The Allocation of Cash Flow by Spanish Firms: New Evidence on the Impact of Financial Frictions*

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Abstract

This paper studies the impact of financial frictions on the allocation of cash flow using administrative data of Spanish non-financial corporations from 2003 to 2019. Employing an analytical framework based on the uses and sources of funds identity, I estimate regression models to examine the allocation of cash flow across its competing uses. My findings reveal that larger financial frictions are, on average, associated with a higher proportion of marginal cash flow allocated to debt repayment and lower proportions allocated to cash savings, investment, and dividend distribution. The analysis also highlights that the effect of financial frictions on the allocation of marginal cash flow varies significantly with variables capturing the economic and financial situation of each firm such as leverage, cash holdings, capital, and the availability of investment opportunities.

JEL codes: G30, G32, G35.

Keywords: Financial frictions, cash flow, investment, dividends, debt, cash savings.

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1 Introduction

Cash flow is one of the primary funding sources for firms, enabling them to allocate funds towards cash savings, investment, debt repayment, and net dividend distributions. Financial frictions limit the availability and increase the cost of funding coming from external debt and equity issuance, which makes cash flow a more relevant determinant of these uses. The seminal paper of Fazzari, Hubbard, and Petersen (1987) offers evidence suggesting that financially constrained firms feature greater sensitivity of investment to cash flow. Since then, many theoretical and empirical studies have aimed at confirming the generality of this finding and characterizing differential patterns across more and less financially constrained firms in other uses of cash flow.

In this paper, I add to this literature by analyzing the allocation of cash flow to alternative uses by Spanish non-financial corporations during the period 2003-2019. I extend the standard approach by interacting a proxy for financial frictions with pre-determined variables describing the economic and financial situation of each firm. My findings suggest that larger financial frictions are, on average, associated with a higher share of cash flow allocated to debt repayment, and with lower shares allocated to cash savings, investment, and dividend distribution. Importantly, my analysis shows that the effects of the proxy for financial frictions on the allocation of cash flow vary significantly with predetermined state variables capturing the economic and financial situation of each firm, such as leverage, cash holdings, capital stock, and availability of investment opportunities.

As in Chang, Dasgupta, Wong, and Yao (2014), I build the empirical analysis on a cash flow identity (akin to a simplified uses and sources of funds identity) that equates cash flow to the sum of all its alternative (net) uses. My baseline specifications consist of regressing the different uses of cash flow on cash flow, control variables, and firm and year fixed effects. I use ordinary least squares (OLS) regressions to estimate each equation separately. The coefficients associated with cash flow, which are deemed *cash flow sensitivities*, measure how much of a marginal unit of cash flow is allocated to the corresponding use. I find that, at the margin, an additional euro of cash flow is followed by average increases of 29 cents in cash savings, 44 cents in investment, 23 cents in debt repayment, and 4 cents in dividend distribution. By construction, the estimated cash flow sensitivities add up to one, as noticed by Chang et al. (2014).[1]

[1] This property is a direct implication of the cash flow identity. While the system of equations can be estimated using seemingly unrelated regressions (SUR) to enforce that the sum of the coefficients associated with cash flow equals one, SUR estimates are equivalent to equation-by-equation OLS estimates if the same set of explanatory variables is included in each equation (Greene, 2012).

To study how financial frictions affect the allocation of marginal cash flow by firms, I extend the baseline specifications with the interaction of the cash flow variable with a proxy for the potential importance of financial frictions. The proxy I use is the *Size-Age* (*SA*) index proposed by Hadlock and Pierce (2010), which captures the idea that younger and smaller firms are more likely to face financial frictions.

Conventional wisdom sustains that firms facing larger financial frictions should allocate a higher share of their cash flow to investment, the rationale being that investment is more profitable at the margin for constrained than for unconstrained firms because of the difficulty of financing it externally (Fazzari et al., 1987). Consistent with this view, many empirical papers show that financial frictions are associated with higher cash flow sensitivities of investment (Fazzari et al., 2000; Drobetz et al., 2017). However, firms facing larger financial frictions might also find it differentially attractive to allocate cash flow towards other uses such as cash savings or debt repayment, since these might contribute to alleviating present and future financial frictions (Dasgupta and Sengupta, 2007; DeAngelo et al., 2011; Denis and McKeon, 2012). Thus, whether investment or other uses of cash flow exhibit larger or lower average sensitivity to cash flow in the presence of financial constraints remains an empirical question that can have different answers in different samples and time periods. Indeed, several studies find that firms facing larger financial frictions allocate a lower share of their cash flow towards investment, and higher shares towards cash savings and debt repayment (Cleary, 1999; Chang et al., 2014).

My findings for Spanish firms during the period 2003-2019 indicate that higher values of the *SA* index are associated, on average, with higher cash flow sensitivities of debt repayment and lower cash flow sensitivities of each of the other uses. Specifically, a one-unit increase in the *SA* index (whose standard deviation is 0.85) is associated with an average increase of 6 cents in the share of marginal cash flow allocated towards debt repayment and average decreases of 2 cents, 3 cents, and 1 cent in the shares allocated to cash savings, investment, and net dividends, respectively. These results support the notion that firms facing larger financial frictions in Spain during the analyzed period employ a larger portion of their cash flow to mitigate these frictions by reducing their reliance on external debt.

Next, I explore whether the impact of potential financial frictions on cash flow sensitivities further varies with variables that are typically treated as *state variables* in structural dynamic models of firms' behavior (e.g., Gao, Whited, and Zhang, 2021): leverage, cash holdings, capital, and availability of investment opportunities. The empirical analysis consists of splitting the observations in my sample based on lagged values of these variables and comparing the effects of financial frictions on the allocation of cash flow across the resulting subsamples.

The main results from this exercise are the following. First, changes in the *SA* index imply minor or insignificant differences in the cash flow sensitivities among firms in the lowest deciles of the distribution of leverage. In contrast, higher values of the *SA* index are associated with a higher cash flow sensitivity of debt repayment and lower cash flow sensitivities of cash saving and investment for firms in the highest deciles of the distribution of leverage. Second, the cash flow sensitivities seem to be unaffected by changes in the *SA* index among firms in the highest deciles of the distribution of cash holdings. However, higher values of the *SA* index are associated with a lower cash flow sensitivity of investment and a higher cash flow sensitivity of debt repayment for firms in the lowest deciles of the distribution of cash holdings. Third, the cash flow sensitivity of investment is decreasing in the *SA* index only among firms in the highest deciles of the distribution of capital. For firms in the lowest deciles of the distribution of capital, higher values of the *SA* index are associated with a higher cash flow sensitivity of debt repayment, lower cash flow sensitivities of cash savings and dividend distribution, and have no significant association with the cash flow sensitivity of investment.

Collectively, these results suggest that the proxy of financial frictions (the *SA* index of Hadlock and Pierce, 2010) captures the likelihood of firms experiencing financial constraints, significantly altering the average cash flow sensitivities of the various uses of cash flow. However, the specific economic and financial situation of each firm (as captured by standard pre-determined state variables) interacts with the likelihood of suffering financial constraints creating a rich and nuanced landscape. Uncontrolled-for variability in those and other relevant state variables across samples might explain the apparently conflicting findings of the literature that has tried to establish if and how financial constraints affect the allocation of cash flow with reduced form methodologies. It also highlights the value that more structural approaches (able to simultaneously account for the dynamics of the relevant state variables) may have in this field.

Finally, I extend the baseline specifications to conduct further analysis that sheds light on other interesting aspects of the allocation of cash flow. First, by dissecting cash flow into its persistent and transitory components, I find that firms allocate these distinct components differently, with a greater proportion of the persistent component channeled into investment, consistent with it containing more information about firms' future profitability. Second, I disaggregate investment into its three components (real investment, financial investment, and trade credit provision), and I find that almost all of the cash flow sensitivity of investment is attributable to the cash flow sensitivities of real investment and trade credit provision. Third, I add two lags of the cash flow variable as additional regressors to explore the existence of slow adjustment in the allocation of cash flow. The results suggest that while some delays exist in the allocation of cash flow to investment, such delays are generally of low magnitude. Fourth, in examining asymmetries between positive and negative cash flow, I find that the main uses to which a marginal unit of positive cash flow is allocated are cash savings and investment, while the main sources that firms use to accommodate an additional unit of negative cash flow are increases in debt and reductions in investment.

Related Literature. My paper relates directly to the literature that studies the effects of financial frictions on the allocation of cash flow. The existing empirical literature explores how financial frictions affect the cash flow sensitivities of investment (Fazzari et al., 1987; Kaplan and Zingales, 1997; Allayannis and Mozumdar, 2004), cash savings (Almeida et al., 2004; Riddick and Whited, 2009), or of all the uses in a unified empirical framework (Gatchev et al., 2010; Chang et al., 2014; Drobetz et al., 2017). My contribution consists of extending the empirical approach of Chang et al. (2014) to explore whether the effects of financial frictions on the allocation of cash flow are contingent upon the economic and financial situation of each firm (as captured by pre-determined state variables such as leverage, cash holdings, capital and the availability of investment opportunities).

Other papers in the literature have already explored heterogeneity in the effects of financial frictions on the allocation of cash flow. For instance, Drobetz et al. (2017) compare the effects of financial frictions in the allocation of cash flow before and after the 2007 crisis. Other papers have explored heterogeneity across the business cycle (e.g., Almeida et al. (2004)), or across the persistent and temporary components of cash flow (e.g., Chang et al. (2014)), for instance. Instead, I present a general overview of heterogeneity across variables that are usually treated as state factors in structural models of firms' behavior. This list of variables is seen as a comprehensive summary, capturing all the important information firms need for deciding how to allocate their cash flow. My findings point to the high relevance of firms' state variables to determining the effects of financial frictions on the allocation of cash flow. This can help reconcile the existence of conflicting findings in the literature that looks at the average effects of measures of firms' predisposition to suffer financial constraints on cash flow sensitivities.

The rest of the article is organized as follows. Section 2 introduces the analytical framework that guides the empirical analysis. Section 3 introduces the data sources and presents summary statistics of key variables. Section 4 describes the empirical strategy and the baseline allocation of cash flow. Section 5 explores how financial frictions affect the allocation of cash flow. Section 6 discusses additional results. Finally, section 7 concludes.

