Key factors influencing the performance of construction companies

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Abstract

In this dissertation we analyse what main factors impact the performance of companies in the construction sector. We find strong evidence that having a high equity ratio, having a large amount of its resources in cash, being able to supply credit to customers, having the government as a shareholder and having a control shareholder are factors that are positively related with performance. Besides these factors we also find that size has an ambiguous relationship with performance and that having a bank as a shareholder is, weakly, negatively related with financial performance. Furthermore, we find that the factors influencing performance on absolute terms are quite similar to the factors influencing relative performance. Our results are robust and hold, with minor differences, across the models we use.

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Resumo

Neste estudo analisamos quais são os principais fatores que influenciam o desempenho de uma empresa de construção. Os principais fatores que encontrámos são ter um elevado rácio de capital, ter uma elevada liquidez, capacidade de conceder crédito a clientes, ter participação do estado no capital e ter um acionista maioritário. Para além destes fatores, encontrámos também que o tamanho de uma empresa tem uma relação não linear com o seu desempenho e que ter um banco como acionista está negativamente relacionado com desempenho. Os resultados obtidos, com pequenas diferenças, são consistentes nos modelos utilizados.

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Lastly, to my family, gratitude and love for helping me shape what I am today.

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1 Introduction

Who should own the companies that build the World and how those companies should operate in order to maximize their efficiency and returns are question that deserve to be answered. Construction companies are not only directly responsible for generating 10 trillion $ in global GDP (Mckinsey report 2017) last year but, by being an industry placed downstream of most other sectors, it plays a crucial role in the World´s economy.

Despite its prominent position in the World's economy, the construction industry has been lagging behind in terms of efficiency growth and productivity in terms of gross value added per labour hour, capital employed and CO_2 emissions. This is reflected in the low average returns, in terms of capital employed, generated by this industry.

There are nonetheless some companies that have been outperforming its peers achieving distinctive results. In this dissertation, I aim to analyse not only which factors impact the performance of construction companies but also the behaviour, with regards to the aspects under analysis, of the top performing companies in this sector. In order to have a holistic view of the performance of a construction company it is necessary to analyse several highly distinctive factors, with this dissertation focusing on 5 key factors, identified both in the literature review and in interviews with industry executives (Table 1). The key factors identified to be both academically relevant and interesting from a managerial perspective are: different capital structures (I), ownership structure (II), scale (III,) cash holdings (IV) and relationships with other vertical and horizontal players (V) influence the performance of these companies. The aspects chosen represent in large part the range of options a manager has in terms of managing its asset and ownership base, being significant because they provide powerful insights which can be applicable by managers in their decision making. Furthermore, this study will provide answers to some currently asked questions which will add to research on capital structure, ownership structure, particularly government ownership, and cash ownership.

1.1 Capital structure

One key question in the construction industry regards its financing, due to the large investments required and high development periods the recourse to debt financing, usually involving large consortiums, is necessary. On a firm perspective this question is presented in the amount of investment it requires from shareholders to maximize returns.

1.2 Ownership structure

Besides the financing of a construction company, another relevant issue facing construction companies is its ownership structure. In this dissertation this issue is analysed form three main perspectives: the existence of a controlling shareholder, the participation in the company´s capital structure of institutional shareholders (i.e. government and banks) and the existence of foreign shareholders (additionally it was analysed the effects of foreign control).

1.3 Size and scale

Other relevant aspect under analysis is the relationship between scale and the performance of construction companies. Although this topic has long gathered significant attention, there is no consensual results around the topic. Concerning this aspect this dissertation finds evidence of the connection between size and performance in construction companies.

1.4 Cash holdings

One of the aspects mostly discussed by construction executives is the strategic relevance of cash holdings. This aspect has a particular strategic relevance within the construction sector due to its relevance in order to be able to take advantage of potential profitable investment opportunities which frequently require significant upfront investments. This topic fails however to generate consensus, with conventional financial theory stating that in competitive markets the availability of own funds is mostly irrelevant with positive NPV projects being able to be financed, nonetheless research has found that not only firms have been increasing their cash holdings Bates, Thomas and Kahle (2009), furthermore

Kim and Bettis (2014) also found that these cash holding are a competitive advantage with positive impacts on a firms returns.

1.5   Relationships with other players

Lastly this dissertation also aims to analyse how trade relationships (credit granted to customers and credit received from suppliers) and participating in joint ventures (either as a minority or as a majority partner) influences a construction firm's profitability.

Hereinafter this dissertation chapters are subdivided to provide an in-depth perspective on each of the 5 diverse key factors under analysis. The structure of this dissertation is as follows: firstly a context regrading this industry is provided, focusing both on the Worldwide perspective and on the Portuguese construction market national perspective, then the existing literature regarding each of the performance components under analysis is explained, followed by an explanation between the data used and the methodology followed in this dissertation to test the impact of each factor as well as the models used and the robustness tests of the results, after the results are presented and discussed taking particular consideration on the applicability of these results, lastly the limitations of this dissertation are detailed and possible further research proposed.

2 The Construction Industry:

The construction industry is one of the most economically relevant sectors Worldwide, itself and related activities representing around 13% of the World's GDP (2017 – Mckinsey report), about 10 trillion dollars and employing directly more than 100 million people. It is a sector that is necessary for the overall function and development of other sectors from tourism to oil and gas.

Currently the most significant construction markets are Asia, followed by Western Europe and North America, representing almost 82% of the market, a significant market concentration.

The sector has had a considerable, and almost uninterrupted growth in the last two and a half decades, with an average of 2.5% yearly growth. Having this growth been stunted by the 2008 financial crises which is, at least partially, responsible for the significant crashes in North America, -24.8% growth between 2005-2010, and Europe's negative growth between 2005-2015. An interesting fact about the impacts of this crisis in the construction sector is the difference it impact had in North America, with a huge decline in the period between 2005-2010, which was followed by a quick recovery, and in Western Europe, smaller annual decline over a longer period between 2005 and 2015. These different reactions to the crises and successive recovery are not only attributed to the different impacts and market characteristics but also with the different approaches each government implements. Particularly, the USA and the EU, with the US taking a policy of quantitative easing since the beginning of the crises and the EU followed an initially more refrained approach with limited ECB purchases.

This growth has however not been consistent across regions, with Asia becoming the undisputed leader while Western Europe and North America now lagging significantly. It is however worth noting that these two regions still represent today about a third of the World's market, representing slightly more than half of the market 1995. The figures are also consistent with what is expected, with emerging markets showing growth rates significantly higher than the World average while more developed markets have more modest growth rates.

Furthermore, it is a sector that is responsible for a significant amount of the energy and raw a material's consumption on a global scale, being the number one sector in terms of raw material's consumption and responsible for about of 30% of the World's greenhouse gas emissions.

