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Article

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Hybrid capital instruments in the financial industry

Abstract

The number and issuances of hybrid capital instruments are growing, especially since the introduction of regulatory capital requirements by the Basel Accords in 1988. This paper analyses the major developments in the hybrid capital market. As the largest issuer of hybrid capital this paper focuses on the financial industry. The main driver behind the market developments is regulatory capital requirements and a major constraint for market growth is the credit rating. Statistical tests accept the hypothesis that rated banks are more likely to issue hybrid capital than banks without a credit rating. Furthermore the level of the Tier 1 ratio has a huge influence on the type of hybrid security, which is issued to fulfil the regulatory capital requirements.

1 Section 1: Introduction

The financial crisis from 2007-2009 revealed major instabilities in the financial services sector and led to the collapse and bankruptcy of several major financial institutions such as Lehman Brothers and the bailout of AIG. Furthermore, the crisis also revealed the risks latent in several financial instruments, both for issuers and investors. Hybrid capital instruments, which combine debt and equity characteristics, were among the instruments, whose risks were underestimated and, therefore, also under-priced. Yu and Van Luu (2012) discuss the strong growth of hybrid capital instruments in the financial industry before the crisis and its decline during the crisis. However, the development of new hybrid capital instruments after the crisis resulted in strong growth in this asset class again. Furthermore the financial industry is the largest issuer of hybrid capital instruments and largest investor in this asset class. Therefore, this paper focuses on the financial industry, which includes banks, insurances, reinsurances, pension funds, hedge funds and other institutional investors.

A considerable amount of hybrid capital instruments appeared in the 1990s shortly after the implementation of the Basel Accords in 1988. This indicates a strong correlation between regulatory requirements and the issuance of hybrids. Hence, this study gives a short overview over the major regulatory requirements. The core of the first Basel Accord, called Basel I, were capi-

tal requirements, which were supposed to provide a sufficient amount of capital to cover unexpected losses. These capital requirements were calculated using the following formula:

$$\text{Capital Ratio} = \frac{\text{Capital (Tier 1 + Tier 2)}}{\text{Risk – Weighted Assets + credit risk equivalents}} = 8\%$$

Further major bankruptcies in the banking sector after the implementation of Basel I showed that the standard was not able to capture all risks latent in the financial industry. Hence, Basel II was implemented in 2004 to stabilise the financial sector. It introduced strict qualitative and reporting requirements and covered further risks latent in the banking sector. Therefore, the total required capital, which is based on those risks, increased as well. Finally the shortcomings of Basel II were exposed during the financial crisis in 2007. Basel III, which was announced in 2009 and phased-in starting in 2013, requires several additional ratios and buffers. Since Basel III is not fully implemented yet its adequacy to stabilise the banking sector cannot be assessed. Table 1 summarises the development of the regulatory capital requirements under the Basel Accords.

Table 1: The development of the regulatory capital requirements

Instruments	Basel I	Basel II	Basel III
Capital Ratio	8% of RWA	8% of RWA	8% of RWA + 2.5% Conservation Buffer 2019
Capital Quality	4% Tier 1	4% Tier 1	4.5% CET 1 2019 6% Tier 1 2019
Risks Covered	Credit Risk Market Risk	Credit Risk Market Risk Operational Risks	Credit Risk Market Risk Operational Risks Liquidity Risk
Buffer	-	-	Countercyclical (CET 1, AT 1) Capital Conservation (CET 1)
Additional Ratios	-	-	Leverage Ratio Liquidity Coverage Ratio Net Stable Funding Ratio

It is striking that with every amendment more risks were covered and, therefore, the required capital increased significantly. Consequently banks have strong incentives to reduce the financing costs implied by the higher regulatory capital requirements.

Additionally the qualitative requirements for regulatory capital were enhanced as well. According to Jablecki (2009), Tier 1 and Tier 2 capital are classifications for the quality of capital under Basel I. Regulatory capital had to be 8% of the risk-weighted assets (RWA) and credit risk equivalents and at least 4% had to consist of Tier 1 capital. The highest qualitative standards were applied to Tier 1 capital.

Figure 1 shows further amendments of the classification of the capital tiers under the Basel Accords.

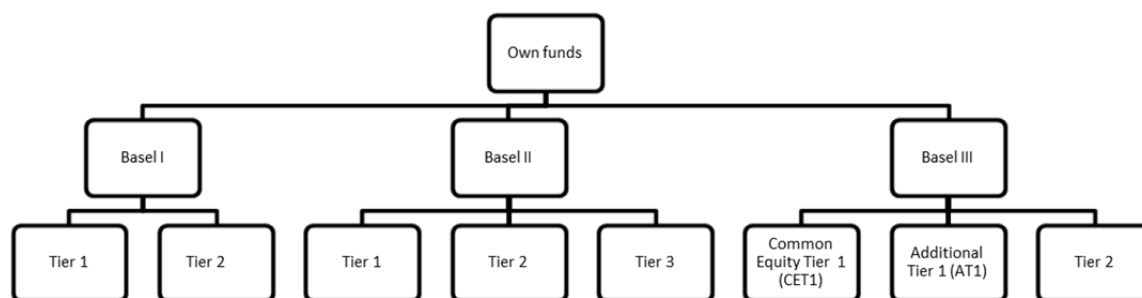


Figure 1: The Capital Tiers under the Basel Accords

Tier 1 capital consists to large parts of common equity under all Basel Accords and the other tiers comprise supplementary types of capital.

