

THE IMPACT OF INTANGIBLE ASSETS ON FINANCIAL AND GOVERNANCE POLICIES: A UNIVARIATE ANALYSIS

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Abstract

This study analyses the impact of the level and the type of the intangible assets on six major financial and governance policies: financial structure, dividend pay-outs, managerial share ownership, external ownership concentration, board of directors' structure and auditing. These policies directly depend on the interactions between managers, shareholders and debt holders. Using a UK cross-sectional sample (374 firms for the year 2000), the results suggest that the bundles of financial and governance policies differ between levels of overall intangible asset intensity, levels of all intangible assets other than research and development (RD), categories of intangible assets (RD versus non-RD) and levels of stock of RD. Hence, the level and type of intangible assets seem to have significant impact on financial and governance policies. Different levels and/or types of intangible assets seem to require different portfolios of financial and governance policies.

Keywords: Corporate Governance; Financial Policies; Intangible Assets

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INTRODUCTION

The emergence of intangible asset intensive firms presents new challenges to several established paradigms. The first concept to be questioned is that of the “firm” itself. Nowadays, firms are “*unique combinations of physical and human capital*” (Zingales, 2000, p. 1626). “*Insiders contribute human capital or intangible assets and outside equity investors contribute most of the money to buy the required operating assets*” (Myers, 2000, p. 1008). As a consequence, long-established academic concepts (such as asset structure) need to be questioned and probably reshaped, and many key assumptions of models, such as those associated with the Modigliani-Miller theorem of irrelevance of financial policies, are no longer tenable.

As “*human capital is emerging as the most crucial asset*” (Zingales, 2000, p. 1624), managers become firms’ “residual claimants” alongside shareholders. In other words, the changes in the nature of the firm and in its assets base seem to have a large impact on the structure of the relations (in other words, the balance of power) between managers, shareholders and debt holders.

Severe agency costs and information asymmetry problems coming from intangible assets’ characteristics have obvious impact on the relationship between shareholders, managers and debt holders, and the way they share risks and returns. Given the nature of a knowledge-intensive firm, asset-substitution and under-investment effects are increasingly important. Very often, investors (shareholders and debt holders)

have limited knowledge about the technicalities of the companies in which they invest. The more important the amount of intangible assets, the greater is the scope for managerial discretionary power. Also, as intangible assets cannot serve as collateral, the risk-shifting incentive (asset-substitution risk) increases. The value of most intangible assets is endangered when bankruptcy occurs. Summing up, intangible assets are associated with significant equity and debt agency costs, information asymmetry costs, transaction and bankruptcy costs. These costs are likely to have an impact on the design of different portfolios of financial and governance policies, which are in place to align the interests of managers, debt holders and shareholders. This study aims to contribute to the understanding of this issue by studying the impact of intangible assets on financial and governance policies in the UK¹.

¹ The study of financial policies and governance structures in the UK is particularly appealing for a number of reasons. First, the UK experienced a number of spectacular corporate failures in the late eighties/early nineties, which generated a broad debate around governance issues, which led to the formulation and implementation of corporate governance codes (the Cadbury code in 1992, the Greenbury code in 1995 and the Hampel report in 1998). Second, given the prescriptive nature of these codes, unlike what happens in other countries, UK firms enjoy greater freedom to choose the mechanisms that better suit their specific circumstances. Third, empirical work in the UK has emphasised the agency theory perspective, ignoring other (complementary or competing) theoretical perspectives.

The rest of the paper is structured as follows. In the next section, we provide an overview of the theoretical foundations about interactions between intangible assets, financial policies and corporate governance theories. Next we develop testable hypotheses. Then we describe the research methodology. The sample selection process and characteristics of the sample are presented before the results and discussion of study. Finally, the paper's main conclusions are presented.

LITERATURE REVIEW

Intangible assets show a set of characteristics – namely, high risk and uncertainty, firm-specificity and human capital intensity – that make them markedly distinct from other sorts of assets. Consequently, one can argue that differences in corporate asset structures – namely the level and the nature of the intangible assets – may affect the distribution of rents among managers, shareholders and debt holders. Managers contribute with human capital, whereas debt holders and shareholders contribute with financial capital to the firm. The maximisation of the utility function of each category of stakeholder is a function of the return level, remuneration structure, risk profile, diversification level and business expertise. This suggests that the interactions among the firm's stakeholders are a complex issue in the presence of intangible assets.

Consequently, the nature of the intangible assets seems to require the use of complementary theoretical perspectives. Indeed, intangible assets have impacts on multiple, key dimensions of a firm, such as the level of non-debt tax shields, bankruptcy costs, agency costs, information asymmetry and transaction costs. This complementarity of theoretical perspectives seems particularly important for understanding the impact of intangible assets on the design of financial and governance policies.

The debt-equity choice conceivably helps to illustrate that complementarity between theoretical perspectives. The income stream from equity is random and, therefore, risky. Shareholders are entitled to a share of that stochastic profit via dividends. In contrast, the income stream from debt is fixed in the absence of bankruptcy (subject to an explicit contract) and debt holders have a senior claim on firms' assets in the event of bankruptcy (Goodacre and Tonks, 1995). Intangible assets increase both agency costs of shareholders (hidden information and hidden action problems become more severe) and agency costs of debt holders (asset substitution and under-investment issues become more important). Moreover, as the value of most intangible assets disappears when bankruptcy occurs, debt holders' senior claim does not have any value. Finally, as expenditures on intangible assets are usually treated as expenses when incurred, they generate non-interest tax shields (making "interest tax shields" redundant), leading to low debt (Bradley *et al.*, 1984; Balakrishnan and Fox, 1993). Since "asset liquidity is

an important determinant of the costs of financial distress" (Shleifer and Vishny, 1992, p. 1364) and the value of most intangible assets depends on the existence of the firm as a "going concern" (Myers, 1977), bankruptcy costs will be relatively higher in intangible asset intensive firms. As a consequence of both high non-interest tax shields and high financial distress costs, the level of debt is expected to be low in intangible assets intensive firms. In contrast, as intangible assets are associated with high levels of information asymmetry, pecking order theory and signalling arguments suggest high levels of debt.

The asymmetric information approach assumes that managers have superior information about future returns and growth opportunities of the firm. One can anticipate that the level of insiders' "superior information" is higher in intangible asset intensive firms². Signalling theory argues that managers have incentives to disclose their superior information to capital markets through their financial choices, namely through financial structure (Ross, 1977) and dividend policy (Bhattacharya, 1979). Since the intensity of the signal should depend positively on the size of the information asymmetry gap and good (low risk) firms are typically more debt-financed, the signalling arguments suggest that managers of intangible asset intensive firms should use more debt.

Within information asymmetry models, signalling theory also suggests that the "informational content of dividends" enables a reduction in the levels of information asymmetry between managers and investors about the future prospects of the firm (Ross, 1977). The credibility of dividend policy as a signal comes partially from the fact that it is too costly for "bad" firms to use it as a signalling device. So, intangible asset intensive firms, if they want to signal "good quality", should have high dividend payouts. Finally, the pecking order theory (Myers and Majluf, 1984; Myers, 1984) argues that firms select financing sources that require lower levels of information disclosure, which means preference for profit retention. As firms with more intangible assets are characterised by high information asymmetry, one anticipates that intangible asset intensive firms show low dividend payouts in order to mitigate the under-investment problem.

Agency models argue that agency costs³ are the main determinant of financial policies. The magnitude of agency costs varies from firm to firm and seems to depend on multiple factors, such as "the taste of managers", "the ease they can exercise their own preferences", "the costs of measuring the manager's

² In this vein, RD costs ratios are often used as a proxy for the size of the information asymmetry problem (e.g., Dittmar *et al.*, 2003; Noe and Rebello, 1996). More, Aboody and Lev (2000) find that officers' gains from insider trading are substantially larger in RD firms than in non-RD firms.

³ Jensen and Meckling (1976) define agency costs as the sum of monitoring expenses, bonding expenditures and the residual loss.