2 The analytical framework

In this section, I outline the construction of the cash flow variable and establish the relationship between the uses of cash flow through a cash flow identity. To provide a clear understanding of each variable mentioned, their definitions are presented in Table A1. To maintain internal coherence in the definition of variables used throughout the empirical analysis, I begin with the uses and sources of funds identity:

$$CF_t + \Delta Debt_t + Equity\ issuance_t = \Delta Cash_t + Inv_t + Div_t, \tag{1}$$

where the sources of funds are the internally generated cash flow (CF_t), and the funding coming from net debt issuance ($\Delta Debt_t$) and equity issuance ($Equity\ issuance_t$). The uses of funds are cash savings ($\Delta Cash_t$), investment (Inv_t) and any net amount of cash distributed to shareholders through dividends or share repurchases (Div_t).

The variable CF_t captures the cash flow resulting from the company's production and sales, in addition to net financial revenue and net of corporate tax payments:

$$CF_t := Operating\ income_t + Net\ financial\ revenue_t - Corporate\ taxes_t.$$

$Debt_t$ is the sum of current and non-current liabilities, and $Cash_t$ is the sum of cash plus equivalent short-term financial assets that can be readily converted into cash. Since I do not observe Inv_t in my data, I compute it as the change in the value of assets excluding cash between periods $t-1$ and t. It is important to note that this measure might include the impact of non-cash items, which do not involve an actual cash flow. Consequently, to ensure that these non-cash items do not influence my measure of investment, I introduce an adjustment term in the definition of Inv_t as follows:

$$Inv_t := (Assets_t - Assets_{t-1}) - (Cash_t - Cash_{t-1}) + Adjustment_t, \tag{2}$$

where the *Adjustment* term is the result of adding and subtracting several components, including depreciation, gains on disposals, changes in the fair value of assets, changes in provisions, variations in the stocks of final goods or raw materials, and the proceeds of tasks performed by the company for assets.

I also lack direct measures of Div_t and $Equity\ issuance_t$. Only a measure of end-of-year equity ($Equity_t$) is observed every year t. The change in equity between years $t-1$ and t then reflects the joint effects of equity issuance, distribution of dividends, and retained earnings during year t. I construct a measure of net dividends for each year t ($Net\ Div_t$), which captures the difference between Div_t and $Equity\ issuance_t$, as the difference between Profit or Loss for the year ($P\&L_t$) and the change in equity ($\Delta Equity_t$):

$$Net\ Div_t := P\&L_t - \Delta Equity_t. \tag{3}$$

The rationale for this definition is as follows: If the profit or loss for the year is different from the change in equity in a period, then the difference must have been distributed to (if positive) or covered by (if negative) shareholders. With this definition, it is helpful to rewrite the identity (4) as a *cash flow identity* where the cash flow of year t equals the sum of its alternative (net) uses at the same year:

$$CF_t = \Delta Cash_t + Inv_t - \Delta Debt_t + Net\ div_t. \tag{4}$$

3 The data

3.1 Sample selection

My sample consists of balance sheet and income statements data of firms appearing in the *Central de Balances Integrada* (CBI) dataset at any point between 2003 and 2019. The CBI contains information on the quasi-universe of Spanish firms, providing an accurate representation of the Spanish economic structure. Following common practice, I focus on for-profit, not government-owned corporations that do not belong to the financial industry, industries heavily influenced by the state (Education, Health, and International organizations), or industries where firms are a minority with respect to self-employed households.

I also apply a variety of filters that exclude observations without valid and consistent information for the variables used in the analysis. After applying these filters, I keep firms for which I have at least 5 observations where all variables are well-defined. The final sample consists of 2,919,644 firm-year observations from 341,562 unique firms. A detailed explanation of the cleaning steps can be found in Appendix A.

3.2 Summary statistics of key variables

Table 1 reports summary statistics for the cash flow variable, the variables that were used to construct it, and other firm-level variables of interest for the rest of the analysis. The definition of each variable is presented in Table A1. To ease the interpretation of the summary statistics, all the variables are expressed as ratios to the average value of assets of each firm unless otherwise specified.

The numbers in Table 1 indicate that on average, every year, firms save cash by 0.89%, invest 3.58%, and distribute net dividends by -0.01%. This is financed using the internally generated cash flow, which amounts to 4.33%, and by increasing debt by 0.12%. The cash flow variable and its uses display significant variation in the sample.

The variable *Residual* measures the residual of the identity (4). The statistics associated with this variable show that the identity (4) holds very well in the data, although not perfectly. Small errors may exist because, as indicated in Appendix A, small discrepancies between the left- and right-hand sides of equation (4) may survive the cleaning process.

4 The average allocation of cash flow by Spanish firms

4.1 Empirical specification

My empirical analysis follows the approach of Chang et al. (2014). The baseline estimations rely on equation (4) and consist of regressing the different uses of cash ($\Delta Cash$, *Inv*, -$\Delta Debt$, and *Net Div*) on cash flow (*CF*), control variables (X), and firm (f) and year (λ) fixed effects. The regression equations are as follows:

$$\Delta Cash_{it} = \beta_1 CF_{it} + \gamma_1 X_{i,t-1} + f_{1,i} + \lambda_{1,t} + \epsilon_{1,it} \tag{5}$$
$$Inv_{it} = \beta_2 CF_{it} + \gamma_2 X_{i,t-1} + f_{2,i} + \lambda_{2,t} + \epsilon_{2,it} \tag{6}$$
$$-\Delta Debt_{it} = \beta_3 CF_{it} + \gamma_3 X_{i,t-1} + f_{3,i} + \lambda_{3,t} + \epsilon_{3,it} \tag{7}$$
$$Net\ Div_{it} = \beta_4 CF_{it} + \gamma_4 X_{i,t-1} + f_{4,i} + \lambda_{4,t} + \epsilon_{4,it} \tag{8}$$

As control variables, I incorporate lagged values of cash holdings (*Cash*), capital (*Capital*), leverage (*Debt*), the logarithm of Assets (*Ln(Assets)*), the annual growth rate of sales (*Sales growth*), and a measure of asset tangibility (*Tangibility*). The inclusion of *Sales growth* as a control variable serves as a proxy for Tobin's Q, which cannot be directly utilized in this analysis due to the majority of firms not being publicly listed. All variables, except *Ln(Assets)* and *Sales growth*, are divided by the average assets of the firm. The allocation of cash flow is characterized by the coefficients $\{\beta_k\}_{k=1}^4$ in equations (5)-(8). It follows from the cash flow identity (4) that the coefficients in equations (5)-(8) have to satisfy the following conditions:

$$\beta_1 + \beta_2 + \beta_3 + \beta_4 = 1, \tag{9}$$

TABLE 1. Summary statistics of key variables.

Panel A: Components of cash flow, cash flow, and its uses.

Variable	Mean	Sd	Percentiles				
			5	25	50	75	95
Sales	1.1435	1.05	0.05	0.32	0.91	1.64	3.17
Inputs	0.7604	0.82	0.02	0.16	0.53	1.07	2.37
Personnel costs	0.3232	0.39	0	0.06	0.21	0.43	1.08
Net financial revenue	-0.0091	0.01	-0.04	-0.01	-4e-3	0	0.01
Corporate taxes	0.0075	0.02	-0.02	0	3e-3	0.01	0.04
CF	0.0433	0.11	-0.12	0.01	0.04	0.09	0.21
Δ*Debt*	0.0012	0.16	-0.24	-0.06	-0.01	0.06	0.27
Δ*Cash*	0.0089	0.10	-0.15	-0.02	1e-3	0.04	0.18
Inv	0.0358	0.17	-0.20	-0.03	0.01	0.09	0.32
Net Div	-0.0001	0.06	-0.02	-4e-18	0	1e-5	0.04
Residual	-9e-8	7e-5	-9e-5	-1e-5	0	1e-5	9e-5

Panel B: Other variables

Variable	Mean	Sd	Percentiles				
			5	25	50	75	95
P&L	0.0141	0.09	-0.13	-2e-3	0.01	0.05	0.14
Δ*Equity*	0.0143	0.10	-0.13	-0.01	0.01	0.04	0.15
Cash	0.1753	0.22	1e-3	0.02	0.09	0.25	0.64
Other assets	0.8247	0.29	0.31	0.65	0.85	1.00	1.26
Account receivables	0.2173	0.23	4e-4	0.04	0.15	0.33	0.67
Δ*Account receivables*	0.0032	0.12	-0.17	-0.03	3e-4	0.03	0.17
Current assets	0.5560	0.35	0.04	0.26	0.55	0.81	1.13
Non-current assets	0.4440	0.33	0.02	0.15	0.38	0.70	1.00
Current liabilities	0.4149	0.41	0.01	0.14	0.33	0.58	1.07
Non-current liabilities	0.1913	0.28	0	0	0.07	0.29	0.75
Account payables	0.3548	0.41	0.01	0.10	0.25	0.49	1.02
Δ*Account payables*	0.0028	0.14	-0.20	-0.04	6e-4	0.04	0.21
Debt	0.6062	0.46	0.04	0.28	0.55	0.84	1.31
Equity	0.3919	0.45	-0.17	0.16	0.39	0.67	0.99
Employees	0.0136	0.02	0	2e-3	0.01	0.02	0.05
Ln(Assets)	-0.6412	1.40	-2.72	-1.58	-0.73	0.18	1.70
Tangibility	0.3886	0.32	0.01	0.11	0.31	0.63	0.97
Sales growth	-0.0117	0.34	-0.49	-0.11	0.01	0.12	0.41
Age	16	9	5	10	15	21	32

Note: Variables are defined in Table A1. All the variables are measured as ratios to the average value of the assets of each firm *(Assets)*, except for *Ln(Assets)*, *Sales growth*, and *Age* which are the logarithm of *Assets*, the one-year log difference of *Sales*, and the difference between the reporting year and the year of incorporation, respectively.

$$\gamma_1 + \gamma_2 + \gamma_3 + \gamma_4 = \mathbf{0}, \tag{10}$$

$$f_{1,i} + f_{2,i} + f_{3,i} + f_{4,i} = 0 \quad \forall i, \text{ and} \tag{11}$$

$$\lambda_{1,t} + \lambda_{2,t} + \lambda_{3,t} + \lambda_{4,t} = 0 \quad \forall t. \tag{12}$$

Condition (9) implies that any change in cash flow has to be used to increase cash savings, invest, repay debt, or distribute dividends. In turn, condition (10) means that the total response of the uses of cash flow to a change in any control variable other than cash flow adds up to zero. To build intuition on this, imagine that an increase in a covariate different from cash flow is correlated with higher values of investment, debt repayment, and distribution of dividends. It follows that a lower value of cash savings is needed to satisfy the identity (4). A similar intuition applies to conditions (11) and (12).

