

# Cash Accumulation by Non-Financial Corporations: New Evidence of the Role of Hedging Needs and Lower Financing Costs in France

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**Abstract** – In this paper, we study the sources of the accumulation of cash by non-financial corporations in France. We notably explore cost-based explanations by proposing a firm-specific measure of the cost of carrying cash that depends on both the firms' short-term financing costs and the share of interest-bearing assets among liquid financial assets. Our analysis suggests that at least one fourth of the rise in the cash ratios between 2011 and 2016 is explained by the decreasing trend in the cost of carrying cash. When factoring in the additional impact of macro-economic developments, our cost-based explanation accounts for up to 40% of the increase in cash holdings. We also identify a novel important determinant of the level of cash holdings: firms hold cash to seize future investment opportunities when they occur, irrespective of the financing conditions that will then prevail. Our results suggest that firms' cash hoarding to avoid foregone investment opportunities in downturns is an active economic stabilizer.

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JEL Classification: G31

Keyword: financing frictions, investment, cash savings, debt capacity

Reminder: The opinions and analyses in this article are those of the author(s) and do not necessarily reflect their institution's or Insee's views.

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*Acknowledgements* – We thank A. Duquerroy, D. Blanchet, S. Roux, O. Simon, G. Lalanne, T. Tressel, C. Rousset and two anonymous referees for very helpful comments. We are also grateful to all participants to ECB's Workshop "France: structural challenges and reform" and the internal Insee seminar (DEE). We remain responsible for errors and omissions.

Received in July 2019, accepted in February 2020.

Citation: Khder, M.-B. & Ray, S. (2020). Cash Accumulation by Non-Financial Corporations: New Evidence of the Role of Hedging Needs and Lower Financing Costs in France. *Economie et Statistique / Economics and Statistics*, 520-521, 103–124. <https://doi.org/10.24187/ecostat.2020.520d.2035>

The recent sharp increase in financial liquid assets held by non-financial corporations (hereafter NFCs) has received considerable attention among policy makers, bankers and researchers in the field of corporate finance. This trend, though observed across a wide range of countries, has mainly been studied in the US. In this paper, we present new evidence on the recent increase in the share of financial liquid assets, and especially of cash holdings, in firms' balance sheets based on French firm-level data and we explore the determinants of cash hoarding.

The increase in French firms' cash holdings has been concomitant with a sustained rise in corporate debt, raising questions regarding the role that cash buffers could play to mitigate the risks associated with rising corporate debt (Khder & Rousset, 2017). Firms' recent cash accumulation is then inherently related to the issue of financial stability, and should also be linked to the transmission of monetary policy. Large cash buffers are likely to introduce a wedge, at least over the short term, between the funding cost of new projects and the level of the interest rates, potentially hampering the transmission of monetary policy. Corporate cash holdings also significantly affect the dynamic structure of banks' liabilities. This illustrates some of the first order macroeconomic and macro-financial consequences of corporates' cash management decisions. Despite the relevance of these questions, the economic literature has arguably not fully explored the determinants of corporates' cash holding. This paper intends to contribute to fill this gap.

Several explanations have been proposed for this shift in corporate cash holding based on the trade-off between the costs and benefits of cash from the perspective of shareholder wealth maximization, and empirical evidence has been provided mainly for the United States. With respect to the benefits, Bates *et al.* (2009), Boileau & Moyen (2016) and Bates *et al.* (2018) suggest that the volatility of corporate cash flows has increased over time, exacerbating firms' hedging needs and fostering precautionary savings, thus making cash holdings all the more valuable. Opler *et al.* (1999), Bates *et al.* (2009), Falato *et al.* (2013), Brown & Petersen (2013), Begenau & Palazzo (2017) and Adler *et al.* (2019) find that the surge in research and development (R&D) expenditure and intangible assets alters firms' ability to access external funding because these assets are relatively less pledgeable, therefore increasing the benefits derived from holding liquid financial assets. On the other hand, Azar *et al.* (2016) argue that the cost of carrying cash has shrunk.

In this paper, we study the evolution of cash holding in France since 2010 and document stylised facts on the dynamics of the cash level of French NFCs. Using firm level data, we explore the respective roles of original measures of costs and benefits associated with cash holdings. We examine the cost-based explanation for rising cash holdings using a new firm-level measure of the opportunity cost of carrying cash (that relies on the differences in firms' external financing costs and in firms' returns on short-term assets). In addition, we identify the role of the timing of investment opportunities on cash accumulation. Some firms choose to hold cash to hedge against the risk of foregoing a profitable investment opportunity because of low cash flows or tightened access to external finance at the time the investment opportunity occurs. We explore this explanation with an original methodology relying on sectoral local heterogeneity of the impact of the business cycle on firms' bankruptcy. We conduct the analysis over the period 2010-2016 on a rich dataset of firms' financial accounts merged with information on the capital linkages between social entities enabling to study the relevant aggregates at the group level.

Our analysis shows that cost-based explanation is the key to understanding the recently observed cash hoarding behaviours, in line with Azar *et al.* (2016). We document a semi-elasticity of the cash-to-asset ratio to the cost of carry of roughly 1.02. The average cost of carry in our database has shifted from 3.9% in 2011<sup>1</sup> to 2.3% in 2016. With our estimates, we explain up to 40% of the recent dynamics of the ratio of cash holdings to total assets (hereafter cash-to-asset ratio or cash ratio) by merely considering the change in the cost of carry that results from the aggregate fall in the cost of short-term financing.<sup>2</sup> When controlling for macroeconomic developments, the additional decrease in the cost of carrying cash at the firm level explains one fourth of the increase in cash holdings. We also document the significant role on cash levels of the hedging need against foregone investment opportunities, suggesting that firms' cash hoarding to avoid foregone investment opportunities in downturns is an important economic stabilizer.

1. Data on the cost of carry are available only since 2011.

2. Alternatively, if we consider the estimate (of Table 5, column 7) where firm-level observations are weighted by total asset size in the regression, and compare the evolution in the weighted mean of the cost of carry and of the cash ratio, we find that cost-based explanation explain 32% of the increase in cash holdings over 2010-2016. Weighting by total asset size – which is the denominator of our cash ratio- ensures extrapolation of our micro-level estimates to account for macro-level trajectory.

The remaining of the paper is organised as follows. The next section reviews the literature. The following section presents the data and the main descriptive statistics on French firms' cash holding. We then expose our empirical strategy in Section 3 and the results and interpretation of regression analyses in Section 4, before concluding.

## 1. Literature Review

Corporate cash holdings result from a trade-off between the costs and benefits of cash, as largely corroborated by the existing empirical literature: management that maximizes shareholder wealth should choose the level of firm' cash holdings such that their marginal benefit equals their marginal cost.

Let's first consider the costs of holding cash. Holding cash is costly because the spread between the marginal cost of external financing and the return on deposits or short-term financial investment is usually positive. Recent contributions argue that cost-based explanations are crucial to understand observed trends in corporate cash holdings. Azar *et al.* (2016) find that variations in the cost of carry, that is the cost of financing a dollar of liquid assets, net of the benefits derived from short-term financial investments, explain much of the secular increase in cash holdings since 1980 in the US. They also provide evidence of the preponderance of the cost-based explanation to cash accumulation in the five largest European economies and in Japan, based this time exclusively on national accounts data. Another source of costs associated with cash holding is the twofold tax disadvantages (Opler *et al.*, 1999), the income derived from liquid assets is taxed first at the corporate level as it increases the corporate income tax base and then, as for other assets, when income is distributed to shareholders because of income tax. Besides, the deductibility of interest payment may be capped; hence, an additional euro of debt invested in financial liquid asset can increase the corporate income tax base even when financing costs exceed the financial profits. However, because of the stability of the marginal corporate income tax rate in France over the period studied, tax-related explanation is unlikely to account for the recent dynamics of corporate cash holdings.<sup>3</sup>

As for the benefits, cash buffers enable firms to protect themselves against adverse cash flow shocks that could force them to liquidate assets or raise external funding at unfavourable conditions (hedging need against illiquidity and

failure risk) and to finance investments regardless of the cost or the access to external financing (hedging need against foregone investment opportunities).<sup>4</sup> Indeed, as originally proposed by Keynes (1936), the main advantage of a liquid balance sheet is that it allows firms to undertake valuable projects when they arise irrespective of when external finance is cheap. Balance sheet liquidity is therefore all the more important that there exist frictions in the access to external financing. If a firm anticipates being financially constrained, its need to hedge against foregone investment opportunities is higher, as well as its optimal level of cash holding.

Linked to these two hedging motives, the literature emphasizes the impact of cash flow volatility on cash accumulation. Han & Qiu (2007) provide a theoretical foundation to this relationship when firms face financial constraints. Bates *et al.* (2009) or Boileau & Moyen (2016) identify the increase in cash flow volatility (Campbell *et al.*, 2001 and Dichev & Tang, 2008 document this stylised fact) as one of the main factors explaining US firms' cash accumulation in the years 2000. To investigate the hedging need against foregone investment opportunities, some studies explore the effect of the correlation between cash flows and investment opportunities on cash hoarding. Acharya *et al.* (2007) develop a model predicting that financially constrained firms with high hedging needs – against foregone opportunities – have a strong propensity to save cash out of cash flows. In contrast, constrained firms with low hedging needs systematically channel cash flows towards debt reduction, as opposed to cash savings. They find strong empirical support in that sense. A key challenge to identify this mechanism is to measure the correlation between cash flows and investment opportunities: the apparent correlation between a firm's cash flows and investment spending is not relevant because the two are endogenously related when the firm is financially constrained. Acharya *et al.* (2007) consider two alternative measures of investment opportunities based on industry-level proxies. Since expenditures in R&D track growth opportunities, they first look at the correlation between a firm's cash flow from current operations and

3. In the US, tax can also affect the level of cash because tax scheme may refrain multinational firms from repatriating cash from affiliates (Foley *et al.*, 2007) but such a channel arguably does not apply to France.