(agent's) performance and evaluating it", "the market for managers", "the market for the firm itself" and "the costs of monitoring and bonding activities" (Jensen and Meckling, 1976, p. 328). All these factors seem to be directly affected by the firm's level of intangible assets. Agency theory also suggests that managers, who have their non-diversifiable human capital invested in the firm, want to ensure the future viability of the firm (Fama, 1980; Zingales, 2000). Since managers are risk averse (and intangible assets investments are particularly risky), one way of reducing their overall risk is decreasing the firm's debt (Friend and Lang, 1988; Berger *et al.*, 1997). Given the relevance of managers' human capital and the asymmetry of expertise between managers and shareholders, the impact of the hidden action and hidden information problems seems crucial in the design of the financial structures in intangible assets intensive firms.

According to transaction-cost economics theory the actual firms face transaction costs, which depend on firms' characteristics. Williamson (1988) argues that financial structures depend mainly on the characteristics of their assets: redeployable assets are financed by debt while non-redeployable assets (such as most intangible assets) are financed by equity.

In the corporate governance literature, it is possible to identify two main theoretical (conflicting) perspectives: agency theory and stewardship theory. Agency theory aims to understand how the aberrant activities of the agent arise and how they can be mitigated. Assuming that agents respond to external incentives that reward performance, the principal has to set up incentive contracts conditional on the achievement of certain results by managers. Two kinds of difficulties arise when writing and enforcing such incentive contracts: the hidden action phenomenon (also known as "moral hazard") and the hidden information problem (often referred as "adverse selection"). Since the incompleteness level of the contracts among managers, shareholders and debt holders seems to increase with intangible asset intensity (due to the characteristics of intangible assets), there is room for an increasing demand for devices to fill those "gaps". Contrasting with this perspective based on conflicting interests, the stewardship approach defends the existence of a collaborative relationship between managers and shareholders. The adoption of one of these two divergent perspectives has significant impact on the choice of devices that can be used as monitoring mechanisms and the nature of the relationship (complementary or substitutability) between them.

Summing up, there are many arguments – non-debt tax shields, bankruptcy costs, agency costs, information asymmetry and transaction costs – suggesting the relevance of the characteristics of intangible assets on the design of the financial structures and governance policies. As a result, if one restricts the analysis to one theoretical framework,

some important arguments could be neglected. So, such arguments are incorporated in the study.

TESTABLE HYPOTHESES

Within the theoretical framework just presented, the objective of this section is to formulate the hypotheses concerning the impact of the level and the type of the intangible assets on financial and governance policies. The result of the interactions among debt holders, shareholders and managers is reflected in six major financial and governance policies: financial structure, dividend policy, managerial equity ownership, external block ownership, board structure and audit demand.

As intangible assets are not a homogeneous category, different types of intangibles assets could be associated with different financing and monitoring policies. However, the data available about the components of the intangible assets limits the identification of different kinds of intangible assets. As a consequence it is possible to identify only three measures associated with different sort of intangible assets. One measure captures the overall level of intangible asset intensity, another the accumulated stock of RD expenditures, and a "residual" variable captures all intangible assets other than RD. Consequently, as the kind of arguments for intangible assets in general are valid for both intangible assets other than RD and for RD, hypotheses concerning the impact on each financial and governance policy of the level and type of intangible assets (more intangible asset intensive firms or less intangible asset intensive firms; more non-RD intangible asset intensive firms or less non-RD intangible asset intensive firms; more RD intensive firms or less RD intensive firms; and, RD firms or non-RD firms) are presented in the same subsection. Finally, since different theories suggest that intangible assets influence the level of each policy in different directions, it is not predictable which theoretical explanation(s) will dominate⁴. As a result, no particular direction is suggested for each hypothesis.

Financial Structure - Intangible asset intensive firms are expected to use more equity to save the high debt costs resulting from asset substitution and under-investment problems (Myers, 1977). However, this choice prevents the use of debt to mitigate potential over-investment problems (Jensen, 1986). Transaction-cost economics theory reinforces the preference for equity to finance intangible assets since it enables significant transaction costs savings (Williamson, 1988)⁵. In its turn, as non-debt tax shields are

⁴ Moreover, as the different theories do not share the same set of assumptions, it cannot be argued that they are competing theories.

⁵ "By definition, firm-specific assets cannot be costlessly redeployed to other uses and therefore cannot be used effectively as collateral for borrowing. Many firm specific assets are intangibles – for example R&D and advertising – and difficult to measure and evaluate" (Balakrishnan and Fox, 1993, p.3).

potentially redundant and the value of most intangible assets is endangered when bankruptcy occurs (Myers, 1984), the trade-off theory suggests a negative relationship between intangible assets and leverage (Castanias, 1983). Managerial self-interest reinforces the preference for equity since the uncertainty associated with intangible assets imposes additional risks on managers (whose human capital is not diversified) (Fama, 1980; Friend and Lang, 1988; Berger *et al.*, 1997). Finally, less collateralisable assets seem to signal a high overall risk of the firm. As a result, intangible assets in general show a negative debt capacity (not a null debt capacity as usually thought) (Barclay *et al.*, 2001).

In contrast, information asymmetry models predict a positive relationship between intangible assets and leverage. Within these models, the pecking order theory predicts a preference for debt (after profit retention) since it requires less information disclosure than an equity issue, while the signalling framework argues that, as safe projects are mainly debt financed, intangible assets must be mainly debt financed to signal their low level of risk.

So, we hypothesise that:

H1a₀: *The financial structure is the same in more intangible asset intensive firms as in less intangible asset intensive firms, ceteris paribus.*

H1a₁: *The financial structure is not the same in more intangible asset intensive firms as in less intangible asset intensive firms, ceteris paribus.*

H1b₀: *The financial structure is the same in more non-RD intangible asset intensive firms as in less non-RD intangible asset intensive firms, ceteris paribus.*

H1b₁: *The financial structure is not the same in more non-RD intangible asset intensive firms as in less non-RD intangible asset intensive firms, ceteris paribus.*

H1c₀: *The financial structure is the same in RD firms as in non-RD firms, ceteris paribus.*

H1c₁: *The financial structure is not the same in RD firms as in non-RD firms, ceteris paribus.*

H1d₀: *The financial structure is the same in more RD intensive firms as in less RD intensive firms, ceteris paribus.*

H1d₁: *The financial structure is not the same in more RD intensive firms as in less RD intensive firms, ceteris paribus.*

Dividend Policy - As financial markets require high premiums for debt due to high agency costs and high discounts in new equity issues due to large information asymmetries, profit retention becomes the lowest cost-funding source for intangible asset intensive firms⁶. Hence, RD intensive firms tend to

pay low dividends (Chan *et al.*, 2001), a finding consistent both with the pecking order (Myers and Majluf, 1984) and agency cost theories⁷. However, this prediction contrasts with signalling arguments (Bhattacharya, 1979), since intangible asset intensive firms should use high dividend payments to signal the high quality of their investments.

Dividend policy can also be seen as a governance device. It reduces the size of potential free cash flow problems and, hence, agency costs of equity, because it directly increases debt or reduces cash (Jensen, 1986). It also increases the probability of new equity issues, exposing the firm to further external monitoring by banks, securities exchange and potential capital suppliers (Easterbrook, 1984; Rozeff, 1982). Nevertheless, Rozeff (1982, p. 258) alerts that, “*increased dividends relative to earnings lower agency costs but raise the transactions costs of external financing. The sum of these two opposing costs determines an optimal dividend pay out*”.