According to the pecking order theory common equity is the least preferable form of financing for a firm. Additionally common equity is the most expensive financing form for firms, as equity holders are subordinated to debt-holders in the case of bankruptcy. Therefore, they face the greatest risk and want to be compensated for that risk by higher returns. This situation created a demand for cheaper equity financing and led to the development of new hybrid capital instruments. Since hybrid capital instruments have equity and debt characteristics, they are cheaper than common equity and at the same time can be used to fulfil regulatory capital requirements. Naturally the amount of hybrid capital instruments, that can be used to fulfil the regulatory capital requirements, is limited. Only 15% to 50% of each capital tier could consist of hybrid securities, depending on the country, where the issuer was located.

Unfortunately, hybrid securities did not fulfil their expected loss-absorbing purpose in the financial crisis. However, selected hybrid securities may still be part of the capital tiers under the current regulatory framework, Basel III.

This paper is structured as follows. Section II discusses the developments in the market for hybrid securities, its main driving factors and also its risks. Additionally the effects of hybrid capital on the capital structure of banks and the impact of credit ratings are evaluated. Section III provides econometrical tests of the influence of the main drivers and also of possible constraints.

2 Section II: Literature Review

2.1 The market development of hybrid securities

Figure 2 presents the Merrill Lynch Euro Subordinated Debt Index for financial institutions to show the development of hybrid capital instruments accounted for as subordinated debt from 1996 to 2015. Due to its focus on financial institutions this index is a representative proxy for the developments of hybrid capital in the financial industry. The issuance of hybrids strongly increased since 2000 and sharply declined during the financial crisis in the beginning of 2008. Acharya et.al. (2011) provide further evidence that large stakes of the capital raised from 2000 to 2006 and even from 2007 to 2009 were in the form of hybrid securities such as preferred stock and subordinated debt. There exist a great variety of hybrids with sometimes more equity-like, debt-like or even insurance-like characteristics. Especially Asset-Backed Capital Commitment Securities (ABC) and Committed Preferred Custodial Trust Securities (CPS) were heavily used to fulfil regulatory capital requirements before the financial crisis according to Culp (2009).



Figure 2: Merrill Lynch Euro Subordinated Debt Index Financial Institutions (Bloomberg, 2015)

These instruments provide flexibility to the issuers and relatively high returns to the investors in comparison to traditional fixed-income instruments. Especially the very low credit spreads since 2005 enhanced the demand for higher yields. Additionally the classification as deeply subordinated debt makes it an interesting investment vehicle for all fixed-income investors such as insurance companies or pension funds that operate under strict mandates.

However, several latent risks were underestimated before the financial crisis, such as the default risk and the deferral of coupons. According to Yu and Van Luu (2012) this risk was seriously under-priced before the financial crisis, as the very low spread differences between Tier 1 securities with deferral and Tier 2 securities without deferral show. Finally extension risk exists, which means that a bank does not call its hybrid security at the first possible call-date. This practice is not favourable for investors, as most hybrid securities were priced based on the Yield-to-Call (YTC) instead of the Yield-to-Maturity (YTM).

The financial crisis has shown that Basel II and the hybrid instruments used as Tier 1 and Tier 2 capital under Basel II are not able to provide sufficient capital during a systemic financial crisis. Hanson, Kashyap and Stein (2010) name various solutions for the problems that were revealed in the financial crisis. One solution is a new structure for hybrid capital – contingent convertibles (CoCos). CoCos or contingent reverse convertibles are eligible for the capital tiers under Basel III and are structured similarly to contingent capital before the crisis. However, they consider various new aspects to strengthen banks' capital bases.

Pitt et.al. (2011) discuss the major differences between CoCos used as gone-concern or going-concern capital. The name CoCo indicates already, that one or several triggers have to be defined to trigger the conversion. There exist three major triggers. Capital-based triggers lead to the conversion of the CoCo, if the bank's capital falls below the threshold of a regulatory capital ratio. So far most CoCo issuances contained triggers based on the Tier 1 ratio. This kind of trigger is easy to understand and very transparent for investors. However, the disclosure requirements for banks have to be significantly enhanced to provide investors the capability to assess and monitor the probability of conversion, which significantly influences the CoCo's riskiness. Otherwise banks might try to adjust their reported capital ratios to levels preventing or triggering a CoCo. Other triggers are a regulatory discretion-based trigger, which means that the respective regulatory authority declares a systemic financial crisis that triggers the mandatory conversion of the CoCo as proposed by The Squam Lake Discussion Group (2010) or a market-based trigger, which could be based on a bank's share price over a certain period or on the CDS spread as discussed by Zähres (2011).

Additionally two possibilities determine the way a CoCo is used very much – the conversion to common equity (CE) or the principal write down (PWD) of the CoCo. The original idea of the structure of CoCos contained an embedded put option to convert the CoCo to common equity, if a certain trigger is breached. According to Pitt et.al. (2011) the CE structure has several advantages. It dilutes the existing shareholders and, therefore, creates an incentive for the management to reduce leverage and risk. Overall regulators seem to prefer CoCos with CE, as it reduces systematic risk significantly.

However, the market for CoCos has to be considered as well. Hence, Avdjiev et.al. (2013) argue strongly in preference of the PWD structure. This strengthens the banks' capital ratios, as leverage is reduced significantly. CoCos with a PWD option are very interesting for fixed-income investors, who are expected to be an important investor group for CoCos. The strict mandates of most fixed-income investors such as insurances or pension funds could prevent them from holding CoCos with a CE option, as their mandate prohibits them to hold equity.

Pitt et.al. (2011) discuss the issuers' costs as another important driver for the market of CoCos. The spread of CE CoCos is on average 2.5% above the spread for other subordinated debt and for PWD CoCos it is 3.9% higher. However, the riskier CoCos with a PWD option dominate the market in comparison to CE CoCos. This can be explained considering the targeted investor groups.

