the company's board is positively related to R&D spending. More recently, Mork *et al*. (2005) affirm that also a concentrated ownership might permit a range of agency problems when pyramidal control structures are dominated by families with little real capital invested. They argue that this in turn may lead to resource misallocation and may negatively affect innovation rates both at a firm level and at an aggregate level. Within the agency theory, finally, a nonlinear relationship between ownership concentration and innovation is suggested by Lee (2005), who analyses the impact of ownership structure on innovation using data on 1044 US firms and 270 Japanese firms for the year 1995. In particular, Lee (2005) maintains that the principal–agent relationship in modern corporations varies by country, depending on the national characteristics of corporate governance and culture. His results, indeed, show that for the USA, at low levels of R&D investment, stock concentration is negatively related to the number of patents granted, and positively related to innovations at high levels. The opposite seems to be true for Japanese firms, where stock concentration is positively related to innovations at low levels of R&D investment and negatively related at high levels.

Some authors have argued that in the presence of a substantial separation between equity ownership and business control, contractual solutions to the problem of agency costs and information asymmetry in innovative productions may be beneficial. For example, Markman *et al*. (2001) discuss the beneficial effect of long-term pay, such as equity-based compensation, in reducing managers' propensity to pursue non-innovative strategies. Nevertheless, others affirm that incentive contracts, aimed at aligning managers' and shareholders' interests, are unlikely to be successful. Francis and Smith (1995) argue that innovative production makes the design of incentive contracts highly costly, because innovation production is risky and idiosyncratic. The authors examine empirically the relationship between ownership structure and innovation outcomes of approximately 900 US corporations over the period 1982–1990, and find that contracting solutions are unlikely to solve agency problems between dispersed shareholders and managers, so that diffusely held firms end up being less innovative than closely held firms. Holmstrom (1989) furthermore argues that the larger the firm's size, the higher the incentive costs of a principal–agent relationship. In particular, contracting costs associated with innovative productions are especially high because of the long-term and high-risk nature of innovation. This implies that larger firms conducting innovative research face more difficulties than small ones, because they have to manage heterogeneous sets of hard-to-measure tasks. Another device that the agency costs approach considers as an important substitute for control over managers is management stockholding. Management stockholding, indeed, works to reduce agency problems between shareholders and managers, because it increases the importance of the equity value in the manager's personal wealth. A positive relationship between R&D intensity and management stockholding is found by Cho (1992). Cho performs a regression analysis using data from 184 US corporations observed in 1986 and reveals a positive effect of various measures of management stockholding (such as the percentage of stockholding held by the Chief Executive Officer) on the ratio of R&D expenditures to sales. This result, Cho argues, can be attributed both to a reduction in agency problems (i.e. stockholder managers want the equity value to increase) and to the fact that management stockholding gives managers more voting power to guarantee their future employment with the firm, therefore reducing managers' risk aversion.

The second approach, i.e. the incomplete contracts framework, suggests that corporate ownership structures differ in their ability to support incomplete contractual relations between various stakeholders.

Battaggion and Tajoli (2001) affirm that the ownership structure shapes the *ex post* bargaining over (and so the final allocation of) the quasi-rent generated by the firm. Thus, the ownership structure can directly affect corporate innovation by influencing the incentives for firm-external investors to participate in innovative activities. From this point of view, the coincidence between equity ownership and business control (which the agency costs approach deems to be beneficial) implies an asymmetric bargaining power between block-holders and small outside investors and, in turn, reduces the capabilities of block-holders to make credible commitments to small outside investors. This should cause difficulties for the firm in raising funds and a consequent decrease of innovative investment projects, which are generally highly costly. The authors then estimate a probit model using data from a sample of 1233 Italian firms over the 1991–1995 period and find that more highly capitalized corporations are more innovative, in terms of patenting activity. A similar conclusion is reached by Ortega-Argilés *et al*. (2005). They perform a regression model using a representative sample of Spanish manufacturing firms for the year 2001 and study the effect of an index of ownership concentration on a firm's number of patents and R&D expenses (weighted by firm size). Doing so, they find that diffusely held companies are more likely to undertake R&D investment and to obtain patents, because – the authors argue – a dispersed ownership grants greater flexibility to the actions of the managers, stimulating their specialization in business control.

Mayer (1997), taking a different view, suggests that concentrated shareholdings may encourage trust and commitments. Indeed, in a system of dispersed shareholdings, individual shareholders can use their 'exit' option anonymously, while a concentrated shareholder cannot do so, because of the reputational consequences. Large shareholdings, thus, should favour long-term relationships between equity owners and other stakeholders – such as employees, suppliers and outside financiers –, and should support firm-specific investments. The reputation concern of large shareholders is highlighted too by Miozzo and Dewick (2002), who examine innovation activity in the construction sector of five European countries during the 1990s and observe that firm-specific investments are more readily financed in the presence of concentrated equity ownership and cross-holdings.

The approach proposed by Lacetera (2001), based on the Organizational Control Theory, tries to integrate the principal–agent and the incomplete contracts perspectives. He argues that the core of the relationship between corporate governance and innovation is neither the agency costs nor the hold-up problem; rather the core is the definition of institutional devices promoting knowledge flows and the integration of different capabilities. From this point of view, equity ownership concentration reduces agency conflicts, yet it implies the involvement of block-holders in long-term firm activities, thus improving the block-holders' knowledge about such activities. He, furthermore, performs an empirical analysis using panel data from a sample of 27 pharmaceutical companies over the 1994–1999 period, and finds that equity ownership concentration positively affects R&D intensity (measured by R&D/sales ratio).

Finally, Cho (1998) cautions researchers that corporate ownership and innovation activity may be linked in a two-way relationship. Cho (1998) performs a simultaneous regression using data on 230 *Fortune 500* manufacturing firms (for the year 1991) and shows that, whereas ownership structure affects R&D spending, the R&D spending affects corporate value and, in turn, ownership structure. This may cast doubt on the empirical results obtained by assuming that the ownership structure is exogenously determined.

3.2 *Owners' Identity*

Based on agency theory, traditional corporate governance studies assume that various ownership constituencies have homogeneous preferences concerning business strategies and innovation. However, the empirical research shows that different owners may even have contrasting preferences with respect

to innovation. Corporate owners may be families, the government and institutional investors. Although the relationship between families or government ownership and corporate innovation production has not benefited from substantive theoretical or empirical insights, the effect of institutional ownership on firms' innovation has received much more attention. A large body of empirical works focuses on this issue in a principal–agent setting and provides mixed evidence.

Hill *et al*. (1988) argue that institutional investors are risk-averse, so that when they are major stockholders they also wield pressure on management to obtain good short-term performance to the detriment of long-term projects and innovation. This conjecture is empirically tested by Graves (1988), through a panel analysis on 22 computer manufacturing companies over the period 1976–1985. He finds that institutional ownership has a negative effect on R&D intensity. Graves (1988) explains this result by arguing that institutional investors have short-term interests and a limited knowledge of the firms or industries in which they operate. Nonetheless, in a subsequent paper, Graves examines 133 US companies and does not find empirical support for the hypothesis of a negative relationship between institutional ownership and R&D investments (Graves, 1990).

Sherman *et al*. (1998) perform ordinary least squares (OLS) regressions using data from a sample of 271 US *Fortune 500* firms for the years 1990, 1991 and 1992, and distinguish four types of firms' institutional investors (pension funds, mutual funds, banks and insurance companies). In doing so, they find that while insurance ownership and bank ownership do not influence corporate R&D expenditure, pension fund ownership has a positive effect and mutual fund ownership has a negative effect on innovation. This result is argued by the authors to be due to the fact that mutual funds concern themselves only with short-term results, while pension funds have long-term interests. Contrastingly, Lee (2005) finds a positive effect of bank ownership on innovation, using data on corporate owner's identity and patents granted for 270 Japanese firms observed in 1995.

Hoskisson *et al*. (2002) also find differences among owners' constituencies' preferences for corporate innovation strategies. These authors distinguish public pension fund ownership from professional investment fund ownership. They perform a two-stage regression analysis on 234 US firms, using data for the years 1990 and 1991, and reveal that pension funds show a preference for internal innovation (R&D intensity and new product intensity) and that investment funds are associated with higher external innovation (external acquisition of new products and acquisitions to develop new processes). Managers of pension funds, indeed, do not feel pressure for immediate returns, rather they have long-term horizons. Conversely, investment fund managers are likely to prefer immediate returns, and acquiring innovative firms presumably produces returns more quickly than investing in internal innovation.