4. Opler *et al.* (1999) call the former channel the "transaction cost motive" and the latter the "precautionary motive", with reference to Keynes (1936). However, the meaning associated with these two terms has evolved in the literature. Therefore, we choose to refer henceforth to the former channel as "hedging need against illiquidity and failure risk" and to the latter as "hedging need against foregone investment opportunities".

its industry-level median R&D expenditures to proxy the correlation between the firm's availability of internal funds and its unconstrained demand for investment. Their second measure consists in the correlation between firm-level cash flow and industry-level market demand, the latter being computed as the median three-year ahead sales growth rate in the firm's industry. However, these measures are arguably affected by the same financial constraints that prevent from merely using the observed correlations between cash flow and investment. In this paper, we assess an alternative sectoral local proxy that aims at capturing the impact of the correlation between cash flows and investment opportunities on cash accumulation.

Other factors have been put forward in the literature to explain firms' level of cash and its recent trend, notably R&D expenditure and the share of intangible capital in presence of financial frictions<sup>5</sup> (Opler *et al.*, 1999; Bates *et al.*, 2009; Begenau & Palazzo, 2017, who document sample-selection effects resulting from a shift toward less profitable "R&D-firms" that typically initially exhibit higher cash ratios going public; Falato *et al.*, 2013 or Adler *et al.*, 2019) or information frictions (Jensen, 1986) – even if Opler *et al.* (1999), Bates *et al.* (2009), Kalcheva & Lins (2007) do not find significant evidence of the influence of principal-agent problem on cash hoarding.

## 2. Data and Descriptive Statistics on Cash and Liquidity Accumulation by French Corporations

### 2.1. Data Sources and Consolidation Method

We use administrative data provided by the French Statistical Institute (Insee) and covering the period 2010-2016. We work at the group level. Indeed, although they file stand-alone accounts, legal units are not necessarily autonomous in their economic decision-making process because of the numerous financial and customer-supplier and operational linkages they are involved in as parts of corporate groups. Consolidating the accounts of legal units is therefore necessary for the quality of the analysis. As shown in Picart (2003), productive activities and financial management activities are likely to be allocated to distinct legal units belonging to the same corporate group. Cash flows are often transferred from legal units involved in production to legal units incorporated for financial management purposes. Some assets, such as real estate, are also often borne by separate legal units with specific

legal status (*Sociétés Civiles Immobilières* for instance), which are in turn more likely to bear the related debt liabilities (Insee, 2019). The existence of intra-group cash transfers, as evidenced by Locorotondo *et al.* (2014), provides support to our assumption that corporate financial policy decisions, in particular regarding cash management, are made at group level, echoing previous research (Lamont, 1997). The level of consolidation matters because it substantially affects the usual financial ratios (Deroyon, 2015) and, as expected, the variation in cash ratios is much larger when computed at the legal unit level than after consolidation. This excess variability at the legal unit level reflects measurement errors due to intra-group reallocation rather than the decision to hoard cash made by groups on economic grounds in the face of variations in financing conditions, warranting consolidation. Finally, consolidation also fosters the comparability with international studies based on datasets such as ORBIS, Compustat (collecting consolidated accounts released by groups in annual reports).

Because our preferred statistical unit is the group, we consolidate financial statements from the "raw" database of legal units ESANE (*Élaboration des statistiques annuelles d'entreprise*). A group is a set of legal units linked by capital ownership, that are identified using the *Liaisons Financières* (LIFI) database, an administrative dataset providing information about the ownership and nationality of the parent company of firms located in France.<sup>6</sup> Based on the raw accounts of legal units, we create for each corporate group a new statistical observation, the "pseudo-group". For each group, the financial statement of the corresponding pseudo-group is calculated from those legal units belonging to the core of the group (i.e. owned at more than 50% by the parent company,<sup>7</sup> and therefore controlled by the group).<sup>8</sup> Our final database is

5. The idea that financially constrained firms have significantly lower payout ratios follows from Fazzari *et al.* (1988) and Fama & French (2002). Alternative approaches to distinguish groups of financially constrained and unconstrained firms merely rely on the firms' size, as in Erickson & Whited (2000). Fama & French (2002) and Frank & Goyal (2003) also associate firm size with the degree of external financing frictions. Other measures of financial constraints are based on credit rating, and notably on the fact of having a credit rating or not (e.g. Whited, 1992; Lemmon & Zender, 2001).

6. The survey is exhaustive on the set of firms that employ more than 500 employees, that generate more than 60 million euros in revenues or that hold more than 1.2 million euros of shares, but is completed by data coming from Bureau Van Dijk (Diane-Amadeus data set) to cover the whole universe of French business groups.

7. The parent company (*tête de groupe*) is the legal unit that owns the majority of other legal units without being in turn owned in majority by them.

8. In a previous version of the paper, the financial statement of a pseudo-group was computed from all the legal units constituting the group, pro rata to parent company's ownership rate in the legal unit. The main regression results were unchanged with this alternative consolidation methodology.

composed, unless otherwise stated, of three types of statistical units: (i) pseudo-groups based on consolidation restatements of core legal units, (ii) legal units related to business groups but not controlled by them, henceforth called legal units loosely related to groups and (iii) independent legal units, not belonging to any group. Legal units at the core of business groups are excluded from the final database once consolidated (to avoid double-counting with pseudo-groups). Our consolidation approach however suffers from some shortcomings: our automatic consolidation is less accurate than consolidation carried out by Insee, which is based on additional data and ongoing discussion with the accountants of larger groups (this does not extend yet to all firms). The coverage of the LIFI database varies over 2010-2016, introducing potential additional measurement errors. Our data on balance sheet items and profit and loss statements cover exclusively the French perimeter of groups, therefore leading to measurement errors for highly internationalized groups. Further details are provided in Appendix 1.

The raw financial data in ESANE come from the balance sheet information collected from firms' tax forms, which covers the universe of French legal units, excluding the financial and agricultural sectors as a rule. In this study, we focus on firms in the private sector and restrict the analysis to the normal tax regime (called BRN for *Bénéfice réel normal*) because it covers most of the total amount of liquid financial assets. Throughout the study, the sector is defined at the group level for pseudo-groups (based on LIFI

database which provides a group-level sector), and at the legal unit level for legal units that are independent or loosely related to business groups. Finally, the location of a consolidated pseudo-group is defined as the region where the largest number of legal units belonging to its core are located.

## 2.2. Examining the Sample

In this section, we present further evidence on the levels and dynamics of corporate cash holdings and financial liquid assets.

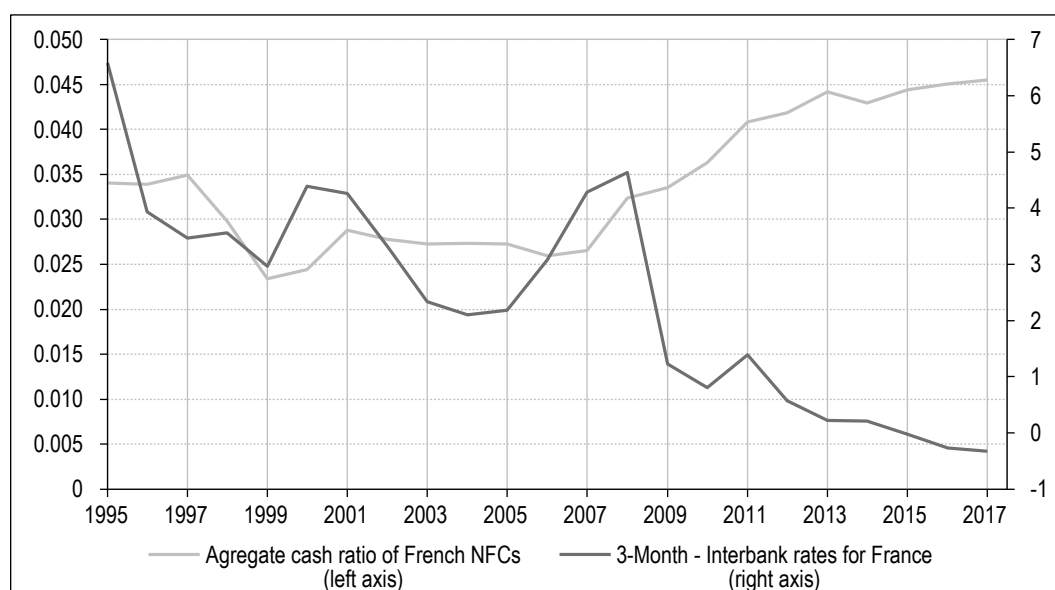
We observe a negative relationship over a longer period between the average cash-to-asset ratio of NFCs and the level of short-term interest rates as measured by the 3-month interbank rates for France<sup>9</sup> (Figure I). In both series, we notice a clear concomitant break, in opposite directions, since the financial crisis.

Analysis at group level allows to track the dynamics of the distribution of cash and financial liquid asset ratios. We observe upwards trends for most of the moments of these distribution, suggesting an overall rightward shift of the distribution (Figure II). Nevertheless, we notice a more pronounced growth of the third quartile suggesting an increase in the concentration of cash holdings. The median cash ratio increased by 3.6 percentage points (pp)<sup>10</sup> between 2010 and 2016 to reach 13.9% in 2016. The rise of

9. Data on NFCs cash in the national financial account are available from 1995 onwards.

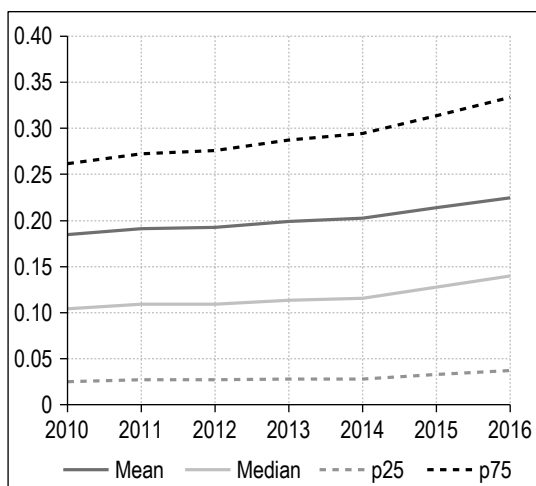
10. percentage of total asset.

