



Corporate governance and the insolvency risk in family-owned mexican companies

El gobierno corporativo y el riesgo de insolvencia en las empresas familiares mexicanas

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Abstract

Corporate governance can mitigate risk and contribute to the continuity of the family business. This is due to the supervision exercised over the activities of the management, facilitating the balance of the achievement of both short-term and long-term interests. In Mexico, the research on the insolvency risk (Altman's Z-score modified index) in the family business is practically non-existent. Therefore, the present exploratory work is interested in determining the relationship between the control mechanisms of corporate governance and the insolvency risk of family businesses quoted during the 2012-2016 period. The analysis of the information has been made through the Generalized Estimation Equations (GEE) model. The results advocate that the size of the board of directors, significantly influences a greater probability (lower Altman's Z-score modified index) of incurring insolvency risk, and differentiation by sector.

JEL code: M19, G30, G32

Keywords: Corporate governance; Family business; insolvency risk; Mexico

Resumen

El gobierno corporativo puede mitigar el riesgo y contribuir en la continuidad de la empresa familiar. Lo anterior por la supervisión de las actividades de la dirección y facilitar el equilibrio de intereses de corto y largo plazo. En México, la investigación sobre el riesgo de insolvencia (índice de Altman Z-score modificado) en la empresa familiar es prácticamente inexistente. Así, el presente trabajo se interesa en determinar la relación entre los mecanismos de control de gobierno corporativo y el riesgo de insolvencia de las empresas familiares cotizadas durante el periodo 2012-2016. El análisis de la información se ha realizado a través del modelo de Ecuaciones de Estimación Generalizadas (GEE por sus siglas en inglés). Los resultados preconizan que el tamaño del consejo de administración influye de manera significativa en una mayor probabilidad (menor índice de Altman Z-score modificado) de incurrir en riesgo de insolvencia, así como una diferenciación por sector

Código JEL: M19, G30, G32

Palabras clave: Gobierno corporativo; Empresa familiar; Riesgo de insolvencia; México

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Introduction

Corporate governance (CG) has become relevant at the international level in recent years, mainly because of the recent financial scandals and their consequences in the United States, Europe, and Latin America. Therefore, there is also greater academic interest in researching this topic in-depth since most companies worldwide are family-owned (Claessens, Djankov, & Lang, 2000; Faccio & Lang, 2002; Anderson & Reeb, 2003; Chrisman, Sharma, Steier, & Chua, 2013; Duréndez, Madrid, & Hernández, 2018).

The presence of family-owned companies in the economic fabric is considerable, as is their high contribution to the generation of wealth, job creation, and social wellbeing (Astrachan & Shanker, 2003; Chrisman et al., 2013). In addition to facing intense and permanent changes in their environments, these companies have significant structural challenges inherent to their family-owned character, mainly related to their CG. Studies on the topic follow one of two recurring perspectives. The first considers that the predominant participation of family members in CG facilitates aligning long-term business objectives at the cost of greater risk aversion (DeAngelo & DeAngelo, 2000; Shleifer & Vishny, 1986; Visintin, Pittino, & Minichilli, 2017). The second advocates that forming a heterogeneous CG prioritizes the short-term economic interest of the company through supervision (Anderson & Reeb, 2003; De Massis, Kotlar, Campopiano, & Cassia, 2013).

In Mexico, a country with an emerging economy, there is insufficient literature on CG and the risk of insolvency of family-owned companies. For this reason, it is important to delve deep into the topic. The Code of Best Practice for Corporate Governance (CBPCG) created by the Business Coordinating Council (Spanish: Consejo Coordinador Empresarial, CCE, 2006), inspired by the provisions of the Organization for Economic Co-operation and Development (OECD), regulates corporate governance.

This study is framed within agency theory, which establishes that the interests pursued by the principal and agent in a family-owned company, together with the asymmetry of information, have repercussions on contract generation and agency costs (Jensen & Meckling, 1998; Shleifer & Vishny, 1986; John & Senbet, 1998; Saltaji, 2013). Based on the above, the following research question is posed: Do the CG control mechanisms of listed family-owned companies significantly influence the risk of insolvency?

This study aims to determine whether the CG control mechanisms significantly influence the risk of insolvency for the case of Mexican, family-owned companies listed on the Mexican Stock Exchange (Spanish: Bolsa Mexicana de Valores, BMV) during the 2012-2016 period. It also aims to contribute to understanding the impact that the CG structure may have on the risk of insolvency of family-owned companies in Mexico.

