What happened to the willingness of companies to invest after the financial crisis? Evidence from Latin American Countries

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Abstract

This paper investigates the changes in corporate investment dynamics in the aftermath of the Global Financial Crisis. Using firm-level data from six Latin American countries during the period 2002-2015, we show that firms are less constrained and have greater ability to invest after the crisis. However, the willingness of firms to invest optimally is reduced. This is supported by strong evidence that during the post-crisis period investment-cash flow sensitivity disappears; investment-*q* sensitivity increases; and the estimated speeds of adjustment for target investment decrease. Moreover, we show that after the crisis firms notably increase their efforts to attain optimal cash and leverage levels. Our analysis implies that firms may not always be willing to invest optimally. The willingness to invest optimally appears to be time-variant and moves together with the dynamics of cash and leverage policies, albeit in opposite directions.

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1. Introduction

The capital expenditures of companies in the aftermath of the crisis have been weak, which is inconsistent with the strong corporate profitability and the lower cost of borrowing observed after the crisis.[2] Recent evidence also shows that investment-cash flow sensitivity (ICFS), generally taken as evidence of the existence of firm-level financial constraints, has weakened around the world.[3] Moreover, investment-*q* sensitivity (IQS) increased in the aftermath of the financial crisis, which is interpreted as an indication of greater investment efficiency.[4] These findings point to a greater ability of firms to take up investment opportunities, whereas the weak investment growth possibly suggests that the willingness to exploit these opportunities is not sufficiently strong.

Motivated by such puzzling combination of weak corporate investment growth and the increased investment power, this paper investigates corporate investment dynamics during the period 2002-2015 using a large sample of firms in six Latin American countries.[5] Specifically, we examine (1) whether there is indeed a divergence between the ability and willingness of firms to invest optimally; (2) how corporate investment behaviour and dynamics are impacted by the financial crisis; and (3) how the investment behaviour of firms compares to the dynamics of optimal leverage and cash holdings before and after the financial crisis. Importantly, we do not only aim at providing key insights into recent anomalies in corporate investment behaviour, but

[2] OECD Business and Finance Outlook 2015 - Corporate investment and stagnation puzzle. https://doi.org/10.1787/9789264234291-6-en

[3] Larkin et al. (2018) show that ICFS has declined or disappeared in rich countries but it is stable and persistent in the countries with low level of development. Chowdhury et al. (2016) find that the ICFS declines following the Sarbanes-Oxley Act and increases during the deregulation period. Moshirian et al. (2017) document that ICFS is more stable in developing economies in which firms have more tangible capital and persistent cash flows.

[4] Following prior research on corporate investment efficiency (e.g., Stein, 2003; Chen et al., 2011; Jiang et al., 2011; and Chen et al., 2017), we use the sensitivity of investment expenditures to investment opportunities as a measure of investment efficiency.

[5] The countries included in the sample, namely Argentina, Brazil, Chile, Colombia, Mexico and Peru, are among the relatively fast-growing emerging markets, characterized by greater growth opportunities, albeit facing difficulties in accessing external funds for private and public investment. Prior research on the corporate investment in LAC is limited. One notable exception is Moshirian et al. (2017) that include firms from LAC in their sample of 41 countries. Also, Magud and Sosa (2015) of International Monetary Fund (IMF) investigates corporate investment in LAC and show that growth opportunities and commodity export prices have a positive and leverage has a negative impact on the investment.

also highlight the ways in which they can be in part explained by and related to the dynamics of other corporate policies.

The analysis is carried out by a detailed examination of three important aspects of corporate investment: the investment-cash flow sensitivity; the investment-*q* sensitivity; and the adjustment speed of target investment. Investigating the investment sensitivities enables us to draw inferences about the investment behaviour of firms. We do so by empirically analysing their reliance on internally generated funds to invest and the responsiveness of investment expenditures to growth opportunities, as well as the firm-specific factors that are likely to impact the changes in both sensitivities. Furthermore, the analysis of adjustment speed allows us to study the persistency in corporate investment over time, across different periods and groups of firms. It also helps us provide further insights into the changing importance of attaining optimal investment levels, compared to other financial policies.

Our analysis contributes to the literature on corporate investment in several distinct ways. First, in addition to a detailed examination of the investment cash-flow sensitivity, we provide a comprehensive analysis of the sensitivity of investment to growth opportunities. While ICFS is generally related to supply-side dynamics and financial constraints, IQS is driven by the responsiveness of firms to investment opportunities and it complements the ICFS analysis in drawing inferences on the ability of firms to invest optimally. Investment-*q* sensitivity strengthens during periods characterized by more efficient capital markets and stronger corporate governance (McLean et al., 2012; Kusnadi et al., 2009). In line with earlier studies in the literature, we interpret increasing (decreasing) investment-*q* sensitivity as evidence of an improving (deteriorating) investment efficiency and a greater (lower) ability of firms to convert growth opportunities into investment.

Second, we explore the impact of the financial crisis of 2008 on the investment behaviour of firms. The crisis provides us with a unique opportunity to examine corporate investment in a setting

where firms experience unanticipated external shocks. Our sample period allows us to distinguish between corporate behaviour before, during and after the crisis where each subperiod is characterised by significantly different economic conditions and market sentiment. The examination of corporate investment patterns in this framework proves valuable to gauge the importance of external factors in the determination of investments and, remarkably, whether the financial crisis changed corporate investment behaviour.

Our third contribution is to investigate the effects of the financial crisis on the speed of adjustment to target investment levels. We acknowledge that observed investment on average is different from optimal levels. Although being away from target investment is costly to firms, adjusting to optimal also involves costs, which can prevent firms from achieving their desired adjustment instantaneously. Examining the adjustment process complements the analysis of investment and help us distinguish between the ability and willingness of firms to invest optimally. For example, if the adjustment speed reduces in periods when the adjustment costs are expected to be lower, this can the point to a reduced willingness to attain desired levels of investment quickly. Moreover, we investigate how the extent to which firms are financially constrained impacts the speed of investment adjustment.

Finally, we examine the dynamics of corporate investment in conjunction with other financial decisions. Although we do not establish the link directly, we note that the misalignment between the ability and willingness of firms to invest optimally can be related to their positions regarding optimal cash holdings and leverage levels. We maintain that the costs of target adjustment in the favourable post-crisis market conditions are on average notably lower. Moreover, we have no reason to expect that these costs should differ significantly across investment, leverage and cash holdings decisions. We then postulate that the estimated speeds of adjustment would reveal information about the willingness of firms to attain target levels and hence their perception regarding the relative importance of each policy. More importantly,

providing evidence for both the pre-crisis and post-crisis periods, and across subgroups of firms, enables us to shed light on the factors that determine adjustment speed.

Overall, our findings reveal that the ability of firms to invest optimally increases significantly in the post-crisis period, as evidenced by the estimated insignificant (significant) investment-cash flow (investment-*q*) sensitivities. We argue that this is mainly due to more favourable credit conditions, lower cost of external capital and stronger corporate governance, which prevail in the aftermath of the crisis. However, during the same period the adjustment speed of firms towards optimal investment drops significantly. This finding is robust to controlling for the factors which may impact the speed of adjustment and the extent to which firms can be financially constrained. Furthermore, in the post-crisis period the speed of adjustment to leverage and cash holdings targets increases significantly. Finally, cash holdings adjustment is faster than that for leverage, both in the pre-crisis and the post-crisis periods. We take this finding as evidence for a major shift in the behaviour of firms after the crisis regarding the importance they attach to attaining optimal investment and financial policies. The evidence that the incentives to attain target investment (leverage and cash holdings) got much weaker (stronger) in the aftermath of the financial crisis of 2008 is strong and robust.

The remainder of the paper is organized as follows. Section 2 provides a brief review of the relevant literature. Section 3 explains the research design and methodology employed in the study. Section 4 presents the summary statistics and the preliminary findings from a univariate analysis. Section 5 examines the changes in investment-cash flow sensitivity and investment efficiency across subperiods and subgroups of firms, in a multivariate setting. Section 6 discusses the impact of the global financial crisis on ICFS and investment efficiency. Section 7 focuses on the dynamic adjustment process. Section 8 includes further robustness checks, focusing on the validity of ICFS as a measure of financial constraints. Section 9 concludes the paper.

2. Related literature

The investment decisions of firms have been widely researched and the debate as to the determinants of investment has been intense. Previous research provides substantial evidence on several important questions including: (1) Are the investment decisions of firms sensitive to the availability of internal funds? (2) Is investment-cash flow sensitivity an indication of financial constraint, or does observed sensitivity arise from other reasons? (3) What are the external factors that determine the cost of external finance and hence corporate investment?

There is ample evidence in the literature that capital expenditures are less dependent on cash flows when firms can raise external finance more easily (e.g. McLean et al., 2012). In our analysis, this is captured through a detailed examination of firm-level investment expenditures in different time periods characterized by significantly different economic conditions. External financial constraints are less binding during the post-crisis period and we expect to find that investment-cash flow sensitivity is much less significant. Similarly, we predict that investment-*q* sensitivity is stronger during the same period, as the ability of firms to raise finance is expected to be greater due to more favourable market factors, including more efficient capital markets, lower asymmetry of information, better corporate governance and, hence, lower cost of capital. The insights provided by prior research into these questions are abundant. It is shown that the wedge between the cost of internal and external finance determines if firms rely on the availability of internal funds to invest. Firms are said to be financially constrained if they cannot raise as much finance as they need to take up valuable investment opportunities. Moreover, firms can be constrained even at moderate levels of cost of external capital when they are small and/or young, do not pay dividends, and have low cash reserves with high levels of leverage. The investment of such firms is said to be sensitive to cash flows where the sensitivity is captured by the estimated relation between investment and cash flow. In what follows we will present the main arguments, mainly in relation

to the investment-cash flow and *q* sensitivities and the adjustment speed, which are relevant to the scope of this study.

2.1. Investment-cash flow sensitivity

The main hypothesis of the ICFS literature is that the investment of financially constrained firms is sensitive to the availability of internal funds. In testing this hypothesis, cash flows are used as a proxy for the availability of internal funds and firms are classified into constrained and unconstrained subgroups using firm characteristics such as size, dividends, age, cash holdings and leverage (e.g. Allayannis and Mozumdar, 2004; Almeida and Campello, 2007; Biddle and Hilary, 2006; Fazzari et al., 1988; Hoshi et al., 1991; Pawlina and Renneborg, 2005). A positive and significant estimated coefficient of cash flows is taken as evidence for both the presence of financial constraints (and hence capital imperfections) and the validity of measures used to identify financially constrained firms. Kaplan and Zingales (1997) argue that ICFS is not a good measure of financial constraints, supporting their argument with the finding that financially unconstrained firms exhibit greater sensitivity to cash flows.

There are studies which also shed doubts on the validity of ICFS as a measure of financial constraints (e.g. Alti, 2003; Chen and Chen, 2012; Gomes, 2001; Moyen, 2004). For example, Chen and Chen (2012) investigate ICFS over a long period time to show that it is not a good measure of financial constraints. They find that ICFS disappears in recent years regardless of the financial position, corporate governance and the market power of firms. Andrén and Jankensgård (2015), by focusing on firms in the oil and gas industry in the US, find that the investment-cash flow sensitivity decreases during the period from 2005 to 2008, when companies enjoyed higher oil prices and collateral value of assets. However, they also show that the investment-cash flow sensitivity increases (decreases) for large and unconstrained (small and constrained) firms when firms have abundant internal funds. The evidence provided for constrained firms is taken as

support for the financing constraints explanation of the investment-cash flow sensitivity, whereas the findings for unconstrained firms are inconsistent with this view. Moshirian et al. (2017) provide evidence that the ICFS decreases in advanced economies as the share of tangible capital also decreases. However, they find that the ICFS is still significant among the developing countries in their sample, since firms in these countries operate with more tangible assets and persistent cash flows. One of the explanations of decreasing level of investment-cash flow sensitivity is the changing composition of total corporate investment. Rising R&D investments may reduce the cash flow sensitivity of physical investments (Brown and Petersen, 2009).