Equations (5)-(8) can be estimated simultaneously using seemingly unrelated regressions (SUR), imposing explicitly the conditions (9)-(12). However, Greene (2012) shows that SUR estimates are equivalent to equation-by-equation ordinary least squares (OLS) estimates if the same set of explanatory variables is included in each equation. As a consequence, as long as the identity (4) holds in the data, the conditions (9)-(12) automatically hold without the need to impose them explicitly. Then, I estimate equations (5)-(8) separately by OLS without imposing the conditions (9)-(12).

4.2 Baseline results

Table 2 reports the baseline results of estimating equations (5)-(8). The coefficients of interest are those associated with *CF*, which measure *cash flow sensitivities*. These coefficients represent what portion of an additional unit of cash flow is dedicated, on average, to the corresponding use.

Table 2 documents positive cash flow sensitivities for every use of cash flow. More concretely, at the margin, an additional euro of cash flow is followed by average increases of 29 cents in cash savings, 44 cents in investment, 23 cents in debt repayment, and 4 cents in net dividends. Note that the sum of the cash flow sensitivities equals one, which means that the condition (9) holds despite not imposing it explicitly in the estimation procedure. Additionally, Table 2 shows that the sum of the coefficients associated with the control variables adds up to zero, as stated in conditions (10).

Table 3 shows the variance decomposition of equations (5)-(8). This Table shows that the cash flow variable explains a sizable portion of the variation in the outcomes (ranging from 9 to 27 percent of the explained variation), although the firm fixed effects are the single most important determinant. Also, Figure 1 shows the evolution of the time fixed effects of equations (5)-(8). The main aggregate trends that are captured by the year fixed effects are two: First, an increase in cash savings during the entire sample period. Second, an increase in investment which is accompanied by an increase in indebtedness in the years leading to the global financial crisis.

In section 6.4 I explore the asymmetries between the allocation of positive and negative realizations on cash flow.

TABLE 2. The allocation of cash flow across competing uses.

	Dependent variable:			
	$\Delta Cash$	Inv	$-\Delta Debt$	$Net\ Div$
	(1)	(2)	(3)	(4)
$CF_{i,t}$	0.29***	0.44***	0.23***	0.04***
	(1.3e-3)	(2.1e-3)	(2.3e-3)	(7e-4)
$Cash_{i,t-1}$	-0.36***	0.29***	0.06***	0.01***
	(1.3e-3)	(1.4e-3)	(1.3e-3)	(4e-4)
$Capital_{i,t-1}$	-0.06***	0.09***	-0.03***	-2.9e-3***
	(6e-4)	(1.3e-3)	(1.2e-3)	(4e-4)
$Debt_{i,t-1}$	-0.06***	-0.10***	0.20***	-0.05***
	(6e-4)	(1.0e-3)	(1.5e-3)	(4e-4)
$Ln(Assets)_{i,t-1}$	0.07***	-0.12***	0.02***	0.03***
	(6e-4)	(1.1e-3)	(1.2e-3)	(3e-4)
$Sales\ growth_{i,t-1}$	-1.2e-3***	-4.3e-3***	4.1e-3***	1.4e-3***
	(2e-4)	(3e-4)	(3e-4)	(1.4e-3)
$Tangibility_{i,t-1}$	-1.73e-9	3.89e-8**	-4.66e-8***	9.45e-9***
	(2.98e-9)	(1.52e-8)	(1.53e-8)	(2.8e-9)
Fixed-effects				
Firm	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Observations	2,919,644	2,919,644	2,919,644	2,919,644
R^2	0.279	0.273	0.248	0.261

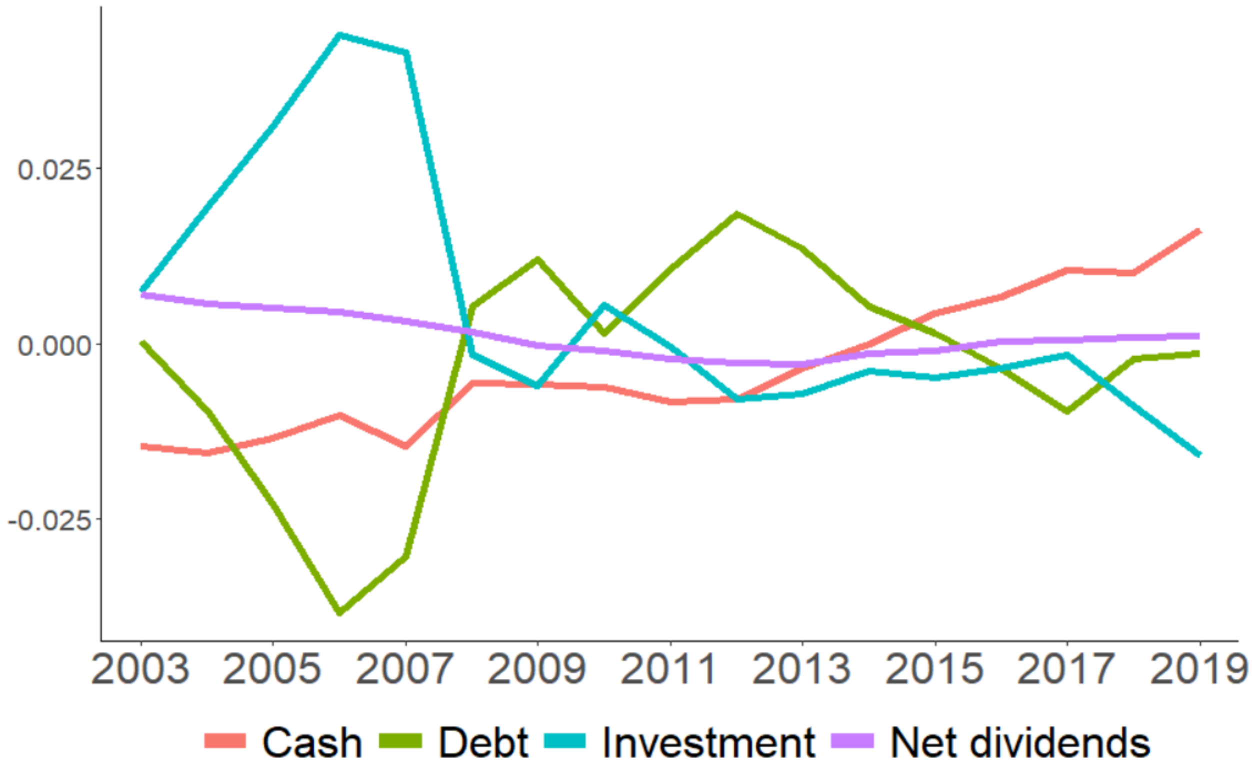
This Table reports the results of estimating equations (5) - (8). All variables are defined as in Table A1. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively. The standard errors are presented in parentheses.

5 The effects of financial frictions

5.1 Proxying for financial frictions

To assess the impact of financial frictions on the allocation of cash flow, it is necessary to quantify the level of financial frictions experienced by firms. However, since this variable

FIGURE 1. Year fixed effects in the allocation of cash flow, 2003-2019.



This Figure plots the value of the year fixed effects in equations (5) - (8). The solid line connects the estimated fixed effects for each year.

TABLE 3. Decomposition of variance between the cash flow variable, the controls taken as a whole, firm fixed effects, and year fixed effects.

	Dependent variable:			
	$\Delta Cash$	*Inv*	$-\Delta Debt$	*Net Div*
Variable	(1)	(2)	(3)	(4)
CF	0.19	0.27	0.11	0.09
Controls	0.14	0.03	0.13	0.07
Firm FE	0.65	0.68	0.74	0.83
Year FE	0.02	0.02	0.02	0.01
R^2	0.29	0.29	0.26	0.27

The numbers associated with each variable indicate what portion of the explained sum of squares is attributed to the corresponding variable.

is not directly observable, researchers often resort to using observable firm characteristics to construct an index that serves as a proxy for the potential relevance of financial frictions to affect firms' behavior. These indexes are designed in a manner where higher values indicate tighter financial frictions, for instance borrowing limits that are more likely to bind, wider interest rate spreads, or financing conditions that more quickly deteriorate with funding needs.

Among the available indexes, I use the *Size-Age* (*SA*) index proposed by Hadlock and Pierce (2010):

$$SA_{it} = -0.737 * Size + 0.043 * Size^2 - 0.04 * Age, \tag{13}$$

where *Size* is the logarithm of Assets, which are measured in millions of inflation-adjusted year 2004 dollars following the authors. To develop this index, Hadlock and Pierce (2010) first used qualitative information to categorize firms' financial constraint status. Then, they estimated a set of ordered logit models in which a firm's categorized level of constraints was modeled as a function of various quantitative factors that the literature identifies as indicators of constraints. The *SA* index was the best-performing model in terms of predictive power among the ones that they assessed.

Hadlock and Pierce (2010) also cast doubts on the validity and convenience of using other popular indexes such as the ones proposed by Kaplan and Zingales (1997) and Whited and Wu (2006), and they make a compelling case that size and age are prominent predictors of the severity of financial frictions. Additionally, an index based on size and age offers the advantage of relying on variables that are arguably more pre-determined than other characteristics used in the construction of other indexes, such as leverage or dividend distribution.

However, using the *SA* index to proxy financial frictions is subject to two potential shortcomings: First, for large enough values of *Size*, the index turns increasing (rather than decreasing) in *Size*. Concretely, the point beyond which the quadratic relationship in *Size* is increasing lies approximately at 8.56. Second, Hadlock and Pierce (2010) constructed their index using COMPUSTAT data for the years 1971-2004 and it is fair to wonder whether this indicator remains valid for a sample of Spanish firms covering the years 2003-2019. I address these two shortcomings as follows.

Table 4 and Figure 2 address the first concern. Table 4 shows summary statistics of *Size* and *Age* in my sample. The first row shows that the maximum value of *Size* in my sample is 7.54, which is below the turning point at which the quadratic relationship in *Size* becomes increasing. Additionally, Figure 2 shows the density of observations by

Size and *Age*, as well as the binscatter plot of the unconditional mean of the *SA* index in bins that contains 5% of the observations each. This Figure confirms that the *SA* index is negatively related to *Size* and *Age*.[2]

Regarding the second potential shortcoming, I acknowledge that the ideal index of financial frictions to perform my tests should be constructed using data that is representative of Spanish firms during the period comprised in this article. Unfortunately, there is no qualitative data on financial frictions to replicate the analysis of Hadlock and Pierce (2010) using my sample. For this reason, I borrow the index from Hadlock and Pierce (2010) and I perform a robustness test to ensure the validity of the *SA* index as a measure of financial frictions. Additionally, using the index proposed by Hadlock and Pierce (2010) enhances the comparability of my results with those obtained by previous papers in the literature.