Finally, in addition to this introduction, the study is structured as follows: a review of the literature, followed by the methodology, then the analysis of the obtained results, and concludes with the discussion and conclusions.

Review of the literature

The theoretical framework of this study lies in agency theory, which states that the interests pursued by the different parties (principal and agent) in a company, together with the asymmetry of information, lead to contract generation and (agency) costs, through the misuse of corporate assets such as undertaking excessively risky or imprudent projects (Jensen & Meckling, 1998; John & Senbet, 1998; Shleifer & Vishny, 1986). According to agency theory, adequate company monitoring implies establishing mechanisms to protect shareholders from the interests of management. These mechanisms must be both internal and external (Saltaji, 2013).

Corporate governance

According to the OECD (2004), “CG is a key element to increase economic efficiency and boost growth, as well as promote investor confidence. Corporate governance encompasses a series of relationships between the management, the Board, shareholders, and other stakeholders of a company. CG also provides a structure to establish company objectives and determines what means can be used to achieve those objectives and to monitor compliance. Good CG must provide appropriate incentives to the Board and the management so that they pursue objectives that serve the interests of the company and its shareholders, as well as facilitate efficient monitoring” (p. 11). In other words, CG is the set of laws, regulations, and practices that minimize the risk of managers expropriating investors (Faría, Millán, & Villa, 2006: 14).

In Mexico, the CBPCG regulates CG and establishes recommendations for all listed companies that list their shares or issue debt securities on the BMV. The integration of the Board of Directors is an essential element for its proper functioning, with a recommendation that 3 to 15 directors (practice 9) comprise it. Independent directors should represent at least 25% of the total directors (practice 12). Additionally, the chairman of the board and the CEO should be different people in order to limit conflicts of interest. Concerning the audit committee—which is responsible for overseeing the company through the establishment and monitoring of an internal control system, ensuring transparency in accountability, and reviewing transactions with related parties—it is recommended that at least 3 independent directors comprise it.

Family-owned company

This study defines a family-owned company as that in which family members actively participate in the ownership and management of the same (Claessens, Djankov, & Lang, 2000; Faccio & Lang, 2002; Anderson & Reeb, 2003; Chrisman et al., 2013; Dinh & Calabrò, 2018). The family should prioritize correct decision-making to obtain better results and future benefits (Carlock & Ward, 2010; Ekanayake & Kuruppuge, 2017). These benefits include a more efficient decision-making process due to the specialization achieved at all levels of the company and the willingness to accept unrestricted risk sharing (Fama & Jensen, 1983).

Size of the board of directors

Since ownership and governance structure influence company decisions (Miller & LeBreton, 2006), the supervisory role exercised by the board of directors is of great importance. Therefore, the corporate governance of family-owned companies plays a key role in strategic decisions, which differs from its role in non-family-owned companies (Bammens, Voordecker, & Van Gils, 2011; Gersick & Felieu, 2013). Some studies from the United States and the United Kingdom indicate that these boards do not function particularly well, or their composition has little positive impact on the performance of these companies (Chrisman, Kellermanns, Chan, & Liano, 2009; Wilson, Wright, & Scholes, 2013; Chrisman, Chua, & Litz, 2004; Schulze, Lubatkin, Dino, & Buchholtz, 2001).

According to Barclay and Holderness (1989), in the United States, company value decreases due to a high concentration of power and the involvement of family in selecting their directors, which prevents or limits the access of other actors to the decision-making process. In the Spanish case, Gomez-Mejia, Nunez-Nickel, and Gutierrez (2001) use the term “cordoned off management”. However, for Demsetz and Lehn (1985), in the North American market, there is the separation of company ownership and control, with the responsibility for commercial decision-making falling more on managers than on minority shareholders. Shleifer and Vishny (1986) recognize that CG is frequently concentrated in the family nucleus in the largest companies. This statement is reinforced by Colli (2003), who identifies that 90% of North

American companies are family-owned

Family-owned companies have larger boards than non-family-owned companies (Gersick & Feliu, 2013; Wilson et al., 2013). In this sense, the study by Wilson et al. (2013), in the United Kingdom, contributes additional characteristics of the boards such as having older members, with experience in management, and having a higher ratio of sitting directors and independent directors.

Based on the review of the literature and considering that a larger board of directors implies higher agency costs, the following hypothesis is established:

H1: A larger board of directors in family-owned companies has a significant impact on a higher risk of insolvency.