Table 1 – Construction Sector's Revenues

	1995	**2000**	**2005**	**2010**	**2015**	**2018**
Asia	1 880	1 895	2 177	2 957	4 080	4 675
Eastern Europe	271	272	352	445	447	468
Middle East	124	143	181	272	335	369
Oceania	163	205	272	329	392	393
South America	284	297	329	453	508	482
Western Europe	1 992	2 179	2 350	2 260	2 144	2 321
Africa	41	48	68	105	139	143
North America	1 089	1 373	1 504	1 131	1 319	1 419
World	5 843	6 412	7 232	7 951	9 364	10 271

Values in Billions of 2010 $

Table 2 – Construction Sector's Revenue Growth

Growth per region	1995-2000	2000-2005	2005-2010	2010-2015	2015-2020	Total
Asia	0.8%	14.9%	35.8%	38.0%	26.3%	171.4%
Eastern Europe	0.4%	29.5%	26.3%	0.5%	7.9%	82.9%
Middle East	15.4%	26.8%	50.7%	23.2%	18.1%	233.4%
Oceania	25.6%	32.5%	21.1%	19.2%	-1.0%	148.7%
South America	4.8%	10.4%	37.8%	12.3%	-6.8%	81.5%
Western Europe	9.4%	7.8%	-3.8%	-5.1%	12.3%	21.8%
Africa	17.0%	41.4%	54.1%	32.9%	8.9%	268.4%
North America	26.2%	9.5%	-24.8%	16.6%	16.6%	34.4%
World	9.7%	12.8%	9.9%	17.8%	17.1%	87.8%

3 Literature Review

Despite the inexistence of significant literature regarding the impacts of either asset structure or ownership structure in construction companies, this study makes use of significant literature around these topics, mainly through studies performed for another industries.

This chapter is divided according to the 5 key components selected for analysis, with each subchapter detailing the relevant literature serving as a preliminary base of this study.

3.1 Capital structure

The study of capital structure is an analysis on what securities mix are used by corporations to finance its activities and the impacts that such mix has on its activities and performance. Research on this subject has been mainly focused on the ratio of debt vs. equity seen on the right side of company's balance sheets and is far from being a consensual topic. The literature proposes several theories, about how a company chooses its capital structure and its impacts.

According to Myers (2001), there is no universal theory of debt-equity choice and there is no reason to expect that one such theory exists, as different types of companies will be affected in asymmetric ways due to its own specific characteristics. Nonetheless there is value in analysing and understanding several conditional theories that have been developed.

In 1958 Modigliani and Miller (1958) suggested, in a now widely accepted theory, that in perfect and frictionless capital markets, financing didn't matter. With any deviation from equilibrium due to the companies' financing choice disappearing due to financial innovation. Although this theory has several important limitations when applied to the real world where capital markets are not always perfect or frictionless. Modigliani and Miller´s assumptions provide an important framework to test different theories on why financing choices can matter. The main reasons according to Myers (2001) are: "taxes, differences in information and agency costs" and most of the optimal capital structure theories differ on the weight and interpretation of those deviations from the "M&M" world.

The static trade-off theory takes primarily into account the taxes deductibility of interest payments and the probability (and cost) of financial distress. With the theory emphasizing that the choice of debt level

should be the one that maximizes the value of the firm, this is when the marginal tax shield is equal to the marginal cost of bankruptcy. The static trade-off theory is a direct deviation of the "M&M" world with the two main differences being the existence of taxes and of costs of financial distress.

The pecking order theory (Donaldson 1961) takes primarily into account the asymmetry of information between firm's insiders (managers and existing shareholders) and outsiders (debtholders and potential equity investors). This theory takes into account that the market is aware of this information asymmetry and will take as a sign the method the company chooses to finance its new projects, with companies picking (in a decreasing degree of confidence they have in its future prospects) internal funds, debt and new equity.

The free cash flow theory (Jensen 1986) focuses on the agency problem between managers and shareholders. According to this theory if the firms operating cash flow significantly exceeds its profitable investment opportunities managers have several incentives to use that exceeding cash in projects that do not maximize shareholder value. The theory further suggests that firms with significant excess cash flows should increase their debt ratio, even when the firm already is at a high debt ratio, due to its effect in aligning the managers' interest with those of the shareholders by preventing managers from engaging in "empire building".

3.2 Size and scale

The impacts that the size of a firm has on its performance has long been subject of intense discussion and significant research. Nevertheless, there has been no convergence of results, with several different outcomes been found across diverse literature. With several theories being associated with each outcome. Overall the two divergent visions are on one side, supported by works such as Fiegenbaum and Karnani (1991), that larger companies have an advantage in terms of costs and in the possibility to participate in more resource intensive projects, thus size having a positive relationship with performance. On the other side, Schneider (1991) states that too large corporations become inefficient, thus establishing a negative relationship between size and performance and O Hope (2008) argues that too large corporations might be an indication of top management focusing on empire building instead

of maximizing shareholder profits. There is also literature finding that size is an insignificant variable when predicting a company's performance such as Whittington (1980).

Although there is no consensus in the overall literature regarding the relationship between size and performance, there are three important pieces of literature to be taken into consideration when designing the methodology and analysing the results obtained. Schmalensee (1989), used data for US corporations between 1953 and 1983, using two-digit SIC level code to classify each company's industry, and found that, controlling for industry, large firms perform better than small firms. In this study, as in most of the works mentioned, the dependent variable chosen to represent returns is the ROA and size is measured in terms of total assets (Log Total Assets). Hall, M., & Weiss, L. (1967) finds that above a certain level, between small and medium enterprises, size is not related with performance hinting at the finding that above a certain threshold a smaller scale is no longer a barrier. In a study regarding Portuguese companies, for the period between 1999 and 2003, Serrasqueiro and Nunes (2008) have found a positive relationship between size and financial performance. Furthermore, the authors suggest this positive impact is due to higher diversification and better capacity to adapt to change, due to a larger buffer.

3.3 Ownership Structure

The ownership structure of a firm, although an "off balance-sheet" item, has significant implications for a firm as it affects the way the company is controlled and in consequence its strategic decision making. The three main aspects of ownership structure being analysed are: the existence of a controlling main shareholder, having governments and banks as shareholders and lastly having a foreign controlling shareholder.

Mintzberg (1983) conjectured that there are two prime dimensions of ownership, involvement, this is if owners are not only able but willing to influence firm´s actions and decisions, and concentration, this is the lever of dispersion of the ownership of the company's shares. [rr1] The first dimension is closely associated with different shareholder types and the second with the dispersion of the company's shares.

On the same perspective, but using a different approach, Tomson and Pederson (2000) focused on different shareholders types and concentration of ownership. They analyse, amongst other topics, the impacts that the presence of certain types of shareholders have on corporate strategy and firm's financial performance. Showing that besides concertation and involvement, it is also important to analyse the effects of different types of owners and thus different objectives and motivations have on the performance of a company.

As a base for these studies lies the different types of relationships a company has with its shareholders, which at times also take the position of different stakeholders (e.g. governments, employees, banks, pension funds) and the constrains and synergies that might arise from said relationship.