Contrary to the view of myopic institutional investors, Hansen and Hill (1991) reveal that larger institutional ownership is associated with higher levels of R&D expenditure. The authors examine 129 US firms over the period 1977–1987 period and find that institutional holdings have a positive effect on R&D intensity. They suggest two possible explanations for their finding: first, institutions are professional decision makers that benefit from economies of scale in information gathering and analysis; second, institutions may be locked in to their stockholdings, so that they cannot exit from a firm's stock without depressing the stock price and suffering a substantial capital loss in other parts of their portfolios. The locked-in position of institutional investors is corroborated by Kochhar and David (1996). They test three competing hypotheses: the myopic investor hypothesis (i.e. institutions have short-term horizons), the superior investor hypothesis (i.e. institutions possess better knowledge about the market than individual investors) and the active investor hypothesis (i.e. institutions cannot easily divest in the short run and consequently encourage investment strategies which are beneficial in the long run). Kochhar and David perform an empirical analysis using information on ownership structure and R&D intensity from a sample of 135 US firms for the year 1989 and propose findings that support the validity of the active investor hypothesis. More recently, David *et al*. (2001), examining a panel of 73 US firms over the 1987–1993 period, found a positive effect of institutional investors' activism on

corporate innovation (measured by R&D expenditures as a percentage of sales and by the number of new products announced by the firm).

Another rationale behind the positive relationship between institutional investor and innovation has been proposed recently by Aghion *et al*. (2009). They argue that institutional owners have better incentives and ability to monitor than other owners. This increased monitoring, in turn, should 'insulate' managers against the reputational consequences of an innovation project's failure due to purely stochastic reasons, and should therefore improve incentives to innovate. Aghion *et al*. also report empirical evidence corroborating their career concerns model, using data on 803 US firms observed in the 1991–1999 period.[10]

4. Corporate Finance

4.1 *Stock Market*

Ensuring the allocation of financial resources to irreversible investments with uncertain returns is one of the essential conditions for innovation. The traditional corporate finance model built on the Modigliani–Miller theorem (Modigliani and Miller, 1958) maintains that, under certain conditions such as perfect and efficient capital markets, financing decisions (i.e. various debt/equity ratios) are irrelevant to the firm's strategy. With respect to R&D investment, however, this proposition may not hold. As Williamson (1988) points out, debt and equity are not only alternative financial instruments, but rather they are alternative governance structures. On the one hand, issuing new equity causes a reduction of the individual shareholder's incentives to monitor. On the other, issuing debt induces shareholders to take large *ex post* risks, because equity holders participate in the returns from successful projects while creditors incur the costs in the event of failure. Williamson (1988) argues that these are the reasons why debt should finance redeployable assets, while non-redeployable assets (i.e. specific investments) are better financed by equity.

Adverse incentive effects of debt financing for innovation are described in detail by Gugler (2001), who finds five reasons why debt is poorly suited to technological investment. First, when R&D assets are financed by debt, their specificity and low resale price may cause insolvency if a project fails. Second, asymmetry of information about R&D projects may discourage creditors from financing innovation activities. Third, early liquidation is likely to occur if cash flows from innovation are set throughout many periods and are insufficient to cover interest payments. Fourth, a large fixed-cost component of R&D expenditure makes diversification difficult. Fifth, creditors may be unwilling to finance risky activities if they do not participate in the high-return states of such activities but are exposed to the costs of failure. These arguments are corroborated by Bradley *et al*. (1984), who show that the debt-to-assets ratio is negatively related to R&D expenses. Analogously, Long and Malitz (1985) find that the five industries with the lowest debt ratios, for example, pharmaceuticals and cosmetics, grow fast and are R&D intensive. Baysinger and Hoskisson (1989), using a sample of 971 US firms over the period 1980–1982 period, show a strong negative relationship between the levels of the long-term debt to assets ratio and the R&D to sales ratio. A negative correlation between a firm's leverage and R&D intensity is found also by Balakrishnan and Fox (1993), examining a sample of 295 US firms across 30 industries over the period 1978–1987, and by Ortega-Argilés *et al*. (2005), using data on Spanish manufacturing firms for the year 2001. In addition, Carpenter and Petersen (2002) study an unbalanced panel of about 2400 publicly traded US firms in the period 1981–1998 and show that equity financing has a positive effect on firm investments for high-tech companies. Nonetheless, as Long and Ravenscraft (1993) point out, a decline in R&D when debt increases is not surprising if the increased debt is the result of financial distress. To the best of our knowledge, only Hansen and Hill (1991), who use data from a sample of 129 US firms over the period 1977–1987 period, find a positive relationship between the firm's leverage and R&D spending.

Large and liquid stock markets, by providing firms with ready equity finance, may therefore play an important role in supporting aggregate corporate innovation activity. Gugler (2001) performs an ordinary least-square regression of the R&D/GDP ratio on the stock market capitalization to GDP ratio, using data on 14 OECD countries in 1994, and finds that stock market capitalization has a positive and statistically significant effect on the R&D/GDP ratio.

Lazonick (2007) argues that the stock market can influence corporate innovation in a variety of ways. First, it induces financial commitment to new firm formation by enabling private equity holders to monetize their stakes. Second, it influences who exercises strategic control by enabling the separation of share ownership from managerial control, so as to give decision makers the power to allocate resources to uncertain innovation processes. Third, it provides funds for mergers and acquisitions. Fourth, it provides the means (such as stock-based compensation) through which managers and employees can be induced to apply their skills to innovative processes, thus facilitating their organizational integration. Fifth, in speculative periods, it serves as a source of financial commitment, providing the corporation with funds without the guarantee of a return.

In two related papers, it has been argued that the relationship between the stock market and innovation may be a two-way relationship (O'Sullivan, 2000; Carpenter *et al*., 2003). O'Sullivan (2000) suggests that shareholders of successful enterprises may not wait until the innovation generates commercial revenues and may 'go public' to take advantage of the stock market's evaluation of the innovation. In doing so, they leave resource allocation under the control of the organization, given the separation of asset ownership and managerial control made possible by the stock market. Carpenter *et al*. (2003), in a study focused on the optical networking industry from 1996 to 2003, show that innovative corporations may supply cash to the stock market as well as the stock market supplying cash to corporations. Indeed, given the large use of stock-based compensation in the New Economy, the stock market increasingly functions as a source of cash for managers who exercise their stock options, even if not for the companies by which managers are employed.

4.2 *Takeovers*

In the presence of active stock markets, takeovers are an important influence on firms' investment strategies. In a typical takeover, a bidder makes a tender offer to the dispersed shareholders of the target firm and, if they accept the offer, acquires the control of the firm and can replace the management. Thus, managers will be more reluctant to take self-serving actions that lower firm value and that increase the probability of a takeover. Takeovers, consequently, are generally viewed as a means for correcting managerial failure and providing a disciplining device (see, for example, Scharfstein, 1988). Nevertheless, takeovers may negatively affect long-term strategies based on specific investments, such as innovation activities. This can happen through both *ex ante* and *ex post* dynamics.

A takeover's *ex ante* effects on innovation comprise two types, both of which are generally thought to affect innovation negatively. First, as Shleifer and Summers (1988) argue, even if takeover is not a certainty but only a possibility, stakeholders may not agree to implicit contracts through which they invest in relation-specific capital because they fear a future breach. In accordance with the theory of rational reputation formation (see Kreps, 1990), Shleifer and Summers affirm that managers adhere to implicit contracts with stakeholders and do not violate such contracts, because by their adherence they develop a reputation for trustworthiness and thus benefit from future implicit contracts. However, as the incumbent managers are removed subsequent to a takeover, the bidder can renege on the existing implicit contracts and expropriate rent from stakeholders. As a result, stakeholders may anticipate that a takeover increases the probability of *ex post* expropriation and in turn provide suboptimal levels of firm-specific investments *ex ante*. Second, under a 'myopia' hypothesis, managers concerned that low short-term profits will result in unwanted takeover attempts will focus on projects with short-term

payoffs and on visible activities, even at the expense of long-term corporate performance (Stein, 1988; Maher and Andersson, 2002). More specifically, if shareholders are imperfectly informed, low short-term profits may cause the stock to become undervalued, so increasing the probability of a takeover. Hence, managers will concern themselves with current earnings.

Following this rationale, Johnston and Rao (1997) study the effects of anti-takeover amendments and argue that these measures enable a firm's management to focus on long-term business strategies without the threats of losing control of the firm or of job displacement. In particular, the authors examine 649 anti-takeover amendments adopted in US firms between 1979 and 1985, and show that the R&D expenditure to sales ratio remains unchanged in each of the five years after adopting an anti-takeover amendment compared to its value prior to the adoption. Pugh *et al*. (1999) use a sample of 183 US firms that adopted an anti-takeover amendment in 1990 and report, for these firms, a strong increase in R&D expenditures (relative to both assets and sales) in the following four years.