According to Avdjiev et.al. (2013) a major problem slows down the growth of the market for CoCos. In 2013 half of all outstanding CoCos were not rated due to different regulatory treatment of CoCos among different jurisdictions around the globe. Especially fixed-income investors are often prohibited to invest into instruments without a credit rating. Recently S&P and Fitch reduced their reluctance to rate CoCos, which triggered higher growth in the CoCos market. Besides the targeted fixed-income investors, European and Asian retail investors and private banks invest strongly into CoCos according to Avdjiev et.al. (2013). Additionally US institutional investors such as hedge funds are attracted by relatively high yields on CoCos in the current low interest environment. Pitt et.al. (2011) estimate the potential market size for CoCos between \$925 billion and \$1.9 trillion.

Generally the market for hybrid capital instruments has recovered from the sharp decline in 2008 and 2009. Especially the start of the phasing-in of Basel III since 2013 led to strong growth.

2.2 Capital Structure Decisions and Rating Impact

Hybrid capital instruments provide benefits to financial companies, which are reflected in the capital structure of the issuing firms. Additionally, constraints such as limited market access are reflected in the capital structure.

Faulkender and Peterson (2006) show that rated firms have far higher leverage levels and issue on average 35% more debt than firms without a rating, which shows a clearly positive correlation between the rating and the use of debt as a financing instrument. Smaller firms, which have to rely on borrowing from financial intermediaries, are far less leveraged, as the imperfect financial contracting and the monitoring costs raise the cost of debt significantly.

Furthermore, Kisgen (2006) discusses the discrete costs that affect debt and equity financing decisions. Hence, he examines the financing decisions of firms near a rating upgrade or downgrade, which would directly affect their cost of debt. His findings indicate that firms close to a change in their rating issue on average 1% less debt relative to equity than firms not close to a rating change. Especially the difference between investment grade, which means a rating of BBB or better by Fitch Ratings, and non-investment grade is enormous. Generally managers seem to prefer higher ratings. This can be explained by lower financing costs and the better market access, which is provided by a good credit rating.

According to Avdjiev et.al. (2013) the rating is one of the major influencing factors for the CoCo market as Hybrid capital instruments are mostly issued as subordinated debt. Since many fixed-income investors operate under strict mandates, that prohibit them to invest in non-rated capital instruments, it is crucial to be rated for all capital instruments in the fixed-income market. Additionally many institutional investors are reluctant to invest into non-rated securities, as it is much more difficult to assess the risk of those securities. Hybrid capital instruments are mostly structured as subordinated debt and, therefore, it is crucial to be rated for those instruments to create a sufficiently large market and attract investors. In this paper it is assumed that a hybrid security is rated, if the issuer has a credit rating.

2.3 The Rating of Hybrid Securities

Fitch's criteria for the rating of bank subordinated and hybrid securities are most relevant for this paper, since the sample for the models in Section III is drawn from the Bankscope database, which is operated by Fitch Ratings.

Fitch classifies certain hybrids such as CoCos into buckets with 0%, 50% or 100% equity credit. Depending on this classification, a hybrid is included in the calculation of Fitch's bank capitalisation ratios. However, the most important aspect for this paper is, that hybrid securities in the 0%, 50% or 100% equity bucket have common features that classify them as CET 1, AT1 or Tier 2 instruments. An instrument in the 100% equity bucket can be either CET1 or AT1 capital and instruments in the 50% equity bucket are usually AT1 capital. All other rated hybrid instruments are assigned to the 0% equity bucket.

3 Section III: Methodology and Models

The following models focus on the financial industry as the issuer of hybrid capital. However, the models do not take into account investors directly due to a lack of data, as many targeted investors such as hedge funds do not disclose their investments. Furthermore, it is not considered, if a rating is investment grade or sub-investment grade due to the lack of reliable data, even in sources such as Bankscope (Fitch Ratings) or Compustat (S&P).

3.1 The impact of the rating on dividend smoothing

The model used to define the influence of the rating on the issuance of hybrid capital instruments is based on Lintner's (1956) model and some amendments of Aivazian, Booth and Cleary (2006). Lintner (1956) uses the following equation to estimate the effect of a firm's dividend smoothing:

$$d_{i,t} = a_i + b_i e_{i,t} + c_i d_{i,t-1} + \varepsilon_i$$

Hereby, Lintner specifies $d_{i,t}$ as the actual dividend, which is an "adjustment of the existing dividend ($d_{i,t-1}$) to the target dividend, which he hypothesized was determined by the firm's target payout rate and normalized earnings ($e_{i,t}$)" (Aivazian, Booth and Cleary, 2006, p.440). The adjustment to the target payout-rate is the smoothing that firms use according to Lintner.

Aivazian, Booth and Cleary (2006) add the influence of ratings to the model. Since capital market participants such as analysts or shareholders closely observe rated firms, they face greater signalling and agency problems than firms without a rating. Therefore, very volatile dividend

payments that are drastically adjusted to the period's earnings can give wrong signals to the capital market. Consequently rated firms follow a dividend-payout strategy and smooth their dividends.

The following equation includes the rating adjustment,

$$d_{i,t} = a_i + b_i e_{i,t} + c_i d_{i,t-1} + f_i(RI * e_{i,t}) + g_i(RI * d_{i,t-1}) + \varepsilon_i$$

where RI is an indicator variable, which is 1 for rated firms and 0 for firms without a rating. Aivazian, Booth and Cleary (2006) found strong support for their hypothesis that rated firms smooth their dividends.

I will apply several ideas of the previously mentioned models to test my hypothesis that *rated banks use more hybrid capital than banks without a credit rating*.