Figure I – Aggregate cash to assets ratio and short-term interest rates in % – national accounts



Sources: Insee, Banque de France, Fed of Saint Louis

Figure II – Moments of the cash to assets ratios



Sources: Insee (Esane/LIFI); authors' calculations.

the median liquid financial asset ratio is less pronounced: only 1.5 pp over the studied period (see Figure A3-I in Appendix 3). Indeed, in the context of very low, or even negative, interest rates, the return on the non-cash interest-bearing financial liquid assets held by NFCs, both short-term debt securities and money market funds (MMFs), has declined. In this environment, firms substituted MMFs for cash; however, firms still have overall increased their holdings of financial liquid assets.

The upward trend is also pervasive across sectors (Figure III). The median levels of financial liquid asset ratios are nevertheless heterogeneous across activities, and the highest in sectors such as professional, scientific and technical services, information and communication and

other services. These sectors have also experienced the highest increase in their financial liquid asset ratio, in line with the results of the literature (e.g., Opler *et al.*, 1999; Bates *et al.*, 2009) linking cash holding to intangible assets and financial frictions.

Small firms (10 to 249 employees) and micro firms (less than 10 employees) tend to hold more cash as a percentage of total asset than larger firms (Figure IV). Size is a major determinant of financial liquid asset holdings. Both the relative position across size categories and the level of the ratios that we document are comparable to what Bates *et al.* (2009) evidenced in the US.

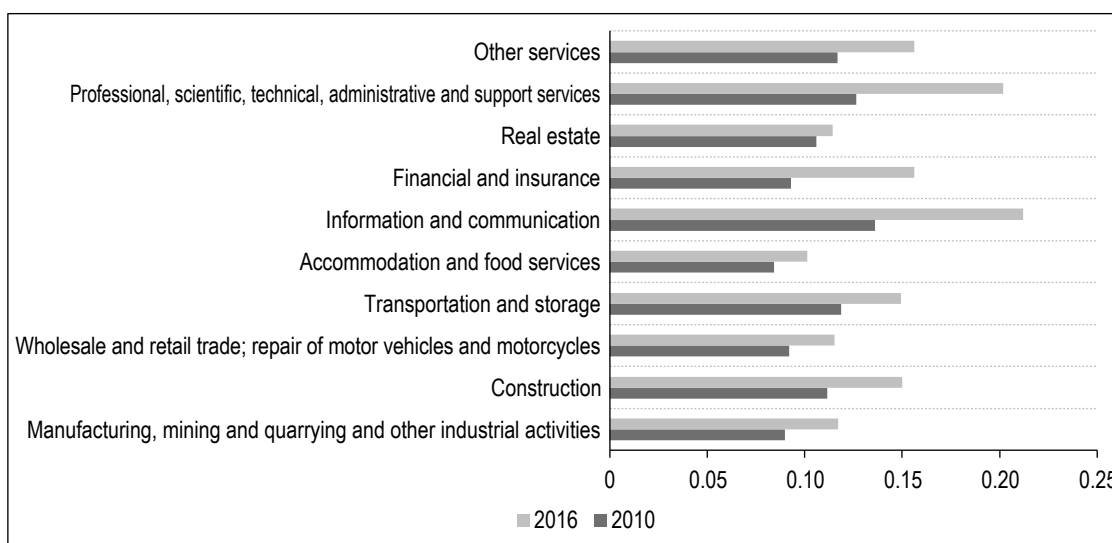
Alternatively, we use exclusively for this paragraph another sample including core legal units fully controlled by a group, but without consolidation restatements, legal units loosely related to a group and independent legal units. With this sample, the median levels of cash asset ratios in the three subsets tend to follow similar upward trends (Figure V); independent legal units exhibit much higher cash ratios than their peers belonging to a group.

### 3. Empirical Strategy

#### 3.1. The Cost of Carry at the Firm Level

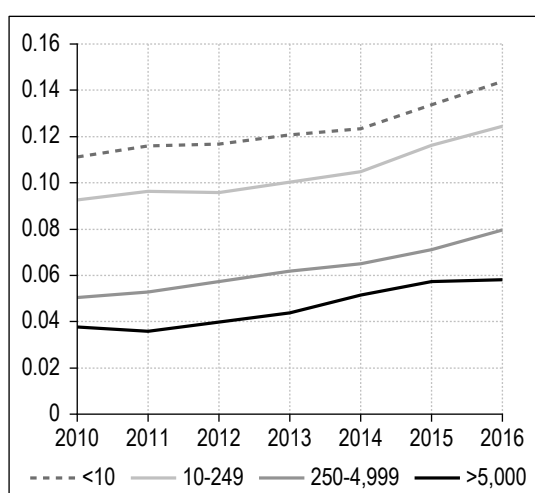
The cost of carrying cash and financial liquid assets corresponds to the difference between the cost of an extra euro of external funding and the return of this extra euro when it is held as liquid financial assets, part of it being deposited in cash accounts or invested in

Figure III – Median of the cash to assets ratios by industry



Sources: Insee (Esane/LIFI); authors' calculations.

Figure IV – Median of the cash to assets ratios by firms' size

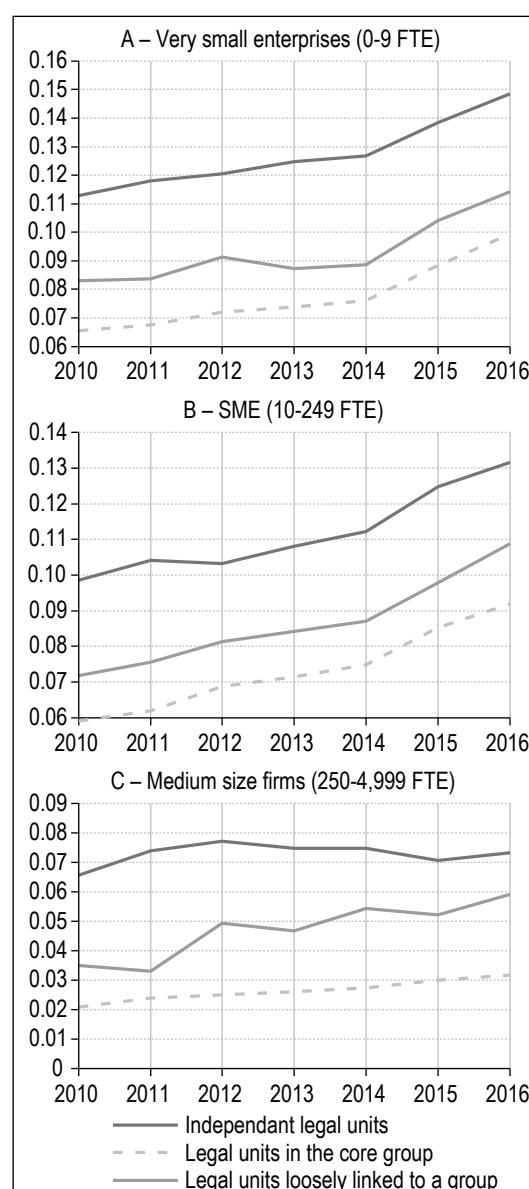


Note: <10 refers to firms (independent, loosely related to groups or after consolidation) with below 10 full time equivalent employees. Sources: Insee (Esane/LIFI); authors' calculations.

short-term interest-bearing financial assets. The cost of carrying cash varies across firms because, on the one hand, the cost of external financing depends on the firm's creditworthiness and, on the other hand, the return on liquid financial asset may differ according to the allocation between interest-bearing and non-interest-bearing assets. Azar *et al.* (2016) explore exclusively this second source of variation to derive a firm-specific cost of carry. With respect to the first source of variability of external financing across firms, they assume in their empirical analysis that the cost of external financing is equal to the 3-month T-Bill rate for all firms. Their assumption that "because cash is a risk-free investment, the cost of capital should correspond to the risk-free rate" does not hold since the cost of capital depends on the overall financial soundness of the firm, and consequently the perceived counterparty risk.

Unlike Azar *et al.* (2016), we exploit both sources of variation across firms of the cost of carry. We therefore introduce a novel proxy of the cost of external financing that a firm is likely to face based on the assessment of its credit risk. This proxy relies on moments of the cost of short-term debt reported by the Banque de France.<sup>11</sup> For each year, we assess the firms' creditworthiness<sup>12</sup> through the Altman Z''-score (Altman, 1983<sup>13</sup>) (see Appendix 1). Altman's Z''-score predicts the probability of business failure, which influences the cost at which a firm can raise additional debt. As exemplified by the 2019 Global Financial Stability Report published by the IMF, it is used, among other

Figure V – Median of the cash to assets ratios by size and status



Sources: Insee (Esane/LIFI), authors' calculations.

tools, by practitioners to gauge a firm's credit strength. We match firm observations and the

11. The moments of the distribution of the annual interest rates on new debt contract - i.e. p5, p25, p50, p75 - are computed by the Banque de France based on their database MContran.

12. We choose to impute a cost of short-term external financing based on credit worthiness rather than using the apparent cost of debt (defined as the ratio of interest payments to outstanding debt) because (i), credit constrained firms do not by definition report debt in the tax file: this would bias our sample towards non-financially constrained firms; (ii) the apparent cost of debt indicates the average price of one unit of debt, whereas we conceptually focus on the marginal cost of one extra unit of debt.