A body of recent literature focuses on new explanations for the relevance of ICFS and the reasons why it has weakened in recent years. The tendency in recent research is to use international data. For example, Mulier et al. (2016) create proxies for the firm's debt/repayment capacity and insolvency risk to identify financially constrained firms in a large sample of European SMEs. They show that ICFS is stronger for constrained firms and conclude the cost of capital is the driving force for the observed relation between investment and cash flows. Chowdhury et al. (2016) contribute by focusing on the impact of information asymmetries on ICFS. They suggest that ICFS is directly related with the information asymmetry which is proxied by the bid-ask spread. They show that ICFS decreases (increases) with a decrease (increase) in information asymmetry, showing that changes in it have a considerable impact on the capital sources of investment decisions. In a more recent paper, Larkin et al. (2018) provide additional evidence on the impact of country-level development and economic growth on the relationship between cash flow and corporate investment in 43 developed and developing countries for the period 1991-2014. They find that ICFS exhibits a sharper decline during the sample period in developed countries, but it is persistent in less developed countries. Their analysis also shows that access to external finance has a considerable impact on ICFS.

2.2. Investment efficiency

In frictionless markets, a firm's investment is determined only by its growth opportunities. However, market frictions (e.g. asymmetric information and agency costs) can make investment less responsive to investment opportunities, leading to sub-optimal investment levels (Wurgler, 2000). In the extant literature, a firm's Tobin's Q is used as a summary statistic for the market's perception of the firm's investment opportunities. In this respect, the sensitivity of a firm's investment expenditures to *q* is used to draw upon on investment efficiency and the extent to which firms invest optimally. For example, Chen et al. (2011), investigating the role of government ownership in China, show that government intervention, which is another form of market imperfection, reduces investment efficiency, captured by the estimated coefficient of *q* in the investment model. In a similar vein, Chen et al. (2017) examine the effect of ownership type on investment-*q* sensitivity and find that foreign institutional ownership increases investment efficiency due to the monitoring and disciplining role of foreign ownership. They argue that the observed striking differences in investment-*q* sensitivities, and hence investment efficiency, arise from the differences in the degree of agency and information problems.

Focusing on the role of stock prices to serve as a signal for facilitating the efficient allocation of resources in the presence of asymmetric information between insiders and outsiders, several studies show that as stock price informativeness improves, investment-*q* sensitivity increases. Jiang et al. (2011) show that agency problems within firms reduce stock price informativeness and lead to a weakened investment-*q* relation. This, in turn, causes investment to deviate from its optimal, which makes investment less efficient. In a similar vein, Chen et al., (2007) argue that the sensitivity of firm investment to stock price is determined by the degree of firm-specific asymmetric information. Prior work also predicts that the relationship between corporate investment and growth opportunities is stronger in periods characterized by more efficient capital markets, better aligned managerial incentives, stronger corporate governance and hence lower cost

of external finance.[6] Finally, McLean et al. (2012) use both investment-cash flow and *q* sensitivities to draw inferences on investment efficiency. They find that in countries with high investment sensitivity to *q* and low investment sensitivity to cash flow, investment leads to greater growth in revenue and profits. They argue that cross-country differences in investment-*q* sensitivity are associated with greater investment efficiency.

2.3. Dynamic investment policy – speed of target adjustment

It is known that market frictions force firms to deviate from their optimal behaviour. The costs of being away from optimal investment can be significant and hence firms attempt to revert to their optimal. However, adjustment is not completed instantaneously, and a partial adjustment process takes place (e.g. Bloom et al., 2007; Dasgupta et al., 2011; Gatchev et al., 2010). This is mainly because there are costs involved in the adjustment process, which impact the speed of adjustment to target investment. The adjustment speed is determined by firm characteristics as well as external market conditions. Being one of the prominent external factors, the global financial crisis of 2008 provides a natural environment to observe the speed of adjustment changes after the global market downturn. Examining the pattern of speed of adjustment – in addition to the sensitivity of investment to *q* and cash flow - before and after the financial crisis enables us to observe the dynamics of investment behaviour in different macroeconomic conditions and draw inferences about the willingness of firms to take up investment opportunities. Conducting this analysis for a sample period that can be divided into subperiods of different conditions allows us to control for one side of the trade-off between adjustment costs and off-target costs. Controlling for the adjustment costs that are expected to be significantly lower in the post-crisis period enables us to provide valuable insights into the willingness of firms to invest optimally.

3. Research design, variable definitions, data

[6] This is supported by the traditional framework provided in Tobin (1969) and Hayashi (1982). In support of this view Kusnadi et al. (2009) finds that greater market efficiency also leads to higher investment sensitivity to *q*.

Our empirical approach considers measuring financial constraints through the estimation of investment-cash flow sensitivity. However, it is important to note that we also control for those factors considered to be related to financial constraints. This is achieved in several ways. First, our analysis controls for time-specific effects that are likely to impact the cost of external capital. Specifically, the investment model is estimated separately for each year and for three subperiods, namely pre-crisis, crisis and post-crisis. Second, we control in our augmented investment model for those factors that can cause firms to be financially constrained. To this effect, we include in our empirical specification the following variables: size, leverage, dividend and cash holdings of firms.[7] Third, we divide firms into constrained and unconstrained sub-samples. To this end, we use the variables that are employed in the literature to distinguish between the two groups of firms. We estimate the following augmented investment specification:

$$Inv_{i,t} = \beta_0 + \beta_1 Cflow_{i,t} + \beta_2 Q_{i,t-1} + \beta_3 Lev_{i,t-1} + \beta_4 Size_{i,t-1} + \beta_5 Div_{i,t-1} + \beta_6 Cash_{i,t-1} + \varepsilon_{i,t} \quad (1)$$

where *Inv* is the firm's capital expenditures (investment), *Cflow* denotes internally generated cash flows; *Q* is a proxy for growth opportunities; *Lev* denotes leverage; *Size* is a proxy for firm size; and *Div* and *Cash* give dividend payouts and cash holdings, respectively. ε denotes the error term. All variables except *Cflow* are lagged once to control for the possibility of reverse causality and endogeneity that is likely to arise. Table 1 gives the definitions of the variables used in the analysis.

Insert Table 1 here

[7] Including these variables in the empirical specification enables us to control the current financial position of the firm in a more comprehensive way (see also Andrén and Jankensgård, 2015). Larger firms have better access to the external capital market as they face lower transaction costs, information asymmetries and agency problems, which in turn influence the investment decision (Kadapakkam et al., 1998). The ability of firms to raise external debt is also important in determining the investment level, which is proxied by leverage (Coldbeck and Ozkan, 2018). Furthermore, dividends are used in the literature as a proxy for financial constraints. Finally, cash holdings are included in the analysis as they constitute an alternative and readily available source of internal funds.

The estimated parameters that are of main interest in equation (1) are β_1 (ICFS) and β_2 (IQS). As explained earlier, they are used to draw inferences on the ability of firms to raise external finance for their investment needs. It is expected that both β_1 and β_2 are positive, but β_1 is significant only for financially constrained firms. The specification given in equation (1) is estimated using OLS to derive annual cross-sectional estimates and fixed effects estimators to obtain the estimates for panel data for the subperiods. For the dynamic analysis of adjustment speeds, we employ a two-stage process (Byoun, 2008; Jiang and Lie, 2016). In the first stage, we predict the target investment level for each firm using equation (1). In the second stage, we regress the change in investment level from year *t*-1 to *t* on the deviation from the predicted level. The estimated coefficient then gives the adjustment speed. A more detailed explanation is given in Section 7 below.

Our sample includes non-financial Latin American firms that are publicly traded. The sample period is from 2002 to 2015, enabling us to examine the corporate investment behaviour of firms before, during and after the financial crisis. The main data source for our analysis is Datastream that provides both accounting and market data for firms. We compile the final sample as follows. First, we exclude financial firms from the sample. Second, we winsorize each variable at 1% level to eliminate the impact of potential outliers (i.e. those observations that lie below the 1st percentile and above the 99th percentile). These criteria left us with an unbalanced panel of 582 firms and 5,960 observations for the empirical analysis. Brazil enters the sample with the highest number of firms, 223, whereas Colombia has the smallest number, with only 24.

4. **Descriptive statistics and univariate analysis**

Table 2 reports the mean and standard deviation of the investment ratio (*Inv*) and other variables for the six countries included in our sample separately, as well as for the whole sample. Moreover, in line with the rest of the analysis, the analysis is carried out over three subperiods:

2002-08 (pre-crisis), 2009 (crisis) and 2010-15 (post-crisis). It is observed that the sharpest drop in capital expenditures around the Global Financial Crisis takes place in 2009. We therefore report the statistics separately for that year. Our calculations suggest that the high level of investment before 2009 was followed by a sharp decline and remained at moderate levels during the post-crisis period. Figure 1 depicts the investment, leverage and cash ratios over time. It shows more clearly the significant changes in the investment, leverage and cash holdings ratios after the crisis.

Insert Figure 1 here

The average investment ratio during the pre-crisis period is 6.4% for all firms in the sample. The largest two average values during this period are observed in Peru (7.3%) and Brazil (6.9%), while the average investment drops in both countries in 2009 to 5.3% and 6.3% respectively. In 2009, the lowest investment is recorded in Mexico at 4.4%, dropping from 5.7% in the pre-crisis period. Interestingly, the average investment increases in 2009 in Argentina and Colombia, from 5.7% and 4.8% to 6.0% and 7.6% respectively. The average investment-to-assets for all firms in 2009 is 5.6, corresponding to a drop of 12.5% from the pre-crisis average.

Insert Table 2 here

The average investment ratio for the whole sample in the post-crisis period increases slightly to 5.9%. However, there are notable differences across countries. For example, compared to 2009, the average investment ratio in the post-crisis period increases sharply in Mexico and Peru to 5.6% and 7.0%, corresponding to increases of 27% and 32%, respectively. However, it drops even further in Brazil during this period to 5.5%, by about 13%.

Comparing the two periods before and after the crisis, the average cash flow ratio (*Cflow*) drops slightly from 9.1% to 8.1% for the whole sample. It decreases in all countries except in Mexico where the average cash flow ratio is 8.8% in both periods. However, Tobin's Q, used as a proxy for the growth opportunities of firms, is only slightly higher in the post-crisis period,

increasing from 1.35 in the pre-crisis to 1.38. However, it is much higher in 2009, at 1.46, probably due to lower assets values, which provide firms with greater investment opportunities.

As for the other variables that are predicted to influence investment, compared to the pre-crisis period, firms on average hold larger cash balances (8.8% vs 10.3%) and have higher leverage (23.6% vs 26%) during the post-crisis period. The leverage (cash holdings) ratio increases during this period in all countries, except for firms in Colombia and Peru. Moreover, following the crisis more firms pay dividends (68.5% and 71.4%). However, the percentage of dividend-paying firms in Mexico drops sharply to 49.5% in the post-crisis period from 59.2% in the pre-crisis period.

Insert Table 3 here

Table 3 presents the correlation coefficients for the variables used in the analysis. The investment expenditures of firms are positively correlated with their cash flows (*Cflow*) and growth opportunities (*Q*). This possibly suggests that, on average, firms in our sample tend to rely on internal sources to finance their investment, and greater growth opportunities lead to higher demand for capital and hence investment. In line with expectations, we also observe that the investment ratio is positively and significantly correlated with firm size, dividend and cash balances of firms. The correlation coefficient for leverage (*Lev*) is negative but insignificant.