The data in Table 4 shows that in my sample firms are, on average, smaller in terms of *Size* but similar in terms of *Age* to the firms in the sample used by Hadlock and Pierce (2010) to construct the *SA* index. To alleviate potential concerns originated by these dissimilarities, I explore how the *SA* index relates to various firm-level characteristics that are considered to be related to financial frictions by the literature. Table 5 reports the results of regressions of such characteristics, which are listed by row, on the *SA* index and sector and year fixed effects. Column (1) of Table 5 shows that the results obtained using the entire sample period, while the results in columns (2) to (4) of Table 5 explore the stability of the coefficients in column (1) across different subsamples of the data.

The findings presented in Table 5 support the validity of the *SA* index as a measure of potential financial frictions. The coefficients in Column (1) demonstrate that the *SA* index is negatively correlated with cash flow, real investment, dividend distribution, and sales growth. Conversely, it is positively correlated with cash holdings and leverage. [3]

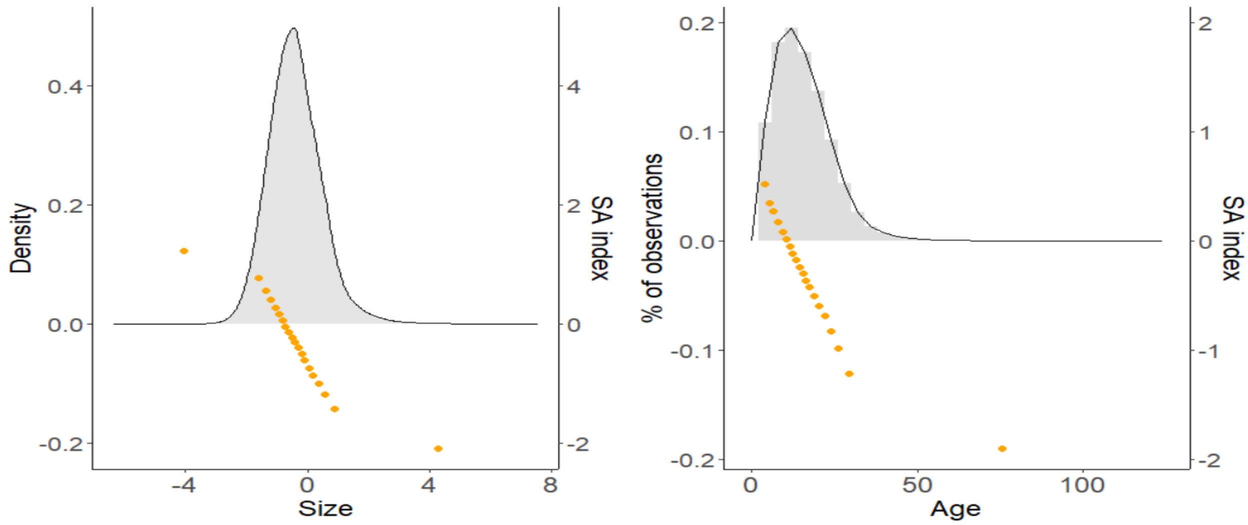
One plausible interpretation of these results is that firms with higher values of the *SA* index are more likely to be distressed firms facing limited profitability and investment opportunities, and having already exhausted their external funding sources. Consequently, these firms are more inclined to reduce their investment activities and dividend distribution.[4]

[2]Figure 2 highlights the existence of outlier observations in terms of *Size* and *Age*. In unreported results, I verify that the findings in this article are robust to trimming the sample at the 99.9% percentile of *Age*, which corresponds to 74 years, and at the 0.1% and 99.9% percentiles of *Size*, which correspond to -2.48 and 2.52.

[3]In unreported results, I replicate this analysis using the index proposed by Whited and Wu (2006) and I find qualitatively similar results.

[4]Table B2 in the appendix reports the average allocation of cash flow by public firms and the impact of financial frictions on such an allocation. The results in Panel B show that, among these firms, higher values

FIGURE 2. Distribution of observations and binscatter plot of the *SA* index by *Size* and *Age*.



This Figure plots the distribution of the firm-year observations by *Size* (left graph) and *Age* (right graph). Additionally, the orange dots in each graph depict the average *SA* index in a bin containing exactly 5% of the observations.

TABLE 4. Summary statistics of the financial frictions index (*SA* index) and its components.

				Percentiles						
		Mean	**Sd**	**0**	**5**	**25**	**50**	**75**	**95**	**1**
	SA	-0.31	0.85	-7.03	-1.76	-0.82	-0.25	0.26	0.99	5.91
Own sample	***Size***	-0.41	0.89	-6.36	-1.74	-1	-0.46	0.11	1.07	7.54
	Age	16	9	3	5	10	15	21	32	119
Hadlock & Pierce (2010)	***Size***	6.77	-		-	-	5.11	-	-	
	Age	15	-		-	-	9	-	-	

This Table reports summary statistics of the *SA* index, as well as of the *Size* and *Age* variables in my sample and in the sample used by Hadlock and Pierce (2010) to construct the *SA* index. *Age* is defined as specified in Table A1. The variable *Size* is computed as the natural logarithm of the firms' assets, denoted in millions of inflation-adjusted year 2004 dollars. This adjustment ensures that the measurement unit of the *Size* variable is similar to the one employed by Hadlock and Pierce (2010). The statistics associated with the sample in Hadlock and Pierce (2010) come from Columns (2) and (5) of Table 2 in their article.

TABLE 5. Relationship between the financial frictions index (*SA* index) and firm characteristics.

	Explanatory variable: $SA_{i,t}$			
	Sample period:			
	2003-2019	2003-2007	2008-2012	2013-2019
Dependent variable	(1)	(2)	(3)	(4)
$Sales\ growth_{i,t}$	-0.005***	-0.001**	-0.006***	-0.006***
	(2e-4)	(4e-4)	(5e-4)	(3e-4)
$Real\ investment_{i,t}$	-0.003***	3e-4	-0.002***	-0.004***
	(1e-4)	(2e-4)	(2e-4)	(2e-4)
$Cash\ flow_{i,t}$	-0.003***	0.003***	-0.008***	-0.003***
	(2e-4)	(2e-4)	(3e-4)	(2e-4)
$Dividend\ payer_{i,t}$	-0.056***	-0.056***	-0.054***	-0.056***
	(5e-4)	(9e-4)	(8e-4)	(6e-4)
$Cash_{i,t}$	0.004**	0.007***	0.002***	0.004***
	(4e-4)	(5e-4)	(5e-4)	(5e-4)
$Debt_{i,t}$	0.083***	0.037***	0.082***	0.105***
	(1.0e-3)	(1.1e-4)	(1.3e-4)	(1.4e-4)

This Table reports the OLS coefficients of SA_{it} in regressions where the dependent variables are listed by row. All variables are defined in Table A1. The regressions also include year and 4 digits industry fixed effect. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively. The standard errors are presented in parentheses.

5.2 Empirical specification and results

To estimate the effects of financial frictions on the allocation of marginal cash flow, I extend the baseline specification with the interaction of the cash flow variable and the *SA* index:

$$y_{it} = \beta_{y,1}CF_{it} + \beta_{y,2}SA_{it} + \beta_{y,3}CF_{it} \times SA_{it} + \gamma_y X_{i,t-1} + f_{y,i} + \lambda_{y,t} + \epsilon_{y,it}, \tag{14}$$

where y_{it} is any of the outcome variables in (5)-(8). The main coefficient of interest is $\beta_{y,3}$, which measures how the cash flow sensitivity of y changes with changes in the *SA* index.

The results of estimating specification (14) are presented in Table 6. The coefficients associated with $CF_t \times SA_{it}$ indicate that higher values of the *SA* index are, on average, associated with an increase in the cash flow sensitivity of debt repayment at the expense of a reduction in the cash flow sensitivity of the rest of the uses.[5] More concretely, a unit

of financial frictions are associated with an increase in the cash flow sensitivity of investment, and with a lower cash flow sensitivity of dividends.

[5] In unreported results, I replicate this analysis using the index proposed by Whited and Wu (2006) and I find qualitatively similar results.

increase in the *SA* index (whose standard deviation is 0.85) is associated with an average increase of 6 cents in the share of a marginal unit of cash flow allocated towards debt repayment and average decreases of 2 cents, 3 cents, and 1 cent in the shares allocated to cash savings, investment, and net dividends, respectively.[6]

These results are consistent with theories that emphasize the value that firms attribute to financial flexibility, which takes the form of unused debt capacity in this case. Along these lines, one interpretation of my results is that firms characterized by higher values of the *SA* index tend to increase their allocation of marginal cash flow towards debt repayment to preserve financial flexibility to fund future investment opportunities (Dasgupta and Sengupta, 2007). Also, these results are in line with the predictions of the model in DeAngelo et al. (2011), which emphasizes that firms' ex-ante financial policies aim to preserve the ability to access the capital markets ex-post in the event of unexpected earnings shortfalls or investment opportunities.

TABLE 6. The impact of financial frictions on the allocation of cash flow.

	Dependent variable:			
	$\Delta Cash_{i,t}$	$Inv_{i,t}$	$-\Delta Debt_{i,t}$	*Net Div*
	(1)	(2)	(3)	(4)
$CF_{i,t}$	0.24***	0.33***	0.38***	0.05***
	(0.001)	(0.002)	(0.002)	(0.001)
$SA_{i,t}$	-0.23***	-0.54***	0.75***	0.02***
	(0.001)	(0.002)	(0.002)	(4e-4)
$CF_{i,t} \times SA_{i,t}$	-0.02***	-0.03***	0.06***	-0.01***
	(0.001)	(0.002)	(0.003)	(0.001)
Fixed-effects				
Firm	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Observations	2,919,644	2,919,644	2,919,644	2,919,644
R^2	0.332	0.389	0.506	0.255

This Table reports the results of estimating specification (14) for each use of cash flow. All variables are defined in Table A1. The specifications include the same controls as in equations (5) - (8) except for *Ln(Assets)*, which has been converted to a discrete variable indicating that *Ln(Assets)* is in the bottom (top) half of its distribution when it equals 0 (1). For brevity, the results related to the controls are omitted from the Table. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively. The standard errors are presented in parentheses.

