

Corporate opacity, family control and cost of debt

Dr. Hinda GMATI

Univ. Manouba, ESCT

Campus universitaire Manouba, 2010, Tunisie

hindgmati@live.fr

Prof. Imen KHANCHEL

Univ. Manouba, ESCT,

Campus universitaire Manouba, 2010, Tunisie

imen.khanchel@esct.uma.tn

Abstract

The purpose of this paper is to examine the impact of corporate opacity on the relationship between family-control and firm's cost of debt. Using S&P500 index data, over the period 2010 to 2017 this study finds that family-control is associated with lower firm's cost of debt. Then, we find that corporate opacity negatively associated to the firm's cost of debt. However, the effect of the interaction variable between corporate opacity and family-control on cost of debt is insignificant. Finally, using fsQCA, we find that a higher firm's cost of debt implies a lower controlling families' and a higher corporate opacity.

Keywords: Family Control, Corporate opacity, fsQCA, S&P500, cost of debt

Introduction

Recent studies have shown that family firms constitute the most fundamental organization form in the whole world. In the US, they account for approximately 90% of incorporated business (Poza, 2007). According to Anderson & Reeb (2003), one-third of the S&P 500 corporations were founded by families. Also, Claessens, Djankov, Fan & Lang (2002) show that family firms are present in over two-thirds of incorporated business in East Asian countries. In Western Europe, about 44% of firms are family-owned (La Porta et al., 1999; Faccio & Lang, 2002). The literature

shows that the majority of family firms have higher valuation and profitability than nonfamily firms (Allouche & Amann, 1998; Daumas, 2012).

In this context, family governance itself plays a particularly important role, as the success of the family firms largely depends on the family, its structures, its processes and how it copes with disruptions (Olson et al., 2003). Also, family governance has received amount attention in recent years (Siebels & Knyphausen Aufseß, 2012). Recently, family governance has received an amount of attention. Precisely, family firms differ from non-family firms (Siebels & Knyphausen Aufseß, 2012).

Gallo & Kenyon-Rouvinez (2005) describe family governance system as “a system of processes and structures put in place at the highest level of the firms, family and ownership to make the best possible decisions regarding the direction of the business and assurance of accountability and control”.

In recent years, a small and growing study examined the impact of family ownership on the agency cost of debt (Anderson, Mansi & Reeb, 2003; Boubakri & Ghouma, 2010; Ellul, Guntay & Lel, 2007; Lin, Ma, Malatesta & Xuan, 2011).

Moreover, controlling families provide the families with greater incentives and capacity for both monitoring and expropriating (Burkat, Panunzi & Shleifer, 2003; Demensetz & Lehm, 1985; Shleifer & Vishny, 1997). Therefore, family control may have a positive or negative impact on a firm’s cost of debt, depending on whether that family’s owned entrenchment incentive dominates their alignment incentive. Thus, controlling families’ incentive as such is not directly observable.

The present study examines how corporate opacity affects the impact of the family control on the firm’s cost of debt using a sample of 291 companies listed on S&P 500 for the period 2010-2017. To measure corporate opacity. We follow the approach of Anderson & Reeb (2009) with a comprehensive index that consists of four components based on disclosure and analyst coverage. This novel study combines fuzzy-set qualitative comparative analysis with linear regression to overcome the well-known limitations of linear regression analysis (Woodside, 2013). This study finds that family control is associated with lower firm’s cost of debt. Then, we find that corporate opacity associates negatively to the firm’s cost of debt. However, we find any significant effect of the corporate opacity on the relationship between control family and cost of debt. Using fsQCA, we find a significant evidence that a higher firm’s cost of debt implies fewer controlling families’ and a higher corporate opacity.

This article makes contributions to the corporate governance and family firms. First, we investigate to further our understanding of the effect of corporate opacity on the impact family control on firm’s cost of debt in the American context. Second, we use an aggregate measurement of firm’s cost of debt that is calculated using government bond rate, a debt adjustment, the

proportions of short and long term debt to total debt, and the stock's effective tax rate.

The paper is organized as follows: Section 2 discusses the relevant literature and develops our hypothesis. Section 3 describes our data, presents our variables and discusses summary statistics. Section 4 presents the main empirical results. Section 5 concludes the study.

Previous literature

An important characteristic of family firms is the mitigation of agency conflicts occurring from the separation of ownership and management as described by Jensen & Meckling (1976). Precisely controlling families reduce owner-manager problems either by directly appointing a family member as CEO or by effectively monitoring professional executives (Demsetz & Lehn, 1985).

However, how corporate opacity affects the impact of family control on firm's cost of debt limited on the theoretical analysis. Furthermore, in this section, we first discuss the relevant literature, present our main arguments, and develop our hypothesis.