Insert table 4 here

Table 4 provide univariate comparisons of the mean values of the explanatory variables used in the analysis. We carry out this analysis by constructing quartiles of investment ratio and investigating whether the firm-specific characteristics of the high-investment firms (in the fourth quartile, Q4) differ significantly from those of the low-investment firms (in the first quartile, Q1). This comparison is carried out for the whole sample period 2002-2015 in Panel A; and the pre-crisis and post-crisis periods separately in Panels B and C. We also present the mean and standard

deviation values of the variables in the second (Q2) and third (Q3) quartiles to examine if there is evidence of a monotonic relation between investment and other firm-specific characteristics.

The univariate results lead to some interesting inferences. The firm-specific characteristics of the high and low-investment firms significantly differ at the 1 percent level in all subperiods, except for the cash holdings and leverage ratios in the post-crisis period. As expected, the findings reveal that firms with greater investment also seem to have higher growth opportunities. Also, as can be seen in Panel A, the relationship is monotonic, evidenced by the fact that the growth opportunities of firms gradually increase as their capital expenditures go up. We observe the same relation between investment and cash flows, where cash flows monotonically increase as investment goes up, possibly supporting the view that, on average, firms rely on internal funds to invest more. This is taken as an initial support for the significant investment-cash flow sensitivity. Across all periods, the difference in the cash flows of firms with the highest and lowest investment ratios is significant. It can also be seen that investment is monotonically and positively related to firm size. In all panels, the largest firms invest significantly more than the smallest firms. We also find that those firms in the highest investment quartile also have greater dividend payouts.

Finally, the results for leverage and cash holdings are mixed. Although the differences between the cash and leverage ratios of the highest and lowest investment quartiles are significant for the whole and pre-crisis periods, in that firms with higher investment ratios also have greater debt and cash holdings, the relation does not hold during the post-crisis period. Moreover, the relationship is not strictly monotonic. We further explore this in the regression analysis section.

5. Cross-sectional and panel data analysis

5.1. Cross-sectional regressions

We start our regression analysis by estimating the investment model in Equation (1) for each year separately. This is done for all firms without distinguishing between the countries in the sample.

Although this analysis does not incorporate time specific effects it is useful to gauge how the investment-cash flow and *q* sensitivities evolve over time. Table 5 presents the regression results derived from the annual estimations. To control for the fixed effects, following Chen and Chen (2012) we demeaned each variable except *Div* that is a dummy variable. As explained earlier, all the regressors, except cash flow (*Cflow*), are lagged one year to minimize endogeneity concerns. Finally, the estimated standard errors are robust to heteroscedasticity.

Our initial findings yield interesting inferences. The estimated ICFS coefficients are generally positive and statistically significant in the pre-crisis period years. That is, higher cash flows lead to greater investment, suggesting that the average sample firm is possibly financially constrained and hence its investment is dependent on the availability of internal funds. The estimated sensitivity turns insignificant in 2007 and 2008 but becomes significant at the 1 percent level in 2009 when, as shown earlier, the crisis adversely affects the average investment expenditures of Latin American firms. This is also consistent with the finding presented in Table 2 that corporate investment expenditures peak in the two years prior to 2009. Interestingly, the estimated ICFS coefficients are statistically insignificant in the post-crisis years (i.e. 2010 to 2015), except for 2015, when the estimated coefficient becomes significant at only a 10 percent level.

It is also important to note that when the estimated coefficients are statistically significant, the economic significances are also greater, as evidenced by the values of the estimated coefficients and their economic significance analysis. For example, in 2006 the estimated coefficient is 0.132 and one standard deviation increase in cash flows leads to 1.22 percentage points increase in the investment ratio. In contrast, in the following two years the estimated coefficients become insignificant and drop to 0.041 and 0.047 respectively and one standard deviation increase in cash flows leads to only 0.3 and 0.4 percentage points increases, respectively.

As for IQS, for most of the pre-crisis and crisis periods the estimated coefficients are insignificant, albeit positive. The exceptions are the two early years in the sample period, 2002

and 2003. The estimated coefficients are not significant until 2011 when the sensitivity increases both economically and significantly and remains approximately the same during the post-crisis period. This is an important finding and can be interpreted as an increased investment efficiency among Latin American Countries and is aligned with the findings presented in Mclean et al. (2012), which show that improvements in investor protection and governance practices increase investment efficiency but decrease investment-cash flow sensitivity.

Overall, our initial findings possibly suggest that firms in LAC become less financially constrained during the sample period, with an increased ability and/or willingness to take up valuable investment opportunities and invest more. We distinguish between the ability and willingness of firms; for example, the increased ability of firms to invest does not necessarily lead to increases in investment, unless firms are also prepared to increase their investment levels.

Insert Table 5 here

The results also show that leverage exerts a negative influence in investment expenditures. Firms with greater leverage seem to invest less, and this is regardless of the period. Interestingly, the negative effect of leverage remains strong, both statistically and economically, in the post-crisis period, when the cost of external finance is known to be lower. The only notable exception is observed in 2015, when the negative estimated coefficient of leverage is insignificant.

The findings reveal that firm size is important in determining the level of investment expenditures. The estimated coefficients of size, proxied by the natural logarithm of total assets, are negative across the sample period, and generally statistically significant. The results suggest that larger firms invest less, possibly because they have lower growth and investment opportunities than smaller firms. An additional explanation is that larger firms have greater flexibility in timing their investment expenditures and hence are able to postpone investing until having enough internal funds, which increases the sensitivity of investment to cash flows. This result is in line with the findings of Francis et al. (2013) and Kadapakkam et al. (1998). In the rest of our analysis

the interactions between investment and firms' size is investigated further by also incorporating firm size as a financial constraint proxy.

The results for dividend and cash holdings are less clear-cut. In the pre-crisis years, whether firms pay out dividends does not make a significant difference in how much they invest. There is some evidence that the relation between dividends and investment is likely to be positive during the pre-crisis period, albeit the only significantly estimated coefficient is observed in 2002. The relationship in 2009 is, however, strong with the positive estimated coefficient that is significant at the 1 percent level. The findings in the post-crisis period are more convincing. The estimated coefficients are negative for all post-crisis years and generally statistically significant. Finally, the estimated relationship between investment and cash holdings of firms is not significant, except in 2010 when it is found that firms with greater cash holdings invest more.

5.2. Country panel data analysis: controlling for fixed effects

Although the results of the demeaned cross-sectional estimations are useful, one disadvantage is that they ignore the panel structure of the sample, and do not control for differences across countries. In Table 6, we report the results obtained from fixed-effects panel data estimations. This enables us efficiently to control for unobserved firm fixed effects which may be important in determining firm-level investment. Moreover, the estimations are run for each country separately to confine the estimations within each country. In these regressions we do not distinguish between the different periods but control for time-specific effects by incorporating time dummies.

Insert Table 6 here

We find that during the sample period the investment-cash flow sensitivities are positive and statistically significant, except in Colombia and Peru. Their economic significance is also strong in that one standard deviation in cash flows leads to 0.60 and 0.62 percentage point increases in investment in the cases of Brazil and Mexico, respectively. The corresponding increases for

Argentina and Chile are respectively, 1.1 and 0.9 percentage points. The same finding holds also for investment-*q* sensitivity, with the exception that Peru replaces Chile for the significantly estimated coefficients of *Q*. The implied economic significances of estimates are 0.17 (Brazil), 0.22 (Mexico), 0.45 (Argentina) and 0.11 (Peru). Similar to what we find earlier using the whole sample, there is relatively strong evidence that firms with greater leverage invest less.

The estimated relationship between investment and leverage is negative and statistically significant, except for Chile and Colombia. This result provides further support for the view that the ability of firms with higher levels of debt to take up investment opportunities is more limited. The findings regarding dividend and cash holdings are, however, mixed. The relationship between investment and dividend is significant only for Mexico and Colombia. The estimated coefficients indicate that firms paying dividends are likely to invest more (less) in Mexico (Colombia). The relation between investment and cash reserves of companies is significant only for Mexican firms, where the estimated coefficient is positive and significant at the 1 percent level.

Overall, there are several important findings that emerge from the analysis so far. First, the significance of investment-cash flow (*q*) sensitivity decreases (increases) during the sample period. This possibly suggests that the financial constraints are relaxed over the estimation period for the firms in the sample, evidenced by a decreasing ICFS over the sample period, especially in the post-crisis period. This coincides with the increasing investment-*q* sensitivity over time, showing that firms with greater ability and/or willingness in taking up their investment opportunities invest more efficiently. Second, the annual cross-sectional analysis indicates that the relationship between investment and its determinants is not constant over time. It is hence important to consider the impact of time-specific effects on the relationship between the investment ratio and the regressors. Third, while the negative effects exerted by firm size and leverage in the investment expenditures of firms are strongly observed, the impact of dividend payouts and cash holdings is statistically weak. However, the former findings can be observed clearly only through yearly cross-sectional

estimates. The investment-cash flow sensitivity becomes positive when the model is estimated for the whole sample. This leads us to the next stage of our empirical analysis, where the results are derived separately for different subperiods, to shed more light on the effects of the external factors that are specific to different time periods.

6. Financial crisis, investment cash-flow and *q* sensitivities

In this section, we provide further panel data estimation results by focusing on two important aspects of our analysis, namely the effects of the financial crisis and financial constraints on the estimated investment-cash flow and *q* sensitivities. In doing so, we control for unobserved time-invariant fixed-effects and firm-invariant time-specific effects.

6.1. Investment in subperiods: pre-crisis, crisis and post-crisis analysis

The investment model is estimated for the entire sample period as well as the two subperiods, namely pre-crisis and post-crisis periods. In doing so, we focus on the impact of the financial crisis on both the investment sensitivities and the relationships between investment and other firm-specific characteristics. The findings are presented in Table 7. We also include the regression results separately for 2009, which are the same as those included in Table 5, for comparison purposes.

We start with the results for the entire sample period 2002-2015 obtained from the fixed-effects estimation of the investment model. In line with what the earlier fixed effects analysis mostly suggests, we find that the estimated investment-cash flow and *q* sensitivities are both positive and significant. A typical firm during the estimation period behaves as though it is financially constrained. The estimated ICFS coefficient is positive and significant at the 1 percent level. Also, the economic significance suggests that one standard deviation increase in cash flows increases investment during the same period by 0.8 percentage points. Similarly, the estimated relation between investment and growth opportunities is positive and significant at the 1 percent

level. The estimated relation suggests that a one standard deviation increase in Q leads to an increase of 0.8 percentage points in investment.

Insert Table 7 here

Consistent with our earlier findings, we find that firms with greater leverage invest less, providing further support for the view that higher debt is likely to reduce the ability of firms to invest. There is a significant and negative relationship between firm size and corporate investment. On the other hand, the estimated coefficients for dividend and cash holdings are not significant.

We next divide the sample period into two subperiods to further investigate if the investment sensitivities change between the pre-crisis and post-crisis periods. The results are supportive of our earlier findings that in the pre-crisis period the investment expenditures of firms are dependent on the cash flow levels of firms. Furthermore, the dependence disappears in the post-crisis period. As shown earlier, the investment-cash flow sensitivity is positive and significant at the 1 percent level in 2009. Our findings so far clearly suggest that the estimated ICFS becomes insignificant after the financial crisis, when investment levels dipped in 2009. This is in line with the view that credit constraints following the crisis were relaxed due to the improved availability of funds, not only in the domestic, but also in the international capital markets.

The findings regarding growth opportunities, proxied by *Q*, provide similar insights to what our earlier investigation does. That is, the estimated investment-*q* sensitivity is insignificant before the crisis, possibly reflecting the restricted ability of firms to take up investment opportunities. Combined with the findings regarding the investment-cash flow sensitivity, we conclude that on average firms before the crisis heavily rely on the availability of internal funds and much less on the availability of growth opportunities. Put differently, the supply-side factors are more important and binding than the demand-side determinants of investment before and during the crisis. However, this is not supported with the finding for cash holdings. The estimated relationship

between investment and cash balances is statistically significant in both subperiods, albeit less significant in the pre-crisis period.