13. Altman's Z''-score (1983) consists of a linear combination of EBITDA/total assets, working capital requirements/total assets, accumulated retained earnings/total assets, and equity at historical cost/total assets. This score is designed to assess the probability of failures of private and publicly listed manufacturing and non-manufacturing companies, but was estimated in 1983 on a limited sample of companies. Nevertheless, Altman *et al.* (2017) rejects, on the basis of ORBIS dataset composed of roughly 2.7 million observations from European firms, the hypothesis of an obsolescence of the parameters estimated in Altman (1983)'s Z''-score in terms of classification performance.

annual cost of short-term debt by merging the percentile of the creditworthiness distribution and the percentile of the cost of debt.<sup>14</sup> With respect to the second source of firm-level variation in the cost of carry pertaining to the return on financial liquid assets, following Azar *et al.* (2016), we use the firm-level share of short-term interest-bearing securities in financial liquid assets in the first year of observation (to alleviate the endogeneity concerns linked to the cost of carry). We assume that short-term investment securities generate an annual return equal to the average annual performance of the money market funds, as published by the Banque de France. The firm-level formula of the cost of carry (CoC) then writes:

$$CoC_{it} = Cost\ of\ short\ term\ debt_{pcti,t} - share_{i,t_0} perfMMF_t \quad (1)$$

Moments of the distribution of firm-specific cost of carry are reported in Table 1. The cost of carrying cash sharply declined between 2011 and 2016, with the mean (the median) value of the CoC decreasing by 1.44 pp (respectively 1.26 pp).<sup>15</sup>

Using the Z''-score as a source of identifying variation in our regressions raises some endogeneity issues. For instance, investors could interpret high cash holdings as a sign of financial soundness, enabling the firm to contract new loans (reverse causality). The increase in leverage would be translated via the Z''-score into a lower decrease in the cost of external funding. This could bias downward (in absolute terms) our estimate of the elasticity of the cash ratio to the cost of carry. However, we first decide to include lagged values of the cost of carry, to mitigate as much as possible endogeneity concerns. Then, we use the percentiles of Z''-score, and not the Z''-score *per se*. This allows us to alleviate, though not totally discard, endogeneity concerns.

Alternatively, and as a robustness check, we use a cost of carry based exclusively on a firm-level measure of the cost of short-term debt. For this alternative indicator, we match firms with the moments of the distribution of the cost of short-term debt based on the SAFE score (Ferrando *et al.*, 2015) rather than the Z''-score.

The SAFE-score aims at measuring the extent of financial constraints faced by firms. It consists of the weighted sum of a firm's financial ratios.<sup>16</sup> The weights are estimated based on the financial constraints, as reported in the survey on the Access to Finance of Enterprises (SAFE) from the ECB, on a sample of micro, small, medium-sized and large European firms from 2010 to 2013. Our preferred measure remains the cost of carry based on the Z''-score, notably because the endogeneity concerns might be more acute for the SAFE-score due to the inclusion of cash-to-asset ratio in its definition.

### 3.2. A New Measure of the Correlation Between Cash Flows and Investment Opportunities

As mentioned in the literature review, theoretical contributions have highlighted that the correlation between cash flows and investment opportunities explains the accumulation of cash by firms, while underlining the difficulty to identify empirically this correlation due to endogeneity concerns (Acharya *et al.*, 2007). Investment opportunities may arise in a state of the world where a firm has low positive cash flows and is subsequently more likely to face financial constraints. In this case, the firm highly values cash holdings, because they would allow seizing an investment opportunity in the future despite low earnings or tightened access to external financing. Firms that are already constrained and not profitable in good times do not have the opportunity to hoard cash to seize future investment opportunities. However, firms whose financial situation is sound enough in good times, but which anticipate a tightening of their access to external financing in bad times, might hoard cash to hedge against foregone investment opportunities.

One key driver of a negative correlation between cash flows and investment opportunities results from assets or firms being sold at distressed

14. We choose not to control for the sector while ranking firm according to their percentile of creditworthiness. Indeed, a sector as a whole could be characterized as a below-average creditworthiness.

15. The weighted (by total asset) mean of the cost of carry decreases by 1.1 pp.

16. Namely the debt/total asset ratio, the paid interest/retained earnings ratio, the profit margin ratio, the tangible asset/total asset ratio, the cash holdings/total asset ratio, and the logarithm of total asset.

Table 1 – Moments of the distribution of the cost of carry

Cost of carry	Number of observations	Number of values	Mean	sd	q10	q25	Median	q75	q90
2011	578,061	138,949	3.86	1.58	2.16	2.75	3.43	4.42	6.65
2016	639,551	162,883	2.42	1.30	0.92	1.51	2.17	2.80	4.71

Sources: Insee (Esane/LIFI), Banque de France; authors' calculations.



prices due to fire sales. As suggested by Shleifer & Vishny (2011, p. 30), “a fire sale is essentially a forced sale of an asset at a dislocated price. The asset sale is forced in the sense that the seller cannot pay creditors without selling assets. The price is dislocated because the highest potential bidders are typically involved in a similar activity as the seller and are therefore themselves indebted and cannot borrow more to buy the asset. [...] Assets are then bought by non-specialists who, knowing that they have less expertise with the assets in question, are only willing to buy at valuations that are much lower.” The frequency and the magnitude of such an event vary across industries and, to some extent, when the relevant secondary market for assets is at least partially local. The intuition is the following: during slowdowns, pressure on firms to “fire sell” their assets, the most extreme pressure being business failure, increases. In sectors and regions where this pressure is the highest, the relative value of holding cash is the greatest, because firms that managed to accumulate enough can make the most of the more numerous fire sales of assets. We do not have proper direct measures of assets prices on the secondary market that would capture sectoral and local specificities with respect to fire sales. The effect of economic growth on the frequency of business defaults at the sector-region level provides a relevant proxy of the exposure to

investment opportunities at distressed prices. We then recover the sector-region elasticities of business failures to the economic cycle by estimating the following regression equation:

$$Default_{s,r,t} = \beta_{s,r} \Delta g_t + \alpha_{s,r} + \delta_t + \epsilon_{s,r,t} \quad (2)$$

where  $Default_{s,r,t}$  is the number of business failures<sup>17</sup> registered in sector  $s$ , region  $r$  and year  $t$  normalized by the number of firms operating<sup>18</sup> in sector  $s$ , region  $r$  at year  $t$ ,  $\beta_{s,r}$  captures the sector-region sensitivity of defaults to the economic cycle,  $\alpha_{s,r}$  are sector-region fixed effects capturing the average local sectoral level of default and  $\delta_t$  are year fixed effects. Estimation runs from 1994 to 2009.<sup>19</sup>  $\Delta g_t$  refers to GDP growth in year  $t$ . Sectors are broadly defined because of the structure of the data on defaults produced by the Banque de France (first level of the French classification of activities), and agriculture and non-profit sectors are excluded. Regions are the new French regions after the territorial reform of 2014. The coefficients of interest in equation (2) are the  $\beta_{s,r}$ , which correspond to the sector-region

17. Business failures at the sectoral local level are disseminated by the Banque de France based on the FIBEN data. The FIBEN database is truncated to the left (sales > 75 000 euros), the number of failures might therefore be underestimated.

18. The number of firms operating in each sector and each region over 1994-2009 is computed using Insee's SIRENE databases.

19. The  $\beta_{s,r}$  elasticities are estimated prior to the main regressions (which aim at explaining the level and dynamics of cash ratios) to mitigate endogeneity concerns.

Table 2 –  $\beta_{s,r}$  sectoral local elasticities of business failures to the economic cycle

Region/Sector	Manufacturing	Construction	Wholesale and retail trade	Transportation and storage	Accommodation and food service	Information and communication	Finance and insurance	Real estate	Administrative and support services	Other services	Mean	Sd.
Île-de-France	-1.33	-1.17	-1.06	-0.83	-1.09	-1.06	-1.37	-1.09	-0.94	-0.71	-1.1	0.2
Centre-Val de Loire	-0.98	-0.83	-0.78	-0.81	-0.88	-0.78	-2.04	-0.99	-0.68	-0.68	-0.9	0.4
Bourgogne Franche-Comté	-0.86	-0.80	-0.80	-0.71	-0.82	-0.78	-1.42	-0.80	-0.74	-0.62	-0.8	0.2
Normandie	-0.96	-1.05	-0.85	-0.81	-0.85	-0.61	-1.87	-1.02	-0.81	-0.67	-1.0	0.4
Hauts-de-France	-1.09	-0.98	-0.79	-0.75	-0.98	-0.79	-1.72	-0.79	-0.75	-0.65	-0.9	0.3
Grand Est	-0.93	-1.09	-0.85	-0.84	-0.80	-0.65	-2.13	-0.85	-0.93	-0.69	-1.0	0.4
Pays de la Loire	-0.88	-0.83	-0.88	-0.76	-0.81	-0.78	-1.38	-0.75	-0.75	-0.68	-0.8	0.2
Bretagne	-1.11	-0.73	-0.80	-0.75	-0.94	-0.99	-1.68	-0.79	-0.74	-0.71	-0.9	0.3
Nouvelle-Aquitaine	-0.93	-0.84	-0.84	-0.74	-0.98	-0.89	-1.52	-0.83	-0.74	-0.66	-0.9	0.2
Occitanie	-1.06	-0.96	-0.85	-0.68	-0.85	-0.96	-1.73	-0.84	-0.80	-0.67	-0.9	0.3
Auvergne Rhône-Alpes	-0.93	-0.93	-0.82	-0.68	-0.86	-0.73	-1.58	-0.95	-0.77	-0.67	-0.9	0.3
Provence Alpes Côte d'Azur	-1.12	-1.15	-0.89	-0.71	-0.98	-1.00	-1.95	-0.96	-0.88	-0.65	-1.0	0.4
Corse	-1.08	-1.35	-0.77	-0.81	-1.56	n.a.	0.45	-0.68	-0.24	-0.34	-0.7	0.6
Mean	-1.0	-1.0	-0.8	-0.8	-1.0	-0.8	-1.5	-0.9	-0.8	-0.6		
Sd.	0.1	0.2	0.1	0.1	0.2	0.1	0.6	0.1	0.2	0.1		

Sources: Insee (Esane/LIFI), Banque de France; authors' calculations.

elasticities of business failures to the economic cycle. The associated estimates vary widely across sectors and across regions. The most negative  $\beta_{s,r}$  are found for sectors such as financial and insurance services, construction, or manufacturing. Conversely, business failures in services appear less sensitive to the cycle. Our estimates also reveal some heterogeneity across regions within sectors. Table 2 reports the estimated value of  $\beta_{s,r}$ .

The sector-region elasticities of business failures to the cycle,  $\beta_{s,r}$ , might partially capture hedging needs against illiquidity and failure risk, in addition to the hedging needs against foregone investment opportunities that we would like to isolate. To purge as much as possible our elasticities of the illiquidity hedging needs, we introduce  $\alpha_{s,r}$  sector-region fixed effects (not interacted with GDP growth) in equation (2).<sup>20</sup> They are more likely to capture hedging needs against illiquidity and failure than the  $\beta_{s,r}$ . Indeed, we assume that firms assess their own probability of failure based on the average sectoral local number of business defaults (captured by the  $\alpha_{s,r}$ ) rather than on the sensitivity of business failures to the cycle (captured by the  $\beta_{s,r}$ ). We will also provide additional robustness tests below to disentangle those two channels.

