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Corporate Interest Rate Management - Hedge or Speculation?

Research Paper[1]

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Abstract
Empirical indications on speculative elements in corporate risk management originates mostly from commodity and FX risk practices. The complexity of interest rate risk is one of the reasons for the meagre evidence from this field. By means of the granularity of our dataset, we develop an innovative approach to disentangle hedging and speculative activities. We separately analyze fixed-rate and floating-rate positions and determine firm-, year-, currency-, and maturity-specific hedge ratios that enable the definition of speculation as activity that increases or holds IR exposure constant. Following this logic, we are able to indicate the relevance of speculative elements in the realm of corporate IR risk management and show that it is more developed compared to an FX setting.

[1] We gratefully acknowledge access to Bloomberg and Compustat Global Vantage database provided by DALAHO, University of Hohenheim.

1 Introduction

"We have also seen that, in the case of interest rates, hedging or speculative behavior is too complex to be captured by a simple proxy such as active swap usage or the level of variation in the share of fixed rate debt" [2]

Several survey and empirical studies demonstrate the relevance of speculative[3] elements in corporate risk management practices. Empirically, most of the attention has been dedicated to commodity (T. R. Adam, Fernando, & Golubeva, 2015; T. R. Adam, Fernando, & Salas, 2017; Brown, Crabb, & Haushalter, 2006) and foreign exchange (FX) risk (Beber & Fabbri, 2012; Géczy, Minton, & Schrand, 2007; Hecht & Lampenius, 2018). Very few empirical evidence comes from corporate interest rate (IR) risk, in spite of survey outcomes in the US (Bodnar, Marston, & Hayt, 1998) and Europe (Glaum, 2002) that indicate speculative activities. What are the reasons for the meagre attention and findings of speculation in corporate interest rate risk management? As the initial quote suggests, interest rate risk is complex. Its differing sub-categories of cash flow and fair value risk as well as important interdependencies through primarily interest swaps make it difficult to analyze using publicly available data. Bartram (2002) and Glaum, (2002) illustrate the importance of interest rate risks and their management for non-financial companies. These take, in contrast to banks and financial corporations, particular interest in the cash flow risk (Backhaus, 2018)[4]. Identifying and disclosing speculative elements entails several potential advantages such as raising the inhibition threshold to prevent derivative losses or providing an enhanced information base for share- and numerous stakeholders. For these reasons, it is important to shed light on the relevance of speculation in interest rate risk management. This paper focuses on the disentanglement of hedging and speculative activities in order to contribute to the identification of speculation in interest rate risk management of non-financial companies.

Interest rate risk implies two unequal types of risk, the cash flow and the fair value risk, with significant interdependencies. The hedging behavior of firms that focus on cash flow risk is dissimilar to those who focus on fair value risk. Using the most common interest rate derivate, a swap contract, (Backhaus, 2018; Chava & Purnanandam, 2007) affects both risk types inversely. An isolated examination might be misleading. Extant literature tackles this matter by analyzing the mix of fixed and floating exposure, which implies combining cash flow and fair value risk (Chava & Purnanandam, 2007; Chernenko & Faulkender, 2011; Oberoi, 2018). Most recently, Oberoi (2018)'s central theme is the choice and trade-off between cash flow and fair value risk. He examines the after-swap composition of fixed and floating rate debt of non-financial firms using the proportion of fixed-rate debt as major element. Chava & Purnanandam (2007) analyse the determinants of a firm's debt structure using the share of floating-rate debt of total corporate debt as key indicator, similar to Chernenko & Faulkender (2011) who also rely on the ratio of floating-rate debt as a fraction of total debt in their study to separate hedging from speculation with interest rate swaps. In the decomposition analysis of their panel data, Chernenko & Faulkender (2011) assume for each of their sample companies a stable target share of fixed-rate debt to separate hedging from speculation and argue that the cross-sectional component examines the hedging part of interest rate swap usage, while the time-series variation delivers insights on a firm's speculative activities with interest rate swaps. Without the strong assumption of an optimal stable hedge ratio over time, Oberoi (2018) states in his analysis of active swap usage and the extent of variation of the after-swap mix that separating hedging and speculation in IR risk management is a major challenge. We suspect that analyzing the mix of fixed and floating exposure might contribute to this issue. To manage the complexity of interest rate risk, data would preferably be needed in a granularity that allows distinguishing between cash flow and fair value risk.