The evidence on the *ex post* effects of takeovers on innovation is mixed. On the one hand, some studies maintain that takeovers are followed by a reduction in innovation production. After a takeover, managerial energy may be absorbed by the restructuring process to the detriment of innovation projects. Moreover, successful bidders often have little interest in the long-term investment strategies of target companies, while they may exhibit rent-seeking behaviour. Smith (1990) investigates changes in firm performance after 58 buyouts of US corporations during the period 1977–1986, and finds a sharp decline of *ex post* R&D expenditures. Similarly, Long and Ravenscraft (1993), using a sample of 72 US companies that experienced buyouts between 1981 and 1987, show a drop of 40% in R&D intensity during the three years after the buyout. Analogous results are reported by Hoskisson *et al*. (1994).

On the other hand, a number of recent papers support the hypothesis that takeovers are not detrimental to long-term investments in R&D and innovation, because new equity funds provide superior management and enable acquired firms to seize innovative opportunities. Zahra (1995) uses data from 47 US companies and finds that, after a buyout, companies enhance their R&D units' size and capabilities. Zahra explains his result by arguing that the increased degree of ownership concentration after a takeover aligns managers' and shareholders' interests and fosters the maximization of the firm's long-term value. Similarly, Wright *et al*. (2001) propose an efficiency approach and argue that buyouts can create entrepreneurial opportunities leading to increased R&D activity and patenting. Bruining and Wright (2002) examine a sample of Dutch firms for the years from 1992 to 1995 and show that buyouts are followed by an increase in new products development. Lerner *et al*. (2008) study the changes in patenting behaviour of 495 US firms over the period 1986–2005 and find that after buyouts, while the level of patenting seems not to change, firms pursue more influential innovations, as measured by patent citations. Ughetto (2010) considers 681 Western European manufacturing firms that underwent a buyout between 1998 and 2004, and finds that, after a buyout, the innovation output of the acquired company increases under particular circumstances (for example, when the bidder devotes a large amount of capital to the deal).

Finally, Sapra *et al*. (2009) predict a U-shaped relationship between the degree of innovation and takeover pressure. They argue that, when takeover pressure is very low, both the takeover premium and the loss of control benefits that managers expect are insignificant. In this case, managers choose greater innovation, because it is associated with some risks but also with a higher unconditional expected payoff. Conversely, when takeover pressure is very high, the expected takeover premium and the expected loss in control benefits are both high, but the former is deemed to dominates the latter. Thus, managers again choose greater innovation. When takeover pressure is moderate, however, the expected loss in control benefits dominates the expected takeover premium, and this encourages managers to choose lower innovation in order to reduce the likelihood of losing control benefits.

Some research has also examined the effects of an acquisition on the innovation activity of the acquiring firm. Hitt *et al*. (1990) maintain that firms may substitute acquisitions for innovation, inasmuch as acquisitions offer immediate entrance to a new market. In turn, the resulting firm's

larger size and increased diversification may negatively affect managers' ability to control strategic investments. Hitt *et al*. (1991) investigate the effect on R&D intensity and patent intensity of 191 acquisitions of US firms completed from 1970 through 1986. They find a negative effect of acquisitions on both R&D and patent intensity of the resulting company. More recently, Ahuja and Katila (2001) examine the acquisition and patenting activity of 72 firms from the global chemicals industry over the period 1980–1991. They show that non-technological acquisitions (i.e. acquisitions that do not involve a technological component by definition) do not affect technological routines of the firm and do not influence its innovation output. Conversely, technological acquisitions (i.e. acquisitions that provide technological inputs to the acquiring firm) may entail a disruption in organizational routines and therefore have a negative impact on the firm's innovation activity. Consistent with these results, Gerpott (1995), using a sample of 92 acquisitions between German firms in 1988, finds that the centralization of strategic R&D decisions in the hands of the acquiring firm's managers is crucial for the success of the R&D projects of the post-acquisition company. Acquisitions are also likely to be associated with increased firm leverage. Hall *et al*. (1990) analyse data on the R&D spending of about 2500 US firms from 1959 to 1987 and find that, due to an increase in leverage, firms involved in acquisitions seem to experience permanent declines in their R&D intensity relative to other firms in the same industry.

5. Labour

At present, firm-specific skills are acknowledged as the fundamental input to innovation production (see, for example, Nickell and Nicolitsas, 1997). Nevertheless, theories of both corporate governance and corporate innovation have done little until recently to address the problems raised by investments in firm-specific human capital. Investment in specialized knowledge and skills introduces a complication into simple models of contracting, inasmuch as such investment is specific to the individual firm where it has been undertaken. Firm-specific training has no effect on the productivity of the worker after he has moved to another firm, so that the wage that an employee might get elsewhere is not affected by the amount of specific training previously received (Becker, 1975). In an incomplete contracting setting, the main consequence of this is that the employer may adjust the wage downwards *ex post*, behaving opportunistically, given that the employee has already applied his effort to the learning process. If the employee anticipates this opportunistic behaviour, he will refrain *ex ante* from developing firm-specific human capital. In the innovation process, this problem is exacerbated by the fact that the final returns of the innovation are unknown *ex ante*. Consequently, employees may be unwilling to apply their effort to the learning process if they do not have a guaranteed return from their investments but have to bear the opportunity costs associated with making those investments. Hence, only when employers commit themselves not to extract rent from workers, do workers have incentives to apply their efforts to collective learning processes. In this context, the problem relevant to innovation relates to the need for institutional devices that protect non-contractible worker investments in firm-specific skills.

5.1 *Labour Unions*

Labour unions are the primary way through which employees can increase their bargaining power over distribution of the enterprise's surplus obtained from successful innovation.

On the one hand, some studies argue that the 'voice function' of unions allows workers to benefit from human capital investments. A seminal analysis supporting this argument is provided by Daniel (1987), who finds that UK unionized firms are more likely to invest and to adopt new technologies. Similarly, Machin and Wadhwani (1991) undertake a probit estimation on 630 UK establishments observed in the 1981–1984 period and show that, in terms of raw correlations, unionism is positively

associated with the level of corporate investments. Corroborating evidence is provided by Michie and Sheehan (2003), who perform a probit estimation on data obtained from 242 UK firms over the period 1994–1996 and show that unionized establishments are positively correlated with product innovation. More recently, a positive relationship between unionized (large) firms and the likelihood of having innovation at the firm level is found also by Rogers (2004), who uses data on around 3400 Australian firms observed from 1993 to 1995.

On the other hand, it may be argued that the development of firm-specific skills is costly for the employee (in terms of effort) as well as for the employer (in terms of resources allocated to the training programs) and that where firms and unions are unable to stipulate incentive-compatible contracts, the employers decrease their investments in human capital and in new technologies in order to avoid union capture. As a result, unionism may have a negative effect on human capital investments. Hirsch and Link (1987) argue that the inefficient bargaining relationship between the union and the firm determines a situation in which unions act as a distortionary tax on the returns from investment in innovation activity. They test this hypothesis on 315 US manufacturing corporations for the year 1985 and find that firms reporting 50% or more unionization are less likely to show product innovation. Similarly, Connolly *et al*. (1986), examining data on 367 firms drawn from the 1977 *Fortune 500*, find that intangible R&D investments add relatively less to the market value of firms in highly unionized industries, and firms in such industries respond by reducing their investments in R&D. Acs and Audretsch (1988) analyse the effect of the percentage of employees belonging to a union (averaged over the period 1973–1975) on the number of total patents in 1982, for a sample of 247 manufacturing industries in the USA. Their regression analysis shows that, to the extent that unions are successful in rent-seeking activities, unionization discourages innovative investments and negatively affects the total number of a firm's innovations. Furthermore, using data on 802 Australian establishments for the years 1989 and 1990, Drago and Wooden (1994) find that a switch from zero to complete union coverage reduces the probability of investment in new technology by almost 8%. Nonetheless, Drago and Wooden (1994) also argue that the union's effects on innovation are likely to depend on unobservable country-specific and political variables that, in their turn, may affect unions' behaviour. More recently, Menezes-Filho *et al*. (1998) have found a nonlinear relationship between union density and R&D intensity. In particular, Menezes-Filho *et al*. (1998) use data on 446 UK companies over the period 1983–1990 period and find that increasing union membership initially increases and finally decreases investments in R&D. So, whether unions can actually provide a way of solving *ex post* distributional conflicts arising in the presence of firm-specific investments remains unclear, and the link between unionism and innovation still appears difficult to disentangle.