As a robustness check, we present an alternative measure of hedging need against foregone investment opportunities, which relies on the

gross amount of business failures rather than on the normalized business failures, therefore changing the dependent variable in equation (2).

In addition to these two variables of interest, we build control variables identified in the literature as important determinant of firms' cash and liquid financial holdings. The list of variables used in our regression and information regarding the way they are built are presented in Table 3.

## 4. Estimation and interpretation

### 4.1. Panel Regression with Firm Fixed Effects

We first estimate a model where yearly firm-level cash ratios<sup>21</sup> are regressed on firm fixed effects, which capture the role of observed and unobserved time invariant firms' characteristics on cash holdings, and on a set of time-varying observable characteristics. Including firm fixed effects enables to capture the effect of the change in the cost of carry at the firm level on the change in the cash ratio. Year fixed effects are included as robustness checks to control

20. In a previous version of the article, from equation (2) were included in our main regressions (with the cash ratio as dependent variable), with a positive and significant influence on cash hoarding, consistently with the hedging against illiquidity motive. For the sake of clarity, we excluded this control variable, with no influence on other estimation coefficients.

21. Regressions with the financial liquid assets/ total asset ratio as dependent variable convey consistent conclusions.

Table 3 – Variables

Variable	Description
Cash / assets ratio (narrow definition)	Cash (CF in the tax files) divided by total assets consolidated at the group level
Cash / assets ratio <sup>1</sup> (extended definition)	Financial liquid assets (CF + CD in the tax files) divided by total assets consolidated at the group level
Cost of carry (CoC)	Firm level cost of short-term funding (based on Z"-score) minus revenues derived from short term financial assets (defined by eq (1))
Cost of short-term debt	Firm level cost of short-term funding (based on the SAFE-score)
Z"- score	Z-score based on net working capital/asset, EBIT/asset, retained earnings/asset and equity/asset as defined in Altman (1983) – percentiles are built based on annual distributions
Financial debt / assets	Consolidated financial debt (DS+DT+DU in the tax files) divided by total assets consolidated at the group level – Intragroup financial debt are fully excluded
Pay-out ratio	Dividend paid by the parent company divided by the consolidated after-tax results
ln(Assets)	Log of the total assets consolidated at the group level
Earnings / assets	Retained earnings divided by the total assets consolidated at the group level
Share of tangible	Tangible assets divided by the total assets consolidated at the group level
SD(EBIT)	Firm-level standard deviation of the level of the Earnings Before Interests and Taxes over the observation period, measuring the volatility of cash flows. Divided by 1000 for presentation purpose.
Hedging needs	The correlation between investment opportunities and the firm's cash flows. It is computed as the correlation between the median industry-level R&D spending and the firm's earnings.
$\beta_{s,r}$	Sector-region elasticities of business failures to the cycle as defined and estimated in Eq (2) and reported in Table 2 – the more negative the $\beta_{s,r}$ , the more sensitive to the economic cycle the firms in sector-region, i.e. the more numerous business failures in case of economic downturns

<sup>1</sup> Also called financial liquid assets to total assets ratio.

Notes: For further details, see Appendix 1, and statistics for these variables in Appendix 3.

Table 4 – Model with firm fixed effects (dependent variable: cash to assets ratio)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	(narrow)	(extended)	(narrow)	(extended)	(narrow)	(extended)	(narrow)	(extended)
Cost of carry(-1)	-0.0102*** (0.0001)	-0.0100*** (0.0001)	-0.0059*** (0.0007)	-0.0078*** (0.0010)			-0.0092*** (0.0001)	-0.0084*** (0.0001)
Cost of short-term debt(-1)					-0.0084*** (0.0001)	-0.0076*** (0.0001)		
Net working capital/ Assets	-0.0676*** (0.0011)	-0.0761*** (0.0011)	-0.0664*** (0.0041)	-0.0754*** (0.0036)	-0.0767*** (0.0003)	-0.0863*** (0.0003)	-0.0559*** (0.0003)	-0.0546*** (0.0004)
Financial debt/ Asset(-1)	-0.0020*** (0.0007)	-0.0023*** (0.0007)	-0.0012 (0.0010)	-0.0019 (0.0013)	0.0004 (0.0003)	-0.0014*** (0.0003)	0.0098*** (0.0002)	0.0020*** (0.0002)
Earnings/Asset	0.0412*** (0.0010)	0.0444*** (0.0010)	0.0408*** (0.0028)	0.0442*** (0.0034)	0.0343*** (0.0004)	0.0370*** (0.0004)	0.0038*** (0.0005)	-0.0458*** (0.0007)
ln(Asset)	-0.0475*** (0.0008)	-0.0416*** (0.0008)	-0.0457*** (0.0013)	-0.0407*** (0.0017)	-0.0360*** (0.0003)	-0.0316*** (0.0003)	-0.0060*** (0.0001)	-0.0020*** (0.0002)
Payout ratio	-0.0065*** (0.0003)	-0.0042*** (0.0003)	-0.0043*** (0.0012)	-0.0032** (0.0015)	-0.0065*** (0.0002)	-0.0042*** (0.0002)	-0.0023*** (0.0002)	-0.0023*** (0.0002)
Fixed Effect	Firm-FE	Firm-FE	Firm-FE & Year-FE	Firm-FE & Year-FE	Firm-FE	Firm-FE	Firm-FE	Firm-FE
Clustering	Firm	Firm	Firm and year	Firm and year	None	None	None	None
Weight	None	None	None	None	None	None	Asset size	Asset size
Sample	Full	Full	Full	Full	Full	Full	Full	Full
Observations	2,473,753	2,473,753	2,473,753	2,473,753	2,124,721	2,124,721	2,473,753	2,473,753
R2	0.82	0.86	0.82	0.86	0.83	0.87	0.88	0.91
Adjusted R2	0.74	0.80	0.74	0.80	0.75	0.81	0.83	0.86

Notes: \*p<0.1; \*\*p<0.05; \*\*\*p<0.01. Variables definitions are given in Table 3. Robust standard errors are reported in parenthesis. Sources: Insee (Esane/LIFI); authors' calculations.

for exogenous year-specific factors that could contribute to the average increase in the cash ratio between 2010 and 2016. The main results are reported in Table 4. Our measures of CoC is included with a one-year lag to mitigate endogeneity issues.<sup>22</sup>

The estimates of the coefficient associated with our CoC are negative and highly statistically significant across all specifications. Based on the estimate in our first specification (Column 1), the change in the mean value of the CoC between 2011 and 2016 explains a change of 1.5 pp in the level of the cash ratio, which is over 40% of the mean increase in the cash ratios over the period. This indicates that cost-based explanations are of paramount importance to understand the recent cash accumulation by firms. The significant effect of the CoC is robust to the inclusion of year fixed effects (column 3): over 25% of the mean increase in the cash ratios is explained by the decrease in the cost of carrying cash. The effect of the CoC is then identified only from within-firm changes in the risk premium, i.e. to put it differently, our result is not identified by the overall downward trend in the cost of funding resulting from expansionary monetary policy over the period of interest because of the year fixed effects. From column 5, we infer that a decrease in our alternative measure of short-term external financing

cost also significantly increases cash hoarding, although this alternative measure ignores the share of interest-bearing financial liquid assets. The negative and significant impact of the CoC on cash ratios holds and is quantitatively similar when we weight firm-level observations by total assets while running the regression (column 7). This enables to draw conclusions on the “macro-evolution” of cash holdings: based on the reported estimate, the change in the mean value of the CoC between 2011 and 2016 explains again roughly 40% of the mean increase in the cash ratios over the period. Our results are also robust to an extended definition of the cash ratio, when cash holdings in the numerator also include marketable securities and own shares beyond mere cash accounts and bank deposits (columns 2, 4, 6, 8). Finally, our results are robust to balancing the panel, and even reinforced (see Appendix 2, Table A2-3 columns 3 and 4).

22. An increase in cash holdings contemporaneously with the diminution of external cost of funding might reflect the accounting rather than the economic phenomenon at play. When the firm's cost of carry decreases, it is more likely to raise financial debt, which gives rise to financial resources recorded on the asset side of the balance sheet as cash before this additional resource is used for investment. On the contrary, if cash holdings increase following a previous decrease in the cost of carry, the firm made the economic decision to keep as cash the additional financial resources it has raised, without assigning those resources to specific investment in the short-term. Finally, endogeneity concerns are only partially alleviated: our model does not allow for fully-fledged causal identification.

We introduce in these regressions a set of time varying variables: an increase in cash holdings go hand in hand with a decrease in net (of cash balances) working capital and with an increase in firm's annual earnings. We include control variables to capture the level of the financial frictions faced by firms. The regression results largely corroborate the negative relationship existing between the ease of access to external financing at the extensive margin (i.e. the degree of financial constraints faced by the firm) and cash accumulation. Firms that exhibit higher payout ratios (which often reflects low financial constraints as documented above) tend to have lower cash ratios. Hadlock & Pierce (2010) document that the higher the size of total asset, the less likely the firm is to be financially constrained. Consequently, the statistically significant negative impact of firm size on cash holdings indicates that firms having easier access to external financing due to lower financial constraints hold less cash.

Cash holdings react differently to an increase in indebtedness across size categories. The positive and significant correlation between indebtedness and cash hoarding once weighting firm-level observations by total assets size suggests that easier access to external funding has fuelled cash accumulation (see below Table 5 columns 7, 8). This result corroborates and extends the findings of Khder & Rousset (2017). Besides, consolidation is required for the adequacy of the analysis: for large consolidated pseudo-groups, while a positive and significant correlation between indebtedness and cash accumulation is evidenced, similar regressions run on their constitutive legal units does not reveal such a correlation (see Appendix 2, Table A2-1 column 3). For large and mid-sized firms, an increase in the lagged ratio of financial debt to total assets is positively correlated with an increase in the cash ratio while they are negatively and significantly correlated for SMEs (Appendix 2, Table A2-2). For large firms, the effect of the CoC on cash accumulation is no longer significantly negative. This could be attributed to the nature of the  $Z''$ -score at the heart of the CoC, which aims at predicting business failures, and is therefore a more accurate proxy of external cost of financing for small firms than for large firms.