In the presence of conflicting theoretical propositions, we hypothesise⁸:

H2a₀: *The dividend policy is the same in more intangible asset intensive firms as in less intangible asset intensive firms, ceteris paribus.*

H2a₁: *The dividend policy is not the same in more intangible asset intensive firms as in less intangible asset intensive firms, ceteris paribus.*

H2b₀: *The dividend policy is the same in more non-RD intangible asset intensive firms as in less non-RD intangible asset intensive firms, ceteris paribus.*

H2b₁: *The dividend policy is not the same in more non-RD intangible asset intensive firms as in less non-RD intangible asset intensive firms, ceteris paribus.*

H2c₀: *The dividend policy is the same in RD firms as in non-RD firms, ceteris paribus.*

H2c₁: *The dividend policy is not the same in RD firms as in non-RD firms, ceteris paribus.*

H2d₀: *The dividend policy is the same in more RD intensive firms as in less RD intensive firms, ceteris paribus.*

H2d₁: *The dividend policy is not the same in more RD intensive firms as in less RD intensive firms, ceteris paribus.*

Managerial Equity Ownership - Jensen and Meckling (1976) argue that managerial equity holdings mitigate agency costs by imposing on managers the

like Chan *et al.* (2001) in the USA, they also find that there is an RD effect in the cross-section of stock returns, with average stock returns increasing as the ratio of a proxy for the stock of RD capital to market value increases.

⁷ Empirical evidence about the Pecking Order Theory is mixed (Harris and Raviv, 1991).

⁸ The preference for profit retention is found in UK RD firms (Seaton and Walker, 2001) and UK companies in general (Vafeas and Theodorou, 1998).

⁶ Al-Horani *et al.* (2003) find that the average monthly return for RD firms in the UK is similar to that for non-RD firms, suggesting that the existence of RD does not make a firm more risky than firms without RD. Nonetheless,

costs of their non-maximising behaviours in proportion to their shareholdings. Moreover, managerial holdings, introducing fewer constraints, can lead to management entrenchment (Morck *et al.*, 1988; McConnell and Servaes, 1990; Demsetz and Villalonga, 2001 for US evidence; Short and Keasey, 1999 for UK evidence). Since intangible assets are harder to monitor (especially in early stages), the scope for opportunism increases. So, under the optimal contractual regime, agency theory predicts high managerial equity ownership in intangible asset intensive firms (Himmelberg *et al.*, 1999). This prediction ignores, however, managerial risk aversion and the source of managerial entrenchment.

Incorporating the opposing arguments, we hypothesise that:

H3a₀: *Managerial equity ownership is the same in more intangible asset intensive firms as in less intangible asset intensive firms, ceteris paribus.*

H3a₁: *Managerial equity ownership is not the same in more intangible asset intensive firms as in less intangible asset intensive firms, ceteris paribus.*

H3b₀: *Managerial equity ownership is the same in more non-RD intangible asset intensive firms as in less non-RD intangible asset intensive firms, ceteris paribus.*

H3b₁: *Managerial equity ownership is not the same in more non-RD intangible asset intensive firms as in less non-RD intangible asset intensive firms, ceteris paribus.*

H3c₀: *Managerial equity ownership is the same in RD firms as in non-RD firms, ceteris paribus.*

H3c₁: *Managerial equity ownership is not the same in RD firms as in non-RD firms, ceteris paribus.*

H3d₀: *Managerial equity ownership is the same in more RD intensive firms as in less RD intensive firms, ceteris paribus.*

H3d₁: *Managerial equity ownership is not the same in more RD intensive firms as in less RD intensive firms, ceteris paribus.*

External Equity Ownership - Agency theory suggests that concentrated ownership creates incentives to actively monitor because large shareholders appropriate a larger proportion of monitoring benefits (Shleifer and Vishny, 1997; Demsetz and Lehn, 1985). However, since investors can diversify their portfolios, Fama (1980) argues that shareholders seem uninterested in wielding direct control of the management of any individual firm (in opposition to Jensen and Meckling's hypothesis).

Where the scope for opportunistic decisions by managers increases, the benefits of closer monitoring are potentially larger. The benefits of ownership also seem to increase with the instability in the firm's environment, "because in less predictable environments, however, managerial behaviour simultaneously figures more prominently in a firm's

fortunes and becomes more difficult to monitor" (Demsetz and Lehn, 1985, p. 1159). Therefore, the nature of intangible assets suggests that intangible asset intensive firms must exhibit more concentrated external ownership. However, as RD spending increases, the technology becomes more specific and, as a consequence, external monitoring by shareholders becomes less effective (Agrawal and Knoeber, 1996; Zeckhauser and Pound, 1990). Finally, Bushman *et al.* (2000) (in Bushman and Smith, 2001) and La Porta *et al.* (2000) consider the existence of a positive relationship between the information provided by the financial reporting system (which is potentially inadequate for intangible assets) and the demand for block equity ownership. Shareholders would react to high levels of information asymmetry by diversifying their portfolios.

So, once more, in the presence of conflicting arguments, we hypothesise that:

H4a₀: *External equity ownership is the same in more intangible asset intensive firms as in less intangible asset intensive firms, ceteris paribus.*

H4a₁: *External equity ownership is not the same in more intangible asset intensive firms as in less intangible asset intensive firms, ceteris paribus.*

H4b₀: *External equity ownership is the same in more non-RD intangible asset intensive firms as in less non-RD intangible asset intensive firms, ceteris paribus.*

H4b₁: *External equity ownership is not the same in more non-RD intangible asset intensive firms as in less non-RD intangible asset intensive firms, ceteris paribus.*

H4c₀: *External equity ownership is the same in RD firms as in non-RD firms, ceteris paribus.*

H4c₁: *External equity ownership is not the same in RD firms as in non-RD firms, ceteris paribus.*

H4d₀: *External equity ownership is the same in more RD intensive firms as in less RD intensive firms, ceteris paribus.*

H4d₁: *External equity ownership is not the same in more RD intensive firms as in less RD intensive firms, ceteris paribus.*

Board Structure - Agency theory argues that, as a result of their independence, non-executive directors (NEDs) are powerful in monitoring executive directors' actions (Jensen and Meckling, 1976). NEDs have incentives to develop their reputations as experts in management control (Fama and Jensen, 1983; Vafeas and Theodorou, 1998). However, some authors argue that boards dominated by NEDs can result in oppressive strategic actions, excessive monitoring, lack of business knowledge and lack of real

independence (Morck *et al.*, 1988; Haniffa and Cooke, 2002)⁹.

Although intangible asset intensive firms are characterised by high managerial discretionary power (due to the severity of hidden information and hidden action problems) and NEDs are a low absolute cost device, the effectiveness of NEDs as monitors and sources of expertise is debatable given the need for a significant amount of very specialized firm-specific expertise. The following hypotheses reflect this uncertainty about the relative strength of the conflicting arguments.

H5a₀: *The board structure is the same in more intangible asset intensive firms as in less intangible asset intensive firms, ceteris paribus.*

H5a₁: *The board structure is not the same in more intangible asset intensive firms as in less intangible asset intensive firms, ceteris paribus.*

H5b₀: *The board structure is the same in more non-RD intangible asset intensive firms as in less non-RD intangible asset intensive firms, ceteris paribus.*

H5b₁: *The board structure is not the same in more non-RD intangible asset intensive firms as in less non-RD intangible asset intensive firms, ceteris paribus.*

H5c₀: *The board structure is the same in RD firms as in non-RD firms, ceteris paribus.*

H5c₁: *The board structure is not the same in RD firms as in non-RD firms, ceteris paribus.*

H5d₀: *The board structure is the same in more RD intensive firms as in less RD intensive firms, ceteris paribus.*

H5d₁: *The board structure is not the same in more RD intensive firms as in less RD intensive firms, ceteris paribus.*

Audit Demand - A key element of the financial reporting process is to guarantee an independent verification of the financial statements prepared by the firm's management (Simunic, 1980; Chan *et al.*, 1993).