The participation of independent directors. Independent directors contribute with their experience in supervising (Anderson & Reeb, 2004; Fich & Slezak, 2008; Heuvel, Gils, & Voordeckers, 2006; Wilson et al., 2013). These directors, however, receive greater pressure from external investors to take risks in order to increase their profits (George, Wiklund, & Zahra, 2005). Their multiple participation in different boards improves their abilities, knowledge, and relational capital, which can facilitate company access to commercially favorable conditions (Arregle, Hitt, Sirmon, & Very, 2007). Conversely, such disperse participation can limit their attention to the particular interests of the company (Wilson et al., 2013).

In family-owned companies, the family can incorporate independent directors to the board of directors to take advantage of their experience and knowledge in the activity sector. According to their study in Belgium, Voordeckers, Van Gils, and Van den Heuvel (2007) indicate that these directors can play an important role in the performance of family-owned companies.

Based on the above, the following hypothesis is stated:

H2: The participation of independent directors in family-owned companies has a significant impact on a lower risk of insolvency.

CEO duality

CEO duality refers to joining the positions of chairman of the board and CEO, that is, the person who occupies the highest executive position in the company is also the highest representative of the board (Fernández-Ortiz, Rodríguez, & Ruíz, 2007). For family-owned companies, the frequent participation of the owner (principal) in the management (principal), coupled with the lack of diversification in the board, ensures effective decision-making, maximizing family wealth and limiting agency costs (Anderson & Reeb, 2003; George et al., 2005; Maury, 2006). There are observations that this alignment has negative consequences, such as the reluctance of managers to carry out risky projects due to concern for their own wellbeing (Fama, 1980; DeAngelo & DeAngelo, 2000; Hiebl, 2013). These observations are consistent with the literature, which mentions that a dual structure can compromise the efficiency of the board of directors, the management and monitoring of the company, and the financial results (Dechow, Sloan, & Sweeny, 1996).

For their part, Braun and Sharma (2007), with public companies in the United States, examined the relationship of the duality of the functions of the chairman of the board and manager with the financial performance of family-owned companies. The results indicated that the separation or not of the functions of these two roles had no impact on company performance.

The hypothesis to contrast is the following:

H3: CEO duality in family-owned companies has a significant impact on a lower risk of insolvency.

Size of the Audit committee

The audit committee is one of the main external control mechanisms. In their comparative study of Europe and Asia, and Faccio, Lang, and Young (2001) recognize that the lack of good supervision causes major investors, such as the founding families, to exploit minority shareholders for the profits generated by the company. This exploitation is done using special dividends or excessive compensation, among other things (DeAngelo & DeAngelo, 2000).

Karamanou and Vefees (2005) state that the size of the audit committee has a significant effect on company performance supervision. Larger audit committees have a broader range of knowledge; however, in practice, audit committees often do not have enough personnel and are generally comprised of four to five members. Larger, more independent, and active audit committees, with greater expertise, are expected to exhibit better oversight of management performance.

In summary, in terms of management, the review of the literature highlights the economic relevance of having efficient CG in the company. Additionally, there are studies that have positively related some of their structural characteristics such as size (Ganga & Vera, 2008), size of the audit committee (Octavia, 2013; Karamanou & Vefees, 2005), chairman-CEO duality (Ruiz-Porras & Steinwascher, 2007; Braun & Sharma, 2007), ownership concentration and multiple participation of the board (Ganga & Vera, 2008; Voordeckers, Van Gils, & Van den Heuvel, 2007), all of which have effects on both financial performance and risk of insolvency.

Based on the review above, the following hypothesis is established:

H4: A large audit committee in family-owned companies has a significant impact on a lower risk of insolvency.

Risk of insolvency and corporate governance

Insolvency has been an important subject of study since the 1930s (Fitzpatrick, 1932; Winakor & Smith, 1935). This status has favored its constant evolution. At first, its precursors used univariate techniques (Beaver, 1966), which were promptly replaced by multivariate analyses (Altman, 1968). Recently, there have been models based on artificial intelligence (Hair, Anderson, Tatham, & Black, 1999) such as self-organized maps (Kohonen, 1982), artificial neural networks (Serrano Cinca & Martín del Brío, 1993), rough sets (McKee, 2000), AdaBoost (Bauer & Kohavi, 1999), data envelopment analysis (Premachandra, Bhabra, & Sueyoshi, 2009), and clusters (Lizano, Ochovo, & de Lema, 2010). However, despite the high confidence level achieved by some of these models, their functionality has been questioned due to the difficulty in replicating them in different contexts, sectors, or periods. This issue has led to the use of the first models based on financial information.