As a final robustness check, we estimate this model on subsamples composed of pseudo-groups only, of independent legal units only, and on legal units belonging to corporate groups (Appendix 2, Table A2-1). The main take-away from this analysis is that cash hoarding behaviours are affected by changes

in the CoC for independent legal units and for pseudo-groups, across all class size roughly. Among very small and small firms, the impact of the decrease in the cost of carry seems to be higher for independent legal units than for legal units belonging to a corporate group.

This first set of regressions presented in Table 4 highlights the key role of cost-based explanations in recent trends observed at the macroeconomic level. The next sub-section further explores these dimensions.

## 4.2. Panel Regression with Sectoral Fixed Effects

Because of the firm fixed effects, we are not able in the first set of regressions to estimate the coefficients associated with sector-region elasticities of business failures to the economic cycle  $\beta_{s,r}$ , since they do not vary over time. Thus, we run similar regressions replacing firm fixed effects by sector and region fixed effects.<sup>23</sup> Sector and region fixed effects are necessary to control for sectoral time-invariant and regional time-invariant features that could otherwise bias the estimate on our sectoral regional elasticities. The new regression model also enables to estimate the effect of other firm-level time-invariant characteristics put forward in the literature as important determinants of the level of cash holdings that could not be identified with the previous regressions such as the volatility of earnings (Bates et al., 2009).

Estimation results with sector-year fixed effects<sup>24</sup> are in line with those obtained when we only exploit within-firm variations (Table 5). We find a statistically significant negative effect on cash hoarding of the different measures of the cost of carry. Regarding the time-invariant characteristics introduced in these regressions, we estimate statistically significant coefficient with the expected signs. We find that firms characterized by more volatile EBIT over the observed period hold higher levels of cash.

The estimates associated with our novel measure  $\beta_{s,r}$  are negative and statistically significant. This result suggests that the higher the sectoral local elasticities of business failures to the cycle (which means more negative  $\beta_{s,r}$ ), or in other words the more numerous the investment opportunities at fire sale prices are, the more firms hoard cash. The estimated effects of this

23. Sectors are defined at the NAF (Nomenclature d'activités françaises) 5-digit level and regions are defined according to the 2014 territorial reform.

24. Our results are also robust to the inclusion of sector-year fixed effects instead of sector fixed effects, to capture sector-level time-varying shocks such as sectoral demand shocks.

variable are noticeable. Based on the estimated negative coefficient associated with the  $\beta_{s,r}$  in Table 5 (column 1), in Ile-de-France, 5 pp of the difference in cash ratios between firms in the business services sector and firms in the manufacturing sector are explained by the elasticities  $\beta_{s,r}$ . Incidentally, the effect is robust to the inclusion of year fixed effects (column 3).

In the robustness test (column 2), our alternative measure of investment opportunities  $\beta_{s,r}$  is as expected significantly and negatively correlated with cash ratio, and with final effect<sup>25</sup> on cash ratio of the same order of magnitude that in our baseline specification (column 1). As another robustness check, we run a regression where firm-level observations are weighted by the size of total assets (column 4): the coefficient on the elasticities  $\beta_{s,r}$  is significant and negative, and 10 times higher than in the similar though unweighted regression (column 1). This shows that sectoral-regional elasticities of business failures are more important for larger firms and are therefore likely to matter at a macroeconomic level. This also hints at the higher likelihood for

larger firms to hedge against foregone investment opportunities by hoarding cash.

At this stage, we cannot discard a selection bias in our empirical framework. Our finding that, in sectors and regions where business defaults are very sensitive to the cycle, firms tend to hoard more cash could stem from a bias in our sample towards surviving firms: the most financially distressed firms, with less cash holdings, might have failed and exited the sample. Correcting for this selection bias (Heckman, 1979) requires a valid instrument for the probability of exiting that does not influence the volume of cash and debt. We do not have such an instrument. However, running our regression model with a balanced or quasi-balanced<sup>26</sup> sample shows that the effect on cash hoarding of sectoral regional elasticities is robust, and even reinforced, when

25. The estimate is facially substantially lower than for the baseline measure of investment opportunities in column 1, but this alternative measure of investment opportunities is not normalized by the number of firms in a given sector-region and thus higher in absolute terms.

26. The quasi-balanced panel includes firms that are present in the database all years except one.

Table 5 – Model with sectoral fixed effects (dependent variable: cash to assets ratio, narrow definition)

	(1)	(2)	(3)	(4)
Cost of Carry (-1)	-0.0102*** (0.0001)	-0.0102*** (0.0001)	-0.0083*** (0.0001)	-0.0058*** (0.0001)
Net Working Capital/Assets	-0.0418*** (0.0002)	-0.0418*** (0.0002)	-0.0399*** (0.0002)	-0.0975*** (0.0003)
Financial debt/Assets (-1)	-0.0093*** (0.0002)	-0.0093*** (0.0002)	-0.0091*** (0.0002)	0.0058*** (0.0001)
sd(EBIT)	0.0253*** (0.0007)	0.0253*** (0.0007)	0.0251*** (0.0007)	0.0001*** (0.00002)
Earnings/Assets	0.0298*** (0.0004)	0.0298*** (0.0004)	0.0306*** (0.0004)	0.0935*** (0.0008)
ln(Asset)	-0.0323*** (0.0001)	-0.0323*** (0.0001)	-0.0318*** (0.0001)	-0.0087*** (0.0001)
$\beta_{\{s,r\}}$ (baseline)	-0.0051** (0.0022)		-0.0052** (0.0022)	-0.0407*** (0.0015)
$\beta_{\{s,r\}}$ (alternative)		-0.00004*** (0.00001)		
Payout ratio	0.0323*** (0.0003)	0.0323*** (0.0003)	0.0340*** (0.0003)	0.0262*** (0.0003)
Tangible assets/Asset	-0.2605*** (0.0009)	-0.2605*** (0.0009)	-0.2605*** (0.0009)	-0.2050*** (0.0006)
Fixed Effects	Sector-FE & Region-FE	Sector-FE & Region-FE	Sector-FE & Region-FE & Year-FE	Sector-FE & Region-FE
Clustering	None	None	None	None
Weight	None	None	None	Asset size
Sample	Full	Full	Full	Full
Observations	2,151,394	2,151,573	2,151,394	2,151,394
R2	0.15	0.15	0.15	0.29
Adjusted R2	0.15	0.15	0.15	0.29

Notes: \*p<0.1; \*\*p<0.05; \*\*\*p<0.01. Variables definitions are given in Table 3.  
Sources: Insee (Esane/LIFI); authors' calculations.

considering surviving firms only: the selection bias does not seem to matter to the first order (Appendix 2, Table A2-3 columns 1 and 2).

### 4.3. Disentangling the Various Mechanisms Captured by the Sectoral Local Elasticities $\beta_{s,r}$

With Table 6, we address the interpretation of the significant effect of our sectoral local elasticities  $\beta_{s,r}$  of business defaults to the cycle on cash hoarding. The effect of the  $\beta_{s,r}$  evidenced so far could capture two distinct channels:

- hedging needs against foregone investment opportunities: some firms, which can afford to accumulate cash in good times, do so because they anticipate in bad times to be financially constrained or to have low earnings and they would like to seize the investment opportunities that could occur in their sector and region because of fire sales of assets during slow-downs;
- hedging needs against illiquidity and failure risk: some firms may hoard cash to avoid defaults and failures, regardless of investment opportunities.

We argue that the sectoral regional elasticities  $\beta_{s,r}$  mostly capture the hedging needs against foregone investment opportunities. To disentangle the contribution of those two channels, we first observe that they have different implications depending on asset specificity in a sector. On the one hand, if the hedging needs against foregone investment opportunities prevail, the more specific assets are to the sector, the more advantage a firm with high cash holdings can draw from asset fire sales of its competitors within the same sector and region. Firms would therefore value cash holdings more in sectors featuring high asset specificity. On the other hand, if the hedging needs against illiquidity prevail, the impact of our sectoral local elasticities should only marginally depend on asset specificity. We proxy the degree of asset specificity to a given sector by the ease with which the assets used in the sector can be redeployed across other sectors following Kim & Kung (2016). We distinguish here by a dummy “high asset specificity” the sectors in which assets are the least easily redeployable across other sectors based on Kim & Kung (2016).<sup>27</sup> The effect of the elasticities  $\beta_{s,r}$  on cash holdings is significantly higher (roughly 10 times higher) in sectors where assets are the most sector-specific (column 1): a high sectoral local elasticity of business failures to the cycle triggers cash hoarding almost exclusively in sectors where assets are sector-specific. This

suggests the  $\beta_{s,r}$  capture first-order hedging needs against foregone investment opportunities, rather than against illiquidity risk.

In columns 2 and 3, we contrast the effect of hedging needs against foregone investment opportunities with that of the real option channel (Pindyck, 1991; Bloom, 2009), which states that, when an investment is irreversible, the firm postpones investment in the face of uncertainty, and values more cash because of the embedded option to invest in the future it provides. In column 2, we show that policy uncertainty, as measured by the Economic Policy Uncertainty index (Baker *et al.* 2016), significantly and positively affects cash holdings, in line with the real option theory.<sup>28</sup> The effect of the  $\beta_{s,r}$  elasticities on cash is however robust (in significance and in order of magnitude, cf. Table 5, column 1) to the inclusion of the economic policy uncertainty index. Besides, we find that higher economic policy uncertainty does not lead to higher cash hoarding in sectors with highest degree of assets specificity (cf. column 3; the interaction term is even significantly negative).<sup>29</sup> The take-away is that the greater effect on cash hoarding of  $\beta_{s,r}$  elasticities in sectors with a high degree of asset specificity arguably cannot be attributed to the real option channel, and thus that our  $\beta_{s,r}$  elasticities primarily measure hedging needs against foregone investment opportunities, rather than the real option channel.