Although a weaker internal control system (Jensen, 1993), a lower reliability of the financial reporting system (Lev, 2001; Lev and Zarowin, 1999), a greater complexity of the auditing work (O'Sullivan, 2000), and a lower observability of managerial actions (Tsui *et al.*, 2001) suggest higher audit costs in intangible asset intensive firms, it is also apparent that most problems associated with fixed asset valuation, inventories and receivables are far less important (if not non-existent) and, most importantly, as most

intangible assets are not disclosed in the balance sheet the scope for auditing work seems quite restricted in intangible asset intensive firms¹⁰. So, the impact of the level and type of intangible assets on the level of audit demand remains undetermined. Consequently, we hypothesise that:

H6a₀: *Audit demand is the same in more intangible asset intensive firms as in less intangible asset intensive firms, ceteris paribus.*

H6a₁: *Audit demand is not the same in more intangible asset intensive firms as in less intangible asset intensive firms, ceteris paribus.*

H6b₀: *Audit demand is the same in more non-RD intangible asset intensive firms as in less non-RD intangible asset intensive firms, ceteris paribus.*

H6b₁: *Audit demand is not the same in more non-RD intangible asset intensive firms as in less non-RD intangible asset intensive firms, ceteris paribus.*

H6c₀: *Audit demand is the same in RD firms as in non-RD firms, ceteris paribus.*

H6c₁: *Audit demand is not the same in RD firms as in non-RD firms, ceteris paribus.*

H6d₀: *Audit demand is the same in more RD intensive firms as in less RD intensive firms, ceteris paribus.*

H6d₁: *Audit demand is not the same in more RD intensive firms as in less RD intensive firms, ceteris paribus.*

RESEARCH METHOD AND VARIABLE MEASUREMENT

RESEARCH METHOD

Regarding the research objective of this study, the model specification aims to test the existence of differences in financial and governance policies between levels and types of intangible assets. These differences must exist for the overall set of financial and governance policies, and for each financial and governance policy.

As a result of the intangible assets' characteristics, intangible asset intensive firms are associated with higher agency, information asymmetry, bankruptcy and transaction costs relative to more traditional firms. These costs can also differ between types of intangible assets. As a consequence, according to the level and type of intangible asset, it is expected that managers, shareholders and debt holders put in place an adequate portfolio of financial policies and governance structures meant to minimise overall costs. Therefore, it is hypothesised that firms with different levels and

⁹ In its turn, the resource dependency theory argues that boards are a potentially useful mechanism to deal with external dependency, reduce transaction costs and decrease environmental uncertainty. Board members provide four kinds of resources: advice, legitimacy, communication channels with external organisations, and support in getting resources from outside the firm (Lynall *et al.*, 2003).

¹⁰ Using UK data, O'Sullivan (2000) finds a positive relationship between RD costs and audit fees because a more specialised staff is required.

types of intangible assets present different portfolios of financial and governance policies. Put simply, an optimal portfolio of financial and governance policies for a given level and/or kind of intangible asset might not be optimal for a different level and/or type of intangible asset.

We investigate the existence of differences in two financial policies (i.e., financial structure (DEBT) and dividend policy (POUT)) and four governance devices (i.e., managerial equity ownership (DIROWN), external block ownership (OUTOWN), board structure (BOARD) and audit demand (AUDIT)) between levels and types of intangible assets. Our model specification needs to be able to check for the existence of significant mean differences between groups on each of the six different financial and governance variables individually (univariate tests), and on the portfolio of the six financial and governance variables altogether (multivariate tests) between groups. These groups (our independent variable) correspond to different levels or types of intangible assets. In the univariate tests (t tests and Mann-Whitney-Wilcoxon (M-W-W) tests), therefore, the null hypothesis assesses the equality of dependent variable (each of the six financial and governance variables) means between two groups. Meanwhile, in multivariate analysis of variance (henceforth MANOVA), the null hypothesis tests the equality of vectors of means on several dependent variables (the six financial and governance variables altogether) between two groups.

VARIABLE MEASUREMENT

INTANGIBLE ASSET VARIABLES - Intangible assets are not homogeneous. The measure of the level of intangible asset intensity should reflect the diverse nature of its components whenever they are associated with different levels of agency costs, information asymmetry, financial distress costs, transaction costs or tax-shield effects. The only internally generated intangible asset that has separate disclosure is RD, as an asset in the balance sheet (but, as just mentioned, only under very strict conditions) and as an expense in the profit and loss account¹¹. Costs incurred with other intangible assets are not separately disclosed. Alternative information sources about intangible assets other than RD are not “complete”¹². Consequently, any measure of advertising expenses is potentially inaccurate.

Since market values are available and reflect the value of all assets, and there is financial information available about one intangible asset component (RD),

¹¹ There is another ‘intangible asset’ – goodwill – that is disclosed in the financial statements.

¹² For instance, the AC Meal Nielsen database does not match the sample resulting from the Datastream International database and reports advertising expenses incurred with advertisement agencies but does not provide information about “in-house” advertising expenses.

proxies for the accumulated stock of RD and the level of all intangible assets other than RD can be developed. As argued previously, it is anticipated that RD is associated with more severe agency costs, information asymmetry, transaction costs and bankruptcy problems than other types of intangible assets. In this way, more than a single measure of the level of intangible asset intensity can be used to investigate the impact of the level and type of intangible assets on financial and governance policies. Thus, three variables are used to measure the level and the type of a firm’s intangible assets: one variable aims to measure all intangible assets, another variable the amount of intangible assets other than RD and, finally, a further variable measures the stock of RD. This seems to be the only possible approach, given the availability of data in the UK for the period analysed. The definition of the three measures of intangible assets follows.

All intangible assets (henceforth ALLIA): ALLIA is a market-based measure of the amount of all intangible assets. Since the market value of the firm reflects the value of tangible and intangible assets, the ratio “Market value of the firm/Assets” is used to reflect the importance of all intangible assets.

The **stock of RD expenditures** (henceforth STRD): STRD is an accounting-based variable that aims to measure the accumulated stock of past RD expenditures (Item 119 of Datastream International). This stock of RD expenditures is subsequently deflated by the market value of the firm¹³. Following Chan *et al.* (2001) and Lev and Sougiannis (1996), the undeflated stock of RD is calculated as:

$$RD_0 + 0.8 * RD_{.1} + 0.6 * RD_{.2} + 0.4 * RD_{.3} + 0.2 * RD_{.4}$$

Intangible assets other than RD (henceforth OTHERIA). OTHERIA is a “residual” variable since it aims to capture the amount of all intangible assets other than RD. Since the market value reflects the value of tangible and intangible assets, (Market value - (Assets + STRD)) reflects the amount of all intangible assets other than RD. Hence, the ratio (Market value - (Assets + STRD)) / Market value is used to measure the level of all types of intangible assets other than RD. Consequently, OTHERIA reflects the limitations of the variables ALLIA and STRD just discussed.

KEY FINANCIAL AND GOVERNANCE VARIABLES - This sub-section presents the computation process and discusses alternative measures for each financial and governance policy.

¹³ As STRD is defined by the ratio between the stock of RD expenditures (an accounting-based number) and the market value of the firm (a market-based number), a high STRD ratio means that capital markets do not recognise the merits of past RD costs as generators of future cash flows. Hence, *ceteris paribus*, a high STRD ratio suggests a low level of “good” past RD expenditures, and a low STRD ratio suggests a high level of “good” past RD expenditures.

Financial Structure: The financial structure variable is calculated as the ratio of the book value of all liabilities to the market value of the firm¹⁴.

Dividend Policy: Dividend policy is measured as the ratio of dividends per share to net earnings per share – full tax¹⁵.

Managerial Equity Ownership: This variable measures the proportion of the company's shares directly or indirectly controlled by executive members of the board, their families or family trusts (beneficial ownership).

External Equity Ownership: This variable measures the proportion of shares owned by all reported external shareholders. As UK listed firms need to disclose the identity and ownership levels of shareholdings in excess of 3% of total equity, this variable measures the percentage of shares owned by investors holding more than 3% of the share capital. Given that 3% represents a large investment, we use the sum of all shareholdings above 3% as a measure of external block equity ownership.

Board Structure: This variable is calculated by dividing the number of non-executive directors by the number of all board members¹⁶.

Audit Demand: This variable is the auditors' remuneration deflated by the market value of the firm¹⁷.

SAMPLE SELECTION AND CHARATERISTICS

SAMPLE SELECTION

¹⁴ From a conceptual perspective, debt should be measured using market values. However, as practitioners tend to think in terms of book values and the book value of debt seems to be strongly related to the book value of the assets-in-place, the misspecification due to using book values is hopefully small (Myers, 1977, Marsh, 1982, Titman and Wessels, 1988, Hirschey and Weygandt, 1985). Moreover, as market values of the debt fluctuate, it is difficult to use it both in terms of empirical research and decision making by managers (Jalilvand and Harris, 1984). Finally, spurious relationships may arise between the market value of the debt and the firm's real characteristics when it is assumed that capital structures adjust gradually to their target levels (Jensen *et al.*, 1992).