Previous results for the effects of firm size and leverage on investment are also confirmed. The estimated coefficients for size and leverage are negative and significant at the 1 percent level. Firms do not change their investment behaviour across the two periods with respect to these variables. Finally, the relationship between investment and dividend is significant only in the pre-crisis period and 2009. The influence of dividend on investment disappears after the crisis.

6.2. Investment among constrained subgroups

Although the above analysis provides interesting inferences for the investment-cash flow and *q* sensitivities, it does not explicitly consider the role which the extent of financial constraints play in determining investment. It is argued that firms rely on the availability of internal funds when they are constrained in raising external finance. In line with prior research on ICFS we use several firm-characteristics to classify firms into constrained and unconstrained subgroups. We then estimate the investment model across the subgroups. Importantly, we carry out this analysis also for the subperiods, which enables us to investigate if the inferences we draw change over time. Following prior literature, we use size, dividends, leverage and cash holdings to identify firms that are more likely to be constrained (Almeida and Campello, 2007; Denis and Sibilkov, 2009). Accordingly, we have eight subgroups for each period, two for each constraint proxy.

Insert Table 8 here

The results are reported in Table 8. In Panel A, we report the findings for the pre-crisis period 2002-08. We find that the investment-cash flow sensitivity is positive and statistically significant at the 1 percent level across all subgroups regardless of their degree of financial constraint. This is consistent with our previous findings that how much firms can invest prior to the crisis is also determined by the availability of internal funds. Comparing their economic significance, however,

we find that the investment-cash flow sensitivity is stronger for larger firms, dividend-paying firms, and firms with greater cash holdings. Although it is difficult to align the result for size with the theoretical explanations of ICFS, the greater investment-cash flow sensitivity for larger firms can possibly indicate that larger firms have other priorities in terms of optimal financial policies. This view is supported by the results derived for dividend payouts and cash holdings, and to some extent for leverage. The investment levels of firms are more sensitive to cash flows for high-cash, high-dividend and low-leverage firms, probably because the optimal levels of these financial decisions are more important than achieving optimal investment levels.

These findings are not consistent with prior research which uses size, cash holdings, dividend payouts and leverage in identifying financially constrained firms. To the extent that these variables capture the degree of financial constraints, our results suggest larger firms, firms with greater dividend payouts and cash reserves, and lower leverage, are more likely to be constrained. We note that this is unlikely to be the case, and a more plausible explanation is, hence, that firms assign a greater importance to maintaining their optimal financial policies, possibly at the expense of investment. However, why larger firms rely more than smaller firms on cash flows to invest is to some extent puzzling.

To further shed lights on the investment-cash flow sensitivity findings, we also consider the differences in the investment-*q* estimates across the financial constraint subgroups. Interestingly, we find that the investment-*q* sensitivity is positive and significant only for the low-cash and high-leverage subgroups. To the extent that the estimated coefficient of Q is a proxy for investment efficiency, the results suggest that those firms with lower cash holdings and higher leverage ratios can invest more efficiently. The highest efficiency, captured by the magnitude of the estimated Q coefficient, is observed in the low-cash subgroup. This coincides with the highest investment-cash flow sensitivity observed in the high-cash subgroup. Although it is not as strong as the cash holdings findings, we report similar results for the leverage subgroups in that the cash flow and *q*

sensitivities move in opposite directions. One further interesting observation is that the positive (negative) effect of cash holdings (leverage) is economically stronger (weaker) in the low-cash (high-leverage) subgroup. Taken together, the results for the pre-crisis period suggest that the cash holdings and leverage policies of firms have a greater influence on their ability to invest optimally.

Moving on to the crisis year results given in Panel B, we observe that the estimated investment-cash flow sensitivities continue to be significant, except for the high-leverage subgroup. The investment-cash flow sensitivity disappears for the high-leverage subgroup. Moreover, the magnitude of the investment-cash flow sensitivity for the low-leverage subgroup increases significantly to 0.166, from 0.067 in the pre-crisis period. There are two possible explanations for this finding. First, the ability of high-leverage firms to invest continues to be strong and hence their investment does not depend on the availability of internal funds. Second, ceteris paribus any increase in cash flows observed during this period is used to reduce leverage. We explore these possibilities by also checking the leverage-cash flow sensitivity by regressing cash flow on leverage, among other determinants, and comparing the average levels of leverage for the leverage subgroups between the pre-crisis and crisis period. Our analysis indicates that increases in cash flows do not lead to lower leverage for the high-leverage group, which rules out the latter possibility as an explanation as to why the estimated ICFS is insignificant for the high-leverage subgroup of firms.

The results for the cash holdings subgroups in 2009 also reveal further insights. It seems that the low-cash firms have to rely on internal funds more than the high-cash firms. Both the economic and statistical significance are stronger for the low-cash firms. Furthermore, in contrast to the finding in the pre-crisis period, the investment-*q* sensitivity is statistically significant only for the high-cash firms. This suggests that investment efficiency, which shows the ability of firms to convert opportunities into investment, is greater for firms with higher cash balances. Put differently, the role of cash holdings is different between the two periods. While the high-cash

holdings firms in the pre-crisis period behave as though they are financially constrained, evidenced by the greater (lower) estimated investment-cash flow (q) sensitivities, the investment behaviour changes during the crisis during which the high-cash firms seem to have greater investment efficiency and lower dependence on the availability of internal funds. That is, there is support for the precautionary role of cash holdings which are used as a hedge for the fluctuations in cash flows. Finally, one additional support for the view that low-cash firms exhibit more of a constrained behaviour is provided by the estimated coefficient of leverage. We find that the negative effect of leverage on investment is stronger in the low-cash subgroup.

The crisis results for the size of firms are also in line with the traditional explanations provided in the literature. Large firms have stronger investment efficiency than small firms and firms with greater dividend payouts.

For the post-crisis period, we observe that the estimated coefficient of q is consistently positive and significant for all sub-samples (Panel C). It possibly indicates that the investment efficiency has increased during the post-crisis period regardless of the firm-characteristics and financial constraints. More importantly, the estimated investment-cash flow sensitivity is insignificant for all of the subgroup of firms, except for the low cash subgroup. This finding provides further support for our earlier results. It also suggests that cash reserves can be used as a proxy for financial constraints. Cash rich firms may spend their cash reserves to finance their investment but cash poor firms still depend on their internal funds. An alternative view can be that, rather than cash flows, cash reserves become more important in financing new investments in the aftermath of the financial crisis.

To sum up, controlling for both the external factors associated with different subperiods and the degree of financial constraints yield additional insights. Our findings confirm that the investment-cash flow sensitivity is positive and significant throughout the pre-crisis and crisis periods, regardless of financial constraint measures. This is an important finding as this suggests

that, on average, the firms in the sample are financially constrained during this period. However, financial constraints do not seem to be driven largely by firm-specific factors. Instead, they are firm-invariant, common to all firms in the sample. This is also confirmed with the finding that the investment-cash flow sensitivity disappears almost completely (i.e, except for low-cash holdings firms) when the external constraints are relaxed after the crisis.

7. Speed of adjustment to optimal investment and financial decisions

The underlying assumption of the empirical strategy we used so far is that firms operate around their optimal investment levels at any point in time and hence the observed investment on average firms are not far from their desired levels. This implies that firms adjust back to their optimal investment instantaneously after they move away from their optimal investment (e.g. due to external shocks). The dynamic view acknowledges that capital market imperfections impact the adjustment process, and hence the desired adjustment is not completed instantly (e.g. Mueller, 2003; Bloom et al., 2007). That is, the adjustment is only partial. In this section, we investigate the dynamics of corporate investment of firms in LAC with a specific focus on the speed of target adjustment and how it is impacted by the financial crisis and financial constraints. In a similar manner to Coldbeck and Ozkan (2018), this study acknowledges that the speed at which firms can reach their optimal investment levels is likely to be determined by external and internal factors that are also important in determining the investment-cash flow and *q* sensitivities.

There is evidence in the literature that firms pursue a target investment policy with changing investment targets over time and across firms (Gatchev et al., 2010; Dasgupta et al., 2011). However, relatively little is known about the investment adjustment process in LAC. In the following, we investigate how the financial crisis of 2008 impact the speeds of adjustment in investment. As discussed earlier, financial crises impose common exogenous shocks which adversely affect the profitability and cash flows of firms, as well as their ability to raise external finance. On the other hand, it is known that the cost of borrowing and the availability of liquidity

changed favourably after the recent financial crisis (Adrian et al., 2017; Bessembinder et al., 2018). Assuming that the costs of adjustment in the post-crisis period are significantly lower, our analysis enables us to provide strong insights into the willingness of firms to invest optimally.

7.1. Speed of adjustment to investment

To investigate the dynamics of investment, following Byoun (2008) and Jiang and Lie (2016), we employ a two-stage process. In the first stage, we derive the predicted target investment using the estimated investment model given in equation (1). In the second stage, we regress the change in investment from year *t-1* to *t* on the deviation from the target investment level. Specifically, our target adjustment equation as follows:

$$Inv_t - Inv_{t-1} = \lambda\,(Inv_t^* - Inv_{t-1}) + \varepsilon_{i,t} \qquad (2)$$

where the LHS gives the change in investment from year *t* to *t-1*. Moreover, $Inv_t^* - Inv_{t-1}$ on the RHS is the deviation from the target at the beginning of year *t*, and Inv_t^* is the target investment level predicted by the fixed effects regressions for the entire period and the subperiods (Equation 1). Finally, λ denotes the adjustment speed towards the target investment level.

The empirical findings presented in Table 9 indicate that firms pursue a target investment strategy for pre- and post-crisis periods but the adjustment speed changes with the firm-specific characteristics and financial constraints. Moreover, the adjustment speed is significantly lower in the post-crisis period, irrespective of the financial constraint subgroups. For the full sample, adjustment speed to target investment is about 0.83 for the pre-crisis period, but it drops to about 0.75 in the post-crisis period. Further analysis suggests that small firms, firms with high dividend payout, high leverage, high cash holdings firms tend to close the gap between target and actual investments more quickly.

Insert Table 9 here

Overall, the analysis suggests that financial constraints are less binding in the post-crisis period and investment efficiency improves significantly. However, this occurs at the same time when firms reduce their speed in adjusting to target investment. There findings are not aligned with the view that firms are expected to adjust faster to target investment when they are less constrained with a greater ability to take up investment opportunities. We investigate this issue further in the next section.

7.2. Speed of adjustment to optimal leverage and cash holdings

Thus far, our estimation analysis has focused on the investment behaviour of subgroups of firms in different subperiods. In this section, we further explore the dynamic adjustment behaviour of the same subgroup of firms with respect to optimal leverage and cash holdings policies. In doing so, the main objective is to investigate if firms also deviate from their financial policies to a similar extent as for their optimal investment levels. Similar to the analysis for investment, we estimate the speed of adjustment for leverage and cash holdings and report the results in Table 10. In estimating optimal cash holdings, *Cash**, and leverage, *Lev**, we use the following specifications:

$$Cash_{i,t} = \beta_0 + \beta_1 Size_{i,t-1} + \beta_2 Q_{i,t-1} + \beta_3 Cflow_{i,t-1} + \beta_4 NWC_{i,t-1} + \beta_5 Inv_{i,t-1} + \beta_6 Lev_{i,t-1} + \beta_7 RD_{i,t-1} + \beta_8 Div_{i,t-1} + \varepsilon_{i,t} \quad (3)$$

$$Lev_{i,t} = \beta_0 + \beta_1 Size_{i,t-1} + \beta_2 Q_{i,t-1} + \beta_3 NDTS_{i,t-1} + \beta_4 Prof_{i,t-1} + \beta_5 CR_{i,t-1} + \beta_6 Tang_{i,t-1} + \varepsilon_{i,t} \quad (4)$$

where *NWC* is the ratio of current assets minus cash and current liabilities to the total assets; *RD* is a dummy variable equals to one if the firm has positive R&D expenditures; *NDTS* is the ratio of depreciation to total assets; *CR* is the ratio of current assets to current liabilities; *Tang* is the ratio of tangible assets to total assets; and *Prof* is the ratio of earnings before interest, taxes, and deprecation (EBITDA) to total assets. Other variables are as previously defined.