[6] Table B1 in the Appendix replicates the results presented in Table 6 using the index proposed by Whited and Wu (2006). Although there are differences in the magnitudes of the estimated coefficients, the qualitative results are similar.

5.3 Interaction with state variables

The previous subsection shows that higher values of the *SA* index are, on average, associated with an increase in the allocation of marginal cash flow toward debt repayment. This subsection explores if such insight can be generalized to the population of firms or if, alternatively, the effects of changes in the *SA* index on the allocation of marginal cash flow are contingent upon the specific economic and financial situation of each firm.

I explore heterogeneity across a list of variables that are typically treated as state variables in structural dynamic models of firms' behavior (e.g., Gao, Whited, and Zhang, 2021): leverage (*Debt*), cash holdings (*Cash*), capital stock (*Capital*), and availability of investment opportunities (*Sales growth*).

Using each of the above variables at a time, I divide the sample into deciles according to the distribution of the corresponding variable. Then, I estimate specification (14) for each subsample separately and I compare the coefficient associated to $CF_{it} \times SA_{it}$ across subsamples.[7]

The results are presented in Figure 3. The Figure is divided into four panels, one for each state variable that is used to split the sample. In turn, each panel contains four columns, one for each use of cash flow. By comparing the estimated coefficients across subsamples (within a panel) one obtains insights on how the effects of changes in the *SA* index on the allocation of marginal cash flow differ across firms with different values of the chosen state variable.

I highlight the following results: First, looking at the heterogeneity across *Debt* (Panel A) we observe that changes in the *SA* index have either small or insignificant effects on the cash flow sensitivities across the first 7 deciles of the distribution of *Debt*. However, higher values of the *SA* index are correlated with a significantly smaller (larger) cash flow sensitivity of investment (debt repayment) in the last three deciles of the distribution of *Debt*.

Second, looking at Panel B we observe that the impact of changes in the *SA* index on the cash flow sensitivities of investment and debt repayment is larger among firms in the lowest deciles of the distribution of *Cash*. In contrast, among firms in the highest deciles of the distribution of *Cash*, the cash flow sensitivities of investment and debt repayment are not significantly affected by changes in the *SA* index.

Third, looking at Panel C we observe that the cash flow sensitivity of investment does not react to changes in the *SA* index for firms in the first 8 deciles of the distribution of *Capital*. For these firms, changes in the *SA* index are correlated with a decrease (increase)

[7] In these specifications, the variable that is used to split the sample is not included in the list of controls.

in the cash flow sensitivities of cash savings and net dividends (debt repayment). However, for firms in the last two deciles of the distribution of *Capital*, the cash flow sensitivity of investment also decreases with the *SA* index.

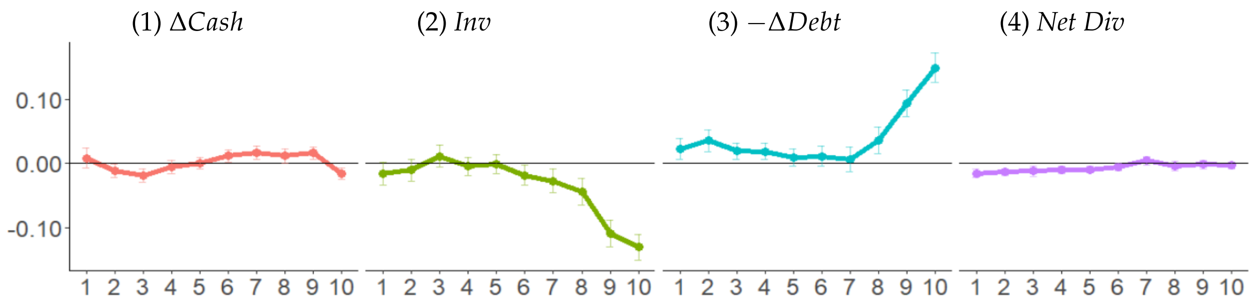
Finally, it is harder to observe a clear pattern when looking at the heterogeneity across *Sales growth* (Panel D). One aspect to highlight is that, among firms in the last deciles of the distribution of *Sales growth*, higher values of the *SA* index are correlated with decreases in the cash flow sensitivity of investment and cash savings, and by increases in the cash flow sensitivity of debt repayment.

The discussion of the results shed light on a potential way to reconcile the apparently conflicting findings of the literature. One prominent example of the debates that have been sustained in the literature is the **contradiction** between the results of Almeida et al. (2004, 2021) and Riddick and Whited (2009). On one hand, Almeida et al. (2004, 2021) show that more financially constrained firms display a larger cash flow sensitivity of cash. They claim that this is evidence of an optimal cash savings policy to balance the profitability of current and future investments. On the other hand, Riddick and Whited (2009) shows that more financially constrained firms display a lower (and even negative) cash flow sensitivity of cash. They argue that this is observed because firms lower cash reserves to invest after receiving positive cash-flow shocks, and vice versa.

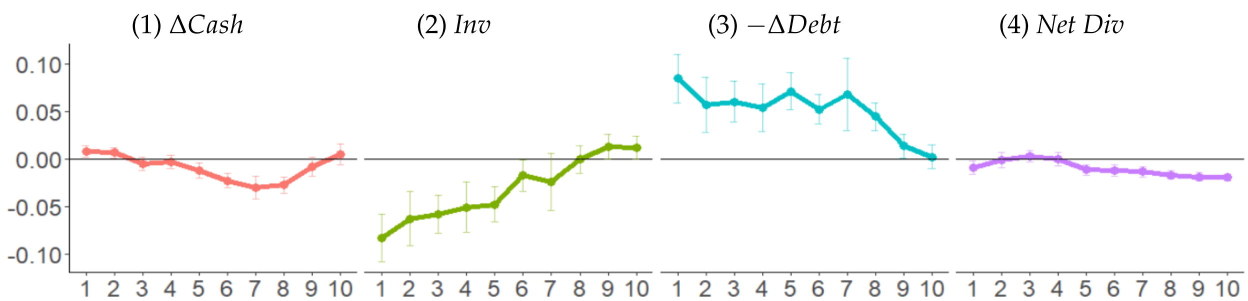
Figure 3 shows that firms will behave in one or another of the ways predicted by Almeida et al. (2004, 2021) and Riddick and Whited (2009) depending on their specific economic and financial situation. For instance, the results in Panel B show that firms in the lowest deciles of the distribution of *Cash* display a larger cash flow sensitivity of cash, which is consistent with the predictions of Almeida et al. (2004, 2021). However, firms in the highest deciles of the distribution of *Cash* display a lower (or null) cash flow sensitivity of cash, which is consistent with the predictions of Riddick and Whited (2009).

FIGURE 3. The impact of financial frictions on the allocation of cash flow. Heterogeneous effects across variables describing the economic and financial situation of firms.

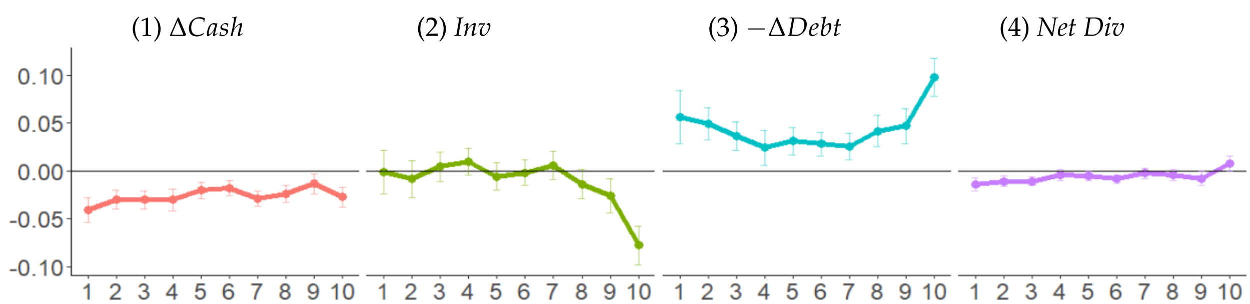
Panel A: Sample split using deciles of *Debt*.



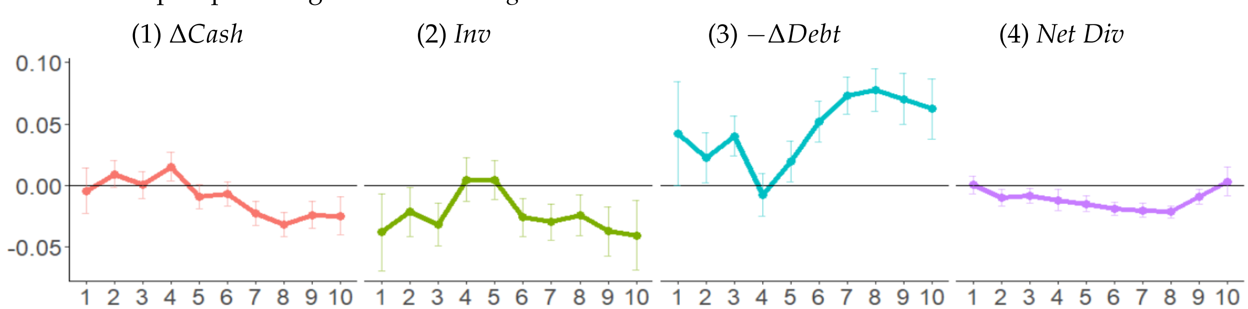
Panel B: Sample split using deciles of *Cash*.



Panel C: Sample split using deciles of *Capital*.



Panel D: Sample split using deciles of *Sales growth*.



This Figure explores the existence of heterogeneity in the effects of financial frictions on the allocation of cash flow across a list of variables: leverage (*Debt*), cash holdings (*Cash*), capital stock (*Capital*), and availability of investment opportunities (*Sales growth*). Using each of these variables at a time, I divide the sample into deciles according to the distribution of the corresponding variable. Then, I estimate specification (14) for each subsample separately and report the coefficients associated with $CF_{it} \times SA_{it}$. In these specifications, the variable that is used to split the sample is not included in the list of controls. The Figure is divided into four panels, one for each state variable that is used to split the sample. In turn, each panel contains four columns, one for each use of cash flow. All variables are defined as in Table A1. The bars centered around each coefficient represent 95% confidence intervals.

