Ownership structure, agency problems of free cash flow and asymmetric information: Evidence from Brazil

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Abstract

Using financial and ownership data from Brazilian firms during the period of 1996 to 2010, we investigate how asymmetric information and agency costs of free cash flow impact the investment-cash flow sensitivity. We document that the largest ultimate shareholder's cash flow rights have a constant relationship to investment-cash flow sensitivity when firms face both overinvestment and underinvestment problems. However, the excess of control rights over cash flow rights have different behavior on investment decision. We find an inverted U-shaped relationship between the excess of control rights and investment-cash flow sensitivity of underinvestment firms, while this relationship is described by a crescent S-shaped function for overinvestment firms. Our results also evidence that negative entrenchment effects of the largest ultimate shareholder make firms more dependent of internal funds than the high costs of external resources caused by asymmetric information in capital market.

Keyword: investment-cash flow sensitivity, ownership and control, asymmetric information, agency costs of free cash flow.

1. Introduction

Why are investment decisions sensitive to cash flow? Many papers have been studied the positive relationship between investment and cash flow trying to find a plausible answer to this question.[1] However, the literature shows that there is no "decisive" answer and suggests that the positive investment-cash flow sensitivity may be related to three explanations at least. First, studies as Fazzari, Hubbard, and Petersen (1988), Bond and Meghir (1994), Carpenter and Guariglia (2003), Carpenter and Guariglia (2008) indicate that this relation is a result of asymmetric information problems which increases the costs of external resources making internal funds the most natural option to seize their investment opportunities (Myers and Majluf 1984). Second, Kaplan and Zingales (1997) and Cleary (1999) do not discard the first explanation but defend that the investment-cash flow sensitivity may also reflect the use of internal funds to anticipate future profitability. And third, other papers in consensus with Jensen (1986), Grossman and Hart (1982), Stulz (1990) argue that the positive relation between investment spending and cash flow indicates the use of internal funds to supply unprofitable investment projects that benefits only entrenchment decision-makers proposes, lessening minority shareholders wealth.

Although there is a large literature supporting Fazzari *et* al (1988)'s arguments, the empirical evidences around the overinvestment and the agency conflicts between managers and shareholders have been recently intensified. Nevertheless, the large body of this literature is concentrated in U.S.

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[1] See Hubbard (1998) for a literature review.

firms where there is little ownership concentration, and the main agency conflict is between managers and shareholders. It makes impossible to generalize these findings to emerging countries where the existence of a controlling shareholder and the weak protection of minority shareholders rights intensify the agency problems between large and minority shareholders. When the large shareholders have severe deviation between control rights and cash flow rights, they have incentives to pursue private interests (La Porta, Lopez-de-Silanes, and Shleifer 1999; Claessens et al. 2002), dividing their costs to minority shareholders (Villalonga and Amit 2006; Burkart, Panunzi, and Shleifer 2003).

This study aims to provide a better understanding of how asymmetric information and agency problems of free cash flow affect investment-cash flow sensitivity taking into account the ultimate ownership and control structure. Our study is based on a sample of corporations listed in Brazilian stock market, with 4236 firm-year observations from 1996 to 2010. One reason to select Brazilian firms as our experimental environment is the highly concentrated ownership in hand of few shareholders, mainly a family or an individual, combined with the possibility of pyramidal ownership and dual-class shares. The scenario of Brazilian firms is particularly interesting and different from U.S. firms, providing new evidences of the effect of ultimate ownership structure on investment decisions that would be difficult to find in U.S. data.

We estimate our models using panel data methodology to eliminate unobserved heterogeneity and employing the System GMM to control for endogeneity problems. Our results reveal that the positive investment-cash flow sensitivity may be related to both underinvestment problems due to asymmetric information in capital market and overinvestment caused by private interest of insiders. The empirical evidences also suggest that ultimate ownership and control structure does not directly impact the firm's investment decision. This finding is in line with (Cho 1998) which finds that investment level affects firm valuation that affects the ownership structure, but the results do not support the reverse situation.

Some papers as Morck, Shleifer, and Vishny (1988) and McConnell and Servaes (1990) document a nonlinearity relation between managers ownership stakes and firm value for U.S. firms. Hadlock (1998) extend these studies investigating the nonlinearity relationship between managerial ownership and investment-cash flow sensitivity. He finds that this relationship is given by an inverted U-shaped function, interpreting this result as evidence of underinvestment problems caused by asymmetric information problems. Pawlina and Renneboog (2005) investigate U.K. firms and find that the relation between investment-cash flow sensitivity and insider ownership is described by S-shaped function. They interpret this result as evidence of overinvestment problems due to agency costs of free cash flow. Wei and Zhang (2008) take into account the largest ultimate shareholder's control rights and cash flow rights to investigate the impact of over- and underinvestment problems on investment-cash flow sensitivity of East Asian countries. They find that increases in cash flow rights cause a reduction on investment-cash flow sensitivity while the increases in the excess of control rights over cash flow rights raise the investment-cash flow sensitivity, supporting evidence of underinvestment problems.

Considering these studies, we observe that they rely on the behavior of insider ownership or large shareholder's rights to infer if its impact on investment-cash flow sensitivity is given by under- or overinvestment problems. On this way, we also propose in this study to group firms a priori as those with under- and overinvestment problems to investigate how is described the behavior between investment-cash flow sensitivity and the largest ultimate shareholder's rights.

We contribute to the finance and ownership structure literature in several ways. First, we investigate the investment-cash flow sensitivity for Brazilian firms, an institutional environmental less explored in the literature. We take into account whether the ultimate ownership structure features affect investment-cash flow sensitivity. More precisely, as family control can attenuate or exacerbate the

relation between investment and internal funds (Pindado, Requejo, and de la Torre 2011; Kuo and Hung 2012; Andres 2011), we attempt to consider the effect of family control on investment decisions. Another interest aspect is the control exercised by the pyramidal ownership structure on investment-cash flow sensitivity. This issue is particularly important because previous studies have documented the possibility of an internal transfer of funds among pyramids chains (Bianco and Casavola 1999; Almeida and Wolfenzon 2006), which may substitute external finance and alleviate financial constraints. On the other side, ultimate owner of pyramids schemes can increase leverage level to rise the availability of funds in their affiliates with the purpose of wealth expropriation (Paligorova and Xu 2012).

Second, we explore the investment-cash flow sensitivity under abnormal investment decisions. In other words, we investigate the relationship of investment and cash flow when firms face asymmetric information problems or agency problems of free cash flow. In line with Degryse and De Jong (2006), we find that the investment decisions of firms with underinvestment problems are less dependent of internal funds than those with overinvestment problems. This finding may suggest that negative entrenchment effects of the largest ultimate shareholder make firms more dependent of internal funds than the high costs of external resources caused by asymmetric information between firm and bondholders.

Third, many papers have focused attention on the agency problems between large and minority shareholder and its relation to fixed investment (Kuo and Hung 2012; Pindado and De La Torre 2009; Pindado, Requejo, and de la Torre 2011; Wei and Zhang 2008; Pawlina and Renneboog 2005). Our contribution to this part of the literature is that the negative entrenchment effects associated with the excess of control rights and the enhancement effect related to amounts of cash flow rights have different behaviors in the presence of underinvestment or overinvestment problems. We empirically show that the relation between the excess of control rights and investment-cash flow sensitivity of overinvestment firms is described by a crescent S-shaped function. Moreover, this relationship is different for underinvestment firms. We find that investment-cash flow sensitivity of underinvestment firms increases until certain point of excess of control rights and decreases after this point, suggesting an inverted U-shaped function. Considering the behavior of the cash flow rights, our results strongly support that the increases of cash flow rights of the largest ultimate shareholder are not related to increase or decrease on investment-cash flow sensitivity of over- and underinvestment firms. Contrary to Wei and Zhang (2008), this finding particularly indicates that the cash flow rights of the largest ultimate shareholder do not attenuate overinvestment problems or exacerbate underinvestment problems on Brazilian corporations.

Finally, it is important to highlight that by paying specific attention on the behavior of the excess of control rights and the cash flow rights of the largest ultimate shareholder on investment decisions, we go a step forward of prior studies which focus on the relationship between insider ownership and investment-cash flow sensitivity (Hadlock 1998; Pawlina and Renneboog 2005; Wei and Zhang 2008). In particular, a larger data information about the excess of control rights and a priori classification of firms as underinvestment and overinvestment problems do possible to extend the work of Wei and Zhang (2008).

The remainder of the paper is organized as follow. Section 2 reviews previous literature about investment-cash flow sensitivity and the ultimate ownership structure, and presents our hypotheses. Section 3 describes the data, summary statistics and methodology used to group firms as underinvestment or overinvestment problems. Section 4 discusses the empirical approach adopted to estimate the investment models. Section 5 presents and discusses the main results of the paper. Finally, section 6 highlights our main findings.

2. Theory and hypotheses development

The positive relation between cash flow and firm's investment spending has been widely studied since Fazzari, Hubbard, and Petersen (1988)'s seminal work. As mentioned above, the investment-cash flow sensitivity may be driven not only by asymmetric information but also by future profitability and overinvestment on unprofitable investment projects. In the presence of asymmetric information, firms tend to pass up some growth opportunities due to the limited internal funds and the scarce of external resources, configuring an underinvestment scenario. The overinvestment problems suppose that firms have low growth opportunities but high free cash flow available in manager's hands, encouraging them to overinvest on unnecessary projects for their own private interests.

To disentangle the effect of asymmetric information and agency problems of free cash flow on investment-cash flow sensitivity, some papers have been used Tobin's *q* or sales growth as an indicative of good or bad prospects (Degryse and De Jong 2006; Kuo and Hung 2012; Broussard, Buchenroth, and Pilotte 2004; Hoshi, Kashyap, and Scharfstein 1991). They consider lower Tobin's *q* (or lower sales growth) firms as those with poor investment opportunities which could suffer from overinvestment problems. On the other side, higher Tobin's *q* (or higher sales growth) firms are considered as those with high investment opportunities, then the investment-cash flow sensitivity indicates asymmetric information problems. However, the theory presupposes that the measure of investment opportunity has to be free of agency problems. As discussed by Chen, Chen, and Wei (2011), the use of only Tobin's *q*, sales growth or the observed free cash flow is not a good way to capture investment opportunities because these proxies can reflect firm's internal conflicts related to weak protection of minority shareholder's rights.[2] They suggest employing the industry sales growth or industry Tobin's *q* as a measure of investment opportunities free of agency problems.