Our novel dataset delivers advanced information on corporate interest rate risk management activities. In particular, we have access to detailed data on both fixed and floating exposure and the way it is hedged. In an innovative approach to disentangle hedging and speculative activities, we use these additional disclosures to determine firm-, year-, currency-, and maturity-specific hedge ratios for interest rate risk management activities for both fixed-

[2] As appeared in the *Journal of Banking and Finance* article "Interest rate risk management and the mix of fixed and floating rate debt" by Oberoi (2018).
[3] The terms speculation and "selective hedging" have been used interchangeably (T. R. Adam et al., 2017).
[4] Faulkender (2005) also refers to interest rate risk as the variability of corporate cash flows.

rate and floating-rate positions separately. We then define speculation as activity that increases or holds IR exposure constant and distinguish it from risk management as activity that reduces IR exposure. Following this classification scheme, we provide evidence indicating the relevance of speculative elements in the realm of corporate IR risk management. In a comparison to the FX setting of Hecht & Lampenius (2018), who discovers a proportion of 80% risk management to 20% speculation, we find that firms hedge about 63% of their interest rate exposure and speculate with the remaining 37% of the exposure. Indicating that speculative activities in IR risk management might be more pronounced in relation to FX risk management, we confirm the survey outcome of Glaum (2002). To our knowledge, we are the first study to deliver such indications based on quantitative data.

As regards the interdependency of accounting and derivative usage, we find speculation to be negatively associated with the probability of applying hedge accounting. Likewise, we observe a positive relationship between firm size and the probability of hedge accounting application. Such a correlation between an accounting policy and speculative elements is merely an indication and never a necessary or sufficient condition for speculation. We further shed light on the determinants of speculation in IR risk management. Contrary to his FX model, Glaum's "proposed model on IR is not able to explain the choice of the firms' interest rate risk strategies". In our logistic regression model, we find that IR-speculators might be bigger and have higher debt ratios compared to IR-risk managers. Unlike the FX model of Hecht (2017), this evidence does not empirically confirm the convexity theories.

The granularity of our datasets also delivers new insights on the structure of corporate interest rate exposure. Until present, literature on corporate interest rate risk analyses the composition of debt. For instance, the current article of Oberoi (2018) uses data on debt and derivative positions (interest rate swaps) to calculate the after-swap mix of fixed and floating rate debt. Chernenko & Faulkender (2011) also use hand-collected information on floating-rate debt adapted to interest rate swap changes to calculate the resulting share of floating-rate debt, similar to Chava & Purnanandam (2007). Our dataset contains separate information on a firm's exposed assets and liabilities that add up to the netted figure of exposure before hedging, available for fixed and floating risk individually. Analyzing the composition of the exposure before hedging shows that assets are indeed significant, primarily for floating positions.

We contribute to the literature on speculative elements in corporate risk management in three ways. First, the granularity of our datasets provides new evidence on the structure of corporate interest rate exposure. We demonstrate that assets are an important component of the interest rate exposure of non-financial firms, especially in terms of floating-rate positions. Second, we establish a hedge ratio measure that allows discriminating interest rate positions according to their impact on future volatility. Consequently, speculation is captured as activity that increases or keeps IR exposure constant, whereas risk management reduces IR exposure. Based on the feasible differentiation of fixed- and floating-rate positions, we further introduce a measure that combines both dimensions with a focus on the floating positions following the cash flow orientation of non-financial companies. Third, based on the resulting classification of interest rate positions we empirically indicate a relevance of speculative elements in corporate IR risk management, where speculators seem to be bigger and more indebted.

The paper is structured as follows. Section 2 introduces our dataset with the sample description and methodology. Section 3 defines the variables for the empirical analysis, where the results are presented in Section 4. Section 5 concludes.

2 Data and Methodology

Exposure to interest rates implies two types of risk: first the cash flow risk and second the fair value risk. While the former represents the direct impact of interest rate changes on payments for floating-rate financial assets and liabilities, the latter describes the effect of interest rate fluctuations on the market value of fixed-rate financial assets and liabilities. Both types can impact the borrowings capacity of a firm (Oberoi, 2018). Recent articles on interest rate risk management of non-financial firms concentrate on the choice and trade-off between cash flow

and fair value risk when examining the fix vs. floating proportion of corporate debt (Chava & Purnanandam, 2007; Chernenko & Faulkender, 2011; Oberoi, 2018). Oberoi (2018)'s quote at the beginning of the paper further illustrates that determining speculation in an IR context is far less obvious than for example in an FX context, also because of the differing types of risk for interest rates, i.e., the cash flow and the fair value risk, that have significant interdependencies. Since corporates are contrary to banks and financial corporations are particularly interested in the cash flow risk (Backhaus, 2018)[5], we put the focus on floating interest rate exposure and develop a new approach to disentangle hedging and speculation in the realm of interest rates.