3.2 Variables, Data and Time Frame

Since the models in this paper focus mostly on issuing companies in the financial industry the data is obtained from Bankscope. The sample contains data from 5320 banks for the period from 2004 to 2014. Variables that indicate, if a bank has a rating or not, comprise proxies for the size of a bank, its growth possibilities, its profitability and its regulatory capital requirements.

Table 2: *Summary of all variables*

Variable	Definition
Hybrid-to-Total-Funding Ratio	$\frac{\text{Hybrid Capital}}{\text{Total Funding}}$
Interest-Expense-on-Hybrids-Fraction	$\frac{\text{Interest Expense Paid on Hybrid Capital}}{\text{Total Interest Expense}}$
Rating Indicator	<i>The Rating Indicator equals 1, if the bank is rated and 0, if the bank is not rated</i>
Size Variables	
Operating Profit	<i>Log of Operating Profit</i>
Total Assets	<i>Log of Total Assets at the end of the year</i>
Growth and Profitability	
M/B Ratio	$\frac{\text{Market price} * \text{Number of outstanding shares}}{\text{Book Value of outstanding shares}}$
Tangible Assets	<i>Log of Book Value of Fixed Assets</i>
Profit before Taxes	<i>Log of Profit before Taxes</i>
Regulatory Variables	
Tier 1 Ratio	<i>Tier 1 Ratio of the Basel Accords</i>
Total Capital Ratio	<i>Total Capital Ratio of the Basel Accords</i>

3.3 Summary Statistics

Table 3 displays the summary statistics that show mostly the expected results. The Hybrid-to-Total-Funding Ratio is a proxy for the use of hybrids as a proportion of total funding. It is on average 12.79% for the complete sample. However, banks with a credit rating use far more hybrids (33%) in comparison to banks without a credit rating (0.09%). The Interest-Expense-on-Hybrids Fraction is a surprisingly small amount of the total interest expense, especially in relation to the amount of hybrids for rated banks. This can be explained by the small amount of observations for this variable.

Table 3: Summary Statistics

	Hybrid- to-Total- Funding Ratio	Interest- Expense- on-Hybrids Fraction	Total Assets	Operati ng Profit	M/B Ratio	Tangible Assets	Profit before Taxes	Tier 1 Ratio	Total Capital Ratio
Total Sample									
Observations	20,342	689	47,349	42,910	8,679	46,808	43,263	29,627	36,006
Mean	12.79%	1.48%	14.34	9.60	2.68	9.65	9.49	16.96%	19.16%
Std. Dev.	12.53	0.05	2.17	2.24	67.60	2.16	2.28	20.09%	19.35%
Banks with Rating									
Observations	7,830	396	31,218	27,536	8,360	30,747	27,684	23,344	25,960
Mean	33.05%	2.29%	14.70	10.15	2.00	9.96	10.13	17.38%	19.54%
Std. Dev.	20.19	0.06	2.35	2.32	47.72	2.37	2.33	21.25%	21.40%
Banks without Rating									
Observations	11,579	45	13,144	12,734	89	13,126	12,910	4,186	7,542
Mean	0.09%	0.00%	13.49	8.41	10.07	9.03	8.09	13.30%	17.15%
Std. Dev.	0.00	0.00	1.41	1.52	85.25	1.41	1.43	5.87%	5.68%

The M/B Ratio gives some surprising results for banks with a credit rating due to a very small number of observations for non-rated banks. Therefore, this variable is not included in the model estimation to prevent biased results. All other size, growth and regulatory variables give reasonable results and are therefore they are included in the models.

Table 4: Variables affecting the Hybrid-to-Total-Funding Ratio and the Rating

Models	Logistic_1	Logistic_2	Logistic_3
Dependent Variable	Hybrid-to-Total-Funding Ratio		Rating (1=yes; 0=no)
Hybrid-to-Total-Funding Ratio			8.96E+67 0.00***
Interest-Expense-on-Hybrids Fraction	1.60E+277 0.00**		
Total Assets	1.82 0.04*	2.13 0.00***	1.21 0.09
Operating Profit	1.75 0.31	0.72 0.00***	0.13 0.00***
Tangible Assets	0.99 0.95	1.08 0.13	0.81 0.02*
Profit before Tax	0.25 0.01*	0.84 0.06	16.68 0.00***
Tier 1 Ratio	3.71 0.00***	0.00 0.00**	26918.44 0.00***
Total Capital Ratio	0.00 0.01***		
Rating Indicator		5.43 0.00***	
Constant	0.11 0.29	0.00 0.00***	0.00 0.00***
Observations	520	8,155	8,155
Pseudo-R²	76%	30%	54%
Legend: *p<0.05; **p<0.01; ***p<0.001			

3.4 Effects on the Hybrid-to-Total-Funding Ratio and the Rating

The next step is to determine the variables that influence the Hybrid-to-Total-Funding Ratio and the Rating to test the following hypothesis can be stated: *The issuance of hybrid securities is affected by firm characteristics and the presence of a rating.*

Since the Hybrid-to-Total-Funding Ratio is a percentage, logistic models with cluster robust standard errors are used. Logistic models are fit by maximum likelihood according to Cameron and Trivedi (2010) and do not deteriorate the results like OLS estimators, when the dependent variable is a proportion including 0 or 1. While the observations for the different banks are expected to be independent, there may be autocorrelation among the bank-year observations for the same bank. The cluster robust standard errors account for possible autocorrelation among the bank-year observations and avoid biased results. In all regression tables the first row for each variable shows the odds ratio and the second row the p-value. The stars indicate significance at the level described in the legend. According to Gould (2000) odds ratios are the exponentiated coefficients of the logistic regression. In contrast to the coefficients, the odds ratios can be interpreted linearly, meaning that a 1-unit increase in the variable affects the variable as reported in the odds ratio. The regression results are presented in table 4 on the previous page.