Other studies as Richardson (2006), Biddle, Hilary, and Verdi (2009) and Verdi (2006) propose to estimate the optimal level of investment and inferring the presence of overinvestment and underinvestment based on the residual of investment model. In general, the estimated results support Jensen (1986)'s theory and signaling that high free cash flow firms tend to overinvest. Nevertheless, we contest the argument that firms with investment above of the optimal level results in agency problems of free cash flow, at the same way that firms with investment below of the optimal level reflects asymmetric information problems. Among those firms considered as with overinvestment problems may have high growth opportunities firms that are investing above the optimal level to anticipate future profitability, as argued by Kaplan and Zingales (1997) and Cleary (1999). And, among the under-investing firms may have firms with asymmetric information problems or those with low investment opportunities and financial distress.

Considering these arguments, we propose to combine the estimation of the optimal level of investment with the industry sales growth to capture the presence of abnormal investment decisions due to asymmetric information problems or agency problems of free cash flow. Thus, we propose the following hypotheses:

Hypothesis 1a: The investment decision of low industry sales growth firms with investment rate above of the optimal level is positively sensitive to cash flow due to agency problems of free cash flow.

Hypothesis 1b: The investment decision of high industry sales growth firms with investment rate below of the optimal level is positively sensitive to cash flow due to asymmetric information problems.

[2] Chen *et* al (2011) employ the cash flow from operations minus cash dividends as a proxy for free cash flow and industry sales growth as investment opportunities to identify firms with agency problems of free cash flow.

As previously pointed, some papers as (Pawlina and Renneboog 2005; Hadlock 1998; Wei and Zhang 2008) have considered insider's ownership stake to identify abnormal investment decisions. Wei and Zhang (2008) follow Claessens *et* al (2002) to discuss that the tendency of over- and underinvestment problems is related to the amounts of the largest ultimate shareholder's cash flow rights and the excess of control rights. Claessens et al. (2002) evidence that the positive incentive effect of the largest shareholder's cash flow rights is associated with increases in firm value. However, the negative entrenchment effect of the largest shareholder's excess of control rights tends to reduce the firm valuation.[3] Based on their assumptions, Wei and Zhang (2008) argue that if the largest shareholder has a tendency to overinvestment (underinvestment) then the increases in cash flow rights attenuate (exacerbate) investment-cash flow sensitivity while the increases in the excess of control rights raise (attenuate) the investment-cash flow sensitivity. They find a U-shaped relationship between cash flow rights and investment-cash flow sensitivity, and their results also suggest that investment of firms with no excess of control rights are less sensitive to cash flow than firms with a separation between largest shareholder's rights. Nevertheless, they posit that the effects of cash flow rights and the excess of control rights have to be combined to indicate over- and underinvestment problems, finding results that support the overinvestment hypothesis.

Considering the arguments used by Wei and Zhang (2008), we expect to find similar results when we take a priori firm's classification as those with underinvestment problems due to asymmetric information and overinvestment problems due to agency costs of free cash flow. Consequently, we formulate our following hypothesis:

Hypothesis 2a: If the firm faces asymmetric information problems, the investment-cash flow sensitivity increases as the largest ultimate shareholder's cash flow rights increase, while the investment-cash flow sensitivity decreases as the largest ultimate shareholder's excess of control rights increase.

Hypothesis 2b: If the firm faces agency problems of free cash flow, the investment-cash flow sensitivity decreases as the largest ultimate shareholder's cash flow rights increase, while the investment-cash flow sensitivity increases as the largest ultimate shareholder's excess of control rights increase.

3. Data, variables construction and summary statistics

3.1 Data source and sample

Our data covers Brazilian public firms that issue stocks on Brazilian Stock Exchange (BM&FBovespa) during the period from 1996-2010. Detailed information on the ownership structure as name of large shareholders and their percentage of control rights and cash flow rights are obtained from "Informativo Anual" and "Formulário de Referência" reports which all public firms must to inform to the market regulator (CVM) [4]. The "Informativo Annual" report is available on CVM's website from 1997 to 2008 and the "Formulário de Referência" is available on CVM's website since 2009's year. As La Porta, Lopez-de-Silanes, and Shleifer (1999), Claessens, Djankov, and Lang (2000) and Faccio and Lang (2002), we also identify if the largest ultimate shareholder is a family or an individual, and if the firm belongs to an indirect ownership structure (pyramidal schemes). Financial

[3] Claessens *et* al (2002) argue that as more cash flow rights the largest shareholder has, the stronger is the incentives for firm run properly and increase his (and firm) wealthy. However, if the large shareholder has large excess of control rights over cash flow rights, he has incentives to become entrenched and to extract outsider shareholder's wealthy.

[4] CVM is the abbreviation of Secutities and Exchange Commission of Brazil.

statements of firms are collected from Economatica and are deflated by IGP-DI (General Prices Index - Internal Availability).

The initial sample consists of a balanced panel data with all Brazilian firms in Economatica during the period of 1996-2010. We exclude financial companies since their financial activities, operating and investments differs from other types of industries sectors. We also delete missing observations on total assets, observations with negative book value of equity and negative sales, and those with missing observations on the amounts of control rights and cash flow rights of the largest ultimate shareholder. Because part of our methodology imposes the presence of endogeneity problems due to the inclusion of lagged dependent variable on regression models, we drop firms with less than three consecutive years. We winsorize all financial variables at the 5% and 95% level to reduce the influence of outliers on regression models.[5] The final sample consists of an unbalanced panel which comprises 467 companies on a total of 4236 observations.

Table 1 presents the sample distribution by industry sector considering total sample, the incidence of family control and pyramidal structure. We note that *Manufacturing* represents 46.4% of the total sample, followed by *Utilities* (15.32%). Family control represents 41.3% of the total sample and more than fifty percent of *Construction, Manufacturing* and *Professional, Scientific and Technical Services* sectors are controlled by a family or an individual. Analyzing the indirect ownership structure, we note that almost 67% of firm-year observations belong to a pyramidal structure. The *Health Care and Social Assistance* is the industry sector with more firms belonging to pyramids (90.32%), followed by *Transporting and Warehousing* (89.55%) and *Education* (83.33%).

Table 1: Sample distribution by industry – total sample, family control and pyramid structure

Codes	Industry Sector Description (NAICS)	Total Sample		Family Control		Pyramid	
		n	%	n	%	n	%
1	Management of Companies and Enterprises	301	7.11	137	45.51	167	55.48
2	Agriculture, Forestry, Fishing and Hunting	42	0.99	33	25	28	66.67
3	Arts, Entertainment and Recreation	12	0.28	3	25	3	25
4	Health Care and Social Assistance	31	0.73	6	19.35	28	90.32
5	Wholesale Trade	31	0.73	8	25.81	31	100
6	Retail Trade	206	4.86	90	43.69	116	56.31
7	Construction	257	6.07	130	50.58	191	74.32
8	Education	24	0.57	12	50	20	83.33
9	Utilities	649	15.32	86	13.25	451	69.49
10	Accomodation and Food Services	29	0.68	2	6.9	20	68.97
11	Real Estate Rental	57	1.35	12	21.05	45	78.95
12	Manufacturing	1,968	46.46	1,031	52.39	1,273	64.72
13	Information	330	7.79	67	20.3	255	77.27
14	Mining	72	1.7	23	31.94	48	66.67
15	Other Services (except Public Administration)	20	0.47	20	100	8	40
16	Administrative, Support , Waste Management and Remediation Service	39	0.92	14	35.9	24	61.54
17	Professional, Scientific and Technical Services	34	0.8	20	58.82	6	17.65
18	Transporting and Warehousing	134	3.16	56	41.79	120	89.55
	Total	4,236	100	1,750	41.31	2,834	66.92

Notes: This table shows the number and percentage of observations by industry sector and ownership structure.

[5] We also test to winsorize variables at 1% and 99%, and at 2.5% and 97.5% levels but the sample continues with a high influence of outliers.

3.2 Measuring investment efficiency and summary statistics

To investigate the impact of the excess of control rights and cash flow rights of the largest ultimate shareholder on abnormal investment decision, we adopt the methodology proposed by Verdi (2006) and Biddle, Hilary, and Verdi (2009). In this methodology, we first estimate the investment model for each industry sector to predict firm's investment level as function of growth opportunities.[6] The residuals are used to infer the optimal and non-optimal investment levels. We classify firms as over-investing if the firm's residual is above from zero and as under-investing if the firm's residual is below from zero. A firm has optimal investment level if the residual equals to zero. The investment model used to estimate the expect investment level is describe in model (1).

$$\left(\frac{I}{K_{t-1}}\right)_{jt} = \alpha_j + \beta_j' \left(Growth\ Opportunities\right)_{j,t-1} + \varepsilon_{jt} \quad (1)$$

where *j* denotes the firm belonged to industry sector *k*, *t* is the period, α is the constant term and ε_{jt} is the idiosyncratic error term. The dependent variable is the investment rate measured as the percentage change in capital stock (*K*). To proxy for growth opportunities the literature suggests to use Tobin's *q* or sales growth (Degryse and De Jong 2006; Broussard, Buchenroth, and Pilotte 2004; Hoshi, Kashyap, and Scharfstein 1991). However, some studies document the likelihood of a measurement error in Tobin's *q* proxy and contest its use as a valid measure for growth opportunity (Gomes 2001). Therefore, we opt to use sales growth to proxy for investment opportunities.

We estimate model (1) by OLS with robust standard errors for each industry sector with more than 30 observations.[7] Based on estimation results of model 1 we use its residuals to construct the inefficient investment proxy. Table 2 shows descriptive statistics of interest variables for total sample and inefficient investment groups. Panel A of table 2 displays the summary statistics of investment residual. As expected the mean value of investment residual equals to zero and the residual values range from -0.6801 to 1.0418. Positive values of investment residual indicate overinvesting firms while negative values indicate underinvesting firms. We have 1855 (1157) firm-year observations with investment below (above) of the optimal investment level. The smaller number of firms classified as overinvesting agrees with Verdi (2006) who says that there are more constrained firms (underinvesting firms) than mature firms in which overinvestment is more pronounced.

The mean investment rate of all firms in sample is 2.51% and the cash flow represents 46.2% of the capital stock. The average book value of total debt is 2.42% of the book value of equity and their profitability measures is equal to 2.77% of total assets and 3.08% of total equity. The divergence between control rights and cash flow rights is, on average, 23.56 p.p., while the amounts of cash flow rights of the largest ultimate shareholder is almost 45%.