¹⁵ Lintner (1956) argues that firms define their long-term dividend policy target as a fraction of their long-term earnings (not as a fraction of their unpredictable equity market value or random income items). Since annual payout ratios might not accurately reflect a firm's dividend policy, an average of last four payout ratios is calculated.

¹⁶ The Cadbury Report (1992) recommends that companies use a greater proportion of NEDs. A minimum of three NEDs is even suggested. Empirical evidence using UK data about the impact of NEDs on a firm's performance is mixed (Weir *et al.*, 2002).

¹⁷ Inaccuracies in the estimation of annual audit fees, the inclusion of non-audit related costs and the group structure of the auditee potentially introduce some measurement bias in this variable (Chan *et al.*, 1993).

The initial sample includes all UK companies listed on the London Stock Exchange (LSE). A total of 1,427 are found in the FBRIT file (Datastream International database) at the end of the year 2000. Financial companies (banks, insurance, life insurance and investment companies) (226 firms) are excluded since they face different regulatory environments than those of the other companies. Companies (404 firms) with missing data in at least one variable are also excluded. Companies with average negative payouts (52 companies) and average payouts ratios above 1 (31 companies) are excluded from the sample due to the lack of economic meaning of these values. Companies (12 firms) with dual class shares are also excluded because they potentially introduce distortion to the analysis (Short and Keasey, 1999; Conyon and Florou, 2002). Finally, in order to assure that firms included in the sample are in a "steady state" (for instance, they are not too young, they have not been recently listed), the existence of financial data in the Datastream database for five years is required. This requirement leads to the exclusion of 328 firms. As a result, the final sample size is 374 companies.

SAMPLE CHARACTERISTICS

Table 1 presents the sample' descriptive statistics for the nine variables used throughout this research.

Some important conclusions arise from the table of descriptive statistics just presented. The differences between the means and the medians of ALLIA suggest the existence of highly intangible asset intensive firms alongside firms with a low level of intangible asset intensity in our sample. In terms of the level of each intangible asset component, the mean level of STRD is around 2% (with a median of 0.00). The mean value of OTHERIA is around 18% (with a median around 19%).

Three important implications come to light from the above statistics. First, the large changes observed in the ratios seem to confirm the expected market uncertainty about the true value of the intangible assets. In this regard, it seems particularly important to emphasise the large variations in the STRD ratio. These variations suggest that, as expected, the market uncertainty about the value of the RD assets is particularly high when compared with other sorts of intangible assets. Second, the amount of intangible assets other than RD (variable OTHERIA) is much more important than the stock of RD. Third, comparing the means and the medians of the two variables, the large differences between the mean and the median values, coupled with high positive skewness and positive kurtosis (values not disclosed) for STRD, suggests that most firms do not disclose RD expenditures. In contrast, the mean and the median values for OTHERIA are quite similar, suggesting that the OTHERIA intensity is spread across all sorts of firms.

Table 1. Summary of Descriptive Statistics of the Variables
Sample: 374 UK Listed Firms, Time-period: year 2000

Variables	Mean	Median	Std. Dev.	Min.	Max.	1st Quart.	3rd Quart.
Intangible asset variables							
ALLIA	2.02	1.27	2.59	0.46	25.44	0.95	2.07
STRD	0.02	0.00	0.48	0.00	0.41	0.00	0.00
OTHERIA	0.18	0.19	0.41	-1.2	0.96	-0.07	0.50
Financial and governance variables							
DEBT	0.40	0.38	0.24	0.01	0.99	0.21	0.57
POUT	0.35	0.36	0.25	0.00	0.97	0.14	0.51
DIROWN	0.08	0.00	0.15	0.00	0.67	0.00	0.09
OUTOWN	0.36	0.34	0.20	0.03	0.97	0.20	0.49
BOARD	0.47	0.50	0.15	0.00	0.83	0.38	0.57
AUDIT	0.00	0.00	0.00	0.00	0.01	0.00	0.00

Notes: ALLIA represents the market value of the firm deflated by the book value of assets; STRD represents the stock of RD expenditures deflated by the market value of the firm; OTHERIA stands for all intangible assets other than RD deflated by the market value of the firm; DEBT represents the debt level deflated by the market value of the firm; POUT is the dividend payout ratio; DIROWN represents managerial equity ownership; OUTOWN stands for the outside block ownership; BOARD represents the board of directors' structure; AUDIT stands for the level of audit demand deflated by the market value of the firm.

DEBT represents on average 40% (with a median of 38%). Considering the payout ratios (computed as an average of the payout ratios of the last four years), about 35% of the firms' profits are distributed to shareholders through dividend payouts (variable POUT). For equity ownership structure, the mean of DIROWN is around 8% (with a median of 0%). Hence, DIROWN shows positive skewness, suggesting the existence of high managerial ownership in some firms (confirmed by the high maximum values for the variable). The mean of OUTOWN is around 36% with a median around 34%. Hence, on average, "small" investors (external investors with less than 3% of all shares) hold about 56% of the capital of a typical UK listed firm. This finding provides strong evidence about the separation of ownership and control in the UK. However, as most small investors do not exercise their voting rights, the effective power of the voting shareholders is well above their nominal shareholding. About 47% (with a median of 50%) of the board members of the typical UK listed company are NEDs. The mean for AUDIT is around 0% of the market value of the firm (with a median around 0%).

RESULTS AND DISCUSSION

EMPIRICAL RESULTS

This section presents the empirical results concerning the impact of different levels/categories of intangible assets on the six financial and governance policies explored in this study. In order to make the presentation clear, this section is divided into four sub-sections. In the first, the impact of the overall level of

intangible asset intensity on the six financial and governance policies is presented. So, hypotheses H1a, H2a, H3a, H4a, H5a and H6a are tested. The second presents the impact of intangible assets other than RD on the six financial and governance policies, that is the empirical tests regarding H1b, H2b, H3b, H4b, H5b and H6b. In the third, two sub-samples based on the existence or not of RD expenses are used to test hypotheses H1c, H2c, H3c, H4c, H5c and H6c. In this way, the impact of different categories of intangible assets (RD and other intangible assets than RD) on the six financial and governance policies is investigated. Finally, the fourth presents the impact of different levels of RD intensity on the six financial and governance policies, testing hypotheses H1d, H2d, H3d, H4d, H5d and H6d.

Each table reports the mean values for intangible asset intensity, financial and governance variables for the year 2000. Pillai's Trace statistics, t and Mann-Whitney-Wilcoxon tests results follow each table^{18,19}.

¹⁸ Pillai's Trace test is used (instead of Wilks' Lambda) because Box's M test is significant (suggesting that the observed covariance matrices of the dependent variables are not equal across groups of firms).

¹⁹ t tests assume a normal distribution for the population from which the sample is selected. The descriptive show that DEBT, POUT, OUTOWN and BOARD present mean values very close to the median values, while DIROWN and AUDIT present important differences between their means and median values, suggesting the existence of significant skewness in the variables' distribution and, therefore, the nonexistence of a

The Overall Level of Intangible Asset Intensity

The following table (Table 2) reports the statistical results for intangible asset intensity (ALLIA) and the six financial and governance variables investigated in this study when the samples are divided in two groups based on the ALLIA variable (i.e., the variable that measures the overall level of intangible assets). So, results provide statistical evidence to test hypotheses H1a (DEBT), H2a (POUT), H3a (DIROWN), H4a (OUTOWN), H5a (BOARD) and H6a (AUDIT).