5.2 *Worker Participation*

Another solution to coordination failures in the development of firm-specific human capital is an internal governance structure – independent of unions – that promotes employee participation in the firm's decision making. Worker participation (by which a direct voice in management is given to the employee along with some control over the allocation of final returns) is a device that may support internal commitments between employees and employer. For example, McCain (1980) develops a theory of board-level worker participation, arguing that it permits improved efficiency by creating a context of joint management and power sharing, and prevents sub-optimal behaviour resulting from incomplete labour contracts. Similarly, Smith (1991) argues that a worker participation mechanism corrects coordination failures, by providing employee 'checks' on management actions, and encourages the development of skills and new knowledge through the protection of investments in firm-specific human capital. Empirical research directly examining the relationship between board-level employee participation and firm innovation activity seems absent, while a few empirical papers focus on worker participation in day-to-day decision making.

Michie and Sheehan (1999a) employ a qualitative response model on a sample of about 400 UK firms for the year 1990 and find that employee participation to the work team decision making correlates positively with the likelihood of firms innovating (measured by both the R&D expenditure and the introduction of new micro-electronic technology in production). In related work, Michie and Sheehan (1999b) explore data on 489 establishments from the United Kingdom's 1990 Workplace Industrial Relations Survey and show that work organizational practices aimed at generating a high-commitment organization are positively correlated with R&D investments. Similar results are obtained by Michie and Sheehan (2003), who obtain similar results by performing a probit estimation using data on 242 UK firms for the period 1994–1996. They find a negative effect of short-term contracts on process innovation, because – the two authors argue – short-term contracts discourage commitments and trust between employer and employee.

Laursen and Foss (2003) systematically test for the relationships between various types of human resource management (HRM) practices and corporate innovation activity, analysing the effect of such practices on tacit knowledge and specific human capital development. Thus, with respect to previous studies, the link between worker participation and innovation is thought to be the mode through which workers acquire skills rather than their incentives to do so. Laursen and Foss empirically analyse data on 1884 Danish business firms observed in the period 1993–1995, and, consistent with their hypothesis, find that HRM systems governed by interdisciplinary work groups, planned job rotation and delegation of responsibility – that promote knowledge development and diffusion within the firm – are the most likely to drive a firm's ability to innovate. Similarly, Shipton *et al*. (2005) examine data drawn from a sample of 111 UK companies observed over the period 1992–1999 and find that the sophistication of HRM practices (in terms of management-employee information sharing, worker training, planned job rotation and other organizational factors) positively relates to innovation in products and production technology. Analogous conclusions are proposed by Searle and Ball (2003), analysing data on 300 UK firms, and by Scott and Bruce (1994) who, using data from a sample of US corporations, find a positive relationship between employees' favour for innovation and collaborative leadership of employers.[11]

5.3 *Employee Resistance to Innovation*

A limited number of papers report some evidence of employee resistance to innovation. This phenomenon is generally explained by the fact that, given the sunk-cost nature of human capital investment necessary for innovation, the lack of institutional devices (such as worker participation) protecting employees' investments causes coordination failures. In particular, employee resistance to innovation is likely to occur when it is uncertain whether the employees will be able to reap the benefits of their investment in human capital.

Zwick (2002) provides an empirical investigation performed on data obtained from questionnaires filled out by 2553 German managers in 1995. He finds that employees do not oppose innovation *per se*, but they resist innovation when the employer is not convincingly committed to avoiding job losses or when the innovation implies an increase in the labour burden. Employee resistance to innovation is shown to be lower when workforce–management relations are better developed, and when the absence of outside options for the workers acts as a disciplinary device. Evidence on this issue is offered also by Hauschildt (1999), who uses data on 151 German firms for the year 1998. Bemmels and Reshef (1991) analyse managers' perceptions of employee reactions to the introduction of new technologies, assessing 206 Canadian manufacturing enterprises over the period 1980–1988. Their results suggest that worker resistance to innovation is lowered by effective participation in the decision making process, while the presence of unions (if it entails new ground for labour–management disputes) increases managers' perceptions of employee resistance.[12]

6. National Structures of Governance and Macro-Evidence

6.1 *Varieties of Capitalism*

As Nelson (1991) explains, differences in corporations' governance structure are in part discretionary (i.e. to some extent the firm decides individually which strategies to use to guide decision making at various levels inside the firm itself) and in part are driven 'exogenously' by the context in which firms operate. As a result, while firms may show different corporate governance structures even within the same sector or country, corporations also develop their organizational structure interdependently with the broader institutional setting in which they are embedded, and this tends to generate dominant patterns of corporate governance at the national level. In turn, national patterns of corporate governance partly shape the various trajectories of technological development that we observe in market economies. In the last two decades, a growing body of literature has tried to conceptualize this phenomenon by profiling 'varieties of capitalism' (Lazonick and O'Sullivan, 1996; Soskice, 1997; Tylecote and Conesa, 1999; Whitley, 1999; Hall and Soskice, 2001; Casper and Matraves, 2003). We briefly review such literature in this section, and discuss how the innovation activity of corporations – at an aggregate level – can be linked to country-specific modes of corporate governance.

Whitley (1999) describes different models of corporate government in market economies as different types of business systems. Business systems are conceived as distinctive patterns of corporate organization that vary across national economies in the mode of coordination of (and interconnection between) shareholders, managers and other employees. Whitley (1999) proposes three key dimensions for comparing business systems: first, ownership coordination, which concerns the relationships between shareholders and controllers of corporate resource allocation and activities (for example, the degree of vertical and horizontal integration), second, non-ownership coordination, which refers to the integration of activities in inter-firm relationships (such as the degree of collaboration between competitors) and third, employment relations, that can be described by the degree of employer-employee interdependence.[13]

Soskice (1997) and Hall and Soskice (2001) directly link national structures of governance to national patterns of corporate innovation. They argue that national systems of institutional coordination devices provide different solutions to incomplete contracting problems across micro-level actors, so that different institutional models sustain different types of innovation. In particular, Hall and Soskice (2001) distinguish between market and non-market forms of business coordination. Market forms of coordination (such as those of the USA, the United Kingdom and other Anglo-Saxon economies) are characterized by liquid capital markets and flexible labour markets, which encourages the use of the exit option by the contract's parties in economic relations. This inhibits commitments, because contractual parties can change quickly. At the opposite end of the spectrum, non-market forms of coordination (typical of Germany, some continental European economies and Japan) have institutional structures that facilitate the solution of incomplete contracting dilemmas. Here, strong labour unions, cross-shareholdings and reputational issues lead to long-term and credible relationships between most actors within the economy. Therefore, on the one hand, market forms of coordination should be better at supporting radical innovation, which requires a low asset specificity (this is the case of pharmaceuticals and biotechnology); on the other hand, non-market forms of coordination facilitate the development of highly specific assets, which substantially characterize incremental innovation (typical of mechanical engineering). Using data from the European Patent Office, Hall and Soskice (2001) show that, according to their argument, in the period 1984–1994 German firms increased their innovative specialization in the mechanical engineering and machine tool sectors, while US firms innovated mainly in the biotechnology and telecommunications sectors.

Casper and Matraves (2003) provide corroborating evidence, reporting aggregate data on R&D expenditure for the pharmaceutical industry, showing that UK firms outperformed German firms in the

late 1990s. Similar conclusions are reached also by Tylecote and Conesa (1999), who show that in the period 1989–1992 innovation activity in Germany was higher in chemicals and motor vehicles, while the USA was more innovative in pharmaceuticals. Within this framework, a country analysis of the French case is provided by Goyer (2001).

From a similar perspective, Lazonick and O'Sullivan (1996) explain national patterns of corporations' innovation by analysing the corporate governance problems relating to financial commitments. The two authors emphasize that the increased concentration of control over shares by fund managers and institutional investors in the USA and United Kingdom forces managers to focus on short-term performance. Thus, the Anglo-Saxon system imposes strong short-term financial criteria on corporate strategies. The authors argue that this is exemplified by US corporations seeking to minimize the skill base on which the innovative process relies, by means of skill-displacing strategies. Conversely, Germany is characterized by strong financial commitments and organizational integration, which makes Germany more competitive in the chemical, electrical and mechanical sectors, where human capital and integrated skills are fundamental.[14]

6.2 *Institutional Complementarities*

Institutional complementarities between macro-spheres of the political economy are particularly relevant in shaping innovation patterns of corporations. According to Milgrom and Roberts (1992), complementarities are present when increasing the amount of one activity increases (or at least does not decrease) the marginal profitability of every other activity in the group. Such a definition can be applied to institutions as well (see, for example, Amable, 2000 – for a general discussion on the relation between complementarities among institutional arrangements and national systems of innovation – and Aoki, 2001).