Panel B of table 2 also shows the summary statistics of financial variables when we split the sample by under- and overinvestment. By construction, overinvesting firms have positive investment rate (0.2499) while the underinvesting firms present negative investment mean (-0.1345). The overinvesting firms have higher mean values for cash flow, leverage, profitability measures (*ROA* and *ROE*) and have a higher increasing in their real sales than the underinvesting firms. The overinvesting

[6] Billett, Garfinkel, and Jiang (2011), Chen *et* al (2011), Biddle *et* al (2009), Verdi (2006) have similar opinion about the investment efficiency. In general, they argue that the optimal level of investment should be determined only by growth opportunities. If investment depends of cash flow, sales, leverage, governance and other factors, then the investment should be considered as inefficient.

[7] For an additional test, we estimate the same model for total sample and include industry and year dummies. In this case, besides of sales growth we also estimate the model using Tobin's *q* as a proxy for investment opportunities. The results are displayed in appendix.

firms are significantly larger (higher total assets) in comparison to the underinvesting firms. Another interesting factor of table 2 is the mean values of sales growth. The investment opportunities of the overinvesting firms are almost five times higher than those of the underinvesting firms. This finding suggests that there are some firms among the overinvesting firms (underinvesting firms) which are investing above (below) of the optimal investment level not only due to agency problems of free cash flow (asymmetric information problems) but because of high (low) investment opportunities.

Table 2: Abnormal investment decisions

Panel A: Investment Residuals

	n	Mean	Std. Dev.	Min	Median	Max
Investment Residuals	4151	0.0000	0.2277	-0.6801	0.0000	1.0418
Underinvestment Residuals	1855	-0.1482	0.1151	-0.6801	-0.1250	-0.0001
Overinvestment Residuals	1157	0.2377	0.2705	0.0001	0.1256	1.0418

Panel B: Summary Statistics by Investment Inefficiency Status

Variables	Total Sample		Underinvestment		Overinvestment		Difference Test
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	
Investment Rate	0.0251	0.2917	-0.1345	0.1141	0.2499	0.2939	0.3844***
CF/K_{t-1}	0.4623	0.8301	0.3912	0.7410	0.5324	0.8265	0.1411***
$\Delta S/K_{t-1}$	0.3013	1.0748	0.1010	0.8625	0.5274	1.1854	0.4262***
Leverage	2.4274	2.8610	2.5312	2.8466	2.3064	2.5122	0.2248**
ROA	0.0277	0.0706	0.0274	0.0710	0.0446	0.0622	0.0172***
ROE	0.0308	0.2615	0.0271	0.2612	0.0890	0.2273	0.0618***
Total Asset	4.45E+06	6.84E+06	4.59E+06	7.14E+06	5.61E+06	7.41E+06	1.02E+06***
Sales Growth	0.0737	0.2344	0.0252	0.2118	0.1274	0.2235	0.1021***
ECR	0.2356	0.2340	0.2492	0.2312	0.2414	0.2394	0.0077
CFR	0.4560	0.2695	0.4502	0.2651	0.4532	0.2597	0.0030
Family Control	0.4131	0.4925	0.4259	0.4946	0.4010	0.4903	0.0248
Pyramid	0.6692	0.4706	0.6620	0.4732	0.7347	0.4417	0.0726***

Notes: This table provides in panel A the statistics descriptive of the investment residual. In panel B are displayed the summary statistics of total sample, firms considered as under-investing and as over-investing. Investment rate is the variation in capital stock (*K*), measured as $(K_t - K_{t-1})/K_{t-1}$. *CF* is the cash flow; ΔS is the variation in real sales (*S*); *Leverage* measures the book value of debt over the book value of equity; *ROA* is the return on the book value of assets; *ROE* is the return on the book value of equity; *Sales Growth* proxies for growth opportunities and is measures as $(S_t - S_{t-1})/(S_{t-1})$. *CFR* is the largest ultimate shareholder's rights; *ECR* is the excess of control rights over cash flow rights and is measured as the difference between control rights and cash flow rights. *Family Control* is a dummy variable that takes value 1 if the largest ultimate shareholder is the controlling shareholder and has a family identity, and 0 otherwise. *Pyramid* is a dummy variable that takes value 1 if the firm belongs to a pyramidal ownership structure, and 0 otherwise. The symbols ***, ** and * denotes statistical significance at the 1%, 5% and 10% level.

On this way, we need to distingue the overinvesting firms which are suffering from agency problems from those that are overinvesting due to investment opportunities. Similar procedure has to be done with the underinvesting firms to detect firms with more investment opportunities and asymmetric information problems. As suggested by the theory, we need a measure of investment opportunity which is free of agency problems (Jensen, 1986; Stulz, 1999). According to Chen, Chen, and Wei (2011), we use industry sales growth (*ISG*) to disentangle the agency problems of free cash flow and asymmetric information problems. As the number of firm-year observations of the overinvesting firms is small in comparison to the underinvesting firms, we divided both groups of firms

by the median of industry sales growth (*ISG*). Table 3 shows the summary statistics for the sub-samples of firms.

Analyzing the underinvesting firms, we observe that firms with low investment opportunities (low *ISG*) have less cash flow, less profitability and similar size (no statistical difference) than the high *ISG* firms. We also note that the return on equity (ROE) of high *ISG* firms is eleven times greater than the low *ISG* firms. The lower levels of profitability combined with high leverage may be indicating the presence of financial distress on the underinvesting firms with low *ISG*. On the other side, the findings support the idea that underinvesting firms with high investment opportunities may be investing below of the optimal level due to asymmetric information problems that mitigate external resources. Another interesting point is the high percentage of pyramidal firms among the underinvesting firms with high *ISG*. This factor can contribute to increase the asymmetric information problems in capital market but may alleviate the financial constraints by internal transfer of funds between the pyramidal chains (Almeida and Wolfenzon 2006; Bianco and Casavola 1999).

Table 3: Summary statistics by underinvestment, overinvestment and industry sales growth level

Variables	Underinvestment				Difference Test	Overinvestment				Difference Test
	LOW Industry Sales Growth		HIGH Industry Sales Growth			LOW Industry Sales Growth		HIGH Industry Sales Growth		
	Mean	Std. Dev.	Mean	Std. Dev.		Mean	Std. Dev.	Mean	Std. Dev.	
Investment Rate	-0.1486	0.1056	-0.1198	0.1207	0.0288***	0.2032	0.2662	0.2977	0.3130	0.0945***
CF/K_{t-1}	0.3187	0.6152	0.4662	0.8458	0.1475***	0.4900	0.7595	0.5765	0.8896	0.0864*
Leverage	2.6676	2.9720	2.3883	2.7033	0.2793**	2.2793	2.4708	2.3341	2.5557	0.0548
ROA	0.0211	0.0725	0.0340	0.0689	0.0128***	0.0515	0.0622	0.0376	0.0616	0.0139***
ROE	0.0046	0.2732	0.0506	0.2460	0.0460***	0.1131	0.2172	0.0641	0.2348	0.0490***
Total Asset	4.50E+06	7.22E+06	4.68E+06	7.05E+06	1.80E+05	5.78E+06	7.24E+06	5.44E+06	7.58E+06	3.41E+05
Sales Growth	-0.0211	0.1966	0.0740	0.2164	0.0950***	0.0856	0.2089	0.1702	0.2299	0.0845***
ECR	0.2512	0.2237	0.2470	0.2390	0.0042	0.2607	0.2446	0.2216	0.2326	0.0391***
CFR	0.4543	0.2684	0.4459	0.2618	0.0083	0.4635	0.2634	0.4426	0.2555	0.0208
Family Control	0.4384	0.4964	0.4128	0.4926	0.0255	0.3771	0.4851	0.4256	0.4949	0.0484*
Pyramid	0.6059	0.4889	0.7208	0.4489	0.1148***	0.7474	0.4349	0.7215	0.4486	0.0259

Notes: This table shows the summary statistics of firms grouped by abnormal investments (underinvestment and overinvestment), reclassified by the level of industry sales growth (*ISG*). Investment rate is the variation in capital stock (*K*), measured as $(K_t - K_{t-1})/K_{t-1}$. *CF* is the cash flow; ΔS is the variation in real sales (*S*); *Leverage* measures the book value of debt over the book value of equity; *ROA* is the return on the book value of assets; *ROE* is the return on the book value of equity; *Sales Growth* proxies for growth opportunities and is measures as $(S_t - S_{t-1})/(S_{t-1})$. *CFR* is the largest ultimate shareholder's rights; *ECR* is the excess of control rights over cash flow rights and is measured as the difference between control rights and cash flow rights. *Family Control* is a dummy variable that takes value 1 if the largest ultimate shareholder is the controlling shareholder and has a family identity, and 0 otherwise. *Pyramid* is a dummy variable that takes value 1 if the firm belongs to a pyramidal ownership structure, and 0 otherwise. The symbols ***, ** and * denotes statistical significance at the 1%, 5% and 10% level.

For the overinvesting firms we note that the high investment opportunities firms (high *ISG*) have increased investment rate, cash flow and leverage in relation to low *ISG* firms. However, the last have more profitability and similar size (no statistical difference) than the firms with high investment opportunities. These results indicate that low profitability and the high levels of cash flow, leverage and investment opportunities (sales growth) can be important factors to increase investment rate above the optimal level. It is important to highlight that low *ISG* firms show return on average eleven times the equity and five times the total assets. These evidences suggest that the overinvesting firms with low

investment opportunities may have sufficient funds to support profitable and/or unprofitable investment projects. We also note that the overinvesting firms with low *ISG* have more divergence between control rights and cash flow rights which can contribute to increase agency problems between large and minority shareholders. In addition, the results evidences that family control may be responsible for an overinvestment in rentable investment projects (high *ISG*-overinvesting firms).

4. Model specification and estimation method

4.1 Baseline specification

We use a version of the investment accelerator model to test our hypotheses. Model (2) describes the investment model used to infer whether the investments of firms are dependent of internal funds.

$$\left(\frac{I}{K_{t-1}}\right)_{i,t} = \alpha_i + \gamma_1\left(\frac{I}{K_{t-1}}\right)_{i,t-1} + \beta_1\left(\frac{CF}{K_{t-1}}\right)_{i,t} + \beta_2\left(\frac{\Delta S}{K_{t-1}}\right)_{i,t} + \beta_3 Size_{i,t} + B'Ownership_{i,t} + \nu_t + \nu_j + \varepsilon_{it} \quad (2)$$

where I is the variation of capital stock (K) from the period t to $t+1.$; α_i captures firm's specific effects; ν_t represents the year dummies which account for business cycle effect; and ν_j the industry dummies to control for industry specific effects. *CF* is cash flow which proxies for the dependency of internal funds, and *S* is the real sales. We include on *Ownership* set the following variables: excess of control rights (*ECR*), cash flow rights (*CFR*), family control and pyramidal. *ECR* is the excess of control rights over cash flow rights and is measured as the difference between control rights and cash flow rights of the largest ultimate shareholder. *CFR* denotes the cash flow rights. *Family* is a dummy variable that takes value 1 if the largest ultimate shareholder is a family or an individual and is the controlling shareholder. *Pyramid* is a dummy variable that takes value 1 if the firm belongs to a pyramidal ownership structure.