Insert Table 10 here

Several important findings emerge from this analysis. First, before the crisis the highest speed of adjustment for the whole sample is observed for the investment target with 83.2 (see Table 9). The adjustment speeds for cash holdings and leverage for the same sample of firms in the pre-crisis period are 64.9 and 52.2 percent. Importantly, the ordering of adjustment speeds remains the same across all subgroups, i.e. firms adjust to their investment targets more quickly than to their leverage and cash holdings targets before the crisis. Second, firms reduce the adjustment speed of target investment in the post crisis period, whereas they adjust faster in the same period with respect to their leverage and cash targets. This holds for all subgroups. Third, firms adjust faster towards their cash target than leverage, both in the pre-crisis and post crisis periods. Importantly, the percentage increase in the speed of adjustment to cash holdings is significantly greater than that for leverage across the subgroups. This is an important finding and we believe that it points to an important shift in the behaviour of firms regarding their optimal financial policies. To the extent that target adjustment speed reflects the desire of firms, as well as their ability, to attain their optimal levels of cash holdings and leverage, the results suggest that holding optimal levels of cash balances becomes an important objective for firms in the aftermath of the crisis. Finally, more in line with the expectations regarding the firms that are likely to be financially constrained, smaller firms and those firms with lower dividends and cash holdings, and higher leverage tend to be more willing to operate around their optimal cash balances. Except for leverage and cash, this is in contrast to what we observe in the pre-crisis period in that larger firms and those with larger dividends have greater adjustment speed.

We argue that, given the more favourable borrowing facilities and generally lower costs of external finance in the post-crisis period, which would lower the expected costs of adjustment, the change in firm behaviour is more likely to be driven by the perceived costs of being away from target levels. The latter costs are more likely to be related to the willingness of firms to attain their

optimal levels. Put differently, firms seem to perceive these costs to be significantly greater for cash holdings than leverage. By the same token, it appears that attaining optimal investment levels comes last in the pecking order.

8. The validity of ICFS as a measure of financial constraints

Our empirical analysis and the interpretation of our results rely on the assumption that ICFS is a valid measure of financial constraints. We acknowledge that there is ample prior work in the literature which sheds doubts on this notion. The first study that provides a direct challenge to the view that the estimated significant relation between cash flow and investment indicates financial constraints is Kaplan and Zingales (1997). Identifying constrained/unconstrained firms based on their dividend payouts, they find that the least constrained firms have the greatest estimated ICFSs. Reinforcing these findings Kadapakkam et al. (1998) show that ICFS is highest (smallest) among larger (smaller) firms. Cleary (1999) examines the sensitivity of investment to liquidity by classifying firms according to their ability to raise external finance. In support of the evidence provided by Kaplan and Zingales (1997), they find that the investment decisions of firms with high creditworthiness reveal greater sensitivity to the availability of internal funds than less creditworthy firms. Gomes (2001) casts further doubt on the financial constraint interpretation of ICFS by finding that cash flow is significantly related to investment in the existence of liquidity constraints only if q is ignored in the model. Furthermore, they also show that investment-cash flow relation is observed even in the absence of financial frictions. Cleary (2006) finds that firms with stronger financial positions show a greater ICFS than firms with weaker financial positions. In contrast to the findings in early work, it is also shown that higher payout firms are more investment-cash flow sensitive than lower payout firms. Considering a U-shaped relation between internal funds and investment, Cleary et al. (2007) provide evidence supporting the view that investment increases (decreases) monotonically with internal funds if they are large (very low).

Gatchev et al. (2010), accounting for the interdependence of financing and investment decisions, find that regardless of the firm's financial health the positive relation between investment and cash flow disappears. They find that firms deal with the fluctuations in their cash flows by changing net debt. That is, when cash flows are low (high) they increase (reduce) debt and reduce (increase) cash balances.

A further important potential problem in estimating the investment-cash flow relation relates to the possibility that the relation is overstated due to error in measuring marginal *q*. It is then also possible that our evidence of weakening – and to some extent disappearing – ICFS after the crisis period can be caused by the measurement error in *q*. Using measurement error-consistent estimators, Erickson and Whited (2000, 2002) show that cash flow does not matter in determining investment even for financially constrained firms. The performance of the q theory of investment improves significantly once purged of measurement error. Since *q* and cash flows are highly correlated, measurement error in these variables (particularly in *q*) may bias their coefficients and significance levels. Chen and Chen (2012) suggest that weakening ICFS is an evidence of the declining information content of the cash flows regarding the investment opportunities, which is in line with the measurement error argument. To control for the impact of measurement error on our results we estimate our main model applying measurement-error consistent estimators in a similar way to Erickson et al. (2014).

Insert Table 11 here

Although it is not possible to test for all the potential empirical and theoretical problems, which identified in the extant literature, we carry out several important further checks to bolster the reliability of our results. The results of these additional estimations are reported in Table 11. In Panel A of Table 11 we address the error-in-variables problems by estimating the static error-corrected model proposed in Erickson et al. (2014). In doing so we treat the lagged investment and

cash flow as measured with error and set higher order cumulants for the independent variables up to fifth order. Additionally, we estimate two dynamic generalised method of moments (GMM) models by treating all the independent variables endogenous and using all available lags are instruments a dynamic investment model. GMM1 corresponds to the Arellano and Bond (1991) first-differences estimator whereas GMM2 is the Blundell and Bond's (1998) system-GMM estimation. The results are driven and presented separately for both pre-crisis and post-crisis periods. The findings are consistent with our earlier insights and the findings of Chen and Chen (2012). First, the adjustment speed of investment, given by 1 *minus* the estimated coefficient of the lagged investment, is lower during the post-crisis period to lend support to the view that the willingness of firms to invest optimally reduced after the financial crisis. Second, both the error-corrected and GMM results suggest a similar pattern regarding both ICFS and IQS. That is, the sensitivity of investment to cash flow (q) becomes insignificant (significant) during the post crisis period. Therefore, disappearance if ICFS during the post-crisis period is not driven by the measurement-error in q.

In Panel B of Table 11, we estimate weighted least squares (WLS) to ensure that our results are not driven by the countries with high number of observations (Khurana et al. 2006). Specifically, the weights are the value of unity divided by the number of firm-year observations per country. Our results are similar to prior findings when we employ WLS. As another robustness check, we run our estimations for the pre- and post-crisis periods excluding the observations with negative cash flows. Allayannis and Mozumdar (2004) argue that low ICFS is driven by the negative cash flows since investment does not respond to the cash flows and firms are able to make only essential investments, which lowers the sensitivity of cash flows to the investment. Given that firms in financial distress are not able to cut their essential investments further, ICFS weakens for the firms with negative cash flows. Therefore, insignificant ICFS during the post-crisis period may be driven by the negative cash flows. Our results remain unchanged when we account for the

negative cash flows. ICFS is still insignificant after the global financial crisis. Finally, we exclude the observations from Colombia and re-run our estimations. Colombia has only 24 firms and 185 observations and different macroeconomic dynamics than the other countries in the sample. The results are qualitatively similar when we drop firms from Colombia.

In Panel C, we divide our sample according to the ratio of property, plant, and equipment to the total assets, which is a measure of the tangible capital. Moshirian et al. (2017) argue that ICFS disappears for the firms having high level of tangible capital through the investment intensity and cash flow persistence channel. Our results are not sensitive to the proportion of tangible investments. In both of the sub-groups, ICFS (IQS) is significant for the pre-crisis (post-crisis) period.

9. Summary and concluding remarks

Recent evidence shows that investment-cash flow (*q*) sensitivity decreased (increased) after the financial crisis of 2008. This is taken as evidence for reduced firm-level financial constraints and improved investment efficiency, which, taken together, point to a greater ability to invest optimally. This view is aligned with the strong corporate profitability and cash flows, but inconsistent with the weak investment growth in the aftermath of the crisis. The motivation of this paper stems from this puzzling pattern. In this paper, we first establish that the investment ability of firms increases after the crisis and then investigate if the willingness of firms is aligned with the higher investment ability. We draw inferences upon the extent of willingness by estimating the speed of adjustment to target investment. Importantly, the examination of the dynamic properties of investment is conducted in conjunction with the dynamics of cash holdings and leverage.

We find that the investment power of firms increases significantly in the post-crisis period, as evidenced by the estimated insignificant (significant) investment-cash flow (investment-*q*) sensitivities. However, during the same period the adjustment speed of firms towards optimal

investment drops significantly. We interpret this as reduced willingness of firms to invest optimally. This finding holds when we control for the factors which may impact the speed of adjustment and the extent to which firms can be financially constrained. Furthermore, the results indicate that in the post-crisis period the speeds of adjustment to leverage and cash holdings targets increase significantly, and the adjustment to cash holdings target is always faster than leverage. We believe that the findings point to an important shift in the behaviour of firms after the crisis. There is clear evidence that the willingness of firms to attain their optimal investment and financial policies is not homogenous across different decisions and it changes over time, suggesting that the relative importance of attaining optimal investment and financial policies is time-variant.

Our findings provide key insights into the puzzling pattern of weak corporate investment during the post-crisis period when the cost of borrowing is low; growth options are greater; and the opportunities to raise finance in integrated global capital markets are stronger. As such, our analysis raises important research questions and hence provides suggestions for avenues for future research. For example, it is important to investigate if the puzzling corporate investment dynamics uncovered in this paper are also present in developed countries. This is a key line of research as it would potentially change the way in which corporate investment is analysed. Our findings advocate an integrated empirical approach that considers the relative optimal positions of firms in relation to other major financial decisions and types of investment (e.g. R&D expenditures). Such an approach would lead to a better understanding of the factors that are relevant to firm value and, possibly, the divergence of interests between managers and shareholders in relation to maintaining optimal investment and financial policies.

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Tables

Table 1: Variable definitions

Inv	The ratio of capital expenditures to the beginning of the year total value of assets
Q	The ratio of book value of total assets minus the book value of equity plus the market value of equity to the book value of total assets
Cflow	The sum of income before extraordinary items plus depreciation scaled by the beginning of the year total assets
Lev	The ratio of total debt to total assets
Size	The natural logarithm of total assets in constant dollars
Div	A dummy variable equals to 1 if the firm pays out any dividend and zero otherwise
Cash	The ratio of cash and equivalents to total assets

This table gives the definitions of the regression variables used in this study.