6 Additional analysis

6.1 Persistent and transitory components of cash flow

This subsection further characterizes the allocation of cash flow by extending the specifications in equations (5) - (8). In this analysis, the cash flow variable is replaced with its persistent and transitory components, which are obtained by applying the Hodrick-Prescott filter to the unscaled cash flow variable and by dividing the resulting cycle and trend components by average assets. This exercise seeks to explore whether firms allocate these different components of cash flow in distinct ways. Concretely, the specifications that are estimated are the following:

$$y_{it} = \beta_{y,1} Transitory_{it} + \beta_{y,2} Persistent_{it} + \gamma_y X_{i,t-1} + f_{y,i} + \lambda_{y,t} + \epsilon_{y,it}, \tag{15}$$

where the coefficients $\beta_{y,1}$ and $\beta_{y,2}$ measure what portion of an additional unit of the transitory and persistent components are allocated to the use y_{it}. $X_{i,t-1}$ includes the same controls used in equations (5) - (8).

The results are shown in Table 7. First, Table 7 shows that a constraint equivalent to (9) holds for both the transitory and persistent components of cash flow. Second, notice that the estimates of $\beta_{y,1}$ in the first row of Table 7 are close to the cash flow sensitivities presented in Table 2. Third, when comparing the coefficients that characterize the marginal allocation of the transitory and persistent components we observe that a larger proportion of an additional unit of the persistent component is devoted to investment, compared to how an additional unit of the transitory component is allocated. This finding is in line with existing evidence (for instance, Chang et al. (2014) and Byun et al. (2019) find similar results) and it is consistent with the conjecture that the persistent component of cash flow contains more information about the future profitability of the firms than the transitory component. In unreported results, I replicated this analysis using a balanced panel of observations, and the results remained qualitatively similar.

6.2 Disagregation of investment

The variable *Inv* that is used in the baseline characterization of the allocation of cash flow can be disgregated into three separate components: real investment (*Real investment*), financial investment (*Financial investment*), and provision of trade credit to customers (Δ *Account receivables*). In this subsection, I study how much of the cash flow sensitivity of investment (*Inv*) can be attributed to each of its components.

TABLE 7. The allocation of the transitory and persistent components of cash flow.

	Dependent variable:			
	ΔCash	*Inv*	-ΔDebt	*Net Div*
	(1)	(2)	(3)	(4)
$Transitory_{i,t}$	0.27***	0.43***	0.27***	0.04***
	(0.002)	(0.003)	(0.003)	(8e-4)
$Persistent_{i,t}$	0.31***	0.45***	0.18***	0.06***
	(0.002)	(0.003)	(0.004)	(0.001)
Fixed-effects				
Firm	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Observations	2,919,644	2,919,644	2,919,644	2,919,644
R^2	0.278	0.274	0.247	0.261

This Table reports the results of estimating the specification (15) for each use of cash flow. The *Transitory* and *Persistent* variables are obtained by applying the Hodrick-Prescott filter to the unscaled cash flow variable and by dividing the resulting cycle and trend components by average assets. The specifications include the same controls as in equations (5) - (8) but, for brevity, the results related to the controls are omitted from the Table. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively. The standard errors are presented in parentheses.

I reproduce the baseline estimation presented in Table 2 but decompose the *Inv* variable into its three components. The results are shown in Table 8, where we observe that in response to a unit increase in cash flow, real investment increases by 23 cents, financial investment by 1 cent, and trade credit provision by 19 cents. The sum of these three coefficients is equal to the cash flow sensitivity of investment (*Inv*) in Table 2.

These results underscore that almost all of the cash flow sensitivity of investment is attributable to the cash flow sensitivities of real investment and trade credit provision. The forthcoming evidence in the following subsection further illuminates the potential reasons behind firms allocating such a substantial share of their cash flow to trade credit provision. One plausible interpretation is that firms utilize trade credit provision as a temporary allocation of their cash flow, which is subsequently redirected towards other uses in the future.

6.3 Allowing for richer dynamics in the allocation of cash flow

Firms may decide to stage their investment after a change in cash flows. For instance, a firm that receives a large inflow of unexpected income may react by saving it first and using it for investment in subsequent periods. To examine the presence of such delays in investment decisions, I expand upon the specifications outlined in equations (5)-(8) by

TABLE 8. The allocation of cash flow across the three components of investment (*Inv*): real investment, financial investment, and provision of trade credit to customers.

	Dependent variable:		
	Real investment	*Financial investment*	*Δ Account receivables*
	(1)	(2)	(3)
CF_t	0.23^{***}	0.01^{***}	0.19^{***}
	(1.6e-4)	(4e-4)	(1.5e-4)
$Cash_{t-1}$	0.07^{***}	0.04^{***}	0.19^{***}
	(9e-4)	(4e-4)	(1.0e-4)
$Capital_{t-1}$	-0.10^{***}	0.02^{***}	0.16^{***}
	(1.0e-4)	(4e-4)	(9e-4)
$Debt_{t-1}$	-0.06^{***}	1e-4	-0.04^{***}
	(7e-4)	(2e-4)	(6e-4)
$Ln(Assets)_{t-1}$	0.03^{***}	-0.02^{***}	0.13^{***}
	(7e-4)	(3e-4)	(8e-4)
$Sales\ growth_{t-1}$	0.01^{***}	$8e\text{-}4^{***}$	-0.01^{***}
	(2e-4)	(9.67e-5)	(2e-4)
$Tangibility_{t-1}$	$3.42e\text{-}8^{**}$	3.82e-9	9.08e-10
	(1.13e-8)	(2.88e-9)	(2.78e-9)
Fixed-effects			
Firm	Yes	Yes	Yes
Year	Yes	Yes	Yes
Observations	2,919,644	2,919,644	2,919,644
R^2	0.252	0.11	40.165

This Table reports the results of estimating a specification similar to equation (6) where the outcome variables are the three components of investment (*Inv*): real investment, financial investment, and provision of trade credit to customers. All variables are defined as in Table A1. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively. The standard errors are presented in parentheses.

incorporating two lags of the cash flow variable.

The outcomes of this analysis are detailed in Table 9. When focusing on the coefficients of the *Real investment* regression, it becomes clear that while there is a significant relationship between contemporaneous *Real investment* and the lagged components of cash flow, this relationship is relatively modest in magnitude compared to the contemporaneous relationship between *Real investment* and *CF*. As a result, it is fair to say that while there exists some evidence of delays in the allocation of cash flow towards real investment, the bulk of the cash flow sensitivity of real investment is contemporaneous.

The results in column (4) uncover another interesting pattern. The firms exhibit a large contemporaneous cash flow sensitivity of trade credit provision, allocating 22 cents out of an additional euro of cash flow to this purpose. However, what makes this pattern particularly interesting is that firms seem to reallocate part of these funds in subsequent periods, particularly towards debt repayment and real investment. The analysis presented in Chang et al. (2014) also reveals a similar pattern, although their findings suggest that firms employ cash holdings, rather than trade credit provision, as a temporary allocation of cash flow that is subsequently utilized to boost investment in the future. [8]

6.4 Asymmetries across positive and negative cash flow

I explore the existence of asymmetric reactions to positive and negative changes in cash flow by extending the specifications in equations (5)-(8) with a dummy variable $NEG_{i,t}$ that equals 1 when the cash flow is negative, and with the interaction of this dummy and the cash flow variable.

To begin with, Table B3 in the Appendix presents summary statistics about the $NEG_{i,t}$ variable, and about negative $(CF_{i,t} \times NEG_{i,t})$ and positive $(CF_{i,t} \times (1 - NEG_{i,t}))$ realizations of cash flow separately. We observe that the averages of negative and positive cash flow are similar in absolute value, and the dispersion of negative and positive cash flow is also similar. However, the first line of Table B3 highlights that the positive realizations of cash flow are much more frequent than the negative ones.

Next, Table 10 presents the results of extending the baseline allocation by adding the $NEG_{i,t}$ variable and its interaction with the cash flow variable. The coefficients in the first

[8] In unreported results, I explore an extension of the analysis presented in Table 9 where I interacte the cash flow variable and its lags with the *SA* index. Among other interesting results, I find that the relationship between *Real investment* and the lagged components of cash flow is higher the higher the *SA* index. This is consistent with the discussion of the results in Section 5.2, where I argued that one potential interpretation of my results is that firms characterized by higher values of the *SA* index tend to increase their allocation of marginal cash flow towards debt repayment to preserve financial flexibility to fund future investment opportunities.

TABLE 9. Dynamic effects in the allocation of cash flow across competing uses.

	Dependent variable:					
	ΔCash	*Real investment*	*Financial investment*	*Δ Account receivables*	*-ΔDebt*	*Net Div*
	(1)	(2)	(3)	(4)	(5)	(6)
CF_t	0.29***	0.23***	0.01***	0.22***	0.22***	0.04***
	(0.001)	(0.002)	(4e-4)	(0.002)	(0.002)	(7e-4)
CF_{t-1}	5e-5	0.03***	2.8e-3***	-0.11***	0.07***	0.01***
	(0.001)	(0.001)	(4e-4)	(0.001)	(0.002)	(6e-4)
CF_{t-2}	0.02***	0.01***	1e-4	-0.03***	4.6e-3***	-3.8e-3***
	(0.001)	(0.001)	(4e-4)	(0.001)	(0.002)	(6e-4)
Fixed-effects						
Firm	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,919,644	2,919,644	2,919,644	2,919,644	2,919,644	2,919,644
R^2	0.279	0.252	0.114	0.171	0.249	0.261

This Table reports the results of estimating an extension of the specifications in equations (5) - (8) where I include two lags of the cash flow variable. All variables are defined as in Table A1. The specifications include the same controls as in equations (5) - (8) but, for brevity, the results related to the controls are omitted from the Table. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively. The standard errors are presented in parentheses.

line are cash flow sensitivities when the marginal unit of cash flow is positive, and the coefficients in the third line measure how the cash flow sensitivities differ when the cash flow is negative instead of positive.

The results indicate that the cash flow sensitivity of *Net Div* is 4 cents regardless of the sign of the cash flow, which means that *Net Div* is adjusted symmetrically for positive and negative cash flow realizations. Turning the attention to the cash flow sensitivity of cash, the results indicate that an additional unit of positive cash flow is followed by an average increase of 45 cents in cash savings, while an additional unit of negative cash flow is followed by an average decrease of 10 (45 - 35) cents in cash savings. Similarly, an additional unit of positive cash flow is followed by an average increase of 49 cents in investment, while an additional unit of negative cash flow is followed by an average decrease of 39 (49 - 10) cents in investment. Finally, we observe that the cash flow sensitivity of debt repayment is only 2 cents when the cash flow is positive, while it is 47 (2 + 45) cents when the cash flow is negative.