We re-estimate model (2) splitting the sample according to quartiles of cash flow rights and divergence between control rights and cash flow rights to analyze the behavior of the largest ultimate shareholder's rights and the investment-cash flow sensitivity[8]. To infer the impact of under- and overinvestment in each quartile's group, we introduce two interaction variables with cash flow which capture the impact of over- and underinvestment on investment-cash flow sensitivity. We estimate equations of the type:

$$\begin{aligned}\left(\frac{I}{K_{t-1}}\right)_{i,t} = \alpha_i + \gamma_1\left(\frac{I}{K_{t-1}}\right)_{i,t-1} + \beta_1\left(\frac{CF}{K_{t-1}}\right)_{i,t} + \beta_{11}\left(\frac{CF}{K_{t-1}}\right)_{i,t} \times Under + \beta_{12}\left(\frac{CF}{K_{t-1}}\right)_{i,t} \times Over \\ + \beta_2\left(\frac{\Delta S}{K_{t-1}}\right)_{i,t} + \beta_3 Size_{i,t} + B'Ownership_{i,t} + \nu_t + \nu_j + \varepsilon_{it}\end{aligned} \quad (3)$$

where *Under* is a dummy variable that takes value 1 if the firm has investment rate below the optimal level and high industry sales growth and 0, otherwise; and *Over* is a dummy variable that assume value 1 if the firm has investment rate above of the optimal level and low industry sales growth, and 0 otherwise.

[8] See appendix for descriptive statistics of financial and ownership structure variables by quartiles.

4.2 Estimation methodology

We estimate models (2) and (3) using the two-step system generalized method of moments (System-GMM) estimator suggested by Blundell and Bond (1998). This approach takes into account the possibility of endogeneity problems owed by the inclusion of one lag of dependent variable as explanatory variable. Firm-specific effects and time-invariant effects are controlled by the use of first-difference. The introduction of lagged levels and first-difference of regressors as instruments enable to handle with the problem of weak instruments which can be produced if we only use the first-difference estimator proposed by Arellano and Bond (1991).

The standard error of the two-step system estimator is usually downward biased. To get a finite-sample correction for two-step estimator we use the Windmeijer (2005)'s robust correction. Except for the lag of dependent variable which has endogenous nature, all other variables are treated as exogenous. To avoid instruments proliferation and consequently endogeneity problems, we limit the maximum number of lags of the dependent variable that can be used as instruments for lags from $t-2$ to $t-4$.[9]

In order to evaluate the correct specification of our models and the legitimacy of instruments we need to investigate whether the instruments set are not correlated with error term. The models validity is tested by the Arellano-Bond autocorrelation test and by the Sargan test (or Hansen test). The Arellano-Bond test (AR test) checks the lack of second-order serial correlation. Under the null of no second order correlation, the AR test is asymptotically distributed as a standard normal. It is important to note that if the error terms are *iid* then it is expect to find first-order correlation in the differenced residuals, but the hypothesis of second-order correlation must be rejected (Guariglia 2008). Our second test (Sargan or Hansen test) analyzes whether the overidentifying conditions are correctly specified. The interest is not to reject this test since under the null the Sargan test indicates the validity of instrument set.

5. Main empirical results

5.1 Results of the investment models

Table 4 shows the estimation results of model 2 for total sample and by firms grouped as those with underinvestment problems (investment rate below the optimal level but high industry sales growth) and those with overinvestment problems (investment rate above the optimal level but low industry sales growth).

The coefficient estimated of cash flow in columns (1), (2) and (3) are positive and significant, implying that the increasing in physical investment are related to a significant dependency of internal funds. This result is consistent with prior studies Degryse and De Jong (2006), Pawlina and Renneboog (2005), Pindado and De La Torre (2009), Hoshi, Kashyap, and Scharfstein (1991), Broussard, Buchenroth, and Pilotte (2004). In columns (4) to (7) we also find a positive and significant coefficient of cash flow, which indicates that both under- and overinvestment firms depend of internal funds to supply investments. The investment-cash flow sensitivity for the overinvestment firms is higher (β=0.1020) in relation to the underinvestment firms (β=0.0650) but there is no statistical significance in the difference coefficient test. However, the interaction terms present in column (3) suggest that

[9] As argued by Roodman (2009), endogeneity problems related to the inclusion of many instruments can overfit the endogenous variables and do not eliminate their endogenous components. The combination of these problems can also impact on Sargan/Hansen test validity.

underinvestment has a negative and significant effect (β=-0.1710) on the investment-cash flow sensitivity, while overinvestment has a positive and significant effect (β=0.0713). The difference coefficient test is significant, indicating that the effects of over- and underinvestment on the investment-cash flow sensitivity play distingue roles. In other words, it suggests that firms with agency problems of free cash flow request more internal funds than underinvestment firms which are suffering from asymmetric information problems in capital market. Degryse and De Jong (2006) find similar results in which firm's with bad prospect (agency problems of free cash flow) have significantly higher investment-cash flow sensitivity than good prospect's firms (firms with asymmetric information problems).

Table 4: Investment models

Variables	Total Sample			Underinvestment		Overinvestment	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Investment rate$_{t-1}$	0.1436***	0.1414***	0.1400***	0.0036	0.0024	0.0424	0.0357
	(0.0324)	(0.0327)	(0.0351)	(0.0423)	(0.0420)	(0.1333)	(0.1243)
CF/K$_{t-1}$	0.0680***	0.0691***	0.0963***	0.0640**	0.0650**	0.0985**	0.1020**
	(0.0204)	(0.0205)	(0.0215)	(0.0287)	(0.0296)	(0.0438)	(0.0443)
ΔS/K$_{t-1}$	0.0309***	0.0299***	0.0272**	0.0216*	0.0228*	0.0118	0.0125
	(0.0115)	(0.0114)	(0.0122)	(0.0129)	(0.0133)	(0.0237)	(0.0232)
Size	0.4352***	0.4349***	0.4225***	-0.0328	-0.0384	0.4146***	0.3915***
	(0.0433)	(0.0429)	(0.0441)	(0.0628)	(0.0639)	(0.0999)	(0.1014)
ECR		-0.0454	-0.0242		-0.0740		-0.0763
		(0.0761)	(0.0726)		(0.1042)		(0.1027)
CFR		-0.0678	-0.0824		-0.0366		-0.2321***
		(0.0575)	(0.0527)		(0.0864)		(0.0959)
Family Control		0.0532	0.0499		0.0262		0.1334**
		(0.0349)	(0.0352)		(0.0571)		(0.0659)
Pyramidal		0.0245	0.0110		0.0264		0.0601
		(0.0253)	(0.0221)		(0.0266)		(0.0515)
(CF/K$_{t-1}$) x Under			-0.1710***				
			(0.0264)				
(CF/K$_{t-1}$) x Over			0.0713***				
			(0.0277)				
Year and Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Num. of Obs.	2943	2942	2942	851	851	567	567
AR(2) (p-value)	0.5606	0.5704	0.4051	0.7920	0.7509	0.7847	0.9302
Sargan (p-value)	0.2878	0.2621	0.0710	0.5966	0.5636	0.0759	0.1657

Notes: This table reports the estimated results for total sample and for firms considered as underinvestment problems due to asymmetric information problems (investment rate below of the optimal level and higher industry sales growth) and overinvestment problems due to agency costs of free cash flow (investment rate above of the optimal level and lower industry sales growth). Investment rate is the variation in capital stock (*K*), measured as $(K_t - K_{t-1})/K_{t-1}$. *CF* is the cash flow; ΔS is the variation in real sales (*S*); *Leverage* measures the book value of debt over the book value of equity; *ROA* is the return on the book value of assets; *ROE* is the return on the book value of equity; *Sales Growth* proxies for growth opportunities and is measures as $(S_t - S_{t-1})/(S_{t-1})$. *CFR* is the largest ultimate shareholder's rights; *ECR* is the excess of control rights over cash flow rights and is measured as the difference between control rights and cash flow rights. *Family Control* is a dummy variable that takes value 1 if the largest ultimate shareholder is the controlling shareholder and has a family identity, and 0 otherwise. *Pyramid* is a dummy variable that takes value 1 if the firm belongs to a pyramidal ownership structure, and 0 otherwise. *Under* is a dummy variable that takes value 1 if the firm has investment rate below of the optimal level (underinvestment) but high *ISG*, and 0 otherwise. *Over* is a dummy variable that takes value 1 if the firm has investment rate above of the optimal level (overinvestment) but low *ISG*, and 0 otherwise. The symbols ***, ** and * denotes statistical significance at the 1%, 5% and 10% level.

Considering the total sample, the increase in real sales is significantly important to explain the increase in investment rate, even more if the firm has underinvestment problems. However, this variable has a positive but non-significant effect for the overinvestment firms, which may be indicating that the increase in real sales is not directly related to an overinvestment tendency. As expected, the positive and precisely determined coefficient of size suggests that the increasing in firm's size impulses the investment rate. For the underinvestment firms, the firm's size has a negative effect but non-significant at conventional statistic levels, indicating that firm's size may be not relevant when firms underinvest due to asymmetric information problems. On the other side, the overinvestment in unprofitable investment projects seems to be higher as firm's size increases (the coefficient of size is positive and significant).

Taking into account the broader sample and the underinvestment firm's group, the set of ownership variables does not play a statistical significant role on firm's investment decision.[10] Nevertheless, for the overinvestment firms, the coefficient of cash flow rights has a negative and significant effect and family control has a positive and significant effect in investment decisions. Increases in cash flow rights of the largest ultimate shareholder may be related to the enhancement effect which alleviates the overinvestment problems as the interests of large and minority shareholders are more aligned (Claessens et al. 2002; Wei and Zhang 2008). However, the family control seems to intensify the investment decision on unprofitable projects of the overinvestment firms. Generally, family firms have high excess of control rights and may use it to expropriate financial resources (La Porta, Lopez-de-Silanes, and Shleifer 1999; Claessens et al. 2002; Kuo and Hung 2012) and can share the costs and the overinvestment losses with the outside shareholders (Burkart, Panunzi, and Shleifer 2003).