In column 6, we interact the  $\beta_{s,r}$  elasticities with the quintile of size. As a reminder, (total asset) size is often considered as a proxy of financial constraints (along with age, cf. Hadlock & Pierce, 2010): the larger the firm, the easier the access to external financing. We find that the effect of the  $\beta_{s,r}$  elasticities on cash hoarding is larger for the fourth and the fifth quintiles of asset size, namely the 40% largest firms. For those large firms, the significant negative coefficient associated with the elasticities mostly reflect the hedging needs against foregone investment opportunities. On the contrary, for the lowest quintiles of size, firms are small and, when they operate in sectors and regions where business failures are highly sensitive to the economic cycle (i.e. when the  $\beta_{s,r}$

27. Namely, the high asset specificity dummy turns to 1 for the 15 out of 53 industries with the least redeployable assets based on Kim & Kung's index, see Kim & Kung (2016) Table 1. [Textile mills, Semiconductor and electronic component manufacturing, Plastics and rubber products manufacturing, etc.]

28. This effect is not more pronounced for industries with higher investment irreversibility.

29. This is somehow at odds with the real option theory that suggests that firms would hoard more cash in sectors where investment is highly specific (and then more likely to be more irreversible) and in times of higher uncertainty.

Table 6 – Model with sectoral fixed effects, further investigation  
(dependent variable: cash to assets ratio, narrow definition)

	(1)	(2)	(3)	(4)	(5)
Cost of Carry (-1)	-0.0083*** (0.0001)	-0.0100*** (0.0001)	-0.0100*** (0.0001)	-0.0087*** (0.0001)	-0.0065*** (0.0001)
Net Working Capital/Asset	-0.0399*** (0.0002)	-0.0415*** (0.0002)	-0.0415*** (0.0002)	-0.0402*** (0.0002)	-0.0389*** (0.0003)
Financial debt/Asset (-1)	-0.0091*** (0.0002)	-0.0093*** (0.0002)	-0.0093*** (0.0002)	-0.0093*** (0.0002)	-0.0084*** (0.0002)
sd(EBIT)	0.0251*** (0.0007)	0.0253*** (0.0007)	0.0253*** (0.0007)	0.0235*** (0.0007)	0.0232*** (0.0008)
Earnings/Asset	0.0306*** (0.0004)	0.0300*** (0.0004)	0.0300*** (0.0004)	0.0371*** (0.0004)	0.0275*** (0.0004)
ln(Asset)	-0.0318*** (0.0001)	-0.0322*** (0.0001)	-0.0322*** (0.0001)	-0.0447*** (0.0003)	-0.0308*** (0.0001)
$\beta_{\{s,r\}}$	-0.0027 (0.0023)	-0.0052** (0.0022)	-0.0027 (0.0023)		
Policy uncertainty		0.0001*** (0.000004)	0.0001*** (0.000004)		
Payout ratio	0.0340*** (0.0003)	0.0321*** (0.0003)	0.0321*** (0.0003)	0.0344*** (0.0003)	0.0340*** (0.0003)
Tangible assets/Asset	-0.2606*** (0.0009)	-0.2607*** (0.0009)	-0.2607*** (0.0009)	-0.2607*** (0.0009)	-0.2639*** (0.0010)
$\beta_{\{s,r\}}$ *high asset specificity	-0.0477*** (0.0077)		-0.0470*** (0.0077)		
Policy uncertainty*high asset specificity			-0.00004** (0.00002)		
$\beta_{\{s,r\}}$ *size quintile 1				0.0160*** (0.0023)	
$\beta_{\{s,r\}}$ *size quintile 2				0.0196*** (0.0023)	
$\beta_{\{s,r\}}$ *size quintile 3				0.0043* (0.0022)	
$\beta_{\{s,r\}}$ *size quintile 4				-0.0197*** (0.0023)	
$\beta_{\{s,r\}}$ *size quintile 5				-0.0556*** (0.0023)	
Hedging needs*size quintile 1					0.0012** (0.0006)
Hedging needs*size quintile 2					-0.0071*** (0.0006)
Hedging needs*size quintile 3					-0.0099*** (0.0006)
Hedging needs*size quintile 4					-0.0142*** (0.0006)
Hedging needs*size quintile 5					-0.0224*** (0.0007)
Fixed Effects	Sect-FE & Reg-FE & Year-FE	Sector-FE & Region-FE	Sector-FE & Region-FE	Sect-FE & Reg-FE & Year-FE	Sect-FE & Reg-FE & Year-FE
Clustering	None	None	None	None	None
Weight	None	None	None	None	None
Sample	Full	Full	Full	Full	Full
Observations	2,151,394	2,151,394	2,151,394	2,151,394	1,814,221
R2	0.15	0.15	0.15	0.16	0.15
Adjusted R2	0.15	0.15	0.15	0.16	0.15

Notes: \*p<0.1; \*\*p<0.05; \*\*\*p<0.01. Variables definitions are given in Table 3.  
Sources: Insee (Esane/LIFI); authors' calculations.

elasticities are more negative), they tend to be more fragile (because they did not have the time to build cash buffers and their business environment is volatile). The primary objective of those smaller firms is to hedge against illiquidity and failure.

Finally, we include Acharya *et al.* (2007)'s measure of hedging needs against foregone investment opportunities in the regression (column 5). This alternative proxy consists of the correlation between investment opportunities and firms' cash flows. It is computed as the correlation between the median industry-level R&D spending<sup>30</sup> and firms' earnings (cf. literature review). First, and in line with Acharya *et al.* (2007)'s findings, we document that the lower the correlation between investment opportunities and cash flows (the hedging needs indicator is thus negative), the higher the cash ratio. This increase in the cash ratio is statistically significantly across almost all asset size categories. Second, the impact of hedging needs on cash hoarding monotonously increases with the size of assets: larger firms (which are typically less financially constrained) with higher hedging needs (i.e. a more negative hedging need indicator) tend to hoard more cash. This result, slightly different from Acharya *et al.*'s claim that only firms with higher financial constraints and high hedging needs choose to hoard cash rather than to reduce debt, hints at the fact that firms that can afford to carry cash (less financially constrained for instance) do so when they anticipate that investment opportunities might arise in times where the firms' cash flows may lag behind: this also provides evidence that the hedging motive against foregone investment opportunities plays a significant role to understand firms' cash hoarding behaviours.

\* \*  
\*

In this paper, we explore the sources of the cash accumulated by NFCs and the determinants of the sharp increase in the cash and liquid financial assets ratios recently observed in France.

We take advantage of firm-level variations in the cost of carrying cash derived from heterogeneous costs of short-term financing to document that this variable largely explains the recent trends. We also find robust evidence that financial constraints and hedging needs are key determinants of firm-level cash accumulation. Based on an original measure of the correlations between cash flows and investment opportunities, that are proxied by the local sectoral elasticities of business defaults to the economic cycle, we document that hedging needs against foregone investment opportunities explain the large difference in the levels of cash across regions and across sectors. Our results have important policy implication, notably with regard to financial stability. They suggest in particular that the current level of cash could be significantly altered in the event of a trend reversal in the cost paid by firms for short-term debts but also that firms' cash buffers are likely to dampen fire sales mechanisms in the upcoming crisis as firms seem to hoard cash in anticipation of the investment opportunities arising in the economic downturns. This result suggests that firms' cash hoarding is an active economic stabilizer. This question could be further explored in future research. □

30. We exploit the R&D survey by the French ministry of Higher education and Research. Industry is defined at the A88 level.

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## APPENDIX 1

## THE CONSOLIDATION METHOD

**Controlling for Intra-Group Operations**

A variable at the group-level is not necessarily the mere sum of the variables of its core legal units. Some variables can be directly summed across all the legal units within a group, because they do not include intra-group flows (respectively intra-group stocks) or because intra-group operations cancel out in summation over the group. Consolidation can thus be carried out directly on the values reported by the legal units for:

- Employment;
- Cash;
- Financial liquid assets other than cash;
- Tangible and intangible fixed capital, and investment;
- Earnings, defined here as earnings minus interests, taxes, depreciation, amortization, and dividends;
- Earnings Before Interest and Taxes (EBIT).

On the other hand, some variables include intra-group operations that do not cancel out when summed over the group, and that would thus lead to double-counting. An example is the outstanding financial debt amount. Intra-group indebtedness turns out to be critical given its recent rise, as evidenced by de Almeida *et al.* (2018). To consolidate non-cumulative variables at the group-level, our preferred approach is: (i) to build at the legal unit level a new variable cleaned of intra-group items; (ii) to carry out consolidation restatement on those "cleaned" variables to construct the pseudo-group's variable. For non-cumulative variables, step (i) is performed as follows:

- Total asset: at the legal unit-level, we retrieve out of the total asset (minus depreciation) the intra-group loans, and financial participation in legal units and loans associated to financial participations;

- Financial debt: we restrict ourselves to a convertible bonds, other bonds and loans by credit institutions. This excludes all intra-group loans;

- Dividends: for a group, we keep only the dividend paid by the parent company, since the other legal units in the group do not own the parent company. The parent company therefore necessarily pays dividends to outside shareholders.

**Altman (1983)'s Z<sup>1</sup>-score**

$$Z^1\text{score} = 3.25 + 6.56 \text{ WorkingCapital} + 3.26 \text{ Earnings} + 6.72 \text{ EBIT} + 1.05 \text{ Equity}$$

where *Working Capital* corresponds to Working capital / Total assets, *Earnings* to Cumulative retained earnings / Total assets, *EBIT* to EBIT / Total assets, and *Equity* to Book value of equity / Total assets.

**Ferrando *et al.* (2015) SAFE-score**

$$\text{SAFE-score} = -1.88 + 0.86 \text{ Finlev} + 0.28 \text{ ipf} + 0.51 \text{ profitmargin} - 0.21 \text{ collateral} - 1.21 \text{ cashholdings} - 0.05 \ln(\text{TotalAssets})$$

where *Finlev* refers to Financial debt / Total assets, *ipf* (the index of financial pressure) to Interest payments / Earnings, *profitmargin* to EBIT / Sales, *collateral* to Fixed assets / Total assets and *cashholdings* to Cash holdings / Total assets.