There is strong statistical evidence (Pillai's trace statistic) that the bundle of financial and governance policies differs between the two groups of firms. As expected, ALLIA is statistically different between the two levels of overall intangible asset intensity. In terms of financial and governance policies, DEBT, OUTOWN and AUDIT show significant differences between the two groups of firms (so, the null hypotheses H1a, H4a and H6a are rejected), while POUT, DIROWN and BOARD do not show significant differences between the two levels of ALLIA.

normal distribution. Fortunately, the violation of this assumption is not critical, since the central limit theorem suggests that, with sufficiently large samples, the sample distributions of means are normally distributed regardless of the variables' distributions (Tabachnick and Fidell, 2001). The final sizes of our samples and sub-samples seem to guarantee that the normality assumption for the distribution of sample means is met.

The Level of Intangible Assets Other Than RD Assets For Non-RD Firms

Table 3 reports the results for intangible asset other than RD intensity and the six financial and governance variables investigated in this study when the sub-sample of non-RD firms is divided into two groups based on OTHERIA – the variable measuring the level of all intangible assets other than RD. Hence, results provide statistical evidence to test hypotheses H1b (DEBT), H2b (POUT), H3b (DIROWN), H4b (OUTOWN), H5b (BOARD) and H6b (AUDIT).

The results just presented in the table above are very similar to the results presented in Table 2 of the previous sub-section. Therefore, the level of “noise” resulting from the mixture of RD with other sorts of intangible assets does not seem to significantly affect the nature of the results.

RD Firms versus non-RD Firms

The following table (Table 4) reports the statistical results for RD intensity and intangible assets other than RD, and the six financial and governance variables investigated in this study when the whole sample is divided into two groups based on the existence of reported RD activities in the last five years. So, hypotheses H1c (DEBT), H2c (POUT), H3c (DIROWN), H4c (OUTOWN), H5c (BOARD) and H6c (AUDIT) are tested.

Table 2. MANOVA, t and M-W-W Tests Results for Intangible Asset Intensity, Financial and Governance Variables - Year 2000

MANOVA test: Pillai's trace = 0.43 - F value = 46.78; Sig.0.00							
Mean Values by Group of Firms							
GROUP	ALLIA	DEBT	POUT	DIROWN	OUTOWN	BOARD	AUDIT
High ALLIA (n=187)	3.10	0.25	0.33	0.08	0.32	0.48	0.00
Low ALLIA (n=187)	0.93	0.55	0.37	0.08	0.39	0.46	0.00
All sample	2.02	0.40	0.35	0.08	0.36	0.47	0.00
t tests							
GROUP	ALLIA	DEBT	POUT	DIROWN	OUTOWN	BOARD	AUDIT
High ALLIA vs Low ALLIA	***	**	-	-	**	+	**
M-W-W tests							
GROUP	ALLIA	DEBT	POUT	DIROWN	OUTOWN	BOARD	AUDIT
High ALLIA vs Low ALLIA	***	**	-	-	**	-	**

Notes: ALLIA represents the market value of the firm deflated by the book value of assets; DEBT represents the debt level deflated by the market value of the firm; POUT is the dividend payout ratio; DIROWN represents managerial equity ownership; OUTOWN stands for outside block ownership; BOARD represents the board of directors' structure; AUDIT stands for the level of audit fees deflated by the market value of the firm. ** Significance level of 0.01 * Significance level of 0.05 (two-tail tests).

Table 3. MANOVA, t and M-W-W Tests Results for Other Intangible Assets Intensity, Financial and Governance Variables – Year 2000

MANOVA test: Pillai's trace = 0.38 - F value = 26.32; Sig.0.00							
Mean Values by Group of Firms							
GROUP	OTHERIA	DEBT	POUT	DIROWN	OUTOWN	BOARD	AUDIT
High OTHERIA (n=133)	0.48	0.29	0.33	0.10	0.34	0.46	0.00
Low OTHERIA (n=133)	-0.16	0.56	0.36	0.10	0.40	0.45	0.00
All sample	0.16	0.43	0.34	0.10	0.37	0.46	0.00
t tests							
GROUP	OTHERIA	DEBT	POUT	DIROWN	OUTOWN	BOARD	AUDIT
High OTHERIA vs Low OTHERIA	***	**	-	-	**	+	**
M-W-W tests							
GROUP	OTHERIA	DEBT	POUT	DIROWN	OUTOWN	BOARD	AUDIT
High OTHERIA vs Low OTHERIA	***	**	-	-	**	-	**

Notes: OTHERIA represents the level of all intangible assets other than RD deflated by the market value of the firm; DEBT represents the debt level deflated by the market value of the firm; POUT is the dividend payout ratio; DIROWN represents managerial equity ownership; OUTOWN stands for outside block ownership; BOARD represents the board of directors' structure; AUDIT stands for the level of audit fees deflated by the market value of the firm. ** Significance level of 0.01 * Significance level of 0.05 (two-tail tests).

Table 4. MANOVA, t and M-W-W Tests Results for Non-RD/RD Intensity, Financial and Governance Variables – Year 2000

MANOVA test: Pillai's trace = 0.08 - F value = 5.22; Sig.0.00

Mean Values by Group of Firms

GROUP	STRD	OTHERIA	DEBT	POUT	DIROWN	OUTOWN	BOARD	AUDIT
RD firms (n=108)	0.06	0.25	0.34	0.37	0.05	0.32	0.50	0.00
Non-RD firms (n=266)	0.00	0.16	0.43	0.34	0.10	0.37	0.46	0.00
All sample	0.02	0.18	0.40	0.35	0.08	0.36	0.47	0.00

t tests

GROUP	STRD	OTHERIA	DEBT	POUT	DIROWN	OUTOWN	BOARD	AUDIT
RD firms vs Non-RD firms	***	+	**	+	**	*	***	*

M-W-W tests

GROUP	STRD	OTHERIA	DEBT	POUT	DIROWN	OUTOWN	BOARD	AUDIT
RD firms vs Non-RD firms	***	+	**	+	**	*	***	-

Notes: STRD stands for the stock of RD expenditures deflated by the market value of the firm; OTHERIA represents the level of all intangible assets other than RD deflated by the market value of the firm; DEBT represents the debt level deflated by the market value of the firm; POUT is the dividend payout ratio; DIROWN represents managerial equity ownership; OUTOWN stands for outside block ownership; BOARD represents the board of directors' structure; AUDIT stands for the level of audit fees deflated by the market value of the firm. ** Significance level of 0.01 * Significance level of 0.05 (two-tail tests).

When one adopts a grouping criterion of firms based on the existence of consistent RD expenditures in the last five years, there is strong statistical evidence (Pillai's trace statistic) that the bundle of financial and governance policies differs between the two groups of firms. Results show some interesting patterns, which contrast with results presented in the two previous subsections. Although DEBT follows the same pattern, OUTOWN and AUDIT now present an ambiguous pattern (H4c and H6c are rejected). DIROWN decreases with the existence of RD activities (H3c0 is rejected). POUT is unrelated to the existence of RD (H2c is not rejected). BOARD is significantly higher in the RD group of firms than in the non-RD group of firms (H5c is rejected). As in previous comparisons,

POUT does not differ between the two groups of firms (H2c is not rejected).

The Level of RD Assets

The following table (Table 5) reports the statistical results for RD and intangible assets other than RD, and the six financial and corporate governance variables when the sub-sample of RD firms is divided into two groups (the high STRD group and the low STRD group) based on the STRD variable (i.e., the variable measuring the accumulated stock of RD expenditures in the last five years). So, hypotheses H1d (DEBT), H2d (POUT), H3d (DIROWN), H4d (OUTOWN), H5d (BOARD) and H6d (AUDIT) are tested.