5.2 The behavior of investment-cash flow sensitivity in the presence of underinvestment and overinvestment

The results discussed in table 4 support the idea that both under-investing and over-investing firms depend of internal funds to supply investment decisions. From this point, we treat as overinvesting firms those with agency problems of free cash flow, and as underinvesting firms those with asymmetric information problems in capital market. In this section, we investigate the investment-cash flow sensitivity behavior between the quartiles of cash flow rights and quartiles of the divergence between control rights and cash flow rights. The results are displayed in table 5 for the divergence quartiles, and in table 6 for the cash flow rights quartiles.[11]

Our main interest is on the interaction variables between cash flow and the indicative dummies of under- and overinvestment. We observe that the underinvestment problem negatively affects the investment-cash flow sensitivity in all quartiles levels of divergence. The interaction term $(CF / K_{t-1}) \times Under$ shows that the negative effect of the underinvestment falls sharply moving from quartile 1 to quartile 2 and the coefficient difference is significant at 1% level. From quartile 2 to 3 there is little change between the interaction terms coefficients. However, the negative effect of underinvestment problems on investment-cash flow sensitivity increases from quartile 3 to 4 and the coefficients are statistical different at conventional levels. The findings indicate an inverted U-shaped relationship between the excess of control rights and the investment-cash flow sensitivity when firms face underinvestment due to asymmetric information problems in capital market. Additionally, the

[10] The results remain the same when we estimate the investment model including each one of the ownership variables separately.

[11] The results remain similar if we do not include the set of ownership and other control variables.

Table 5: Investment models by divergence (*ECR*) quartiles

Panel A: Investment models by divergence quartiles

	Quartile 1		Quartile 2		Quartile 3		Quartile 4	
	[-1; 0.0092)		[0.0092; 0.1853)		[0.1853; 0.3904)		(0.3904;1]	
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Investment rate$_{t-1}$	0.1351**	0.1347**	0.0632	0.0629	0.1954***	0.2288***	0.2028***	0.1913***
	(0.0727)	(0.0599)	(0.0568)	(0.0576)	(0.0528)	(0.0575)	(0.0780)	(0.0737)
CF/K$_{t-1}$	0.0875**	0.1480***	0.0772***	0.0500**	0.0748	0.0539	0.0274	0.0278
	(0.0425)	(0.0427)	(0.0254)	(0.0255)	(0.0578)	(0.0413)	(0.0459)	(0.0431)
(CF/K$_{t-1}$) x Under		-0.2493***		-0.0445		-0.0470**		-0.1774***
		(0.0189)		(0.0314)		(0.0205)		(0.0419)
(CF/K$_{t-1}$) x Over		-0.0306		0.1186**		0.1607***		0.1700***
		(0.0410)		(0.0467)		(0.0299)		(0.0294)
ΔS/K$_{t-1}$	0.0214	0.0185	0.0257*	0.0314**	0.0251**	0.0260**	0.0486*	0.0479*
	(0.0265)	(0.0225)	(0.0142)	(0.0151)	(0.0125)	(0.0129)	(0.0267)	(0.0285)
Size	0.3410***	0.3705***	0.5214***	0.4866***	0.5011***	0.4438***	0.3834***	0.3542***
	(0.0944)	(0.0765)	(0.0813)	(0.0894)	(0.0919)	(0.0994)	(0.0702)	(0.0758)
ECR	-0.0719	-0.0250	-0.1422	-0.1350	-0.0297	-0.0564	-0.0431	-0.0856
	(0.2293)	(0.1884)	(0.1408)	(0.1417)	(0.1054)	(0.1093)	(0.0772)	(0.0781)
CFR	0.1141	0.0131	0.0411	0.0477	-0.1161	-0.1596	-0.1273	-0.1613*
	(0.1022)	(0.0850)	(0.0836)	(0.0819)	(0.1429)	(0.1425)	(0.0919)	(0.0869)
Family Control	0.0760	0.0422	0.0234	0.0122	0.0677	0.0899	0.0461	0.0504
	(0.0942)	(0.0871)	(0.0669)	(0.0685)	(0.0640)	(0.0640)	(0.0510)	(0.0462)
Pyramidal	0.1406*	0.0674	-0.0002	0.0111	0.0203	0.0129	-0.0086	-0.0375
	(0.0769)	(0.0509)	(0.0326)	(0.0322)	(0.0446)	(0.0403)	(0.0494)	(0.0473)
Year and Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Num. of Obs.	1059	1059	1059	1059	1059	1059	1059	1059
AR(2) Test (p-value)	0.5873	0.8668	0.6472	0.7097	0.2191	0.7195	0.6620	0.9026
Sargan Test (p-value)	0.3814	0.3336	0.6868	0.5057	0.3788	0.2495	0.1438	0.0594

Panel B: Difference Coefficient Test of interaction variables between quartiles (*t*-value)

Quartile(n)-Quartile(n+1)	Under	5.5881***	0.0667	2.7955***	-
Quartile(n)-Quartile(n+2)	Under	7.2553***	2.5382**	-	-
Quartile(n)-Quartile(n+1)	Over	2.4009**	0.7592	0.2218	-
Quartile(n)-Quartile(n+2)	Over	3.7699***	0.9314	-	-

Notes: This table reports the estimated results by when the sample is divided by quartile of the excess of control rights. See notes of table 4 for variables detailed informations. The symbols ***, ** and * denotes statistical significance at the 1%, 5% and 10% level.

investment-cash flow sensitivity seems to be less affected by underinvestment if the largest ultimate shareholder has the lowest or highest levels of excess of control rights. In other words, the underinvestment problems should be alleviated as the interests of large and minority shareholders become more aligned. Nevertheless, higher levels of divergence between control rights and cash flow rights are usually accompanied by a controlling shareholder, usually a family control.[12] Although the controlling shareholder can increase agency problems between large and minority shareholder, he can reduce asymmetric information between managers and shareholders, and between firm and bondholders (Andres 2011; Wang 2006; Anderson and Reeb 2003) and ease his tendency of expropriation to seize growth opportunities (Grossman and Hart 1982). As suggested by (Kuo and

[12] See in table A2 of appendix that 61.84% of firms in quartile 4 of divergence have family control.

Hung 2012) the cross-subsidization with the network of family-owners can also reduce the underinvestment problems.

The results of table 5 also evidences that the overinvestment positively affects the investment-cash flow sensitivity as the excess of control rights increases. Only exception is for quartile 1 in which the coefficient of the interaction term $(CF / K_{t-1}) \times Over$ is negative and insignificant. Moving from quartile 1 to quartile 2, the effect of overinvestment on investment-cash flow sensitivity rises and the difference coefficient is significant at 5% level. We observe little difference moving from quartile 2 to higher levels of divergence, which is also evidenced by the non-significance at conventional levels for the difference coefficient tests. Considering from the first to other quartiles, the findings suggest that the effect of overinvestment on investment-cash flow sensitivity is a crescent function of the excess of control rights, although this effect tends to be similar when the level of excess of control rights is superior of 0.1853.

Overall, the estimated results in table 5 show that the level of excess of control rights is intrinsically related to how under- and overinvestment problems affect firm's investment decisions. To complete our investigation, we estimate the investment model by the quartiles of cash flow rights of the largest ultimate shareholder. The results are presented in table 6.

The effect of underinvestment on investment cash flow sensitivity is negative and significant in the four quartiles of cash flow rights. Moving from quartile 1 to quartile 2, we observe that the negative effect of the interaction term $(CF / K_{t-1}) \times Under$ increases, although the difference coefficient is non-significant at conventional levels. The negative effect of underinvestment falls from quartile 2 to quartile 3 but there is no statistical difference between the estimated coefficients. From quartile 3 to quartile 4 of ownership, there is little difference between the negative effects of underinvestment but this difference has no statistical significance. We do not find significant statistical difference between the coefficients of interaction term $(CF / K_{t-1}) \times Under$ on other quartiles pairwise combination. These findings suggest that the relationship between investment-cash flow sensitivity of underinvestment firms and cash flow rights of the largest ultimate shareholder seems to be constant.

Considering the overinvestment problems, the interaction term $(CF / K_{t-1}) \times Over$ is positive and statistical significant in quartile 1 and quartile 3 of cash flow rights but the effects are insignificant for quartile 2 and quartile 4. We observe that the estimated relationship between overinvestment and investment-cash flow sensitivity has two minimum points in quartile 2 and quartile 4. However, there is insignificant statistical difference between the estimated coefficients $(CF / K_{t-1}) \times Over$ for all quartiles arrangement. The findings may be signaling that as the cash flow rights of the largest ultimate shareholder increases, the effect of overinvestment on investment-cash flow sensitivity remains the same.

We also note two other interesting results of table 6. The first is the negative and significant impact of divergence in quartile 4 of cash flow rights. This estimated result indicates that the increases in the excess of control rights reduce the investment rate when the largest ultimate shareholder has higher ownership stakes. And, the second is the positive and significant coefficient of family control also in quartile 4, suggesting that the presence of family control in the highest level of cash flow rights helps to increase investment rate.

Table 6: Investment models by cash flow rights

Panel A: Investment models by cash flow rights quartiles								
	Quartile 1		Quartile 2		Quartile 3		Quartile 4	
	[0;0.2244)		[0.2244; 0.4242)		[0.4242; 0.6647)		[0.6647; 1]	
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Investment rate$_{t-1}$	0.0997*	0.0810*	0.0993*	0.1069***	0.2311***	0.2495***	0.0977	0.0693
	(0.0531)	(0.0495)	(0.0552)	(0.0411)	(0.0601)	(0.0762)	(0.0699)	(0.0672)
CF/K$_{t-1}$	0.0432	0.0692	0.0435	0.0427	0.0849***	0.0859***	0.0312	0.0873**
	(0.0768)	(0.0692)	(0.0494)	(0.0379)	(0.0330)	(0.0304)	(0.0279)	(0.0392)
(CF/K$_{t-1}$) x Under		-0.1483**		-0.2164***		-0.1531***		-0.1573***
		(0.0635)		(0.0157)		(0.0392)		(0.0393)
(CF/K$_{t-1}$) x Over		0.0913**		0.0374		0.1171***		0.0585
		(0.0437)		(0.0466)		(0.0354)		(0.0644)
ΔS/K$_{t-1}$	0.0226	0.0262	0.0250	0.0336**	0.0264*	0.0412*	0.0513***	0.0508**
	(0.0253)	(0.0171)	(0.0172)	(0.0167)	(0.0154)	(0.0206)	(0.0196)	(0.0215)
Size	0.5593***	0.4833***	0.3950***	0.3858***	0.3716***	0.3398***	0.4619***	0.4225***
	(0.0737)	(0.0705)	(0.0911)	(0.0743)	(0.1179)	(0.1064)	(0.0664)	(0.0712)
ECR	0.0347	0.0570	-0.0023	-0.0417	-0.0403	0.0535	-0.3084*	-0.3073*
	(0.1174)	(0.1002)	(0.0823)	(0.0655)	(0.1350)	(0.1243)	(0.1727)	(0.1449)
CFR	0.0645	0.0125	-0.0680	-0.0587	-0.1451	-0.2628**	-0.0134	-0.0334
	(0.1193)	(0.1116)	(0.1117)	(0.1033)	(0.1374)	(0.1245)	(0.0854)	(0.0753)
Family Control	0.1228	0.1073	-0.0136	-0.0062	-0.0125	-0.0013	0.2107***	0.1899***
	(0.0954)	(0.0865)	(0.0430)	(0.0395)	(0.0541)	(0.0554)	(0.0627)	(0.0659)
Pyramidal	0.0421	0.0384	0.0266	0.0346	0.0166	-0.0373	0.0518	0.0664
	(0.0478)	(0.0444)	(0.0460)	(0.0425)	(0.0392)	(0.0331)	(0.0417)	(0.0378)
Year and Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Num. of Obs.	1059	1059	1059	1059	1059	1059	1059	1059
AR(2) Test (p-value)	0.6266	0.3344	0.8690	0.9680	0.6525	0.9953	0.9418	0.9614
Sargan Test (p-value)	0.3063	0.2382	0.3447	0.6393	0.8356	0.4146	0.6381	0.6894
Panel B: Difference Coefficient Test of interaction variables between quartiles (*t*-value)								
Quartile(n)-Quartile(n+1)	Under	1.0411		1.4990		0.0757		-
Quartile(n)-Quartile(n+2)	Under	0.0643		1.3965		-		-
Quartile(n)-Quartile(n+1)	Over	0.8437		1.3619		0.7974		
Quartile(n)-Quartile(n+2)	Over	0.4588		0.2654		-		-