Table 2. Descriptive statistics by country

		Brazil	Mexico	Argentina	Chile	Colombia	Peru	Total
Inv	Pre-crisis	0.069	0.057	0.057	0.063	0.048	0.073	0.064
	Crisis	0.063	0.044	0.060	0.050	0.076	0.053	0.056
	Post-crisis	0.055	0.056	0.074	0.059	0.053	0.070	0.059
SD		*0.007*	*0.007*	*0.009*	*0.007*	*0.015*	*0.011*	*0.004*
Q	Pre-crisis	1.422	1.283	1.048	1.405	1.011	1.417	1.348
	Crisis	1.596	1.445	1.055	1.448	1.361	1.490	1.461
	Post-crisis	1.383	1.558	1.337	1.337	1.226	1.318	1.383
SD		*0.113*	*0.138*	*0.165*	*0.056*	*0.177*	*0.086*	*0.058*
Cflow	Pre-crisis	0.057	0.088	0.092	0.105	0.100	0.168	0.091
	Crisis	0.086	0.079	0.078	0.081	0.088	0.136	0.089
	Post-crisis	0.058	0.088	0.082	0.094	0.081	0.129	0.081
SD		*0.016*	*0.005*	*0.007*	*0.012*	*0.010*	*0.021*	*0.005*
Lev	Pre-crisis	0.287	0.222	0.210	0.216	0.096	0.201	0.236
	Crisis	0.298	0.268	0.194	0.217	0.137	0.189	0.246
	Post-crisis	0.306	0.274	0.216	0.239	0.194	0.186	0.260
SD		*0.009*	*0.028*	*0.011*	*0.013*	*0.049*	*0.008*	*0.012*
Size	Pre-crisis	13.024	13.706	12.013	12.391	17.700	12.106	12.893
	Crisis	13.745	13.855	12.133	12.862	18.672	12.395	13.358
	Post-crisis	13.936	14.163	12.270	13.296	19.103	12.934	13.761
SD		*0.481*	*0.233*	*0.128*	*0.452*	*0.719*	*0.420*	*0.434*
Div	Pre-crisis	0.661	0.592	0.344	0.896	0.875	0.652	0.685
	Crisis	0.744	0.493	0.481	0.856	0.846	0.564	0.685
	Post-crisis	0.739	0.495	0.546	0.865	0.852	0.749	0.714
SD		*0.047*	*0.056*	*0.103*	*0.021*	*0.015*	*0.093*	*0.017*
Cash	Pre-crisis	0.103	0.080	0.075	0.067	0.078	0.084	0.084
	Crisis	0.132	0.100	0.081	0.094	0.069	0.087	0.106
	Post-crisis	0.134	0.097	0.090	0.079	0.076	0.069	0.103
SD		*0.018*	*0.011*	*0.007*	*0.013*	*0.005*	*0.010*	*0.012*
# of obs.		2171	969	587	1411	185	637	5960
# of firms		223	85	55	130	24	63	582

This table reports the mean values of the regression variables for each country and sub-period separately. The full sample includes 582 firms and 5960 firm-year observations from six Latin American countries over the sample period 2002-2015. Pre-crisis, Crisis and Post-crisis refer to the periods 2002-2008, 2009, and 2010-2015 respectively. The last column gives the mean values for the whole sample of firms in each sub-period. The statistics for Brazil and Mexico, the largest economies in the sample, are reported in the first two columns. *Inv* is the ratio of capital expenditures to the beginning of the year total assets, *Q* is the ratio of book value of total assets minus the book value of equity plus the market value of equity to the book value of total assets, *Cflow* is the sum of income before extraordinary items plus depreciation scaled by the beginning of the year total assets, *Lev* is the ratio of total debt to total assets, *Size* is the natural logarithm of the total assets in dollars, *Div* is a dummy variable 1 if the firm payout any dividend and zero, otherwise and *Cash* is the ratio of cash and equivalents to the total assets. SD is the standard deviation of the mean values across the sub-periods.

Table 3. Correlation matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) *Inv*	1	0.241*	0.388*	0.006	0.140*	0.195*	0.171*
(2) *Q*	0.192*	1	0.361*	0.066*	0.165*	0.144*	0.205*
(3) *Cflow*	0.281*	0.147*	1	-0.197*	0.043*	0.347*	0.204*
(4) *Lev*	-0.019	0.015	-0.230*	1	0.304*	-0.082*	-0.023
(5) *Size*	0.080*	0.020	0.100*	0.240*	1	0.274*	0.202*
(6) *Div*	0.109*	0.075*	0.317*	-0.104*	0.274*	1	0.199*
(7) *Cash*	0.079*	0.215*	0.141*	-0.078*	0.049*	0.140*	1

This table presents Spearman (top) and Pearson (down) correlation coefficients among the variables. *Inv* is the ratio of capital expenditures to the beginning of the year total assets, *Q* is the ratio of book value of total assets minus the book value of equity plus the market value of equity to the book value of total assets, *Cflow* is the sum of income before extraordinary items plus depreciation scaled by the beginning of the year total assets, *Lev* is the ratio of total debt to total assets, *Size* is the natural logarithm of the total assets in dollars, *Div* is a dummy variable 1 if the firm payout any dividend and zero, otherwise and *Cash* is the ratio of cash and equivalents to the total assets. * denotes the significance level at 1%.

Table 4. Descriptive statistics by quartiles of investments

	Panel A: Entire period					Panel B: Pre-crisis period			Panel C: Post-crisis period		
	Q1	Q2	Q3	Q4	t-stat	Q1	Q4	t-test	Q1	Q4	t-stat
Inv	0.010	0.034	0.062	0.141	-72.059***	0.010	0.149	-52.771***	0.009	0.139	-52.281***
	(0.008)	(0.010)	(0.018)	(0.069)		(0.008)	(0.068)		(0.007)	(0.066)	
Q	1.277	1.290	1.402	1.529	-9.247***	1.277	1.573	-6.848***	1.288	1.500	-5.598***
	(0.774)	(0.616)	(0.691)	(0.714)		(0.853)	(0.725)		(0.717)	(0.701)	
Cflow	0.036	0.076	0.101	0.134	-19.251***	0.015	0.155	-16.588***	0.045	0.117	-10.840***
	(0.158)	(0.099)	(0.105)	(0.121)		(0.172)	(0.134)		(0.140)	(0.107)	
Lev	0.229	0.256	0.252	0.257	-4.553***	0.226	0.255	-3.119***	0.259	0.268	-0.961
	(0.185)	(0.170)	(0.160)	(0.160)		(0.188)	(0.153)		(0.193)	(0.166)	
Size	12.673	13.368	13.615	13.717	-13.417***	12.131	13.238	-10.364***	13.342	14.050	-6.290***
	(2.198)	(2.086)	(1.995)	(2.044)		(2.068)	1.838)		(2.178)	(2.031)	
Div	0.536	0.703	0.794	0.764	-13.484***	0.438	0.821	-15.814***	0.597	0.723	-5.006***
	(0.499)	(0.457)	(0.404)	(0.425)		(0.497)	(0.384)		(0.491)	(0.448)	
Cash	0.087	0.101	0.097	0.094	-1.904*	0.075	0.088	-2.330**	0.100	0.102	-0.258
	(0.127)	(0.101)	(0.092)	(0.086)		(0.126)	(0.087)		(0.125)	(0.093)	
# of obs.	1521	1482	1501	1456		671	671		700	700	

This table reports the mean and standard deviation (in parenthesis) of the variables by constructing quartiles of investment ratio (*Inv*)and investigating whether the mean values of the variables of the high-investment firms (in the fourth quartile, Q4) differ significantly from those of the low-investment firms (in the first quartile, Q1). This comparison is carried out for the whole sample period 2002-2015 in Panel A; and the pre-crisis and post-crisis periods separately in Panels B and C. We also present the mean and standard deviation values of the variables in the second (Q2) and third (Q3) quartiles to examine if there is evidence of a monotonic relation between investment and other regression variables. The full sample includes 582 firms and 5960 firm-year observations from six Latin American countries over the sample period 2002-2015. Pre-crisis and Post-crisis refer to the periods 2002-2008, and 2010-2015 respectively. *Inv* is the ratio of capital expenditures to the beginning of the year total assets, *Q* is the ratio of book value of total assets minus the book value of equity plus the market value of equity to the book value of total assets, *Cflow* is the sum of income before extraordinary items plus depreciation scaled by the beginning of the year total assets, *Lev* is the ratio of total debt to total assets, *Size* is the natural logarithm of the total assets in dollars, *Div* is a dummy variable 1 if the firm payout any dividend and zero, otherwise and *Cash* is the ratio of cash and equivalents to the total assets ***, **, and * show the significance level at 1%, 5%, and 10%, respectively. t-stat indicates the t-values which compares the investment ratio in Q1 and Q4.

Table 5. Cross-sectional estimations of investment

	Q_{t-1}	$Cflow_t$	Lev_{t-1}	$Size_{t-1}$	Div_{t-1}	$Cash_{t-1}$	Constant	N	R^2
2002	0.015***	0.051**	-0.052	0.002	0.012**	0.029	-0.004	311	0.106
	(0.006)	(0.025)	(0.040)	(0.005)	(0.005)	(0.039)	(0.004)		
2003	0.013*	0.061	-0.112***	-0.003	0.006	0.046	-0.008*	338	0.156
	(0.008)	(0.039)	(0.028)	(0.005)	(0.005)	(0.043)	(0.004)		
2004	-0.007	0.094***	-0.076***	-0.010	0.006	0.036	-0.015***	365	0.126
	(0.005)	(0.034)	(0.028)	(0.007)	(0.004)	(0.040)	(0.004)		
2005	0.003	0.102**	-0.067**	-0.016*	0.005	-0.003	-0.011***	383	0.118
	(0.005)	(0.043)	(0.030)	(0.008)	(0.005)	(0.050)	(0.003)		
2006	0.011	0.132***	-0.063**	-0.016**	0.005	0.017	-0.004	405	0.145
	(0.009)	(0.035)	(0.030)	(0.008)	(0.005)	(0.051)	(0.003)		
2007	0.010	0.041	-0.118***	-0.033***	0.006	-0.027	0.004	433	0.125
	(0.008)	(0.032)	(0.039)	(0.011)	(0.004)	(0.046)	(0.003)		
2008	0.010	0.047	-0.121***	-0.025	0.005	0.021	0.013***	449	0.075
	(0.007)	(0.033)	(0.043)	(0.016)	(0.006)	(0.044)	(0.005)		
2009	0.007	0.120***	-0.090***	-0.021***	0.008**	0.039	-0.010***	476	0.154
	(0.006)	(0.036)	(0.027)	(0.008)	(0.004)	(0.033)	(0.003)		
2010	0.007	0.025	-0.065**	-0.019**	-0.001	0.079**	-0.005	479	0.069
	(0.006)	(0.038)	(0.026)	(0.008)	(0.004)	(0.035)	(0.003)		
2011	0.022***	0.018	-0.083***	-0.018**	-0.009**	-0.012	0.009**	489	0.119
	(0.005)	(0.025)	(0.022)	(0.007)	(0.004)	(0.033)	(0.004)		
2012	0.010*	0.026	-0.095***	-0.012**	-0.002	-0.009	0.001	481	0.084
	(0.006)	(0.021)	(0.020)	(0.005)	(0.004)	(0.030)	(0.004)		
2013	0.022***	-0.010	-0.092***	-0.015**	-0.010**	0.006	0.011**	472	0.105
	(0.007)	(0.039)	(0.034)	(0.007)	(0.005)	(0.042)	(0.004)		
2014	0.013**	0.040	-0.058*	-0.008	0.001	0.075	-0.001	447	0.074
	(0.006)	(0.052)	(0.030)	(0.007)	(0.006)	(0.059)	(0.005)		
2015	0.022***	0.094*	-0.016	-0.006	-0.011*	0.049	0.005	432	0.143
	(0.006)	(0.054)	(0.026)	(0.005)	(0.006)	(0.048)	(0.005)		

This table reports annual cross-sectional regression estimates of Equation (1). Dependent variable is *Inv* is the ratio of capital expenditures to the beginning of the year total assets, *Q* is the ratio of book value of total assets minus the book value of equity plus the market value of equity to the book value of total assets, *Cflow* is the sum of income before extraordinary items plus depreciation scaled by the beginning of the year total assets, *Lev* is the ratio of total debt to total assets, *Size* is the natural logarithm of the total assets in dollars, *Div* is a dummy variable 1 if the firm payout any dividend and zero, otherwise and *Cash* is the ratio of cash and equivalents to the total assets All variables except Div_{t-1} are demeaned by firm to remove the fixed effects. ***, **, and * indicate the significance level at 1%, 5%, and 10%, respectively. Robust standard errors are reported in parenthesis. N is the number of observations in each year.