The initial impulse for our innovative procedure is the granularity of our dataset. We examine publicly available accounting data from France due to the prevailing unique regulatory environment, where the regulating authority endorses the publication of advanced disclosures on corporate risk management that exceed existing IFRS requirements via an optional supplement. In the preparation guidelines (position paper n°2009-16, Autorité des Marchés Financiers, 2009) for this so-called 'registration document'[6], the supervisor of the French financial markets, the Autorité des Marchés Financiers (AMF), recommends enhanced corporate disclosures concerning the management of financial risks. Exceeding the requirements of IFRS 7 §33 and 34, as a result firms provide information on their interest rate risk practices of unique data granularity. In detail, firms typically specify separately their fixed and floating assets and liabilities that are subject to interest rate risk. Further, the registration documents contain the aggregate of these figures, i.e., the net position before hedging for fixed and floating rates individually. In addition, the firms provide information on the corresponding hedged amounts and the resulting net position after hedging for each type risk. Further to this, this information on interest rate exposure is not only given per firm and year but also in terms of currency and maturity, where the latter is usually distinguished into maturities up to one, between one and five as well as beyond five years. Consequently, the information provided in the registration documents enables the calculation of firm-, year-, currency-, and maturity-specific hedge ratios for interest rate risk. To demonstrate the structure of the data analyzed, we make use of a hypothetical example of the reported information: Assume a firm reports 50 units of fixed assets and 30 units of fixed liabilities to be subject to interest rate risk at a particular reporting date, for a specific currency and these positions are maturing within one year. The netted figure of 20 units is reported as exposure before hedging. Further, the firms reports a corresponding hedged amount of, for example, 10 units in the respective currency, as well as the resulting the exposure after hedging of 10 units. Similar to this example with fixed assets in Euros and a maturity of maximally one year, the firm reports its floating rate exposure in the same structure. In addition, both the fixed and floating interest rate information is specified separately for maturities between one and five as well as beyond five years, and if applicable, the firm states this data also for further applicable currencies[7].

Our dataset allows further enables the enhancement of the specification of a firm's interest rate exposure. Exposure, not only on interest rates, usually has two sides: assets and liabilities or long and short. For example, following the cash flow risk, a raise in interest rates increases both incoming payments on floating-rate assets and outgoing payments of floating-rate debt. Consequently, the accurate exposure to interest rate risk is the netted figure of both assets and liabilities ("net position"). Due to a lack of available data, literature has so far concentrated on debt issues and the mix of fixed- and floating-rate debt (Antoniou, Zhao, & Zhou, 2009; Chava & Purnanandam, 2007; Chernenko & Faulkender, 2011; Faulkender, 2005; Oberoi, 2018). In case that liabilities dominate the net position and assets are negligibly small, the approach of contemplating merely the liability side would be justified; otherwise a potential bias could result. We analyze assets, liabilities and the net position of our dataset across all firms, currencies and maturities and separately for fixed and floating positions. Our sample firms exhibit average fixed [floating] assets of 155.3 [764.7] million Euros and average fixed [floating] liabilities of 1008.9 [490.4] million Euros. The average net position for fixed [floating] positions accounts for -1501.5 [-58.5] million Euros

[5] An analysis of our sample firms underlines this hypothesis. We randomly select 19 of our sample firms to check whether they state in the registration documents the importance of each type of risk. Almost all firms put the emphasis on the volatility of financial expenses, i.e., the cash flow risk, with merely one firm indicating that it arbitrates between both types of risk.

[6] For details on the 'registration document' refer to http://www.amf-france.org/en_US/Acteurs-et-produits/Societes-cotees-et-operations-financieres/Document-de-reference.html.

[7] 37% (25 out of 68) of our sample firms do not distinguish between maturities and only state their exposure before hedging, hedged amounts and exposure after hedging separately for fixed and floating positions.

and is not the mere subtraction of liabilities from assets, because few firms do not distinguish between assets and liabilities but directly state the value for the net positions. The histogram in Figure 1 [2] displays the distribution of the values for the fixed [floating] net position across our sample. The values and the graphical representation clearly indicate that, especially for floating positions (Figure 2), assets are significant. Figure 1 with the distribution of fixed net exposure provides evidence that for fixed exposure to interest rate risk, assets might be insignificant. Nevertheless, in individual cases on firm level a closer consideration might be advisable to not bias the analysis. In conclusion, we find the net position to be a more accurate measure of a firm's interest rate exposure, particularly for floating positions.