Family control and agency cost of debt

Theoretical evidence for the impact of family control on the agency cost of debt is inconclusive. On one hand, family control and concentrate ownership can exacerbate agency problems and increase firm's cost of debt. In the same vein, the existence of dominant shareholders elevates the risk of strategic default (Bolton & Scharfstein, 1996; Hart & Moore, 1994; Hart & Moore, 1998).

According to Aslan & Kumar (2012), controlling families can influence post default restructuring and extract some of the surplus from creditors. Controlling families can also extract private benefits on the expense of firm's other constituents. Moreover, Anderson & Reeb (2009) show that family firms are more opaque than diffused shareholder firms which makes fraud more likely.

On the other hand, controlling families might mitigate shareholder-debt holder conflict and decrease firm's cost of debt. Furthermore, family members have a long-term commitment to the firm, spanning various generations and highly undiversified investment. Therefore, the combination of the long-term commitment, the reputation and the high-undiversified investments takes suggest controlling families are more likely to value firm survival over strict wealth maximization.

Empirical evidence on the effect of the family control on the firm's cost of debt remains mixed. Anderson et al. (2003) suggest that family control is associated with lower firm's cost of debt for S&P 500 firms. Yet, Lin et al. (2011) and Aslan & Kumar (2012) find that family ownership is associated with higher cost of debt.

Thus, the preceding analysis suggests that family firms have a lower cost of debt relative to non-family firms.

Therefore, we state our first hypothesis as follows:

H1: family control has negatively effect on cost of debt.

Family firms and corporate opacity information

Corporate information can be one way for listed firms to signal that they act in the best interest of the investors. According to agency theory, when firms have a concentrated ownership, they will be less likely to disclose information because bloc holders have greater access to internal information (Chau & Gray, 2002; Jensen & Meckling, 1976; Mohamed & Sulong, 2010). Particularly, when ownership becomes concentrated in the family, agency based economic explications seem insufficient to explain some empirical evidences (GomezMejia, Cruz, Berrone & Castro, 2011).

Compared to nonfamily firms, family firms are less likely to manage earnings and more likely to convey financial information of higher quality (Cascino et al., 2010; Jiraporn & DaDalt, 2009).

Corporate information is essential for investors to effectively discriminate among borrowers (Stiglitz, 2000). According to Leuz et al. (2003), to lower the likelihood of outside intervention, investors have incentives to manipulate earnings. In addition, analysts are less willing to follow firms with potential to manipulate earnings such as family firms (Lang et al., 2004).

An important issue in the literature is the effect of family control on the corporate information. According to Ali et al. (2007) and Wang (2006), family firms in the S&P 500 index have better financial reporting quality, larger analyst following, and smaller bid ask spreads than nonfamily firms. In contrast, Anderson et al. (2009) show that family firms are less transparent than nonfamily firms. In addition, family firms in the S&P 1500 index are less likely to provide voluntary disclosures such as conference calls and earnings forecasts (Chen et al., 2008).

Our second hypothesis centers around the notion that controlling families affects corporate opacity to the point of entrenchment and extract private benefits. Therefore, our second hypothesis is as follows:

H2: controlling families possess strong incentives to foster and exploit corporate opacity.

Corporate opacity, family control and firm's cost of debt

Corporate information can be used to mitigate the agency problems between shareholders, managers and creditors (Bushaman & Smith, 2001; Watts & Zimmerman, 1986). Therefore, the corporate transparency reduces information asymmetry between owners and investors and more transparent firms are likely to rely more on equity than debt (Myers & Majluf, 1984).

According to institutional theory, companies are strongly influenced by their institutional environment as a result of ownership structure and control rights (Deepphouse & Suchman, 2008; Scott, 1992). Thus, a weak institutional environment is likely to foster owners' expropriation behavior (Dyck & Zingales, 2004; La Porta et al., 2000). Furthermore, Chang et al. (2006)

examine the effect of greater equity analyst following on debt ratios. They find that greater equity analysts following is associated with lower debt ratios.

In family firms, if creditors perceive a higher probability of expropriating behavior by controlling families, they demand more transparent information and consequently set debt contracting terms that are more sensitive to the transparency information. In this process, Leuz et al. (2003) suggest that when controlling families are more likely to expropriate outside investors, corporate information is perceived to be more opaque and thus creditors may require higher returns on their loans to compensate the higher risk. In other words, corporate opacity issues more when the potential agency problems between controlling families and creditors are serve.

Formally, we estimate our third hypothesis as:

H3: the effect of corporate opacity information on the impact of family control and firm's cost of debt is stronger.