That information was the basis for the short-term prediction of insolvency of companies through a reliable mathematical model based on effective decision-making on the possibilities of bankruptcy (Altman, 1968). The Altman Z-score model is widely known and used in different studies to establish whether a company is financially sound, with a medium probability of bankruptcy, or in a situation of insolvency or potential failure (Altman, 2000). This model is a multivariate formula widely accepted by auditors and financial managers, and the basis for database systems since the mid-1980s. In summary, this model has been used for more than 50 years, which gives it robustness in its use.

There are studies on the efficiency and importance of the Altman Z-score model at the international level and its applications in finance and related areas (Altman, Iwanicz-Drozdowska, Laitinen, & Suvas, 2014). These authors reviewed an analysis of 33 scientific articles published since 2000 in major international financial and accounting journals. Additionally, they used a large sample of international companies to evaluate the classification performance of the model in the event of bankruptcy and predicting companies in financial difficulties. This performance analysis included companies from 31 European countries and three non-European countries. Except for the United States and China, the companies in the sample are, for the most part, private and include non-financial companies in all industrial sectors. Therefore, this study

used the modified Altman Z-score model. The results indicate that although a general international model functions reasonably well for most countries, with a predictive accuracy of 75%, and exceptionally well for others (more than 90%), the classification accuracy could be considerably better with an separate estimate for each country, particularly using additional variables. Table 1 illustrates the studies in Latin American countries.

Table 1
 Altman Z-score model in Latin American Countries

Study	Study summary	Country	Methodology
Altman, Baidya, and Dias model (Altman, Baidya, & Dias, 1979)	Bankruptcy risk analysis of 23 companies during a period of national crisis.	Brazil	Adaptation of the Altman model with a scope of 1 to 3 years before bankruptcy. 22 of the original Altman ratios adapted to the characteristics of the macroenvironment are used. Adaptation of variables, for example, accounting variables due to different international interpretations of balance sheets. The prediction oscillated between 88% a year prior and 78% three years prior.
Swanson and Tybout model (Swanson & Tybout, 1988)	Impact on business survival of the association of bankruptcies, real interest types, and establishment of credit “stocks” at a macroeconomic level.	Argentina	Adaptation of the Altman model according to the available data. 16 ratios and 3 factors are used. Construction of standardization ratios.
Pascale model (Pascale, 1988)	Predict company bankruptcy in the national manufacturing industry using 44 companies.	Uruguay	Adaptation of the Altman model with a scope of 1 to 3 years before bankruptcy. Uses 13 ratios, of which 6 have no component specification. It had 91.8% company classification accuracy
Hernández (2014)	Mobilization of the Altman model for all companies in the Latin American context	Costa Rica	Adaptation of the Altman model. Uses 5 ratios for public companies or 4 ratios for closed-end management companies to simplify using the tool.
Altman, Hartzell, and Peck (1995)	A scoring system (EMS model) was used for emerging market corporate bonds in Mexico. The EMS model is an improved version of the statistically proven Z-score model (Altman, 1968).	Mexico	Use of the Altman Z-score model for emerging markets.

Source: own elaboration based on Ibarra (2001)

In all the studies, the adaptations to the Altman model result from a lack of relevant and sufficient databases. Given the scant studies, the authors recognize the importance of replicating them in emerging countries, including different sectors and companies of different sizes, as is the case of family-owned companies.

Some studies have related CG with the risk of insolvency (Darrat, Gray, Park, & Wu, 2014; Uang, Citron, Sudarsanam, & Taffler, 2006; Vaknin, 2010). Insolvency is the inability to pay debts (Park & Hancer, 2012). There is a close relationship between CG and the risk of insolvency given the existence of inefficient stakeholder contracts that lead the company to different types of risk. Most studies identify the relationships as positive, estimating that with higher CG standards, there is a lower risk of insolvency (Cheung, Fung, & Tsai, 2010). In the same vein, Rodríguez and Noguera (2014) highlight the positive impact of other CG factors such as the level of transparency and deconcentration of power. Some inconclusive studies have tried to relate it with the size of the board of directors and the deconcentration of information (Nakano & Nguyen, 2012). Vaknin (2010), in a study of 122 American companies, analyzed the risk of family-owned companies using the Z-score model, finding that family-owned companies are less risky and thus more resilient to financial

crises. The results of this study indicate that family-owned companies are more financially sound, despite possibly suffering from asymmetric information and agency costs.