The logistic_1 and logistic_2 model show the factors that influence the Hybrid-to-Total-Funding Ratio, while the logistic_3 model tests the influence on the rating indicator. In the logistic_2 and logistics_3 model the Rating Indicator is included, while the Interest-Expense-on-Hybrids and total capital ratio are omitted to improve the results, which increases the observations from 520 in the first model to 8,155. The high Pseudo- R^2 of 30-76% underline the high explanatory power of the models. The regression results presented in table 4 indicate a positive correlation between the Hybrid-to-Total-Funding Ratio and the Rating Indicator. Furthermore, the Total Assets, Profit before Tax and Tier 1 Ratio are highly significant and give the intuitive positive results. They will be used as explanatory variables further on. In contrast, the Operating Profit, Tangible Assets and Total Capital ratio will be omitted to avoid biased results, as their significance is less striking.

3.5 Rating-Dependent Hybrid Capital

The model that examines the issuance of hybrid capital is tested by the methodology of Lintner (1956) and Aivazian, Booth and Cleary (2006) described in Section 3.1:

$$R_{H_{i,t}} = \alpha_i + \beta_i R_{Int_{i,t}} + \gamma_i R_{H_{i,t-1}} + \varepsilon_i$$

The Hybrid-to-Total-Funding Ratio ($R_{H_{i,t}}$), as a proxy for the use of hybrids for financing purposes, depends on the Interest-Expense-on-Hybrids Fraction ($R_{Int_{i,t}}$). Furthermore, the use of hybrids in the previous year is given by the lagged Hybrid-to-Total-Funding Ratio ($R_{H_{i,t-1}}$). ε_i gives the standard errors. Banks that issued hybrids in the past are likely to have the characteristics of hybrid instruments embedded in their financing strategy. Additionally the issuer's costs for hybrids will reduce the amount of hybrids, if they are too high. Since the rating has a great influence on financing costs such as interest payments, a small odds ratio is expected for the Interest-Expense-on-Hybrids Fraction.

The rating indicator (RI) introduced by Aivazian, Booth and Cleary (2006) is used to model the impact of the credit rating on banks in the following equation:

$$R_{H_{i,t}} = \alpha_i + \beta_i R_{Int_{i,t}} + \gamma_i R_{H_{i,t-1}} + \delta_i (RI * R_{Int_{i,t}}) + \mu_i (RI * R_{H_{i,t-1}}) + \varepsilon_i$$

The rating indicator is 1 for rated banks and 0 for banks without a credit rating. It acts as an interaction variable with the lagged Hybrid-to-Total-Funding Ratio ($RI * R_{H_{i,t-1}}$) and the Interest-Expense-on-Hybrids Fraction ($RI * R_{Int_{i,t}}$). It will give results, if a bank has a credit rating.

Generalised linear models (GLM) are used for the estimation. Smithson and Verkuilen (2006) argue that GLM gives reliable result even, if the dependent variable is a proportion including 0 and 1. This type of estimator accounts for the skewness and heteroskedasticity present in models with a proportion as dependent variable. In this paper the GLM follows a Bernoulli distribution. Additionally it is estimated as a logit model with maximum likelihood and robust standard errors. The results of the model are displayed in table 5.

Table 5: *The impact of the Rating on the Hybrid-to-Total-Funding Ratio*

Models	GLM_1	GLM_2	GLM_3
Dependent Variable	Hybrid-to-Total-Funding Ratio		
Lagged Hybrid-to-Total-Funding Ratio	64.83014 0.01**	7333.44 0.61	7333.44 0.61
Interest-Expense-on-Hybrids Fraction	317.9483 0.00***	18.01 0.01**	18.01 0.01**
Lagged Hybrid-to-Total-Funding Ratio for rated banks		3.00E+22 0.00**	3.00E+22 0.00**
Interest-Expense-on-Hybrids Fraction for rated banks			1
Constant	0.00 0.00***	0.00 0.00***	0.00 0.00***
Observations	613	383	383
Legend:	* p<0.05; ** p<0.01; *** p<0.001		

The GLM_1 model tests the impacts of the lagged Hybrid-to-Total-Funding Ratio and the Interest-Expense-on-Hybrids Fraction on the issuance of hybrid capital in relation to total funding using a Linter-type regression. Both variables are significantly different from 0 and have high odds ratios greater than 1. This means that they are very likely to affect the issuance of hybrid capital in the current period.

The GLM_2 model includes the lagged Hybrid-to-Total-Funding Ratio for rated banks. It shows the results only for rated banks, as the rating indicator acts as an interaction variable. The high significance and high odds ratio indicate that rated banks are very likely to issue hybrid capital in the current period. Moreover, the Interest-Expense-on-Hybrids Fraction has a high odds ratio as well. This result is a bit puzzling, as a small odds ratio was expected. However, the summary statistics in Section 3.3 showed that the interest expense on hybrid securities is only a small proportion of the total interest expenses. Consequently the regression results indicate that hybrid securities are cost-effective in comparison to some other types of financing. Finally the GLM_3 model includes the Interest-Expense-on-Hybrids Fraction for rated banks. Unfortunately this variable was omitted due to collinearity. Hence, it does not influence the other results, which stay the same as for the GLM_2 model.