METHODOLOGY

Sample and data source

Our initial sample of study consists of firms that were listed on the S&P 500 index, over the period 2010 to 2017. We first excluded companies in finance and insurance sectors, because the regulation of ownership structure and corporate opacity for those sectors differs across companies. Then, we skipped firms that are not listed in the Anderson & Reeb database (2012). So, our final sample consists of 291 family and nonfamily firms. Therefore, we obtained our accounting, financial and governance data from Bloomberg database and we collected family control data from Anderson & Reeb database (2012).

Measurement variables

Cost of debt

Cost of debt (after tax): after tax weighted average cost of debt for the security is calculated using government bond rates, a debt adjustment factor, the proportions of short- and long-term debt to total debt, and the stock's effective tax rate. The adjustment factor represents the average yield above government bonds for a given rating class. The debt adjustment factor is only used when a company does not have a fair market curve (FMC). When a company does not have a credit rating, an assumed rate of 1.38 (the equivalent rate of a BBB+

Standard & Poor's long term currency issuer rating) is used.

The exact calculation of the cost of debt adjustment factor is a Bloomberg propriety calculation.

Cost of debt= $[(SD/TD) * (CS*AF)] + [(SD/TD) * (CL*AF)] * (1-TR)$ Where:

SD: short-term debt;

TD: total debt;

CS: pre-tax cost of short-term debt;

AF: debt adjustment factor;

LD: long-term debt;

CL: pre-tax cost of long-term debt;

TR: effective tax rate;

Independent variables

Corporate opacity information: Following Anderson et al. (2009), we used four components to develop the corporate opacity index that are in trading volume, analyst coverage, proportion of zero return trading days, and stock return volatilities.

Family control: we defined family firms as companies where family members (founders or founders' descendants) hold a minimum of 5% or greater ownerships take (Anderson et al., 2009; Shleifer & Vishny, 1986; Villalonga & Amit, 2006). To categorize a firm as a family firm, our study uses a binary variable that equals one when family member holds a 5 % or larger ownership and zero otherwise.

Control variables

We included ten control variables that can affect a firm's cost of debt: firm size, return on assets, Tobin's Q, free cash flow, ratio of fixed assets to total assets, ratio of debt to total assets, current ratio, board size, board duality and board independent. Theoretical and empirical evidence on the effect of these variables on firm's cost of debt are relatively well known (Anderson et al., 2003; Lin et al., 2011; Petersen & Rajan, 1994; Pittman & Fortin, 2004). Detailed descriptions of all control variables are provided in table 1.

Insert table 1

Descriptive statistics

Table 2 provides four panels of summary statistics for our sample of firms. Panel A illustrates the frequency of family firms and nonfamily firms. Panel B presents means, standard deviation, minimum and maximum values for our sample. Panel B shows also, the means, standard deviation, minimum, and maximum values for family firms and nonfamily firms. Panel C provides a correlation matrix for key variables for our sample. Finally, panel D presents the means for comparison tests between family and non-family firms.

Insert table 2

Panel A provides descriptive statistics for family firms and nonfamily firms in the S&P 500 index. We find that, on average family firms pay a significantly lower cost of debt (2.001) than nonfamily firms (2.175), the difference is statistically significant (p-value=0.001).

The corporate opacity index is 0.485 for family firms and 0.498 for nonfamily firms. The difference is also significant (pvalue= 0.0594).

Family firms are also larger than nonfamily firms. Compared with nonfamily firms, family firms have a lower PPE ratio (0.234 versus 0.267). On average, family firms pay a lower cost of debt but they have a higher current ratio (2.189) than nonfamily firms (1.873), indicating that family firms may prefer a low risk capital structure. Nonfamily firms are more independent than family firms (85.41 versus 76.08). We also find that family firms outperform nonfamily firms: free cash flow (2168 versus 1849), return on assets (8.33 versus 7.20) and Tobin's Q (2.44 versus 2.29).

Panel C of table 2 presents the correlation matrix. The firm's cost of debt is negatively correlated with corporate opacity index, CEO duality, board size, firm performance (return on assets, free cash flow, and Tobin's q), and current ratio. However, it is positively correlated with firm independent, firm size, and PPE ratio.

To summarize, family firms are different from nonfamily firms in their cost of debt, corporate opacity, firm size, performance, and internal corporate governance.