Company characteristics

Alamro & Al-soub (2012) state that large companies can adequately exploit economies of scale and, therefore, be more efficient compared to small companies. In a study in Malaysia, Ali & Fauzi (2018) found a significant relationship between company size and a lower risk of insolvency, because smaller companies tend to have less power than their larger counterparts and have more difficulties in competing with larger companies in highly competitive markets. Based on the above, the following hypothesis is established, expecting a positive relationship based on the fact that large companies can better manage risk than smaller ones.

H5: The larger size of a family-owned business has a significant impact on a lower risk of insolvency.

The economic sector plays a key role in the success or failure of family-owned companies. Previous studies illustrate that the industry effect impacts the analysis of financial failures (Smith & Liou, 2007). Based on the above, the following hypothesis is established:

H6: The construction and manufacturing sector of the family-owned company has a significant impact on a lower risk of insolvency.

Methodology

This study is of a descriptive, exploratory, and causal type, and uses panel data. The study sample comprises family-owned companies listed on the BMV during the 2012-2016 period. The database Economática was used to obtain the financial information of the companies. The information related to family ownership and CG for the sample of companies was obtained from the annual reports published by the BMV on their website corresponding to the fiscal years previously mentioned. The study excluded financial entities and “nonprofits” due to their highly specific characteristics. At first, 79 family-owned companies were identified using the annual reports based on the majority of shareholdings being under one family name and where a member or members of said family participated in the board of directors or management of the company. Of these companies, 12 were eliminated as they lacked the financial information required for this study. The 67 family-owned companies (335 observations) that comprise the final sample (see Table 2) are representative of the different economic sectors they participate in, based on the central limit theorem.

Table 2
 Sample by activity sector

Sector	Family-owned company	%
Industrial	14	21
Materials	18	27
Fast-moving consumer products	17	25
Health	3	4
Telecommunication services	6	9
Consumer discretionary	9	13
Total	67	100

Source: own elaboration based on the BMV (2017)

Econometric model

The data analysis used the Generalized Estimating Equation (GEE) (Liang & Zeger, 1986) as an extension of quasi-likelihood models, which allows the modeling of responses correlated among themselves. More specifically, this model is used in studies where more than one measurement is taken for a single variable, such as the panel data design used in this study, supported by the SPSS statistics program. GEE models are used to analyze longitudinal data with repeated observations of one response variable, taken at different points in time, in a single individual or company. For the correct analysis of these data, it is necessary to consider the possible correlation between the measures of each subject. In linear models, this correlation is ignored; thus, estimator variance would be incorrect, obtaining erroneous conclusions regarding statistical significance. The GEE models marginal or demographic expectations, incorporating the correlation between observations of a single individual and assuming independence among these individuals. Additionally, these models are extremely flexible, needing only a transformation or link function, a variance function, and a correlation structure to provide a good estimate.

With the established model detailed below, it was possible to analyze the impact of some CG control mechanisms on the risk of insolvency for family-owned companies listed on the BMV during the 2012-2016 period, considering some control variables such as company size and activity sector.

$$Zscore = Zs_{it} = \beta_0 + \beta_1 LN_TCA_{it} + \beta_2 TICA_{it} + \beta_3 LN_TCAU_{it} + \beta_4 DC_{it} + \beta_5 LN_TAM_{it} + \beta_6 SECTOR_{it} + \varepsilon_{it} \quad (1)$$

Variables

Dependent

Zs is the risk of insolvency measured using the Altman Z-score (1968) model, modified for implementation in emerging markets (Altman, Hartzell & Peck, 1995; Altman, 2000). This function was modified to apply it to companies from all sectors and unlisted companies. These changes were made by eliminating the Sales/Total assets ratio, which is highly sensitive to company activity sector and, mainly, to minimize the potential industry effects of different types of asset financing such as capital leases (Maina & Sakwa, 2010). They also modified the X4 indicator to consider the book value of net capital instead of the market value. This study uses this adjusted version since different sectors are used and in a Mexican context. Therefore, the function is the following:

$$Zs = 6.56 * X1 + 3.26 * X2 + 6.72 * X3 + 1.05 * X4 \quad (2)$$

Where X1 is the net working capital / total assets; X2 is the retained earnings / total assets; X3 is the UAII / total assets; X4 is the book value of equity / total liability. The accounting data from the financial reports of the studied companies have been used exclusively for these variables.