Table 5. MANOVA, t and M-W-W Tests Results for RD Intensity, Financial and Governance Variables – Year 2000**MANOVA test: Pillai's trace = 0.25 - F value = 5.62; Sig.0.00****Mean Values by Group of Firms**

GROUP	STRD	OTHERIA	DEBT	POUT	DIROWN	OUTOWN	BOARD	AUDIT
High STRD (n=54)	0.10	0.15	0.35	0.31	0.07	0.37	0.48	0.00
vs Low STRD (n=54)	0.07	0.35	0.33	0.43	0.03	0.27	0.52	0.00
	0.06	0.25	0.34	0.37	0.05	0.32	0.50	0.00

t tests

GROUP	STRD	OTHERIA	DEBT	POUT	DIROWN	OUTOWN	BOARD	AUDIT
High STRD firms vs Low STRD firms	***	*	+	*	+	***	-	***

M-W-W tests

GROUP	STRD	OTHERIA	DEBT	POUT	DIROWN	OUTOWN	BOARD	AUDIT
High STRD firms vs Low STRD firms	***	-	-	*	+	***	-	***

Notes: SRTD stands for the stock of RD expenditures deflated by the market value of the firm; OTHERIA represents the level of all intangible assets other than RD deflated by the market value of the firm; DEBT represents the debt level deflated by the market value of the firm; POUT is the dividend payout ratio; DIROWN represents managerial equity ownership; OUTOWN stands for outside block ownership; BOARD represents the board of directors' structure; AUDIT stands for the level of audit fees deflated by the market value of the firm. ** Significance level of 0.01 * Significance level of 0.05 (two-tail tests).

Table 5 provides strong statistical evidence (Pillai's trace statistic) that the bundle of financial and governance policies differs between the two groups of firms. Nevertheless, results presented in the Table are considerably different from previous results. In contrast with what has been reported in previous tables, DEBT does not systematically differ between RD levels, while POUT shows systematic differences (H2d is rejected). It is higher in the low STRD group of firms than in the high STRD group of firms. OUTOWN does not systematically differ between RD levels (H4d is rejected), directors ownership (DIROWN) and the board structure (BOARD) do not differ between RD levels (H3d and H5d are not rejected). Finally, AUDIT shows systematic differences between RD levels (H6d is rejected). It is higher in the high STRD group of firms than in the low STRD group of firms.

DISCUSSION OF THE FINDINGS

Results show that financial and governance policies as a whole are significantly different between high intangible asset intensive firms and low intangible asset intensive firms (both for the whole sample and for the analysis excluding RD firms). Results also confirm that, as a whole, financial and governance policies differ between RD firms and non-RD firms,

and between high RD intensive firms and low RD intensive firms. Indeed, all Pillai's trace values are associated with significant F tests at usual significance levels.

Univariate tests also provide evidence that some financial and governance policies – DEBT, OUTOWN and AUDIT - clearly differ across levels of overall intangible asset intensity (ALLIA variable) and intangible assets other than RD (OTHERIA variable) (the null hypotheses H1a, H4a, H6a, H1b, H4b and H6b are rejected). POUT, DIROWN and BOARD do not present significant differences between high and low levels of ALLIA and OTHERIA (the null hypotheses H2a, H3a, H5a, and H2b, H3b and H5b are not rejected, respectively). Results concerning STRD are far less "stable". While the comparisons between RD firms and non-RD firms show that DEBT is consistently higher in non-RD firms (H1c is rejected), DIROWN is consistently higher in non-RD firms (H3c is rejected) and BOARD is consistently higher in RD firms (H5c is rejected), it is found that POUT does not differ (H2c is not rejected) and OUTOWN and AUDIT do not show systematic differences between RD firms and non-RD firms (H4c and H6c are not rejected). When RD intensive firms are compared with low RD intensive firms, DEBT, DIROWN and OUTOWN do not show systematic differences (H1d, H3d, H4d are not rejected), while POUT and BOARD are higher in

the low RD intensive group of firms and AUDIT is higher in the high RD intensive group of firms (H2d, H5d and H6d are rejected).

Like Bah and Dumontier (2001), we find that higher intangible asset intensity and RD activity are associated with lower leverage (the null hypotheses H1a, H1b and H1c are systematically rejected). These results suggest that asset-substitution (risk-shifting) (Jensen and Meckling, 1976), under-investment (Myers, 1977), transaction costs (Williamson, 1988), bankruptcy costs and non-debt tax shields arguments (DeAngelo and Masulis, 1980) prevail over equity agency costs (Jensen and Meckling, 1976) and signalling arguments (Ross, 1977). Therefore, the design of the financial structure in high intangible/RD intensive firms does not seem to provide any clear governance effect for these types of companies. The financial structure seems designed to protect the value of managers' human capital and debt holders' financial capital.

As Bah and Dumontier (2001) find, POUT does not show systematic significant differences between groups of firms (H2a, H2b and H2c are not rejected) with the exception of the higher payout in the low STRD group (H2d is rejected). Overall, it seems that the high equity agency costs and Bhattacharya's (1979) signalling arguments (which would justify high dividend payouts) are off-set by high agency costs of debt, costs arising from information asymmetry (that are at the origin of Myers and Majluf's (1984) pecking order theory), and high transaction costs of debt and equity associated with RD/intangible assets.

In terms of ownership structure, overall, the results suggest that managerial equity ownership is not used as a mechanism to align managers' and shareholders' interests in intangible asset intensive/RD firms. Indeed, there is no difference in managerial equity holdings between high and low levels of intangible asset/intangible assets other than RD (H3a and H3b are not rejected) and between high RD intensive and low RD intensive firms (H3d is not rejected). It is found that managerial equity ownership is lower in RD firms than in non-RD firms (H3c is rejected)²⁰. Two sorts of arguments may justify this result. First, as managers are under-diversified agents and have their entire human capital invested in the firm (which invests in risky intangible assets / RD), to invest a large stake of financial wealth in the same firm seems too costly for managers. Second, if one concedes that large equity holdings generate rents to managers (the entrenchment argument) and managerial entrenchment is likely to occur at lower levels of equity ownership in intangible asset/RD intensive firms because of the key role of managers' human

capital, then a reduction of managerial ownership might be suitable from the shareholders' perspective to rebalance the relative power of managers and shareholders. Summing up, potential alignment arguments seem to be cancelled by possible countervailing entrenchment and risk aversion effects.

There is evidence that OUTOWN is lower in high intangible asset intensive firms than in low intangible asset intensive firms (indeed, H4a is rejected)²¹. Hence, in contrast to the predictions that concentrated shareholder ownership generates more monitoring activity (Shleifer and Vishny, 1997) and that the benefits of closer monitoring increases with the firm's environment instability (Demsetz and Lehn, 1985), our results suggest that concentrated external ownership is not used as a governance device in intangible asset intensive/RD firms. Potential private benefits associated with large ownership also do not seem to be important. The results seem to provide evidence for two strands of thought. First, since investors can diversify their portfolios, they seem uninterested in wielding direct control of the management of any individual firm (supporting Fama's (1980) argument, while contrasting with Jensen and Meckling's (1976) point of view). Second, shareholders seem to react to high levels of information asymmetry about the firms they invest in by diversifying their portfolios. The exercise of the voting rights might be too expensive and, to some extent, ineffective since, as argued by Zeckhauser and Pound (1990), the benefits of concentrated ownership are based on the assumption of "well-informed" shareholders, which may not be the case in intangible asset/RD intensive sectors.

BOARD shows no differences between levels of intangible asset intensity (H5a, H5b and H5d are not rejected). However, BOARD shows significant differences between RD and non-RD firms (H5c0 is rejected). This result suggests that the benefits of using NEDs as a monitoring and disciplining mechanism (as suggested by the agency theory) and advising device (as suggested by the resource dependence theory) exceed the costs (particularly the lack of expertise and real independence) for firms involved in RD. Monitoring by NEDs could be used to bridge the "expertise gap" between managers and shareholders, which is particularly wide in RD firms where shareholders are not as knowledgeable as managers about the technicalities of firms' RD projects. However, the level of RD intensity does not seem to be relevant for the board design.

Finally, the mean differences for AUDIT suggest that high intangible assets/intangible assets other than RD intensity are associated with lower audit demand (H6a and H6b are rejected). Consistent with O'Sullivan (2000), RD intensive firms pay higher

²⁰ Using US data, Clinch (1991) finds that there is very little or no difference in managerial equity holdings between high RD firms and low RD firms, while McConnell and Servaes (1995) find that managerial ownership is normally higher in high-growth firms than in low growth firms.