Table 6. Fixed effect regression estimates of investments by country

	Brazil	Mexico	Argentina	Chile	Colombia	Peru
Q_{t-1}	0.011***	0.011**	0.029**	0.009	-0.008	0.008*
	(0.003)	(0.005)	(0.015)	(0.006)	(0.011)	(0.004)
$Cflow_t$	0.040***	0.078***	0.084***	0.083***	0.092	0.047
	(0.014)	(0.026)	(0.029)	(0.030)	(0.083)	(0.035)
Lev_{t-1}	-0.082***	-0.053***	-0.030	-0.095***	0.019	-0.094**
	(0.016)	(0.015)	(0.035)	(0.030)	(0.067)	(0.037)
$Size_{t-1}$	-0.015**	-0.008*	-0.030***	-0.010	-0.024	-0.020*
	(0.006)	(0.005)	(0.011)	(0.007)	(0.016)	(0.011)
Div_{t-1}	0.008	0.008**	-0.006	-0.006	-0.029**	0.001
	(0.005)	(0.004)	(0.006)	(0.011)	(0.013)	(0.011)
$Cash_{t-1}$	-0.003	0.107***	0.097	0.029	0.129	-0.056
	(0.023)	(0.038)	(0.063)	(0.030)	(0.080)	(0.055)
Constant	0.265***	0.143**	0.412***	0.190**	0.483*	0.284**
	(0.074)	(0.065)	(0.128)	(0.085)	(0.268)	(0.136)
R^2	0.156	0.210	0.229	0.125	0.142	0.135
# of obs.	2171	969	587	1411	185	637

This table reports fixed effect regression estimates of Equation (1) for each country separately. The estimation period is 2002-2015. The estimates for Brazil and Mexico, the largest economies in the sample, are reported in the first two columns of results. Dependent variable is *Inv* is the ratio of capital expenditures to the beginning of the year total assets, *Q* is the ratio of book value of total assets minus the book value of equity plus the market value of equity to the book value of total assets, *Cflow* is the sum of income before extraordinary items plus depreciation scaled by the beginning of the year total assets, *Lev* is the ratio of total debt to total assets, *Size* is the natural logarithm of the total assets in dollars, *Div* is a dummy variable 1 if the firm payout any dividend and zero, otherwise and *Cash* is the ratio of cash and equivalents to the total assets Estimations include firm and year dummies. ***, **, and * indicate the significance levels at 1%, 5%, and 10%, respectively. Standard errors (in parenthesis) are clustered at firm level. Within R^2 values are reported.

Table 7. Fixed effect regression estimates of investments for sub-periods

	Entire period	Pre-crisis	Crisis	Post-crisis
Q_{t-1}	0.011***	0.005	0.007	0.019***
	(0.002)	(0.003)	(0.006)	(0.004)
$Cflow_t$	0.060***	0.062***	0.120***	0.021
	(0.011)	(0.015)	(0.036)	(0.021)
Lev_{t-1}	-0.077***	-0.099***	-0.090***	-0.067***
	(0.011)	(0.017)	(0.027)	(0.018)
$Size_{t-1}$	-0.016***	-0.014***	-0.021***	-0.016***
	(0.003)	(0.005)	(0.008)	(0.006)
Div_{t-1}	0.003	0.011**	0.008**	-0.005
	(0.003)	(0.005)	(0.004)	(0.004)
$Cash_{t-1}$	0.024	0.051*	0.039	0.066***
	(0.016)	(0.030)	(0.033)	(0.023)
Constant	0.257***	0.244***	-0.010***	0.252***
	(0.040)	(0.068)	(0.003)	(0.079)
R^2	0.126	0.140	0.154	0.093
# of obs.	5960	2684	476	2800

This table reports fixed effect regression estimates of Equation (1) the entire sample period and three sub-periods. The full sample includes 582 firms and 5960 firm-year observations from six Latin American countries over the sample period 2002-2015. Pre-crisis, Crisis and Post-crisis refer to the periods 2002-2008, 2009, and 2010-2015 respectively. Dependent variable is *Inv* is the ratio of capital expenditures to the beginning of the year total assets, *Q* is the ratio of book value of total assets minus the book value of equity plus the market value of equity to the book value of total assets, *Cflow* is the sum of income before extraordinary items plus depreciation scaled by the beginning of the year total assets, *Lev* is the ratio of total debt to total assets, *Size* is the natural logarithm of the total assets in dollars, *Div* is a dummy variable 1 if the firm payout any dividend and zero, otherwise and *Cash* is the ratio of cash and equivalents to the total assets. Estimations include firm and year dummies. ***, **, and * indicate the significance level at 1%, 5%, and 10%, respectively. Standard errors (in parenthesis) are clustered at the firm level. Within R^2 values are reported.

Table 8. Fixed effect regression estimates of investments for sub-periods and sub-samples

Panel A: Pre-crisis period								
	Small	Large	Low Dividend	High Dividend	Low Leverage	High Leverage	Low Cash	High Cash
Q_{t-1}	0.006	0.002	0.008	0.002	-0.005	0.017***	0.011**	-0.004
	(0.004)	(0.006)	(0.006)	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)
	[0.501]	[0.132]	[0.674]	[0.137]	[-0.394]	[1.207]	[1.376]	[-0.314]
$Cflow_t$	0.054***	0.091***	0.054***	0.089***	0.067***	0.061***	0.044***	0.099***
	(0.016)	(0.033)	(0.017)	(0.025)	(0.021)	(0.023)	(0.015)	(0.034)
	[0.940]	[0.879]	[0.972]	[0.820]	[0.933]	[0.860]	[0.642]	[1.182]
Lev_{t-1}	-0.098***	-0.104***	-0.077***	-0.141***	-0.106***	-0.098***	-0.065***	-0.150***
	(0.021)	(0.027)	(0.020)	(0.028)	(0.031)	(0.021)	(0.018)	(0.034)
$Size_{t-1}$	-0.015*	-0.009	-0.021**	-0.006	-0.013*	-0.017**	-0.014***	-0.016
	(0.008)	(0.008)	(0.010)	(0.007)	(0.008)	(0.007)	(0.005)	(0.011)
Div_{t-1}	0.009	0.013*	0.009	0.018**	0.008	0.011**	0.012***	0.008
	(0.006)	(0.007)	(0.006)	(0.007)	(0.007)	(0.005)	(0.004)	(0.011)
$Cash_{t-1}$	-0.008	0.137***	0.024	0.080***	0.055	0.042	0.121**	0.033
	(0.028)	(0.045)	(0.057)	(0.027)	(0.040)	(0.033)	(0.049)	(0.033)
Constant	0.218**	0.188*	0.303**	0.141*	0.211**	0.291***	0.218***	0.284**
	(0.085)	(0.105)	(0.122)	(0.084)	(0.092)	(0.097)	(0.064)	(0.133)
R^2	0.109	0.195	0.164	0.149	0.127	0.171	0.123	0.185
# of obs.	1291	1393	1020	1664	1300	1384	1680	1004
Panel B: Crisis period								
	Small	Large	Low Dividend	High Dividend	Low Leverage	High Leverage	Low Cash	High Cash
Q_{t-1}	-0.001	0.034***	0.000	0.017**	0.015**	0.010	-0.009	0.031***
	(0.007)	(0.010)	(0.007)	(0.007)	(0.007)	(0.009)	(0.009)	(0.009)
	[-0.045]	[0.972]	[0.000]	[0.604]	[0.642]	[0.319]	[-0.317]	[1.231]
$Cflow_t$	0.099***	0.174*	0.054***	0.241***	0.166***	0.025	0.131***	0.083*
	(0.025)	(0.096)	(0.020)	(0.058)	(0.052)	(0.033)	(0.038)	(0.048)
	[1.058]	[0.951]	[0.633]	[1.395]	[1.397]	[0.208]	[1.162]	[0.624]
Lev_{t-1}	-0.090***	-0.072*	-0.092**	-0.075**	-0.095**	-0.114***	-0.114***	-0.074*
	(0.034)	(0.040)	(0.038)	(0.035)	(0.042)	(0.039)	(0.035)	(0.040)
$Size_{t-1}$	-0.015*	-0.037***	-0.019	-0.021***	-0.011	-0.041***	-0.019**	-0.036***
	(0.008)	(0.011)	(0.011)	(0.008)	(0.008)	(0.010)	(0.009)	(0.009)
Div_{t-1}	0.002	0.012**			0.012**	0.002	0.005	0.012*
	(0.005)	(0.006)			(0.005)	(0.005)	(0.004)	(0.007)
$Cash_{t-1}$	0.007	0.047	-0.017	0.058	0.032	0.039	0.089	0.008
	(0.039)	(0.056)	(0.051)	(0.038)	(0.037)	(0.067)	(0.078)	(0.038)
Constant	-0.009***	-0.008	-0.009***	-0.001	-0.014***	-0.004	-0.010***	-0.008
	(0.003)	(0.005)	(0.002)	(0.003)	(0.004)	(0.004)	(0.003)	(0.007)
R^2	0.110	0.265	0.148	0.199	0.163	0.202	0.153	0.242
# of obs.	237	239	128	348	242	234	297	179
Panel C: Post-crisis period								
	Small	Large	Low Dividend	High Dividend	Low Leverage	High Leverage	Low Cash	High Cash

Q_{t-1}	0.027***	0.013***	0.016*	0.020***	0.012**	0.029***	0.021***	0.018**
	(0.007)	(0.004)	(0.009)	(0.005)	(0.005)	(0.006)	(0.004)	(0.008)
	[2.011]	[0.831]	[1.048]	[1.404]	[0.934]	[1.730]	[1.196]	[1.478]
$Cflow_t$	0.012	0.030	0.020	0.025	0.030	0.020	0.054**	-0.006
	(0.023)	(0.044)	(0.028)	(0.031)	(0.026)	(0.032)	(0.021)	(0.034)
	[0.168]	[0.255]	[0.290]	[0.207]	[0.379]	[0.202]	[0.583]	[-0.075]
Lev_{t-1}	-0.081***	-0.053***	-0.048*	-0.084***	-0.071***	-0.066***	-0.067***	-0.067**
	(0.026)	(0.020)	(0.028)	(0.017)	(0.021)	(0.025)	(0.021)	(0.031)
$Size_{t-1}$	-0.014*	-0.017**	-0.018*	-0.014*	-0.004	-0.026***	-0.012*	-0.018**
	(0.007)	(0.009)	(0.009)	(0.007)	(0.007)	(0.009)	(0.008)	(0.009)
Div_{t-1}	0.000	-0.009	-0.003	-0.010**	-0.009*	0.000	-0.004	-0.004
	(0.005)	(0.006)	(0.005)	(0.005)	(0.005)	(0.006)	(0.004)	(0.008)
$Cash_{t-1}$	0.034	0.123***	0.085**	0.054***	0.060***	0.089**	0.106**	0.056**
	(0.028)	(0.033)	(0.040)	(0.020)	(0.022)	(0.037)	(0.043)	(0.024)
Constant	0.194**	0.306**	0.268**	0.248**	0.093	0.403***	0.210***	0.281**
	(0.089)	(0.131)	(0.116)	(0.110)	(0.086)	(0.129)	(0.108)	(0.116)
R^2	0.105	0.108	0.069	0.125	0.060	0.157	0.115	0.083
# of obs.	1367	1433	989	1811	1410	1390	1728	1072

This table presents fixed effect regression estimates of Equation (1) for sub-samples of firms in three sub-periods. Sub-samples in each period are determined by using the median values of four financial constraint firm-specific characteristics in the relevant sub-period. Pre-crisis, Crisis and Post-crisis refer to the periods 2002-2008, 2009, and 2010-2015 respectively. Dependent variable is *Inv* is the ratio of capital expenditures to the beginning of the year total assets, *Q* is the ratio of book value of total assets minus the book value of equity plus the market value of equity to the book value of total assets, *Cflow* is the sum of income before extraordinary items plus depreciation scaled by the beginning of the year total assets, *Lev* is the ratio of total debt to total assets, *Size* is the natural logarithm of the total assets in dollars, *Div* is a dummy variable 1 if the firm payout any dividend and zero, otherwise and *Cash* is the ratio of cash and equivalents to the total assets In addition to the estimated coefficients, we also report the economic significances of the variables *Q* and *Cflow* in brackets. Economic significances of *Q* and *Cflow* show the percentage point increase in *Inv* with respect to one standard deviation change in *Q* and *Cflow*. All estimations include firm and year dummies. ***, **, and * indicate the significance level at 1%, 5%, and 10%, respectively. Standard errors (in parenthesis) are clustered at the firm level. Within R^2 values are reported.