It is important to note that three probability areas explain the modified Altman Z-score index (Zs): safe > 2.90, gray 1.21 – 2.90, and dangerous < 1.21. Therefore, the lower this indicator, the greater the risk of insolvency in the next two years, possibly reaching imminent bankruptcy.

Additionally, three reasons justify using this indicator. The first is the ease of calculation since it uses purely accounting data that are easily gleaned from the Economática database. Second, its international application in different scientific studies for different countries worldwide for more than 50 years (Altman, Iwanicz-Drozdowska, Laitinen, & Suvas, 2014). Finally, as noted by Zmijewski (1984, p. 59), the studies generally estimate financial problem prediction models in non-random samples. Model estimation in these samples can result in biased parameters and probability estimations if appropriate estimation techniques are not used.

Independent

Ln_TCA is the size of the board of directors measured using the logarithm of the number of directors, including permanent, independent, and related directors.

TICA is the number of independent directors among the total directors that comprise the board of directors.

Ln_TCAU is the size of the audit committee measured by the logarithm of the number of members.

DC is the duality of the chairman of the board and the chief executive officer (CEO). This variable has a value of 1 when there is duality and 0 otherwise.

Control

Ln_TAM represents the size of the family-owned company measured using the logarithm of the total assets. This measurement has been used in previous studies on the risk of insolvency, such as that by Megginson, Meles, Sampagnaro, and Verdoliva (2016).

SECTOR is the economic activity sector of the family-owned company. This variable has a value of 1 when the sector is secondary and 2 when it is tertiary.

Results

Below are the obtained results analyzed using descriptive statistics (Tables 3, 4, and 5) and the estimation of the GEE model (Table 6).

Table 3 illustrates the average per year of the modified Altman Z-score index of the 67 family-owned companies in the sample. It is important to note that, per year, the Z-score average for these companies is above 2.74, which confirms that family-owned companies are financially sound (Carlock & Ward, 2010; McConaughy, Matthews, & Fialko, 2001).

Table 3
Information of the modified Altman Z-score index for 2012-2016

Year	N	Mean	Standard deviation	Standard error	95% confidence level for the mean		Minimum	Maximum
					Lower limit	Upper limit		
2012	67	3.3016	2.12991	.26021	2.7821	3.8211	-.05	10.24
2013	67	3.0542	1.90706	.23298	2.5891	3.5194	.31	7.94
2014	67	3.0151	1.99608	.24386	2.5282	3.5020	.06	8.06
2015	67	2.8894	2.15200	.26291	2.3645	3.4144	-2.50	8.75
2016	67	2.7447	2.28551	.27922	2.1873	3.3022	-2.16	9.28

Source: own elaboration

As illustrated in Table 3, most family-owned companies do not have CEO duality (64.5%). However, 35.5% of these companies have a CEO who is also the chairman of the board (dual structure). Additionally, most family-owned companies are in the secondary sector (73.1%), with many companies dedicated to construction and manufacturing.

Table 4
 Categorical variable information

			N	Percentage
Factor	DC	No	216	64.5%
		Yes	119	35.5%
		Total	335	100.0%
SECTOR	Secondary sector	245	73.1%	
	Tertiary sector	90	26.9%	
	Total	335	100.0%	

Source: own elaboration

Table 5 illustrates the descriptive statistics of the continuous variables. It is important to note that the indicator for the risk of insolvency (modified Altman Z-score index) has a mean of 6.2510, which explains that on average family-owned companies are in a fairly safe and financially sound area, given that the modified Altman Z-score is above 2.90.

Table 5
 Continuous variable information

		N	Minimum	Maximum	Mean	Standard deviation
Dependent variable	Z-score	335	.75	13.49	6.2510	2.09384
Covariable	Ln_TCA	335	1.61	3.09	2.3999	.31799
	Ln_TCAU	335	.69	1.79	1.1528	.14244
	TICA	335	.00	.88	.4176	.20672
	Ln_TAM	335	.00	4.51	3.3995	.67999

Ln_TCA is the size of the board of directors measured using the logarithm of the number of members.

TICA is the independence rate of the board of directors

Ln_TCAU is the size of the audit committee measured using the logarithm of the number of members.

Ln_TAM is the size of the company measured using the logarithm of total assets.