Furthermore, several studies, such as William (2005) studies have focused on reviewing the literature regarding effects on performance of having governments or governmental institutions as shareholders, taking into account several factors and being based on significantly different datasets.

As described by William (2005), most studies so far have found a negative impact of government ownership on performance, supporting the theory that the government might be less careful with taxpayer's money than investors are with theirs.

In one of the few contradictory results, Kole and Mulherin (1997) studied the performance of companies invested by the US government concluding that no significant difference could be found when compared with private sector firms within the same industry. The authors also state that the study results might differ from the common results regarding "the inefficiency of government enterprises" due to all the firms included in the study operating in competitive industries, a fact which forces them to operate efficiently. A significant conclusion implied in the study is that governments also tend to invest in lower performing industries which explains the negative correlation found when comparing with private firms without weighting in industry.

There is however another theory on the reason why companies partially owned by the government might underperform its peers. Governments tend to prefer firms to pursue other non-economic objectives. Such objectives may become harder to measure and specially to compare with those of firms purely focused on delivering financial returns.

Furthermore, there is evidence that in markets with a higher degree of government involvement in the economy there may be a positive performance effect in firms with a moderate degree of government ownership. In this line, Sun et al. (2002) found an inverse U-Shaped relationship between government ownership and firm performance for a sample of Chinese companies traded in the Shanghai and Shenzhen Exchanges. The authors argue that these relationships can be explained by a trade-off, where on the positive side the government provides political backing and signals to the market its support for the participated company decreasing its perceived risk and on the negative side there is the pressure from government to pursue non-economic goals and to favour certain interest groups.

This last section of literature is particularly applicable in this dissertation due to the high level of government involvement in the countries that account for the majority of the share of the construction industry, and thus of this dissertations observations.

3.4 Cash holdings

In the perfect world of fully transparent and frictionless financial markets, no company would hold a significant amount of cash above its day to day operational requirements. There are however several indications that, in the real world, firms hold an increasing amount of cash, through a simple observations of the amounts of cash held by some of the World's largest companies. This has been a topic that has drawn significant interest not only in academia (Seiferd and Gonenc 2016).

There are currently two main research based views regarding cash holding. The economic research-based based criticism of cash hoarding can be traced to Jensen (1989) and Fama (1980), who focus their research on the negative incentives that excessive cash have on managers own interests.

A second line of literature, primarily hypothesised by strategy scholars, has focused on the potential strategic benefits that holding high amounts of cash (George 2005) or high levels of cash (O´Brien et all 2009) have on a company through its enablement of the pursuit of profitable business opportunities. Holding cash only at a level required for transaction needs is often seen as a value optimizing approach in economics. Excess cash holdings above those required for transaction needs can be seen as wasteful

since those cash holding generate very low measurable returns while incurring a significant opportunity cost.

Having this perspective into consideration, finance and economics literature usually considers that excess cash holdings are a symptom of either managerial inefficiency or self-serving management behaviour and thus negatively related to performance Dielmar et al. (2003). "The suggestion is that excess cash should either be invested in positive NPV projects or paid to shareholders in the form of dividends of share repurchases" Kim and Bettis (2014). One particular formalization of this assumptions formulated by Jensen (1986) is that self-interested managers, without a personal interest in the financial success of the company, might squander the firm's resource. A solution recommended by Jensen (1989) is the substitution of equity for debt, with a better governance being achieved by the reduction of cash available for value destructive projects. The findings of Jensen are consistent with previous literature, reinforcing the view that excess cash due to its negative impacts on agency costs, is negatively correlated with performance, Leibenstein (1966) and Williamson (1967).

On a different note, O´Brien and Folta (2009) found, that under certain circumstances (such as the existence of capital market frictions) cash may have a positive impact on performance. Furthermore, there is also some evidence, according to Myers and Majluf (1984), that by having insufficient cash firms might have to forego profitable (positive NPV) projects.

These last insights related to the importance of cash to take advantage profitable business opportunities has long been a practical topic for construction executives. "Cash is King" is a favourite of Alex Spanos, American construction CEO, who on several occasions attributed part of his success to his strategy of maintaining a high amount of cash holdings in order to be able to survive markets downturns and be independent to make investments when the opportunity arise, without financing constrains. It is necessary to note that due to the fact that Alex Spanos was the full owner and CEO of his company, eliminating the possibility for agency problems.

Something the literature seems to ignore is a quite recurrent issue that concerns multinationals and the repatriation of cash and can be relevant in the context of this dissertation. The transaction costs of large

sums of cash (foreign exchange transaction costs, and capital mobility restrictions) and taxation lead to the hoarding of cash in some low tax, low capital mobility geographies.[1]

3.5 Relationships with other players

The impacts of participating in joint ventures, either as a minority or as a majority investor has not gathered sufficient academic interest. There is nonetheless existing literature related to the classification of joint ventures (Nippa et al. 2007) and what factors influence their performance (Sridharan 1995).

When classifying a joint venture Nippa et al. (2007) use publicly disclosed contracts for their database of joint ventures. This approach is however impossible to follow in this dissertation due to inexistent data. The process followed here to classify participations in a joint venture is the existence of positive payments from or to minority interests in the balance sheets.

Shidharan (1995), when analysing joint ventures competing for Singapore's Mass Rapid Transit contracts, suggests that there are several factors playing a role in the success of joint ventures in the construction industry. The study suggests that variables such as partner selection, need, commitment, conflict, control and cultural differences influence the performance of joint ventures.

In addition to financing itself with equity, and interest-bearing debt, a company can finance part of its activities from its trade creditors, in a non-interest paying manner. It also may face the reverse situation where it is itself financing some of its clients.

This issue is of particular relevance for the construction industry, as being able and or willing to offer it clients a reasonably high collection period is critical in winning business contracts for large infrastructure projects in developing countries. Governments in those countries tend to be unable to finance these projects' initial investments via infrastructure expenditure or outside loans. In some situations, long maturity payment schedules are a requirement to even be able to place a bid on some

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[1] As anecdotal evidence consider the cases of US tech companies, who have significant amounts of cash away from the US IRS (in Ireland for example), and Portuguese construction companies that experience large difficulties repatriating cash from Angola.

projects. Foulks (2005) states that companies that do not properly manage their accounts receivables will find themselves under liquidity and profitability constrains. Berry and Jarvis (2007) state that in defining a credit policy companies should consider the trade-off between managing sales (either securing or increasing volume) and the trade credit conditions (administrative costs and risks incurred by providing credit to customers) necessary for this management.

Lazaridis (2005) found that, along with stimulating sales, providing credit to customers also increased a company's inventory management policies and reduce the risks of a stock-out. The impacts of how a credit policy impacts a company performance were further studied by Eliots (2009), who found evidence that a very relevant part of a firm's own credit policy is to take into consideration the credit policy of its competitors.