Empirical evidence

Impact of family control on cost of debt

To examine our first hypothesis that family control is associated with a lower cost of debt than nonfamily firms, we estimate the regression model as follows:

$$\text{Cost of debt}_i = \alpha + \beta_1 \text{family firm} + \beta_2 \text{opacity} + \beta_j \text{control variables} + \varepsilon_i \quad \text{eq. (1)}$$

cost of debt (after tax) is calculated using government bond rates, a debt adjustment factor, the proportions of short and long term debt to total debt, and the stock's effective tax rate. Corporate opacity is an opacity index comprising four components (trading volume, bid-ask spread, analyst coverage, and stock volatility). Family control is a binary variable that equals one when family member holds a 5% or greater ownership and zero otherwise.

Insert table 3

Table 3 presents three results. Column1 reports regression results for full sample. Column2 reports regression results for non-family firms. Column3 reports regression results for family firms. The coefficient of family control is -0.151*. We find that family control is associated with a lower firm's cost of debt. Same finding provided by Anderson et al. (2003.) and Ma et al. (2017). Which suggest that family firms have a lower cost of debt both in China and the USA, despite the immense difference in investor protection and other institutions.

However, Ellut et al. (2007) suggest that family firms are associated with a higher cost of debt than non-family firms. This inconsistency motivates us to examine other factors that may affect the relationship between family control and firm's cost of debt.

Impact of Corporate opacity on cost of debt

To examine our second hypothesis that controlling families possess higher incentives to foster and exploit corporate opacity, we estimate the regression model as follows:

$$\text{Cost of debt}_{it} = \alpha + \beta_1 \text{opacity} + \beta_j \text{control variables} + \varepsilon_i \quad \text{eq. (2)}$$

We find that a negatively significant association between firm's cost of debt and corporate opacity index (-0.532***). This finding indicates that when firms are more opaque, they pay less firms cost of debt.

Impact of corporate opacity on the effect of family control on firm's cost of debt

The literature shows that entrenched majority shareholders tend to provide relatively more opaque information to outside investors (Anderson et al., 2009; Fan & Wong 2002; Lang et al. 2004; Leuz et al., 2003). We argue that the negative effect of family control on the cost of debt should therefore be lower when corporate opacity is relatively higher.

To examine the moderating role of corporate opacity, we estimate the regression model as follows:

$$\text{Cost of debt}_{it} = \alpha + \beta_1 \text{family firm} + \beta_2 \text{opacity} + \beta_3 \text{family firm} * \text{opacity} + \beta_j \text{control variables} + \varepsilon_i \quad \text{eq. (3)}$$

We conclude that the names of family businesses can be considered as a guaranteeing symbol by creditors. This implies that the opacity and the degree of concentration of family companies have no effect on the level of the cost of debt.

Qualitative comparative analysis (QCA)

Qualitative comparative analysis (QCA) is a relatively new technique that uses Boolean algebra to compare cases (Ragin, 2000). The QCA's emphasis on causal configurations gives this method a significant advantage over other techniques.

QCA also helps identify multiple cause combinations, while bridging the gap between qualitative and quantitative analysis. QCA provides powerful tools for the analysis of causal complexity. It is also ideal for small to mid-size N research designs, especially in economics and commerce (for recent applications, see Apetrei et al., 2016, Lassala et al., 2017).

According to Rihoux and Ragin (2009), conventional quantitative approaches such as regression analysis are epistemologically different from comparative configuration methods. Epistemological differences are an improvement rather than a disadvantage because they admit two different but potentially complementary approaches to the same research question.

The decision to use QCA is motivated by the need to overcome the limitations of multivariate analyses when relationships are asymmetrical and complex (Woodside, 2013). Unlike conventional techniques, QCA is based on the assumption that causality is complex rather than Classical techniques assumed that the causal conditions are "independent" variables whose effects on the result are linear and additive. In complex truth tables, the rows (combinations of causal conditions) can be numerous because the number of causal combinations is a geometric function of the number of causal conditions: The number of causal combinations is 2^k , where k is the number of conditions causal.

Therefore, to present the outcomes of the fsQCA, we estimate the following equation:

$$COD_{fsct} = f(Fam, opacity\ index, firm\ size, tobin's\ q, ppe) \quad eq. (4)$$

Eq. (4) associated the cost of debt with family control, corporate opacity, firm size, Tobin's Q and net property, plant, and equipment. We noted:

Y: cost of debt

F: family control

S: firm size

T: Tobin's Q

P: net property, plant, and equipment

X: corporate opacity index

Table 4 shows the intermediate solution. The solution term in truth table (table 3) presents the relationship between sets of conditions and the outcome.

Corroborating within random regression, family control is associated with a lower firm's cost of debt when firms are more opaque, they pay less firms cost of debt and no significant effect of the relationship between family control and corporate opacity on the cost of debt. However, using fsQCA, we find in the context of large companies that a higher cost of debt combined with a higher corporate opacity, a low controlling families', a higher PPE and a low Tobin's Q.