Source: own elaboration

Robustness analysis of the model

In order to analyze the statistical robustness of the model estimators, the first step was to determine the presence of heteroscedasticity in the remainders of said model. In this case, with an indicative pattern that there is no homogeneity in the variance of the remainders through the model predictions, the Huber-White sandwich estimator test was used to rule out the assumption of heteroscedasticity. In this case, the “deviance” remainder was used.

In order to assess the linearity of the residues of the generated “deviance” remainder variable, a Q-Q graph was made between the expected and observed values, illustrating a linear trend of the remainders.

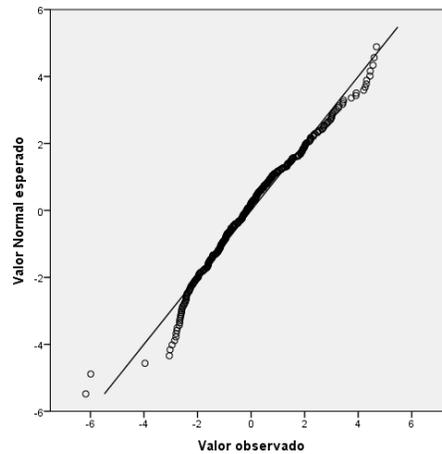


Figure 1. Normal Q-Q of deviance remainder

Additionally, the current two most used normality tests were implemented, Shapiro-Wilk (0.979, $gl=335$, $sig.=0.000$) and Kolmogorov-Smirnov (0.056, $gl=335$, $sig.=0.012$), whose significant results illustrate that the remainders do not follow a normal distribution, which supports using the GEE model.

It is necessary for the predictive variables to be independent of each other so that the estimators of the regression coefficients, their effect magnitudes, and significance are unbiased to rule out multicollinearity. This aspect has been assessed and ruled out using variance inflation factor (VIF), which demonstrated values above 1 and below 1.5.

Finally, to continue with the proper interpretation of the results, the overall significance of the model was evaluated using the omnibus test (Chi-square=68.954, $gl=6$, $sig.=0.000$), which compares the adjusted model with the model made up of only the intersection. The significant result of the test indicates the goodness of fit of the model, and it can be stated that there are differences between the adjusted model and the model with just the intersection or constant, that is, at least one of the calculated coefficients for the model is statistically significant.

Results of the GEE model

As demonstrated in Table 5, the estimation of the GEE model indicated that the best and most statistically significant predictors to explain the CG mechanisms that impact on the risk of insolvency of Mexican family-owned companies are the size of the board of directors and the active sector of the company. The reason is that in all cases, convergence was reached in the parameter estimation when the working correlation matrix has an independent structure (quasi-likelihood under independence criterion QIC). In all other cases, convergence was not reached and thus these cases were not in the respective table since the parameter data were redundant.

Table 6
 Estimations of the GEE model

Parameter	B	Standard error	95% Wald confidence interval		Hypothesis contrast		
			Lower	Upper	Wald Chi-square	gl	Sig.
(Intersection)	2.491	.4517	1.606	3.376	30.418	1	.000
Ln_TCA	-.435	.1128	-.656	-.214	14.911	1	.000
TICA	.257	.1560	-.049	.563	2.713	1	.100
Ln_TCAU	.177	.2326	-.279	.633	.580	1	.446

[DC=0]	.087	.0672	-.044	.219	1.687	1	.194
[DC=1]	0 ^a	.	.	.	.	.	.
Ln_TAM	-.063	.0249	-.112	-.015	6.464	1	.011
[sector=1]	.482	.0735	.338	.626	43.017	1	.000
[sector=2]	0 ^a	.	.	.	.	.	.
(Scale)	.335						

Dependent variable: Z-score

Model: (Intersection), Ln_TCA, Ln_TCAU, TICA, DC, Ln_TAM, SECTOR,

a. Defined as zero because this parameter is redundant.

Probability distribution: gamma; link function: logarithm

Source: own elaboration.