4 Data and methodology

4.1 Data sources

This study analyses construction companies from across the Globe, between 1980 and 2018, combining several sources to increase the number of companies under analysis. Financial data, for the years between 1980 and 2018, was taken from WRDS, Thomson Reuters and Bloomberg financial databases. Ownership data, for the years between 2014 and 2018, was taken from Thomson Reuters Ownership database. The companies selected where the ones with the global industry classification standard code for Construction and Engineering (201030).

The combined datasets, after removing missing data points, cover 2581 distinct companies representing 10816 data points between 2014 and 2018. Although companies are spread across 95 countries, most of them are originally from Asia, with Japan, India and China representing 38% of total entries. The variables used in order to perform the proposed analysis are detailed and explained in **Table 3 – Summary of variables**.

Table 3 – Summary of variables

Aspect under consideration	Description	Variable
Performance (dependent variables)	• ROA	Net profit/Total Assets
	• Binary ROA	1 for the top 20% ROA performers, 0 otherwise
1. Capital structure	• Equity ratio	Total Equity/Total assets
2. Ownership structure	• Existing main shareholder	1 if any shareholders has above 50% of the company's shares, 0 otherwise
	• Foreign investment	1 is any foreign shareholder owns above 0,1% of the company's shares, 0 otherwise
	• Foreign control	1 if any foreign shareholder has above 50% of the company's shares, 0 otherwise
	• Gov	1 is any government or governmental entity owns above 0,1% of the company's shares, 0 otherwise
	• Bank	1 is any bank owns above 0,1% of the company's shares, 0 otherwise
3. Size	• Total Assets	Log (total assets)
4. Cash holdings	• Cash	Cash and short term investments/Total Assets
5. Relationship with other players	• Minority interest paid	1 if minority interest paid account >0, 0 otherwise
	• Minority interest received	1 if minority interest received account >0, 0 otherwise
	• Trade creditors	Trade creditors / total assets
	• Accounts receivable	Accounts receivables / total assets
Control variables	• Country	The 94 countries of origin of each company was defined as 93 separate dummy variables.

The entire dataset covering financial data for the overarching period from 1980-2018 presented 61851 observations. The dataset for ownership data for the same period presented 12908 observations. The transformations made were the following: All the observations that presented a ROA below -100% were removed. Further regarding outliers, the top performers of the industry where kept in the sample, as one of the objectives of the study is to analyse the reasons for the exceptional performance of that group of companies. However, the main models were also tested without this top and bottom performers (3 standard deviations from the mean) and the results are robust.

One of the limitations of the dataset used is the concentration of observations on more recent years. For example in China, there is only data from 1998 onwards. On top of this limitation, the ownership data was only available for the years between 2014 and 2018.

Altogether the data sources provide a good sample of the construction industry representing, for the year 2018, about one third of the total revenues generated by sector.

4.2 Methodology – Models

In order to analyse the main factors influencing the performance of construction companies and to understand the main characteristics of the top performing group of construction companies, this dissertation follows two approaches to study the key factors impacting a construction firm performance. The first of the methodologies, this study uses ordinary least squares regressions (OLS) to understand the impacts each of the variables has on returns, hereinafter absolute performance.

Model 1 is hereinafter called main model, because it delivers the primary conclusions in this dissertation. This model includes all variables, except the variable country.

Model 1 (Main Model):

$$ROA_{i,t} = \alpha + \beta 1 \text{ Equity Ratio}_{i,t} + \beta 2 \text{ Existing main shareholder}_{i,t} +$$
$$\beta 3 \text{ Foreign participations}_{i,t} + \beta 4 \text{ Foreign control}_{i,t} +$$
$$\beta 5 \text{ Government participations}_{i,t} + \beta 6 \text{ Bank participation}_{i,t} + \beta 7 \text{ Size}_{i,t} +$$
$$\beta 8 \text{ Cash ratio}_{i,t} + \beta 9 \text{ Minority interest paid}_{i,t} +$$
$$\beta 10 \text{ Minority interest received}_{i,t} + \beta 11 \text{ Trade creditors}_{i,t} +$$
$$\beta 12 \text{ Trade receivables}_{i,t} + \varepsilon_{i,t} \qquad (1)$$

Model 2, hereinafter Main Model + Country, is similar to model 1 with the addition of the country dummies (93 different variables, representing the 94 countries in the sample). These variables are included to test if different environments, particular legal and geopolitical, have an impact on the performance of a construction company. Each 93 countries (alphabetically from Australia to

Zimbabwe) was treated as a separate dummy variable, taking the value of 1 if the company originates from that country, and 0 otherwise. Companies originating in Argentina will get 0 in all country dummies.

Model 2 (Main Model + Country)

$ROA_{i,t} = \alpha + \beta1 \text{ Equity Ratio}_{i,t} + \beta2 \text{ Existing main shareholder}_{i,t} +$

$\qquad \beta3 \text{ Foreign participations}_{i,t} + \beta4 \text{ Foreign control}_{i,t} +$

$\qquad \beta5 \text{ Government participations}_{i,t} + \beta6 \text{ Bank participation}_{i,t} + \beta7 \text{ Size}_{i,t} +$

$\qquad \beta8 \text{ Cash ratio}_{i,t} + \beta9 \text{ Minority interest paid}_{i,t} +$

$\qquad \beta10 \text{ Minority interest received}_{i,t} + \beta11 \text{ Trade creditors}_{i,t} +$

$\qquad \beta12 \text{ Trade receivables}_{i,t} + \beta13 \text{ CountryAustralia}_{i,t} + \cdots +$

$\qquad \beta105 \text{ CountryZimbabwe}_{i,t} + \varepsilon_{i,t}$

$\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad$ (2)

Model 3, hereinafter Autoregressive Model, is similar to model 1 with the independent variables 1 year lagged, this autoregressive model is used to validate the possible causal relationship between the variables under analysis and firm performance.

Model 3 (Autoregressive Model)

$ROA_{i,t+1} = \alpha + \beta1 \text{ Equity Ratio}_{i,t} + \beta2 \text{ Existing main shareholder}_{i,t} +$

$\qquad \beta3 \text{ Foreign participations}_{i,t} + \beta4 \text{ Foreign control}_{i,t} +$

$\qquad \beta5 \text{ Government participations}_{i,t} + \beta6 \text{ Bank participation}_{i,t} + \beta7 \text{ Size}_{i,t} +$

$\qquad \beta8 \text{ Cash ratio}_{i,t} + \beta9 \text{ Minority interest paid}_{i,t} +$

$\qquad \beta10 \text{ Minority interest received}_{i,t} + \beta11 \text{ Trade creditors}_{i,t} +$

$\qquad \beta12 \text{ Trade receivables}_{i,t} + \varepsilon_{i,t+1}$

$\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad$ (3)

The second methodology, used to understand the key characteristics of the top performing construction companies, hereinafter relative performance, is a probit regression. This methodology has previously being used to predict financial distress (Zmijewski 1984) with significant success. In this dissertation this methodology is used to identify the predictors of financial success, defined in relative terms as belonging to the top 20% performers each year. In order to use this methodology the performance variable, ROA, is transformed into a dummy variable (Binary ROA) taking the value of 1 if the company belongs to the top 20% of performers, each year, and the value of zero otherwise.