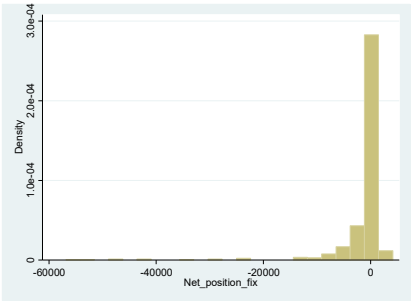

Figure 1: Histogram Net Position Fix and Floating

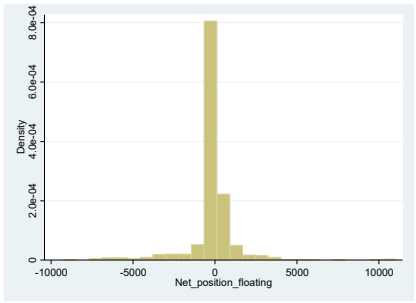

Figure 2: Histogram Net Position Fix and Floating

As the position paper of the AMF with the recommendations and the details on the elaboration of the registration document dates from December 2009, we start our analysis with the year 2010. Our initial sample includes all French firms quoted in the CAC All-Tradable index as of April 2016. From these 333 firms, we exclude 18 financial firms due to their different business model and motivation for derivative usage. For all remaining 315 firms, we hand-collect the reported information on IR-exposure and corresponding hedged amounts per year, currency, maturity and type of risk (fix or floating). Since 178 firms do not have any or no significant IR exposure and 69 firm do not report the IR exposure according to the recommendations of the AMF[8], our final sample counts 68 firms. 12 of these firms are non-active hedgers, i.e., they do never hedge throughout the sample period. For the purpose of analysing the relevance of speculation, we drop these companies to avoid a bias towards companies that never hedge their IR risks. We match the sample firm's information on IR exposure with firm characteristics from the Compustat Global Vantage database. To eliminate data outliers, we winsorize the firm characteristics to the 1st and 99th percentile. The hand-collected data on interest rate risk management activities is not winsorized, since all data points are meaningful. We ignore all transaction costs related to hedging activities.

3 Variable Definitions

The granularity of our dataset allows a separate evaluation of cash flow and fair value risk. Further, the detailed information provided in the registration documents enables us to determine firm-, year-, currency-, and maturity-specific hedge ratios for interest rate risk management activities for fix and floating components separately. For this purpose, we define risk management [speculation] as the conscious reduction [increase] of future volatility that results from future movements in interest rates (Géczy et al., 2007; Hentschel & Kothari, 2001), and assume IR markets to be efficient in the weak sense of informational efficiency (Fama, 1970). We assess the IR activities of a firm by means of hedge ratios (HR), determined as the percentage of IR exposure covered by financial instruments. We further define the hedge ratio in t (HR_t) as $HR_t = H_t / E_t^b$, where H_t denotes the hedged amount in t and E_t^b the exposure before hedging in t. Since both H_t (short and long) and E_t^b can be positive or negative, HR can also take positive and negative values. Note that a short [long] derivative position (H_t) is identified through a negative [positive] sign and that a combination with a positive [negative] exposure (E_t^b) results in negative [positive] hedge ratio (HR_t).

[8] Due to the optional disclosure of the detailed IR data, our results might be subject to a selection bias.

This table reports the hedge ratio (HR) classification, defined as the percentage of IR exposure covered by financial instruments ($HR_t = H_t / \mathrm{E}_t^b$), where H_t and E_t^b denote the hedged amount in t and the exposure before hedging in t, respectively. HR captures risk management, as well as, speculative positions, where we define a positive [negative] IR exposure combined with a short position in a derivative contract to result in a negative [positive] HR, since a short derivative position is identified using a negative sign. On the other hand, a positive [negative] exposure in combination with a long position in a derivative contract is defined as positive [negative] HR. Based on this nomenclature, HR separates risk management from speculation, where we introduce the following classification: (a) risk management, seeking a reduction in volatility with $-2 < HR < 0$; (b) active speculative, seeking additional profits by increasing volatility with $HR < -2$ or $HR > 0$; (c) passive speculative, seeking constant volatility with $HR = -2$ or $HR = 0$.

Position	Hedge Ratio	Impact on Volatility
Risk Management	$-2 < HR < -1$	Decrease
	$HR = -1$ (Full Hedge*)	Decrease
	$-1 < HR < 0$	Decrease
Active Speculation	$HR < -2$	Increase
	$0 < HR$	Increase
Passive Speculation	$HR = -2$	None
	$HR = 0$	None

Table 1: Hedge Ratio Classification

* *We do not know time-to-maturity of the derivatives, thus, a full hedge is not identical to a perfect hedge, as known from the literature (Hull, 2015).*

Table 1 illustrates this interaction of exposure and corresponding derivative transactions and classifies interest rate positions according to HR and the implicit effect on volatility. First, risk management reduces volatility with $-2 < HR < 0$*, where e.g.,* $HR = -.5$ *and* $HR = -1.5$ *result in the same volatility. Second, active speculative raises volatility with* $HR < -2$ *or* $HR > 0$*, and passive speculative positions hold volatility constant with* $HR = -2$ *or* $HR = 0$*. This method allows us to determine interest rate positions that either decrease, increase or keep IR exposure constant, and hence we can identify when firms enhance or do not reduce future volatility with derivatives transactions, i.e. engage in speculation.*