3.6 Hybrid Capital to fulfil Regulatory Capital Requirements

Regulatory capital requirements are a very important driver for the issuance of hybrids. The model to estimate this relationship is based on a methodology of Kisgen (2006). He uses “Plus or Minus Tests” to test the effect of firms being close to a rating-upgrade or downgrade on their net debt-issuances based on ratings of S&P. Generally S&P assigns issuers ratings of A, AA or BBB etc. based on their creditworthiness. Those ratings are called broad ratings. Overall 18 broad ratings exist. Additionally S&P assigns ratings of A+, B- or BB+ etc., which show that a firm is on the upper- or lower border of the broad rating. Hence, firms with a “plus” in their broad rating are close to a rating-upgrade and firms with a “minus” are close to a rating-downgrade.

Kisgen (2006) creates two dummy variables to replicate the effect of the “plus” or “minus” in the broad ratings. The first dummy variable CRPlus equals 1 for firms with a “plus” in their broad rating and 0 otherwise. They are close to a rating-upgrade. The second dummy variable CRMi-nus equals 1 for firms with a “minus” in their broad rating and 0 otherwise. Those firms are a close to a rating-downgrade. Additionally Kisgen (2006) adds a set of control variables for firm size, leverage and profitability that are known to affect the quality of ratings. Finally, the author runs regressions using several formulas. For this paper the following regression equation is the most important:

$$\text{NetDI}_{i,t} = \alpha + \beta_1 \text{CR}_{\text{plus}} + \beta_2 \text{CR}_{\text{minus}} + \phi(K_{it}) + \varepsilon_{it},$$

where $\text{NetDI}_{i,t}$ is the net debt-issuance at time t for company i , CR_{plus} is the first dummy variable, CR_{minus} is the second dummy variable and K_{it} is the set of control variables. The standard errors are given by ε_{it} .

This paper focuses on the effect of the regulatory capital requirements on the issuance of hybrid securities instead of straight-debt issuances used by Kisgen (2006). So far the focus was mostly on hybrid capital instruments without further breakdown. Since hybrid capital instruments have different structures as discussed in Section II, a further breakdown into hybrids is necessary depending on their classification, as an instrument with more equity-like or more debt-like characteristics is issued for different purposes. Bankscope provides a classification of hybrid securities accounted for as debt and hybrids reported as equity. Those hybrid securities are used for different purposes, which is reflected in their classification. The issuances of both types of hybrids are calculated as a fraction of the total hybrids. Therefore, the dependent variables in my model are the Equity-Classed Hybrid Fraction (R_{EH}) and the Debt-Classed Hybrid Fraction (R_{DH}).

Furthermore, Fitch Ratings classifies hybrids into buckets with 0%, 50% or 100% equity credit, as described in Section 2.3. Hybrids with a 100% equity-credit assigned by Fitch Ratings fulfil even the strict requirements of CET 1 capital. Additionally hybrids with a 50% equity-credit are still eligible as AT 1 capital. Hybrids of the 0% equity bucket are only eligible as supplementary Tier 2 capital. The issuances of those hybrids are calculated as a fraction of the total hybrids, which gives further depended variables:

0 % Equity-Credit Hybrid Fraction (R_{0EH})

50% Equity-Credit Hybrid Fraction (R_{50EH})

100% Equity-Credit Hybrid Fraction (R_{100EH})

Additionally banks are ranked into thirds depending on their capital ratios to account for the different purposes of the hybrid securities. The level of the Tier 1 ratio should affect the type of hybrid securities issued. Therefore, the Tier 1 ratio is divided into three parts depending on its level. According to the BCBS (2013) 10.5% is the required minimum capital ratio, when Basel III is completely implemented in 2019. Hence, 11% is the threshold for the low third ($T1R_{low}$). Globally banks use more equity in certain regions and, therefore, the mean of the Tier 1 Ratio of 16.96% in the sample might be misleading. Consequently the mean is used as the threshold for the high third ($T1R_{high}$). All other banks are ranked in the medium third ($T1R_{middle}$) with Tier 1 Ratios between 11% and 16%. Dummy variables are created, which are 1, if the bank's Tier 1 ratio is in the respective third, and 0 otherwise.

Finally a set of control variables that resemble the market access and capital structure of a bank is constructed including total assets are a proxy for the market access, which also reflected in the rating in the previous sections. Additionally the profit before taxes is a proxy for profitability and the debt ratio is a proxy for the overall leverage of a bank. The control variables are expected to influence the amount and type of hybrid capital instruments that is used to fulfil the regulatory capital requirements. This leads to the hypothesis that *banks issue different hybrid securities depending on the level of their Tier 1 ratio*. A model, which is based on Kisgen's (2006) methodology, is used to test this hypothesis:

$$R_{H_{it}} = \alpha + \beta_1 T1R_{low} + \beta_2 T1R_{high} + \beta_3 T1R_{middle} + \delta(CV_{it}) + \varepsilon_{it}$$

where $R_{H_{it}}$ is one of the different hybrid fractions at time t for bank i , $T1R_{low}$, $T1R_{middle}$, $T1R_{high}$ are the dummy variables for the thirds of the Tier 1 ratio, and CV_{it} is the set of control variables. The standard errors are given by ε_{it} .