Model 4, hereinafter Main Model Binary, is identical to model 1 using the probit methodology instead of an OLS regression.

Model 4 (Main Model Binary):

$Binary\ ROA_{i,t} = \alpha + \beta1\ \text{Equity Ratio}_{i,t}\ + \beta2\ \text{Existing main shareholder}_{i,t}\ +$

$\qquad\qquad \beta3\ \text{Foreign participations}_{i,t} + \beta4\ \text{Foreign control}_{i,t} +$

$\qquad\qquad \beta5\ \text{Government participations}_{i,t}\ + \beta6\ \text{Bank participation}_{i,t}\ + \beta7\ \text{Size}_{i,t} +$

$\qquad\qquad \beta8\ \text{Cash ratio}_{i,t}\ + \beta9\ \text{Minority interest paid}_{i,t} +$

$\qquad\qquad \beta10\ \text{Minority interest received}_{i,t} + \beta11\ \text{Trade creditors}_{i,t} +$

$\qquad\qquad \beta12\ \text{Trade receivables}_{i,t} + \varepsilon_{i,t}$ (4)

Models 5 and 6 adjust Models 2 and 3 by also using a probit model to test the Binary ROA instead of ROA.

Model 5 (Main Model + Country Binary)

$Binary\ ROA_{i,t} = \alpha + \beta1\ \text{Equity Ratio}_{i,t} + \beta2\ \text{Existing main shareholder}_{i,t} +$

$\qquad \beta3\ \text{Foreign participations}_{i,t} + \beta4\ \text{Foreign control}_{i,t} +$

$\qquad \beta5\ \text{Government participations}_{i,t} + \beta6\ \text{Bank participation}_{i,t} + \beta7\ \text{Size}_{i,t} +$

$\qquad \beta8\ \text{Cash ratio}_{i,t} + \beta9\ \text{Minority interest paid}_{i,t} +$

$\qquad \beta10\ \text{Minority interest received}_{i,t} + \beta11\ \text{Trade creditors}_{i,t} +$

$\qquad \beta12\ \text{Trade receivables}_{i,t} + \beta13\ \text{CountryAustralia}_{i,t} + \cdots +$

$\qquad \beta105\ \text{CountryZimbabwe}_{i,t} + \varepsilon_{i,t}$ (5)

Model 6 (Autoregressive Model Binary)

$Binary\ ROA_{i,t+1} = \alpha + \beta1\ \text{Equity Ratio}_{i,t} + \beta2\ \text{Existing main shareholder}_{i,t} +$

$\qquad \beta3\ \text{Foreign participations}_{i,t} + \beta4\ \text{Foreign control}_{i,t} +$

$\qquad \beta5\ \text{Government participations}_{i,t} + \beta6\ \text{Bank participation}_{i,t} + \beta7\ \text{Size}_{i,t} +$

$\qquad \beta8\ \text{Cash ratio}_{i,t} + \beta9\ \text{Minority interest paid}_{i,t} +$

$\qquad \beta10\ \text{Minority interest received}_{i,t} + \beta11\ \text{Trade creditors}_{i,t} +$

$\qquad \beta12\ \text{Trade receivables}_{i,t} + \varepsilon_{i,t+1}$ (6)

5 Results

This chapter presents and discusses the results obtained in the models detailed in the previous chapter, research and methodology. This chapter follows the following structure: firstly the overall results of Model 1, the Main Model, and Model 4, Main Model Binary, are presented. Secondly, important differences between Models 1 and 4 and the other models are shown and possible explanations for divergences presented, lastly the holistic view of the results regarding each of the five key factors under analysis are presented.

Table 4 – Regression Results without country dummies next presents the regression estimates and results for all models on the main variables, excluding the country dummies, which are presented separately in **Table 5 – Regression Results for country dummies**.

Table 4 – Regression Results without country dummies

Results for the OLS regressions on models 1 and 3 and on the Probit regressions on models 4 and 6. Dependent variables change from the period's ROA (1) amd (2) to the next period's ROA (3) in the OLS regressions and from a dummy taking the value one if the firm is a top 20% ROA worldwide performer in the period (4) and (5) or a top 20% ROA worldwide performer in the next period (6). Values for the coefficient estimates in all described variables. Standard errors are in parenthesis *** $p < 0.001$, ** $p < 0.01$, * $p < 0.5$, ●<0.1.

	(1)	(2)	(3)	(4)	(5)	(6)
	Main Model	Main + Country	Autoreg Model	Main Model Bin	Main + Country Bin	Autoreg Model Bin
Dependent variable	**ROA$_t$**	**ROA$_t$**	**ROA$_{t+1}$**	**Binary ROA$_t$**	**Binary ROA$_t$**	**Binary ROA$_{t+1}$**
(Intercept)	-8.727***	-3.063	-3.044**	-1.131***	-1.082*	-0.807***
	(0.861)	(1.888)	(0.987)	(0.18)	(0.422)	(0.19)
Minority.interest.received	-0.545	-0.657	-0.308	-0.177●	-0.320*	-0.134
	(0.408)	(0.605)	(0.464)	(0.094)	(0.159)	(0.101)
Minority.interest.paid	-0.029	-0.745**	-0.182	-0.066	-0.011	-0.065
	(0.209)	(0.273)	(0.235)	(0.045)	(0.069)	(0.049)
Trade.creditors	0.360	2.445*	0.183	-0.630**	0.142	-0.543*
	(0.92)	(1.211)	(1.047)	(0.201)	(0.303)	(0.213)
Equity.ratio	8.636***	8.717***	4.399***	1.493***	1.815***	0.937***
	(0.404)	(0.542)	(0.465)	(0.085)	(0.136)	(0.089)
Existing.main.shareholder	1.292***	1.433***	1.130***	0.227***	0.241***	0.179***
	(0.168)	(0.226)	(0.191)	(0.033)	(0.053)	(0.035)
Foreign.control	1.053***	-0.224	0.982***	0.370***	0.066	0.287***
	(0.224)	(0.327)	(0.255)	(0.043)	(0.076)	(0.045)
Foreign.investment.	-0.368●	0.440	0.087	0.045	0.180**	0.135**
	(0.195)	(0.27)	(0.224)	(0.04)	(0.067)	(0.043)
Gov	2.637***	2.267***	2.340***	0.534***	0.512***	0.439***
	(0.289)	(0.39)	(0.326)	(0.053)	(0.087)	(0.056)
Bank	-0.384*	-0.501●	-0.022	-0.283***	-0.006	-0.171***
	(0.175)	(0.274)	(0.196)	(0.038)	(0.068)	(0.04)
Total.assets	0.309***	0.570***	0.122*	-0.042***	-0.003	-0.055***
	(0.043)	(0.064)	(0.049)	(0.009)	(0.016)	(0.009)
Accounts.receivable	3.653***	2.408**	2.256**	0.382**	0.534**	0.189
	(0.622)	(0.839)	(0.713)	(0.128)	(0.204)	(0.136)
Cash	8.211***	8.074***	6.940***	1.291***	1.800***	0.916***
	(0.637)	(0.82)	(0.74)	(0.119)	(0.183)	(0.125)
Countries dummies	X	See Table 5	X	X	See Table 5	X
	OLS	OLS	OLS	Probit	Probit	Probit
Nr. of Observations	10 816	10 816	7970	10 816	10 816	7970
Adjusted R$_2$	0.090	0.172	0.044	X	X	X
McFadden R$_2$	X	X	X	0.114	0.198	0.069