Notes: This table reports the estimated results by when the sample is divided by quartile of the largest ultimate shareholder's cash flow rights. See notes of table 4 for variables detailed information. The symbols ***, ** and * denotes statistical significance at the 1%, 5% and 10% level.

5.3 Robustness checks

Our results in tables 5 and 6 indicate that the excess of control rights has a non-monotonic relationship with the investment-cash flow sensitivity for firms with both under- and overinvestment problems, while the cash flow rights seems to have a constant relationship. To establish the robustness of the results, we interact the cubic and quadratic form of divergence and cash flow rights with cash flow. The results are presented in table 7.

Table 7: Investment model including quadratic and cubic form

Panel A: Divergence behavior

	Underinvestment problems			Overinvestment problems		
Variables	Linear	Quadratic	Cubic	Linear	Quadratic	Cubic
$Investment_{t-1}$	0.1520***	0.1549***	0.1550***	0.1385***	0.1387***	0.1388***
	(0.0334)	(0.0322)	(0.0321)	(0.0345)	(0.0351)	(0.0345)
(CF/K_{t-1})	0.1113***	0.1056***	0.1041***	0.0475**	0.0471**	0.0453**
	(0.0212)	(0.0208)	(0.0206)	(0.0195)	(0.0196)	(0.0196)
(CF/K_{t-1})x(Under or Over)	-0.1995***	-0.2199***	-0.2252***	0.0991***	0.0899**	0.0695**
	(0.0201)	(0.0183)	(0.0182)	(0.0319)	(0.0403)	(0.0432)
(CF/K_{t-1}) x(ECR)x(Under or Over)	0.1171	0.5799***	1.0917***	0.1809**	0.3441	1.3342**
	(0.1105)	(0.1236)	(0.3930)	(0.0824)	(0.2297)	(0.5915)
(CF/K_{t-1}) x$(ECR)^2$x(Under or Over)		-0.8432***	-2.9646**		-0.2529	-3.9316**
		(0.1918)	(1.5066)		(0.2692)	(1.8556)
(CF/K_{t-1}) x$(ECR)^3$x(Under or Over)			1.8403			3.0236**
			(1.2496)			(1.4475)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Year and Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes
AR(2) (p-value)	0.6315	0.7049	0.6563	0.3873	0.3905	0.3392
Sargan (p-value)	0.1073	0.1372	0.1428	0.0761	0.0686	0.0619

Panel B: Cash flow rights behavior

	Underinvestment problems			Overinvestment problems		
Variables	Linear	Quadratic	Cubic	Linear	Quadratic	Cubic
$Investment_{t-1}$	0.1527***	0.1531***	0.1532***	0.1381***	0.1387***	0.1385***
	(0.0334)	(0.0332)	(0.0332)	(0.0347)	(0.0344)	(0.0342)
(CF/K_{t-1})	0.1103***	0.1110***	0.1111***	0.0459**	0.0455**	0.0453**
	(0.0211)	(0.0213)	(0.0213)	(0.0195)	(0.0195)	(0.0195)
(CF/K_{t-1})x(Under or Over)	-0.1939***	-0.2193***	-0.2259***	0.1465***	0.0958	-0.0099
	(0.0353)	(0.0488)	(0.0644)	(0.0502)	(0.0754)	(0.1620)
(CF/K_{t-1})x(CFR)x(Under or Over)	0.0252	0.1801	0.2509	-0.0121	0.3124	1.3497
	(0.0669)	(0.2213)	(0.6426)	(0.1192)	(0.3849)	(1.4855)
(CF/K_{t-1})x$(CFR)^2$x(Under or Over)		-0.1721	-0.3430		-0.3762	-2.8594
		(0.2392)	(1.6327)		(0.4793)	(3.4058)
(CF/K_{t-1})x$(CFR)^3$x(Under or Over)			0.1136			1.6839
			(1.1232)			(2.1792)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Year and Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes
AR(2) Test (p-value)	0.5573	0.5763	0.5728	0.3595	0.3749	0.3962
Sargan Test (p-value)	0.1036	0.1045	0.1040	0.0700	0.0601	0.0605

Notes: This table reports the estimated results including linear, quadratic and cubic form of *ECR* and *CFR* estimated by System GMM. According to the columns, *Under or Over* signal if the interaction variable is related to dummy variables of under- or overinvestment problems. We include ownership and control variables and other control variables on estimation process but we do not report here (the results remains similar to those of table 4. The symbols ***, ** and * denotes statistical significance at the 1%, 5% and 10% level.

Panel A of table 7 display the estimated results of the divergence behavior. For the underinvestment firms, the linear model shows that the interaction term $(CF/K_{t-1})\times(ECR)\times Under$ is insignificant at conventional levels, but is positive and significant for quadratic and cubic models. The square term of *ECR* negatively affects the investment-cash flow sensitivity in quadratic and cubic

models, while the cubic term of *ECR* has non-significant effect on cubic model. The combination of the insignificant effect of the cubic *ECR* and the square *ECR* in the quadratic model suggests that the excess of control rights has a quadratic relationship with investment-cash flow sensitivity for underinvestment firms. The negative impact of $(CF/K_{t-1})\times(ECR)^2\times Under$ confirms the inverted U-shaped relationship suggested by table 5 results.

Taking into account the overinvestment firms, we observe that the interaction term $(CF/K_{t-1})\times(ECR)\times Over$ is positive and significant for linear and cubic models, but is non-significant for quadratic model. The square *ECR* has a negative and insignificant impact on the investment-cash flow sensitivity. The interaction term $(CF/K_{t-1})\times(ECR)^3\times Over$ is positive and significant, indicating a crescent S-shaped function between the excess of control rights and the investment-cash flow sensitivity in overinvestment firms and confirms the crescent function observed in table 6.

Panel B of table 7 show the estimated results for the cash flow rights behavior for under- and overinvestment firms. [13] For both set of firms we note that the square and cubic interaction terms are not significant on quadratic and cubic models. Only the interaction term $(CF/K_{t-1})\times Under$ and $(CF/K_{t-1})\times Over$ has significant effect on linear models. The findings reinforce that the relationship between the cash flow rights and the investment-cash flow sensitivity may be constant in under- and overinvestment firms.

For an additional test, we follow Davies, Hillier, and McColgan (2005) and find the local maximum and/or minimum turning points of the functions found above, and use them as critical values to estimate a piecewise linear regression as applied by Pawlina and Renneboog (2005), Cho (1998), Morck, Shleifer, and Vishny (1988). For the underinvestment firms, the evidences above indicate that the relationship between divergence and investment-cash flow sensitivity is a quadratic function which reaches its maximum point when the excess of control rights is equal to 34.38 percentage points (pp). For overinvestment firms, we find a crescent cubic function which has one local maximum and one local minimum point. In those firms, the investment-cash flow sensitivity increases until 23.15pp divergence level, falls after this points and turns to increase after 63.53pp. As we find a constant relationship between cash flow rights and investment-cash flow sensitivity, we do not have critical values, thus we use the terciles as breaking points.[14] Table 8 presents the coefficients resulting from the piecewise linear regression.

The results of table 8 confirm those found in table 7. An examination on panel A of table 8 results suggests that the investment-cash flow sensitivity of underinvestment firms increases as the excess of control rights reaches the 34.38pp and then declines after this point, having the behavior of an inverted U-shaped function. In panel B, the divergence level up to 23.15pp has a positive and significant effect, indicating increases in investment-cash flow sensitivity of overinvestment firms. Although the two coefficients related to the excess of control rights up to 23.15pp have non-significant effect for the overinvestment firms, they have the expected sign which suggests a decreasing in investment-cash flow sensitivity after 23.15pp and an increasing after 63.53pp. A possible reason for the lack of significance is the small number of overinvestment firms with those levels of divergence.

Panel C and panel D of table 8 displays the piecewise model results for the cash flow rights behavior. As expected, no one interaction variables are statistical significant at conventional levels for both under- and overinvestment firms. In a further analyzes we also carry out the median, quartile and

[13] Many papers assume as a valid specification model when Sargan test p-value is inferior of 10% but superior of 1% statistical level. See (Ding, Guariglia, and Knight ; Guariglia 2008).

[14] The use of median, quartiles and quintiles as cutoff points produces similar results.

quintic values of cash flow rights as cutting off points to estimate the piecewise linear model, and again the interaction terms do not have significant effect on the investment-cash flow sensitivity.