Table 6: Summary of Variables for the estimation of the impact of regulatory capital

Variable	Description
Equity-Classed Hybrid Fraction (R_EH)	$\frac{\text{Hybrid accounted for as Equity}}{\text{Total Hybrids}}$
Debt-Classed Hybrid Fraction (R_DH)	$\frac{\text{Hybrid accounted for as Debt}}{\text{Total Hybrids}}$
0 % Equity-Credit Hybrid Fraction (R_OEH)	$\frac{\text{Hybrid with a 0\% Equity stake}}{\text{Total Hybrids}}$
50% Equity-Credit Hybrid Fraction (R_50EH)	$\frac{\text{Hybrid with a 50\% Equity stake}}{\text{Total Hybrids}}$
100% Equity-Credit Hybrid Fraction (R_100EH)	$\frac{\text{Hybrid with a 100\% Equity stake}}{\text{Total Hybrids}}$
Tier 1 Ratio low (T1R _{low})	A dummy variable, which 1 for banks with Tier 1 Ratio smaller than 11% and 0 otherwise.
Tier 1 Ratio high (T1R _{high})	A dummy variable, which 1 for banks with Tier 1 Ratio greater than 16% and 0 otherwise.
Tier 1 Ratio medium (T1R _{middle})	A dummy variable, which 1 for banks with Tier 1 Ratio between 11% and 16% and 0 otherwise
Control Variables (CV)	
Log of Total Assets	Natural logarithm of a bank's Total Assets.
Profit before Taxes	Natural logarithm of Profit before Taxes
Debt Ratio	$\frac{\text{Total Liabilities}}{\text{Total Assets}}$

Overall the same sample of 5,320 banks as in the previous parts is used. Unfortunately the observations are limited due to the very specific nature and classification used for the different hybrid fractions. Other databases like Compustat and Datastream do not provide a larger sample as well. Therefore, some of the results might be slightly biased due to the restricted sample size.

3.6.1 Debt-classed and Equity-classed Hybrid Capital

The first groups of hybrid capital instruments to be examined are the Hybrid-to-Total-Funding Ratio, the Debt-Classed Hybrid Fraction and Equity-Classed Hybrid Fraction. The Hybrid-to-Total-Funding Ratio and Debt-Classed Hybrid Fraction are expected to be mainly financing tools. Hence, the Tier 1 ratio should not affect them too much. In contrast, the Equity-Classed Hybrid

Fraction is assumed to have a strong relationship with the Tier 1 ratio, as more equity-like hybrids are definitely eligible for the Tier 1 ratio. The following model introduced in Section 3.6 is used:

$$R_{H_{i,t}} = \alpha + \beta_1 T1R_{low} + \beta_2 T1R_{high} + \beta_3 T1R_{middle} + \delta(CV_{it}) + \varepsilon_{it}$$

Again logistic models with cluster robust standard errors are used to estimate the models, as the dependent variables are proportions. The results are displayed in table 7.

While a high number of observations is available for the Hybrid-to-Total-Funding Ratio (19,231) and debt-classed hybrid securities (18,947) far less observations (1,253) are available for hybrids of the Equity-Classed Hybrid Fraction in comparison to the other groups. Hence, less equity-classed hybrids are used overall.

Table 7: *The impact of the Tier 1 Ratio on Total and Debt- or Equity-classed Hybrids*

Models	Logistic_1	Logistic_2	Logistic_3
Dependent Variable	Hybrid-to-Total-Funding Ratio	Debt-Classed Hybrid Fraction	Equity-Classed Hybrid Fraction
Tier_1_low	1.47	1.47	0.00
	0.42	0.42	0.00***
Tier_1_high	0.75	0.75	1.63
	0.00***	0.00***	0.13
Tier_1_middle	1.32	1.32	562575.50
	0.56	0.56	0.00***
Profit before Tax	0.81	0.81	0.70
	0.00***	0.00***	0.00***
Total Assets	1.97	1.97	1.77
	0.00***	0.00***	0.00***
Debt Ratio	0.31	0.33	7.05
	0.07	0.08	0.07
Constant	0.00	0.00	0.00
	0.00***	0.00***	0.00***
Observations	19,231	18,047	1,253
Pseudo-R²	20%	20%	6%
Legend: * p<0.05; ** p<0.01; *** p<0.001			

The results for the logistic regressions are very similar for the Hybrid-to-Total-Funding Ratio and the Debt-Classed Hybrid Fraction. Only small deviations in the odds ratios are observed. Furthermore, banks high Tier 1 Ratio have a small odds ratio, which reduces the odds that those banks issue all types of hybrids and debt classed hybrids by 25%. In contrary, banks with small

and medium Tier 1 Ratios are not significantly different from 0. The results indicate that banks with high Tier 1 Ratios are less likely to issue hybrids in general and also debt-classed hybrid securities.

In comparison the Equity-Classed Hybrid Fraction (Logistic_3 model) shows strong relationships with the low and medium third of the Tier 1 ratio. Banks with a low Tier 1 Ratio are less likely to issue equity-classed hybrid securities, which can be explained with the high yield that such banks have to pay on their equity-classed hybrids. Investors require a higher compensation for the risk they take by investing into the hybrids of those banks, as they are financially less stable than other banks, which is expressed in a low Tier 1 ratio. In contrary, banks with a medium Tier 1 ratio have an extremely large odds ratio, which makes it very likely that those banks issue more equity-classed hybrid capital instruments. Additionally their market conditions are much more favourable and investors require a lower risk premium. Furthermore banks with medium Tier 1 ratios seem to strengthen their regulatory capital ratios with the more flexible and cost-effective equity-classed hybrid securities instead of traditional equity instruments like common shares. All control variables except for the debt ratio are significant and show reasonable results. The total assets have an odds ratio greater than 1 in all models, which shows that large banks with a good market access are more likely to issue more of all types of hybrid securities. Finally more profitable banks have an odds ratio smaller than 1 in all models. Hence, the odds that those banks issue any type of hybrid or debt-classed hybrids reduce by 19%. The odds for those banks to issue equity-classed hybrids reduce even by 30%.