**Building the Sectoral Local Elasticities of Business Failures to the Cycle for Pseudo-Groups**

For a group, we construct the sectoral local elasticities of business failures to the cycle as a weighted average of the sectoral local elasticities of all the constitutive legal units. The weights are computed as the lagged share of the legal unit in the assets of the group.

## ADDITIONAL REGRESSIONS

Table A2-1 – Model with firm fixed effects, by firm status  
(dependent variable: cash to assets ratio)

	Pseudo-groups	Independent legal units	Legal units in a group
Cost of carry lag1 x <10	-0.0023*** (0.0007)	-0.0064*** (0.0007)	-0.0033*** (0.0005)
Cost of carry lag1 x 10-249	-0.0035*** (0.0007)	-0.0059*** (0.0008)	-0.0023*** (0.0008)
Cost of carry lag1 x 250-4,999	-0.0028*** (0.0010)	-0.0033 (0.0023)	0.0003 (0.0020)
Cost of carry lag1 >5,000	-0.00001 (0.0034)		0.0061 (0.0040)
NWC / asset	-0.0229*** (0.0048)	-0.0774*** (0.0052)	-0.0222*** (0.0015)
Earnings / Asset	0.0182*** (0.0042)	0.0428*** (0.0033)	0.0075*** (0.0004)
ln(Asset)	-0.0334*** (0.0018)	-0.0442*** (0.0016)	-0.0412*** (0.0009)
Payout ratio	-0.0023 (0.0018)	-0.0044*** (0.0012)	-0.0019** (0.0009)
Financial debt / Asset x <10	-0.0052 (0.0066)	-0.0046 (0.0035)	0.0001 (0.0004)
Financial debt / Asset x 10-249	-0.0062* (0.0035)	-0.0058 (0.0043)	-0.0003 (0.0006)
Financial debt / Asset x 50-4,999	0.0102 (0.0089)	0.0515 (0.0472)	0.0128** (0.0065)
Financial debt / Asset x >5,000	0.0526** (0.0221)		-0.0005 (0.0080)
Full sample	Group level	Indep. legal units	Legal units in groups
Firm-FE	Yes	Yes	Yes
Sector-FE	No	No	No
Year-FE	Yes	Yes	Yes
SE-Clustering	Firm+Year	Firm+Year	Firm+Year
Observations	276,405	2,038,952	1,393,598
R2	0.86	0.82	0.79
Adjusted R2	0.78	0.74	0.70

Notes: \*p<0.1; \*\*p<0.05; \*\*\*p<0.01. Variables definitions are given in Table 3.  
Sources: Insee (Esane/LIFI); authors' calculations.

Table A2-2 – Model with firm fixed effects, by firm size  
(dependent variable: cash to assets ratio, narrow definition)

	Large firms	Mid-size firms	SMEs
Cost of Carry (-1)	-0.0049 (0.0054)	-0.0093*** (0.0015)	-0.0116*** (0.0003)
Net Working Capital/Asset	-0.0095 (0.0237)	-0.0212 (0.0209)	-0.1193*** (0.0057)
Financial debt/Asset (-1)	0.0176 (0.0170)	0.0094 (0.0105)	-0.0063*** (0.0017)
Earnings/Asset	-0.0392 (0.0305)	0.0209 (0.0216)	0.0887*** (0.0044)
ln(Asset)	-0.0208 (0.0203)	-0.0051 (0.0090)	-0.0001 (0.0017)
Payout ratio	-0.0223 (0.0196)	-0.0044 (0.0065)	-0.0023*** (0.0005)
Fixed Effects	Firm-FE	Firm-FE	Firm-FE
Clustering	Firm	Firm	Firm
Weight	None	None	None
Sample	> 5,000 FTE	250 FTE - 4,999 FTE	10 FTE - 249 FTE
Observations	553	1,209	541,628
R2	0.81	0.86	0.87
Adjusted R2	0.74	0.79	0.81

Notes: \*p<0.1; \*\*p<0.05; \*\*\*p<0.01. Variables definitions are given in Table 3.  
Sources: Insee (Esane/LIFI); authors' calculations.

Table A2-3 – Model with balanced sample and quasi-balanced sample  
(dependent variable: cash to assets ratio, narrow definition)

	(1)	(2)	(3)	(4)
Cost of Carry (-1)	-0.0067*** (0.0001)	-0.0062*** (0.0001)	-0.0114*** (0.0002)	-0.0125*** (0.0002)
Net Working Capital/Asset	-0.0433*** (0.0003)	-0.0478*** (0.0003)	-0.0708*** (0.0013)	-0.0767*** (0.0016)
Financial debt/Asset(-1)	-0.0076*** (0.0002)	-0.0078*** (0.0003)	-0.0012* (0.0007)	-0.0014* (0.0009)
sd(EBIT)	0.0133*** (0.0007)	0.0089*** (0.0008)		
Earnings/Asset	0.0409*** (0.0005)	0.0486*** (0.0006)	0.0467*** (0.0013)	0.0511*** (0.0014)
ln(Asset)	-0.0242*** (0.0001)	-0.0214*** (0.0002)	-0.0412*** (0.0010)	-0.0339*** (0.0011)
$\beta_{\{s,r\}}$ (deviation)	-0.0097*** (0.0025)	-0.0069** (0.0027)		
Payout ratio	0.0338*** (0.0003)	0.0331*** (0.0003)	-0.0060*** (0.0003)	-0.0054*** (0.0003)
Tangible assets/Asset	-0.2495*** (0.0011)	-0.2510*** (0.0012)		
Fixed Effects	Sect.-FE & Reg.-FE & Year-FE	Sect.-FE & Reg.-FE & Year-FE	Firm-FE	Firm-FE
Clustering	None	None	Firm	Firm
Weight	None	None	None	None
Sample	At least 6 years	Balanced panel	At least 6 years	Balanced panel
Observations	1,512,449	1,243,475	1,543,338	1,268,913
R2	0.14	0.14	0.79	0.80
Adjusted R2	0.14	0.14	0.73	0.74

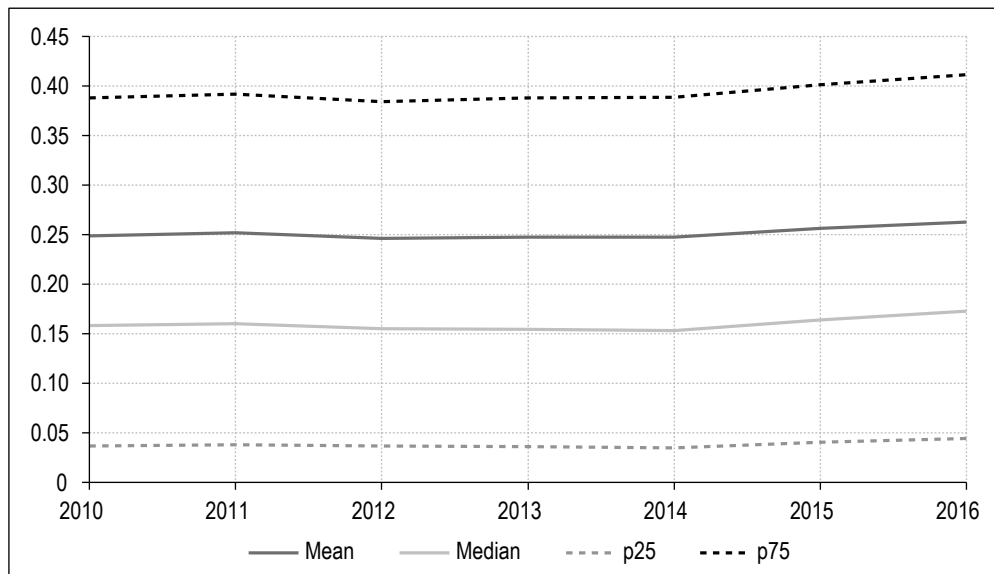
Notes: Variables definitions are given in Table 3. Columns 1 and 2 refer to regression models of Table 6 column 1 with quasi-balanced and balanced sample. Columns 3 and 4 refer to regression models of Table 5 column 1 with quasi-balanced and balanced sample.  
Sources: Insee (Esane/LIFI); authors' calculations.

Table A3-1 – Descriptive statistics

Variable name	Number of observations	Number of values	mean	sd	q10	q25	median	q75	q90
Cash/Assets	3,665,675	3,111,314	0.20	0.23	0.00	0.03	0.12	0.30	0.55
Cost of Carry (-1)	3,665,675	794,329	3.20	1.77	1.38	2.04	2.75	3.80	5.99
Cost of short-term debt (-1)	3,665,675	454	3.31	1.82	1.38	2.09	2.84	3.95	6.34
Net Working Capital/Asset	3,665,675	3,304,077	0.07	0.75	-0.36	-0.10	0.05	0.26	0.50
Financial debt/Asset(-1)	3,665,675	1,899,255	0.16	0.96	0.00	0.00	0.03	0.20	0.44
Earnings/Asset	3,665,675	2,902,546	-0.02	0.40	-0.19	-0.01	0.02	0.10	0.19
ln(Asset)	3,665,675	1,776,417	5.89	1.75	3.82	4.93	5.90	6.89	7.96
Tangible assets/Asset	3,665,675	2,873,422	0.14	0.20	0.00	0.01	0.06	0.18	0.40
sd(EBIT)	3,665,675	904,318	150	4730	5	13	30	71	172
$\beta_{\{s,r\}}$ (baseline)	3,665,675	285,356	-0.88	0.24	-1.09	-1.02	-0.88	-0.80	-0.69
$\beta_{\{s,r\}}$ (alternative)	3,665,675	285,352	-43.89	44.31	-93.31	-59.48	-35.27	-14.16	0.00
Payout ratio	3,665,675	576,980	6.02	10782	0.00	0.00	0.00	0.00	0.42
Policy Uncertainty	3,665,675	6	250	38	191	224	248	279	310
Hedging needs	3,665,675	531,896	-0.11	0.64	-0.93	-0.68	-0.20	0.43	0.86

Notes: Variables definitions are given in Table 3.  
Sources: Insee (Esane/LIFI).

Figure A3.1 – Moments of the financial liquid assets to assets ratios



Sources: Insee (Esane/LIFI); authors' calculations.