In the table above, the predictor of the CG mechanism related to the size of the board of directors demonstrates that the more members in the board, the lower the modified Altman Z-score index of the family-owned company. This relation indicates that there is a greater likelihood of incurring a risk of insolvency. In this same vein, Beasley (1996) considers that the size of the board of directors significantly impacts on the likelihood of financial fraud affecting its performance. The results indicate that the more members of the board, the higher the risk of poor performance; therefore, the risk of insolvency could manifest itself in the company. Similarly, Chrisman et al. (2009) and Wilson et al. (2013) note that a large board of directors does not function properly or, at least, its composition has little positive impact on the performance of the family-owned company. However, comparing family-owned and non-family-owned companies, some authors note that the former have more directors than the latter (Gersick & Feliu, 2013; Wilson et al., 2013). Additionally, the results also demonstrate that family-owned companies in the secondary sector (construction and manufacturing) are associated with a higher Z-score, which indicates a lower risk of insolvency. Concerning the participation of independent directors, the size of the audit committee, CEO duality, and company size, the model estimation did not provide statistically significant values below 0.05; as such, no association was found between these CG variables and risk of insolvency. The non-significant results in the size of the audit committee can be because most family-owned companies have, on average, three members in said committee, which implies less supervision of the financial information generated by the company, which could, in turn, increase the likelihood of incurring risk of insolvency. Based on the above, the general hypotheses H1 and H6 are accepted; however, hypotheses H2, H3, H4, and H5 were not empirically proven.

Discussion of the results

Agency theory is pertinent to the objectives of this study because the origin of the problem is the separation of ownership and management. Some academics, however, consider this perspective to be limited (Corbetta & Salvato, 2004; Klein & Kellermanns, 2008) because family-owned companies also pursue non-economic and socioemotional objectives (Astrachan & Jaskiewicz, 2008; Gomez-Mejia, Nunez-Nickel, & Gutierrez, 2001). However, the financial results depend on the character of the agency costs, with some increasing and others decreasing counteracting the former (Braun & Sharma, 2007).

By their nature, family-owned companies are more reserved in their CG practices (Ali, Chen, & Radhakrishnan, 2007). This characteristic notwithstanding, the company results can be optimized if family ownership can be controlled and used properly (Ng, 2005). These CG practices have some synergies and relevance for emerging economies, as is the case of Mexico. However, the character of the business structures in this country, for example, the large number of family-owned companies, limits the generalization of the findings and points to the need for further research into these companies. The continuity and longevity of family-owned companies depends on their financial viability or performance, that is, whether they remain solvent or face imminent bankruptcy in the next two years.

The results obtained indicate that the risk of insolvency (modified Altman Z-score) explains that, on average, Mexican family-owned companies were financially sound during the study period (Vaknin, 2010), and had a high likelihood of continuing in the market with good financial performance, the reason being that these companies are more conservative and because of the family interest in maintaining control of the company for future generations. However, the larger the board of directors, the higher the risk of insolvency (lower modified Altman Z-score index).

Conclusions

This study focused on exploring CG mechanisms and their relationship with the risk of insolvency of family-owned companies listed on the BMV during the 2012-2016 period. Currently, there is little empirical evidence in Mexico on the topic studied and this study pioneers the field of study since the modified Altman Z-score index has been tested for decades in different countries such as Mexico (Altman et al., 2014). Generally, the family-owned company is recognized as risk-averse, conservative, and financially sound in contrast to the non-family-owned company (Carlock & Ward, 2010; McConaughy, Matthews, & Fialko, 2001).

Among the results obtained, there are statistically significant associations between the size of the board of directors and active sector with the risk of insolvency, which indicates that family-owned companies in the construction and manufacturing industry have a higher modified Altman Z-score index and lower risk of insolvency. However, the size of the board of directors (more directors) demonstrates a significant association with a lower modified Altman Z-score index, explained as a greater likelihood of incurring a risk of insolvency. The other mechanisms did not provide significant data; therefore, their relationship with the risk of insolvency could not be empirically proven.

A limitation of this study lies in its focus on Mexican family-owned companies listed on the BMV during a specific period. For this reason, the effects of the CG mechanisms and their relationship with the risk of insolvency for family-owned companies in other countries were not analyzed, the same reason for which non-family-owned companies were also not analyzed. Another limitation was the lack of readily available annual information on the specific characteristics of this type of company, as well as information on family and non-family shareholders, directors and managers, generation, and successor. Access to this additional information would have allowed a more in-depth study of the different agency problems.

As future lines of research, it should be possible to carry out comparative studies of family-owned and non-family owned companies, of countries with emerging economies, as well as incorporating other study variables such as the generation number, succession, family assembly, family board, and family protocol, among others.

Finally, this exploratory study enriches the existing literature on the topic of CG and the risk of insolvency for Mexican family-owned companies. It should prove useful for family-owned companies to adopt proper mechanisms for good CG. It should also prove useful for universities, so that professors and researchers investigate these relevant topics further, to update study programs in the economic, financial, and business areas, and to motivate students to develop both undergraduate and postgraduate theses.

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