Hall and Gingerich (2004) provide an empirical analysis of the economic effects of institutional complementarities in the macroeconomy. They consider the relationship between the labour market (as described by the level of wage-claims coordination, the degree of wage coordination between unions and employers, and labour turnover) and some institutions of corporate governance (such as shareholder control power, dispersion of control and size of the stock market).[15] First, they find a strong and statistically significant relationship between coordination in labour relations and corporate governance. Countries show high levels of coordination in both their labour relations and their corporate governance spheres, or in neither of them. Second, the authors argue that, on the one hand, in highly coordinated economies firms easily enter into collaborative arrangements with other firms for the purpose of research and product development, thus substantial amounts of technology transfer take place through inter-firm collaboration; on the other hand, where fluid capital markets facilitate the movement of funds across endeavours, firms find it more efficient to access technology by licensing or by acquiring other firms, and they are more likely to invest in assets that can be switched to other uses as new opportunities emerge. The authors conclude that aggregate economic performance should be better in nations where institutional arrangements correspond more closely to pure types of liberal or coordinated economic organizations.

7. Conclusions

Although, since the pioneering contribution of Schumpeter (1934, 1942), there have been significant advances made in the economics of innovation with, for example, the game-theoretical literature (for example, Gilbert and Newbery, 1982; Reinganum, 1983; Denicolò, 2000), traditional studies are shown to be persistently unable to explain why firms with similar size and market power can have greatly differing innovation performances. As many authors note (for example, Nelson, 1991; O'Sullivan, 2000; Lazonick, 2003), both theoretical models and empirical analysis along traditional lines of research

leave unexplained a large part of the picture, and are perhaps most accurately described as fragile. In particular, the traditional literature – albeit extensive and assorted – tends to treat the firm as a black box, where internal structure, contracts and government modes at the various levels of the firm itself disappear. Contrastingly, a more recent and rather heterogeneous literature recognizes the importance of corporate governance for a firm's performance, and affirms that differences in the various dimensions of a corporation's governance do matter for its innovation activity. Innovation, indeed, does not appear as a result of technological determinism in a context of profit-maximizing firms, but rather it emerges (or it does not) because individuals decide to invest (or not to invest) in innovative projects, where these investments decisions are shaped by the corporate governance system.

In this paper, we have examined the main contributions exploring the relationship between the various dimensions of corporate governance and firms' innovation performance, providing, to the best of our knowledge, the first literature review on this theme.

To organize such a body of literature is difficult, because studies on this issue form a heterogeneous puzzle that covers interrelated (but apparently far removed) aspects of corporate organization. In particular, we have began by briefly discussing how different approaches to the analysis of the firm deal with technological innovation, in order to outline the theoretical ground on which the various studies linking innovation to corporate governance develop. We have then described the main channels through which a system of corporate governance shapes innovation activity, having classified them in the three dimensions of corporate ownership, corporate finance and labour. Finally, we have examined the literature on varieties of capitalism, and discussed the relationship between national patterns of corporate governance and aggregate innovation activity of corporations.

As it emerges in this paper, the literature on corporate governance and innovation is extremely heterogeneous. While the variety of the contributions on this issue reflects the complexity of the theme, it also entails mixed results that rarely show cohesiveness. The reason why both theoretical and empirical studies often lead to contradictory findings is probably due to the fact that they tend to focus on individual dimensions of corporate governance taken as exogenously determined. However, these dimensions must not be studied in isolation, as if they were independent, if we are to explore satisfactorily their effect on firms' innovation activity. The contractual relationship between employees and employer cannot be seriously considered as being independent of the corporate ownership structure, which in turn affects (and can be affected by) the corporate financial strategies. Thus a dispersed ownership structure, for example, characterized by the involvement of thousands of small equity investors, may positively affect corporate innovation activity because it favours the commitment of capital to long-term investment projects (Battaggion and Tajoli, 2001; Lazonick, 2007). At the same time, however, it may reduce the ability of the employer to enter into long-term relationships with workers, because individual shareholders can easily use the exit option, therefore depressing the worker's incentives to develop human capital (Mayer, 1997; Hall and Soskice, 2001). In addition, diffuse equity ownership also pushes managers towards short-run strategies because it increases the probability of an ownership change due to takeover (Johnston and Rao, 1997; Shleifer and Summers, 1988; Maher and Andersson, 2002). Therefore, while this literature provides an examination of a large range of aspects relevant to the understanding of a firm's innovation, aspects which have been overlooked by previous research, there is much that remains to be done. Firstly, well suited econometric techniques (such as simultaneous regression analysis) should be used in empirical research, when corporate governance variables are placed in relation with innovation performance indicators. Endogeneity problems are likely to occur in empirical corporate governance studies, because of the interrelation between the various dimensions of corporate governance (Roe, 2003), and because of a nexus of reverse causality that might flow from a corporation's innovation to its governance structure (Cho, 1998). Single-equation linear regressions, largely used in the existing literature, may lead to incomplete or misleading results. Secondly, the analysis of firm-level organizational strategies should be better integrated with an analysis of what corporate law and labour law prescribe at a national

level. Future research might consider investigating how different settings of corporate law affect the innovation activity of corporations and what are the relative effects of individual norms within such settings. For example, the growing and prestigious 'law and finance' literature maintains that shareholder empowerment and stronger institutions of minority shareholder protection have a positive effect on the long-run performance of corporations, because they increase corporations' access to external capital by boosting the stock markets (see La Porta *et al*., 1998; Pagano and Volpin, 2005). But the same literature does not address the risk of opportunistic actions taken by small and diversified shareholders, which may pervasively depress corporate specific investing and innovation activity (as suggested by Stout, 2010, and Belloc, 2010). We believe that further investigations in this research area, encompassing various levels of analysis and methodologies, may deeply improve the understanding of the determinants of corporate innovation, and so provide useful policy prescriptions.

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Notes

1. Whereas neoclassical economics focused on markets as networks of input/output relations among individual rational agents, in his 1942 book Schumpeter tended to focus on firms as the specific and bounded carriers of the innovation dynamics. Thus Schumpeter changed both the unit of analysis and the unit of operation.
2. A large number of studies discuss the patent race framework; see, for example, Shapiro (1985), Vickers (1986), Beath *et al*. (1989), Aoki (1991), Aghion and Howitt (1992), Scotchmere (1996), Denicolò (1996, 2000), Maurer and Scotchmere (2002), Weeds (2002), Judd (2003) and Hunt (2004).
3. In particular, product innovations refer to the occurrence of new or improved goods and services, process innovations refer to the improvements in the ways of producing these goods and services. Moreover, Edquist *et al*. (2001) have suggested dividing innovations into technological innovations and organizational innovations, where the former relates to new types of goods or machinery used in production, and the latter to new ways of organizing work. Organizational innovation, then, is not limited to the organization of the production process within a given firm, but may also include arrangements across firms. The literature reviewed in this paper concentrates solely on technological innovation, while non-technological innovation – such as organizational changes, marketing-related changes, and financial innovations – is not discussed.
4. The term 'corporate governance' has been used over the years to mean various and rather different concepts. One of the most common definitions is Shleifer and Vishny's (1997, p. 737), according to which '*corporate governance deals with the ways in which suppliers of finance to corporations assure themselves of getting a return on their investments*'. For the purposes of this paper, however, we find this definition restrictive. Thus we rely on a broader concept of corporate governance, as defined in the text.
5. See, for example, Gugler (2001).
6. Pagano and Rossi (2004), in a Grossman–Hart–Moore setting, argue that, in particular, the second-best allocation of intellectual assets entails an underinvestment of human capital when many agents should make investments specific to the same piece of intellectual property.
7. See Alchian and Demsetz (1972) for a pioneering contribution on asymmetric information problems within firms, and Holmstrom (1982) and Holmstrom and Milgrom (1994) for an assessment of moral

hazard in teams. See also Smith (1998) for a discussion of the shareholder primacy view in legal scholarship.
8. See Lazonick and Prencipe (2005) for a case study analysis of the innovation process at Rolls-Royce using this approach.
9. See Bitar (2003) for an introductory discussion on agency theory and corporate innovation.
10. For further evidence on a positive relation between institutional ownership and innovation, see Baysinger *et al*. (1991), Szewczyk *et al*. (1996) and Eng and Shackell (2001).
11. For a survey on the relation between various types of HRM practices and corporate performance outcomes, though excluding innovation, see Michie and Oughton (2003). The relation between work group organization and innovation is also discussed in the literature on the so-called organizational climate – i.e. the workers' perception of their work environment – (see Kelly and Kranzberg, 1978, for a comprehensive overview on this theme).
12. For a bargaining model of the interaction between employers and organized workers on the timing of innovation see Ulph and Ulph (1998).
13. For a detailed discussion on national institutional diversity and technological development see, among others, Berger and Dore (1996) and Chandler *et al*. (1997).
14. Different modes of coordination at the national level encourage the development of different forms of firm organization, as organizational studies (not reviewed in this paper) largely discuss. In particular, non-market forms of coordination sustain the J-form organization, which promotes learning and knowledge creation within an organizational community based on intensive interaction and knowledge sharing across different functional units (Aoki, 1988). Conversely, liberal market economies are better able to foster adhocracies (often named Silicon Valley type companies), that tend to rely more upon individual specialists organized in flexible market-based project teams (Mintzberg, 1979).
15. Note that Hall and Gingerich (2004) use a definition of corporate governance that does not encompass any labour-related aspect.