In summary, the main uses to which a marginal unit of positive cash flow is allocated are cash savings (45 cents) and investment (49 cents), while the main sources that firms use to accommodate an additional unit of negative cash flow are increases in debt (47 cents) and reductions in investment (39 cents).

TABLE 10. Allowing for asymmetry in the allocation of positive and negative cash flow across competing uses.

	Dependent variable:			
	$\Delta Cash$	Inv	$-\Delta Debt$	$Net\ Div$
	(1)	(2)	(3)	(4)
$CF_{i,t}$	0.45^{***}	0.49^{***}	0.02^{***}	0.04^{***}
	(0.002)	(0.003)	(0.003)	(9e-4)
$NEG_{i,t}$	-4e-4	$1.7e\text{-}3^{***}$	$-2.0e\text{-}3^{**}$	$1e\text{-}3^{***}$
	(2e-4)	(4e-4)	(5e-4)	(2e-4)
$CF_{i,t} \times NEG_{i,t}$	-0.35^{***}	-0.10^{***}	0.45^{***}	-2e-4
	(0.003)	(0.005)	(0.005)	(0.002)
Fixed-effects				
Firm	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Observations	2,919,644	2,919,644	2,919,644	2,919,644
R^2	0.289	0.274	0.255	0.261

This Table reports the results of estimating an extension of the specifications in equations (5) - (8) where I interact the cash flow variable with the indicator $NEG_{i,t}$. All variables are defined as in Table A1, except for the $NEG_{i,t}$ dummy, which is equal to 1 when the cash flow variable is negative. The specifications include the same controls as in equations (5) - (8) but, for brevity, the results related to the controls are omitted from the Table. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively. The standard errors are presented in parentheses.

7 Conclusion

This paper examines the impact of financial frictions on the allocation of cash flow by Spanish non-financial corporations. My findings suggest that larger financial frictions, as proxied by the *Size-Age* (*SA*) index proposed by Hadlock and Pierce (2010), are associated, on average, with a higher proportion of cash flow allocated to debt repayment and lower proportions allocated to cash savings, investment, and dividend distribution. Importantly, the analysis highlights that the effect of the proxy for financial frictions on the allocation of cash flow varies significantly with variables capturing the economic and financial situation of each firm.

The empirical analysis is built on a cash flow identity (which is derived from a uses and sources of funds identity) that equates cash flow to the sum of all its alternative uses. The empirical analysis uses administrative data from a comprehensive sample of Spanish non-financial corporations over the period from 2003 to 2019. By regressing the different uses of cash flow on cash flow itself, control variables, and firm and year fixed effects, I obtain empirical estimates of cash flow sensitivities, which quantify the marginal allocation of cash flow to each use.

The baseline characterization of the allocation of cash flow indicates that an additional euro of cash flow is associated, on average, with increases in cash savings, investment, debt repayment, and dividend distribution. Next, I extend the analysis to explore how changes in the proxy for financial frictions affect the allocation of cash flow. I find that higher values of the proxy for financial frictions are associated, on average, with a higher cash flow sensitivity of debt repayment and lower cash flow sensitivities of cash savings, investment, and dividend distribution. Furthermore, I document that the effect of the proxy for financial frictions on the allocation of cash flow varies significantly with pre-determined variables that characterize the economic and financial situation of each firm, such as leverage, cash holdings, capital, and the availability of investment opportunities.

The results discussed in this article are relevant for three main reasons. First, they contribute to the understanding of the relationship between financial frictions and the allocation of cash flow. The results suggest that the effects of financial frictions on cash flow allocation are contingent upon the specific economic and financial situation of each firm (as captured by standard pre-determined state variables). Uncontrolled-for variability in those and other relevant state variables across samples might explain the apparently conflicting findings of the literature that has tried to establish if and how financial constraints affect the allocation of cash flow with reduced form methodologies. Second, they also highlight the value that more structural approaches (able to simultaneously account for the dynamics of the relevant state variables) may have in this field. A structural model can provide precise predictions on the sign and magnitude of the cash flow sensitivities contingent on the state of the firm. Such predictions can be validated with the empirical methodology proposed in this paper. Finally, the findings bear direct relevance to policymakers. The analysis of heterogeneous effects of financial frictions offers valuable insights to enhance the precision of policies, such as direct transfers or subsidized credit guarantees, targeting specific firms for purposes such as promoting investment. These results contribute to anticipating the response of certain firms when provided with additional cash flow (in the case of a direct transfer) or increased borrowing capacity (in the case of a subsidized credit guarantee).

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Appendix A: Data Appendix

This appendix outlines the steps undertaken in the cleaning process of the *Central de Balances Integrada* (CBI) dataset. These steps were executed to yield the sample of observations that form the basis of analysis in this study. The definitions of the variables mentioned below can be found in Table A1.

The CBI contains the balance sheet and profit and loss account of Spanish corporations since 1995. Following Almunia et al. (2018), I exclude data from 1995 to 1999 because in these years the quality of the data was relatively poor and its coverage was limited. To prevent the events triggered by the pandemic from affecting my estimates, the data included in this study only extends until 2019.

Step 1. I delete observations that do not pass the quality tests applied by the provider, which are reflected in the variable *calidad* that takes a value of 1 if the observation passes the tests and 0 otherwise. The forms received from the companies are subject to a company-by-company filtering process to guarantee the quality and consistency of the information incorporated into the database. This implies that the raw data received by the managers of the CBI is not integrated into the database until it has passed numerous tests, both logical and arithmetical, which are aimed at guaranteeing internal and external consistency. The details of this filtering process can be found in the supplementary material that appends the annual publication of the main results in the CBI dataset by the Bank of Spain. This supplementary material is only available in Spanish (see, for example, *suplemento metodológico 2020*).

Step 2. Further to the quality controls applied by the data provider, I implement three filters to focus on private, for-profit, non-financial corporations. First, I use the first letter of the tax identifier (*cif*) to exclude entities that are arguably not-for-profit enterprises. Table A2 lists what type and how many observations were deleted in this step. Second, I use the *gsec09* variable, which represents the section codes of the National Classification of Economic Activities (CNAE-2009), to delete observations for firms belonging to the financial industry (K), the public administration (O), industries heavily influenced by the government (P, Q, U), or industries where firms are a minority compared to self-employed households (T). Table A3 provides details on what industries and how many observations were deleted in this step. Third, I use the *grup* variable, which is an identifier of government or non-government ownership of firms, to delete any remaining entities controlled by the government. Panel A of Table A4 provides details on how many observations were deleted in this step.

Step 3. I remove all observations corresponding to firms that report dubious informa-

TABLE A1. Definition of variables.

Panel A: Variables used to measure cash flow and its uses

Name	Definition
Sales	*Net turnover* (c200001) plus *Other operating income* (c200006).
Inputs	*Net purchases* (c200010) plus *Other operating costs*. (c200012).
Personnel Costs	*Personnel Costs* (c200025).
Operating income	*Sales - Inputs - Personnel Costs*.
Net Financial Revenue	*Net Financial Revenue* (c290042).
Corporate income taxes	*Corporate income taxes* (c200069).
Provisions	*Provisions* (c200177).
Assets	*Assets* (c200135).
Cash	*Cash and equivalents* (c200129) plus *Short-term financial investment* (c200128).
Adjustment	*Depreciation* (c200043) - *Gains on disposal* (c290059) - *Changes in fair value* (c290068) + Annual change in *Provisions* (c200177) - *Variation in stock of final goods* (c200003) - *Variation in stock of raw materials* (c200011) - *Tasks performed for asset* (c200005).
P&L	*Profit (loss) for the year* (c290070).
Equity	*Equity* (c200145).
Debt	*Non-current Liabilities* (c200158) plus *Current Liabilities* (c200180).
Residual	Difference between the left- and right-hand sides of identity (4).

Panel B: Other variables

Name	Variables definition
Year	Year associated with the information reported by the firm (any).
Year of incorporation	Year in which the firm was incorporated (anyconst).
Age	Year minus Year of incorporation.
Calidad	Indicator if the firm complies or not with quality standards (calidad).
Cif	Tax identification number associated with the firm (cif).
Gsec09	CNAE 2009 section code. It has a length of one alphanumeric position (gsec09).
grup	Identifier of government or non-government ownership of firms (grup).
Employees	Average number of employees (units) (c200084).
Output	Value of output (c200075).
Tangibility	*Tangible assets and Property* (c200098).
Capital	*Intangible assets* (c200089) plus *Tangibility* (c200098).
Sales growth	Annual change in log of *Sales*.
Current liabilities	*Current liabilities* (c200180).
Non-current liabilities	*Non-current liabilities* (c200158).
Long-term interest-bearing debt	*Long-term external funds* (c200151).
Short-term interest-bearing debt	*Short-term interest-bearing external funds* (c209166).
Account payables	*Short-term non-interest-bearing external funds* (c209179).
Account receivables	*Trade and other receivables* (c200121).
Financial investment	*Long-term financial investment* (c200103).
Real investment	*Inv* - Annual change in *Financial investment* - Annual change in *Account receivables*

This Table reports the variables in the CBI dataset that were used to construct the variables used in the empirical analysis. The names under the "Name" column refer to the names used in this paper, while the names and the codes under the "Definition" column refer to the names and the codes of the variables in the CBI dataset. The codes are reported in parentheses. In the empirical analysis, all the variables are measured as ratios to the average value of assets of each firm (*Assets*), except for *Ln(Assets)*, *Sales growth*, and *Age* which are measured as the logarithm of *Assets*, the one-year log difference of *Sales*, and the difference between the reporting year and the year of incorporation, respectively.

tion on their *Year of incorporation*. Specifically, I exclude firms that report a *Year of incorporation* that is either negative or greater than any of the years in which the firm reports data.

Step 4. I apply a set of filters to remove observations that involve apparent reporting inconsistencies or are likely to belong to inactive or insolvent firms. First, I delete observations with negative or zero *output*, *sales*, *assets*, or *capital*. Second, I delete observations where *cash* is negative or larger than *assets*. Third, I eliminate observations that exhibit negative values for either *personnel costs* or *inputs*. Fourth, I delete observations where *long-term interest-bearing debt* is negative or larger than *non-current liabilities*. Similarly, I delete observations where *short-term interest-bearing debt* or *account payables* is negative or larger than *current liabilities*. Fifth, I delete observations for which the sum of *equity*, *debt*, and *provisions* differs substantially from the value of assets. Concretely, I delete observations for which the ratio of the sum of equity, liabilities, and provisions to assets is larger (lower) than the percentile 99.9 (0.1) in the sample prior to this deletion. Additionally, I delete observations for which the ratio of the sum of the uses of cash flow to cash flow is larger (lower) than 1.01 (0.99). [9] Finally, I delete observations where the ratio of the right- to the left-hand side of the cash flow identity (4) is bigger (smaller) than 1.01 (0.99).