We conclude that, despite the fact that companies are large and have a higher PPE, if they are more opaque, they pay a higher cost of debt in the case of firms less controlled by members of the family.

Qualitative comparative analysis (QCA) evaluates the relationship between an outcome and all possible Boolean combination of conditions (Longest and Vaisey, 2008). In our study, we give an outcome set Y and predictor F, S, T, P and X. QCA examines which combinations of F, S, T, P and X are most likely to produce Y.

According to the QCA, capital letter indicates the robust presence of variable, and the lower case letter indicates the poor presence of variable (Longest & Vaisey, 2008).

Conclusion

This study investigated the role of family control in the firm's cost of debt and makes some important contributions to the corporate governance and family firms' literature. First, the

investigation started as a way to increase our understanding of the effect of the interaction of corporate opacity and family control on the firm's cost of debt in American context.

Second, we use an aggregate measurement of firm's cost of debt that is calculated using government bond rate, a debt adjustment, the proportions of short and long-term debt to total debt, and the stock's effective tax rate. In addition, we used a multiple technique to increase the robustness of results and underlined the limitation of within and random regression analysis.

The result suggests that the fsQCA technique provide deeper empirical insight. Using fsQCA, we find in the context of large companies that a higher cost of debt combined with a higher corporate opacity, a low controlling families', a higher PPE and a low Tobin's Q.

References

- Anderson, R. C., & Reeb, D. M. (2003). Founding-family ownership and firm performance: Evidence from the S&P 500. *The Journal of Finance*, 58(3), 1301–1328 04258.
- Anderson, R., Duru, A., & Reeb, D. (2009). Founders, heirs, and corporate opacity in the United States. *Journal of Financial Economics*, 92, 205–222.
- Anderson, R., Mansi, S., & Reeb, D. (2003). Founding family ownership and the agency cost of debt. *Journal of Financial Economics*, 68, 263–285.
- Apetrei, A., Paniagua, J., & Sapena, J. (2016). Do financial crises moderate entrepreneurial recipes? A comparative fuzzyanalysis. *Journal of Promotion Management*, 22(4), 482–495.
- Boubakri, N., & Ghouma, H. (2010). Control/ownership structure, creditorrights protection, and the cost of debt financing: International evidence. *Journal of Banking and Finance*, 34, 2481–2499.
- Burkart, M., Panunzi, F., & Shleifer, A. (2003). Family firms. *The Journal of Finance*, 58, 2167–2202
- Bushman, R. M., Piotroski, J., & Smith, A. (2004). What determines corporate transparency? *Journal of Accounting Research*, 42, 207–252.
- Chen, C., Li, Z., Su, X., & Sun, Z. (2011). Rent-seeking incentives, corporate political connections, and the control structure of private firms: Chinese evidence. *Journal of Corporate Finance*, 17, 229–243.
- Claessens, S., Djankov, S., Fan, J. P. H., & Lang, L. H. P. (2002). Disentangling the incentive and entrenchment effects of large shareholdings. *The Journal of Finance*, 57, 2741–2771.
- Demsetz, H., & Lehn, K. (1985). The structure of corporate ownership. *Journal of Political Economy*, 93, 1155–1177.
- Dyck, A., & Zingales, L. (2004). Private benefits of control: An international comparison. *The Journal of Finance*, 59, 537–600.
- Ellul, A., Guntay, L., & LeL, U. (2007). External governance and debt agency costs of family firms (Federal Reserve International Finance Discussion Paper No. 908).
- Faccio, M., & Lang, L. H. P. (2002). The ultimate ownership of Western European corporations. *Journal of Financial Economics*, 65, 365–395.
- Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*, 3(4), 305–360 56619.
- La Porta, R., Lopez-de-Silanes, F., Shleifer, A., & Vishny, R. (2000). Investor protection and corporate governance. *Journal of Financial Economics*, 58, 3–27.
- Lang, M., Lins, K., & Miller, D. (2004). Concentrated control, analyst following, and valuation: Do analysts matter most when investors are protected least? *Journal of Accounting Research*, 42, 589–