Table 5 – Regression Results for country dummies

Country dummies estimates for the OLS regression on model 2 and on the Probit regression on models 5. Dependent variables represent the period's ROA (2) in the OLS regressions and a dummy taking the value one if the firm is a top 20% ROA worldwide performer in the period (5). Values for the coefficient estimates for the other variables in the previous Table. Standard errors are in parenthesis *** p < 0.001, ** p < 0.01, * p < 0.5, ●<0.1.

	Model (2)	Model (5)		Model (2)	Model (5)		Model (2)	Model (5)		Model (2)	Model (5)
Australia	-16.229*** (1.569)	-1.161*** (0.32)	France	-12.213*** (1.75)	-2.132*** (0.481)	Mongolia	-13.339*** (2.518)	-2.276** (0.725)	South Africa	-14.496*** (1.673)	-0.929** (0.343)
Austria	-11.938*** (2.048)	-5.777 (132.0)	Germany	-11.263*** (1.899)	-1.471*** (0.418)	Morocco	-10.365*** (2.297)	-0.584 (0.461)	Spain	-13.2*** (1.85)	-1.528*** (0.45)
Bahrain	-12.701● (6.776)	-5.78 (605.1)	Greece	-14.46*** (1.998)	-1.555** (0.494)	Nepal	-4.654 (4.096)	4.5 (349.302)	Sri Lanka	-6.795*** (1.845)	-0.525 (0.365)
Banglad.	-7.125*** (2.076)	-0.218 (0.415)	Hong Kong	-12.595*** (3.594)	-6.237 (287.8)	Netherl.	-13.991*** (2.443)	-5.51 (174.361)	Sweden	-10.269*** (1.716)	-0.562 (0.342)
Belgium	-13.333*** (2.295)	-6.608 (145.9)	Hungary	-8.538● (4.891)	-5.365 (427.7)	New Zealand	-8.988** (2.736)	-0.83 (0.562)	Switzer.	-8.291*** (2.101)	-0.356 (0.42)
Bermuda	-15.842*** (1.615)	-1.939*** (0.355)	India	-10.411*** (1.413)	-1.195*** (0.286)	Nigeria	-8.288*** (2.113)	-0.955* (0.438)	Taiwan	-11.725*** (1.485)	-1.27*** (0.303)
Bolivia	-8.225** (3.043)	0.369 (0.696)	Indonesia	-12.731*** (1.591)	-1.598*** (0.329)	Norway	-10.868*** (2.367)	-1.092* (0.523)	Thailand	-11.58*** (1.543)	-1.065*** (0.314)
Botswana	-11.104* (4.891)	-5.874 (427.82)	Ireland	-5.797* (2.303)	0.428 (0.48)	Oman	-4.161● (2.514)	-0.719 (0.496)	Trinidad	-20.811*** (3.588)	-6.126 (274.632)
Brazil	-18.533*** (1.779)	-1.143** (0.381)	Iran	-7.737*** (1.744)	-0.227 (0.35)	Pakistan	-5.449** (1.696)	-0.188 (0.341)	Tunisia	-15.214*** (2.128)	-6.082 (134.388)
Bulgaria	-15.553*** (2.057)	-2.216*** (0.507)	Israel	-10.521*** (1.776)	-1.255** (0.405)	Palestine	-4.739 (3.586)	-0.797 (0.685)	Turkey	-9.54*** (1.604)	-0.628* (0.319)
Canada	-10.034*** (1.614)	-1.036** (0.331)	Italy	-13.952*** (1.837)	-5.801 (105.64)	Panama	-12.167*** (3.605)	-5.691 (298.206)	Uganda	-7.189 (4.902)	-5.364 (427.855)
Cayman Islands	-10.22*** (1.437)	-1.079*** (0.288)	Jamaica	-6.419● (3.59)	4.476 (302.19)	Peru	-12.891*** (1.98)	-5.638 (122.796)	Ukraine	-10.885 (6.772)	-5.095 (605.102)
Chile	-10.726*** (1.578)	-1.296*** (0.337)	Japan	-11.242*** (1.419)	-1.896*** (0.29)	Philippin.	-9.943*** (2.431)	-0.591 (0.484)	UAE	-15.255*** (2.036)	-6.428 (121.436)
China	-12.265*** (1.419)	-1.624*** (0.289)	Jordan	-15.657*** (2.09)	-1.525*** (0.461)	Poland	-11.519*** (1.512)	-1.395*** (0.314)	UK	-6.859*** (1.574)	-0.337 (0.314)
Colombia	-10.844*** (1.993)	-0.973* (0.426)	Kazakh.	-7.927 (4.892)	-5.066 (413.303)	Portugal	-12.07*** (2.366)	-5.67 (171.326)	Tanzania	-9.189* (3.588)	-0.466 (0.697)
Costa Rica	12.961*** (3.601)	5.087 (298.4)	Kenya	-10.489*** (3.046)	-1.148● (0.602)	Qatar	-9.575*** (2.727)	-0.957● (0.561)	USA	-9.228*** (1.491)	-0.559● (0.3)
Croatia	-11.324*** (3.05)	-1.573● (0.809)	Kuwait	-12.098*** (2.165)	-1.791*** (0.524)	Korea	-12.141*** (1.442)	-1.396*** (0.294)	Uruguay	-3.615 (3.272)	0.288 (0.641)
Cyprus	-13.327*** (2.725)	-6.044 (200.5)	Lebanon	1.52 (3.588)	4.63 (301.7)	Romania	-13.567*** (1.853)	-2.194*** (0.461)	Vietnam	-8.323*** (1.441)	-1.155*** (0.294)
Czech Republic	-28.903*** (6.772)	-4.994 (605.1)	Lithuania	-16.036** (4.89)	-6.751 (427.6)	Russia	-11.094*** (1.828)	-1.112** (0.391)	Virgin Islands	-39.614*** (3.623)	-6.308 (302.456)
Denmark	-10.382*** (2.124)	-0.632 (0.426)	Luxemb.	-11.466● (6.774)	-4.963 (605.1)	Saudi Arabia	-9.047*** (1.772)	-0.556 (0.355)	Zambia	-13.567** (4.885)	-6.123 (424.356)
Ecuador	-5.935* (2.715)	-0.23 (0.532)	Macedon.	-11.9* (4.887)	-5.696 (427.9)	Serbia	-11.45*** (3.28)	-5.756 (265.777)	Zimbabwe	-11.437*** (2.724)	-5.563 (203.112)
Egypt	-10.453*** (1.777)	-1.239*** (0.376)	Malaysia	-13.189*** (1.456)	-1.451*** (0.297)	Singapore	-13.902*** (1.505)	-1.816*** (0.317)			
Estonia	-11.795** (3.592)	-5.841 (298.08)	Mauritius	-8.741● (4.894)	-5.613 (425.461)	Slovakia	-15.373*** (2.158)	-1.383** (0.456)			
Finland	-10.708*** (2.162)	-0.988* (0.462)	Mexico	-8.057*** (1.818)	-1.006** (0.382)	Slovenia	-11.519* (4.894)	-5.231 (427.849)			