The information in the registration document about interest rate risks yields to the fact that we possess individual firm-year observations for the fixed and floating interest rate risk portion, i.e., we can derive a hedge ratio for both the fixed and floating position at one point in time, for one company, currency and maturity. We refrain from analyzing the fixed and floating positions separately, since this might be misleading. Interest rate risk is different compared to e.g., foreign exchange risk, because it implies two diverse types of risk – cash flow and fair value risk – with meaningful interdependencies. A company that focuses on cash flow risk does not hedge the same way as a company that focuses on fair value risk. Further, the most common instrument to hedge interest rate risk, a swap contract (Backhaus, 2018; Chava & Purnanandam, 2007)), creates mutual reactions for both types of risk. For instance, a company with a cash flow risk orientation aims at reducing the volatility of its floating-rate financial exposure and hence swaps floating-rate positions into fixed-rate positions. This decreases the floating-rate exposure (cash flow risk) and increases at the same time the fixed-rate exposure (fair value risk). Evaluating both types of risk separately might lead to systematic bias. The argument that a firm focusing on the cash flow [fair

value] risk should only be analyzed using the floating [fixed]-rate positions is appropriate, but in case of missing observations for one type of risk, a joint examination allows considering the other risk type and hence evaluating a firm's risk activities even with missing observations. Further, incorporating both risk types fosters a holistic view of a firm's IR risk management approach. Therefore, we construct a combined measure that considers both the fixed and floating positions, where the main emphasis is on floating risk actions in accordance with the cash flow interest rate risk orientation of non-financial sample firms. For positions where the hedge ratio for both the fixed and floating part indicates risk management [speculation] according to Table 1, the combined measure takes the value of risk management [speculation]. In case the hedge ratio for the fixed exposure illustrates speculation [risk management] but the hedge ratio for the floating exposure illustrates risk management [speculation], we categorize this position as risk management [speculation]. This particular classification scheme distinguishes us from prior studies. Unlike prior literature, our measures are not subject to estimation errors in exposure or the direction of utilized IR derivatives.

4 Empirical Results

4.1 Relevance of Speculations

By means of the advanced disclosures on corporate interest rate risk management of our sample firms and the resulting firm-, currency-, year- and maturity-specific hedge ratios, we are able to capture speculation as activity that increases or holds IR exposure constant and distinguish it from risk management as activity that reduces IR exposure. Using this hedge ratio classification (Table 1), we examine whether the interest rate activities of our sample firms are formed by risk management considerations or speculative motives. It is important to keep in mind that we possess a firm-year observation for the fixed and floating interest rate risk portion separately, i.e., we are able to calculate two hedge ratios per firm-year. Our developed joint measure of both fixed- and floating-rate positions puts the emphasis on floating-rate risk following the cash flow risk orientation of our sample and non-financial sample firms in general. We do not evaluate the fixed or floating risk portion separately because this might induce a systematic bias (for details, please refer to section 3). On a first glance, we find that approximately 36% of the combined interest rate positions can be classified as risk management, whereas speculation can be divided into active (28%) and passive speculation (34%). However, interest rate observations might differ significantly with regard to the amount of exposure, and an observation with an exposure of 0.5 million Euros should not be equally relevant as an observation with an exposure of 500 million Euros. For this reason, we evaluate the data in relative terms, i.e. we relate the exposure before hedging per interest rate position to overall firm exposure. In this way, speculation with 0.5 million Euros at stake is not given equal weight than speculation with 500 million Euros. Now we find that firms hedge 63% of their IR exposure, i.e., 63% percent of firm exposure is classified as risk management while 37 percent is classified as speculation. In relation to the findings with FX data of Hecht & Lampenius (2018), where firms speculate with about 20 percent of their FX exposure, we observe speculation to be more pronounced in IR risk management compared to FX risk management. This finding verifies the survey results of Glaum (2002), and is, to the best of our knowledge, the first study to provide such evidence on the basis of quantitative data. However, it is important to recall that defining speculation for interest rates is a difficult endeavor. Regarding the differing cash flow and the fair value risk, we have clearly demonstrated and found consistent evidence that the cash flow risk is of particular interest for non-financial companies. Nevertheless, a company managing its cash flow risk might decide, according to their views on future IR developments, to change its derivative activities and maybe also look after the impact of changing interest rates on fair values. In this respect, we have introduced an innovative classification scheme that combines both a fixed and a floating observation at one point in time. In case when these two observations are contrarian, we follow the cash flow risk orientation of non-financial firms and give higher weight to floating risk component. While we are convinced that this is the right approach, it is nevertheless an error-prone component of our analysis.

4.2 Hedge Accounting and Speculation

We use our dataset to investigate the application of hedge accounting for non-financial companies and whether it is connected with speculation. Survey evidence from the US as well as Germany and Switzerland indicates that 25% and 28% of the corporate sample firms refrain from the application of hedge accounting (Glaum & Klöcker, 2011; Kawaller, 2002), Hecht (2017) shows in an FX-environment that in France 26% of the companies do not apply hedge accounting. In our present IR-context, we find that 20% (11 out of 56) of our non-financial sample firms can be characterized as non-HA-adopters. Before Hecht (2017), literature has to our knowledge never analyzed potential correlations of the accounting practice of hedge accounting with speculation. His motivation to examine this relationship was based on ambiguous statements in annual corporate disclosures, where speculation is explicitly regarded as part of hedging policy without the application of hedge accounting. In his FX setting, Hecht (2017) finds that firms that do not apply hedge accounting are more likely to speculate more than firms that apply hedge accounting. He points out that this relationship is a mere indication and it cannot be regarded as necessary or sufficient condition for the detection of speculation.