- Lassala, C., Apetrei, A., & Sapena, J. (2017). Sustainability matter and financial performance of companies. *Sustainability*, 9(9), 1498.
- Leuz, C., Nanda, D., & Wysocki, P. (2003). Earnings management and investor protection: An international comparison. *Journal of Financial Economics*, 69, 505–527.
- Lin, C., Ma, Y., Malatesta, P., & Xuan, Y. (2011). Ownership structure and the cost of corporate borrowing. *Journal of Financial Economics*, 100, 1–23.
- Myers, S. C., & Majluf, N. S. (1984). Corporate financing and investment decisions when firms have information that investors do not have. *Journal of Financial Economics*, 13, 187–221.
- Pajunen, K. (2008). Institutions and inflows of foreign direct investment: A fuzzy-set analysis. *Journal of International Business Studies*, 39(4), 652–669 00172.
- Petersen, M. A., & Rajan, R. G. (1994). The benefits of lending relationships: Evidence from small business data. *The Journal of Finance*, 49, 3–37.
- Pittman, J. A., & Fortin, S. (2004). Auditor choice and the cost of debt capital for newly public firms. *Journal of Accounting and Economics*, 37, 113–136.
- Ragin, C. C. (2000). *Fuzzy-set social science*. University of Chicago Press 03205.
- Ragin, C. C. (2006). Set relations in social research: Evaluating their consistency and coverage. *Political Analysis*, 14(3), 291–310 00659
- Rey, M., Galende, M., Fuente, M., & Sainz-Palmero, G. (2017). Multiobjective based Fuzzy Rule Based Systems (FRBSs) for trade-off improvement in accuracy and interpretability: A rule relevance point of view. *Knowledge-Based Systems*, 127, 67–84 00000.
- Rihoux, B., & Ragin, C. C. (2009). *Configurational comparative methods: Qualitative comparative analysis (QCA) and related techniques*. SAGE 01124 Google-Books-ID: sAcIYzgO3nkC
- Schneider, C. Q., & Wagemann, C. (2012). *Set-theoretic methods: A user's guide for qualitative comparative analysis and fuzzy sets in social science*. Cambridge: Cambridge University Press 00019.
- Shleifer, A., & Vishny, R. W. (1997). A survey of corporate governance. *The Journal of Finance*, 52(2), 737–783 16569.
- Villalonga, B., & Amit, R. (2006). How do family ownership, control, and management affect firm value? *Journal of Financial Economics*, 80, 385–417.
- Villalonga, B., & Amit, R. (2009). How are U.S. family firms controlled? *Review of Financial Studies*, 22, 3047–3091.
- Wang, D. (2006). Founding family ownership and earnings quality. *Journal of Accounting Research*, 44, 619–656.
- Watts, R. L., & Zimmerman, J. L. (1986). *Positive accounting theory*. Upper Saddle River, NJ: Prentice Hall.
- Woodside, A. G. (2013). Moving beyond multiple regression analysis to algorithms: Calling for adoption of a paradigm shift from symmetric to asymmetric thinking in data analysis and crafting theory. *Journal of Business Research*, 66(4), 463–47

Table 1: variables description

Variables	Descriptions
Cost of debt (COD)	WACC cost of debt (after tax): after tax weighted average cost of debt for the security, calculated using government bond rates, a debt adjustment factor, the proportions of short and long term debt to total debt, and the stock's effective tax rate.
Corporate opacity (OPACITY)	The corporate opacity index ranks four components; namely, trading volume, analyst coverage, bid-ask spread, and stock volatility.
Family control (FC)	A binary variable that equals one when family member holds a 5 % or greater ownership and zero otherwise.
Trading Volume (VOL)	The natural logarithm of average daily shares traded divided by the average daily shares outstanding.
Tot analyst (ANAL)	The number of equity analysts following each firm.
bid-ask spread (SPREAD)	The ask price minus the bid price divided by the average of the bid and ask price.
Stock volatility (RISK)	Standard deviation of daily stock returns during the year.
Board independent (BI)	The number of independent directors divided by total board directors.
Board size (BS)	The total number of directors on the board.
Return on assets (ROA)	Earnings before interest and taxes divided by total assets.
Free cash flow (FCF)	The natural logarithm of free cash flow.
firm size (FS)	The natural logarithm of total assets.
Current Ratio (CR)	Current assets divided by current liabilities.

Tobin's Q Ratio(T'Q)	The market value of total assets divided by the book value of total assets.
Net property, plant, and equipment (PPE)	Net property, plant, and equipment divided by total assets.