Table 8: Piecewise linear regression

Panel A: Excess of control rights and Investment-cash flow sensitivity of Underinvestment firms			
Variables	Intercept	$ECR_{\text{up to 34.38p.p.}}$	$ECR_{\text{over 34.38p.p.}}$
Coefficient	-0.2174***	0.3177***	-0.4126***
Std. Error	(0.0188)	(0.0719)	(0.0969)
AR(2) (p-value)	0.6950	Sargan (p-value)	0.1478

Panel B: Excess of control rights and Investment-cash flow sensitivity of Overinvestment firms				
Variables	Intercept	$ECR_{\text{up to 23.15p.p.}}$	$ECR_{\text{23.15 p.p. to 63.53p.p.}}$	$ECR_{\text{over 63.53p.p.}}$
Coefficient	0.0755*	0.6516**	-0.3385	0.6288
Std. Error	(0.0412)	(0.2842)	(0.2344)	(0.4045)
AR(2) (p-value)	0.3372	Sargan (p-value)	0.0603	

Panel C: Cash flow rights and Investment-cash flow sensitivity of Underinvestment firms				
	Intercept	$CFR_{\text{up to 29.05\%}}$	$CFR_{\text{29.05\% to 57.24\%}}$	$CFR_{\text{over 57.24\%}}$
Coefficient	-0.2063***	0.0401	0.1244	-0.1516
Std. Error	(0.0502)	(0.2213)	(0.2143)	(0.2243)
AR(2) (p-value)	0.5847	Sargan (p-value)	0.1029	

Panel D: Cash flow rights and Investment-cash flow sensitivity of Overinvestment firms				
	Intercept	$CFR_{\text{up to 29.05\%}}$	$CFR_{\text{29.05\% to 57.24\%}}$	$CFR_{\text{over 57.24\%}}$
Coefficient	0.1391	-0.0574	0.2037	-0.4793
Std. Error	(0.1049)	(0.5299)	(0.2969)	(0.3932)
AR(2) (p-value)	0.3691	Sargan (p-value)	0.0531	

Notes: This table reports only the estimated results for the variables in the brackets of the following equation:

$$(I/K_{t-1})_{i,t} = \alpha_i + \gamma_1 (I/K_{t-1})_{i,t-1} + \beta_1 (CF/K_{t-1})_{i,t} + (CF/K_{t-1})_{i,t} \times (Under/Over) \times [\boldsymbol{\beta_{10}} + \boldsymbol{\beta_{11}}\mathbf{PW_1} + \boldsymbol{\beta_{12}}\mathbf{PW_2} + \boldsymbol{\beta_{13}}\mathbf{PW_3}]$$
$$+ \beta_2 (\Delta S/K_{t-1})_{i,t} + \beta_3 Size_{i,t} + B' Ownership_{i,t} + \nu_t + \nu_j + \varepsilon_{it}$$

where, *PW* denotes the piecewise used on estimation results. The sample is divided according to maximum and minimum local points of estimated functions on table 6 and 7. For firms with underinvestment problems, *PW* of the excess of control rights have one limited point: $ECR_{up\ to 34.38p.p}$ = the largest ultimate shareholder's excess of control rights if the excess of control rights <34.38 percentage points, and =34.38p.p if his excess of control rights >34.38p.p. $ECR_{over 34.38p.p}$=0 if the if the excess of control rights<34.38p.p, and is equal to the excess of control rights minus 34.38p.p. if the excess of control rights >34.38p.p. For firms with overinvestment problems we have two critical values 23.15p.p and 63.53p.p. Thus, $ECR_{up\ to\ 23.15p.p.=}$ the largest ultimate shareholder's excess of control rights if the excess of control rights <23.15 percentage points, and =23.15p.p if his excess of control rights >23.15p.p; $ECR_{23.15\ p.p.\ to\ 63.53p.p.}$=0 if the largest ultimate shareholder's excess of control rights<23.15p.p, but it is equal to the largest ultimate shareholder's excess of control rights minus 23.15p.p. if the largest ultimate shareholder's excess of control rights belongs to (23.15p.p.; 63.53p.p). $ECR_{over\ 63.53p.p.}$=0 if the if the excess of control rights<63.53p.p, and is equal to the excess of control rights minus 63.53p.p. if the excess of control rights >63.53p.p.

6. Conclusion

In this study, we investigate the relationship between investment and cash flow for an unbalanced panel of Brazilian firms in the period of 1996-2010. Our main interest is to understand how underinvestment problems due to asymmetric information and overinvestment caused by agency costs

of free cash flow affect firm's investment decisions and how they are related to the largest ultimate shareholder's cash flow rights and the excess of control rights. Contrary to other papers which grouped firms as over- and underinvestment according to Tobin's q or sales growth (Hoshi, Kashyap, and Scharfstein 1991; Degryse and De Jong 2006; Broussard, Buchenroth, and Pilotte 2004; Kuo and Hung 2012), we follow Verdi (2006) and estimate the optimal investment level considering only sales growth as independent variable. Nevertheless, it is not sufficient to indicate that firms grouped as underinvestment (overinvestment) are really suffering from asymmetric information (agency problems of free cash flow) problems since their growth opportunities are lower (higher) in relation to sample mean. On this way, we combine those results with the industry sales growth, an investment opportunity proxy, which is free of agency internal conflicts related to weak protection of minority shareholders (Chen, Chen, and Wei 2011).

We find evidence that investment is strongly cash flow sensitive. Furthermore, firms with underinvestment or with overinvestment problems depend of internal funds to supply investments. As underinvestment firms suffer from asymmetric information in capital market, the cost of external funds is more expensive, forcing them to use internal funds to support growth opportunities (Myers and Majluf 1984; Fazzari, Hubbard, and Petersen 1988; Allayannis and Mozumdar 2004; Hadlock 1998). On the other side, the investment-cash flow sensitivity of overinvestment firms seems to be closely related to overspend tendency in unprofitable investment projects which does not raise firm's value (Jensen 1986; Stulz 1990; Degryse and De Jong 2006). Besides, similar to Degryse and De Jong (2006), our results evidence that the investment decisions of underinvestment firm are less dependent of internal funds than overinvestment firms, suggesting that the impact of asymmetric information problems on investment decision is lower in relation to agency problems of free cash flow.

Our results do not support the idea that investment-cash flow sensitivity and the excess of control rights, and the cash flow rights have a monotonic relationship. In the presence of underinvestment problems due to asymmetric information, we find that the behavior of investment-cash flow sensitivity and the excess of control rights is described by an inverted U-shaped function, while the investment-cash flow sensitivity is constant as cash flow rights increases. In part, this finding is in line with Hadlock (1998) and suggests that investment-cash flow sensitivity stop increasing in a certain level of excess control rights (34.38pp) and falls after this point. This falling part is not associated to the enhancement effect of cash flow rights since its impact is constant. The decreasing investment-cash flow sensitivity when the excess of control rights is higher may be associated to a reducing on the largest ultimate shareholder's tendency of firm's wealth expropriation in front of growth opportunities and asymmetric information problems in capital market.

When firms face overinvestment problems due to agency costs of free cash flow we find that the relationship between investment-cash flow sensitivity and the excess of control rights is represented by a crescent S-shaped function. As for underinvestment firms, the cash flow rights have a constant impact on the investment-cash flow sensitivity of overinvestment firms. The findings suggest that the tendency of overinvestment increases as the interests between large and minority shareholders become less aligned (higher excess of control rights) and the increasing cash flow rights is not sufficient to reduce this tendency. Pawlina and Rennebog (2005) also find a S-shaped function associated to the relationship of investment-cash flow sensitivity and the alignment of interests between insiders and minority shareholders, attributing this behavior to a overinvestment problems.

REFERENCES

Allayannis, G., and A. Mozumdar, 2004, The impact of negative cash flow and influential observations on investment-cash flow sensitivity estimates, *Journal of Banking and Finance* 28, 901-930.

Almeida, H. V., and D. Wolfenzon, 2006, A theory of pyramidal ownership and family business groups, *Journal of Finance* 61, 2637-2680.

Anderson, R. C., and D. M. Reeb, 2003, Founding-family ownership, corporate diversification, and firm leverage, *Journal of Law and Economics* 46, 653-684.

Andres, C., 2011, Family ownership, financing constraints and investment decisions, *Applied Financial Economics* 21, 1641-1659.

Arellano, M., and S. Bond, 1991, Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations, *Review of Economic Studies* 58, 277-297.

Bianco, M., and P. Casavola, 1999, Italian corporate governance:: Effects on financial structure and firm performance, *European Economic Review* 43, 1057-1069.

Biddle, G. C., G. Hilary, and R. S. Verdi, 2009, How does financial reporting quality relate to investment efficiency?, *Journal of Accounting and Economics* 48, 112-131.

Billett, M. T., J. A. Garfinkel, and Y. Jiang, 2011, The influence of governance on investment: Evidence from a hazard model, *Journal of Financial Economics* 102, 643-670.

Blundell, R., and S. Bond, 1998, Initial conditions and moment restrictions in dynamic panel data models, *Journal of Econometrics* 87, 115-143.

Bond, S., and C. Meghir, 1994, Dynamic investment models and the firm's financial policy, *Review of Economic Studies* 61, 197-222.

Broussard, J. P., S. A. Buchenroth, and E. A. Pilotte, 2004, CEO incentives, cash flow, and investment, *Financial Management* 33, 51-70.

Burkart, M., F. Panunzi, and A. Shleifer, 2003, Family Firms, *The Journal of Finance* 58, 2167-2202.

Carpenter, R. E., and A. Guariglia, 2003, *Cash flow, investment, and investment opportunities* (University of Nottingham, School of Economics, Nottingham).

———, 2008, Cash flow, investment, and investment opportunities: New tests using UK panel data, *Journal of Banking and Finance* 32, 1894-1906.

Chen, K. C. W., Z. Chen, and K. C. J. Wei, 2011, Agency costs of free cash flow and the effect of shareholder rights on the implied cost of equity capital, *Journal of Financial and Quantitative Analysis* 46, 171-207.

Cho, M. H., 1998, Ownership structure, investment, and the corporate value: An empirical analysis, *Journal of Financial Economics* 47, 103-121.

Claessens, S., S. Djankov, J. P. H. Fan, and L. H. P. Lang, 2002, Disentangling the incentive and entrenchment effects of large shareholdings, *Journal of Finance* 57, 2741-2771.

Claessens, S., S. Djankov, and L. H. P. Lang, 2000, The separation of ownership and control in East Asian Corporations, *Journal of Financial Economics* 58, 81-112.

Cleary, S., 1999, The relationship between firm investment and financial status, *Journal of Finance* 54, 673-692.

Davies, J. R., D. Hillier, and P. McColgan, 2005, Ownership structure, managerial behavior and corporate value, *Journal of Corporate Finance* 11, 645-660.

Degryse, H., and A. De Jong, 2006, Investment and internal finance: Asymmetric information or managerial discretion?, *International Journal of Industrial Organization* 24, 125-147.

Ding, S., A. Guariglia, and J. Knight, Investment and financing constraints in China: Does working capital management make a difference?, *Journal of Banking & Finance*.

Faccio, M., and L. H. P. Lang, 2002, The ultimate ownership of Western European corporations, *Journal of Financial Economics* 65, 365-395.