Conducting a similar analysis in the realm of IR risk management, we introduce a dummy variable (HA) that takes the value of one [.5] if a firm [partially] applies hedge accounting and zero otherwise. Since IAS 39 can restrict the designation of derivate instruments and contexts as hedging relationships, we classify a firm as hedge accounting user if it predominantly applies hedge accounting. Firms that are labelled partial hedge accounting user do only fractionally designate IR derivatives as hedge accounting relationship. Typical for this group are comments in the registration documents such as that IR derivatives may be designated in accordance with hedge accounting but they are not always eligible for it. Since the borders between all three subgroups can be vague, this subgroup contains only three firms.

To investigate whether the application of hedge accounting correlates with the extent of corporate speculation, we conduct a multinomial logit regression analysis. The dependent variable in our model with robust standard errors is the established dummy variable “Hedge accounting” with its three possible characteristics. Independent variables include first a “Speculation ratio”, which signifies the value-weighted proportion of speculation[9] per firm. Similar to section 4.1, we assess speculation in relative terms to not give equal weight to a position with 0.5 million Euros and 500 million Euros, i.e., we evaluate the exposure before hedging per speculative currency position to total firm exposure. The resulting “Speculation ratio” varies from zero to one and suggests for a value of e.g., .3 that a firm speculates with 30% of its overall IR exposure. According to Glaum & Klöcker (2011), we further control for firm size, growth opportunities and leverage. Due to data availability reasons, we use the logarithm of total assets (log (total assets) for size, and capital expenditures over total revenues (capex ratio) for growth opportunities. Following Glaum & Klöcker (2011), we employ the debt ratio (total liabilities over total assets) as approximation for leverage. Table 2 displays the summary statistics of these firm characteristics. Since the dummy variable “Hedge accounting” as well as “Speculation ratio” remain the same per firm over time, we drop all duplicated values to rely on one observation per firm to not bias the results. Due to non-availability of data for capital expenditures, we lose two firms.

[9] Speculation comprises now both active and passive speculation.

	N	Mean	SD	Min	p25	p50	p75	Max
Log (total assets)	944	8.56	1.61	4.42	7.48	8.56	9.94	12.02
Log (mkt value)	926	7.89	1.77	2.99	6.68	8.22	9.16	11.10
R&D ratio	614	0.05	0.05	0.00	0.02	0.03	0.05	0.26
Capex ratio	942	0.06	0.08	0.01	0.02	0.04	0.07	0.47
Quick ratio	939	0.37	0.36	0.04	0.17	0.30	0.42	2.25
Interest coverage	939	53.1	258.9	-13.51	3.195	6.904	12.12	2107
Debt ratio	944	0.62	0.14	0.26	0.53	0.62	0.73	0.98
Debt ratio short-term	940	0.35	0.17	0.06	0.22	0.30	0.49	0.75

Table 2: Descriptive Statistics

This table reports summary statistics of our sample. Log (total assets) is the logarithm of total assets, log (mkt value) the logarithm of market capitalization, the R&D [Capex] ratio divides the R&D Expense [capital expenditures] by total revenues and the quick ratio captures the sum of cash plus short-term investments divided by total current liabilities. Current ratio is measured by the sum pretax income and interest expense divided by interest expense. The [short-term] debt ratio captures total [current] liabilities in relation to total assets.

As shown in table 3, the extent of speculation is associated with the application of the hedge accounting. In detail, we find that a one-unit increase in the variable "speculation ratio" correlates with an increase of 7.755 in the relative log odds of being a non-HA-user compared to a HA-user, significant at the 5% threshold. In other words, firms that do not apply hedge accounting are more likely to speculate more than firms that apply hedge accounting.10 This negative relationship between speculation and the probability of applying hedge accounting confirms the findings of Hecht (2017) in an IR-environment. As mentioned above, we stress once more that this link to hedge accounting is under no circumstances a necessary or sufficient condition for speculation. Further, we observe a statistically significant correlation between firm size and hedge accounting. We find that companies that do not apply hedge accounting are presumably smaller than hedge accounting users, significant at the 1% level. This pattern is in line with Glaum & Klöcker (2011) who also associate the usage of hedge accounting with bigger firm size.

[10] Since the group of partial HA-users comprises merely three firms, we do not interpret these sub-results.