Table 2: summary statistics**Panel A : Frequency family**

FC	Freq.	Percent	Cum.
0	1,856	79.73	79.73
1	472	20.27	100.00

Panel B : Summary statistics• **All sample**

	Count	means	p50	Sd	min	Max
COD	2308	2.140	2.08	0.87	0.00	5.96
RISK	2261	0.249	0.17	0.30	0.01	4.91
Volume	2261	3.37e+08	1.88e+08	5.91e+08	1.08e+06	1.23e+10
SPREAD	1924	0.055	0.04	0.06	0.01	1.65
Shares Outstanding	2306	668.757	317.98	1175.09	25.54	10615.38
VOL	2251	13.228	13.23	0.52	7.04	14.83
ANAL	2274	22.005	21.00	8.09	1.00	61.00
BI	2298	83.523	87.50	10.17	0.00	100.00
BS	2302	10.872	11.00	2.00	5.00	18.00
ROA	2302	7.433	7.11	7.09	-61.82	44.08
FCF	2311	1914.423	743.95	4307.94	-10048.00	70019.00
Total Assets	2314	29674.422	13385.11	54359.62	0.00	747793.00
CR	2280	1.938	1.56	1.41	0.17	19.07
T'Q	2291	2.322	1.92	1.46	0.68	20.92
PPE	2308	0.261	0.17	0.23	0.00	0.95
OPACITY 1	1900	0.496	0.50	0.16	0.06	0.94
OPACITY 2	1900	0.000	0.02	1.10	-4.14	18.52

Notes: COD= Cost of debt, RISK= Stock volatility, SPREAD= bid-ask spread, Shares Outstanding VOL= Trading Volume, ANAL= Tot analyst, BD= CEO Duality, BI= Board independent, BS= Board size, ROA= Return on assets, FCF= Free cash flow, FS= firm size, Total Assets, CR= Current Ratio, T'Q= Tobin's Q Ratio, PPE= Net property, plant, and equipment, OPACITY 1 et OPACITY 2= Corporate opacity firms.

• **Summary statistics Nonfamily firms**

Variable	Obs	Mean	Std. Dev.	Min	Max
COD	1,838	2.175779	.860599	0	5.9597
RISK	1,812	.2417201	.2435039	.0118	2.886
Volume	1,812	3.30e+08	5.89e+08	1081666	1.23e+10
SPREAD	1,546	.0553346	.0646054	.0077	1.6501
Shares Outstanding	1,839	623.1005	1073.466	25.5414	10615.38
VOL	1,802	13.25267	.5119048	7.037144	14.82602
ANAL	1,823	21.75151	7.866491	1	61
BI	1,832	85.41375	8.51551	0	100
BS	1,832	10.81223	1.930158	5	18
ROA	1,835	7.204395	7.200521	-61.8205	42.2794
FCF	1,840	1849.308	4293.395	-10048	70019
Total Assets	1,843	29466.71	56050.05	0	747793
CR	1,819	1.873518	1.167461	.1685	9.5921
T'Q	1,831	2.291083	1.461637	.6896	20.9228
PPE	1,839	.267239	.2426892	.0053717	.9474287
OPACITY 1	1,524	.4981773	.1565946	.0833333	.9444444
OPACITY 2	1,524	.0416024	1.08807	-4.137633	18.51553

Notes: COD= Cost of debt, RISK= Stock volatility, SPREAD= bid-ask spread, Shares Outstanding VOL= Trading Volume, ANAL= Tot analyst, BD= CEO Duality, BI= Board independent, BS= Board size, ROA= Return on assets, FCF= Free cash flow, FS= firm size, Total Assets, CR= Current Ratio, T'Q= Tobin's Q Ratio, PPE= Net property, plant, and equipment, OPACITY 1 et OPACITY 2= Corporate opacity firms.

• **Summary statistics Family firms**

Variable	Obs	Mean	Std. Dev.	Min	Max
COD	470	2.001984	.9121434	0	5.3323
RISK	449	.2801886	.4754675	.0215	4.911
SPREAD	378	.0550079	.0516259	.0121	.575
Shares Outstanding	467	848.5487	1498.164	31.0398	8668
VOL	449	13.12748	.5597847	9.623059	14.35568
ANAL	451	23.03104	8.874879	2	54
BI	466	76.08798	12.47344	33.333	100
BS	470	11.10638	2.217723	5	17
ROA	467	8.333281	6.589334	-19.5355	44.0807
FCF	471	2168.802	4359.583	-2340	31378
Total Assets	471	30487.17	47211.82	1089.432	257808
CR	461	2.189964	2.106927	.1749	19.0688
T'Q	460	2.444104	1.443796	.6784	11.2854
PPE	469	.2349529	.1943739	0	.8443278
OPACITY 1	376	.4850768	.1743741	.0555556	.9444444
OPACITY 2	376	-.1686225	1.117933	-4.017502	6.853088

Notes : COD= Cost of debt, RISK= Stock volatility, SPREAD= bid-ask spread, Shares Outstanding VOL= Trading Volume, ANAL= Tot analyst, BD= CEO Duality, BI= Board independent, BS= Board size, ROA= Return on assets, FCF= Free cash flow, FS= firm size, Total Assets, CR= Current Ratio, T'Q= Tobin's Q Ratio, PPE= Net property, plant, and equipment, OPACITY 1 et OPACITY 2= Corporate opacity firms.