References

Acs, Z.J. and Audretsch, D.B. (1988) Innovation in large and small firms: an empirical analysis. *American Economic Review* 78(4): 678–690.

Aghion, P. and Howitt, P. (1992) A model of growth through creative destruction. *Econometrica* 60(2): 323–351.

Aghion, P. and Tirole, J. (1994) The management of innovation. *Quarterly Journal of Economics* 109(4): 1185–1209.

Aghion, P., Bloom, N., Blundell, R., Griffith, R. and Howitt, P. (2005) Competition and innovation: an inverted-U relationship. *Quarterly Journal of Economics* 120(2): 701–728.

Aghion, P., Van Reenen, J. and Zingales, L. (2009) Innovation and institutional ownership. CEPR Discussion Paper 7195.

Ahn, S. (2002) Competition, innovation and productivity growth: a review of theory and evidence. OECD Economics Working Papers 317.

Ahuja, G. and Katila, R. (2001) Technological acquisitions and the innovation performance of acquiring firms: A Longitudinal Study. *Strategic Management Journal* 22: 197–220.

Alchian, A.A. and Demsetz, H. (1972) Production, information costs, and economic organization. *American Economic Review* 62(5): 777–795.

Amable, B. (2000) Institutional complementarity and diversity of social systems of innovation and production. *Review of International Political Economy* 7(4): 645–687.

Aoki, R. (1991) R&D competition for product innovation: an endless race. *American Economic Review* 81(2): 252–256.

Aoki, M. (1988) *Information, incentives, and bargaining in the Japanese economy*. Cambridge, UK: Cambridge University Press.

Aoki, M. (2001) *Toward a Comparative Institutional Analysis*. Cambridge, MA: MIT Press.
Arrow, K.J. (1962) Economic welfare and the allocation of resources for invention. In R. Nelson (ed.), *The Rate and Direction of Inventive Activity: Economic and Social Factors* (pp. 609–626). Princeton: Princeton University Press.
Balakrishnan, S. and Fox, I. (1993) Asset specificity, firm heterogeneity and capital structure. *Strategic Management Journal* 14(1): 3–16.
Battaggion, M.R. and Tajoli L. (2001) Ownership structure, innovation process and competitive performance: the case of Italy. CESPRI Working Paper 120, Milan.
Baysinger, B.D. and Hoskisson, R.E. (1989) Diversification strategy and R&D intensity in large multiproduct firms. *Academy of Management Journal* 32(2): 310–332.
Baysinger, B.D., Kosnik, R.D. and Turk T.A. (1991) Effects of board and ownership structure on corporate R&D strategy. *Academy of Management Journal* 34(1): 205–214.
Beath, J., Katsoulacos, Y. and Ulph, D. (1989) Strategic R&D policy. *Economic Journal* 99(395): 74–83.
Becker, G.S. (1975) *Human Capital*, 2nd. New York: National Bureau of Economic Research.
Belloc, F. (2010) The dark side of shareholder protection: cross-country evidence from innovation performance. Quaderni del Dipartimento di Economia Politica Working Paper 583/2010, University of Siena, Siena.
Bemmels, B. and Reshef, Y. (1991) Manufacturing employees and technological change. *Journal of Labor Research* 12(3): 231–246.
Berger, S. and Dore, R. (1996) *National Diversity and Global Capitalism*. Ithaca: Cornell University Press.
Berle, A.A. and Means, G. (1932) *The Modern Corporation and Private Property*. New York: Macmillan.
Bitar, J. (2003) The impact of corporate governance on innovation: strategy in turbulent environments. *La Chaire de management stratégique international* 5(1): 1–21.
Blair, M.M. (1995) *Ownership and Control: Rethinking Corporate Governance for the Twenty-First Century*. Washington: Brookings Institution Press.
Blair, M.M. (1999) Firm specific human capital and theory of the firm. In M.M. Blair and M.J. Roe (eds), *Employees and Corporate Governance* (pp. 58–90). Washington: Brookings Institution Press.
Blair, M.M. and Stout L.A. (1999) A team production theory of corporate law. *Virginia Law Review* 85(2): 248–328.
Blair, M.M. and Stout L.A. (2006) Specific investment and corporate law. *European Business Organizational Law Review* 7(2): 473–500.
Bradley, M., Jarrel G. and Kim, E.H. (1984) On the existence of an optimal board composition, and ownership structure: the case of banking. *Journal of Finance* 39: 857–878.
Bruining, H. and Wright, M. (2002) Entrepreneurial orientation in management buyouts and the contribution of venture capital. *Venture Capital: An International Journal of Entrepreneurial Finance* 4: 147–168.
Carpenter, R.E. and Petersen, B.C. (2002) Capital market imperfections, high-tech investment, and new equity financing. *Economic Journal* 112(477): 54–72.
Carpenter, R.E., Lazonick, W. and O'Sullivan, M. (2003) The stock market and innovative capability in the new economy: the optical networking industry. *Industrial and Corporate Change* 12(5): 963–1034.
Casper, S. and Matraves, C. (2003) Institutional frameworks and innovations in the German and UK pharmaceutical industry. *Research Policy* 32: 1865–1879.
Chandler, A.D., Amatori, F. and Hikino, T. (1997) *Big Business and the Wealth of Nations*. Cambridge, UK: Cambridge University Press.
Cho, S. (1992) Agency costs, management stockholding, and research and development expenditures. *Seoul Journal of Economics* 5(2): 127–152.
Cho, M.H. (1998) Ownership structure, investment, and the corporate value: an empirical analysis. *Journal of Financial Economics* 47(1): 103–121.
Coase, R.H. (1937) The nature of the firm. *Economica* 4(16): 386–405.
Cohen, W. and Levin, R. (1989) Empirical studies of innovation and market structure. In R. Schmalensee and R.D. Willig (eds), *Handbook of Industrial Organization* (pp. 1059–1107). London, UK: North Holland.
Connolly, R.A., Hirsh, B.T. and Hirschey, M. (1986) Union rent seeking, intangible capital, and market value of the firm. *Review of Economics and Statistics* 68(4): 567–577.
Daniel, W. (1987) Workplace involvement in technical change. *Policy Studies* 7(4): 43–57.