Dependent Variable	Independent Variables	Coef.	p-value
Hedge accounting	Base Outcome		
No hedge accounting	Speculation ratio	7.755	0.012**
	Log (total assets)	-2.561	0.002***
	Capex ratio	-1.258	0.823
	Debt ratio	2.419	0.563
	Constant	11.669	0.001***
Partial hedge accounting	Speculation ratio	-0.196	0.897
	Log (total assets)	0.193	0.281
	Capex ratio	1.412	0.670
	Debt ratio	2.240	0.635
	Constant	-5.981	0.100
Observations		54	
Pseudo R-squared		0.361	

Table 3: Hedge Accounting – Multinomial Logistic Regression

*This table reports the multinomial logistic regression results of the application of hedge accounting as a function of firm characteristics with robust standard errors and the case of hedge accounting application as base outcome. The dependent variable can take the values "hedge accounting", "no hedge accounting" or "partial hedge accounting" according to a firm's approach on the application of this optional accounting policy. The independent variables are defined as follows: Speculation ratio measures the value-weighted proportion of speculation per firm on a metric scale from 0 to 1, where 0 [1] indicates risk management [speculation] with a firm's total IR exposure. Log (total assets) is the logarithm of total assets, the capex ratio divides the capital expenditures by total revenues and the debt ratio captures total liabilities in relation to total assets. *, ** and *** denote significance at the 10%, 5% and 1% level, respectively.*

4.3 Determinants of IR-Speculation

Empirical evidence on speculative elements in corporate risk management originates mostly from commodity and FX risk practices. Glaum (2002) for example states that his FX model is able to work out determinants that might explain why a firm take bets in financial markets, his model for interest rates, however, fails to do so due to insignificant chi-square values. Based on the additional disclosures from our French sample firms we are able to identify speculation and distinguish it from risk management. Using this advantage, we develop a model to work out potential determinants of speculation. To motivate our empirical model, we start with the various theories that provide different rationales for speculation.

Stulz (1996) argues that speculation might be value-enhancing if firms possess private information and have the financial strength for speculative positions. Stulz (1996) points out that firms can make use of their information advantage to create value through timing the market. Such firms should be resilient enough to withstand potential

losses from incorrect market views, to not suffer from underinvestment. According to Stulz (1996), rather bigger firms typically possess specialized information as well as a sufficient financial endowment. He points out, however, that in an FX-context, most FX dealers do not have such an informational advantage about future FX-rates. We assume the same for an IR-context for non-financial firms and hence this theory is inadequate for our case.

Further, the convexity theories of Adam et al. (2007) and Campbell & Kracaw (1999) also illustrate why firms have an incentive to speculate. The tendency for speculation originates from a profit function that is convex in investment. This convexity of the investment opportunities results in the rationale that positive speculative outcomes enable productive investments to be conducted, that would elsewise be abandoned. According to Campbell & Kracaw (1999), this pattern should be observable with firms that exhibit the follow characteristics: significant growth opportunities [growth], meagre internal resources [liquidity] as well as high cost of asymmetric information [size]. Similar to Adam et al. (2017) and Graham et al. (2001), we presume that informational asymmetry affects smaller firms more than bigger firms and that smaller firms are more constrained in external financing. We attempt to work out potential determinants of speculation in an IR environment by testing theories in favor of speculation empirically. Since non-financial companies do not seem to have a comparative advantage for e.g., future IR-rates, we stick to the theoretical foundations of Adam et al. (2007) and Campbell & Kracaw (1999). That is, we expect speculation to be negatively [positively] {negatively} correlated with firm size [growth opportunities] {liquidity}.

To test these hypotheses, we drawn on the calculated firm-, currency-, year- and maturity-specific hedge ratios enabling us to separate speculation (increasing or holding IR exposure constant) from risk management (reducing IR exposure). We use this differentiation and construct as dependent variable a dummy variable that equals one if a firm is speculating with an interest rate position and zero otherwise, according to Table 1 and our classification scheme with an emphasis on the cash flow interest rate risk detailed in section 3. Following the convexity theories, we classify the independent variables into the three categories size, growth and liquidity. We measure firm size by the logarithm of total assets (log (total assets) and alternatively by the logarithm of market capitalization (log (mkt value). Growth opportunities are approximated by the ratio of research and development expenses over total revenue (R&D ratio) and as secondary proxy, in line with Beber & Fabbri (2012) by capital expenditures to total revenues (capex ratio).[11] Our approach to model the corporate liquidity situation is twofold. Following (Géczy et al., 2007), we first calculate a short- and long-term liquidity indicator, i.e. quick ratio (cash and short-term investments to total current liabilities) and interest coverage ((pretax income + interest expense) / interest expense), respectively. Second, we investigate the levels of indebtedness. We use the debt ratio (total liabilities to total assets) and since we are particularly interested in near-term settings, where profitable investments can only be realized due to positive outcomes of speculative activities, we further utilize the short-term debt ratio with total current liabilities to total assets.