Panel C : Correlation Matrix

Variables	COD	OPACITY 1	BD	BI	BS	ROA	FCF	FS	CR	T'Q	PPE
COD	1.0000										
OPACITY 1	-0.0210	1.0000									
BD	-0.0293	-0.0840	1.0000								
BI	0.0445	-0.0646	0.2311	1.0000							
BS	-0.0448	-0.2200	0.0433	0.0547	1.0000						
ROA	-0.2061	0.0367	0.0539	-0.0979	-0.1071	1.0000					
FCF	-0.0880	-0.2434	0.0837	0.1357	0.3265	0.1044	1.0000				
FS	0.0422	-0.2816	0.1114	0.1718	0.4274	-0.2553	0.7791	1.0000			
CR	-0.0083	0.1575	-0.0693	-0.0778	-0.2564	0.2132	-0.1296	-0.2642	1.0000		
T'Q	-0.1630	0.1471	0.0138	-0.1478	-0.1921	0.5415	-0.0749	-0.4016	0.1928	1.0000	
PPE	0.0580	0.0136	0.0803	-0.0149	0.0904	-0.0247	-0.0438	0.1607	-0.2365	-0.0904	1.0000

Notes : COD= Cost of debt, BD= CEO Duality, BI= Board independent, BS= Board size, ROA= Return on assets, FCF= Free cash flow, FS= firm size, Total Assets, CR= Current Ratio, T'Q= Tobin's Q Ratio, PPE= Net property, plant, and equipment, OPACITY 1 et OPACITY 2= Corporate opacity firms

Panel D : Means differences

Variables	Means differences	
	Z Wilcoxon	Prob
COD	3.276	0.0011
BI	15.433	0.0000
BS	-2.177	0.0295
ROA	-3.734	0.0002
FCF	-1.756	0.0790
CR	-2.497	0.0125
T'Q	-2.171	0.0299
FS	-0.027	0.9786
PPE	0.0000	0.6171
BD	7.041	0.0000
OPACITY 1	1.885	0.0594
OPACITY 2	2.888	0.0039

Notes: COD= Cost of debt, BD= CEO Duality, BI= Board independent, BS= Board size, ROA= Return on assets, FCF= Free cash flow, FS= firm size, Total Assets, CR= Current Ratio, T'Q= Tobin's Q Ratio, PPE= Net property, plant, and equipment, OPACITY 1 et OPACITY 2= Corporate opacity firms.

Table 3: Empirical results

	(1)	(2)	(3)
VARIABLES	COD	COD	COD
fam	-0.177** (0.0849)	- -	- -
Fam* opacityindex	0.0970 (0.0885)	- -	- -
BI	0.00174 (0.00310)	0.00476 (0.00390)	-0.00400 (0.00573)
BS	-0.0445*** (0.0111)	-0.0335*** (0.0124)	-0.0864*** (0.0272)
FCF	-3.93e-05*** (8.29e-06)	-4.08e-05*** (1.08e-05)	-3.52e-05*** (1.09e-05)
CR	0.0407* (0.0219)	0.0469 (0.0329)	0.0257 (0.0334)
TQ	-0.00617 (0.0241)	0.00492 (0.0259)	-0.0594 (0.0421)
FS	0.237*** (0.0408)	0.218*** (0.0441)	0.245** (0.119)
CEO	-0.0637 (0.0498)	-0.0795 (0.0567)	-0.0284 (0.102)
PPE	-5.68e-06*** (1.24e-06)	-6.15e-06*** (1.54e-06)	1.47e-06 (7.28e-06)
opacityindex	0.0127 (0.0284)	0.0175 (0.0320)	0.0260 (0.0577)
Constant	0.188 (0.471)	-0.0384 (0.539)	1.004 (1.330)
Observations	1,869	1,500	369
Number of id	286	229	57

Notes : COD= Cost of debt, BD= CEO Duality, BI= Board independent, BS= Board size, ROA= Return on assets, FCF= Free cash flow, FS= firm size, Total Assets, CR= Current Ratio, T'Q= Tobin's Q Ratio, PPE= Net property, plant, and equipment, OPACITY 1 et OPACITY 2= Corporate opacity firms

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 4 : Intermediate solution

Set	Raw Coverage	Unique Coverage	Solution Consistency
f*S*t*P*X	0.324	0.324	0.849
Notes : Y: cost of debt, F: family control, S: firm size, T: Tobin's Q, P: net property, plant, and equipment, X: corporate opacity index.			