Table 9. The speed of adjustment in sub-periods and sub-samples

	Entire period	Pre-crisis	Post-crisis
	Dependent variable: ΔInv_t		
Full Sample			
Inv_t* - Inv_{t-1}	0.664*	0.832*	0.751*
	(0.022)	(0.037)	(0.034)
Small Size			
Inv_t* - Inv_{t-1}	0.707*	0.865*	0.789*
	(0.029)	(0.044)	(0.043)
Large Size			
Inv_t* - Inv_{t-1}	0.618*	0.806*	0.695*
	(0.033)	(0.057)	(0.052)
Low Div			
Inv_t* - Inv_{t-1}	0.633*	0.795*	0.663*
	(0.037)	(0.051)	(0.063)
High Div			
Inv_t* - Inv_{t-1}	0.682*	0.850*	0.819*
	(0.026)	(0.047)	(0.029)
Low Lev			
Inv_t* - Inv_{t-1}	0.637*	0.767*	0.705*
	(0.035)	(0.055)	(0.056)
High Lev			
Inv_t* - Inv_{t-1}	0.689*	0.884*	0.791*
	(0.027)	(0.047)	(0.041)
Low Cash			
Inv_t* - Inv_{t-1}	0.652*	0.790*	0.749*
	(0.026)	(0.046)	(0.036)
High Cash			
Inv_t* - Inv_{t-1}	0.673*	0.878*	0.758*
	(0.036)	(0.057)	(0.063)

This table reports estimates of adjustment speeds of investment for the entire (2002-2015), pre-crisis (2002-2008), and post-crisis (2010-2015) periods. We regress the change in investment from year *t-1* to *t* on the deviation from the target investment level. Specifically, our target adjustment equation as follows:

$$(Inv_{i,t} - Inv_{i,t-1}) = \lambda \left(Inv^*_{i,t} - Inv_{i,t-1}\right) + \varepsilon_{i,t}$$

where the LHS gives the change in investment from year *t* to *t-1* and $(Inv^*_t - Inv_{t-1})$ is the deviation from the target at the beginning of year *t*, and Inv^*_t is the target investment level predicted by estimating Eq. (1). *Inv* is the ratio of capital expenditures to the beginning of the year total assets, *Lev* is the ratio of total debt to total assets, *Size* is the natural logarithm of the total assets in dollars, *Div* is a dummy variable 1 if the firm payout any dividend and zero, otherwise and *Cash* is the ratio of cash and equivalents to the total assets. *i* ant *t* subscripts represent firms and years, respectively. All estimations include firm and year dummies. Standard errors (in parenthesis) are clustered at the firm level. * denotes the significance level at 1%.

Table 10. The speed of adjustment towards target cash holdings and capital structure in sub-periods and sub-samples

	Dep. var. = $\Delta Cash_t$		Dep. var. = ΔLev_t	
	Pre-crisis	Post-crisis	Pre-crisis	Post-crisis
	(1)	(2)	(3)	(4)
Full Sample				
$Target_t^*$ - $Actual_{t-1}$	0.649*	0.788*	0.522*	0.579*
	(0.047)	(0.037)	(0.036)	(0.033)
Small Size				
$Target_t^*$ - $Actual_{t-1}$	0.588*	0.797*	0.484*	0.577*
	(0.065)	(0.051)	(0.040)	(0.043)
Large Size				
$Target_t^*$ - $Actual_{t-1}$	0.733*	0.767*	0.565*	0.583*
	(0.054)	(0.045)	(0.055)	(0.052)
Low Div				
$Target_t^*$ - $Actual_{t-1}$	0.637*	0.858*	0.538*	0.602*
	(0.094)	(0.053)	(0.060)	(0.056)
High Div				
$Target_t^*$ - $Actual_{t-1}$	0.661*	0.715*	0.524*	0.556*
	(0.040)	(0.043)	(0.030)	(0.030)
Low Lev				
$Target_t^*$ - $Actual_{t-1}$	0.597*	0.722*	0.520*	0.535*
	(0.061)	(0.047)	(0.041)	(0.044)
High Lev				
$Target_t^*$ - $Actual_{t-1}$	0.749*	0.863*	0.530*	0.607*
	(0.057)	(0.055)	(0.050)	(0.046)
Low Cash				
$Target_t^*$ - $Actual_{t-1}$	0.738*	0.868*	0.499*	0.585*
	(0.045)	(0.051)	(0.051)	(0.044)
High Cash				
$Target_t^*$ - $Actual_{t-1}$	0.632*	0.769*	0.557*	0.574*
	(0.055)	(0.044)	(0.047)	(0.051)

This table reports estimates of adjustment speeds of investment for the pre-crisis period (2002-2008) and post-crisis periods (2010-2015). We regress the changes in cash holdings (Columns 1 and 2) and leverage (Columns 3 and 4) from year *t-1* to *t* on the deviation from the target cash and leverage levels. Specifically, our target adjustment equations for cash holdings and leverage are as follows:

$(Cash_{i,t} - Cash_{i,t-1}) = \lambda \left(Cash_{i,t}^* - Cash_{i,t-1}\right) + \varepsilon_{i,t}$

$(Lev_{i,t} - Lev_{i,t-1}) = \lambda \left(Lev_{i,t}^* - Lev_{i,t-1}\right) + \varepsilon_{i,t}$

where the LHS gives the change in cash ratio or leverage from year *t* to *t-1* and $(Cash_{i,t}^* - Cash_{i,t-1})$ and $\left(Lev_{i,t}^* - Lev_{i,t-1}\right)$ are the deviations from the target at the beginning of year *t*, and $Cash_t^*$ and Lev_t^* are the target cash and leverage levels predicted by estimating Equations (3) and (4). *Inv* is the ratio of capital expenditures to the beginning of the year total assets, *Lev* is the ratio of total debt to total assets, *Size* is the natural logarithm of the total assets in dollars, *Div* is a dummy variable 1 if the firm payout any dividend and zero, otherwise and *Cash* is the ratio of cash and equivalents to the total assets The coefficient of $Target_t^*$ - $Actual_{t-1}$ shows the adjustment speed. *i* ant *t* subscripts represent the firms and years, respectively. All estimations include firm and year dummies. Standard errors (in parenthesis) are clustered at the firm level. * denotes the significance level at 1%.

Table 11. Robustness checks

Panel A. Error corrected models and endogeneity						
	Pre-crisis			Post-crisis		
	EIV	GMM1	GMM2	EIV	GMM1	GMM2
Inv_{t-1}		0.250***	0.420***		0.415***	0.541***
		(0.047)	(0.143)		(0.054)	(0.039)
Q_{t-1}	-0.002	0.007	0.006	0.017***	0.029***	0.010**
	(0.003)	(0.008)	(0.005)	(0.003)	(0.007)	(0.005)
$Cflow_t$	0.059***	0.100***	0.143***	0.023	-0.033	0.026
	(0.010)	(0.035)	(0.029)	(0.028)	(0.043)	(0.028)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
# of obs.	2684	2217	2684	2800	2257	2800
AR(1) p value		0.000	0.000		0.000	0.000
AR(2) p value		0.868	0.742		0.253	0.261
Hansen p-value	0.587	0.329	0.126	0.138	0.110	0.012
Panel B. WLS, negative cash flow, and non-Colombian sample						
	Pre-crisis			Post-crisis		
	WLS	Exc. Colombia	Exc. neg. cflow	WLS	Exc. Colombia	Exc. neg. cflow
Q_{t-1}	0.003	0.005	0.004	0.017***	0.020***	0.021***
	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)
$Cflow_t$	0.085***	0.060***	0.099***	0.010	0.023	0.008
	(0.022)	(0.015)	(0.025)	(0.029)	(0.022)	(0.041)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.154	0.140	0.152	0.091	0.093	0.120
# of obs.	2,684	2,620	2,355	2,800	2,692	2,447
Panel C. Asset composition and investment						
	Pre-crisis			Post-crisis		
	Low-tang	High-tang		Low-tang	High-tang	
Q_{t-1}	0.003	0.008		0.013***	0.031***	
	(0.003)	(0.007)		(0.004)	(0.006)	
$Cflow_t$	0.051**	0.061***		0.028	0.042	
	(0.021)	(0.021)		(0.022)	(0.037)	
Controls	Yes	Yes		Yes	Yes	
R^2	0.127	0.159		0.087	0.199	
# of obs.	1,305	1,379		1,429	1,371	

Panel A estimates the static error-corrected model (EIV) proposed by Erickson et al. (2014) and dynamic GMM estimations. GMM1 corresponds to the Arellano Bond (1991) differenced estimator. GMM2 is the Blundell and Bond (1998) System-GMM estimation. In the error-corrected models we treat Inv_{t-1} and $Cflow_t$ as measued with error. We set higher order cumulants for the independent variables up to fifth order. In GMM estimations all independent variables are treated as endogeneous and all available lags are used as instruments. Panel B reports the weighted least square (WLS) estimation results and sub-sample analysis by excluding the Colombia and observations with negative cash flows. In weighted least squares (WLS) estimations the weights are the unity

divided by the number of observations per country. Panel C reports the fixed effects estimation results for the tangible capital (low-tang vs. high-tang) sub-samples. We use property, plant, and equipment as a proxy for the tangible capital. Robust standard errors are in parantheses. ***, **, and * indicate the significance level at 1%, 5%, and 10%, respectively.

Figures

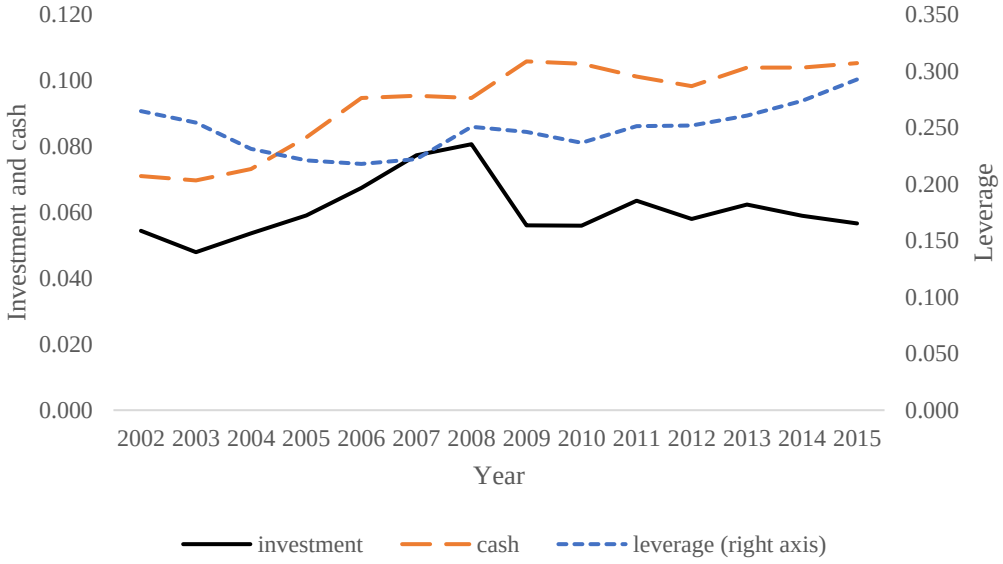

Figure 1. Investments, cash holdings and leverage over years