Table 4 reports the outcome of the logistic regression model with robust standard errors. According to the main regression model in Panel A, we find that speculators are bigger, have more growth opportunities and higher short-term liquidity with at the same time higher debt ratios compared to risk managers. In detail, the coefficient for the variable log (total assets) of .373 with a statistical significance at the 1% level shows that a one-unit increase in the variable log (total assets) correlates with a .373 increase in the log-odds of the dependent variable. This means that companies that speculate are more likely to be bigger than companies that perform risk management, a finding that does not confirm our expected negative relation between firm size and speculation. Further, companies that speculate exhibit a higher probability, significant at the 1% level, to have more growth opportunities than companies that follow risk management motives. This is in line with the convexity theories. As regards internal funds, we find that speculators are more likely to have higher short-term liquidity but at the same time higher debt levels than risk managers, where the quick [debt] ratio is significant at the 1% [10%] level.

[11] Please note that we do not employ the book-to-market-ratio due to potential misinterpretations. Géczy et al. (2007) state off-balance sheet correlations with speculation as one explanation.

Panel A: Main regression model

Dependent Variable	Independent Variables	Coef.	p-value
HR classification	Log (total assets)	0.373	0.000***
	R&D ratio	7.981	0.000***
	Quick ratio	0.771	0.008***
	Debt ratio	1.582	0.059**
	Constant	-4.414	0.000***
Observations	502		
Pseudo R-squared	0.06		

Panel B: Alternative regression model

Dependent Variable	Independent Variables	Coef.	p-value
HR classification	Log (mkt value)	0.204	0.000***
	Capex ratio	-0.342	0.748
	Interest coverage	0.001	0.152
	Debt ratio short-term	1.359	0.010***
	Constant	-1.470	0.003***
Observations	733		
Pseudo R-squared	0.03		

Table 4: Determinants of Speculation – Logistic Regression

*This table reports the logistic regression results of our classification of IR derivative positions as a function of firm characteristics with robust standard errors and the risk manager classification as base outcome. Following Table 1, the dependent variable HR classification can take the values 0 [1] for positions classified as risk management [speculation], where active and passive speculation are grouped together. The independent variables are the firm characteristics detailed in Table 2. Panel A details our main regression model with one financial characteristic per category size and growth, as well as one short-term liquidity indicator and one debt measure. In Panel B, we substitute each variable to examine consistency in an alternative regression model. Log (total assets) is the logarithm of total assets, log (mkt value) the logarithm of market capitalization, the R&D [Capex] ratio divides the R&D Expense [capital expenditures] by total revenues, the quick ratio captures the sum of cash plus short-term investments divided by total current liabilities and interest coverage is measured by the sum pretax income and interest expense divided by interest expense. The [short-term] debt ratio captures total [current] liabilities in relation to total assets. *, ** and *** denote significance at the 10%, 5% and 1% level, respectively.*

Following the approach of Hecht (2017), we substitute each variable to examine consistency in an alternative regression model in Panel B. We observe the same relationships between speculation and firm size ((log (mkt value) as well as corporate debt levels (short-term debt ratio). Hence, IR-speculator seem to be bigger and more indebted than IR-risk managers. Concerning growth opportunities and liquidity, the secondary proxies capex ratio and interest coverage are insignificant. Taken together, this evidence does not empirically confirm the convexity theories and is not in line with the findings of Hecht (2017), who tests the convexity theories in an FX-context and finds that FX-speculators are smaller, have more growth opportunities and possess less internal resources than FX-risk managers.

5 Conclusion

Interest rate risk is complex. It involves two different types of risk, the cash flow and the fair value risk, with significant interdependencies, what makes determining speculation empirically a difficult endeavor. To overcome this limitation and unlike literature, we analyze both risk types individually, where we accommodate the cash flow risk focus of non-financial companies. Following this innovative approach, we calculate firm-, year-, currency-, and maturity-specific hedge ratios for each risk type separately. These hedge ratios allow for a classification into speculation (increasing or holding IR exposure constant) and risk management (reducing IR exposure). Using this classification scheme, we indicate empirically that speculative elements are relevant in interest rate risk management. Our findings suggest that these speculative activities are more pronounced in relation to FX risk management, and that the level of speculation is negatively correlated with the probability of applying hedge accounting. Further, the analysis of the determinants of speculation in IR risk management does not empirically confirm the convexity theories: we find that IR-speculators might be bigger and have higher debt ratios compared to IR-risk managers.

Appendix: Definition of Variables

Variables	Description of variables
Capex ratio	Capital Expenditures / Total Revenues
Quick ratio	(Cash + Short-Term Investments) / Total Current Liabilities)
Debt ratio	Total Liabilities / Total Assets
Debt ratio short term	Total Current Liabilities / Total Assets
$E_t^b(\cdot)$	Exposure before hedging in t
HR	Hedge ratio with $HR_t = H_t / \mathrm{E}_t^e$ percentage of FX exposure covered by financial instruments
$H_t(\cdot)$	Hedged amount in t indicated by derivative instruments reported
Log (mkt value)	Log (Com. Shares Outstanding * Closing Share Price End of Year)
Interest coverage	(Pretax Income + Interest Expense) / Interest Expense
R&D ratio	R&D Expense / Total Revenues

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