Overall the results indicate that well-capitalised banks do not rely on hybrid securities to fulfil their capital requirements. In comparison, banks with medium Tier 1 ratios are likely to issue equity-classed hybrid capital to fulfil the regulatory capital requirements. In contrast, banks with small Tier 1 ratios are less likely to issue equity-classed hybrid securities. It was expected that especially badly capitalised banks issue equity-classed hybrid securities to strengthen their capital ratios. Their low financial stability might increase the costs of issuing hybrid capital for those banks and restrict their market access.

3.6.2 Hybrids with 0%, 50% or 100% Equity-Credit

As discussed in Section 2.4 rating agencies assign hybrid capital instruments to a bucket with a certain equity-credit. Especially CoCos, which are issued more and more frequently, depend heavily on their assigned equity-credit. The model developed in Section 3.6 is used once more:

$$R_{H_{i,t}} = \alpha + \beta_1 T1R_{low} + \beta_2 T1R_{high} + \beta_3 T1R_{middle} + \delta(CV_{it}) + \varepsilon_{it},$$

where $T1R_{low}$, $T1R_{middle}$, $T1R_{high}$ are the dummy variables for the three levels of the Tier 1 Ratio, CV_{it} is the set of control variables and the dependent variables are different Equity-Credit-Hybrid Fractions ($R_{H_{i,t}}$). The standard errors are given by ε_{it} . Again logistic models are used for the reasons discussed in the previous sections, as the dependent variables are proportions. The results of the regressions are displayed in table 8 on the following page.

Table 8: *The impact of the Tier 1 Ratio on the 0%, 50%, 100% Equity-Credit Hybrid Fraction*

Models	Logistic_1	Logistic_2	Logistic_3
Dependent Variable	0% Equity-Credit Hybrid Fraction	50% Equity-Credit Hybrid Fraction	100% Equity-Credit Hybrid Fraction
Tier_1_low	0.05 0.00**	238,722.20 0.00***	0.62 0.58
Tier_1_high	1.14 0.84	0.91 0.90	1.07 0.91
Tier_1_middle	32.17 0.00**	0.00 0.00***	1.52 0.56
Profit before Tax	1.37 0.25	1.14 0.47	0.66 0.05
Total Assets	0.96 0.89	1.16 0.52	1.24 0.43
Debt Ratio	6.30E+11 0.01**	0.10 0.74	22,080.51 0.16
Constant	0.00 0.00***	0.04 0.54	0.00 0.12
Observations	337	419	393
Pseudo-R ²	14%	4%	7%
Legend:	* p<0.05; ** p<0.01; *** p<0.001		

The Logistic_1 and Logistic_2 models have a good explanatory power with a Pseudo-R² of 4-14% considering their sample sizes of just 337-419 observations. In the Logistic_1 model hybrids with 0% Equity-Credit are more likely (high odds ratio) to be issued by Banks with a medium Tier 1 ratio and less likely (small odds ratio) to be issued by banks with a small Tier 1 ratio. Those banks are likely to pay a risk premium on their hybrid securities, as the low Tier 1 ratio indicates low financial robustness. Hence, hybrids with may not be cost-effective for those banks. In contrast banks with a medium Tier 1 ratio seem to issue hybrids of the 0% equity bucket to fulfil their regulatory capital requirements. Additionally 0% equity-credit hybrids are not significant for banks with a high Tier 1 Ratio. The only significant control variable is the debt

ratio, which has a very high odds ratio. Hence, highly leveraged banks are likely to rely heavily on financing with 0% equity-credit hybrid securities. to attract investors by higher yields in comparison to traditional debt financing, while not raising leverage too much.

The results of the Logistic_2 model for the low and medium Tier 1 ratios are exactly opposite to the results of the Logistic_1 model. Banks with low Tier 1 ratios have an odds ratio greater than 1 and Banks with medium Tier 1 ratios have an odds ratio smaller than 1. Hence, low Tier 1 ratios make it very likely that banks issue hybrids of the 50% Equity-Credit Hybrid Fraction. These banks need to strengthen their Tier 1 ratios and hybrids with a 50% equity-credit are very cost-effective instruments to do so. In contrast banks with a medium Tier 1 ratio are not likely to issue hybrid securities with 50% equity-credit, as they are already relatively well capitalised. Unfortunately the control variables are not significantly different from 0 in the Logistic_2 model.

Finally hybrids of the 100% Equity-Credit Hybrid Fraction were expected to be a popular financing tool especially for banks that struggle to fulfil the regulatory capital requirements and for banks with high leverage and lower profitability. However, none of the explanatory variables is significantly different from 0. These results are puzzling. Due to the very small number of observations (393) the statistical significance is reduced very much.

Summarising the hypothesis that *banks issue different hybrid securities depending on the level of their Tier 1 ratio* is accepted.

4 Conclusion

Several models tested the hypothesis that the issuance of hybrid securities is affected by firm characteristics and the presence of a rating. This hypothesis is accepted with the market access, profitability and the regulatory capital requirements being the most influencing factors. Furthermore the hypothesis that rated banks use more hybrid capital than firms without a credit rating is accepted as well. It can be criticised that this paper assumes that hybrid securities are rated, if the issuer has a credit rating. Hybrid issuances usually have an own rating depending on the structure of the underlying instrument. However, hybrid ratings are based on an anchor rating, while being rated a few notches lower.

The hypothesis that banks issue different hybrid securities depending on the level of their Tier 1 ratio is tested using a methodology of Kisgen (2006). The findings indicate that well-capitalised banks do not rely on hybrid securities to fulfil their capital requirements. In contrary low and medium capitalised banks are likely to issue hybrid securities to fulfil their capital requirements.

Moreover, the level of regulatory capital seems to influence the type of hybrid security, which is issued, as well.

The drivers of hybrid capital and its use for the financial industry require further research, especially when a larger sample size of rated hybrid securities is available.

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