Dasgupta, P. and Stiglitz, J. (1980) Uncertainty, industrial structure, and the speed of R&D. *Bell Journal of Economics* 11(1): 1–28.
David, P., Hitt, M.A. and Gimeno, J. (2001) The influence of activism by institutional investors on R&D. *Academy of Management Journal* 44(1): 144–157.
Denicolò, V. (1996) Patent race and optimal patent breadth and length. *Journal of Industrial Economics* 44(3): 249–265.
Denicolò, V. (2000) Two-stage patent races and patent policy. *RAND Journal of Economics* 31(3): 488–501.
Dosi, C., Freeman, C., Nelson, R., Silverberg, G. and Soete, L. (eds) (1988) *Technical Change and Economic Theory.* New York: Pinter Publisher.
Drago, R. and Wooden, M. (1994) Unions, innovation and investment: Australian evidence. *Applied Economics* 26(6): 609–615.
Edquist, C., Hommen, L. and McKelvey, M. (2001) *Innovation and Employment: Process Versus Product Innovation*. Cheltenham, UK: Elgar.
Eng, L.L. and Shackell, M. (2001) The implications of long term performance plans and institutional ownership for firm's research and development investments. *Journal of Accounting, Auditing and Finance* 16(2): 117–39.
Evans, D.S. and Schmalensee, R. (2002) Some economic aspects of antitrust analysis in dynamically competitive industries. *Innovation Policy and the Economy* 2: 1–49.
Fagerberg, J., Mowery, D.C. and Nelson, R.R. (eds) (2005) *The Oxford Handbook of Innovation.* Oxford: Oxford University Press.
Francis, J. and Smith, A. (1995) Agency costs and innovation: some empirical evidence. *Journal of Accounting and Economics* 19: 383–409.
Gerpott, T. (1995) Successful integration of R&D functions after acquisitions: an explanatory empirical study. *R&D Management* 25(2): 161–178.
Gilbert, R.J. and Newbery, D.M.G. (1982) Preemptive patenting and the persistence of monopoly. *American Economic Review* 72(3): 514–526.
Goyer, M. (2001) Corporate governance and the innovation system in France 1985-2000. *Industry and Innovation* 8(2): 135–158.
Graves, S.B. (1988) Institutional ownership and corporate R&D in the computer industry. *Academy of Management Journal* 31: 417–428.
Graves, S.B. (1990) Institutional ownership and corporate R&D investment: a multi-industry study. *Technological Forecasting and Social Change* 37(1): 59–76.
Grossman, S.J. and Hart O.D. (1986) The cost and benefit of ownership: a theory of vertical and lateral integration. *Journal of Political Economy* 94(4): 691–719.
Gugler, K. (2001) *Corporate Governance and Economic Performance.* Oxford: Oxford University Press.
Hall, P. and Gingerich, D.W. (2004) Varieties of capitalism and institutional complementarities in the macroeconomy: an empirical analysis. MPIfG Discussion Paper 04/5.
Hall, P. and Soskice, D. (2001) An introduction to varieties of capitalism. In P. Hall and D. Soskice (eds), *Varieties of Capitalism* (pp. 1–68). Cambridge, MA: Harvard University Press.
Hall, B.H., Berndt E. and Levin, R.C. (1990) The impact of corporate restructuring on industrial research and development. *Brookings Papers on Economic Activity: Microeconomics* 1990: 85–124.
Hansen, G.S. and Hill, C.W. (1991) Are institutional investors myopic? A time-series study of four technology-driven industries. *Strategic Management Journal* 12(1): 1–16.
Hart, O.D. and Moore, J. (1990) Property rights and the nature of the firm. *Journal of Political Economy* 98(6): 1119–1158.
Hauschildt, J. (1999) Opposition to innovations – destructive or constructive?. In K. Brockhoff, A. Chakrabarti and J. Hauschildt (eds), *The Dynamics of Innovation* (pp. 217–240). Berlin: Springer.
Hill, C.W. and Snell, S.A. (1988) External control, corporate strategy, and firm performance in research-intensive industries. *Strategic Management Journal* 9(6): 577–590.
Hill, C.W., Hitt, M.A. and Hoskisson, R.E. (1988) Declining US competitiveness: reflections on a crisis. *Academy of Management Executive* 2(1): 51–60.
Hirsch, B.T. and Link, A.N. (1987) Labor union effects on innovative activity. *Journal of Labor Research* 8(4): 323–332.

Hitt, M.A., Hoskisson, R.E. and Ireland, R.D. (1990) Mergers and acquisitions and managerial commitment to innovation in M-form firms. *Strategic Management Journal* 11: 29–47.
Hitt, M.A., Hoskisson, R.E., Ireland, R.D. and Harrison, J.S. (1991) Effects of acquisitions on R&D inputs and outputs. *Academy of Management Journal* 34(3): 693–706.
Holmstrom B. (1982) Moral hazard in teams. *The Bell Journal of Economics* 13(2): 324–340.
Holmstrom B. (1989) Agency costs and innovation. *Journal of Economic Behavior and Organization* 12(3): 305–327.
Holmstrom B. and Milgrom P. (1994) The firm as an incentive system. *American Economic Review* 84(4): 972–991.
Hoskisson, R.E., Hitt, M.A. and Ireland, D. (1994) The effects of acquisition and restructuring (strategic refocusing) strategies on innovation. In G. Von Krogh, A. Sinatra and H. Singh (eds), *The Management of Corporate Acquisitions: International Perspectives* (pp. 144–169). New York: Macmillan.
Hoskisson, R.E., Hitt, M.A., Johnson, R.A. and Grossman, W. (2002) Conflicting voices: the effects of institutional ownership heterogeneity and internal governance on corporate innovation strategies. *Academy of Management Journal* 45(4): 697–716.
Hunt, R.M. (2004) Patentability, industry structure, and innovation. *Journal of Industrial Economics* 52(3): 401–425.
Jensen, M.C. and Meckling, W.H. (1976) Theory of the firm: managerial behavior, agency costs and ownership structure. *Journal of Financial Economics* 3(4): 305–360.
Johnson, M.S. and Rao, R.P. (1997) The impact of antitakeover amendments on corporate financial performance. *Financial Review* 32(3): 659–690.
Judd, K.L. (2003) Closed-loop equilibrium in a multi-stage innovation race. *Economic Theory* 21(2–3): 673–695.
Kamien, M.I. and Schwartz, N.L. (1975) Market structure and innovation: a survey. *Journal of Economic Literature* 3(1): 1–37.
Kelly, P. and Kranzberg, M. (1978) (eds), *Technological Innovation: a Critical Review of Current Knowledge*. San Francisco, CA: San Francisco Press.
Kochhar, R. and David, P. (1996) Institutional investors and firm innovation: a test of competing hypothesis. *Strategic Management Journal* 17(1): 73–84.
Kreps, D. (1990) Corporate culture and economic theory. In J. Alt and K. Shepsle (eds), *Perspectives on Positive Political Economy* (pp. 90–143). Cambridge, UK: Cambridge University Press.
Krugman, P. (1979) A model of innovation, technology transfer, and the world distribution of income. *Journal of Political Economy* 87(2): 253–266.
La Porta, R., Lopez-de-Silanes, F., Shleifer, A. and Vishny, R.W. (1998) Law and finance. *Journal of Political Economy*, 106(6): 1113–1155.
Lacetera, N. (2001) Corporate governance and the governance of innovation: the case of pharmaceutical industry. *Journal of Management and Governance* 5: 29–59.
Laursen, K. and Foss, N.J. (2003) New human resource management practices, complementarities and the impact on innovation performance. *Cambridge Journal of Economics* 27(2): 243–263.
Lazonick, W. (2003) The theory of the market economy and the social foundations of the innovative enterprise. *Economic and Industrial Democracy* 24(1): 9–44.
Lazonick, W. (2007) The US stock market and the governance of innovative enterprise. *Industrial and Corporate Change* 16(6): 983–1035.
Lazonick, W. and O'Sullivan M. (1996) Organization, finance and international competition. *Industrial and Corporate Change* 5(1): 1–49.
Lazonick, W. and Prencipe A. (2005) Dynamic capabilities and sustained innovation: strategic control and financial commitment at Rolls-Royce plc. *Industrial and Corporate Change* 14(3): 501–542.
Lee, P.M. (2005) A comparison of ownership structures and innovation of US and Japanese firms. *Managerial and Decision Economics* 26: 39–50.
Lerner, J., Sørensen, M. and Strömberg, P. (2008) Private equity and long-run investment: the case of innovation. NBER Working Paper 14623.
Long, M. and Malitz, I. (1985) The investment-financing nexus: some empirical evidence. *Midland Corporate Finance Journal* 3(1): 53–59.