5.1 Overall results

The results of model 1 show that between the five key factors under analysis several have a relevant and statistical significant relationship both with the performance and with belonging to the top performing group of construction companies.

This dissertation finds that the most significant elements on absolute performance (as measured by the dependent variable ROA – Models 1, 2 and 3) are: having a high equity ratio, having a large amount of its resources in cash, being able to supply credit to customers, having the government as a shareholder and having a control shareholder. Furthermore, evidence that size has a small but statistically significant positive influence on performance and that a bank participation is negatively associated with performance.

Although similar, when analysing relative performance (as measured by the Binary ROA, indicating top 20% performers worldwide – Models 4, 5 and 6), this dissertation finds that there are material differences when comparing to the analysis of the absolute performance detailed above. In terms of relative performance, it is found that the main factors are the same.

The differences in Model 4 to the results from Model 1 lie in the identification of having a high payment period and size, which has a positive absolute impact as negatively influencing factors. Both these variables present a non-linear relationship with absolute performance. **Figure 3 – Average total assets per performance decile** visually represents this conclusion.

Another 2 key differences observed deserve further analysis. The variable trade payables which is statistically insignificant in explaining ROA absolute performance in model 1, is statistically significant with a negative sign in explaining belonging to the top ROA performing group (as measured by the Binary ROA variable in Model 4). This result indicates that the relationship between a high payment period and performance is not linear. **Figure 4 – Average trade creditors per performance decile** depicts this relationship.

The impact of size also show some interesting results, with size being positively related with performance but negatively related with belonging to the top performing group. This statistically

significant, and apparently contradictory results again indicate a potential non-linear relationship between the variable in question and finance performance.

One further result worth noting lies in the different coefficients obtained for the two variables representing having a controlling shareholder. Having a controlling shareholder is positive and significant in determining performance, which is also significantly accentuated if that control is foreign. This latter effect only disappears when we control for the country of original with the tens of dummies in models (2) and (5).

The results detailed above, relating to the OLS regression of Model 1 and the probit regression of model 4, are substantially aligned with the remaining models, which serve as robustness tests for the main models.

5.2 Capital structure

An equity based capital structure is positively related with both absolute (Model 1) and relative performance (Model 4). This result is consistent and statistical significant at 0.1%, across all models tested. Furthermore, due to its consistency with the autoregressive models, model 3 and 6, there is evidence of the relationship being causal, with higher equity leading to higher performance,

This result is further confirmed when analysing the descriptive statistics showing the average decile in each decile. The top performing firms, defined as companies in the first decile each year, hereinafter D1, showing an average equity of 59.9%, significantly higher than the average of the control group, deciles 0, 4 and 5 (ROA betwenn 30% and 70%), which present an average equity of 42.4%.

This results are consistent with our expectations due to the specificities of the construction industry, a industry in which there is significant amount information asymmetry between the constructors and potential debtholders.

5.3 Ownership structure

In terms of ownership structure this dissertation finds that having a controlling shareholder, either foreign or domestic, is positively correlated with financial performance. Furthermore, having the

government as a shareholder is also found to be positively related with financial performance. When comparing companies with governmental participation with companies without government participation this study finds that the first group has a significantly higher returns on assets (5.8%) when compared with the later (3.2%). Lastly, in terms of ownership structure, this study finds that having a banks participation is negatively related with the financial performance of a construction company.

Across all models it is clear that the existence of a controlling shareholder positively influences the absolute and relative performance of a construction. This result, although small in magnitude in Model 1, with companies having a controlling shareholder suggest a ROA 1.29% higher than companies with dispersed control. Due to its consistency this result is a strong indicator that a concentrated control is indeed relevant for a construction company's performance.

The participation of governments or governmental entity is found to significantly impact performance and to be positively related with belonging to the top performing group of construction companies. Taking into account Model 1, a firm with government participation has a ROA 2.6% above a firm without a government as its shareholder. This result suggests that besides participation in a company's capital, and arguably of more importance in the bigger picture for a national construction sector, governments can provide comprehensive advantages and incentives for its construction sector. Amongst them one stands out in importance: support for the award and enforcement of contracts, particularly abroad through diplomatic channels. This measure is of high importance particularly for countries with small and stagnant construction markets in order to open new opportunities for companies. Furthermore, it is of high importance for business dealing in less developed countries without a fully transparent legal system in order to assure a lawful treatment of investments.

Regarding the participation of banks on a company's capital structure of a construction company, although based in model one there is evidence for a week negative relationship between bank shareholders and performance, this results are inconsistent across the models with the variable losing significance in Models 3 and 6.

These results, regarding institutional investors, are also quite consistent with our expectations, with benefits of higher cooperation between construction companies and their largest customers, governments, appearing to outweigh potential managerial inefficiencies. Regarding bank ownership, the results are potentially explained by the fact that a significant part of banks positions in construction companies were obtained by banks as a collateral from already defaulting companies.

5.4 Size and scale

Regarding scale, evidence indicates the existence of a non-linear, weak but statistically significant positive, relationship between size and performance, with this study finding scale to be positive associated with absolute performance but negatively associated with our relative measurement of ROA. These results are consistent and statistical significant across all models and support previous literature, suggesting that size is only relevant up to a certain threshold. That threshold should be the size required to participate in large scale profitable projects.

5.5 Cash holdings

This is one of the factors to more strongly impact positively the performance of construction companies. "Cash is king" the old adage holds true here. This dissertation finds that having a larger part of its assets in cash is positively associated in all the models. This results are further validated when analysing how top performing companies, D1 in terms of ROA, have significantly higher cash ratio (16.95%) than the control group, formed by deciles 0, 4 and 5 (11.4%). **Figure 1 – Average cash holdings per performance decile** illustrates this effect.