Step 5. I delete observations where any of the following variables take values smaller (larger) than the 0.01 (0.99) percentile of the corresponding variable in sample prior to this deletion: *Sales*, *Inputs*, *Personnel costs*, *Net financial revenue*, *Corporate income taxes*, *CF*, *Inv*, Δ *Debt*, Δ *Cash*, *Net Div*. This last step aims to eliminate any remaining outliers that could potentially result from measurement errors in the reported data.

Step 6. Finally, I exclude firms for which the clean sample contains less than 5 observations. Panel C of Table A4 summarizes how each of the cleaning steps mentioned above affects the number of observations in my dataset.

[9] The quality filter applied by the data provider admits arithmetic errors that are not substantial in magnitude. More details on this can be found in the supplementary material (*suplemento metodológico*). In the same spirit, I do not require the accounting identities to hold exactly in the data.

TABLE A2. Description of preserved and deleted observations based on tax identifiers.

	Code	Firm-year Observations	Description	Description in Spanish
Preserved entities	A	1,236,381	Corporation	*Sociedades anónimas*
	B	12,855,214	Limited liability company	*Sociedades de responsabilidad limitada*
	C	2,395	Business partnership	*Sociedades colectivas*
	D	1,242	Limited partnership	*Sociedades comanditarias*
	J	4,976	Civil society	*Sociedades civiles*
	U	1,758	Joint venture	*Uniones Temporales de Empresas*
	N	569	Foreign entity	*Entidades extranjeras*
	W	1,336	Branch entity	*Establecimientos permanentes de entidades no residentes en territorio español*
Deleted entities	E	966	Joint ownership, inheritance in abeyance, or other entity	*Comunidades de bienes, herencias yacentes y demás entidades carentes de personalidad jurídica no incluidas expresamente en otras claves*
	F	46,490	Cooperative society	*Sociedades cooperativas*
	G	14,070	Association	*Asociaciones*
	H	88	Residents' association under a horizontal property regime	*Comunidades de propietarios en régimen de propiedad horizontal*
	P	8	Local corporation	*Corporaciones Locales*
	Q	1,079	Public institution	*Organismos públicos*
	R	257	Religious institution	*Congregaciones e instituciones religiosas*
	S	13	State or Autonomous Community Institution	*Órganos de la Administración del Estado y de las Comunidades Autónomas*
	V	11,178	Other type undefined in another code	*Otros tipos no definidos en el resto de claves*
	Invalid	961	Observations having a cif with an invalid structure	

TABLE A3. Description of preserved and deleted industries.

	Code	Firm-year observations	Description
Preserved industries	A	351,080	Agriculture, livestock, forestry and fisheries
	B	32,676	Extractive industries
	C	1,454,500	Manufacturing industry
	D	217,694	Supply of electric energy, gas, steam and air conditioning
	E	37,238	Water supply, sanitation activities, waste management and decontamination
	F	2,390,059	Construction
	G	3,138,008	Wholesale and retail; repair of motor vehicles and motorcycles
	H	497,186	Transportation and storage
	I	821,142	Hospitality
	J	398,044	Information and communications
	L	1,443,679	Real estate activities
	M	1,465,585	Professional, scientific and technical activities
	N	562,090	Administrative activities and auxiliary services
	R	244,530	Artistic, recreational and entertainment activities
	S	256,332	Other services
Deleted industries	K	48,857	Financial and insurance activities
	O	0	Public administration and defense; compulsory social security
	P	206,896	Education
	Q	302,770	Health and social services activities
	T	0	Household activities as employers of domestic personnel; household activities as producers of goods and services for their own use
	U	0	Activities of extraterritorial organizations and organizations
	-	235,505	Missing data

TABLE A4. Selecting the final sample.

Panel A: Details on the number of observations deleted using the *grup* variable.

	Code	Firm-year observations	Description
Preserved firms	1	13,296,895	Private
Deleted firms	0	0	Not reported
	2	884	Government-owned (unclassified)
	3	1,922	Central government-owned
	4	1,992	Regional government-owned
	5	8,150	Local government-owned

Panel B: Details on the number of observations deleted in Step 4.

	Remaining firm-year Observations
4.1 Negative or zero *output*, *sales*, *assets*, or *capital*	9,792,111
4.2 Negative *cash* or *cash* larger than *assets*	9,595,479
4.3 Negative *personnel costs* or *inputs*	9,585,526
4.4 Discrepancies in liability structure	9,357,713
4.5 Discrepancies in main balance sheet components or cash flow identity	9,007,777

Panel C: Summary of cleaning steps.

Sequentially applied filters	Remaining firm-year observations
0. Initial sample	17,767,139
1. Preserving observations passing the quality filter (*calidad*)	14,178,981
2. Preserving for-profit firms	13,296,895
3. Deleting firms with dubious data on year of incorporation	12,378,693
4. Deleting observations with apparent reporting inconsistencies or likely belonging to inactive firms	9,007,777
5. Deleting outliers	7,952,533
6. Preserving firms with at least 5 observations in the clean sample	2,919,644

This Table contains details about the cleaning steps that are applied to the CBI dataset. Please, see the text of Appendix A for additional explanations.

Appendix B: Additional results

TABLE B1. The impact of financial frictions on the allocation of cash flow. Financial constraints using the index proposed by Whited and Wu (2006).

	Dependent variable:			
	$\Delta Cash_{i,t}$	$Inv_{i,t}$	$-\Delta Debt_{i,t}$	*Net Div*
	(1)	(2)	(3)	(4)
$CF_{i,t}$	0.29^{***}	0.42^{***}	0.26^{***}	0.03^{***}
	(2.5e-3)	(2.3e-3)	(3.5e-3)	(9e-4)
$WW_{i,t}$	-0.06^{***}	-0.12^{***}	0.28^{***}	-0.10^{***}
	(3.2e-3)	(4e-3)	(7.3e-3)	(2.5e-3)
$CF_{i,t} \times WW_{i,t}$	-0.18^{***}	-0.16^{***}	0.47^{***}	-0.13^{***}
	(0.05)	(0.01)	(0.05)	(0.01)
Fixed-effects				
Firm	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Observations	2,919,644	2,919,644	2,919,644	2,919,644
R^2	0.270	0.264	0.258	0.263

This Table reports the results of estimating specification (14) for each use of cash flow. *WW* is the index of financial frictions proposed by Whited and Wu (2006), which is computed as follows: -0.091 *CF/Assets* - 0.062 *{Net Div > 0}* + 0.021 * *Non-current liabilities/Assets* - 0.044 $Ln(Assets)_{1997}$ + 0.102 *isg* - 0.035 *sg*. $Ln(Assets)_{1997}$ is the log of *Assets* expressed in millions of 1997 dollars, *isg* is the annual change in the log of 3-digits industry sales, and *sg* is the annual change in the log of firm-level sales. All other variables are defined in Table A1. The specifications include the same controls as in equations (5) - (8) except for *Ln(Assets)*, which has been converted to a discrete variable indicating that *Ln(Assets)* is in the bottom (top) half of its distribution when it equals 0 (1). For brevity, the results related to the controls are omitted from the Table. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively. The standard errors are presented in parentheses.

TABLE B2. The allocation of cash flow across competing uses by public firms.

Panel A: Baseline allocation of cash flow

	Dependent variable:			
	ΔCash	*Inv*	*-ΔDebt*	*Net Div*
	(1)	(2)	(3)	(4)
$CF_{i,t}$	0.13**	0.40***	0.29**	0.18**
	(0.06)	(0.12)	(0.13)	(0.07)
$Cash_{i,t-1}$	-0.49***	0.54***	-0.09	0.04
	(0.09)	(0.09)	(0.09)	(0.03)
$Capital_{i,t-1}$	-0.02	0.04	-0.06	0.04
	(0.03)	(0.05)	(0.05)	(0.03)
$Debt_{i,t-1}$	-0.03	-0.23***	0.33***	-0.06**
	(0.03)	(0.06)	(0.06)	(0.03)
$Ln(Assets)_{i,t-1}$	0.03***	0.04**	-0.08***	0.01
	(0.01)	(0.02)	(0.02)	(0.02)
$Sales\ growth_{i,t-1}$	-7.7e-5	-0.01	2.3e-3	7.7e-3
	(0.01)	(0.02)	(0.02)	(0.01)
$Tangibility_{i,t-1}$	4.07e-8***	-1.88e-8	-2.85e-8	6.47e-9
	(1.34e-9)	(3.74e-8)	(4.18e-8)	(8.2e-9)
Fixed-effects				
Firm	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Observations	918	918	918	918
R^2	0.310	0.289	0.297	0.337

Panel B: Effects of financial frictions on the allocation of cash flow

	Dependent variable:			
	$\Delta Cash_{i,t}$	$Inv_{i,t}$	$-\Delta Debt_{i,t}$	*Net Div*
	(1)	(2)	(3)	(4)
$CF_{i,t}$	0.17	1.26***	-0.09	-0.34*
	(0.18)	(0.37)	(0.35)	(0.21)
$SA_{i,t}$	-0.14***	-0.46***	0.48**	0.12***
	(0.05)	(0.13)	(0.19)	(0.02)
$CF_{i,t} \times SA_{i,t}$	0.01	0.26**	-0.11	-0.16***
	(0.04)	(0.10)	(0.09)	(0.06)
Fixed-effects				
Firm	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Observations	918	918	918	918
R^2	0.329	0.386	0.392	0.364

This Table reports the results of estimating equations (5) - (8). The sample includes only public firms only. All variables are defined as in Table A1. ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively. The standard errors are presented in parentheses.

TABLE B3. Summary statistics of negative and positive cash flow.

Variable	**Mean**	**Sd**	**Percentiles**				
			5	**25**	**50**	**75**	**95**
$NEG_{i,t}$	0.2141	0.41	0	0	0	0	1
$CF_{i,t} \times (1 - NEG_{i,t})$	0.0793	0.07	0.01	0.03	0.06	0.11	0.23
$CF_{i,t} \times NEG_{i,t}$	-0.0885	0.11	-0.3	-0.12	-0.05	-0.02	0