Fazzari, S. M., R. G. Hubbard, and B. C. Petersen, 1988, Financing constraints and corporate investment, *Brookings Papers on Economic Activity* 1, 141-195.

Gomes, J. F., 2001, Financing investment, *American Economic Review* 91, 1263-1285.

Grossman, S., and O. Hart, 1982, *Corporate Financial Structure and Managerial Incentives*.

Guariglia, A., 2008, Internal financial constraints, external financial constraints, and investment choice: Evidence from a panel of UK firms, *Journal of Banking and Finance* 32, 1795-1809.

Hadlock, C. J., 1998, Ownership, liquidity, and investment, *RAND Journal of Economics* 29, 487-508.

Hoshi, T., A. Kashyap, and D. Scharfstein, 1991, Corporate structure, liquidity, and investment: Evidence from Japanese industrial groups, *Quarterly Journal of Economics* 106, 33-60.

Hubbard, R. G., 1998, Capital-Market Imperfections and Investment, *Journal of Economic Literature* 36, 193-225.

Jensen, M. C., 1986, Agency costs of free cash flow, corporate finance, and takeovers, *American Economic Review* 76, 323-329.

Kaplan, S. N., and L. Zingales, 1997, Do investment-cash flow sensitivities provide useful measures of financing constraints?, *Quarterly Journal of Economics* 112, 169-213.

Kuo, Y.-P., and J.-H. Hung, 2012, Family Control and Investment-Cash Flow Sensitivity: Moderating Effects of Excess Control Rights and Board Independence, *Corporate Governance: An International Review* 20, 253-266.

La Porta, R., F. Lopez-de-Silanes, and A. Shleifer, 1999, Corporate ownership around the world, *Journal of Finance* 54, 471-517.

McConnell, J. J., and H. Servaes, 1990, Additional evidence on equity ownership and corporate value, *Journal of Financial Economics* 27, 595-612.

Morck, R., A. Shleifer, and R. W. Vishny, 1988, Management ownership and market valuation. An empirical analysis, *Journal of Financial Economics* 20, 293-315.

Myers, S. C., and N. S. Majluf, 1984, Corporate financing and investment decisions when firms have information that investors do not have, *Journal of Financial Economics* 13, 187-221.

Paligorova, T., and Z. Xu, 2012, Complex ownership and capital structure, *Journal of Corporate Finance* 18, 701-716.

Pawlina, G., and L. Renneboog, 2005, Is investment-cash flow sensitivity caused by agency costs or asymmetric information? Evidence from the UK, *European Financial Management* 11, 483-513.

Pindado, J., and C. De La Torre, 2009, Effect of ownership structure on underinvestment and overinvestment: Empirical evidence from Spain, *Accounting and Finance* 49, 363-383.

Pindado, J., I. Requejo, and C. de la Torre, 2011, Family control and investment–cash flow sensitivity: Empirical evidence from the Euro zone, *Journal of Corporate Finance* 17, 1389-1409.

Richardson, S., 2006, Over-investment of free cash flow, *Review of Accounting Studies* 11, 159-189.

Stulz, R., 1990, Managerial discretion and optimal financing policies, *Journal of Financial Economics* 26, 3-27.

Villalonga, B., and R. Amit, 2006, How do family ownership, control and management affect firm value?, *Journal of Financial Economics* 80, 385-417.

Wang, D., 2006, Founding family ownership and earnings quality, *Journal of Accounting Research* 44, 619-656.

Wei, K. C. J., and Y. Zhang, 2008, Ownership structure, cash flow, and capital investment: Evidence from East Asian economies before the financial crisis, *Journal of Corporate Finance* 14, 118-132.

Windmeijer, F., 2005, A finite sample correction for the variance of linear efficient two-step GMM estimators, *Journal of Econometrics* 126, 25-51.

Appendix

Table A1: Estimating the optimal level

Panel A: Descriptive Statistics

Variables	Mean	Std. Deviation	Min	Median	Max
(I/K_{t-1})	0.0251	0.2917	-0.3865	-0.0406	0.9116
Sales Growth (SG)	0.0737	0.2344	-0.3323	0.0405	0.6521
Tobin's *q*	1.1255	0.5249	0.5065	0.9709	2.5477

Panel B: Investment Efficiency model by Sales Growth –OLS (robust) for each industry sector

Industry Sector	Constant	Sales Growth$_{t-1}$	R^2
Management of Companies and Enterprises	0.0134	0.2300**	0.0396
	(0.0242)	(0.0938)	
Agriculture, Forestry, Fishing and Hunting	0.0750	0.2758	0.0435
	(0.0693)	(0.2285)	
Health Care and Social Assistance	-0.1064	1.2649***	0.5135
	(0.0733)	(0.3510)	
Wholesale Trade	-0.0069	0.4290*	0.0863
	(0.0378)	(0.2212)	
Retail Trade	-0.0022	0.4434***	0.1006
	(0.0179)	(0.1043)	
Construction	0.0129	0.4304***	0.1343
	(0.0285)	(0.0862)	
Utilities	-0.0443***	0.0116	0.0001
	(0.0092)	(0.0546)	
Real Estate Rental	0.1299*	-0.2488	0.0486
	(0.0711)	(0.1653)	
Manufacturing	-0.0007	0.1844***	0.0233
	(0.0065)	(0.0365)	
Information	-0.0098	0.1833**	0.0190
	(0.0216)	(0.0776)	
Mining	0.0996***	-0.1591	0.0193
	(0.0342)	(0.1468)	
Administrative, Support , Waste Management and Remediation Service	-0.0221	-0.0305	0.0007
	(0.0603)	(0.1727)	
Transporting and Warehousing	0.1075**	0.0189	0.0002
	(0.0446)	(0.1510)	

Panel C: Robustness for Investment Efficiency model – OLS (robust) Pooled Time Series and industry dummies

	Proxy	Constant	Growth Opportunities	R^2
Total Sample	Sales Growth	0.0986	0.3229***	0.0512
		(0.4662)	(0.1052)	
	Tobin's *q*	-0.5196	0.2155**	0.0316
		(0.8439)	(0.0874)	

Table A2: Summary statistics by quartiles of cash flow rights and excess of control rights.

Panel A: Quartiles of the largest ultimate shareholder's cash flow rights

	Quartile 1 [0; 0.22439)		Quartile 2 [0.22439; 0.42418)		Quartile 3 [0.42418; 0.66467)		Quartile 4 [0.66467; 1]	
Variables	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Investment Rate	0.0348	0.2951	0.0172	0.2736	0.0476	0.3242	0.0001	0.2679
CF/K_{t-1}	0.4395	0.7769	0.3871	0.6771	0.5984	1.0515	0.4195	0.7413
$\Delta S/K_{t-1}$	0.3272	1.0822	0.2519	1.0337	0.4082	1.1999	0.2151	0.9558
Total Asset	5.08E+06	7.70E+06	4.74E+06	7.18E+06	4.12E+06	6.59E+06	3.86E+06	5.63E+06
Leverage	2.3629	2.7354	2.5382	3.0039	2.3535	2.7823	2.4550	2.9143
ROA	0.0290	0.0686	0.0249	0.0686	0.0254	0.0700	0.0313	0.0750
ROE	0.0387	0.2512	0.0207	0.2648	0.0258	0.2544	0.0378	0.2749
Sales Growth	0.0778	0.2202	0.0602	0.2374	0.0966	0.2524	0.0599	0.2242
ECR	0.3394	0.2765	0.3296	0.2259	0.1977	0.1815	0.0754	0.1097
CFR	0.1347	0.0588	0.3215	0.0572	0.5394	0.0674	0.8284	0.1109
Family Control	0.3362	0.4726	0.4372	0.4963	0.4778	0.4997	0.4013	0.4904
Pyramid	0.7422	0.4376	0.6657	0.4720	0.6893	0.4630	0.5794	0.4939

Panel B: Quartiles of the largest ultimate shareholder's excess of control rights over cash flow rights

	Quartile 1 [-1;0.0092)		Quartile 2 [0.0092; 0.1853)		Quartile 3 (0.1853;0.39048)		Quartile 4 [0.39048;1]	
Variables	Mean	Std. Dev.	Mean2	Std. Dev.	Mean5	Std. Dev.	Mean8	Std. Dev
Investment Rate	0.1037	0.3563	-0.0079	0.2659	0.0104	0.2665	-0.0003	0.2592
CF/K_{t-1}	0.7326	1.1049	0.3679	0.6628	0.4226	0.8114	0.3541	0.6388
$\Delta S/K_{t-1}$	0.6652	1.4735	0.2000	0.9392	0.1591	0.8435	0.2044	0.8722
Total Asset	4.07E+06	6.28E+06	3.94E+06	6.45E+06	4.55E+06	7.28E+06	5.24E+06	7.21E+06
Leverage	2.3770	2.8773	2.3424	2.9119	2.4188	2.7039	2.5721	2.9441
ROA	0.0357	0.0738	0.0236	0.0697	0.0253	0.0686	0.0262	0.0698
ROE	0.0531	0.2700	0.0138	0.2623	0.0257	0.2530	0.0305	0.2591
Sales Growth	0.1288	0.2651	0.0532	0.2178	0.0523	0.2214	0.0645	0.2250
ECR	-0.0060	0.0356	0.0939	0.0517	0.2854	0.0578	0.5699	0.1393
CFR	0.6038	0.2841	0.5004	0.3022	0.4343	0.2061	0.2850	0.1504
Family Control	0.2767	0.4476	0.2377	0.4259	0.5203	0.4998	0.6184	0.4860
Pyramid	0.5392	0.4987	0.6459	0.4785	0.6937	0.4612	0.7983	0.4015

Notes: This table shows the summary statistics of firms grouped by quartiles of excess of control rights and cash flow rights. Investment rate is the variation in capital stock (*K*), measured as $(K_t - K_{t-1})/K_{t-1}$. *CF* is the cash flow; ΔS is the variation in real sales (*S*); *Leverage* measures the book value of debt over the book value of equity; *ROA* is the return on the book value of assets; *ROE* is the return on the book value of equity; *Sales Growth* proxies for growth opportunities and is measures as $(S_t - S_{t-1})/(S_{t-1})$. *CFR* is the largest ultimate shareholder's rights; *ECR* is the excess of control rights over cash flow rights and is measured as the difference between control rights and cash flow rights. *Family Control* is a dummy variable that takes value 1 if the largest ultimate shareholder is the controlling shareholder and has a family identity, and 0 otherwise. *Pyramid* is a dummy variable that takes value 1 if the firm belongs to a pyramidal ownership structure, and 0 otherwise.