5.6 Relationships with other players

Lastly regarding relationships with other players this dissertation finds that being able to concede credit to customers is positively correlated with the financial performance of a construction company. This results were expected by the necessity of granting credit to customers in some cases just to apply to some of the most profitable construction projects. The other related variables analysed here were all

found to be statistically insignificant to explain the performance of a construction company. This results provides some insight in itself. The fact that participating in joint ventures is not statistically significant to explain the performance of construction companies might be an indicator of the competitiveness in the industry, with constructions companies easily outsourcing parts of projects when necessary or profitable, without needing a lot of formal agreements.

6 Conclusions

The insights gathered in this dissertation shed some light regarding the driving factors for the performance of a construction company and regarding on how the industry operates. The results show that three key characteristics describe the construction sector: a high degree of information asymmetry, a high degree of cooperation within the sector and lastly a need for cooperation with other stakeholders. Furthermore the results indicate that to properly compete within this sector a minimum scale is necessary.

Information asymmetry is seen in the high positive impact high equity and cash holdings have on performance measurements. These results are aligned with the pecking order theory and seem to indicate that, in the construction industry, the benefits in resilience and investment flexibility outweigh the negative incentives given to managers by this excess of resource availability.

The statistic insignificance regarding the impacts of participating in joint ventures show that within this sector the outsourcing and cooperation with competitors is a easily achievable and do not require a joint venture structure. This is seen when analysing the construction sector in which most projects will have more than one construction company involved.

Cooperation with stakeholders outside the industry appears to present challenges not found when discussing cooperation with competitors, this conclusion is drawn from the high positive impact of government participation on the capital of construction companies. This result, which contradicts most the existing literature regarding government ownership, indicates that proximity with the sector largest customer is very important in terms of planning for the future.

Lastly, size appears to be a gatekeeper within this sector but not relevant above a certain threshold level.

Further research and limitations

Our data seems overly centered in Asian countries when compared with the weight of the Continent on the sector's revenues, this over exposure to Asia might compromise the applicability of some results. With regard to the data used it could have been interesting to include additional variables, such as: a measure of internationalization - how much of a company's revenues are generated abroad, the concentration of a company's debt and the participation on its ownership structure of other types of institutional shareholders, such as private equity firms and other construction companies: A different methodology in computing the variables regarding joint ventures, using contracts to analyse participation on joint ventures would provide.

Regarding the methodology used some potential improvement might be obtained by including additional control variables, such as GDP, HDI, population and economic freedom index, which might better achieve what this dissertation tries to achieve with the variable country.

These limitations can be mitigated in further research, particularly the application of these models to regional data. Furthermore additional research can be performed by using the proposed methodology to study the impacts these variables might have on other industry sectors.

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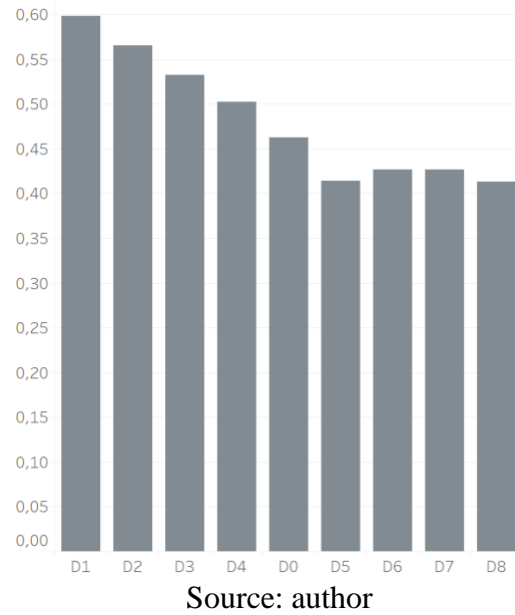
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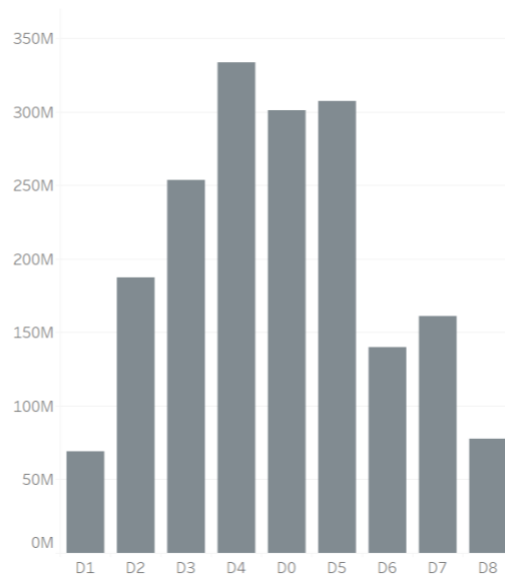
8 Appendix

Figure 1 – Average cash holdings per performance decile
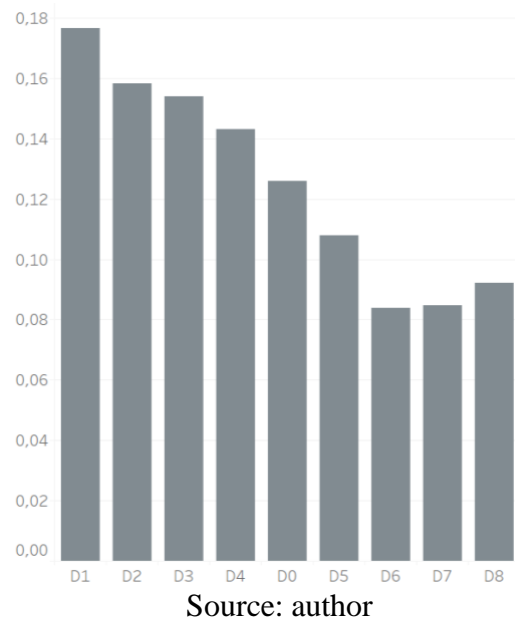
Source: author

Figure 2 – Average equity ratio per performance decile
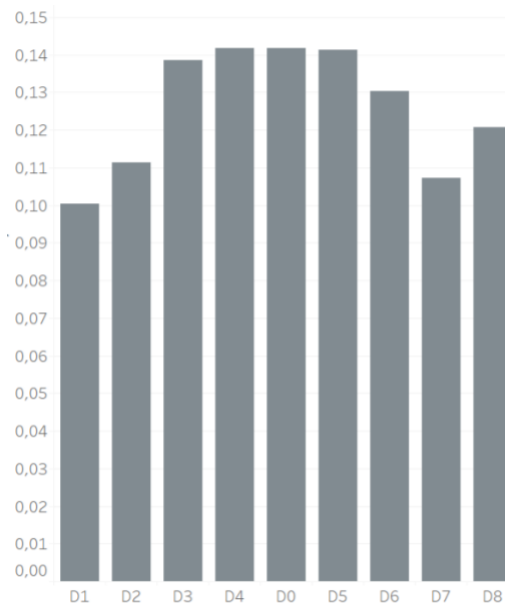

Source: author

Figure 3 – Average total assets per performance decile

Source: author

Figure 4 – Average trade creditors per performance decile

Source: author