²¹ Using US data, McConnell and Servaes (1995) find that ownership by large external investors does not present systematic differences between high-growth firms and low growth firms.

audit fees than non-RD intensive firms (H6d is rejected). No difference is found between RD firms and non-RD firms (H6c is not rejected). Although requiring more qualified audit staff (O’ Sullivan, 2000), financial statements of intangible asset intensive firms do not seem to have too much to be audited. “*In the extreme case, items such as capitalised goodwill may be virtually costless to audit once the amount of goodwill and the appropriate rate of write off has been determined*” (Chan et al., 1993, p. 769). Results concerning RD intensive firms may suggest the importance of potential litigation costs for auditors arising from the bankruptcy of firms involved in unsuccessful RD projects.

Overall, the results suggest that high agency costs of debt, high bankruptcy costs, high information asymmetry and the irrelevance of debt tax shields seem to outweigh equity agency costs and signalling arguments. As a result, both financial policies – financial structure and dividend policy – seem to be designed in a way that protects debt holders’ interests and isolates managers from financial market discipline. As a consequence, theory predicts that alternative governance devices must be in place to protect shareholders’ interests. Nevertheless, corporate governance devices also do not seem to be designed to reduce equity agency costs and information asymmetry problems. In general, results suggest that managerial equity ownership, block external ownership and audit demand decrease with intangible assets, while the board structure does not show significant differences. Only the board structure of RD firms provides evidence of the monitoring and advising role of NEDs in this particular kind of firms and audit demand is higher in RD intensive companies. Overall, these results suggest that the effects of managerial risk aversion, the lack of adequate monitoring skills by block holders and the absence of disciplining financial policies seem only marginally off-set by increased board independence and audit demand.

SENSITIVITY ANALYSES

An analysis of the impact of the level and type of the intangible assets on financial and governance policies using data from the year 2001 is performed. Overall, findings (not reported here) using 2001 data are consistent with results presented using data 2000. In fact, only for the OUTOWN variable changes are found. Like in 2000, there is evidence that OUTOWN is lower in high intangible asset intensive firms than in low intangible asset firms (indeed H4a is also rejected in 2001), but no consistent evidence regarding other comparisons is found (H4b, H4c and H4d are rejected in 2000 but not in 2001).

Analysis of observations with extreme values is also performed (for the years 2000 and 2001) to evaluate the existence of univariate outliers. Where influential observations are found, a winsorization method is used to check the robustness of the results. Extreme values (defined as values that are more than

three standard deviations away from their mean) are replaced by values three standard deviations away from the mean. Results (not reported here) do not show significant differences from the results previously presented. Indeed, the difference is that the null hypotheses H6c (which tests the existence of differences in AUDIT between RD firms and non-RD firms) is not rejected in the current analyses while they are rejected in results presented in Table 4. In 2001 the null hypotheses H5c (which tests the existence of differences in BOARD between RD firms and non-RD firms) is not rejected in the current analyses while it is rejected in the analyses with extreme values (results not reported here).

The decision by some firms about to capitalize RD expenditures as assets can potentially introduce some noise in the empirical findings. Analyses (not presented here) attempt to address this issue by excluding the RD “capitalisers” from the samples (years 2000 and 2001). Only a few changes are found. When firms presenting RD expenditures are compared with firms that do not present RD expenditures, the null hypotheses H6c (which tests the existence of differences in AUDIT) and H4c (which tests the existence of differences in OUTOWN) are not rejected while they are rejected by results presented in Table 4. For ALLIA comparisons, H2a (variable POUT) is now rejected, while it is not in Table 2. In 2001 the null hypotheses H5c (which tests the existence of differences in BOARD) is not rejected in the current analyses while it is rejected in the analyses with extreme values (results not reported here).

Cluster analysis (for the years 2000 and 2001) is carried out using OTHERIA and STRD as clustering variables. The Ward method is used as clustering technique. We impose the identification of two clusters. Based on these two clusters, we compare DEBT, POUT, DIROWN, OUTOWN, BOARD and AUDIT. Overall, results (not reported here) are quite consistent with results presented in Table 2. However, OUTOWN does not present significant differences while POUT turns to be significantly different in 2001.

SUMMARY AND CONCLUSIONS

In this study, we test a set of hypotheses designed to investigate whether financial and governance policies, as a bundle and individually, differ between levels and types of intangible assets. Theory suggests that the design of the financial and governance policies is determined by the specific characteristics of intangible assets, namely high risk and uncertainty, high bankruptcy costs, high levels of agency costs and information asymmetry, and the importance of managers’ human capital.

The main findings can be summarised as follows. Results suggest that the bundles of financial and governance policies differ between levels of overall intangible asset intensity, levels of all intangible assets other than RD, categories of intangible assets (RD versus non-RD) and levels of stock of RD. Hence, the

level and type of intangible assets seem to have significant impact on financial and governance policies. Different levels and/or types of intangible assets seem to require different portfolios of financial and governance policies.

A closer inspection of the patterns of the different financial and governance policies suggest that they potentially protect unequally debt holders, shareholders and managers. In fact, overall, since leverage decreases and dividend payouts do not change (or even decrease) when intangible asset/RD increases, both financial policies seem to protect debt holders' interests (by reducing debt agency costs and bankruptcy risks) and managers' welfare (by reducing the monitoring by financial markets and protecting the value of their human capital). As a consequence, both financial policies seem to exacerbate shareholders' agency and information asymmetry problems resulting from the intrinsic characteristics of intangible assets.

The expected reaction of shareholders, by putting in place an alternative, efficient cost-benefit package of governance devices – managerial equity ownership, external equity ownership, board structure and audit demand – is, in general, not found. As managers invest all their human capital in the firm, are risk averse and have a better business knowledge, they might not wish or need to increase their equity ownership to extract private rents and boost their entrenchment level. Bearing inflated equity agency costs and facing increasing information asymmetry, shareholders seem to react by reducing their level of equity ownership when levels of intangible assets/RD activity increase. Moreover, audit demand and the proportion of NEDs on the board (two inexpensive governance devices but potentially very effective given the intangible assets characteristics) are found to be negatively related or not related with the level of intangible assets, respectively. The exceptions occur when analysing the board structures of RD versus non-RD companies and the level of audit demand of RD firms. Boards of RD firms show a larger proportion of NEDs than boards on non-RD firms. It is possible that, in contexts of extreme hidden action and hidden information problems, board structure plays an important monitoring and disciplining role. Finally, it is found that the level of audit demand is higher in high RD intensive firms than in low RD intensive firms. Whether this result comes from further monitoring activity or from additional potential litigation costs is an unanswered question.

The analysis carried out in this study has, at least, three major caveats. First, as in all univariate analyses, only one explanatory variable – the level or the type of intangible asset – is used, meaning that the effects of all other potential explanatory variables are not incorporated in the analysis. As pointed out by Hermalin and Weisbach (1991, p. 103), “firms vary in many dimensions, and, consequently, the underlying degree of divergence between shareholders' interest and management's interest will also vary”. Therefore, our results might be spurious or distorted by the

influence of these uncontrolled “dimensions” that, alongside the level and type of intangible assets, also determine the levels of agency costs, information asymmetry, transaction costs, bankruptcy costs and non-debt tax shields, and consequently determine the use of each financial and governance policy.

Second, we have not considered the possible endogenous nature of the portfolio of financial and governance policies. As the different financial and governance policies tend to act interdependently, theory suggests that the efficiency level of a particular policy depends not only on the level of firms' specific characteristics but also on the level of other financial and governance devices. Optimising firms tend to use each policy up to the point where their marginal benefit equals their marginal costs. This logic is ignored in this study.

Finally, we do not consider all possible governance/incentives devices²². Therefore, because of the simultaneity issue, it could happen that the structure of the financial and governance policies' portfolios reported in this study is determined by the level of financial and governance policies not analysed.

Future improvements to this study include the development of a multivariate approach that control the existence of other firm-specific characteristics (other than the level and type of intangible assets), which also potentially influence the design of financial and governance policies, and investigate the effects of the inter-dependent nature of financial and governance policies (endogeneity issue) on the final design of those financial and governance policies.

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²² For instance, Dedman *et al.* (2004) report that UK biotech firms show no differences in managerial equity ownership and external block ownership but higher levels of stock options plans than non-RD firms of same size.

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