Long, W.F. and Ravenscraft, D.J. (1993) LBOs, debt and R&D intensity. *Strategic Management Journal* 14: 119–135.
Loury, G.C. (1979) Market structure and innovation. *Quarterly Journal of Economics* 93(3): 395–410.
Machin, S. and Wadhwani, S. (1991) The effects of unions on investment and innovation: evidence from WIRS. *Economic Journal* 101(2): 324–330.
Maher, M. and Andersson, T. (2002) Corporate governance: effects on firm performance and economic growth. In J. McCahery, L. Renneboog, P. Moerland and T. Raaijmakers (eds), *Corporate Governance Regimes: Convergence and Diversity*. Oxford: Oxford University Press.
Malerba, F. (2005) Sectoral systems of innovation: a framework for linking innovation to the knowledge base, structure and dynamics of sectors. *Economics of Innovation and New Technology* 14(1–2): 63–82.
Markman, G.D., Balkin, D.B. and Schjoedt, L. (2001) Governing the innovation process in entrepreneurial firms. *Journal of High Technology Management Research* 12: 273–293.
Maurer, S.M. and Scotchmere S. (2002) The independent innovation defence in intellectual property. *Economica* 69(276): 535–547.
Mayer, C. (1997) Corporate governance, competition and performance. *Journal of Law and Society* 24(1): 152–176.
McCain, R.A. (1980) A theory of codetermination. *Journal of Economics* 40(1–2): 65–90.
Menezes-Filho, N., Ulph, D. and Van Reenen, J. (1998) R&D and unionism: comparative evidence from British companies and establishments. *Industrial and Labor Relations Review* 52(1): 45–63.
Michie, J. and Oughton, C. (2003) HRM, employee share ownership and corporate performance. *Research and Practices in Human Resource Management* 11(1): 15–36.
Michie, J. and Sheehan, M. (1999a) No innovation without representation? An analysis of participation, representation, R&D and innovation. *Economic Analysis* 2: 85–98.
Michie, J. and Sheehan, M. (1999b) HRM practices, R&D expenditure and innovative investment: evidence from the UK's 1990 workplace industrial relations survey (WIRS). *Industrial and Corporate Change* 8(2): 211–234.
Michie, J. and Sheehan, M. (2003) Labour market deregulation, "flexibility" and innovation. *Cambridge Journal of Economics* 27(1): 123–143.
Milgrom, P. and Roberts, J. (1992) *Economics, Organization and Management*. Eaglewood Cliffs, NJ: Prentice Hall.
Mintzberg, H. (1979) *The Structuring of Organization*. Eaglewood Cliffs, NJ: Prentice Hall.
Miozzo, M. and Dewick, P. (2002) Building competitive advantage: innovation and corporate governance in European construction. *Research Policy* 31: 989–1008.
Modigliani, F. and Miller, M.H. (1958) The cost of capital, corporate finance and the theory of investment. *American Economic Review* 48: 261–297.
Mork, R., Wolfenzon, D. and Yeung, B. (2005) Corporate governance, economic entrenchment, and growth. *Journal of Economic Literature* 43(3): 655–720.
Nelson, R. (1991) Why do firms differ, and how does it matter? *Strategic Management Journal* 12: 61–74.
Nelson, R. and Winter S. (1982) *An Evolutionary Theory of Economic Change*. Cambridge, MA: The Belknap Press of Harvard University Press.
Nickell, S. and Nicolitsas, D. (1997) Human capital, investment and innovation: what are the connection? CEP Discussion Paper 20. Oxford: University of Oxford.
Ortega-Argilés, R., Moreno, R. and Caralt, R. (2005) Ownership structure and innovation: is there a real link? *Annals of Regional Science* 39(4): 637–662.
O'Sullivan, M. (2000) The innovative enterprise and corporate governance. *Cambridge Journal of Economics* 24: 393–416.
Pagano, U. and Rossi, M.A. (2004) Incomplete contracts, intellectual property and institutional complementarities. *European Journal of Law and Economics* 18: 55–76.
Pagano, M. and Volpin, P.F. (2005) Shareholder protection, stock market development, and politics. *Journal of the European Economic Association* 4(2–3): 315–341.
Pugh, W.N., Jahera, J.S. and Oswald, S. (1999) ESOPs, takeover protection, and corporate decision making. *Journal of Economics and Finance* 48(5): 1985–1999.
Rajan, R.G. and Zingales, L. (1998) Power in the theory of the firm. *Quarterly Journal of Economics* 113: 387–432.

Reinganum, J.F. (1983) Uncertain innovation and the persistence of monopoly. *American Economic Review* 73(4): 741–748.
Roe, M.J. (2003) *Political Determinants of Corporate Governance*. Oxford: Oxford University Press.
Rogers, M. (2004) Networks, firm size and innovation. *Small Business Economics* 22: 141–153.
Ross, S.A. (1973) The economic theory of agency: the principal's problem. *American Economic Review* 63(2): 134–139.
Sapra, H., Subramanian, A. and Subramanian, K. (2009) Corporate governance and innovation theory and evidence. Chicago Booth Working Paper 08-05, University of Chicago Booth School of Business.
Scharfstein, D. (1988) The disciplinary role of takeovers. *Review of Economic Studies* 55(2): 165–199.
Schumpeter, J.A. (1934) *The Theory of Economic Development*. Cambridge, MA: Harvard University Press.
Schumpeter, J.A. (1942) *Capitalism, Socialism and Democracy*. New York: Harper and Row.
Scotchmere, S. (1996) Protecting early innovators: should second-generation products be patentable? *RAND Journal of Economics* 27(2): 322–331.
Scott, S.G. and Bruce, R.A. (1994) Determinants of innovative behavior: a path model of individual innovation in the workplace. *Academy of Management Journal* 37(3): 580–607.
Searle, R.H. and Ball, K.S. (2003) Supporting innovation through HR policy: evidence from the UK. *Creativity and Innovation Management* 12(1): 50–61.
Shapiro, C. (1985) Patent licensing and R&D rivalry. *American Economic Review* 75(2): 25–30.
Sherman, H., Beldona, S. and Joshi, M.P. (1998) Institutional investor heterogeneity: implications for strategic decisions. *Corporate Governance* 6(3): 166–173.
Shipton, H., Fay D., West, M., Patterson, M. and Birdi, K. (2005) Managing people to promote innovation. *Creativity and Innovation Management* 14(2): 118–128.
Shleifer, A. and Summers, L. (1988) Breach of trust in hostile takeovers. In A. Auerbach (ed.), *Corporate Takeovers: Causes and Consequences* (pp. 33–55). Chicago: University of Chicago Press.
Shleifer, A. and Vishny, R.W. (1997) A survey of corporate governance. *Journal of Finance* 52(2): 737–783.
Smith, A.J. (1990) Corporate ownership structure and performance: the case of management buyouts. *Journal of Financial Economics* 27(1): 143–164.
Smith, S.C. (1991) On the economic rationale for co-determination law. *Journal of Economic Behaviour and Organization* 16(3): 61–81.
Smith, G. (1998) The shareholder primacy norm. *Journal of Corporation Law* 23(2): 277–323.
Soskice, D. (1997) German technology policy, innovation and national institutional framework. *Industry and Innovation* 4(1): 75–96.
Stein, J.C. (1988) Takeover threats and managerial myopia. *Journal of Political Economy* 96(1): 61–80.
Stout, L.A. (2006) The mythical benefits of shareholder control. *Virginia Law Review* 93: 789–809.
Sutton, J. (1991) *Sunk Costs and Market Structure*. Cambridge, MA: MIT Press.
Sutton, J. (1996) Schumpeter lecture: technology and market structure. *European Economic Review* 40: 511–530.
Sutton, J. (1998) *Technology and Market Structure*. Cambridge, MA: MIT Press.
Szewczyk, S.H., Tsetsekos, G.P. and Zantout, Z. (1996) The valuation of corporate R&D expenditures: evidence from investment opportunities and free cash flow. *Financial Management* 25: 105–110.
Teece, D. and Pisano, G. (1994) The dynamic capabilities of firms: an introduction. *Industrial and Corporate Change* 3(3): 537–556.
Teece, D., Pisano, G. and Shuen, A. (1997) Dynamic capabilities and strategic management. *Strategic Management Journal* 18(7): 509–533.
Tylecote, A. and Conesa, E. (1999) Corporate governance, innovation systems and industrial performance. *Industry and Innovation* 6(1): 25–50.
Ughetto, E. (2010) Assessing the contribution to innovation of private equity investors: a study on European buyouts. *Research Policy* 39: 126–140.
Ulph, A. and Ulph, D. (1988) Bargaining structures and delay in innovation. *Scandinavian Journal of Economics* 90(4): 475–491.
Van Cayseele, P.J.G. (1998) Market structure and innovation: a survey of the last twenty years. *De Economist* 146(3): 391–417.
Vickers, J. (1986) The evolution of market structure when there is a sequence of innovations. *Journal of Industrial Economics* 35(1): 1–12.

Weeds, H. (2002) Strategic delay in a real options model of R&D competition. *Review of Economic Studies* 69(3): 729–747.
Whitley, R. (1999) *Divergent Capitalisms: The Social Structuring and Change of Business Systems*. Oxford: Oxford University Press.
Williamson, O.E. (1985) *The Economic Institutions of Capitalism: Firms, Markets, Relational Contracts*. New York: Free Press.
Williamson, O.E. (1988) Corporate finance and corporate governance. *Journal of Finance* 43(3): 567–591.
Wright, M., Hoskisson, R.E. and Busenitz, L.W. (2001) Firm rebirth: buyouts as facilitators of strategic growth and entrepreneurship. *Academy of Management Executive* 15(1): 111–125.
Zahra, S.A. (1995) Corporate entrepreneurship and financial performance: the case of management leveraged buyouts. *Journal of Business Venturing* 10(3): 225–247.
Zwick, T. (2002) Employee resistance against innovations. *International Journal of Manpower* 23(6): 542–552.